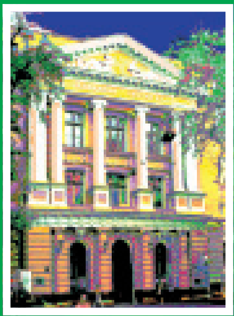

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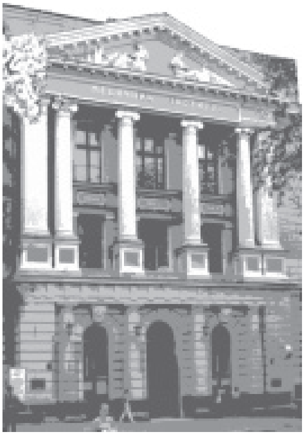
GENERAL SURGERY

ОДЕСЬКИЙ МЕДУНІВЕРСИТЕТ

ОДЕСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ

THE ODESSA STATE MEDICAL UNIVERSITY



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GENERAL SURGERY

Selected lectures

Edited by prof. **V. V. Mishchenko**

Recommended
by the Central Methodical Committee
for Higher Medical Education of the
Ministry of Health of Ukraine as a manual
for students of higher medical educational establishments
of the IV level of accreditation using English

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The Odessa State Medical University
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The textbooks on general surgery course published the previous years have lost their actuality on some problems. The curriculum organization on the credit-module system basis according to the new syllabus requires new educational-methodical supplies. This manual presents in English the lecture course taking into account the achievements of surgery. The manual is made up by the Odesa State Medical University General Surgery Department's staff.

Рекомендовано Центральним методичним кабінетом з вищої медичної освіти МОЗ України як навчальний посібник для студентів вищих медичних навчальних закладів IV рівня акредитації, які опановують навчальну дисципліну англійською мовою. Лист ЦМК з ВМО МОЗ № 23-01-25/6 від 25.01.2007.

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FOREWORD

The lecturers of the General Surgery Department of the Odessa State Medical University, who wrote this book, made an attempt to unite all the topics of the lecture course according to the new curriculum on the general surgery on the basis of credit-module system in organization of the educational process for English-speaking students. It gives students who are trained in the higher medical institutions of Ukraine in English, a full notion of the general surgery course.

The main issues presented in the course are based on the scientific and practical achievements of the last years. The authors aimed at expanding students' knowledge on history of the development of surgery as a discipline. Significant additions were included in the following parts: care of patients, haemotransfusion, surgical infection, anaesthesia and others which have been changed in accordance with the newest scientific and practical achievements.

The parts which will be studied by students the next years are given briefly.

We hope that this manual will provide students with sufficient information on general surgery and they will use it in future practice.

We admit that we did not manage to avoid some drawbacks. The authors would accept any critical remarks and recommendations with gratitude and will take them into account in the following editions.

Lecture I

INTRODUCTION

Dear young colleagues!

It is a joyful day today both in your life and in the life of the department. After you learnt the bases of anatomy, histology and some other disciplines, the clinical life begins. We are glad to greet you in the General Surgery Department and to share our experience and skills with you. We sincerely congratulate you on this day — the beginning of clinical disciplines studying.

The students work in the clinic and direct contact with patients, as well as the work in operating, dressing and other rooms of the surgical hospital, has features to which students should pay attention from the first day of study at the surgical clinic. Some of them are following:

1. The students for the first time come into professional contact with patients, get acquainted with various diseases and psychology of a sick person. It is necessary to remember, that not every patient with readiness will agree to be an object of study, and in many cases patients reject that students carry out dressings or any other medical and surgical manipulations. This is connected with distrust to the quality of student's knowledge and care of health. Therefore, it is very important that students, as soon as possible, acquire theoretical and practical skills, have a professional appearance and deserved the patient's trust.

2. In each surgical clinic there are always some severily ill patients with various pathologies. Some patients are nervous, expecting for operation; others are already recovering from surgical intervention and demand, naturally, intensive therapy, rest, and care. Therefore, silent conversation gets special significance in surgical clinic, it is impossible to laugh, joke, and behave thoughtlessly, it is necessary to observe order while moving as groups of students

through the corridors and chambers, from one to another floor. It is no less significant to know that training is being carried out at the same time with correct and sensitive approach to the patient;

3. Features of surgical methods of treatment and threat of wounds infection demand to stick to specific actions, which directed to preserving sterility of dressing and instruments, surgeon's and operation sister's clothes, protection of postoperative wound against infection. At the operation block, dressing and manipulation rooms, special rules of behavior and certain habits, which students will gradually seize, have been developed. We shall acquaint you with them during lectures and practical classes, during the time of night duty in the clinic, during practical training, lessons in the circle of student's scientific organization (SSO). Today it is important that you carry out all of these requirements, which are directed towards the protection of the patient against infection.

It is necessary to remember that a student should always have a tidy appearance, clean lab coat, medical mask, change of shoes.

4. Despite of achievements of surgery, surgical methods of treatment still now are aggressive and cause the negative emotions in people which are not used to that. Changing a dressing is mostly painful and surgical intervention is frequently accompanied by significant haemorrhage and suppuration. Experience testifies that during the first attendance of these work sites students feel bad, lose consciousness while observing surgical operations or manipulations. It is necessary to remember this, and at the first displays of feeling bad students should immediately inform the teacher.

HISTORY OF SURGERY DEVELOPMENT

Surgery is a section of medicine, which because of different social and economic periods developed extremely irregularly. After the period of prosperity in some ancient countries (2–4 thousand years BC) the period of its almost full degradation came in the middle ages when the church domination hindered sharply the development of medicine and surgery. At last, from XIX–XX century up to the present time, the period of most intensive and rapid surgery development has proceeded.

Information about surgery is received from archeological excavations of old burials, old manuscripts, papyruses and books, pictures on rocks, vases, antique sculptures and even from national eposes and legends, proverbs, sayings, etc. Early people struggled with the forces of nature, trusted in evil and kind spirits, and used elementary means of treatment. There is no doubt that the most ancient medical tools were used in case of traumatic damages (while hunting, at war) and in wound complications, in the case of bleeding during birth and other diseases.

Through the person's importence to the forces of nature animalism and fetishism, shamanism and sorcery got wide spreading. All natural phenomena (fire, water, air, ground) and all illnesses of a person were connected with evil spirits (fever, shakes, swelling, etc.), which should be gotten rid of, expelled from the body of a patient or deceived (dance with noisy effects, masks, terrible clothes of shaman). Gradually people who had "contact" with these spirits singled out into separate castes of pagan priest and sorcerers.

Such "skilled craftsmen" were mostly concentrated in the temples, churches, imperial palaces, empirically accumulating experience for treating diseases and mixing this experience with demonisms and mysticism. So, gradually being separated, two qualitatively different directions were developed in medicine: temple medicine, which was more perfect and scientific, and folk medicine, which was primitive and developed empirically, without any claims for scientific character of knowledge.

"Surgery" (from Greek *cheir* — hand, *ergon* — action) means "hand action". This name occurred in the ancient times and was also used for contraposition of surgery as a trade to internal medicine, which was not investigated enough yet, complex and mysterious science. People who had full training in temples or in special medical schools were engaged in internal medicine. Any person had an opportunity to be engaged in hand action, i. e. dressing of wounds, stop of external bleeding, setting of dislocations and treatment of fractures. More often this work was carried out by the uneducated barber, chiropodist or soldier-sorcerers, sorcerers.

For many thousands of years, people with diverse diseases, which had external attributes of illness — wounds, trophic ulcers, abscesses, inflammatory diseases of the eyes and external genitals, parasitic illnesses and tumours, visited such "surgeons". Thus, the circle of pathological conditions in which the surgeons were engaged was very big, but the level of theoretical grounding of these doctors — very low.

Nevertheless, there was a quick decrease in culture, science and medicine, which was observed during the Middle Ages and that for 2–4 thousand years BC in many countries of the ancient world there was enough developed and well organized medicine and surgery.

Despite the elementary view about the world (recognition of the four elements — ground, water, air and fire), in ancient Egypt and Iran, Assyria and Babylon, India and China there were advanced grain husbandry, complex irrigational systems were buit, mathematics, mechanics and bronze, of which knifes and other medical tools were developed.

In these countries with a hot climate and a lot of skin and parasite diseases the priest of temple medicine gave a lot of attention to hygiene, body cult, water procedures and physical exercises. Bodies of the dead rather frequently were embalmed, therefore doctors of temple medicine had some conception of anatomy and human physiology, knew about the movement of the blood in vessels and distinguished the lighter "blood of the day" and darker, venous blood, which they named "blood of the night".

For doctors and military doctors training, the special schools were created, and in Egypt — the "House of Life," where young men studied nature, veterinary science and medicine. Among the doctors that were engaged in practice, some specialization was even observed, because someone became famous for experience in the treatment of eye and skin diseases, others — in the treatment of external genitals, others — in the treatment of mental diseases.

The most notable doctors specialized in internal diseases, which they treated with herbs, diet, physical exercises or councils. Surgeons were engaged in "hand action", that is treated wounds and wound complications, bleedings, fractures and dislocations, superficially located purulent diseases and tumours. Thus, they differed from doctors of internal diseases, which developed the so-called "medicine of herbs" — surgeons gave more attention to practical habits and improvement of "knife medicine". Thus, for the reduction of painful sensations doctors gave wine, opium, mandragora extract to their patients. While performing surgical interventions, they used bronze knifes and a big set of other surgical tools.

Nevertheless, understanding the extent of complexity and responsibility of surgical operations, rather severe laws were declared in some countries, which, undoubtedly, limited a wide development of surgery. The fullest idea of medicine and doctors of that time we received from the so-called code of laws of tsar Hammurapy from Babylon and the laws of Asbestos from Iran, where the questions of payment and compensations for the successful treatment, a certain degree of punishment for an unsuccessful operation and consequences of bad treatment were very precisely determined.

It is necessary to note, that only people who proved their qualification three times and successfully treated patients were admitted to medicine and surgical operations. After successful surgical treatment a "knife owner" was allowed to get payment or fee, which, depending on the patient's social level and well-being, was paid in cows, sheep, money, ornaments from precious metals or as a mould of the organ which was successfully cured.

At the same time if the knife medicine was used in an unqualified way, and the surgical treatment was poorly done and had negative consequences, the doctor was judged and severely punished — one or both eyes were put out, a finger, wrist or whole hand were cut off.

Doctors had relatively honorable and very high social status in society, but Assyrian laws, nevertheless, specified that the doctor should search for any opportunity to improving his personal knowledge, to be polite, to keep medical secrets, to not afflict patients with unanswerable conjectures, and to speak only of probable things. Any modern doctor can use this wise advice.

Medicine and, particularly, surgery obtained the highest development in ancient China and India. Famous creations of Indian literature are the Ayurveda ("Book of Life") where centuries-old experience of Indian doctors is generalized, which testifies that surgeons of ancient India treated wounds with success and almost sewed them tightly after the withdrawal of foreign objects, grounded plastic surgery ("Indian way"), with success carried out plastic of the nose, ears, lips. Some historians mark that they also perform abdominal intervention during intestinal obstruction and suturing the intestines.

No less than in India successes of medicine were observed in ancient China. Knife medicine was considered as the most responsible way of treatment which doctors used, who successfully treated patients with "knife incision" no less than three times. In China surgery was very highly appreciated and characterized as a "precious heaven gift and an eternal source of glory". Chinese surgeons Hua-to, Ben-tsao used bamboo trunk for fixing fractures, studied anatomy on corpses, performed laparotomy and Cesarean section, used a wide range of medical plants and accupuncture.

Such sciences as “ pulse study”, “studies about the windows of a human body”, “study about the organism juices” (urine, blood, bile, etc.) were created in ancient China. Even in those old times, wise advice, which has not lost its actuality even today, were offered for young doctors. For example: “He who hid an illness from the doctor has deceived himself”, or “Do not treat only the head if the head is ill, or only the leg if the leg is ill”, or “The doctor should treat only that which is possible to cure, but if the disease cannot be cured — try to facilitate the sufferings of the patient”. Unfortunately, it is necessary to note that in some countries where medicine sometimes is a source of enrichment for the doctor, even the patient who does not need an operation, is prescribed treatment which costs a lot and also which is not useful to the patient, but only serves making the doctor wealthier.

Especially rich heritage is left by doctors of ancient Greece and Rome. In these advanced countries, books, collections, which are written by Hippocrates, Celsus, Galen, became a source of medical knowledge and influenced medicine for all peoples of Europe down through the Middle Ages.

Hippocrates (459–377 BC) is an outstanding doctor-physician, talented surgeon and tutor. He attentively collected anamnesis of his patients, in detail described the clinical symptoms of diseases, studied anatomy on corpses. Using various surgical means of treatment, he payed much attention to psychotherapy as well, suggesting physical exercises and natural treatment (sun, air, water). “Hippocrates’ Oath” gained the greatest fame, which young doctors give before beginning professional work.

The development of ancient Rome determined the medicine center transfer from Greece to Rome, though the Roman doctors were followers of Hippocrates. The most outstanding representatives of Roman medicine were Celsus (I century AD) and Galen (II century AD). The works of Celsus and the treatises of Galen were the basic supervising guids for doctors of the West Europe down to XV–XVIII century.

Celsus for the first time used ligature for vessels ligation in wounds with the purpose of bleeding stoppage, used lead tubes for draining wounds. In his works we find the first detailed description of the clinical course of the neglected cancer of the lower lip.

During the first period of his activity Galen was the gladiators’ doctor. He observed the course of processes which occurred in wounds, tried to suture wounds with silk, used bronze tubes for draining wounds. He considered that pus was an obligatory component of the healing process, confusing wound complications with the regeneration process (healing through pyesis). Studying anatomy and human physiology, he considered that the center of blood circulation is not the heart but the liver. He admired very much also the searching for medical herbs and manufacturing curative preparations and "miracle means of treatment".

Despite the achievements of some representatives of the medical profession, it is necessary to emphasize that there were a few doctors, they treated mainly the palace people and high officials and they were inaccessible for the simple people. A known ancient Greek historian Gerodot described a custom that sick people were brought to crowded areas or markets and people, who were passing by, could give advice concerning treatment.

A lot of the surgical achievements were forgotten after the dawnfall of the Roman empire. Surgery confronted with a violent resistance on the part of church, attendants of a cult and religious fans who forbade autopsy, the performance of any operation connected with bleeding. Attempts of studying anatomy on corpses resulted in accusation of heresy and the scientist was threatened with the fire of inquisition. The domination of the church during the gloomy centuries of the Middle Ages put practically insuperable obstacles for the development of surgery, which became increasingly simpler to transform into craft.

But many daredevils and talented doctors continued to study and develop surgery, overcoming the backwardness of religious prejudices and gained certain successe. There are many outstanding doctors: an Arabian doctor Ibn Sina (Avicenna), who left over 100 scientific works about different questions of medicine and surgery; A. Visalus — a founder of normal anatomy; V. Harvey opened the laws of the blood circulation in a person: Ge De Sholiak, A. Paré, Bruno De Longenburg, Paracelsus and other surgeons. The whole epoch in the history of surgery was created by M. I. Pyrogov who was not only a fine anatomist, brilliant surgeon, but also a talented scientist, innovator and statesman.

Almost till XVIII century progress of surgery was insignificant, that mostly connected with a poor social status of surgeons. An overturn took place in the XVIII century, when a surgeon Lafrangi from Milan for the first time was allowed to lecture in surgery at the medical faculty of Sorbona University (1719). In 1731 the French Surgical Academy was founded.

Thus, in spite of the fact that surgical actions belong to the most ancient habits of medical trade, surgeons for a long time did not find recognition in official medicine and even didn't rank among doctors. It is necessary to note also that even when surgery was at last recognized as the official medical specialty, it could not be improved sufficiently until scientists of the whole world did not found a way to overcome three main obstacles:

1. Shock, which was frequently observed during an operation because of the lack of anesthetizing means.

2. Infections, which complicated all surgical interventions because of lack of aseptic and antiseptic means.

3. Bleeding and its consequences which doctors could not fight with because of a still unsolved problem of isohemagglutination and there were no study of blood groups.

Further we shall be convinced that all these main obstacles in surgery development obtained scientific explanations only at the end of the XIX century and mainly in the XX century. Many questions of surgery have not been answered even today and demand studying. But the basic ways concerning the further development of surgery have been already determined and introduce into life actively.

Surgeons of Ukraine, following the well-known traditions of M. I. Pyrogov, B. A. Karavayev, S. M. Kolomnin, M. V. Sklifosovski, O. S. Yatsenko, V. F. Grube, A. G. Podrez and other outstanding surgeons, which worked in Ukraine, achieved great successes. Names of M. M. Volkovich, K. M. Sapezhko, M. P. Trinkler were known far outside of Ukraine. They united the best surgeons, directing their activity by practical application of surgical achievements. The schools of M. M. Volkovich, M. P. Trinkler, and K. M. Sapezhko were inseperably linked with advanced rural surgeons. This connection to a great extent was assisted by M. I. Pyrogov both by his works and by direct participation in creative activity of Ukrainian surgeons. "Pyrogov connected the university, academic surgery to the rural one", — wrote V. A. Oppel. The close links of the academic surgery with the rural one was one of features of surgical schools in Kiev, Kharkov and Odessa in the first twentieth anniversary of the XX century. M. M. Volkovich, M. P. Trinkler and K. M. Sapezhko's schools assisted in the association and improvement of the best forces of rural surgery.

Such outstanding Ukrainian surgeons as A. T. Bogayevsky, O. A. Yutsevich, V. G. Kozlovsky, Ya. V. Silberberg, L. I. Malinovsky, etc. were born in the depths of rural surgery. They together with other outstanding surgeons solved a number of major problems in surgery. The successful development of abdominal surgery is obliged to a great extent to A. T. Bogayevsky, M. P. Trinkler, O. A. Yutsevich, M. M. Volkovich, K. M. Sapezhko, V. G. Kozlovsky, L. I. Malinovsky, etc. Besides abdominal surgery, Ukrainian surgeons contributed much to orthopaedics. I. F. Sabaneyev, A. G. Podrez, M. M. Volkovich, K. F. Vegner and other surgeons suggested new osteoplastic operations, developed a functional method for treating bone fractures and other rational ways of treating pseudoarthrosis, contractures, and osteo-articulate tuberculosis. The operations of I. F. Sabaneyev were included into the arsenal of classical operations, and operative receptions and therapeutical ways of treating tuberculosis of the bones, suggested by A. G. Podrez, M. M. Volkovich, N. I. Kefer and other surgeons, have not lost its value even today.

Surgeons Ye. K. Istomin, O. O. Abrazhanov, Ya. O. Galperin, O. I. Meshchaninov, I. P. Sklyarov, I. D. Maslov, Ye. Yu. Kramarenko, V. L. Pokatilo, Ya. V. Silberberg, N. I. Kefer played a big role in the organization of surgical help to the population; also academic surgeons M. M. Volkovich, M. P. Trinkler, O. P. Krimov, I. V. Kudintsev, V. M. Shamov, O. V. Melnikov, etc. worked together with them. They were the initiators of convocation of the first congresses of surgeons.

At the first regional and republican congresses of surgeons (1923; 1927) in Odessa, Kharkov for the first time in the history of surgery the question of improvement of surgical service to rural population, about the struggle against traumatism, the organization of urgent help in acute peritonitis, the problems of cancer, tuberculosis and training of surgical staff were discussed. Other important problems, the solution of which had state importance, discussed at these congresses. The congresses not only summed up the results of work, fixed the achievements, but also elaborated the program of further activity of surgeons in the near future.

Surgeons of Ukraine always actively participated at work of health protection bodies, in the activity of surgical societies, popularized the medical knowledge. They were conductors of major state measures directed to the improvement of the public health care. The surgeons were the initiators of the creation of the efficient system of anticancer and antituberculosis services, precise organization of fast and urgent help in the republic. Prophylactic medical examination of the population, which is one of the basic part of medical prophylaxis, was offered.

Well-known surgical schools were created. V. M. Shamov, O. V. Melnikov, who worked in Ukraine almost 20 years, played a big role in the foundation of these schools. Their numerous followers created surgical schools too. The scientific development of the basic problems of haemotransfusion, introduction into the practice of the cadaveric haemotransfusion, solving importent problems of neurosurgery, abdominal surgery, endocrinology, tissue transplantation, malignant tumours, battlefield surgery belong to V. M. Shamov and his school. He has published more then 100 big works, some monographs and a lot of collections devoted to the most actual questions of theoretical and practical surgery. O. V. Melnikov is one of the founders of the Ukrainian schools of oncologists and gastric surgery. He had trained many followers, who are developing his ideas. He wrote more than 10 monographs and 130 works on problems of modern surgery.

It's difficult to overestimate the role of O. P. Krimov, M. I. Sitenko, V. P. Filatov, N. I. Kefer, I. V. Kudintsev, Ya. O. Galperin, I. M. Ishchenko, M. M. Amosov, M. S. Kolomiychenko, O. I. Arutyunov, M. P. Novachenko, I. Ya. Deyneka, M. M. Milostanov, Z. Y. Geymanovich, O. O. Shalimov and many other Ukrainian surgeons in the development of surgery.

O. P. Krymov created his own school. He published over 130 works, including 10 monographs and a widely known surgery textbook. His work "The Studies of Hernias" is the most detailed research on this question in world literature. I. V. Kudintsev, the follower of L. V. Orlov, is one of the first organizers of urgent help at the acute surgical diseases. The development of important problems of abdominal surgery and urology belongs to him and his school.

Ya. O. Galperin, a follower of S. I. Spasokukotsky, created his school, suggested a lot of new ideas in surgery of oesophagus, stomach and others. I. M. Ishchenko, a follower of O. P. Krymov, one of the founders of the Ukrainian school of neurosurgeons, published over 100 works devoted to craniocerebral trauma, shock, bleeding, purulent infection, battlefield surgery, surgery of the stomach, spleen, bilious duct, development of the surgical science and the history of surgery. He is the organizer of many congresses and plenums of surgeons of Ukraine.

The development of the chest surgery initiated by Ukrainian surgeons (B. Yu. Frankenberg, Yu. Yu. Kramarenko, O. P. Krymov) gained in scope in 1948–1951.

A particulary successfull development chest surgery acquired in 1952, when the first chair of thoracic surgery headed by M. M. Amosov was founded at the Institute of Postgraduate Training in Kiev. M. M. Amosov elaborated the indications to surgical treatment of suppurative processes, tuberculosis damage, the technique of pneumonectomy and lobectomy, ways of anaesthesia during these operations. He achieved the lowest lethality after these operations. After the active participation of M. M. Amosov, many thoracic surgeons were prepared in Ukraine; departments of thoracic surgery were opened in all of regional centers.

Together with thoracic surgery, surgery of the heart and vessels has got wide development last years. In Ukraine, the majority of surgical interventions on the heart were performed by M. M. Amosov. Heart surgery was successfully developed: in Kiev by O. O. Shalimov, who was a prominent surgeon, talented scientist, innovator and organizer of the Institute of Clinical and Experimental Surgery, in Lvov — by M. V. Danylenko, in Donetsk — by V. K. Gusak, etc.

M. I. Sytenko is one of the founders of the Ukrainian school of orthopedists-traumatologists, a talented organizer of trauma service in our country. His works on the questions of orthopaedic aid and purely theoretic questions were always actual. He made a big contribution to the research of bone callous, the process of bone tissue regeneration, developed the technique of early treatment of diaphysar and epiphysar fractures in newborns with the application of spokes of his own design, the technique of treatment of radial bone fracture, developed the diagnosis of supracondilar fractures of the shoulder and methods of treatment, determined the indications to surgical treatment of bone fractures. M. I. Sytenko created a big school of followers.

M. P. Novachenko, the follower of M. I. Sytenko, published over 100 works, several monographs, elaborated the technique of original operations on the big joints, with osteomyelitis and bone tuberculosis, free bone plasty. In his activity the idea of M. I. Sytenko concerning the organization of orthopaedic-traumatologic care and preventive actions of traumatism got further development in Ukraine. M. I. Kolomiychenko published over 90 works devoted to surgery of the heart, pericardium, oesophagus, cardiospasmus, plasty, history of surgery, and organization of surgical aid in the republic.

A. I. Arutyunov promoted the development of neurosurgery and the organization of neurosurgical care in the country. He brought up a lot of followers — A. P. Romodanov, Yu. A. Zozulya. In the creation of the Ukrainian school of neurosurgeons, a significant role was played by Z. Y. Geymanovich, O. Y. Geymanovich.

O. O. Fedorovsky made an important contribution to the experimental surgery, treatment of burn traumas, and development of the haemotransfusion technique.

M. M. Milostanov put much work in the development of urgent medical service, battlefield surgery, treatment of wounds and the introduction of haemotransfusion to the practice. He wrote 80 works, among which a number of textbooks and manuals.

An important role belongs to I. T. Shevchenko, I. Ya. Deyneka and other surgeons in foundation of the oncologists school in Ukraine. I. Ya. Deyneka, the follower of O.V. Melnikov, published over 140 works and 4 monographs, and created a big school of specialists. His followers are at the head of chairs in many institutes.

A certain contribution in the history of surgery in Ukraine, in the history of domestic medicine was made by S. A. Verkhratsky. His works on the history of surgery in Ukraine have big scientific value.

K. T. Ovnatanyan, I. I. Kalchenko, G. G. Karavanov, A. Z. Tseytlin, A. A. Chayka and other surgeons of Ukraine have created schools of followers.

MODERN IDEAS OF SURGERY, SURGICAL DISEASES AND SURGICAL PROFESSION

A modern idea of surgery, certainly, considerably differs from the old notion about this profession. Surgery developed as an additional medical specialty before. During last 100 years it has undergone significant and profound changes, owing to which it can be considered one of the youngest branch of medical science, which is developing rather quickly.

If before only people who had different pathological processes, external features of diseases came to surgeons, today the concept of "general surgery" got narrower.

After the mastering anatomy and physiology, introduction of anaesthesia and methods of surgical infection prevention, surgery undergoes such a stormy period of development that a lot of specialties which were under the competence of surgery before became separated and independent. So, at the last decade, traumatology and orthopaedics, obstetrics and gynaecology, oncology, urology, eye diseases, anesthesiology, reanimatology, otorhinolaringology, etc. became independent scientific-practical disciplines.

In the big industrial centers of our country, as well as in other developed countries of the world, the process of further specialization of surgical aid is still going on. Taking into account the features of the organization of these services, the requirement for special equipment, surgery of the lungs and mediastinum, surgery of the heart and large vessels, surgery of the oesophagus and rectum and others are becoming more separated as independent disciplines. Specialization of surgical aid is the progressive phenomenon of modern medicine.

The concept of "surgical diseases" is continuously changing. After the established traditions, all illnesses or pathological conditions which for their normalization, certainly, demand correction with the help of a knife belong to "surgical" diseases. They are trauma and wounds, hernias and tumours of different localization, dead tissues and maldevelopment, acute-purulent inflammatory processes, etc.

At the same time there are a lot of diseases which can be treated either by the general physician or by the surgeon. They are stomach and duodenal ulcers, cholelithiasis, disease of the thyroid gland, bronchoectatic diseases, chronic purulent disease of the lungs, hereditary and acquired heart diseases, etc. The doctor should estimate the severity of the disease, prognosis in usage of this or that method of treatment, the presence of complications and threat to life or health of the patient. Such diseases are called "conditionally surgical" because under unfavourable conditions (bleeding, perforation of the ulcer, etc.) conservative treatment becomes unreasonable and the patients are further treated by the surgeon.

We shall also specify that with the development of surgery, medical knowledge, medical techniques many diseases previously regarded as therapeutic and were outside the competence of a surgeon, today are treated by surgical methods in specialized laboratories and institutes, ever more belong to the category of "surgical" pathology. In particular, this concerns such new parts of surgery as heart surgery, surgery of the large and small arterial vessels, tracheobronchial surgery, transplantation of the kidneys, etc.

The profession of a doctor-surgeon is difficult and labor-intensive, demands selflessness, physical, intellectual, and nervous effort The work of surgeon is extremely interesting and gives many joyful and happy moments to the doctor who operates on a severely ill patient, but it also brings much sorrow. Unfortunately, surgical intervention which is directed to the patient's recovery does not always come to a successful end. Some patients have serious complications and sometimes with a lethal outcome which, certainly, upsets the surgeon who performed the operation. Each doctor takes seriously the failures of treatment, as he understands that some complications are possible to explain by the severity of the pathology or imperfection of science, whereas other unsuccessful cases, undoubtedly, are connected with insufficient knowledge of the surgeon, probably, with defects of patient preparation to the operation and mistakes in technique of its performing, that is insufficient professional qualification of the doctor.

The work of a surgeon is hard, intense, and sometimes even exhausting. And each student who is going to devote himself to this profession can understand this. It is necessary to study very long, persistently and steadily to achieve the true art of a surgeon. Without any exaggeration it is possible to say that a surgeon studies all his life long. Keeping in mind the P. O. Gertsen's expression that "the best tool of a surgeon is his fingers", it is necessary to remember always that a knife is a two-edged weapon, which can do not only good but much harm to a patient. The doctor-surgeon should constantly improve his knowledge, love his profession and patients, develop dexterity of fingers and hands, and study diligence, persistence and patience. What will the training of surgery be like at the medical university?

The teaching of surgery is carried out consistently in the departments of general surgery, faculty and hospital surgery, and internship. After receiving the profession of a doctor, further specialization and improvement are carried out in the departments of advanced medical studies (AMS) once every five years. Due to the wide development of surgical methods of treatment of diverse diseases, departments of the II, III, IV, V courses do not duplicate one another, but supplement and expand the knowledge of students.

After studying the basis of surgery at the department of general surgery, students of the III and IV courses study classical symptomatology, treatment methods of some pathological conditions, and on the V course are acquainted with diveations from the classical course of diseases, with treatment methods of their complicated forms. Besides, on the V course, students are acquainted with the work of some specialized services — surgery of heart and large vessels, surgery of the lungs and mediastinum.

Despite the further ever particular surgical education, the continual search for new modern means of training, there are some questions which make the base for the whole process of training in school. The department of general surgery, where students learn the following sections of medicine, is engaged in these questions. What tasks bring the department's attention?

1. Introduction to the speciality: to acquaint students with work of the surgical department and surgical service, elements of deontology and medical ethics.

2. To teach the students some professional knowledge, which form the basis of medicine and surgery. These are such questions and sections of surgery, as aseptics and antiseptics, the basis of anaesthesia, bleeding and blood loss, haemotransfusion and blood substitutes, the basis of traumatology, diagnosis, prevention and treatment of surgical infection, the organization of an operation and caring for the patient in the pre- and postoperative periods, and a number of other problems.

3. To aspire that elements of clinical thinking, which collect over the years and develop only due to long-term operational experience, form in students in the department of general surgery. It is necessary to always remember that it is not necessary to treat the disease which, at first sight, seems simple but the patient with his psychological features, complicated concomitant diseases and individual qualities. In spite of the fact that many questions concerning separate pathology is not a subject of the department of general surgery, students already now should think above the questions of operational risk, trauma and danger of an operation, get theoretical knowledge and practical habits which are directed on the correction of disturbances which arise in a patient. Let's notice that all additional data which students will receive, reading not only textbooks, but also monographs, periodic literature, only expand their outlook, give confidence in work, assist in the formation of a future doctor.

4. Besides of professional knowledge and habits, students in this department may raise the general educational level, get acquainted with the history of world and home achievements, know the development and prospects of home surgery, truly estimate those advantages which are given by the public health services.

HISTORY OF THE GENERAL SURGERY DEPARTMENT

The clinic of general surgery contains 120 regular beds. All necessary conditions for qualitative training of students are created at the department. The department has its own lecture auditorium, sufficient number of educational rooms, acceptance chamber, scheduled and urgent operational rooms, wound-dressing rooms, radiological cabinets and clinical laboratory.

In the practical classes students get acquainted with these rooms in more details. It is necessary to emphasize that our department has very old and kind traditions, which today we try to support and augment.

The department was founded in 1903, first as a theoretical, then clinical base, and was situated in 4 rooms on the first floor of the main educational building of the Odessa Medical University. First it was called the “Department of Surgical Pathology and Therapy with Desmurgy and the Study of Dislocations and Fractures”.

For 5 years the department did not develop, and the heads were changing almost every year. The first head of the department was prof. Shchogolev Mykola Oleksandrovych; from 1904 till 1907 — private-senior lecturer I. F. Sabaneyev.

In 1907 the department was headed by prof. Konstantin Petrovich Serapin who transformed it from theoretical to clinical, and we rightfully consider him the founder of the clinic of general surgery. Without taking into consideration the break (in 1914–1918 he was called to military service), prof. K. P. Serapin headed the department and clinic till 1920. First the clinic was small with only 22 beds, located in a two-storied house of the city ambulance station of the infectious hospital. After the 3rd floor building in 1913 the bed fund started to increase gradually.

All the heads of the clinic brought something significantly new to development of surgical science. Professors I. Ye. Kornman, A. G. Sosnovsky, I. O. Bakkal, which headed the department after prof. K. P. Serapin, developed the methods of anaesthesia, applied new ways of antiseptics, put into practice haemotransfusion, treated traumatological patients, patients with purulent pathology, applied new surgical interventions.

The most active period of surgery development of our department occurred in 1950–1970, when the clinic was headed by the honored worker of science prof. I. Ya. Deyneka. During this period, employees of the clinic started to develop more intensively the question of stomach and intestine surgery, apply intervention on the organs of the mediastinum, and carry out the operations on the lungs and heart. Parasitic diseases, mostly human echinococcus, were intensively studied.

I. Ya. Deyneka's numerous disciples prepared and successfully defended theses of candidate and doctor degree, introduced new methods of diagnosis and treatment of different diseases. Some of them work in other cities of our country now, many left to work in our medical university; they head the departments, work as senior lecturers and assistants (prof. A. I. Tregubenko, prof. A. O. Babur, prof. A. M. Torbynsky, associate professor T. V. Khomitska, V. V. Pirozhenko, etc.).

In 1960–1978 prof. K. D. Dvuzhilna became the head of the clinic. She paid much attention to the features of the course and treatment of wound infections, to the functional disturbances in diseases of the thyroid gland, to hormonal disturbances in duodenal ulcer, and to new antiseptic means, etc.

From 1978 till 1989 the department was headed by prof. L. Z. Drobkov. Under his supervision the staff of the clinic directed their efforts to study of most serious displays of surgical infection — peritonitis and surgical sepsis, on the estimation of immunobiological violations in patients with this pathology, the search for means of correction of intoxication syndrome and the improvement of consequences of surgical treatment of these conditions.

The departament of the general surgery was headed by professor B. I. Dmytriyev from 1989 to 2004. He provided a proper material support of surgical clinic; the educational-clinical base of faculty extended. The basic direction of scientific researches was devoted to problems of diagnosis, treatment, preventive maintenance of diseases of the liver, pancreas, endotoxicosis problem, diabetes.

In 2004 the General Surgery Departament and the surgical clinic were headed by professor V. V. Mishchenko. A basic direction of scientific-practical activities of clinic is diagnosis, preventive maintenance, treatment of acute surgical diseases of abdominal organs. 14 teachers work in the department today.

At the department the students can get elucidation of any unclear question and take the first steps in mastering the doctor profession. It is desirable that each student would regard the teacher not only as a teacher of discipline, but also as a mentor, senior comrade, friend.

Lecture II

ORGANIZATION OF SURGICAL SERVICE

The course of general surgery begins with the study of the surgical departments work organization and care of patients. Why are the 1st year students involved in patients observation today and is sanitary practice introduced after the end of the II year of study?

Sanitary practice and care of patients are included into the educational process of medical schools in order to help students mastering all knowledge necessary for hospital attendants and nurses. The majority of students consider that they enter the institute to be a doctor, but a doctor should know all of the work habits of hospital attendants and nurses and be able to carry them out better than his subordinates, and doing like this he will be a good doctor.

The modern idea of surgery considerably differs from the former one. If surgery was considered to be a medical specialty before, for the last 100 years it had such radical changes, so today it is possible to reckon it as one of the youngest and quickest developing part of medicine. If before only people with various pathological processes, which had external signs of illness, went to surgeons, today the concept of "general surgery" is getting narrower.

Due to the development of anatomy and physiology, the introduction of anaesthesia and preventive measures of surgical infection, haemotransfusion, surgery obtained quick development, which led to appearing independent disciplines: traumatology and orthopaedics, obstetrics and gynaecology, oncology and urology, skin and eye diseases, otorhinolaringology, etc. The specialization is on even nowadays. The departments of cardiovascular surgery, toracic department, esophagus department, microsurgery, proctology, etc. are open. Specialization, certainly, is a positive thing. It gives an opportunity for highly skilled treatment, but it has its disadvantages. In fact, before the beginning of treatment in such a department, one of the doctors should first make a diagnosis. So, doctors, in particular section doctors, should have full knowledge of all diseases. Therefore the university studying is carried out in such great volume for students of all faculties.

The organization of surgical care during the period of existence of surgery as specialty, had essential changes: from barber, chiropodist, and medical hospitals — to modern structure. The modern surgical service is a component of the medical network. It contains medical and preventive establishments, polyclinics — state, joint-stock and private.

Institutions of motherhood and childhood care (maternity hospitals and female consultations, children's houses, boarding schools, etc.) are somewhat separated in our country.

All medical institutions work according to a territorial principle — they serve the inhabitants of a certain area. In big factories there are polyclinics, medical-sanitary parts, which serve the staff of this factory.

The basic medical institution is an ambulance station (from the word *ambular* — walk slowly on foot). 80% of the population begin and finish treatment in out-patient establishments and only 20% are hospitalized.

The greatest importance in organisation of medical care for the rural population, which lives in rural medical territory, have the *medical assistant-obstetrics stations* (MAOS). They are necessary for a small population in the country; the settlements are 3–5 km from local hospitals. There there should be two medical workers: the medical assistant and midwife. The primary goal of MAOS is rendering urgent aid in an ambulance station or house, and revealing infectious diseases. The medical assistant keeps in close touch with the local hospital, refers patients who demand medical assistance and consultation to it, consult them with the doctor during consultation at the MAOS.

MAOS takes part in prophylactic medical examination of the population and reveals early forms of diseases and carries out sanitary-educational work.

The rural medical ambulance station settles in the country, its task — to render the first medical aid to the rural population, manage the MAOS, and carrying out preventive means.

The polyclinic is a many-profile out-patient medical institution, which is a part of the incorporated hospital. Its staff consists of: therapeutists, surgeons, traumatologists, stomatologists, ophthalmologists, otorhinolaringologists and doctors of other specialties. Depending on the amount of attendance they are divided into 3 categories. In case of more than 1,000 attendances the polyclinic belongs to the 1st category. The local doctor carries out reception in turn: either in the morning, or in the evening. Recently, the family doctor, who carries out treatment of patients of a certain region and involves in consultations different experts, was introduced into practice.

Enlargement of polyclinics became the important step, which gives the opportunity to equip them by diagnostic facilities and make more convenient for population.

The main task of a polyclinic is diagnostic, treatment, preventive measures of diseases and expertise work capacity. For expertise of work capacity in a polyclinic medical control commition (MCC) and medical expert commission (MEC) exist. If the patient is not able to work more than 4 months, he is appointed a physical inability group. The polyclinic and local doctors provide medical service not only in the polyclinic but at houses, such a polyclinic doctor is called a family doctor. The family doctor comes to the patient on a call or visits him without invitation.

The *medical center of health care* is treatment-prophylactic establishment at the enterprise or collective farms. Depending on the amount of workers or collective farmers, they can be doctors' or medical assistants'. At big factories the center of public health services were turned into *medical* and *sanitary posts* (MSP). The open MSP carried out treatment-prophylactic measures in nearby territory, i.e. among the inhabitants of a given area, the closed ones serve only the workers of the enterprises. The task of the MSP is similar to the center of public health services'. The MSP doctor is the basic workshop therapeutist. He carries out dispanserization and preventive surveys, early revealing diseases, preventive measures of professional diseases.

Since the 40s, prophylactic centers have appeared in our country. Preventive measures of diseases and sanitary-educational work with healthy people are mainly carried out in clinics. There are such clinics: narcological; tuberculosis prophylactic centre; oncological; dermatovenerological; psychiatrical, etc. Children's polyclinics and female consultations belong to clinical methods of service. Workers of the clinics take part in carrying out prophylactic medical examination. In clinics, certainly, there is a hospital, where patients are treated. After recovery, patients are on the books for a long time.

Thus, it is possible to draw a conclusion that rendering medical surgical aid in the country side and in the city is not identical. In the country side the first medical service takes place at the MAOS, then at the rural medical ambulance station, local hospital, and district and regional hospitals. In the city first aid, as usually doctors', is emergency care, then at once the patient is delivered to a specialized hospital.

Today the medical stations and hospitals of urgent aid are created in all big cities and settlements of our country. The Odessa first-aid station was one of the first in Europe. It was initiated under direct participation and the means of a count N. N. Tolstoi. It was created because of an accident happened to his daughter, who swallowed a fish bone in the evening. The count Tolstoi sent for many doctors, but nobody came; the doctor arrived only in the morning and removed the bone from her throat. After that Tolstoi sent a messenger into many countries of Europe to find out whether there were any medical establishments there providing emergency aid. Such medical establishments in Europe were not found. Then the station, which had some carriages and medium-level medical personnel, was created.

Now in Odessa, substations of emergency aid and specialized brigades have been organised. If earlier the emergency aid served for quick deliver of the patient to a medical hospital, today its doctors can render highly skilled medical aid.

The surgical aid is given in the district, city and regional hospitals. On this level depending on the equipment and qualification the specialized aid is provided. The management of the hospitals is carried out by republican scientific institutes and centers. So, in Kiev, there is the Scientific Institute of Clinical and Experimental Surgery, and in Kharkov — the Institute of Urgent Surgery. The basis of them is made by the surgical department (hospital).

For successful treatment of surgical patients it is necessary to develop and equip the surgical department. The department should answer the volume of the carried out work according to its purpose and specialization. Peculiarity of surgical patients treatment consists in creation of special conditions which provide, first of all, preventive maintenance of wound infections. The following one belongs to the surgical department: acceptance chamber, wound area (clean and purulent), operation, dressing, manipulation, and also bathrooms, bathing, dining room, buffet, chief of the department office and doctors' office, X-ray cabinet, laboratory and other rooms. The chambers should have 1–2 beds. The area — 7.5–9 m^2 for each bed. If there is an opportunity, clean and purulent departments should be allocated. If it is not possible, clean and purulent chambers.

Medical Staff

The head nurse and the head scrub nurse are by one in each department. For each operational table there are 2 scrub nurses. One dressing nurse for the dressing room. For every 10 beds there can be one ward nurse in the postoperative wards and one — for 15 beds in preoperative wards.

Junior Medical Staff

The amount of ward aid-women are according to the amount of medical nurses. Two aid-women should be at the operational room. One aid-woman is in the acceptance chamber, barmaid, door-keeper — 1 post for the department.

Wards and their Equipment

The ward should be for 1–2 patients. Furniture should be convenient and smooth, easy-to-wash. There should be nothing superfluous. The beds shoud be specialized, functional, bedside-table, chair-stool, above-the-bed demountable table for feeding the seriously ill patients (one for every 5 persons); supports for haemotransfusion and solutions (one for every 10 beds), stretcher-wheelchair or a wheelchair (one for every 10 beds), a vessel and urine dispenser in a sufficient amount. Buffet and dining room should be provided with enough utensils.

Operating Block

It should be isolated from other wards. Windows should be opposite to the north for reduction of solar beam reflection from nickelized tools on the operating field. In the summer, through wrong orientation of windows, the temperature of the air in the operating room increases, which complicates the surgeons work. The operating block consists of a lot of rooms connected to themselves: operating, preoperating, autoclave (operating, instrumental), etc.

In the instrumental room the tools are kept. The surgeon before an operation selects the necessary tools, which are sterilized by the scrub nurse. In general, there are certain sets of instruments, which are sterilized during an operation by the scrub nurse, according to the operation list, which is sent to the operating room in advance.

In the autoclave, as a rule, are dry-heat case and autoclaves.

Preoperative room is the room where the surgeon washes his hands and puts on sterile clothes. The preoperative room can be adjoined with a changing room where the surgeon changes clothes. In some surgical departments surgeons dress in sterile linen, but nowadays the single-use surgical garb has been applied. Equipment at the preoperative room: sand-glass, three washstands, disinfectant solutions, steam sterilizer with sterile lab coats, masks and other linen.

The operating room is the basic room of the operational block. Equipment: operating tables (minimum two, but no more), shadowless lamp, little tables for the scrub nurse, a table for instruments, support for basins, fitted with oilcloth, so that not to create noise from the instruments, which supports the haemotransfusions, narcotic solution devices of different marks, a little table for the anesthetist, device for mechanical ventilation of the lungs, defibrillator, diathermocoagulator, electric pump and other equipment depending on the kind of operation.

Functional Duties of the Surgeon

1. Examination, making the diagnosis, surgical interventions performing, postoperative care of the patient and medicaments prescription and functional treatment, meals, regimen of movement.
2. Performing morning and evening rounds; supervising bandages, dressings, haemotransfusion.
3. Talk and meeting with the patient's relatives (for this purpose special time should be determined in surgical departments).
4. Guidance and control of the work of the medical nurse, hospital attendant.

Functional Duties of the Medical Nurse at the Surgical Department

Medical nurses of the surgical department are on duty without the right to sleep. Care during an operation (bandage, drainage) enters the duties of medical nurses of the surgical department. The nurse also watches over urination, intestinal evacuations and reports to the doctor on duty or treating doctor. Until the patient finally wakes up after narcosis, a nurse-anesthesist should constantly be near him after that she pass the patient to the nurse on duty. During the duty the nurse follows the doctor's indications, takes body temperature, gathers patient's excretions for analyses (urine analysis, faeces, phlegm etc.). The nurse prepares the patient for operation. Over the night and in the evening she gives clyster, processes the skin, carries out preventive measures against bedsore, fills in the medical documentation, pastes analyses in the case report at night, writes down passport data. The nurse is the first assistant to the doctor, particularly the scrub nurse.

Scrub Nurse

Her functional tasks differ from the duties of an on-duty nurse. First of all, it is preparation of the instruments, suturing and dressing material for the operation. It is necessary to strictly adhere to sterility during the operation. A scrub nurse is personally responsible for asepsis violations during the operation and for the different complications in the postoperative period, such as suppuration of operational wounds, etc. The scrub nurse organizes over the work of the operating room and supervises their current, scheduled and general cleaning, dresses the surgeon sterile clothes, gives the instruments during the operation. She is the first assistant of the operating surgeon, and a good nurse should know the course of a majority of operations and understand the surgeon without words. Sending operational material for histological exam is the scrub nurse's duty.

Functional Duties of Aid Woman

An operating aid woman conducts a damp cleaning of the operating room during the operation and at the end of the operation list, takes part at general cleanings of the operating room no less than once a week, brings patients to the operating room and transports back to his ward, brings dressings, linen and medicines from autoclave and drugstores, washes used surgical instruments.

Functional duties of a ward aid woman: replacement of bed linens and underwear, washing and cleaning the patients at the ward, feeding the patients at the ward (in general the nurse can carry out the same work), cleaning the wards and manipulation rooms, halls, corridors and places of general purpose, giving urinals, urine and faeces analyses transport to the laboratory, the dead — to the mortuary.

Admission Office

The admission office of the hospital is intended for reception, registration, examination and sanitary-hygienic processing of patients, who are brought to the hospital. Patients can enter the hospital by polyclinics referral. Patients can be brought to the hospital by an ambulance car. In some cases patients can turn to the hospital without an appointment card. Patients (up to 15%) can be directed by the professor managing the department (thematic patients) to the department on the basis of which clinics (departments) are.

The admission office can be centralized and decentralized, because there is an opportunity of examination with experts of different profiles (surgeon, urologist, traumatologist, gynaecologist, etc.). The reception department consists of a lobby, registry, examination rooms and sanitary controls. In some reception departments, there are beds for temporary patient supervision and isolators for infectious patients. In those hospitals and departments which carry out emergency care for the surgical and traumatologic patients, there is a X-ray cabinet, laboratory, operating, dressing room (clean and purulent), reanimation. Each patient at the admission office should feel the sensitive attitude of the medical staff.

MEDICAL DOCUMENTATION

Medical surgical documentation has big organizational, practical, legal and research values. A list of documents, which should be made, is precisely determined in definite cases. Official documents, which are prepared during the primary and following examinations, should be complete and written on-time by the doctor-surgeon or nurse.

Medical work at the city polyclinic department is recorded in the medical card of the outpatient. Passport data are filled in on the title page of this card. On the first page of an outpatient's card there are final diagnoses with an indicated number, date of definition. On the following page the anamnesis, the objective data and the intended treatment are described. Lower marks are made about the sick-lists and vaccinations. The results of additional investigations (gastrofibroscopy, X-ray, ultrasound, etc.), medical report after treatment at the hospital are pasted in to the outpatient's card. At a polyclinic there is a book of sick-lists giving. If it is necessary to direct a patient to the medical expert comission (MEC), separate coupon of reference to the sheet of MEC increases, which comes back from MEC to the medical consulting commission (MCC). For registration of students, pupils of technical schools, schools disability the special form is approved: certificate of temporary disability of students, pupils of technical and secondary schools.

For direction of patients to sanatoriums and rest homes the sanatorium-resort card is filled out at the polyclinic.

After visiting patients at home by call a book of emergency calls is filled in.

At the hospital, in the reception of the surgical department there must be a journal of the reception of patients and hospitalization refusals, outpatient journal, inpatient journal, journal of people who had traumas, log-book for taking analyses of blood for alcohol test, rabies journal, etc. The case history is the main document at the hospital. This document has a big legal meaning. Each doctor should know this well. The passport part of the case history is filled by the nurse on duty. Diagnoses at the patient's admission and the clinical diagnosis are written and signed by the doctor. All other records in the case history are done by the ward doctor or the doctor in charge, the chief of the department certifies it and the head doctor of the hospital checks it.

The registration of work of the operating room of the surgical department is carried out at the operational journal. The following is marked in it: last, first, patronymic name of the patient, date and time of operation, diagnosis before the operation and after it, type of anaesthesia, amount of anesthetizing substance, name of surgion, course of operation, all complications occurred during the operation, data from the biopsy or histological analysis of the removed material, end of the operation, healing of the operation wound, if the patient died — specify the reason of death, with signature of the operating surgeon.

At the surgical department blood is transfused frequently. Therefore there should be a book of blood and plasma transfusion, and also a book of blood substitutes transfusion registration. Accordingly, at the case history the report of haemotransfusion is recorded.

Students fill in these documents during practical classes on haemotransfusion. During operation the surgeon removes a part of an organ, sometimes the whole organ, which should be sent for histological analysis. For this purpose, there is a special form, which is filled in by the operating surgeon — an appointment card for pathological anatomy research of the removed tissue.

At the surgical hospitals, the medical death certificate, which is then fixed in a registry office, is given to the relatives. At the hospital, there is a registration journal of preserving and delivery of poisoning, strong, and scarce medicines.

The list of prescriptions is filled in every day by the treating doctor. The diet, regime, drug treatment, physiotherapeutic procedures are marked in it. The nurse, after performing these assignments makes a mark in it.

The doctor's on duty journal is filled by every doctor on duty. Data about patients' transfer, admission, discharge, severely ill patients, all the operated the day before patients and those who have a fever are noted in it.

The diagnosis, kind of operation, diagnostic studies (blood and urine analyses, blood group, Rh-factor, X-ray examination, etc.), and recommendations concerning the out-patient and sanatorium treatment, type of sanatorium and its specificity, list of medical treatment, which was carried out, must be written down to the medical report.

The nurse handing over the watching fills in the journal of the watch transmission. The amount of inventory, syringes, hot-water bottles, catheters, probes, thermometers, drugs, in particular strong drugs, and narcotics is marked there.

In connection with the beginning of clinical training, it is necessary to pay attention to the value of medical deontology and medical ethics, which students learn during all their term of studying, but elements which are necessary to know in the 2nd year.

The term "deontology" (from Greek *deon* — proper, *logos* — study) was introduced at the beginning of the XIX century by an English philosopher Bentham as the name of the science about professional behavior of a person. Deontology is closely intewoven with ethics, which is the doctrine of morals, principles. So, medical ethics and deontology means a set of behavioral norms and morals of medical workers.

Medical deontology is not only rules of doctor's behavior, relations of the doctor with patients, other people and all medical staff but also preparation of doctors for the profession, their aspiration for self-improvement.

The emblem of the International Society of Surgeons declares: “Surgery gives life”. We should never forget the ancient precepts: “Do not harm first of all”.

While working at the medical institution the doctor, nurse and aid women should use words very cautiously. Eastern wisdom says: “The wound done by a knife can be cured, but the wound done by the tongue never heals”. In connection with this we should underline the importance of observing medical secrecy. What is the “medical secrecy”? These are data received by the doctor from the patient during a conversation or examination and treatment, which should not be provided in society or among relative and close friends, and data which the doctor should not inform the patient, as it can serve as a reason for mental trauma (bad diagnosis, bad prognosis, etc.). However, it is important to understand that medical secrecy should not become a conflict to the public. Medical secrets should always exist untill they violate the interests of society (hiding a criminal, concealing information of infectious diseases, etc.).

Naturally, there are a number of serious questions before young men and women who decided to devote themself to medicine, namely: what should a doctor of our time be like, what qualities should he aquire during the years of university studying in order to bring maximum benefit to people and society.

Its a good luck if a person finds his vocation, which is a big creative successes. The formation of a doctor is a difficult and temporary process. If we look at the past, it is necessary to determine the decisive motives for the senior generation of the best representatives of medicine? Sometimes, like Mykola Ivanovych Pyrogov’s example testifies the motives like that occur as if subconsciously, in the early childhood. Meditating on his life way, the ingenious surgeon came to a conclusion that two insignificant cases in his childhood played a certain role in the formation of his moral representations and future aspirations. The first one happened while the small Pyrogov was walking with his favorite old nurse by a bank of the small river Jauza. A desperate squeal got their attention. It appeared that near water two boys were playing with a dog, one tried to drown it and another one tried to interfere. The nurse praised the boy for displaying regret to the poor animal. These words, in particular, somehow were marked in M. I. Pyrogov’s memory. The second case is connected to the famous professor Ye. O. Mukhin who attended the house; he was invited to a serious patient with acute articulate rheumatism, who was the elder brother of Nikolai Ivanovich. The atmosphere of respectful expectation of the well-known doctor, his solemn arrival in a carriage, imposing appearance, process of examination of the patient, as well as the fact that Ye. O. Mukhin's recommendations made a positive effect (the patient quickly recovered), — all of this impressed the boy very much. For a long time his favorite hobby was a home "doctor" game. He admired this game like a student-physician of the first year, and truthfully, he was not even 15 years old there.

At the same age an outstanding surgeon, founder of the first surgical magazine "Bulletin of surgery", professor of the military medical college, Nikolai Aleksandrovich Velyaminov disregarded his aristocratic family to enter the medical faculty.

The founder of antiseptics Joseph Lister, who inspired to "work for the welfare of neighbours", from the age of 17, began preparing for the doctor's activity.

The famous therapeutist Sergei Pavlovich Botkin at young age dreamed of the mathematic faculty, but he became a physician rather unexpectedly. The first acquaintance with medicine radically changed his intentions.

A professor Theodore Billroth from Vienna, who had a remarkable talent for music, was going to devote his life to art and only after his mother insisting he received medical education. Not long after he became one of the leading feagures of medical science.

What qualities make up a doctor? I. P. Pavlov considers that a doctor should be able to analyze the facts, but mainly, synthesize them, he should be able to collect the facts offered to him by nature. Experience takes from nature everything he wants, "the facts is the air of the scientist".

Veresayev in his "Notes of the doctor" proves how the diagnosis is established with the help of synthesis and analysis, collecting facts, supervision, revealing fine symptoms and the correct interpretation. He was impressed by the discussion of the patient's condition made by the professor: "Eventually the professor started making conclusions. He went to them slowly like a blind along a steep mountain path: any smallest sign was not omitted but attentively discussed in order to explain any unuseful symptom on which I did not pay attention to, he turned upside down a store of anatomy, physiology and pathology, he faced all the contradictions and ambiguities and left them only after full explanation... The complicated and unclear picture which, in my opinion, was impossible to understand, turned out to be absolutely lucid and understandable, and it was considered on the basis of such insignificant data which were ridiculous to think".

The difficulty of the profession is that patients are not alike and need an individual care.

In one of his letters A. P. Tchekhov noted: "sometimes doctors have very bad days and hours. God forbid". Such days and hours like that are inevitable doctor's concomitants. Only he knows sleepless nights "with fixed thoughts about the destiny of severely ill patients".

A remarkable doctor S. S. Yudin after the death of a 30-year old woman-agronomist accused himself till the end of life when he did not detected intestinal obstruction and prescribed laxatives. And an outstanding diagnostician S. P. Botkin could not forgive himself for the lack of any objective data, did not believe the complaints of a strong headache of a young medical assistant, who arrived at the clinic again after recovery from abdominal typhus. The young man was discharged from the clinic with a mark as a "melingerer", and the next day he died. Autopsy showed abscess of the brain.

An operation, as V. I. Rozhanovsky marks, is a huge responsible act which should be taken seriously, with responsibility. There are cases in the history of national medicine when serious emotional experiences caused by sharp feeling of medical responsibility for a mistake or failure had tragic consequences. So, prof. S. P. Kolomnin (1866) committed suicide after the death of a patient operated on by him with the usage of a new method of anaesthesia (cocaine).

In 1928 a popular doctor-gynaecologist Z. V. Vasilyeva from Saratov began to use morphine, being unable to endure the death of her friend, a talented surgeon N. V. Almazova, whom she operated. These cases are exclusive but they prove how difficult is sometimes responsibility of a doctor and how much power and self-possession are needed so that not to be bent under its weight.

Hence comes conclusion that doctors should take care of one another, protect from worries and emotional anxieties, which our difficult profession is rich in. The example of such attitude to profession at the end of his life is the life of the Leningrad professor P. A. Kupriyanov, an outstanding doctor for his scientific merits and sincere nobleness. He was seriously ill, and it was time for serious surgical intervention. When the head of the department addressed to him with the request to designate the surgeon who would operate him, P. A. Kupriyanov looked at him amazed and said: "I understand my condition and I know that it is a punishment to operate me. Don't you think that I could severely punish anybody of my friends?" There are a number of examples like that.

Prof. V. R. Rozhanovsky says that some doctors and students are notable for great indiscretion. They are ready to inform patients of the necessary and unnecessary. There was such a case: one known pathologist was operated on at the clinic of a well known Moscow surgeon concerning polyposis of the stomach. He told that before the operation a young assistant who carried out curation, wishing to strike with erudition, for a long time and in details told him (the patient) about the outcomes of operation in cases of polyposis of the stomach, the mortality percentage and malignant transformation of polyps, etc. Imagine, that the patient — an outstanding pathologist who many times carried out post-mortem examination of people who died after such operations, having a number of works concerning this question, was so traumatized by the conversation with his "doctor" that for a long time after the operation was thinking with fear about the impression made by this conversation.

It is difficult to be a doctor, but to be a good doctor is much more difficult because it needs permanent skills training.

Lecture III

COMMON CARE FOR PATIENTS

Regimen is an appropriate order established in the patient care institutions of out-patient or in-patient type with the purpose of creating the best conditions for the recovery of patients. The regimen is equally obligatory for patients and personnel, but personnel actively make and support it, but patients submit to it.

The **regimen of the patient care institutions** consists of:

1. Internal regulations.
2. Sanitary-hygienic regimen of the patient care institution.
3. Personal hygiene of the patient and personnel.
4. Temperature, illumination and ventilation regimen.
5. Balanced diet regimen.
6. Treatment of patients.

The regimen at the departments and hospitals of different structures has its own peculiarities. The regimen of the infectious hospital differs from the regimen of the surgical hospital, the regimen of the maternity hospital and gynaecology unit differs from the regimen of the children's and therapeutic department. Inside the hospital, the regimen of departments and even wards also can have its own features. Each patient, depending on the disease, is arrenged an individual regimen concerning movement, meal, etc. A prescribed regimen is entered into the prescription list and medical card: "bed rest", "active", etc. Walks, period of activity, massage, diet and additional meals for patients are indicated.

The greatest importance for successful treatment of patients is the condition of the nerve system, belief in recovery, confidence in his hospital doctor and medical personnel.

Organization and conducting of **therapeutic-protective regimen** in hospitals have great value in creating conditions, which have a good influence on the patient's nervous system. The basis of this regimen consist of measures which protect the patient from harmful environmental factors which can negatively affect him, complicating the disease course, as well as the measures, creating conditions which favorably influence an organism, support spiritual vivacity, psychological tone of the patient, help him actively take part in the process of therapy.

Basic elements of therapeutic-protective regimen:

1. Whenever possible, painful sensations shoud be eliminated. It is, in particular, actual at the surgical departments of hospitals where almost all patients feel pain, from time to time rather intensive, which deprives them of sleep and rest.

2. Try to avoid negative emotions, caused by aftervision, acoustical and olfactory sensations.

3. Combine the regimen of rest with physical activity and increase the patient's general psychological tone.

4. Organize such surrounding conditions which favorably influence the patient.

Even a simple list of basic elements of a therapeutic-protective regimen proves that its influence involves all the patient's stay at the hospital beginning with the moment of reception till discharge from the hospital.

The word of the doctor and medical personnel, which can become for the patient both the reason of iatrogenic diseases, and a source of cheerfulness, is of great importance. For example, accidentally read and misinterpreted case history as well as lab analyses results can influence the mentality of a patient and the treatment result.

It is strictly forbidden for medical personnel to discuss a patient's condition and have a talk on medical themes in wards. Case reports are kept in special rooms, where patients are prohibited to enter. It is forbidden to talk to other patients about the health of their neighbors and the possible outcome of their disease. The doctor is obliged to give confidence to patients in good results of treatment and favourable outcome of operation.

At the surgical hospital it is necessary to avoid of negative emotions, connected with the look of medical subjects (blood-stained pieces of gauze, napkins, syringes and scalpels, clips with traces of blood, basins filled with used dressings, drenched with pus and blood). The doctor's appearance, in particular the surgeon's, is extremely important. In the operating room, he should not appear in the patient's presence in a blood-stained gown. Smoking is forbidden at the hospital territory too. A doctor and smoking are incompatible. The doctor's face should be clean and shaved. It is not necessary to "hold an actor's smile", but nevertheless, the doctor's face should look like well-wishing.

Rest, prolongation of physiological night sleep and obligatory day rest have great importance for the patient. Personnel change, wards cleaning and taking the body temperature are conducted after the patients get up, not earlier than 7 o'clock.

For reducing noise, it is necessary to install a soundproof door in the operating and dressing rooms, and equip with silent signal system. Patients should not groan, especially scream during an operation or dressing the wounds. Because of achievements in anesthesiology screaming at the operating and dressing-room is not permissible. While patients are sleeping and having rest, it is expedient to bring medical procedures to minimum, and emergency help should be provided with silent performance of manipulations, using local light sources.

The regimen of rest should be combined with possible physical activity of the patient — hygienic morning and curative gymnastics, walking in fresh air, the organization of cultural entertainments.

The therapeutic-protective regimen needs strict observance of an appropriate day regimen. At the majority of hospitals of our country the regimen is approximately alike. Here is an approximate day regimen of the surgical department and a list of the nurse's functional duties.

7.00	Time for getting up. The nurse turns on the lights in the wards, reminds the patients that it is necessary to go through the analyses that the doctor ordered (urine, feces).
7.05–7.30	Taking the body temperature. The nurse hands round thermometers, watches for correct measurement of the body temperature, writes down the results to the temperature sheet and reports for the regular doctor.
7.30–8.00	Morning wash up. The nurse helps seriously ill patients with washing. She cleans the mouth, eyes, and nose, brushes patients' hair, makes the bed, puts the patient in the correct bed position, sends urine and feces to the laboratory, prepares patients for operation: evacuates the intestines, shaves the operational area.

8.00–8.30	Medicines dispensing. The nurse dispenses medicines to patients and watches taking them over. The patient is obliged to take the medicine in the presence of the nurse (tablets, powder and rare medical forms) who explains how they should be taken.
8.30–9.00	Breakfast. The nurse helps giving the food, and feeds the patients in bed.
9.00–10.00	The doctor's round. Together with doctor the nurse takes part in the round; reports on the patient's condition, writes down the doctor's orders to the prescription list.
10.00–13.00	Following the medical indications according to the prescription list. She accompanies the patients to the X-ray room, consultations, probing, taking of gastric juices, puts on mustard plasters, warm com presses, makes injections, looks after the infirm patients and postoperative patients, accompanies patients to wound dressings.
13.00–13.30	Medicines dispensing. She distributes medicines again and watches the patients taking them.
13.30–14.30	Dinner. Helps in giving food, feeds seriously ill patients.
14.30–16.30	After-dinner rest. Airs the wards, looks after seriously ill patients.
16.30–17.00	Day-time taking the body temperature. She dispenses thermometers, writes down the results of measurements in the temperature sheets and in the case records.
17.00–17.30	After-dinner tea.
17.30–19.00	Visits of relatives, free time.
19.00–19.30	Medicines dispensing. The nurse gives medicines before supper and watches taking them.
19.30–20.00	Supper. Helps with supper, feeds seriously ill patients.
20.00–21.30	Performance of evening indications. The nurse prepares patients for operations and X-ray exams (clyster, stomach cleansing, etc.), applying cups, compresses, mustard plasters, etc.
21.30–22.00	Evening wash up. Helps patients brush their teeth, wash them, makes the bed, puts patients in a convenient position on the bed, airs the ward.

22.00–7.00 Sleep time. The nurse is on duty in the department without the right to sleep.

The sanitary-hygienic regimen is a number of laws, which determine the sanitary condition of the territory and wards in the hospital.

The territory of the hospital should be protected, entrances and roads between constructions — paved or asphalted. Water supply and sewerage are necessary. For dry garbage it is necessary to have boxes with closing lids, the place under the boxes and around them should be concreted. It is necessary, in due time, to evacuate boxes and periodically disinfect them. The territory of the hospital should be regularly tidied up. Doing up hospital rooms should be damp and done no less than 3–4 times per day with specially marked stock. These intervals should be individual for wards, operating and dressing rooms, buffet, bath and lavatory rooms. Panels are washed in medical establishments with a damp duster 1 time every three days. Once a month the window, plafonds, ceiling, doors should be cleaned of dust. The surfaces of radiators and pipes of the central heating should be wiped with a damp duster every day.

Sanitary-Hygienic Regimen in the Admission Office

The doctor examines everyone who enters the admission office, so that in due time patients with pyo-septic wounds can be revealed and isolated. The patient's skin and temperature are checked. Wooden spatulas are destroyed after use; metal ones are disinfected (immersed in a 2% formalin solution by 30 min or boiled for 30 min). Thermometers are kept for disinfection in a 0.5% solution of chloramine (30 min) or a 3% solution of hydrogen peroxide (80 min), or a 0.1% solution of desoxyne-1 (15 min). Inspection of a patient is conducted on a couch covered with oilcloth: after every patient's examination the oilcloth is wiped with a duster moistened in chloramine solution with a 0.5% solution of washing liquid, or a 3% solution of hydrogen peroxide with a 0.5% solution of washing liquid (desoxyne-1). After the patient is examined, a wound inspected and bandages changed the personnel disinfects the hands — washes them in warm running water with soap for 2 min. For this purpose, bars of laundry or toilet soap in small packing (for one use) are used. After the patient's inspection for pyo-septic diseases, purulent wounds are cleaned, the personnel disinfect the hands with bactericidal preparations (80% ethyl spirit, solution of chlorhexidine bigluconate in 70% ethyl spirit, 0.5% solution of chloramine). The working solutions for the mentioned above preparations are prepared at the drugstore of the treatment-prophylactic establishment. The container with the solution is placed near the washstand, in the dressing-room, for disinfecting hands with ethyl spirit or chlorhexidine preparations; it is put on the palmar surface of the hands by 5–8 ml and rubbed into the skin for 2 min. Such a solution is applied 10 times. Brushes for hands processing are washed and boiled in 2% soda solution for 15 min. Clean brushes are kept in sterile drums. They are taken out with sterile forcepts.

Each employee of the admission office has an individual towel. Towels are changed once a day. Inspection of wounds and changing of bandages are carried out only in dressing gowns, slippers, hats, masks, gloves. When cleaning purulent wounds, abscesses, phlegmons, etc., additionally oil-cloth apron are put on, which are disinfected after each use, as well as oilcloths on couches (solution chloramine or 3% solution of hydrogen peroxide with 0.5% solution of washing liquid).

The patient in the admission office passes full sanitary cleaning — takes a shower or bath, cats the nails. For washing, a patient receives a clean wash cloth. After sanitary cleaning, he puts on clean hospital linen, dressing gown or pajamas, slippers.

The admission room is tidied up no less than two times a day in a damp way with disinfect solutions: 1% solution of chloramine, 0.2% solution of desoxyne-1, 0.5% solution of chlordesine, etc. Cleaning material (buckets, basins, etc.) are marked and strictly used according to the purpose. Dusters are strictly kept according to cleaning purpose. After use, cleaning material is disinfected (soaked in 1% solution of chloramine for 60 min, 0.2% solution of sulphochlorantine — 60 min, 2% solution of dichloride-1 — 60 min, 1% solution chlordesine — 60 min).

Sanitary-Hygienic Regimen in the Surgical Department

After the patients' discharge, the bed, bedside-table, support for urine vessel, wiped with a moistened duster with disinfectant solution (1% solution chloramine B or 0.75% solution chloramine B, 0.5% solution of detergent, 0.2% solution of desaxon-1, 0.5% solution of chlordesine, etc.).

It is not allowed to accept to the surgical department soft toys which could not be disinfected.

Patients with pyo-septic diseases and postoperative purulent complications are isolated in separate wards or departments. In these wards, ultra-violet bactericidal irradiators of the close type should be established.

The personnel who work in purulent units and wards, after work, change surgical coats, masks and hats.

Hands are disinfected with 70% spirit or chlorhexidine for 2 min.

The department is kept in order. Cleaning is carried out not less than twice per day by a damp way with a soap-soda solution. Disinfectants are used after linen is changed and in the case of occurrence of hospital infections. In wards for patients with pyo-septic diseases and postoperative purulent complications, daily cleaning is carried out with necessary application of disinfectant solutions (1% solution of chloramine, 3% solution of hydrogen peroxide with 0.5% solution of detergent, 0.2% solution of desaxone-1, chlordesine).

Sanitary-Hygienic Regimen at the Operating Block, Wards and Resuscitation Departments

The operating block is separated from other rooms of the surgical department by a tambour, equipped with a source of bactericidal ultra-violet irradiators. The door to the operating room is constantly held shut. The operating block is equipped with stationary bactericidal irradiators and ventilating devices with prevailing of air inflow over drawing out. In the air inflow system bacterial filters are set. In the operating, dressing-rooms, wards and departments of intensive therapy for decreasing microbic fertilization, the following air-filters are recommended — AFMR-0.9, AFMR-1.5 (air filters mobile recirculatory).

The operating rooms are strictly divided for clean and purulent operations. If there are no conditions for these requirements observance, operations concerning purulent processes are carried out on specially alloted days with the following disinfection of the operational block and all equipment. Surgeons, scrub nurses and all the personnel taking part in the operation take a hygienic shower before the operation, put on operational linen (pajamas, slippers, cap and surgical coat). Before entering the operational room, the surgical coat is put off, a mask, shoe covers are put on, and then they go into the preoperating room, where hands are cleaned and a sterile surgical coat, mask and gloves are put on. The “rule of the red strip” is strictly kept. Everyone who enters the operating room (over the red strip) should have sterile linen on. Students and all other persons before entering the operating room put on a 4-layered mask and diligently hide their hair under the medical cap, then they put on shoe covers. For utilized shoe covers, a bucket with a lid is put. It is prohibited to be in the operating room in street shoes and for those who do not participate in the operation.

Patients are brought to the operating room in the surgical transport, which belongs to the department. In front of the operating block, he is put in to the surgical transport of the operating block and delivered to the operational table. The operating room’s barrow is in the preoperating room at the same place. Every day the barrows are cleaned with a duster moistened in disinfectant solution (1% solution of chloramine, etc.). Everything that is brought in the operating room (devices, apparatus and other objects) is disinfected (1% solution chloramine, etc.). A table for sterile instruments is covered with a sterile cloth directly before the operation, sterile instruments are placed on it and it’s covered with a sterile cover from above. A dressing material and instruments used during the operation, are collected in special bowls. It is strictly forbidden to keep in the operational room the objects which are not used during operation.

At the surgical department pure and purulent dressing rooms are strictly distinguished. If there is only one dressing room, the cleaning of purulent wounds is carried out after pure manipulations are done with the following cleansing of the room and all the equipment with disinfectant solutions (1% solution chloramine B, 3% hydrogen peroxide and 0.5% washing solution, etc.). Employees of the dressing rooms, resuscitation and intensive therapy departments have to change surgical coats, caps and masks every day. Nurses, while dressing the patient’s purulent wound must put on an oilcloth apron, which is disinfected after every dressing (wiped with a duster moistened in a 1% solution of chloramine B), and their hands are cleaned with 70% spirit or 1% solution of chlorhexidine.

After dressings, the dressing material is put in special containers, and damp cleansing with the application of disinfectant solutions is conducted (1% solution chloramine, 6% solution of hydrogen peroxide and 0.5% solution of detergent, etc.). Infected dressing material is burned. The personnel who do not work in the dressing room, wards and departments of intensive therapy is forbidden to enter the postoperative ward. Before a patient is moved from the operating room to the intensive therapy ward, the bed and bedside-table are processed with disinfectant solutions (1% solution of chloramine or 0.2% solution of desoxine-1). The bed must be made with bed linen, which has undergone processing.

Cleansing of the operational block, dressing rooms and intensive therapy, and resuscitation departments is done in a damp way no less than twice a day with disinfectants (chloramine, desoxine, chlordesine, etc.). General cleansing in the operational block and dressing room is conducted once a week. The operational block and dressing room are first cleared of things and equipment, ventilators, medicines, etc. As a disinfectant, a complex, which consists of a 6% solution of hydrogen peroxide and 0.5% solution of detergent, is used. After disinfection, the operating room and dressing-room are irradiated with ultra-violet light (direct or reflected), hanging or ceiling bactericidal lamps are switched on.

For utilization of dressing and waste products after operations, muffle furnaces are established.

Personal Hygiene of Patients and Personnel

The personnel should have working clothes and correctly use them: outer and working clothes should be kept separately, in different wardrobes; they should not leave the hospital territory in working clothes and wear it over the working time. The linen should be kept in a dry, light, ventilated room and clean separately from dirty ones. The dirty linen should be disinfected. At admission the patients are carried out cleansing and later on should follow the rules of personal hygiene. It is necessary to make the bed and to change bed-clothes and underwear once a week. Each patient should have an individual towel, a glass for medicines, a mug. Objects of care for patients should be washed after every use and keep in a closed dresser. While walking, patients should not leave the hospital territory.

The doctors, nurses and aid women' cloths should be of different colors.

Sanitary-Hygienic Regimen of Patients Feeding

In the organization of nutrition, it is necessary to consider not only the quantity and quality of a diet but also a properly serving table, pleasant appearance of dishes, temperature of food, fast service. We shall notice that the centralized system of nutrition, which exists in hospitals, presents real difficulties as for preservation of ready food quality while delivering it from the kitchen to the patients' wards. The food temperature falls, flavoring qualities deteriorate, calories number reduces.

Organization of patients' nutrition is an important thing in the complex of medical measures. Equipment of public catering organization and the buffet departments of treatment-prophylactic establishment are under doctor's responsibility. The doctor-dietician provides the control over sanitary requirements performing by public catering organization's workers handing out of food to the wards is done by the barmaid and duty nurses of the department from dishes marked “for food handing out”. The technicians who are occupied with wards and other rooms cleansing are not allowed to hand out food. Patients (except the seriously ill patients) take food in a special room — a dining room. Personal food products (house-made) are kept in the bedside-table (dry products which do not spoil) and in special alloted refrigerators (products which quickly spoil). The range and amount should be approved by the doctor.

After each food handing out, the cafeteria and dining room are diligently cleansed with disinfectants (1% chloramine solution, etc.). Wisps of bast for tableware and wiping tables, after the end of cleaning, are boiled or disinfected, and then dried and kept in special clean containers with a cover. The personnel of the public catering organization and cafeteria should keep the rules of personal hygiene: before visiting the toilet surgical coats are to be removed, after visiting the toilet hands are to be washed and disinfected with 0.5% chloramine solution or 0.5% chlorhexine solution or other preparations.

The majority of surgical diseases are accompanied by deterioration in nutrition. The condition of protein balance before an operation, in many respects, depends on the character and phase of the basic pathological process (inflammation, trauma, etc.) and peculiarities of nutrition.

During acute surgical diseases, in particular intestinal obstraction a patient within some hours, and sometimes minutes, can lose a huge amount of protein, salt and water. In the case of acute traumas the big loss of liquid is specially dangerous. During chronic diseases the most dangerous is protein loss.

Malnutrition is very dangerous. It can lead to a severe course of the hospital infection, violation in wounds healing, development of protein-free oedemas. Malnutrition increases a possibility of shock development, colloid-osmotic pressure fall, immunobiological protective reactions of an organism are disturbed, repairing processes in tissue and the blood cells regeneration slow down, the synthesis of hormones and enzymes increases, tendency to infectious complications rises. Valuable food and effective metabolism, tolerance to operational trauma increases, postoperating complications incidence decreases, patients manage the infection better.

There are two ways nutrients delivery to an organism — natural and artificial. A great number of diseases and postoperating conditions make the normal process of natural nutrition is impossible. In these cases artificial nutrition applied. Different forms of artificial nutrition are distinguished: parenteral, enteral (through a probe or ostomy) and combined. The enteral form is the closest to natural nutrition. It is always applied if there are no direct contradictions to its usage.

The patient's diet during the preoperative period should be enriched with vitamins, due to foods and vitamins. The products which may cause meteorism (leguminous, cabbage, whole milk, etc.) are excluded 3–5 days before the operation.

In order to avoid aspiration of food remains from stomach to lungs, the last meal should be not less than 8 h before the operation.

During the postoperative period it is necessary to compensate the increased expenses of an organism both during the operation and first days after it. It is necessary to replace the waisted liquid, protein, mineral substances, vitamins, in particular vitamins C, A, K. If necessary parenteral nutrition is provided. Depending on the extent and type of operative intervention, pathogenetically grounded "surgical" diets are distinguished.

Surgical Diets

Zero surgical diets. The purpose is mechanically and chemically preserving nutrition. It is fluid, semifluid, jelly-like grated food in three consecutive diets: 0 (0a), 0b (1a-surgical), 0c (1b-surgical).

Diet 0 (0a) is appointed on the 2nd, 3rd, 4th day after operation on gastrointestinal tract (perforating ulcers suturing, resections of the stomach, small and large intestines, etc.).

Diet 0b (1a-surgical). Appointed on the 2nd–4th days after diet 0a. It differs from the 0b with some meals adding to the grated and gruel boiled rice, buckwheat, porriage with meat broth or water with 1/4–1/2 milk, mucous groat soup with semolina on vegetable broth, steamed omelettes, fine boiled eggs, steam souffles of low-fat meat and fish (up to 100 g), oil, mousse from not sour berries. Food is given 4–5 times a day, no more than 350–400 g.

Diet 0c (1b-surgical). Serves for extention of the diet and transition to physiological high-grade meal. The diet includes cream soup, steamed foods of grated boiled meat, chicken or fish, fresh cottage cheese grated with milk to the consistence of sour cream, steamed cheese food, sour-milk products, baked apples, grated fruit and vegetables. Up to 100 g of white crackers, grated dairy porridge. Food is given 6 times a day. The temperature of hot foods is no more than 50°C, cold — no less than 20°C.

In the case of organ-saving operations (different kinds of vagotomy) the term of surgical diets in the postoperative period is kept. The day after the operation, a patient can have fine portions of food (drink of cooled boiled water (sipping) up to 0.5 l a day). The next day, the zero diet 0 (0a) is appointed for the period of 1–2 days, on the 3rd–4th day — diet 0b (1a-surgical) for a period of 2–3 days, then during a few days (3–4) the patients receive diet 0c (1b-surgical) with the following transition to diet N1.

Diet N5a surgical is appointed on the 3rd, 4th, 5th day after the operation on the gallbladder (cholecystectomia). It differs from the diet 1a and 1b by the restriction of fats, exclusion of broths, roasted cottage cheese and yolk eggs, fresh milk and its products. Mucous vegetarian soups, steam foods with boiled then cutted very small meat, porridge with rice, buckwheat and oatmeal, compotes, juices of not sour fruits and berries, and vegetable juices are recommended. Bread and bakery products are not allowed. Water is given in small portions up to 2 l. The diet is for 1-2 weeks.

Diet N5b surgical is appointed on the 3rd, 4th, 5th day after an operation on the pancreas. It differs from diet N 5a in that it contains foods of white-eggs (cocktail) and unboiled juices of vegetables: pumpkin, carrots, cucumber, which is capable of inhibiting trypsin, and also it includes calcinating cheese, capable of increasing the bicarbonate function of the pancreas. The rest points of the diet 5b are similar to diet 5a. It is appointed for 1–2 weeks.

Diet N1. Indications:

1. Gastric and duodenal ulcer during the period of recovery after or during exacerbations.
2. Exacerbation of gastritis with preserved or elevated acidity.
3. Exacerbation of gastritis during recovery.

Purpose: moderate chemical, mechanical and thermal sparing of the gastrointestinal tract.

The prepared food is mainly grated, boiled in water or steamed. Certain dishes are baked without a crust. Fish and not rough sorts of meat are prepared as a piece. Limited salt. Cold and hot dishes are not allowed. White bread of the previous day baking or dried, dry biscuit are recommended. Forbidden: rye and fresh bread, products from fancy pastry. Grated vegetable soups or well-boiled groats, vermicelli, boiled chicken and meat are also recommended. Soups are filled with butter and cream. Meat and fish broths, mushrooms and strong vegetable soups, cabbage soup, borshch, okroshka are not allowed. Low-fat meat, without tendons, meat of birds — without skin. Steamed cutlets, meatballs, boiled meat baked in the oven are prepared. Fat and tough sorts of meat, bird meat — goose, duck, canned food, smoked meat are not allowed. Fish should be low-fat. Dairy products with high acidity, hot and salty cheese are not allowed. Eggs — 2–3 per day, steam omelette. As for groats, millet, corn, bean and macaroni are not allowed. Concerning vegetables — white cabbage, radish, sorrel, spinach, onions, cucumbers, salty and salted vegetables, mushrooms are not allowed. Fruits should be sweet, grated, cooked. Forbidden: sour, unripe, rich in cellulose fruit and berries, chocolate, ice-cream, carbonated drinks, kvass, and black coffee. Among fats — unsalted butter and purified oil are recommended.

Diet N5. Indication: acute hepatitis and cholecystitis, chronic hepatitis, cirrhosis of the liver without its insufficiency, cholelithic disease without exacerbation, if there are no accompanying diseases of the stomach and intestines.

Purpose: chemical protection of the liver under the conditions of high-grade nutrition, promoting to the normalization of liver function and biliary tracts activity, improvement of bile secretion.

Boiled, baked, occasionally stewed foods are prepared. Forbidden: cold foods, spinach, sorrel, garden radish, green onions, garlic, mushrooms, pickled and salty vegetables, chocolate, cream products, black coffee, cocoa, cold drinks, horse-radish, pepper, mustard, meat and fish broths, okroshka, green soups.

Low-fat meat, baked after boiling and milk sausages are appointed. Fish — low-fat boiled, milk, kefir, sour milk, sour cream — as seasoning, semi-fat and low-fat cottage cheese and its products, non-spicy cheese. Eggs, baked egg-white omelette. No more than one yolk per day, with cholelithic disease — up to 1/2 yolks; any porriage. Vegetables — raw, boiled and stewed.

Diet N7. Indication: acute nephritis during recovery (from 3rd–4th weeks of treatment), chronic nephritis without exacerbation and kidney failure.

Purpose: moderate kidney protection, reduction of hypertensia and swelling, improvement of excretion of nitric and other products of metabolism from the organism. Proteins are limited. Food is prepared without salt. The amount of salt is controlled by the doctor (no more than 3–6 g a day). The food is salted at the table. Bread — without salt. Soups — with vegetables and groats. The use of milk is limited. Meat and fish broths are not allowed. Fowl — low-fat, boiled, baked after boiling is recommended. Fish — only boiled, low-fat. Cheese is not excluded from dairy products.

Diet N9. Indication: diabetes of mild and moderate severity. Variants of diet N9 take into account the course of insulin therapy, accompanying disease and other factors.

Purpose: to provide the normalization of carbohydrate exchange and to prevent violation of fat exchange.

Rye bread, protein bread, on the average 300 g, soups from different vegetables, borshch, light, low-fat meat, fish, mushroom broths with vegetables and reduced groats. Groats are limited according to carbohydrates norms. Gruel with buckwheat, millet, oatmeal, leguminous. Recommended: cabbage, vegetable marrows, pumpkin, salad, cucumbers, tomatoes, eggplants. Drinks — tea, coffee with milk, vegetable juices with not sweet fruits and berries, broth of dogrose. Butter, melted butter, oil. Sugar and sweets excluded, limited amount of salt, rice, semolina, poppy products, potatos, salty and pickled vegetables, fresh fruit, grapes, raisins, bananas, figs, dates, sweets and ice-cream. Animal and culinary fats are not allowed.

Diet N15. Indications: various diseases, which do not demand a special diet, without violation of digestion. A transitive diet to general food during recovery and after medical diets.

Purpose: to provide full-value nutrition under the conditions of a hospital. Energy value and chemical accord to the normal nutrition of healthy people, who are not occupied with physical work. Vitamins are given in increased amounts. All kinds of culinary processing of food are allowed. Spicy products and those which are hardly to digest are taken out of the diet. Energy value: 2,800–2,900 kcal, protein — 90–95 g, fats — 100–105 g, carbohydrates — 400 g, salts — up to 15 g Regime — 4 times a day. Sour-milk products are included. Margarine, fatty meat, goose, and mustard are limited.

Parenteral Nutrition in the Surgical Clinic

Parenteral nutrition is widely applied in cases when enteral or probe feeding is impossible. It is one of the forms of diethotherapy, during which nutrition support is carried out through blood circulation. Parenteral nutrition is recommended during pronounced violations of protein exchange, caused by poor enteral nutrition and increased protein metabolism. Disorder of protein exchange is one of most vivid displays of metabolic reactions to trauma, bleeding, operation, acute diseases, etc. It is also necessary to consider that elevated disintegration and loss of protein, as a rule, occurs simultaneously with the decrease in oral income of nutrients.

In the surgical clinic parenteral nutrition is recommended:

1. During severe traumas with injury to the osteo-articulate apparatus, internal organs, and burns.

2. During surgical interventions on organs of the gastrointestinal tract if the patient cannot take food enterally (tumors, burns, stomach and esophageal strictures, impassability of the intestines, penetrating wounds of abdomen with injury to the gastrointestinal tract, etc.), as well as during postoperative complications (peritonitis, retroperitoneal and abdominal abscesses), gastric and intestinal fistulas and other surgical diseases.

3. In reanimational practice: during extensive operations on the chest organs.

4. During acute pyo-septic processes.

The following preparations are applied for parenteral diethotherapy:

Casein hydrolysate is a solution of amino acids and peptides received by way of hydrolysis of full-value protein (casein) with the preservation of all irreplaceable amino acids in it. It is deprived of antigenic qualities and toxicity, sterile, apyrogenic; hydrolysate-103; aminopeptide; fibrinosolum; aminosolum (Sweden); aminonum (Finland); alvedosin (Germany); travamin (USA); proteolizate (Czech); pasedrolum (Japan).

Polyamine is developed by the Central Hematology and Haemotransfusion Research Institute.

Mixture of 13 amino acids (8 are irreplaceable). 1 l of preparation contains 80 g of amino acids and 50 g of sorbite. This preparation is entered slowly i/v (10–20 drops per min.), 400–800 ml per day for 5 days and more.

Amikin. Suggested by the Kiev Research Institute for Hematology of haemotransfusion together with the Ukrainian Research Institute for Meat-and-Milk Industry. Light-yellow transparent liquid contains 4.55–5.5 g of protein in 100 ml.

Hydrolysine. Acidic hydrolysate of the blood. Suggested by the St-Perersburg Research Institute for Hematology and haemotransfusion. Contains 8 g/l of general nitrogen, 40% of amino nitrogen, 0.58 g/l of ammonia.

Aminocrovine. Incomplete hydrolysate of homogeneous protein of utilized blood. It contains 44–56 g of protein. All irreplaceable amino acids are preserved in the preparation.

Blood, plasma, albumin, protein are not applied for parenteral nutrition. Plasma protein is used by the organism for plastic purposes only on the 10th–25th day after introduction, because they should be split up to the stage of amino acids before they can be applied.

The most widespread and reliable kind of energetic material is glucose. It is recommended to enter a 10–40% solution of glucose. At the same time with glucose, insulin should be given with the ratio of 1 U for every 5 g of glucose.

Fatty emulsions are also applied for parenteral nutrition. It is introlipid (Sweden), lipofundinum (Germany).

During parenteral nutrition, it is very important to enter potassium salts, because the introduction of concentrated solutions of glucose in a complex with amino acids generates hypokalemia. Therefore, even for the lack of deficiency it is necessary to enter 3 g of potassium chloride for every 150 g of infused glucose. The control over potassium level and other electrolytes in blood serum is obligatory.

Lecture IV

MEDICAL MANIPULATIONS IN THE PROCESS OF EXAMINATION AND CARE FOR SURGICAL PATIENTS

TRADITIONAL METHODS

The simplest method of examination of patients is anthropometry. This is an examination of the physical development of a person. Height, weight, circumference of the chest, respiratory function (spirometry), muscular forces (dynamometry) are determined. This manipulation is conducted while patient admission to the medical establishment, sanatorium, or rest home. It is obligatory in sanitary establishments unlike to medical hospitals.

Height is measured with an auxanometer. While measuring the height, the patient stands with his back to the post, touching it with his heels, buttocks, shoulder and back of the head. The head is in such position so that the corners of the eyes and the top edge of the external acoustical duct are on one and the same line. The height is determined after lowering the board onto the head with its bottom edge. In some cases height is measured sitting.

Weighing is carried out on medical scales. The patient is weighed at admission to the medical establishment and further no less than once a week, under the same conditions: on an empty stomach, in underwear, after emptying the urinary bladder and intestines. Seriously ill patients are weighed sitting.

Circumference of the chest is measured with a centimeter tape, putting it in the front on the 9th rib under the nipples in men, and in the back under the lower corners of the scapula. Hands are lowered; breathing is voluntary without any deep inhalations and exhalations. Measurements are conducted at the height of inhalation and exhalation.

Spirometry is carried out with the help of a spirometer. The patient takes a deep breath, holds the nose and slowly exhales deeply into a glass tip in the mouth. The tip is sterilized by boiling.

Bed sores prevention. More often bed sores appear on the back of the head, shoulder, spinous process of the vertebra, sacrum, heels, iliac bone, pubis, sternum, etc. The skin on these areas is wiped with a disinfectant solution (camphor spirit, liquid ammonia, cologne, etc.), and a rubber circle covered with an oilcloth is laid under the areas where bed sores are probable. The rubber circle is laid so that the sacrum is inside of it and the bed does not touch it.

Washing the patient. Equipment: jug, dressing forceps, sterile cotton tampons, water or disinfectant solution ($KMnO_4$, furacillin 1:5,000 etc.). The temperature of the solution should be 35–38°C. While washing under the buttocks, a vessel is laid. The patient lays on his back, legs are bent at the knees, hips are separated. They take the jug in the left hand, and pour the external genitals. A cotton tampon is used to wipe in the direction towards the anus. After that, the surface is dried with dry tampons. In women, syringing is applied with the help of a tip which is entered into the vagina with the depth of 6–7 cm.

Processing the mouth. The mouth of seriously ill patients is processed with the help of a spatula, tweezers and platens damped with a 2% solution of soda or a 5% solution of boric acid, potassium permanganate or warm water.

Processing the eyes. The eyes are washed with the help of sterile gauze tampons moistened in a 3% solution of boric acid. Instillation is performed by a special pipette, the lower eyelid is pulled down by the left hand and a drop is released closer to the nose. After a little waiting, the second drop is released, and the patient is suggested to close his eyes. The rest of the medicine is soaked up with a cotton swab. Ointments are put under the eyelid with a special spatula.

Processing the ears. While forming wax plug in seriously ill patients, drops of peroxide of hydrogen are put in the ear, and then the plug is taken out with the help of a gauze turunda. It is possible to wash away the wax plug with a Furacillin solution. The Janet's syringe for 150 ml is applied. The patient is seated sideways to the doctor and with his hands he holds a a barrel-like wash-basin under the ear lobe. The auricle is pushed back and upwards. The cannula of the syringe is entered into the external acoustical duct and slowly the piston of the syringe is pressed. When the drug-solution is brought into the ear, the nurse moves the auricle back and upwards, the patient bends his head in the opposite direction, and the medicine is dropped into it, counting the amount of drops; after that the external acoustical duct is closed with a cotton swab.

Care for the nose. For removing scabs from the nose turundas are entered into the nasal entrance, moistened with vaseline oil or glycerin and in some minutes, while rotating them, take them out with the scabs.

Care for the hair. The simplest method is combing, but, as a rule, it is not applied in medical establishments.

Body temperature. The measuring of the temperature is a daily duty of the nurse. The medical thermometer is calibrated from 34 up to 42°C. The mercury column does not fall down by itself, it needs to be shaken down. Thermometers are kept in cups with disinfectant solutions (3% solution of hydrogen peroxide, 0.5% solution of chloramine). Before use the thermometer needs to be wiped with a towel, bring the mercury mark to 35°C and place it under the patient's armpit, preliminary wiping it with a towel for sweat. The vessel with mercury should be densely touched by the patient's body. The patient should hold the thermometer for 10 min. For seriously ill patients, it is possible to measure temperature in the rectum, but it is necessary to remember, that the temperature is 0.5–1°C higher there. Before entering the thermometer into the rectum, it is necessary to grease with vaseline. Children's temperature can be taken in the inguinal wrinkle. The child bends his leg in the hip, so that the wrinkle in the groin will appear. Time of measurement of temperature: 6–7 am and 4–5 pm. While measuring temperature the patient should sit or lie down. With the presence of family the temperature may increase by 1.5–2°C. The temperature is written down in the temperature sheet. In the morning the body temperature is always lower than in the evening.

Agents influencing blood circulation. In connection with the fact that mustard plasters, jars, leeches, compresses, baths can entail heavy complications in patient, the nurse should know well the indications and competently technically performs them.

Mustard plaster. Validity of mustard plasters is determined by their specific smell of mustard oil, and they should not flake off. The sizes of mustard plasters are 12×18 cm. Mustard is put on dense hygroscopic paper in a special manner. It is possible to apply mustard plasters on all areas of the body except for the bottom of feet and palms. Before applying mustard plaster, moisten with water (water temperature no more than 45°C) and put with the mustard underneath for 10–15 min. It is better to put a layer of gauze or thin paper under the mustard plaster, and a towel above. It is necessary to remember that with long-term expositions burns, even of II degree, are possible. After mustard plasters removing, the skin needs to be washed with warm water, wiped dry, and the patient should be wrapped in a warm blanket.

Mustard baths. For a mustard bath the water temperature should be 50°C. 50 g of dry mustard should be used for a bucket of water. Time of exposition is 20–30 min. After a mustard bath the feet are washed by warm water and wiped dry. After a mustard bath the feet are better to put on warm socks.

Cups. There are different kinds of cups: usual — Bier's cups and wet cups. The amount for one patient can range from 10 to 20. When applying cups, the patient lays on the belly or on the side. A metal core with a cotton swab on the end is moistened with spirit or ether. The unnecessary liquid is pressed out so as not to burn the patient. If the skin is very hairy, it should be shaved or densely greased with vaseline. The cup is held in the left hand close to the patient's body, with the right hand enter an inflamed tampon into the cup and as soon as it goes out, quickly put the cup on the body. The inflamed tampon can not be held in the cup for a long time, because it makes a cup too hot. The patient's hair should be covered during this procedure with a towel. The cups are kept on usually 15–20 min. Remove them cautiously: incline to one side, pressing on the skin with a finger. Haemorrhages and oedema are on the skin after cups removing. The skin on the site of exposition is cautiously wiped from vaseline. After use the cups are wiped with spirit and are stored in a special box.

Bloodletting. During bloodletting the patient should lay so as not to see the blood, because it may course fainting. A pillow is put under the ulnar bend so that the upper extremity is straightened at the elbow; they cover the pillow with a towel and oilcloth. The skin is disinfected. Equipment for bloodletting: syringe, needle with a thick tube through which blood goes in graduated utensils. 300–500 ml of blood is taken from the patient. A tourniquet is put on the patient's shoulder so that there is a pulse on a.radialis. The patient should gripe and undo his fist several times. The index finger of the left hand fixes the vein, and the right one needles into the skin (the incision of a needle should be directed upwards), then the vein. While piercing the wall of the vein, a typical push is felt. After piercing the walls of the vein, the needle is moved upwards by 2–3 cm. If blood is not drawn from the needle, it is necessary to pull it towards yourself and try again to pierce the vein. During bloodletting it is necessary to watch the patient closely. After bloodletting the ulnar bend is disinfected and bandaged.

Leeches. Special medical leeches are applied. One leech sucks from 6 up to 10 ml of the blood. Usually 6 to 12 leeches are used. It is impossible to put leeches on areas where arteries and veins are close to the skin, because erosive bleeding can occur. The skin, where leeches are applied, is moistened with sweet water. They place the leech in a test tube with its head towards the opening. They put the test tube at the necessary place. They wait until the leech sticks to. The leech sticks to the skin for 30–60 min, and then falls off by itself. If it is necessary to remove it earlier, it is moistened with salt water. It is impossible to tear them off. Aseptic bandages are placed on bleeding sites. Leeches are used one time, and then they are distroyed.

Warming compress. It consists of a piece of dense hygroscopic tissue moistened and pressed, oilcloths or wax papers, cotton and bandage. The warming compress promotes blood flow and resorption of the inflammatory infiltration; it can be put on any part of the body. Each following layer of the compress should be 2 cm wider than the previous one. Firstly the compress is prepared, and then put on any site, fixed with a woolen scarf. Duration of a compress exposition is 10 h. The compress is changed in the morning and in the evening. Solutions for compress: warm water, light solution of vinegar (one teaspoon for 0.5 l of water), vodka, cologne, etc.

Cold compresses are applied on the wound. A cotton tissue is moistened with cold water and put on the injured area for 10–15 min.

Poultices. Applied as an anti-inflammatory agent. Heated up linen seed, chaff, salt or sand are used for this purpose.

Hot-water bags can be rubber and electric. The rubber hot-water bag is a 1.5–2 l reservoir with a screwed top. Hot water is poured into the bag only to 3/4 of the volume, let out the free air and screw on the top. After that, check for tightness by turning the hot-water bottle upside down, wrap in a towel and put on the sore place. It is necessary to periodically observe the skin under the bottle. The bottle is indicated very carefully in cases of abdominal pain (the bag is categorically contraindicated for acute appendicitis).

Ice blister. It is prescribed in bleeding. Usually the round rubber reservoirs with a wide hole and top are used. Crushed ice is put into the reservoir, screw on the top, cover with a towel and put on the body. It is not recommended to use a blister for more than 30 min. After a 2-hour break the exposition can be repeated.

Baths can be sedentary, general, manual, gentle, and medical etc.. If the temperature of a bath is lower than 20°C it is a cold bath, 20–34°C — cool, 34–35°C — indifferent, 36–40°C — warm, 40°C and higher — hot. The nurse should observe for the procedure constantly.

Wiping (sponging). It is applied for treatment of itching and as a tempering. They take 2 bed sheets, wrap up the patient, wipe him with one of them moistened in warm water, then the same patient is repeatedly wrapped up with a cooler bed sheet. After wiping, the skin should be dried with a dry towel.

In the department, the senior nurse writes out the medicines according with to applications of the ward nurses who daily write out the medical assignments from medical histories to special writing-books or sheets, which are individual for each patient, and submit the list of drugs appointed to each patient to the senior nurse.

Drugs which belong to the A and B list are stored separately in special safes. A list of preparations which belongs to the A and B list (soporifics, codeine, platyphyllin, etc.) with instructions of the greatest single and daily doses, should be placed on the inside of the door of the safe. Stocks of narcotics should not exceed a 5-day requirement. Stocks of strong drugs should not exceed a 10-day requirement. Medicines which contain narcotics are subject to an object-quantitative account in a special journal, numbered and stamped. In the log-book of narcotic preparations, each analgesic is given a definite sheet, where the name of the medicines, amount, date of application, surname, name of the patient, number of his case record, amount of used ampoules and any remainder are specified.

There are different methods of giving drugs:

— external — through the skin, mucous membrane, respiratory tracts;

— enteral — through the mouth, under the tongue, through the rectum;

— parenteral — administration of medicine into an organism outside the digestive tract.

External Usage of Drugs

Only fat-soluble drugs are absorbed through the excretory ductules of the lacrimal gland and hair follicles of the skin; therefore the external use of medicines is directed, first of all, at their local action on the skin, mucous membrane or wounded area.

Rubbing — administration of drugs through the skin like liquids or ointments. Rubbing is conducted on the following parts of the skin: the bending surface of the forearm, the back surface of the hips, lateral surfaces of the thorax, abdomen that is such areas where the skin is thinner and not covered with hair. If the hair can be shaven there, it is necessary. The skin should be clean on the rubbed area. The necessary amount of ointment or liquid is put on the skin and rubbed in circular movements until the skin becomes dry. Contra-indications to such a procedure: inflammatory changes of the skin (eczema, dermatites, etc.).

Greasing as a method of different drugs administration is widely applied mainly in skin diseases. Cotton or gauze tampons are moistened in the solution and applied to the skin of the patient with easy longitudinal movements. With the presence of hair, greasing is conducted in the direction of its growth. With purulent diseases, the skin is greased around the focus of damage from periphery to the center.

Plaster is a sticky ointment base of dense consistence covered with impenetrable gauze. The ointment base contains active drugs. Contra-indications to the application of plaster are following: eczema, allergic dermatitis. Before applying a plaster the skin is diligently degreased with medical spirit, and the hair is shaven. They remove the plaster gradually; starting with one edge, which is moistened with spirit.

Powdering or sprinkling with powdery drugs (talc or rice powder) is applied for drying the skin for intertrigo and hyperhidrosis. A powder is applied to the skin on the hyperhidrosis site with a clean cotton tampon.

Aerosol inhalation is appointed to a patient for the improvement of bronchial permeability: dicreasing of sputum viscosity, fight against infection, protection of the respiratory ways mucosa from harmful action of irritating agents. The advantages for administering drugs by way of inhalation are following:

1. Direct action to the pathological process in the lungs.
2. The agents get to the focus of damage beyond the liver unchanged, which predetermines a high concentration of the drug.

Disadvantages:
1. Inaccuracy of dosage.
2. Bad penetration of aerosol into the pathological focus during acute insufficiency of bronchial permeability.
3. A possible aerosol causes irritation of the mucous membranes.
Steam, thermal and oil inhalations are used in medical practice. For steam inhalation a simple steam inhaler is used. While heating water, the steam that is formed, sucks in the drug and disperses it, creating an aerosol which a glass tube puts into the respiratory tract of the patient. For inhalation, solutions of menthol, eucalyptus, antibiotics are applied. Temperature of the aerosol is 57–60°C. While conducting thermal inhalation, a compressor, which carries out dispersion by the compressed air, is used. The aerosol has the temperature of 39–40°C. For inhalation a 2% solution of house-hold soda in a mix with alkaline mineral waters and solutions of antibiotics are applied. With oil inhalation, the oil, covering with a thin layer the mucous membrane of respiratory tract, protects it from mechanical and chemical agents and prevents the absorption of toxic substances.

Instillation of drops into the ear. Before instillation into the ear, the drops are warmed up to the body temperature because the cold drops irritate the labyrinth and can cause dizziness. A pipette is used for instillation into the ear.

Enteral administration of drugs (through the mouth, under the tongue and into the rectum) is the most popular way of treatment because it is the simplest and most convenient method of taking different medical forms (dragee, tablets, capsules, powders). Disadvantages of this way are incomplete absorption of preparations in the digestive tract, partial or full destruction of the medical forms by the digestive enzymes, inactivation in the liver, impossibility to provide a certain concentration of medicines in the blood.

Tablets, dragee or capsules are put on the root of the tongue and washed down with a drink of water. Taking a powder, the patient unwraps the wrapper, forms it into a groove and pours out the contents onto the root of the tongue, washing it down with water. It is possible to dissolve the powder first in water and then drink it after.

Water solutions, infusions, mixtures, broths are given to patients in graduated beakers.

Spirit infusions, extracts and some medical solutions are appointed in capsules. The necessary amount of drops is measured with the help of a pipette into a beaker, add water, and given to the patient to drink.

Some drugs (validol, nitroglycerine, sex hormones, etc.) are taken under the tongue. The good blood circulation in the mucous membrane of the mouth provides full and fast absorption of medicines. With such administration, a medicine is not destroyed by digestive enzymes and enters the general flow of blood circulation, outside the liver.

Administration of medicines into the rectum is given to patients with intestinal impassability, dysfunction of the act of swallowing and mental patients who refuse to take medicines.

Sometimes administration of medicines is taken place by means of electrophoresis.

Parenteral Administration of Drugs

Injection is the administration of drugs intracutaneously, subcutaneouly, intramuscularly, intravenously, intraarterially, intracostally and into the spinocerebral channel, and in different cavities of a person. The nurse should master the techniques of injections. For drugs, recently, disposable plastic syringes of different volume are used — from 1 up to 20 ml; "Luer" and "Record" syringes were used earlier. In some cases a syringe-tubes (basically in war time) is used. For intravenous injections needles with the length of 5–6 cm and the opening of 0.3–0.5 mm are used. Needles with the length of 3–4 cm and an opening of 0.5–1 mm are used for subcutaneous injections, needles with the length of 8–10 cm and the opening of 0.8–1.5 mm are used for intramuscular injections. Syringes are stored in special cases, a brass mandrin should be on the tip of the needle. It is necessary to check the passability of needles before the injection. Syringes are assembled with the help of tweezers. The left hand takes the cylinder, the right one inserts the piston into the cylinder. The little finger of the left hand holds the piston, the right one with the help of tweezers puts the top on the needle. Medicines are collected from an ampoule which is hold with the 2–3 fingers of the left hand into a syringe. Before filling the syringe with the medicine, it is necessary to read the name of medicine on the ampoule (!). It is necessary to have two needles always: one for a set of medicines, the other one — for the injection. Medicines are collected into the syringe by suction, pulling the piston.

Intracutaneous administration of drugs. For this purpose it is better to use the anterior surface of the forearm. The needle enters only to the corneal layer of the skin. It is possible to administer intracutaneously only 0.1 ml of solution. After administering, a knoll like lemon peel forms on the skin.

Subcutaneous introduction is applied for fast action drugs. The most convenient for hypodermic introduction are the following areas: external surface of the shoulder or radial edge of the forearm, infrascapular area, anterior external surface of the hip, lateral surface of the abdominal wall and the bottom part of the inguinal areas.

Intramuscular injections are done on the following areas: external top quadrant of the gluteal region (remember the gluteal nerve which passes in the internal quadrant of the gluteus), muscular hips (its external surface), abdominal direct muscles, etc.

Intravenous introduction of drugs. The techniques is similar to that of bloodletting. More often, for intravenous introduction the ulnar veins, less often — veins on the hand or subclavian veins are used. For administering a large amount of liquid disposable systems are applied. It is possible a jet introduction of liquid into the vein.

Venesection is rarely applied now. It is already a small operation, and it is carried out by surgeons under operational conditions.

Pleural tapping is carried out with diagnostic and medical purposes. For diagnostic tapping a 20-g syringe and a needle of 7–10 cm in length with the tip of 1–1.2 mm and abruptly oblique end are applied. Prepation for the tapping is the same as for an operation. The patient sits on a chair with his face towards the chair back, hands being in front on the chest. The tapping is carried out in the area between the 7th–9th ribs behind the middle average axillary line to the right or left, other intercostal spaces are possible depending on the purpose.

Puncture of the abdominal cavity is a very important diagnostic and medical method. The needle is the same as in pleural tapping, and the same diligent aseptics are applied. The puncture is done, as a rule, a little below the navel along the middle line.

Paracentesis is a more complicated puncture of the abdominal cavity with the help of a special device — a trocar. The trocar consists of the cylinder with the diameter of 0.3–0.5 cm, in its middle on the handle — a sharp metal tip, which sticks out by 2–3 mm. After disinfecting the skin with subcutaneous fat is anesthetized, with the scalpel only the skin is incision and the trocar is entered the abdominal cavity with rotatory movements. The trocar is held like a spear. After entering the abdominal cavity, the spear is taken out. Through the trocar it is possible to administer a catheter or liquid into the abdominal cavity.

Arthrocentesis — a simple manipulation, but it requires the strictest aseptics. The joint is punctured at the site where there are no main vessels and nerves. The puncture is carried out for diagnosis and administering medicinal substances into the joint.

Paracentesis of the urinary bladder is carried out with acute retention of the urine. It is an emergency or urgent manipulation, and every doctor should master it, irrespectively of his speciality. A thick needle punctures the bladder behind the medium line above the pubis; the skin is moved to the side. The observance of aseptics and anaesthesia is obligatory.

Pulse examination. Elementary medical manipulation. Pulse is examined in a sitting or laying patient by 2–4 fingers. It is impossible to measure the pulse by one finger (and also feel your pulse). Examine the frequency, rhythm, strain and filling of the pulse. Calculation is conducted for 30 s to 1 min.

Measurements of arterial pressure. Korotkov's method with the help of the Riva—Rocci devices is popular. Recently, truly, a majority of doctors measure arterial pressure with the help of a sphygmomanometer. There is an arrow which specifies the arterial pressure. It's convenient, portable. Techniques of measurement: the patient sits or lays, a cuff put by 5 cm above the elbow bend. With a stethoscope or phonendoscope, the beating of the pulse on the above the ulnar artery are auscultated. With its disappearance, start releasing slowly air from the cuff. When the beating of the pulse is heard again, this is the systolic pressure, further continue releasing the air until the tones disappearance, this is the diastolic pressure.

Measurement of venous pressure is conducted with the help of the Valdman's device. The ulnar or clavicular vein is punctured and connected to the device. Venous pressure is measured in millimeters of water column. Normally the VP ranges from 50 to 100 mm of water column. The patient during inspection should lie.

Throat swab. The patient opens his mouth widely. With a spatula they squeeze the root of the tongue, wipe the tonsils with a sterile tampon, then the posterior wall of the throat and arches. The edge of the test tube, where the tampon was placed, is burnt.

Gastric intubation is applied to examine gastric juice, artificial feeding and gastric lavage. For this purpose thick and thin gastric probes are used. If the thick probe is applied — the contents of the stomach flows out itself, during washing with a thin probe, it is necessary to extract with the help of a Janet's or "Record" syringe. The thick probe is entered through the mouth, the thin one is also possible to enter through the mouth, but it is entered through the nose then it irritates the throat less without retching. The equipment for gastric lavage: a watering can for 1–1.5 l, thick gastric probe (length up to 1.5 m), a jug with water or a Janet's syringe, solutions (water, 2% solution of soda, 0.1% solution of $KMnO_4$ (light pink)), oilcloth apron, bucket for water, stomach contents. Techniques of procedure: the patient is sitting, leaning on the back of the chair, the head is inclined forward, knees are separated. Before gastric lavage it is necessary to dispose the patient psychologically and diligently explain him the meaning of the happening, what the patient and doctor should do. The depth for entering the gastric probe is the distance from the front teeth to the navel plus the width of the palm of the patient's hand.

The bedpan is applied for emptying the bladder and intestines for bedridden patients. There are enameled and rubber bedpans. Before giving the patient the bedpan it is rinsed with hot water. The nurse, with one hand under the sacrum, helps the patient rise a little, and with the right hand between the separated legs brings the bedpan under the gluteus. Cautiously she takes away the bedpan not to spill its contents on the bed, at once the bedpan is covered with an oilcloth or newspaper and is taken out to the toilet room. After defecation the patient needs to be washed.

Flatus tube is applied in meteorism, delay in emptying the intestines and gases, which happens frequently in patients after operative interventions. The soft rubber thick-walled tube with the length of 30–50 cm and a diameter of 3–4 cm is applied for this purpose. On the part which will enter the rectum it is necessary to make some punched holes. The tubes are boiled, greased with sterile vaseline or other fat; the patient separates his gluteus and with cautious movements the tube is entered into the anus so that 5–6 cm are left externally. The external end of the tube is wrapped in cotton wool or gauze. It can be lowered into a bedpan with water. Hold the tube in the rectum no more than 2 h (avoidance of bedsores).

Enema. In healthy people intestines are emptied once a day. After an operation patients frequently have constipation, in these cases if there are no contraindications, laxatives or enema are used. Also the bowel should be opened before radiographic examination, before operations and abortions. Enema is entering of a liquid into the lower part of the thick intestines. There can be cleaning, siphon, nutrient, medical and drip enemas.

Cleansing enemas are made with Esmarch's mug (enameled capacity of 1–2 l) with a rubber hose with the diameter of 1 cm and the length of 1.5 m. There is a valve and tip on the end (glass, ebonite or plastic) with the length of 8–10 cm. Technique: the patient lays on the left side with legs bent and brought to the stomach, less often on his back (postoperative patients). The capacity and rubber tube are filled with water, the tip is greased with vaseline, the buttocks are separated, and the tip is entered with the depth of 5–6 cm. The tip is entered, first, upwards and forward, and then rotating towards the sacrum. The tip needs to be entered accurately so not to injure any haemorrhoidal nodes, if there are any, and the mucous membrane. The Esmarch's mug after opening the valve is lifted up to 1 m, in some cases it is necessary to add 1–2 l of water, constantly watching so that air does not enter the intestines.

After entering water, the patient should keep it for 10 min, lying on his back, and only after that the intestines are emptied into the bedpan or toilet. In some cases it is necessary to use a finger to get feces from the ampoule of the rectum that was stopped up. For increasing the effect of enema a little bit of children's soap, 2–3 spoons of oil or glycerin, 1–2 spoons of kitchen salt, 30–40 ml of 3% of hydrogen peroxide, chamomile extract with valeriana root, etc. can be added to the water. The temperature of water should be near 20°C.

Siphon enema. When a cleansing enema does not help, a siphon one is applied. It works acccording to the principle of the connected vessels. Structure: a watering can, rubber tube 1.5–3 m in length and 1.5–2 cm of diameter with a control glass without a tip. It is better to use a thick gastric probe for this purpose. The temperature of water is 38°C (warm). Position of the patient is the same as for cleansing enemas. The end of the probe is moved towards the sigmoid intestine as far as possible, supervising its position in the rectum with the index finger. The watering can discended, filled with water and slowly rised up to 1–1.5 m. As the can gots empty, more water is added. As soon as the patient becomes disturbed, the can is lowered and inclined into the bucket where the liquid goes out. This is repeated several times, the amount of water used in a siphon enema is up to 10 l.

Medical enemas are general and local. Microenema — 50–100 ml of solution, the temperature is no less than 40°C. Before applying the medical enema, the cleansing one is done. The microenema contains nonpathogenic, soothing, anticonvulsive, somnolent substances. With the long-term use of medicinal substances, the drip method is applied and the enema is called drip. The speed of introduction is 60–80 drops a min. It is possible to give up to 3 l of liquid a day.

Nutrient enemas are applied when patients cannot be fed by usual methods. Nutritious solutions are entered into the rectum by the drip method (water, amino acids, spirit, glucose, fibers). Volume of nutrient enemas is 250 g, the temperature — 38–40°C, 1–2 times a day.

Catheterization of the bladder. It is applied in urinary retention. It is possible to carry out after reflex empting of the bladder is attempted (we've already mentioned it above). Catheterization is the administering of a catheter into the cavity of the bladder. It is a dangerous manipulation, and each doctor should know its technique. There are different types of catheters: soft — rubber and firm — metal, female and male. Before using a catheter it is necessarily to disinfect it. Metal catheters consist of a handle, core and beak with two apertures. A male catheter has the length of 30 cm, female — 12–15 cm and the beak is less curved. The technique of catheter introduction in the woman: the woman is irrigated, with the left hand they separate the labia majora pudendi, and with the right one they enter the catheter through the external aperture of the urethra into the bladder. The metal catheter is held with the hand, the rubber — tweezers. Catheterization in women is relatively easy, in men — difficult. The length of the urethra in men is 20–25 cm and it has two physiologic constrictions. Technique of performance: the patient lies on his back; between the legs there is a urinal. They take the head of the penis in the left hand between the 2nd and 3rd fingers, disinfect it with sublimate or spirit. With the right hand and with the help of tweezers they enter the rubber catheter, disinfected and greased with liquid vaseline. The catheter is held with the help of the 5th finger. Technique of catheterization with a metal catheter: with the left hand take the head of the penis, the straight part of the catheter is directed towards the navel, and the beak downwards. They pull the penis onto the catheter so that the beak covers it completely. After that, the catheter elevates upwards vertically, guided by the flaps on the handle. It is impossible to spare much effort, because the bleeding is possible.

MODERN WAYS OF DIAGNOSIS AND TREATMENT IN SURGERY

Laparoscopy

The method of laparoscopic examination (whether peritoneoscopy, pelvioscopy, etc.) was suggested in 1901 by a Russian doctor D. Ott. However, at first it did not receive a wide spreading and recognition due to a number of reasons, the main of which was the absence of special equipment. Enthusiasts of this method of examination used a thoracoscope, cystoscope for a long time. Recently, laparoscopes with high-wave optics and a conductor of a cold jet of light to examine the organs have appeared. They have completely replaced models of optical tubes existing before. These laparoscopes appeared to be effective enough not only in elective but also in emergency surgery, gynaecology, in detection and differential diagnosis of traumas of the abdominal cavity, pelvis minor and retroperitoneal cavities. Modern laparoscopy works out not only the tasks of visual diagnosis of diseases of the organs of the abdominal cavity, pelvis minor and retroperitoneal cavity. In a combination with instrumental palpation of the abdominal organs, radiographic contrast study of the hepatobiliar and pancreaticoduodenal zones, cholecystostomy and biopsy of cancer suspicious formations and other operations under laparoscopic control (such as cholecystectomy, appendectomy, ovariectomy and even resection of the stomach and removal of the whole large intestines and a lot more) are performed.

Principles and Technique of Complex Laparoscopy

Laparoscopic examination consists of the following stages: preparation of the patient, application of pneumoperitoneum, introduction of trocar and an optical tube, examination of the abdominal cavity, instrumental palpation, target biopsy, photolaparoscopy and the end of the examination. Psychological preparation of the patient: the patient should know what kind of examination will take place and understand its necessity. It is necessary to cleanse the gastrointestinal tract, carry out premedication by administering 1 ml of 2% promedol and 0.5 ml of 0.1% solution of atropine.

Application of pneumoperitoneum: piercing should be done at a distance from the enlarged organs, vascular prexuses and from the possible sites of adhessions. The place of applying pneumoperitoneum should be the place for applying the trocar and optical tube. The best one for this purpose is the point located on the middle line 2–4 cm lower than the navel. There are no vascular formations there, it is convenient for applying imposing pneumoperitoneum, applying the optical device and examining all the organs of the abdominal cavity and pelvis. The pathological formations are seldom observed there, which excludes their wounding.

Introduction of trocar. At the moment of trocar application the patient should tense the abdominal wall so that the doctor can feel the resistance of the aponeurosis of the white line of the abdomen. It is undesirable to cut the aponeurosis, because of hernia formation at this place. It is possible to fix the anterior abdominal wall, which helps in applying the trocar. The trocar should be directed at the angle of 45–60° in relation to the axis of the patient's body. There is no need to enter the trocar more than 0.5 cm into the depth of the abdominal cavity.

Overview of the organs of the abdominal cavity is carried out consistently. Starting with the right hypochondria, then the left, the pelvic cavity and finish with the right hypochondria again. If the purpose is local or target exam, first of all the area under interest is surveyed.

After the end of the exam and other manipulations in the abdominal cavity, the optical tube is removed, and then through the trocar's crane gas is let out from the abdominal cavity; one suture is applied on the wound.

Endoscopic Examinations

The development of fibrous optics and the creation on its base of the endoscopic fiberscope in the 60s of XX century is the best achievement of science and technology. The introduction of endoscopic methods of examination in clinical practice determined the progress in many sections of medicine: gastroenterology, pulmonology, obstetrics, gynaecology, urology, pediatrics. The development of special equipment and the application of radiological techniques, electric current, ultrasound, laser and other physical, chemical and biological factors during endoscopic interventions have transformed endoscopy into an independent field of medicine with opportunities of studying the pathogenesis, pathophysiology of diseases, solving diagnostic, tactic and medical tasks. Endoscopy became the property not only of large clinical centers but also the achievement of practical public health services even in regional hospitals. It is necessary to realize that now the qualified work of doctors of many specialties is inconceivable without endoscopic examinations.

Modern endoscopes are created on the basis of fibrous optics. Flexibility made them safe and effective, providing wide practical application. The most rapid period of new endoscopes introduction fell on 60–70-s of the XX century, their amount increased. The most widespread are endoscopes from the companies “Olympus” (Japan) and “ASM” (USA).

Ultrasound Diagnosis in Surgery

In clinical medicine ultrasound diagnosis began to be applied at the beginning of the 50s of the XX century. That time the equipment intended for revealing cracks in metal objects. For the next four decades there was a rapid development of ultrasound diagnosis, technical improvements, which allowed to extend diagnostic opportunities of ultrasound devices. Today one can say with certainty that ultrasound researches have occupied one of leading places in modern clinical medicine.

Cryosurgery

The application of cold together with medicinal herbs and bloodletting is the oldest in the history of mankind method of treatment. In the works of the “Father of Medicine” — Hyppocrates — the medical effects of local application of cold to stop bleedings in wounds and traumatic oedema are described in details. Cold is the oldest anesthetizing agent. In the Middle Ages military surgeons used it as anaesthesia during surgical operations.

Despite the fact that cryosurgical treatment of different damages to the skin began a long time ago, the rapid development of cryosurgery in the modern meaning of this term became possible only as a result of technical progress and the opportunity to create complicated modern devices for cryogenic destruction in the depth of tissues and organs of a patient. Cryosurgery is widely applied in neurosurgery, ophthalmology, othorhinolaryngology, gynaecology, and urology. The first cryosurgical operation in the former USSR was conducted in 1962 by I. Kooper, and A. Li in 1961 offered the device like a metal probe through which liquid nitrogen is able to enter directly the pathologically changed organs — their parts, mucous membranes, skin. In 1971, Laberopulos proposed a cryoscalpel.

E. E. Sandomirsky and coauthors (1979), A. I. Paches and coauthors (1978), V. M. Zaporozhan (1982) and many other authors, who studied the peculiarities of influence of low temperatures onto the organs and tissue with different kinds of pathology, showed that cryosurgery is a physiologic and sparing method of treatment, which is exsanguinate, painless, less traumatic, has high technical opportunities, absence of complications, which allows to use it in medical practice.

Application of Laser Beams in Surgery

At the beginning of 60-s of the XX century, due to the researches of the Nobel Prize winners N. G. Basov and A. M. Prokhorov and their American colleagues C. Tauns and A. Shavlov, the new principle of increasing radiowaves with the help of a bundle of “active” molecules was investigated. The optical quantum generator, which operates on a crystal of artificial ruby was created.

The essence of the laser action consists in the following: during the activity of a powerful light flash created by a pumping light, the active substance turns to the excited condition. In a certain time period (105–106 s) a part of the excited atoms comes back to the initial condition, thus releasing light quantum. Due to numerous reflection from resonator’s mirrors the amount of collisions of photons with active substance increases, therefore an avalanche of light quantum, which after achieving a certain capacity escapes as a bright light impulse with a very high concentration of energy, forms.

The first working laser plant was designed in the USA in 1960. Since the studying of the biological interaction of laser radiation with biological objects has started. Researches concluded that the laser beam can be manipulated with high accuracy, influencing areas of tissues of any size, groups of cells, endocellular structures, for example, the nucleus of a cell, etc.

First, the laser was applied mainly in oncology, ophthalmology and some other fields of surgery and subsequently received wide recognition in medicine.

Ultraviolet Irradiation of Blood

The first positive results from clinical application of irradiation by ultra-violet rays became possible after the invention of the first device for irradiation of blood (E. K. Knott). In 1928 for the first time in the world, the reinfusion of irradiated blood was conducted in a patient after a septic abortion, which was treated earlier without success. After this therapy the patient recovered. Since the 80s, ultra-violet irradiation of blood (UVIB) has been widely applied in medical establishments. For irradiating blood, lamps, which radiate ultra-violet rays both of the short and mixed type, are used. The reinfusion of irradiated blood promotes the pain disappearance, wounds healing, the general state of health improves, working ability increases, sleep and the body temperature normalizes. The method has no complications and contraindications and has the following action:

— bactericidal, antibacterial;

— anti-inflammatory;

— desintoxication;

— stimulates oxidation-reduction reactions, reduces hypoxia in tissue;

— raises the resistance of an organism to infections;

— stimulates phagocytosis, etc.

Lecture V

DESMURGY

Desmurgy is a doctrine of bandages. It is an independent section of general surgery. It is the teaching of applying bandages with the purpose of treatment of injuries and some diseases. The term "desmurgy" means a branch of practical surgery which studies the applying bandages. It includes two concepts:

1. The bandaging material, which is applied directly to the wound (dry, damp, ointment bandages).
2. The external part of a bandage, which is applied for the fixing of the bandaging material on the wound.

A bandage in a wider understanding means a complex of agents applied with the purpose of protection of wounds or pathological cells from the influence of the environment for a more or less long-acting term.

In a narrow sense, a bandage means a material (bandage, plaster, etc.), which is applied on a wound for fixing the bandage material with medical agents. Finally, the term "bandaging" means a process of applying or changing medical bandages with its fixation.

The beginning of using bandages dates from the ancient times. Hippocrates wrote about the application of dry bandages and aseptic bandages (cloths moistened with wine, alum, copper salts) and about ointment bandages (moistened with oils), drainages etc. Sponge and dry leaves were used as bandages, for fixing the bandage — sticky plaster, pitches and external cotton bandages. In ancient India cotton, vegetative fibers, etc. were used as bandage material. On Scythian bowls (IV–III century AD), founded in the area of Kerch, there is a picture with a man who is bandaging a wound.

In the works of Celsius, bandages moistened with vinegar are mentioned. Galen applied the drainage bandages with bronze tubes.

Avicenna used gypsostarch bandages for treating fractures for the first time. In the middle ages, bandages with tampons (Roter and Roland), with turunda (Goy de Sholiak) were applied. The XVIII century was the start of the use of adhesive (plaster) bandages. The art of desmurgy reached the greatest development in the XIX century, in the first place due to a number of wars at that period, and secondly due to existing concept concerning protection of a wound against harmful influence of the environment (special medical-protective bandage of J. Lister, 1867).

M. I. Pyrogov's contributed much to desmurgy. He repeatedly touched technique of bandaging in his book "Beginning of general field surgery development," in which he presented his experience of plaster bandages application on the battle-field.

The classical principles developed by the end of the XIX century were assumed as the basis of modern desmurgy. New achievements in science, though they did not pass over this ancient sphere of medicine, nevertheless did not change it substentially. Bandages are the basis of desmurgy till now.

There are some general tendencies in the desmurgy development. First, trying to make a complex of agents for applying bandages, the purpose of which is help with the work of the medical personnel during mass admission of victims.

Second, the application of glue preparations (BF-6, furoplast) for protecting wounds against undesirable external influence during treatment or providing the fixion of bandage material (cleol, collodium).

Third, the replacement of traditional bandaging material with ductile one, which provides, simultaneously a protective effect and the introduction of antiseptics directly to the damaged place due to medical additions to plastic mixes (armored cellulose bandage).

Fourth, the replacement of existing gauze bandages with tubular bandages, net rollers, which provide fast and reliable fixion of bandage material. The purpose of wounds bandaging:

— protection of the wound against harmful external influence;
— prevention of reinfections of wounds;
— sometimes stoppage of bleeding from the wound;
— fight against wound infection by agents with adsorbing and hygroscopic properties.

In his book "Physical antiseptics", M. Ye. Preobrazhensky (1894) proved that the bandage material, which absorbs the contents of the wound well, is one of the best ways of discharging infection from the wound.

If the purpose and influence of bandaging to the wound is known, it is easy to come to conclusion, which bandaging material is the most suitable and corresponds to the following requirements:

— it does not irritate the wound or adjoining tissue;

— it does not change its properties during sterilization;

— it does not lose qualities during a long-term preservation;

— it has a convenient form and, most important, — high absorbability.

Thus, the most suitable material for bandaging is cotton, gauze and lignin. These three kinds of bandages have been proven in surgery.

White cotton, which is applied for bandaging, consists of long and thin fibers. In order to make cotton suitable for bandages, it is necessary to degrease it. After degreasing, it is necessary to bleach the cotton a chloral bath and leave it for some time in the open air. After that, it should be washed with a weak solution of hydrochloric acid to neutralize the reaction. Then, it should be washed out with water and dried. A lump of such cotton drowns in water because it absorbs water quickly.

Grey, not degreased cotton, is used in the medical practice for the protection of a sore place against the external influences, for compresses, for putting under a plaster bandage, etc.

The other widespread bandage material — gauze — has got its name from the city of origin (the city of Gauze in northern France) where it was made for the first time. Gauze is a soft cotton fabric made of degreased cotton. There are many kinds of gauze; medical practice uses 2–3 kinds, which should satisfy a number of requirements.

For bandaging, only degreased gauze, which is capable of absorbing liquids, is suitable.

Two sorts of gauze are used in the medical practice: bandaging gauze that is less dense, which contains 7×8 strings on 1 cm^2, and bandaging gauze that is more dense, which contains 14×14 or 17×17 strings by 1 cm^2. The first one absorbs liquids faster; the second — slower, however it is stronger than the first one.

Lignin is mechanically and chemically processed wood of conifers and leaf-bearing trees. The color of lignin is white-yellow. It soaks up wet, pus, and easily undergoes sterilization.

The shortcomings of lignin are the following:

1. It is not sufficiently elastic and breaks into fine pieces.
2. During long preservation, it loses its elasticity and crumbles.

3. It easily breaks under the influence of wound secretion.

4. When wet, it turns into a continuous layer.

Taking this into account, lignin is applied to such wounds that are in need of changing often.

Types of bandages (according to type and purpose):

1. Simple, soft, protective or medical.
2. Preasure (hemostatic).
3. Immovable (immobilizing), transportable and medical.
4. Extendable (bandages for stretching).
5. Correctable — for unloading bones and joints, correction of erroneous positions.

Depending upon the material, which is used for fixing, the following ones are distinguished:

1. Soft bandages (bandage, contour, cravat, sling-like, etc.).
2. Hard bandages (transport and medical splints, orthopaedic devices, artificial limbs, corsets).
3. Bandages which harden (plasters, zinc-gelatinous, starch, bandages made of polymeric materials).

SOFT BANDAGES

Soft bandages are divided into:

1. Bandage:
— gauze bandages;
— knitted tubular (reticular) bandages;
— elastic textile bandages.
2. Adhesive:
— synthetic glues (cleol, collodion, BF);
— adhesive plaster.
3. Cravat.
4. Sling-like.
5. Contour:
— standard contour (suspensors, bandage, retalast, bandage);
— individual contour (made in case of need).

Bandages. Bandage — a long strip of gauze or other material is intended for fastening a bandage or immobilization support-motor apparatus (when the bandage is saturated with substances that harden — plaster, starch).

Gauze bandages till nowdays are the basic material used for bandaging. They have different width (5–20 cm) and length (5–7 m). Narrow bandages are used for bandaging finger and hand, wide ones — for bandaging the stomach, pelvis, breast, hips.

Bandages after aseptic procedures can be used repeatedly. They are soaked in a 3% solution of hydrogen peroxide with 0.5% solution of detergents, washed and sterilized in an autoclave. Bandages are washed in soapsuds at the temperature of 35–37°C, rinsed and dried.

Medical knitted tubular (reticular) bandages are intended for fixing bandaging material at any part of the body. They are produced as a roll. Unlike to usual bandages, they are not winded arouned but pulled on a damaged site of the body. Eventually, it fixes the bandaging material without impeding mobility of joints.

Elastic textile bandages are applied mainly in traumatology and sport medicine.

Adhesive bandages are applied for the protection of open damages and superficious inflamatory processes. They provide fixation of the bandaging material applied over the wound.

Cleol consists of rosin — 40 g, 96% ethyl spirit — 33 g, ether — 25 g, and sunflower oil — 2 g.

Collodion includes 4 g of colloxiline, 76 g of ether, 20 g of 96% ethyl spirit. Collodion and still better glue BF-6 can be used for protection of aseptic postoperative wounds without gauze, rendering sterile glue on the surface of a small wound (protective film).

Plaster. It is used for the protection of fresh noninfected wounds as a way of the bandaging material fixation. Adhesive plaster is used for connection of the edges of wounds. In pediatric surgery — for plaster stretching with fractures of tubular bones.

Cravat bandages. It is a piece of material of a triangular form. It is used for the bandaging material fixation, in particular while rendering first aid.

Sling-like bandages. These are strips of gauze or any other fabric incision on both sides, intended for holding the bandaging material on the nose, chin, and occipital area.

Contour bandages. They are made of pieces of material according to the profile of a closed bandaged part of the body. Contour bandages are fixed with the help of sewed tape. Sometimes for fixing the appendix, contour bandages of the stomach are used. Elastic reticular bandage (retalast) is made of rubber, braided by a cotton string. This reticular looking like a stocking (from 5 up to 20 m) seven sizes (0–6) is applied for fixing bandage material on any body area.

Technique of Applying Soft Bandages

The strict following certain rules while applying a soft fixing bandage provides the fullfillment of bandaging requirements:

1. The patient should be in a convenient position; he can lay or sit, if the damaged part of the body is approximately at the level of the breast of the rendering aid person.
2. A bandaged part of the body while applying a bandage is immobile. The endings should be in a physiological position, which provides maximal relaxation of the muscles.
3. The operator should be in front of the patient, to see any reaction to pain which is caused by the bandage.
4. The bandage is applied central (in the direction from periphery to the thorax) and begins with a fixing turn.
5. During typical application, the bandages should be held in the right hand and the free end (beginning) — in the left.
6. Unroll the bandage from left to right, without taking hands off of the surface which is being bandaged.
7. Each following turn should cover from half up to two-thirds of the width of the previous turn.

The demands to a finished bandage are following:

1. The bandage should reliably fix the damaged area until the following bandaging.
2. The bandage should be put on firmly but not tightly; it should not give feeling of discomfort to the patient.
3. The bandage should be even, without any wrinkles and nice-looking.
4. The bandage should make even pressure upon the corresponding part of the body and be immobile.
5. The knot at the end of the bandage cannot be on the damaged area of the body.

Basic Types of Bandages

1. Circular bandage. It is convenient when bandaging circular surfaces. Each following turn covers the previous one. Sphere of application: the lower third of the shoulder, ankle joint. A disadvantage is that the circular bandage can turn around, displacing the material.

2. Spiral bandage. It is applied on the extremities, trunk, and thorax. The bandage is very simple and is quickly applied, but it can easily slip down.

3. Spica bandage. It is applied for fixation of a great amount of bandaging material on the extremities.

4. Cross bandage. It is applied on the body surface which differ in form (volume). The bandage forms a figure 8. It is applied on the occipital area.

5. Spiral reverse bandage. It is applied on the humeral joint, shoulder girdle and the areas under the armpits.

6. Turtle bandage (diverges and converges). It is applied on large joints (knee, ulnar, talocrural).

7. Turning bandage. It is applied on the stump after an operation (amputation) of the extremities, hands or feet.

8. T-shaped bandage. It is applied on the perineum or axillary area.

Tipes of Bandages According to Localization

Bandages on the head and neck are applied during bleedings. For closing the forehead, temporal and occipital areas, circular bandages are applied.

For closing the whole hair area of the head the Hippocrates' cap and night-cap are applied, bridle — on the chin area, sling-like bandage — on the nose, forehead, occipital area, cross — on the occipital site.

Bandages on the thorax, humeral zone and the upper extremities. For this purpose, spica and cross, cravat and spiral bandages are applied. The Dezault's and Velpeau's bandages are used with clavicle fracture, bruise or dislocation of the shoulder.

The bandage on forearm and shoulder is a spiral turtle one; on the 1st finger — a spica one; on the other fingers — spiral bandages like a mitten.

On radiocarpal joint — a cross one, bandages on the stomach and pelvis — plaster and spiral bandages. On the pelvis, inguinal area, perineum — variaties of spica bandages.

On the calcaneal area — diverging turtle bandage. On the 1st toe — a turning one. On the upper and lower extremities, it is best to use bandages from medical reticular bandage (retalast).

HARD BANDAGES

Hard, or retentive, bandages are applied with the purpose to deprive of mobility the damaged area of the body, to provide it rest for a long time and at the certain position. They are applied for fractured bones of the extremities for transport or medical immobilization, as well as for inflammatory diseases of the extremities, in particular joints (tuberculosis of bones and joints). Immovable bandages are applied also after operations on bones and joints of the extremities with massive damage to the soft tissue.

Standard splints and standard fixing material, extending devices, artificial limbs, and orthopaedical devices belong to the hard (retentive) bandages. The correct way of hard bandages application is the same as for soft bandages, but they should be performed more diligently, because they are applied for 1.5–2 months and any mistake may bring fatal harm to the patient. It is necessary to watch the condition of the extremities closely in connection with a possibility of uneven pressure of the bandage and the formation of necrosis, especially where the bones stick out.

Transportable and Medical Splints

They are mostly used for immobilizing the extremities. Medical splints are applied in hospitals to treat fractured bones of the extremities. Splints should be rather strong and manageable, provide reliable immobilization. They are made from cardboard, wooden plates (Diterichs' splints), plastic, polyethylene (inflatable splints) or metal (Cramer's and Esmarch's splints,) for treating fractures by the stretching method.

Transport Immobilization

The basic requirements are following:

1. The splints should be sturdy, portable and simple.
2. They should immobilize two-three of the nearest joints.
3. The fixing splint should not constrain vessels and nerves.

With closed injuries, the splints should be applied over clothes. With open — for the first time, it is necessary to apply a sterile bandage to the wound. The splint should be applied strongly and prevent displacement of fragments, otherwise large vessels and nerves can be damaged by bone fragments.

Transport splints are divided into fixing and distraction.

Fixing splints provide immobilization for parts of the body — standard ladder-like Cramer's splints and Esmarch's splints. Synthetic plastic splints, pneumatic inflatable splints are convenient. For the lack of special means, improvised means or improvised splints are used.

With a fractured clavicle cotton-gauze rings are applied. With a damaged spine and bones of the pelvis — long boards and shield, in damage to the hip — Diterich's splints.

Extension splints have a direct relation to traumatology and will be described in details in the section "Fractures". They create immobilization and at the same time provide stretching (medical metal splints and apparatus).

Artificial limbs and orthopaedic apparatus are produced in orthopaedic factories for long-lasting immobilization of the extremities (orthopaedic footwear or devices made of metal, plastic and leather).

Bandages which Harden

Plaster, zinc-gelatinous and starch, and also glutinous, of rare glass and bandages with polymeric materials belong to this group of bandages, which harden.

Plaster bandages are prepared from calcium sulfate, which is rubbed in bandages made of hygroscopic gauze. Nowadays, the medical industry delivers ready-made bandages for medical institutions; therefore a plaster mechanic at traumatology departments has more time, necessary for defining the quality of the plaster and preparation of the plaster bandage.

The quality of the plaster is determined as follows: in a tray a small amount of plaster powder is mixed with warm water in the ratio of 2:1. A ball is made of plaster solution, which must harden in 5–10 min and remain intact when dropped on the floor. If the ball breaks, the plaster is not suitable for use. Hot water accelerates the hardening process of plaster.

In traumatology, there are special plaster rooms for applying and removing plaster bandages. They are equipped with special inventory and instruments. Plaster bandage or longets are soaked in a basin with warm water and then wait for the excretion of air blisters to end. Each plaster bandage take out by both ends with two hands.

The bandage is wrung on each side in order to get the water out. The wrung bandage is circularly rolled up on the ends. Before applying the bandage, the skin is greased with Vaseline or a cotton stocking is put on, leaving the fingers open. The extremities are kept at the neutral position. For immobilization of the extremities during a fracture, an unpadded plaster cast is applied, in other cases — the protruding area of the extremity is covered with a cotton-gauze (padded bandage). A 5–6-layer bandage is solid enough. The condition of the extremity should be watched for two days after applying the bandage. If the extremity gets cold, pain occurs, the plaster bandage should be incision with scissors or a special saw. Each plaster bandage is marked with an indelible pencil. It contains the schematic image of the fracture or the inflammatory focus, the bandage application and removal date.

The plaster dries within 24 h. The bandage is dried with a mobile electric heater.

There are the following kinds of plaster bandages:

1. Circular dense ones — for immobilization of the extremities and trunk in fracture.

2. Fracture brace is applied on one joint or a certain segment of the extremity, which provides rest and immobilization during contusions, fractures, inflammatory processes.

3. Slab of plaster is applied with bruises, fractures and inflammatory processes. It can be posterior, palm (anterior) and P-shaped.

4. Slab of plaster and circulating bandage is a splint, which is fixed by circular plaster bandages in bones fractures.

5. Fenestrated and bridge-shaped bandages are used for the treatment of wounds with the immobilization of the extremities. For the reliability of the fixion of the extremities in the position of the hardening plaster bandages with spacer are used.

6. The hinged-plaster bandage is applied for training movements in the joint.

7. Plaster corsets, collars, bandage-beds are applied in the treatment of orthopaedic diseases, chronic inflammatory diseases of the bones, during a definite period after a fractured backbone, etc. The plaster bandage is the optimal kind of bandages which harden. The zinc-gelatinous bandage is applied during the treatment of varicose ulcers of the lower extremities, which do not heal easily, purulent wounds, consequences of fractures.

The zinc-gelatinous mass of Unna is dissolved in a water bath; they soak with it the turns of bandages applied to the skin of the definit segment of the extremity. While applying the extension bandages, circular turns of the bandage (the first layer) are carried out; they are carefully saturated with paste, longitudinal strips of gauze are put on (the second layer) for extension traction, and they are fixed with circular turns (the third layer), diligently saturating the bandage with paste. The zinc-gelatinous bandage is prepared by the following recipe: zinc oxide — 100 g, gelatin — 200 g, water — 300 ml, glycerin — 400 ml.

Starch bandage is prepared from starchy gauze bandages. The technique for applying is similar to plaster one. Starch bandage is less solid, but its application is more easy.

Adhesive bandages made of rare glass (siliceous sodium), celluloid, and dextrin are mostly used when applying replacable bandages (corsets, splints, and removable joint-immobilizer).

Bandages made of polymeric materials (plastubol, bumetol, etc.) are applied by way of spraying aerosol with these substances on wounds, burns or postoperative wounds. For several seconds after spraying the aerosol, a transparent protective film, which provides not only function of the bandage but also visual supervision of the wound, appears. When introducing medical preparations into the structure of the aerosol, they also have a direct medical effect.

The bandage with villiage cheese and 1/8 part of liquid ammonia or 10% of KOH can be applied in the villiage because of the lack of other hardening agents.

Celluloid bandages are made as follows: celluloid is dissolved in acetone and glue, which was formed, and grease the gauze bandage.

Possible complications as a result of wrong application of a bandage which hardens: hypostases, decrease in muscular force and immobilization, impairment of blood circulation.

A student should know and be able to apply such bandages as: "night cap", "Hippocrates' cap", bandage on the occipital area, on both eyes, Dezault's bandage, "bridle", Velpeau's bandage, sling bandage, bandage on the mammary glands, occlusion bandage with damage to the thorax, spica bandage on the humeral joint, a "turtle-like" bandage on the ulnar joint and a "knight glove".

Lecture VI

ASEPTICS AND ANTISEPTICS

Aseptics is a set of measure aimed at the prevention of infection getting to the wound, in an organism of the patient, creation of sterile conditions for surgical work by use of organizational actions, active disinfecting chemical substances, as well as technical means and physical factors.

Two basic principles are underlined in modern aseptics:

1. Everything that adjoins to the wound should be sterile.
2. All surgical patients should be divided into two groups: "pure" and "purulent".

It is impossible to work without aseptics rules observance in surgery.

It is necessary to know its sources and ways of spread to prevent infection from getting to the wound

Exogenous infection gets to the wound from the environment by three basic ways: respiratory, contact and implant.

With the air-drop way of spreading the infection gets to the wound from the air.

The complex of measures is provided to prevent respiratory infection.

In order to prevent infection all patients should pass sanitary-and-hygienic treatment at admission: shower, changing clothes of the patient, special processing — under indications.

The organization of medical-diagnostic departments is arrenged according to a contingent of patients, sanitary norms.

Careful, repeated damp cleansing with antiseptic means should be carried out in the surgical department.

The rooms are to be ventillated according to the ventillating schedule, which cleans the air.

The usage of special clothes (surgical coates, special suits, head-dresses, mask, slipper, stockings) is necessary in the department. It is prohibited to leave the department in special clothes.

The strict observance of aseptics rules is obligatory in the operational block, as it is the cleanest place in the surgical hospital. For prevention of dirtying the air and rooms in immediate proximity to the operational wound a zone-like principle is observed in the organization of the operating room: zones of absolute sterility, relative sterility, limited routine and general hospital mode (non sterile).

There are some kinds of cleansing in the operating room: current, after each operation, at the end of the working day, in the beginning of the working day and general (once a week).

Preventive maintenance of contact and implantation infections consists in reaching sterility (full clearing from microorganisms of everything that adjoins the wound): surgical tools, dressing material and surgical linen, hands of the surgeon, operating area (skin of the patient), as well as in maintenance of the strict sterility of all subjects introduced in an organism of the patient (material for suturing, drainages, catheter, artificial limbs, metal constructions, transplanted organs, etc.).

Sterilization is the basis of aseptics. It is the achieved by methods and means of sterilization are used which provide destruction of pathogenic and non-pathogenic microorganisms. Hence they should be effective in relation to bactericidal and sporicidal activity, safe for the patient and medical personnel.

Physical and chemical methods of sterilization are used in aseptics.

Physical Methods of Sterilization

1. Burning and boiling are not used in surgical clinic for sterilization now, as these methods of sterilization do not create conditions for destruction of microbes, spores in particular.

2. Steam sterilization under pressure of 2 atmospheres (in the autoclave) allows to raise a boiling point of water and accordingly temperature of the steam up to 132.9°C . At this method of sterilization the tools, dressing, the linen and other materials are loaded into the autoclave in a special metal boxes of Schimmelbusch. At pressure of 1,1 atmospheres a mode of sterilization spend lasts for 1 h, at 1,5 atmospheres — 45 min, at 2 atmospheres — 30 min.

3. Sterilization by hot air (dry heat) is carried out in dry-heat cases sterilizers within 1 h at the temperature of 180°C .

Central sterilizing should be organized in hospitals.

4. Ray sterilization is carried out with the help of γ-ray, ultraviolet ray, ultrasound.

Chemical Methods of Sterilization

1. Gas sterilization is carried out in special hermetic wards with the use of formalin or ethylene steams within 6–48 h. This method is used first of all for sterilization of optical tools.

2. Sterilization by solutions of chemical antiseptics is applied first of all for processing cutting surgical tools. Chemical antiseptics are 6% solution of hydrogen peroxide, chlorhexidine alcoholic solution, pervomure, threefold solution, 96° ethanol. Tools wetted in the given solutions for 2–6 h are considered to be sterile.

Sterilization of Instruments

The best method of instruments sterilization is boiling in a 2% solution of sodium hydrocarbonate or in water for 45 min. Before sterilization the instruments are cleansed — washed with hot water for 30 s, then washed in a washing solution at the temperature of 50°C for 15 min. After that they wash in a washing solution for 30 s, rinse in running water, boil in distilled water for 5 min, dry with hot air at the temperature of 85°C . The quality of the sterilization is determined with the help of amidopyrine, benzidine and phenolphtalein tests for the presence of residual components of the washing preparation in the blood. With the presence of pus disinfection of the tool is carried out — it is boiled for 30 min in a 2% solution of sodium hydrocarbonate. Besides boiling, the instruments are sterilized in dry exciccators or autoclave, and undergo chemical sterilization (threefold solution, spirit, etc.).

Sterilization of Gloves

Gloves are sprinkled with powder or talc, wrapped in a gauze napkin and kept in sterilizer boxes. Sterilization is on under pressure of 1.5 atm at the temperature of 120°C for 45 min. Gloves are also boiled in water for 45 min or dipped into a detergent solution for 60 min. Gloves are sterilized with ethylene oxide in portable gas sterilizers. After using gloves wash under running water with soap, disinfect in a 1% solution of chloramines for 30 min, rinse under running water, dry.

Sterilization of Suture Material

Sterilization of suture material takes place in different ways: thermal, chemical, gamma irradiation. The suture material applied in surgery differs by chemical structure, physical properties and origin. It is mostly silk, cotton and synthetic materials. Now the silk isn't almost used, as it irritates very much.

Generally, silk sutures are received sterile. But if they are not processed, the following measures are used:

1. Silk is washed in warm water with soap, dried, reeled on a coil and dipped into ether for 12–24 h, then dipped into a 70% solution of ethanol for the same time period, then boiled for 10 min and stored in hermetically sealed cups according to the Cocher's method (in 95% ethanol). Before using this silk is boiled again for 2 min in a solution of corrosive sublimate.

2. Silk is washed with soap twice, rinsed with warm water, dried and wound on the reels. They degrease, dip into ether for 12–24 h. Then they boil in distilled water for 45 min and sink into the hermetically sealed cup with 96% spirit for 6–12 h. After that, the silk is suitable for application. In the cup, the spirit is replaced every 7 days. Kapron and lavsan sutures are sterilized in the steam autoclave (like operational linen) or boiled (like tools) for 45 min.

Catgut is produced with a preserving solution (96% spirit — 89.0 ml, glycerin — 6.0 ml, gasoline aviation — 1 ml, distilled water — 4.0 ml), sterilized by gamma irradiation. Polymers hydroxyacetic acid (dexon) or polypropylene (proflax), and also vicryl are artificial sutures, which are absorbed.

Preparation of the Surgeon's Hands and the Operating Field

Preparation of the surgeon's hands plays a special role in the preventive measures of wound infections. The surgeon should avoid of pollution of hands, diligently watch the condition of the skin, for occurrences of microtraumas (cracks); the skin is processed with special creams, oil solutions (glycerin, liquid ammonia, etc.).

There are many different methods of surgeon's hands processing. Various methods of surgeon's hands processing can be divided into three groups:

1) methods with mechanical cleaning of the skin and its subsequent stiffenning with different antiseptics;

2) methods of only stifenning;

3) methods of processing with the application of surface-active substances — detergents.

The Furbringer's and Ahlfeld's methods belong to the first group. According to the Furbringer's method the hands are washed with warm water and soap with the help of brushes for 10 min, after drying hands are processed with 70% ethanol (3 min) and 0.5% solution of corrosive sublimate (3 min). Ahlfeld modified this method — excluded the processing with the solution of corrosive sublimate and replaced 70% ethanol by 96% one.

These methods today are almost not applied because of significant trauma to the epidermis by the brushes and the occurrence of dermatitis.

Methods which are based only on the stiffenning of the skin are applied, basically, under field conditions and in emergency situations. The methods of Brun (processing of hands with 96% spirit), Heisner (processing of hands with a mixture of iodine and gasoline in a ratio of 1:1), Pokotilo (processing of hands with 5% water solution of tannin), Zabludovsky (processing of hands with a 5% spirits solution of tannin), Bakkala (processing of hands with a 1% solution of brilliant green) belong to this group. An essential disadvantage of these methods is their negative influence on the skin (burns, dermatitis, and allergy).

The third group of methods with the application of detergents is the most wide-spread. A high sterility is seen because detergents deep penetrate into skin. Having excluded mechanical cleaning and long skin stiffenning, damage to the epidermis and the occurrence of dermatitis is prevented. The Spasokukotsky—Kochergin's method of hand processing with a 0.5% solution of liquid ammonia in two basins by 3 min each, after drying up — with 96° spirit, fingertips — with the iodine solution belongs to this group.

Recently, such detergents are widely used in processing hands as: 0.5% spirit solution of chlorhexidine bigluconate, 3% water solution of novosept, 1% solution of degmine or degmicide, 0.02% solution of dioxide, solution of pervomur (hydrogen peroxide with antacid). Dioxide, the preparation of mercury, is very toxic, accumulates in the kidneys, can cause dermatitis of the hand skin. Sterilium, hospisept are applied for processing hands of the surgeon now.

OP-7, rocal are also used in hands processing. However, all these methods do not guarantee 100% sterility, therefore surgeons use gloves (rubber, latex, etc.) after processing hands.

The operational field is processed by the modified Grosich—Filonchikov's method: twice processing of the skin with 70% spirit and rubbed with 2–5% solution of iodine. Solutions of Iodonatum, iodoperonium, 1% solution of degmicidium, 1% solution of rocal, 2.4% solution of pervomurium are also used to process the operational field.

Ways of Control over Sterility

Methods of the control over sterility are divided into direct and indirect.

The direct method of sterility consists in bacteriological exam of sterilized tools, hands of the surgeon, the operational field, operational linen, dressing. Sampling is carried out by way of smear taking with a sterile wadded tampon, inoculation of medium is performed in order to determine bacterial pollution.

The indirect methods allow to get quickly data on sterility and is applied at each sterilization. At autoclaving an ampoule with a powder substance which temperature of fusion ranges within 110–120°C is packed in the box. If during sterilization the substance has fused, the material is sterile and vice versa. Benzoic acid, resorcin, antipirin are used for this purpose. Similar methods are applied for sterilization in dry heater: ascorbic acid, succinic acid, tiourea.

Antiseptics is a system of measures directed on destruction of microorganisms in a wound, the pathological focus, in organs and tissues, and an organism of the patient as a whole, using active chemical substances and biological factors, and mechanical and physical methods of influence as well.

There are mechanical, physical, chemical, biological and mixed antiseptics.

Mechanical antiseptics is elimination of microorganisms by mechanical methods: removal of tissue sites sated with bacteria, infectioned clots of blood, purulent exudation. The methods of mechanical antiseptics consist of:

1. A toilet of a wound which is made at any bandaging. The bandage applied before is removed, the skin is processed around the wound. Purulent exudation, the infected clots, free necrotizing tissue are deleted from the wound. The wound processing with a pulsing jet of antiseptics is applied with the same purpose.

2. Primary surgical processing of the wound, which makes an infected wound sterile by way of incision the edges, walls and floor of the wound together with alien bodies and necrotic zones.

3. Secondary surgical processing of the wound which is carried out with the presence of a purulent wound, consists of the removal

of necrotizing tissues, revision of the wound itself, carrying out additional incisions for providing free outflow of pus.

4. Other operations and manipulations: lancing of abscesses, phlegmons, a puncture of abscess, etc.

Physical antiseptics is elimination of microorganisms with the help of physical methods. The basic methods of physical antiseptics are as follows:

1. Usage of hygroscopic dressing for exudate evacuation: gauze tampons, balls, napkins, cotton wool, cotton-gauze tampons.

2. Usage of hypertonic NaCl 10% solution for improvement of outflow from the wound, which osmotic pressure is higher than in the blood plasma.

3. Drainage, as an important element of physical antiseptics, is applied for treatment of all kinds of wounds and based on a capillary principle and communicating vessels. Passive, active and flow-washing drainage are distinguished.

4. The sorptional way of wounds treatment is applied with sorbents usage — substances which adsorb toxins and microorganisms. They are carbon-containing substances as a powder or fibres.

5. In treatment of wounds with the purpose of struggle against microbes the method of drying is applied: special wards with the controlled abacterial medium, various devices for local use.

6. Use of technical means:

— ultrasonic devices for ultrasonic cavitation of wounds;

— laser devices for processing wound surfaces with focused and unfocused ray, irradiations of blood;

— use of ultra-violet ray for processing wounds, blood;

— use of X-ray radiation for suppression of an infection in tissues.

The chemical antiseptics is elimination of microorganisms in the wound, pathological focus or an organism of the patient and in the environment around with the help of various chemical substances.

The basic groups of chemical antiseptics.

1. Group of haloids:

Iodine — 1–5% alcohol tincture;

— iodinol — 1% solution;

— iodonate, iodopirol, povidon-iodine — organic compounds of iodine;

— water and alcohol solution of iodine and potassium iodid;

— chloramin — 3% water solution.

2. Salts of heavy metals:

— corrosive sublimate (sulema) — in concentration 1:1,000;

— mercury oxycyanid — desinfectant means;

— preparations of silver — 0.1–2% and 5–20% solutions of nitrate of silver;

— protargol, collargol — antiseptic means of external application.

3. Spirits — ethanol 70%, 96%.

4. Aldehydes — formalin — 37% solution of formaldehyde — a strong disinfectant, lisol, a 2% solution — a disinfectant.

5. Phenols — carbolic acid, a threefold solution (20 g of formalin, 10 g of carbolic acid, 30 g of natrium bicarbonate and water up to 1 l).

6. Dyes — brilliant blue 1–2% a solution, brilliant green 1–2% solution.

7. Acids —boric acid — 2–4% a solution, salicylic acid.

8. Alkalis — liquid ammonia — for external application.

9. Oxidizer — hydrogen peroxide — 3–6% solution, potassium permanganate — 0.02–0.1% and 2–5% solutions.

10. Detergents (superficially active substances) — chlorhexidin bigluconate — 0.5% alcoholic solution and 0.1–0.2% water solution, cerigel, degmin, degmicid.

11. Derivatives of nitrofuran — furacillin 1:5,000, furadonin, furagin, furasolidon.

12. Derivatives of 8-oxychinolon — nitroxolin (5-NOX), enteroseptol, intestepan.

13. Derivatives of chinoxalin — dioxydin — 0.1–1% water solution.

14. Derivatives of nitroimidasol — metronidazole (metragil, flagil, trychopol).

15. Vegetable antiseptics — phytoncides, chlorophylipt, ectyricide, balis.

16. Sulfonamides — streptocide, ethasol, sulfadimesin, sulfasin, sulfadimetoxyn, sulfalen, biseptol (Bactrim).

Biological Antiseptics

The basic preparations and methods:

1. Proteolytic enzymes — trypsin, chemotrypsin, chemopsin, terralitin.

2. Means of passive immunization — antitetanus serum, antitetanus gamma-globulin, antigangren serum, antistaphylococcal, anti-

streptococcal, anticoli bacteriophages, antistaphylococcal and anticoli hyperimmune plasma.

3. Methods of stimulation of nonspecific immunity — ultra-violet irradiation, vitamin treatment, a full-value nutrition, ultra-violet and laser irradiation of blood, haemotransfusion and its preparations (a suspension of lymphocytes).

4. The substances stimulating nonspecific immunity — Thymalin, T-activin, prodigiosan, levomisol, reaferon, roferon, roncoleukin, β-leukin.

5. The preparations stimulating specific immunity — staphylococcal and tetanic anatoxin.

The basic means of biological antiseptics are antibiotics.

Antibiotics (AB) — products of the microorganism' vital activity, inhibiting growth and development of certain groups of other microorganisms and used for treatment and prophylaxis of a surgical infection.

According to the mechanism of action AB are divided into:

1. Inhibitors of the cellular wall synthesis (β-lactam AB — penicillins, cephalosporins, carbopenems, monobactams; glycopeptids — vancomycin and teicoplanin.

2. Inhibitors of protein synthesis (aminoglycosides, tetracyclines, macrolids, lincosamines, streptogramines, chramphenicol, fusidic acid, oxasolidones).

3. Inhibitors of the nucleinic acids synthesis (the inhibitors synthesis predecessors — sulfonamides; the DNA replication inhibitors — chinolones; the RNA-polymerase inhibitors — rifampicin.

4. Other AB (cytoplasmic membranes inhibitors — polymyxines; the preparations changing DNA — nitroimidasols).

Basic Groups of Antibiotics

1. Penicillins: penicillin, oxacillin, methycillin, ampicillin, amoxycillin, bicillin, ampiox, augmentin, unasin.

2. Streptomycins.

3. Tetracycline: methacyclin, doxacyclin.

4. Macrolids: erythromycin, oleandomycin, roxythromycin, azythromycin, clarythromycin.

5. Aminoglycosides: kanamycin, gentamycin, thobramycin, sizmomycin, amycacin, netromycin.

6. Chloramphenicols.

7. Rifampicins.

8. Antifungal antibiotics: levorin, nystatin.

9. Polimyxin B.

10. Lincosamins: lincomycin, clindamycin.

11. Cephalosporins: 1st generation — ceporin, cephalexin, cephazolin, cephamesin, kefzol, 2nd generation — cephamandol, cephmetazol, cephoxitin, cephaclor, cephuroxim, cephotetam, 3rd generation — cephthriaxon, cephotoxim, cephixim, cephtibuten, cephpiramid, cephtazidim, 4th generation — cephpirom (caten).

12. Carbopenems: imipenem, meropenem, tienam.

13. Glycopeptids — vancomycin and teicoplanin.

The search for new AB preparations last years are concentrated on preparations active against Gr+ microorganisms.

The first representative of synthetic antibiotics of a new class — oxasolidons is Zivox (linesolid).

For rational choice of AB we should know the most often agents of nosocomial and outhospital infections and their resistency to these preparations in the given hospital. It is necessary to make a list of drugs preferable for administration in the given surgical hospital which is revised 1–2 times a year taking into account epidemic data, appearing of new AB, changes of approaches for prophylaxis and treatment of pyo-septic complications.

The new approach to application of AB is their rotation — cyclic change of antibacterial means used as preparations of choice. Rotation promotes reduction of quantity, but does not eliminate resistant microorganisms strains.

Lecture VII

HAEMORRHAGE. METHODS OF BLEEDING CONTROL

Hemorrhage (haemorrhagia) is one of the most often complications of traumas and different human diseases — a direct cause of death of nearly 40% of patients. Effective methods of struggle with bleeding allow to improve the result of treatment, decrease the mortality and to increase the safety of surgical operations.

Hemorrhage is the blood outpouring from damaged blood vessels. There are different classifications of bleedings depending upon the principle which makes up their basis. Physiological (menstruation) and pathological (traumas, tumours, and inflammatory processes) bleedings are distinguished.

Pathological bleedings can be caused by damage to the vessel's wall in trauma (h. per rhexin), due to pathological process (h. per diabrosim), which destroys the wall of a vessel (tumor, inflammatory process, ulcer), or due to imbalance of permeability of the vascular wall during infectious processes, scurvy, sepsis (h. per diapedesin).

According to the anatomic principle depending upon the kind of a damaged vessel the arterial, venous, capillary, parenchymatous bleedings are distinguished. The most dangerous is arterial bleeding, which results in rapid anemia and death of the patient in case of inefficient treatment. The color of the blood, speed of discharge, pulsating blood stream have importance for differential diagnosis of the specified kinds of bleedings. For example, the classic arterial bleeding manifests itself in bright red blood, high speed of discharge and pulsating blood stream. The venous bleeding, in contrast, is characterized by dark blood, even and slow blood flow. But the signs can have a relative value, as multiple venous bleedings (from the main veins) can be accompanied by pulsating blood-stream of bright red color (for example, from the jugular vein).

The most informative attribute for differentiating the kinds of bleedings are the results of applying a tourniquet. A proximal application of the tourniquet in relation to the wound stops arterial bleeding.

Capillary bleeding is small; the blood flows from the whole surface of the wound, stopping, as a rule, independently.

A special kind of capillary bleeding is parenchymatous one (in damage of the liver, spleen, etc.), thus the whole wounded surface bleeds, and the blood does not stop independently, because the bleeding vessels are fixed in the stroma and do not collapse. Parenchymatous frequently results in acute anemia.

Depending upon where blood is flowing, external and internal bleedings are distinguished. With internal bleeding the blood pours into different cavities and tissues: abdominal (hemoperitoneum), chest (hemothorax), cardiac sac (hemopericardium), joint cavity (hemarthrosis), into soft tissue (hematoma).

Revealing blood in the secretion and excretion of an organism allows to find the place of bleeding and to take effective measures in stopping the internal bleeding. Depending upon the revealing of blood in secretion and excretion the following kinds of internal bleeding are distinguished:

— nasal bleed (epistaxis);
— haemoptysis, bleeding from the respiratory tract (haemoptoe);
— bloody defecation (melena), caused by bleeding from different parts of the gastrointestinal tract;
— bleeding from the urinary tracts (haematuria);
— bleeding from the genitals (metrorrhagia);
— intestinal bleeding (enterorrhagia);
— stomach bleeding (gastrorrhagia).

Hemorrhages when the discharges blood is not found and only secondary attributes of bleeding are registered (anemia, data from laboratory analyses) are called latent.

By the time of occurrence the following are distinguished: primary bleedings (that occurred directly after the damage to the vessel) and secondary ones (a while after the bleeding stopped).

Secondary bleedings are divided into early (first 2 days after damage) and late (from the 3rd day to several months). Secondary haemorrhages can be caused by insufficient stopping of bleedings during surgical processing or operative intervention (badly fastened knot, slipping of the ligature), changes in the chemical compound of the blood (avitaminosis, decrease in blood coagulation ability, haemophilia) addition of septic processes (putrefactive infection of the wound with the following melting of blood clots), tumour processes (tumor decay).

The clinical picture of bleedings consists of local attributes and general symptoms. The major attribute is the revealing of blood. During internal bleedings local attributes depend upon the compressed organ, concentration of the blood (weakening in damaged sites during intraabdominal bleedings, symptoms of tamponade of the heart during accumulation of blood in the pericardium — weakness, arrhythmia, expansion of cardiac dullness, etc.).

The general attributes are characterized by the development of the acute anemia clinical picture as collapse and anemia of the brain: paleness of the skin and mucous, dryness of the skin, thirstiness, sharp features of the face, pulse fall (frequent, small filling and pressure), decrease in blood pressure, blackness in the eyes, anxiety, drowsiness, loss of consciousness, weakness, involuntary urination and defecation.

Laboratory methods of diagnosis help the doctor estimate the severity of blood loss and its threat to life.

Analysis of amount of erythrocytes, haemoglobin, hematocrit have special value for estimation of the severity of bleeding and blood loss, which has taken place. The amount of erythrocytes and haemoglobin is a relative indicator because they are made without taking into account the amount of blood. Within first 3 h the amount of haemoglobin and erythrocytes almost do not differ from the normal level. Hydremic reaction (saturation of the blood with tissue fluid instead of lost erythrocytes) is found only in a few hours and lasts for 10–11 days. The more massive the blood loss the more intensive the hydraemia reaction. Despite of the bleeding arrest, the parameters (erythrocytes, haemoglobin) continue to reduce and anemia increases. In a mild degree of blood loss (globular volume (GV) — 10–20%) the contents of erythrocytes is on the average $4.4 \cdot 10^{12}$/l, with moderate blood loss (deficiency of GV — from 20 up to 30%) — $3.5 \cdot 10^{12}$/l, in severe degree (deficiency of GV is 30% and greater) — $2.6 \cdot 10^{12}$/l.

Amount of haemoglobin during blood loss change as the following:

— mild degree — 108–158 g/l;

— middle — from 108 up to 141 g/l;

— severe — from 25 up to 108 g/l.

In practical work, the hematocrit number is widely used for the definition of the extent of blood loss. Normal — 45–50%. The mild degree of blood loss is accompanied by a decrease in hematocrit up to 30%, moderate — up to 25%, severe — lower than 25%. The hematocrit also depends on the terms of research after the acute blood loss. During first 2–3 h the hematocrit level does not differ from normal, but with development of hydraemia reactions and haemodilution of blood the hematocrit number gradually reduces.

In emergency surgery, the Phillips—Barashkov's test is widely spread for the estimation of blood loss degree. It consists in definition of relative density of blood and plasma with the application of a solution of copper sulfate (relative density is from 1.034 up to 1.075). A drop of blood is sunk from the height of 1 cm into a solution (relative density is 1.050). If the density of blood is lower than the density of the solution, the drop will rise to the surface at once, and if it is greater, it will sink. The density is determined until the drop of blood remains hanging in the liquid for 3–4 s.

If the relative density of blood is 1.057–1.054, according to Barashkov the blood loss makes up 500 ml, if the relative density is 1.053–1.050 — from 600 up to 1,000 ml, if 1.049–1.044 — 1,100–1,500 ml, if 1.043 and lower — more than 1,500 ml.

For quality evaluation of blood loss the principal value is the blood volume (BV), plasma volume (PV), GV.

The basis of the methods determining BV and its components consists of the principle of dissolution of a certain indicator, the concentration, which is determined a while after the introduction into plasma or blood. Radioisotope techniques are applied to define BV with the help of carbon isotopes ($^{51}C_2$ and $^{52}C_2$), iodine isotopes (^{131}I and ^{132}I), dyes (Evans' blue — color T-1824) or dextrin (polyglukine). The parameters of BV and its components are calculated by the body weight of the patient and the average hematologic parameters received from healthy people.

The following degrees of blood loss are distinguished:

— I mild (blood loss up to 500 ml);

— II middle (from 600 up to 1,000 ml);

— III severe (from 1,100 up to 1,500 ml);

— IV fatal (over 50% of the amount of blood).

The determination of the blood loss degree has a big value in the prognosis of bleeding and treatment. For consequences of bleeding the size and speed of blood loss, the general condition of an organism, the age of the patient and the condition of the cardiovascular system are important. During bleeding a complex mechanism of adaptation to blood loss develops in an organism, which consists of: angiospasm, acceleration of cardiac activity and respiration, increase in BV due to the intake of blood and tissue fluid into the blood channel from the depot. The condition of coagulation blood system has great importance for the bleeding outcome. With disturbances of coagulation (for example, haemophilia) even a small bleeding can lead to acute anemia and death of the patient.

Complications and consequences of bleeding can be different. Sudden loss of blood causes the acute anemia picture with the development of haemorrhagic shock of different degrees of severity. Arterial and central venous pressure with the development of anemia of the brain tissue decreases first. In massive blood loss the condition of the patient sharply worsens: sharp features of the face, dense cold sweat, paleness and cyanosis of the skin, cold extremities, decrease in body temperature, drowsiness, indifference, dilated pupils. Involuntary defecation can be observed. During progressing — unconsciousness. Death can come because of rather small bleedings if the vital functions of organs (hemorrhages in the brain, in the pericardium cavity with the development of cardiac tamponade) increase. Air embolism can occur in damage of large main veins, in particular on the neck.

Hemorrhage leads to a number of severe complications. When hematoma of the soft tissue collides with the opening of a large vascular tube, a pulsating hematoma can develop. Further, with the formation of connective tissue capsules, artificial traumatic aneurysm (arterial, arteriovenous) takes place, which is very dangerous because of the late complications development (ruptures, thromboses, embolism, and ischemia of tissue).

Hematomas are nutrient medium for the development of microorganisms, which get directly with a wound or hematogenously. Thus, abscesses occur. Blood clots which irritate the surrounding tissue serve as the reason for local inflammation with the proliferation of tissue and the formation of scars of different density. That is why haemorrhages in serous cavities (pleural, pericardium, abdominal) can lead to the development of adhesive process, which adversely effect the organ's functions (adhesive pericarditis, pleuritis, adhesive intestinal obstruction). haemorrhages in the joints frequently disrupt their mobility, because of salts deposit and the development of exostosis.

Methods of Bleeding Arrest

Medical practice and first aid for bleedings depends upon the localization, volume and character of bleeding, severity of somatic condition of the patient. Temporary and complete ways of bleeding arrest are distinguished. Methods of temporary bleeding arrest are applied basically during the pre-admission period, during transportation of the patient.

Methods of temporary bleeding arrest are the following: bandage application, lifted position of the extremities, maximal bending of the extremities in the joint and compression of the vessels at this site, manual pressing of the vessel on an extent, application of a tourniquet and a clip on the vessel which is bleeding in the wound. Any of the methods has certain indications. Bandage is used mainly with injury of fine and average diameter vessels; it does not stop the bleeding in large arteries injury. The raised position of the extremities is applied for injuried capillaries and fine veins, frequently in a combination with a bandage.

The maximal joint bending of extremities is used in wounds of the popliteal, humeral, femoral arteries. Manual pressing along the artery is applied in emergency with injury of large arteries (carotid, humeral, etc.) as means of temporary stoppage of haemorrhage before applying a tourniquet or while taking it off.

It is impossible to arrest bleeding for a long time with this method, because the hand putting on the pressure gets tired.

Applying a tourniquet is the basic method of temporal bleeding stoppage. While applying a tourniquet, it is necessary to follow the following rules:

1. A tourniquet is applied mostly in case of arterial bleeding.

2. A tourniquet is applied on the extremities with one bone (shoulder, hip), because being applied on the forearm or shin it is less effective (the vessel passes through the interosseous membrane and only the veins will be compressed).

3. A lining should be under the tourniquet (so that not to injure the skin).

4. It is necessary to apply a tourniquet on the upper and middle third of the hip or shoulder, so that there is no compression of the nerves (ulnar, ischiadicus).

5. A tourniquet is applied for 2 h, during the winter period the extremities are to be warmed so that frostbite does not occur.

6. It is necessary to let the tourniquet up a few times during 2 h, combining this method of bleeding arrest with manual pressing the

vessels; in the summer — for 1–1.5 h, in the winter — for 1 h, then every 15 min.

7. If the tourniquet is applied correctly, the skin is pale, pulsation of the arteries under the site of the applied tourniquet is absent.

A good method of haemorrhage stoppage is applying a haemostatic clip on the vessel which bleeds in the wound. Accordingly transport immobilization is necessary.

Complete arrest of bleeding is carried out in a hospital. 4 groups of methods of haemostasis are distinguished:

1) mechanical;
2) thermal;
3) chemical;
4) biological.

Tying a vessel in wounds on an extent, imposing a vascular suture, applying a bandage and tamponade, application of vascular prosthetic device (shunts) belong to **mechanical methods** of haemostasis.

Ligation is the most widespread method to stop bleedings; it is applied in wound of fine and middle caliber vessels, except for main vessels. Ambruas Paré applied ligation for the first time. Imposing a vascular suture or applying prosthetic devices (shunts) is an ideal method to stop bleedings. A great merit in the development of the techniques of vascular sutures belongs to Alexis Karrel. Different kinds of sutures and prosthetic devices are applied. Corpses' vessels, specially prepared, autograft (of the patient's vein), synthetic prosthetic devices (nylon, dacron, etc.) can be used as prosthetic devices.

If it is impossible to use any of the mentioned methods, capillary and parenchimatous bleeding can be stopped by tamponade of the wounds with gauze tampons. This method is compelled, with the pollution of the wound it can assist in the development of the wound infection. Tamponade of the wound is carried out during 48 h. The compelled mean is leaving in the wound the clip applied on the vessel if it is impossible to impose a ligature. This means is not reliable because the bleeding can start again after the removal of the clip.

Thermal methods of bleeding arrest consist in application of high and low temperatures. In order to stop parenchymatous haemorrhages they use hot solutions of 0.85% sodium chloride. Electrocauter, ultrasonocauter, surgical laser are used for cauterization of vessels which bleed. As the way of haemostasis with the help of low temperatures regional cooling (blister with ice, devices of local hypothermia), as well as cryodestruction (with the help of different cryogenic devices) are applied.

Chemical methods of haemostasis include the application of vasoconstrictive devices and the preparations which promote the blood coagulation abilities (adrenaline, preparations of ergot, calcium chloride, ε-aminocapronic acid, etc.).

Means of bleeding arrest are divided into external and internal. Among external means adrenalin is applied. At local application it causes narrowing and coagulation of vessels. Adrenaline is used at local anaesthesia (in dental practice). The shortcoming of the method is that after the termination of adrenaline action in the postoperative period the vessels can dilate and bleeding renews.

Hydrogen peroxide is applied with mucosa haemorrhages (the nose, gindiva, tongue, after tooth extraction).

Internal means of arrest of bleeding are divided into 2 subgroups: drugs which provide narrowing of vessels (adrenalin, adroxon) and drugs which increase blood coagulation (calcium chloride, ε-amynocapronic acid, sodium ethamsylate).

Biological methods of haemostasis can be divided into the following groups:

1. Tamponade of bleeding wounds with animal tissue rich in thromboplastin (omentum, fatty tissue, muscle, fascia, etc.). This technique is applied mainly with parenchymatous capillary bleeding.

2. Local application of blood preparations (thrombin, haemostatic sponge, fibrinous film, biological antiseptic tampon, etc.).

3. Haemotransfusion and application of blood preparations which make better its ability to coagulate (plasma, thrombocyte mass, fibrinogen, prothrombin complex, antihemophylic globulin A). The indication for haemotransfusion is the degree of blood loss. With the mild degree (up to 500 ml) haemotransfusion is indicated, blood loss is compensated for with blood substitutes and infusion agents.

With moderate blood loss it is necessary to compensate up to 50% of the lost blood by transfusion, the rest is compensated with blood substitutes. With severe blood loss (1,500 ml and more), it should be compensated as soon as possible with fresh blood and usage of direct transfusion.

4. The administration of vitamins (C, K as vicasol) assists in the improvement of blood coagulation and stopping haemorrhages.

5. The application of blood serum of human and animals, which is injected intramuscularly, gives a haemostatic effect, increases an ability of blood to coagulate.

Lecture VIII

HAEMOTRANSFUSION

Blood is a fluid tissue of a human organism which performs important functions. It's known from the course of physiology. However, in the clinic we face with this tissue in special aspect because from old time and to nowadays it is a riddle, and the attempts to apply it for treatment remain inviting because in some cases they are magically effective.

It was considered that blood is the source of life, there is a soul in it and consequently with blood loss the soul is lost also. Many researchers associated the action of blood with a person's character, force and physical ability. That is why the blood baths in ancient Egypt and drinking of lost gladiator's blood in Rome were recommended.

The magical action of blood was named the Medea's method of treatment. Ovidios Nazon describes the attempts of Medea to rejuvenate an old man with young blood: "Medea with a sword out the throat of the old man and let the old blood pour out, she poured juice in him. After having drunk, with his mouth or wound, Ezon's gray hair removed and his beard and hair became black. The leanness, as well as both paleness and decrepitude disappeared. The body became plump, the wrinkles became smooth. Ezon was surprised; he remembered himself like this forty years ago".

Certainly, there are a lot of exaggerations in this legend, but the fact that it underlines the important role of blood in the human life is doubtless. In 1492 blood was transfused from two young men to Pope Innokenti VIII, aiming to rejuvenate him, but the miracle did not take place — the pope died from old age and the young men died too.

Attempts to apply blood for treatment were going on. In 1667, the blood of a lamb was successfully transfused to a person by doctor Deni. Then a period of failures came, which for a long time hampered the use of blood. The opponents of haemotransfusion considered that “lamb’s blood, which was transfused into the vein of a person, can give him the features of cattle: dullness and cattle inclinations”. From the first haemotransfusion and to our days haemotransfusiology passed a difficult, sometimes tragic path. It has been caused by the absence of knowledge in anatomy, physiology and the knowledge of the role of blood in a human organism.

Harvey’s discovery (1682) gave a representation of the blood system; the analysis of the reasons of unsuccessful transfusions led at last to the opening of agglutination that is the process of conglutination of erythrocytes, and, finally, to the discovery of the blood groups.

But from time to time doctors transfused blood in cases of emergency, despite of prohibition and punishment. J. Blundell (1820) in England, Volf (1832) and O. M. Filomafitsky (1848) in Russia successfully transfused blood from person to person, aiming to explain the mechanism of its action. The beginning of the previous century was marked by discovery of the blood groups: 1901 — K. Landsteiner (three groups) and 1907 — Ya. Yansky (the fourth group). Mechanisms of action of transfused blood were studied (O. M. Filomafitsky), conditions of its preservation (in 1914, V. Yurevich and M. Rozengard suggested the application of sodium citrate for the prevention of blood coagulation), source of receiving blood (1919, V. Shamov suggested the application of the cadaveric blood).

The system of organization of blood service (1926, due to O. O. Bogdanov’s efforts the Institute of Haemotransfusion was opened in Moscow for the first time in the world) was created and became stronger.

Today the work concerning the study of the specificity of blood, application of blood or its certain components is on.

Now in the clinical practice while solving the question of haemotransfusion doctors take into account the features of blood, opened by immunologists. It is necessary to always remember that blood is a fluid tissue and its transfusion is similar to tissue transplantation, in which over 300 various antigens, which form a number of systems, are revealed. But the clinic takes into account not all of them but only the system which determines the groups of blood and Rh-factor. The blood group is a genetically caused sign, which provides the association of antigens which are in uniform elements and blood plasma. In 1901, K. Landsteiner — a doctor from Vienna — opened a phenomenon of agglutination, having distributed people into three groups of blood. He had found that the serum of the first group agglutinates with erythrocytes of the second and third groups. The serum of the third group agglutinates with erythrocytes of the second group. In a due course Ya. Yansky discovered also the fourth blood group. The similar phenomenon was explained by the existence of the AB0 system, in other words — this is a set of agglutinins and agglutinogens in a certain individual.

According to the statistic data, 42–44% of people in Europe have the second blood group, 38–39% — the first, 12–14% — the third, 4–6% — the fourth. Each blood group is determined by the association of agglutinins and agglutinogens. So, in the first group there are agglutinins α, β and agglutinogen 0; in the second — accordingly β and A, in the third — α and B and in the fourth — AB0. The blood groups are designated with the presence of agglutinogens: 0 (I); A (II), B (III), AB (IV). Agglutinogens A, B, and 0 are thermolabile organic compounds (glycoprotein). They are situated in erythrocytes and make the antibodies formation. These antigens already appear in a 3-month fetus and do not change during life. It was considered before that antigen is not present, therefore it was designated as 0. However, today it is known that there is an antigen in the first blood group, but it does not produce the agglutination reactions, therefore it is designated as 0 and it is not taken into account during haemotransfusion.

Agglutinins are thermolabile globulins. They exist in plasma and also in tissue fluid. Their accumulation in plasma occurs gradually, reaching such level (titer) when they are capable of serving as the reason of agglutination reaction. In newborns, the titer is low, but it gradually increases, reaching a maximum at 10–20 years. The titer of agglutinin usually is in adults from 1:32 up to 1:128, β — from 1:16 to 1:64. The higher the titer the more the opportunity of agglutination reaction in interference of the same name agglutinogens of erythrocytes.

During haemotransfusion the Ottenberg's rule was kept: "During haemotransfusion the erythrocytes which are introducted (agglutinogens) agglutinate because the entered plasma (agglutinins) is diluted in the total amount of fluid and their titer becomes insufficient for patient's erythrocytes agglutination". Indeed, clinical physicians warned that in the case of acute anemia during the attempt of fast compensation of blood loss with donor blood of the first group the patient erythrocytes agglutinated because of the high concentration of agglutinins which were entered. This is called *opposite agglutina-*

tion. Therefore, big amount of compatible blood was not recommended to transfuse but to add the fluid into the system. Eventually, the agglutination during the transfusion of the same blood group, in particular the second group was observed.

Last years researches of immunologists and haemotransfusiologists allow to consider the reasons of these manifestations. It was appeared that there are some subgroups of agglutinogens: A_1, A_2, A_3, A_4, A_x, A_z, etc. The strongest antigen is A_1, it exists in approximately 88% of people with the second blood group. This antigen serves as the reason for fast agglutination reaction. A little bit weaker is the action of A_2, which is observed in 12% of people with the second blood group. Other subgroups of antigen A — weak and are not practically taken into account clinically.

Agglutinogen B has also some subgroups (B_1, B_2, B_3), but their titer and antigenic action is insignificant, therefore they are not considered clinically too.

Antigens A_1 and A_2 are capable to produce antibodies against themselves, which called extra-agglutinins $\alpha 1$ and $\alpha 2$. Their association and reactions during haemotransfusion are unforeseen within the limits of one (second) blood group. So, if the patient has A_1 (II) $\beta\alpha_2$ blood group, and the donor has A_2 (II) β, the agglutination may begin because of reaction of extra-agglutinins α_2 of the recipients with the donor's agglutinogen A_2.

During lifetime, when antigens A and B enter an organism, the immune agglutinins α and β are formed. They increase the titer of natural agglutinins sometimes up to 1:512 and then there is no opportunity for it to weaken in a cultivation of liquid of an organism which can lead to agglutination. That is why the Ottenberg's rule begins to loose its force in practice, and more often only the same blood group transfusion is discussed. It is already become a law in children.

During haemotransfusion, not only the AB0 system but also the Rh-factor system is taken into account. In 1940 K. Landshteiner and A. Wiener, during introduction of erythrocytes to a rabbit from an anthropoid ape, revealed that it produces antibodies, which are capable of agglutinating erythrocytes. The factor capable to produce antibodies was found in human blood erythrocytes and recently in its fluid part. It received the name of Rh-factor. The structure of this antigen is not completely known, but it is considered that it is a polymucoprotein compound. 85% of people are Rh-positive (their erythrocytes contain the Rh-factor), and 15% — Rh-negative. So, during haemotransfusion there is always a danger of the Rh-conflict: whether during a repeated transfusion to the Rh-negative patient of Rh-positive blood, whether during the transfusion of Rh-negative blood which contains antibodies to a Rh-positive patient. Such a simple system in modern medicine is not accurate because it has been revealed that a person has 6 antigens Rh-Hr (D, C, E, d, c, e). The first three antigens are a version of the Rh-factor: D (Rh_0), C (rh'), E (rh"). D is the strongest antigen and E is the weakest one.

As a result, the presence of antigen D (rh_0) is taken into account, 2–3% of Rh-negative donors have antigens C (rh') and E (rh"). That is why the group of donors with Rh-negative blood can treat those that have no antigens D (rh_0), C (rh'), E (rh"), and the recipient should be considered Rh-negative only if he has no antigen D. Thus, in a human blood there can be one type of Rh-factor or a combination of several types and specific antibodies develop to each of them.

The atigens of H_r–H_{r0}, hr', hr" system are in the erythrocytes, but their antigenic properties are weak. At the same time, in case of their presence in a Rh-negative donor during haemotransfusion to a Rh-positive recipient, posttransfusion reaction can occur. It is necessary to remember about these features of the immune system and during haemotransfusion it is necessary to know the Rh-factor and to conduct tests on Rh-compatibility, and, in general, it is better to transfuse the blood of the same group and the same Rh-factor.

Definition of Blood Group

There are some ways of blood group definition:

a) with the help of standard serums (known agglutinins);

b) with the help of standard erythrocytes (known agglutinogens);

c) the modern method, which is widely practiced, is the application of anti-A and anti-B monoclonal antibodies.

It's necessary to estimate the validity of standard serums in definition of the blood group — serum should be transparent, have no additional inclusions and correspond to the terms of preservation. Definition is conducted at an ambient temperature (17–20°C), in Petri's dishes or special plates. As a rule, serums of first, second and third groups are taken. The serum from the fourth group is applied as a control. Always they use serums of two titers; therefore two drops of standard serum of every of three groups are put on the dish. The blood which must be examined is added there (5–10 times less volume). The serums are mixed with the drop of blood and the answer is determined by the agglutination reaction. If the investigated blood is of the first group, the agglutination is not present in any of the serums, if of the second group — agglutination appears with the serum of the first and third groups, if the blood is of the third group, the agglutination appears in the first and second serum, if agglutination occurs in all of the serums it is the fourth group.

Definition of the blood group with the help of standard erythrocytes is carried out, as a rule, at haemotransfusion stations, because erythrocytes preservation and transportation is difficult. It is necessary to remember that in this case the agglutinogens are known, therefore, the investigated serum, which is received by precipitation or centrifugation of patient's blood, is added to the drop of standard erythrocytes.

The results are determined 5 min after mixing the serum and standard erythrocytes. If there is agglutination with the erythrocytes of the second and third groups, it is the first blood group. If there is agglutination of the erythrocytes only in the third group, the patient has the second blood group, if agglutination of the erythrocytes of the second group — the third blood group. In case of the absence of agglutination in all the kinds of standard erythrocytes, the fourth blood group is determined. While registering the reaction, it is possible to determine agglutination there where it is actually absent. The reasons for this phenomenon (pseudo-agglutination) can be:

1. Low temperature in the room (under 15°C).
2. The registration of the reaction took place later than 5 min — the serum dries out and stimulates agglutination.
3. At low temperature erythrocytes develop into "monetary columns", stimulating agglutination; it easily disappears while rocking the plate or by adding a physiological solution.
4. Concentrated standard serum.
5. With presence of immune antibodies in the investigated blood, if the patient suffers from sepsis, systemic blood diseases.

Sometimes agglutination can not be noticed, it happens under the following circumstances:

a) definition of the blood groups is carried out at the temperature higher than 25–30°C;

b) if the reaction is taken into account earlier than 5 min.

c) if the titer of agglutinins is low (lower than 1:32) and thus the blood group is determined with the help of one series of serums;

d) if the ratio of serum-blood is not correct and the quantity of blood is too big.

The most reliable method of definition of blood group is using cyoclones anti-A and anti-B. They are the product of hybridome cellular lines, received as a result of the merge of mouse antibody-producing B-lymphocytes with cells of mouse myeloma. Cyoclones are not the products of vital activity of human cells, it is ascitic diluted liquid from mice — carriers corresponding with the hybridome, which contains specific antibodies of class M, which are directed against antigen A and B.

Cyoclones anti-A and B are produced as a liquid in bottles or ampoules of 20, 50, 100 and 200 dozes. The liquid contains preservatives — 0.1% sodium azide, colored blue (anti-A) or pink (anti-B). The bottles are kept for two years in a refrigerator at the temperature of +2 to +8°C. In definition of the blood group with native blood with and without preservatives the best results happen at high concentration of erythrocytes. On the plate, at the room temperature of 15–20°C, 1 drop (0.1 ml) of the anti-A and anti-B cyoclones is put, then the examined blood (the drop should be 10 times less) is mixed for 3 min long, watching for the reaction. If agglutination is not present in both cyoclones, it is the I blood group; if agglutination occurs with anti-A cyoclones, it is the II group; if with anti-B, it is the third group, and if agglutination is present in both cyoclones — IV blood group.

Definition of Rh-factor

There are some methods of Rh-factor definition in human blood. In emergency situations an express-method is used. To the standard anti-Rhesus-serum of the same with the investigated blood group the blood is added for definition of Rh-factor. A standard serum AB (IV), which does not contain any antibodies, is used as a control. The reaction is determined during 3–5 min. The presence of agglutination of erythrocytes with anti-Rhesus-serum testifies that the blood is Rh-positive, the absence of agglutination — Rh-negative. This method is allowed only in special emergency cases and further it is necessary to determine Rh-factor by laboratory methods.

The most reliable method of Rh-factor definition is the test-tube: the reaction is conducted in suspension of gelatin or polyglukin (conagglutination). Two lines of test-tubes (from two series of anti-Rhesus-serum) 3 test tubes in each one are taken for investigation. In each test tube 0.1 ml anti-Rhesus-serum of the same group with the researched blood is poured. Then erythrocytes from the examined blood are added to the first test tube, standard Rh-positive erythrocytes — to the second, standard Rh-negative erythrocytes — to the third. After that, 2–3 ml of 10% solution of gelatin are added to all test tubes and kept in the thermostat for 1 h at the temperature of 37°C. Determination of the reaction is carried out after shaking the test tubes. The presence of agglutination reaction in the examined blood testifies that the blood is Rh-positive, the second and third test tubes serve as a control.

Sources of Blood Obtaining

The basic source for receiving blood is healthy donors. It is legal to take blood from adult people who have not suffered from tuberculosis, syphilis, malaria, are not in the recovery period after the infectious disease, virus hepatitis. It is prohibited to take blood from exhausted people, with metabolism disorder, oncologic patients and also those who suffer from suppuration processes. The single doze of taken blood should not exceed 450 ml. The break between blood taking is 2 months.

The attitude towards a donor is different in different countries. So, in Italy the donorship is considered as an act of "Christian mercy, love and brotherhood", and the donor who gives blood receives forgiveness of sins. In Holland the person who gives blood 10 times receives a medal with K. Landsteiner's image. In our country the donor service can be paid if the donor receives material compensation, and also gratuitous if people give blood once a year disinterestedly.

Blood taken from a donor should be kept under special conditions. The history of preservation of blood has begun since 1865, when Doctor V. Sutugin purposed to defibrinate and preserve blood at the temperature of 0°C. In 1867 Rautenberg suggested to mix blood with a solution of carbonic sodium. It prevented it from coagulation. In 1914 Yurevich and Rozengrad suggested the application of sodium citrate in the ratio of 1:10 for preventing blood from coagulation. Nowadays blood is preserved with a solution of glucicir (sodium of hydrocitrate, glucose and distilled water) according to the calculation of 25 ml for 100 ml of blood. Before preservatives of various structure were applied. Besides of preservatives, they contained glucose and chloramphenicol. The blood prepared by such a method is kept in sterile bottles at the temperature of +4–+6°C in the refrigerator. The term of preservation is 10–11 days, but the optimum term is 7 days.

Blood can be preserved by adding heparin (50–60 mg for 1 l of blood). This blood is applied in devices of artificial blood circulation, term of its preservation — 24 h. The preservation of blood is done at low temperatures (–196°C). Such frozen blood is suitable for transfusion in 2 to 10 years. However, because of complex specifications on preserving such blood, this method did not have wide spreading.

There are also other sources of blood obtaining:

1. Utilized blood is the blood received during bloodletting concerning different diseases, which do not influence its structure. For example, hypertonic disease.

2. Auto-blood is the blood taken from a patient before an operation or during an operation if it poured into cavities as a result of vessels rupturing. This blood should not contain any impurities (bile, intestinal and gastric contents, urine).

3. Umbilical-placental blood. Its application was suggested by prof. M. S. Malinovsky. It contains an increased amount of enzymes, proteins, hormones (folliculinum). The amount of blood which is taken changes from 100 up to 400 ml. Today it is widely used for preparing blood components.

4. Cadaveric blood. In his works V. Shamov proved that even 10–12 h after the death the blood keeps its properties. Therefore he suggested taking blood from cadavers. They should be people who died in the result of sudden, more often traumatic, injuries. The blood is prepared under sterile conditions no later than 6–8 h after the death.

Thus, all the above stated proves that haemotransfusion has passed through clinical to scientifically-grounded methods of preparations, preservation and application as a powerful medical factor. The system of preparation, preservation and application of blood was established. In big hospitals there are stations for blood purveyance. No matter what kind of blood preparation should be used, it is necessary to remember that the donor's blood is subject for investigation in order to prevent from making harm to the patient.

Finding the mechanism of transfused blood action eventually determines the indications for haemotransfusion.

Mechanism of Transfused Blood Action

The effect of transfused blood depends upon the amount, method and speed of transfusion. The entered blood has a substitutive, haemostatic action, increases metabolism, shows immunobiological, desintoxicative and nutritious effect. The basic mechanism of action transfusing blood is transport of oxygen.

In surgical practice the substitutive action is the most important, blood replacement is necessary, because it threatens the life of the patient. Replacement can be carried out rationally, it is impossible to compensate 100% of the blood loss. Usually, 1/3 of the lost blood is transfused, then salty solutions and again blood is transfused. The transfused blood irritates the baroreceptors, assists in the tone of the vascular wall, increases the volume of the circulating blood, respiratory surface of erythrocytes and make influence upon the organs of haemocirculation.

The haemostatic effect is achieved due to the introduction of coagulation factors of the blood — thrombocytes. In particular, it's found while transfusing fresh blood (direct or 1–3 days after preservation). Together with the donor's blood, antibodies, globulins, which make immune correction on the organism of the patient, are entered. The entered blood replaces protein, carbohydrates and fats. Besides, protein of the blood adsorbs harmful substances (poison, bacterial toxins), strengthens metabolism oxidizing processes, excretion of urine, i.e. performs detoxication action.

INDICATIONS AND CONTRAINDICATIONS FOR HAEMOTRANSFUSION

Proceeding from the mechanism of transfused blood action, there are certain absolute and relative indications for haemotransfusion. But if the question is about haemotransfusion after blood loss, which has an obvious threat to the life of the patient, any contra-indications are not taken into consideration. Indications to haemotransfusion are following:

a) acute anemia (hemorrhagic shock) in the case of a decrease in the level of haemoglobin by 1/4 and a decrease in ABP lower than 80 mmHg. In pediatric practice the following calculation is applied: the body weight in kg is multiplied by 25 ml and by the units which does not suffice up to 10 g% of haemoglobin;

b) bringing a patient out of traumatic shock and during large operations with the purpose of fighting against postoperative shock;

c) detoxication after poisonings and bacterial insemination, with the purpose of immuno-stimulation;

d) homeostasis disturbances because haemotransfusion corrects the disturbances of water-electrolytic metabolism;

e) performing homeostasis with the presence of bleeding: the best thing in this situation is direct haemotransfusion or fresh-citrate blood introduction;

f) transfusion of blood and its components (plasma) after the exhaustion of the organism with the purpose of nutrition.

Contraindications to haemotransfusion are the following:

a) acute infringement of the liver, kidneys or heart functions;

b) inflammatory diseases of the vessels (thrombophlebitis, phlebitis, embolism);

c) allergic conditions;

d) active tuberculosis processes and also inflammatory diseases of the lung tissue.

As it was already marked, all these contra-indications become relative in cases of acute anemia. Certainly, the risk grows; therefore it is possible to apply certain blood components, abrupt transfusion, it is necessary to adjust the speed and quantity of blood which is to be given.

METHODS AND TECHNIQUE OF HAEMOTRANSFUSION

Direct, indirect, reverse, exchange and extra-corporate methods of haemotransfusion are distinguished.

Direct transfusion is the direct use of the donor's blood, which is immidiately entered to the patient avoiding of the preservation stage. Such blood is the most valuable, but thus there is the danger of infecting the patient with donor's diseases about which he couldn't know himself. A number of devices (Beck's, Juvalier's), as well as syringes are applied for direct transfusion. The blood transfer from the donor to the recipient occurs under sterile conditions.

Indirect method: the blood is taken from the donor, mixed with a preservative, kept under certain conditions and after 5–10 days is ready for transfusion. Single-use systems, which consist of a set of tubules and filters, are applied for indirect transfusions. The system contains a manometer and gas-cylinder, which allows the creation of pressure (180–200 mmHg) for intra-arterial haemotransfusion.

Exchange transfusion, or reinfusion — the use of blood which was taken from a cavity. In effect this is autotransfusion. Blood without clots and different admixtures is at once put back into the circulatory system of the patient. During reinfusion, the blood is filtered through filters and sterile gauze linings; a small amount of heparin is added. Technically it is carried out like indirect transfusion. Exchange transfusion is applied during acute poisonings (arsenic, mushrooms, carbonic oxide, lead, mercury and other poison). Bloodletting is carried out and then the same amount of donor blood is given.

Thus, a system of approach to haemotransfusion was established. Before haemotransfusion, the doctor should use a number of actions:

1. To determine the indications for haemotransfusion — the purpose of transfusion.
2. To estimate possible contra-indications, select the methods of blood introduction, determine its amount and speed.
3. To define the blood group and Rh-factor of the recipient and the donor.
4. To realize the direct tests for compatibility, to estimate beforehand the eligibility of blood for transfusion.
5. To make tests for Rh-compatibility.
6. To check the biological compatibility of blood by jet (thrice) introducin of 15–20 ml of blood with intervals of 3 min.

The special documentation or special report of haemotransfusion are filled in during haemotransfusion. For the control of possible complications measuring of the body temperature during the first 2 h and urine analysis within the first day are carried out.

Proceeding from various indications, it is possible to apply such methods of entering blood: intravenous, intraarterial, intraosseous, through cavernous bodies.

Clinical practice testifies that not always it's necessary to transfuse the whole blood. Frequently, some of its components are used and sometimes constituents — preparations of blood which are prepared with special technologies.

Blood components are prepared with the help of differential centrifugation of the whole blood. Erythromass (erythrocitic suspension, washed erythrocytes), leukomass, thrombomass, and native plasma are blood components. Erythromass is a preserved blood, from which plasma is removed; it is expedient for anemia. Washed erythrocytes are erythromass where plasma is completely absent. Erythrocytic suspension is the blood which is deprived of plasma, which is replaced with a physiological solution with the addition of chloramphenicolum, rivanol and glucose. Leukocytic-thrombocytic mass received after the centrifugation of blood and leukocytes and thrombocytes are separated.

It is necessary to remember that all preparations which contain erythrocytes are entered into a person's organism just like preserved blood — observing the rules of transfusion and technique of transfusion. They are the same as for preserved blood. Leukocytic-thrombocytic mass is entered without observing the group type, applied 24–72 h from the moment of preservation, entered intramuscularly. Native plasma is a fluid part of the blood without corpuscular elements. It is obtained after centrifugation of preserved blood. It is kept just like blood, but no more than for 72 h. It is entered with observing the group type. Ways of entering are the same as for preserved blood.

Today, methods of preserving plasma by freezing or drying have been developed. Dry plasma is kept for 3–6 years. Before application, they dilute it with physiological solution or distilled water. They enter it into an organism the same way like blood. Recently, special kinds of plasma (antihemophilic, antistaphylococcus, anti-blue-pus) that are received after immunization of donors with weakened toxins — anatoxins of corresponding activators, are widely used.

Preparations of blood are made of blood plasma. According to the action they belong to haemocorrectors (fibrinogen, cryoprecipitate, antihemophilic globulin, fibrinosin, and thrombin) or preparations of complex action.

Fibrinogen is excreted from plasma, put into bottles by 1 g and it has no group specificity. Before applying, it is diluted with distilled water or a physiological solution, entered intravenously. Fibrinogen is used for preparing the following medicines of local action: fibrin film, biological antiseptic tampon, haemostatic sponge.

Fibrinolysin — an enzyme extracted from plasma, has the property to dissolve blood clots. Correctors of the coagulation system of the blood, such as thrombin, fibrin film, haemostatic sponge are applied rather widely to stop bleeding by application.

Albumen, protein, serum, specific immunoglobulin belong to preparations of complex action.

Albumen and protein are allocated from plasma as 10% or 25% solutions, they have no specificity. They are entered intravenously, widely applied for treating various intoxications.

Serum is plasma which does not contain fibrinogen. Serum is preserved and entered just like native plasma. Sometimes calcium, vitamins, spirit are added.

Specific immunoglobulins (anti-staphylococcus, anti-tetanic, anti-influenzal, anti-blue-pus) are allocated from plasma of people who had corresponding diseases or were immunized with weakened toxins. Immunoglobulins have no group specificity, entered intramuscularly.

Blood Substitutes

Some of blood functions can be replaced with various preparations that are biological or chemical derivatives. According to the mechanism of action they are divided into 4 groups:

1. Anti-shock (hemodynamical) blood substitutes carry out the function of filling the circulatory system, restoring the normal blood volume which was disturbed as a result of blood loss or shock. Low and average-molecular dextran (rheopolyglucin, polyglucin) and compounds of gelatin (gelatinolum, haemogel, plasmogel, etc.) belong to this group.

2. Desintoxication blood substitutes which are used in treating intoxications of various genesis (poisoning, endotoxicoses of various origin, burn and radiation sickness). Compounds of low-molecular polyvinylpyrolidone (haemodes, neohaemodes, periston, neocompensan) or polyvinyl spirit (polydesum) belong to this group.

3. Preparations for parenteral feeding which are applied in treating protein insufficiency, and also for correcting nutrition during the postoperative period in patients with operations on gastrointestinal tract. Albuminous hydrolysate (casein hydrolysate, hydrolysin, aminocrovin, aminopeptide, amikin, aminosol, aminon), mixes of amino acids (polyamine, moriamin, aminofusin, vamin, friamin), fatty emulsions (lipofundin, intralipid, liposalve), and also saccharum and multinuclear spirits (glucose, sorbitol, fructose) belong to this group. Hydrolyzine, hydrolyzate casein, amynocrovin are not applied now, as they cause often collateral reactions and are withdrawn from production.

4. Regulators of the water-salt metabolism are applied for oligemia to increase osmotic pressure for treating infringements in the

water-electrolytic metabolism, for improving rheologic properties of the blood. They are applied for different kinds of shock: dehydration, intoxication. Various salt solutions: Ringer solution, isotonic solution of sodium chloride, trisaminum, lactosolum, disolum, trisolum, chlosolum, etc. belong to this group.

Ringer solution:

sodium chloride — 8.0 g
kalium chloride — 0.075 g
calcium chloride — 0.1 g
distilled water up to 1 l

Ringer—Lock solution:

sodium chloride — 9.0 g
sodium bicarbonate — 0.2 g
kalium chloride — 0.2 g
calcium chloride — 0.2 g
glucose — 1 g
bidistilled water up to 1 l

Lactasol:

sodium chloride — 6.2 g
sodium bicarbonate — 0.3 g
kalium chloride — 0.3 g
calcium chloride — 0.16 g
magnesium chloride — 0.1 g
sodium lactate — 0.3 g
distilled water up to 1 l

Recently, blood substitutes with function of transferring oxygen have been developed and improved clinical usage (hemoglobin emulsion), which will appreciably help in the application instead of the whole blood in the near future.

Complications during Haemotransfusion and Preventive Measures

Blood and its preparations, which are powerful stimulators of vital activity of an organism, are not deprived of some negative qualities and cause serious complications. As a rule, the complications arise when under circumstances the rules of haemotransfusion are infringed. Sometimes underestimation in the condition of the patient, violation of conditions of blood preservation and transfusion technique are damaged. So, disregard of the diseases from which the donor suffered in the past, ignoring of a number of clinical-biochemical investigations of the donor's blood can lead to infection of the patient with hepatites, malaria, syphilis, sepsis, AIDS and other infectious diseases.

Incorrect blood preservation, lack of sterility, deranged ratio of preservatives and blood can lead to sepsis, thrombembolia. Infringement of the rules for the techniques of haemotransfusion can cause inflammation of the vascular walls (phlebitis), air or thrombembolia. Ignoring the accompanying diseases can lead to their exacerbation (nephritis, hepatites) or cause cardiac activity decompensation in patient. Under long preservation of blood, infringements of the preservation temperature can bring to haemolysis of erythrocytes, change in the protein structure, which is found in pyrogenic reactions. They can be mild (rise in the body temperature by 1°C), moderate (by 1.5–2°C), severe (greater than by 2°C). Usually these complications are observed 10–15 min after the start of haemotransfusion (fever, pain in the back, faintness). Treatment is in immidiate stoppage of haemotransfusion, introduction of desensitized preparations (chloric calcium, dimedrol, pipolphenum), it is necessary to warm the patient, to give pyramidon, analginum. In case of increased protein sensitivity of an organism and disregard of biological test there can be allergic reactions, itching, rash, hypostases, rise in the temperature, shortness of breath, and sometimes anaphylactic shock occurs. Thus vomiting, damage in breathing, falling of the arterial pressure, bronchospasm, oedema of the lungs may occur. With the presence of these symptoms transfusion is stopped, the patient is given the mentioned preparations and in a case of anaphylaxis — glucocorticoids, cardiac preparations; patients are administered artificial breathing (apparatus).

The most difficult complication is post-transfusion, or haemotransfusion shock which can arise as a result of incompatibility of blood group or Rh-factor, and also after the introduction of a large amount of haemolyzed blood. During transfusion of incompatible blood fever, faintness, pain in the chest, decrease in arterial pressure, rise in body temperature, attributes of kidney irritation (albuminuria, hematuria, oliguria, and sometimes anuria), jaundice, renal-hepatic block which results in death, may develop. It is necessary to remember that in the pathogenesis of this complication consists of haemolysis of entered erythrocytes.

Sometimes this complication develops quickly or can sometimes appear on the 2nd–3rd day after haemotransfusion. It depends upon the doze of the entered blood. If the patient was under narcosis or used desensitized preparations, the development of haemotransfusion shock can take a long time. In case of the occurrence of this complication, haemotransfusion should be stopped; the patient is given a significant amount of liquid, desensitized preparations, and pararenal blockade is carried out. Haemodialysis, sometimes bloodletting and transfusion of the same group of blood are done.

If the Rh-factor was determined incorrectly or the test for Rh-compatibility was not done, Rh-conflict can take place. In newborns this complication is referred to as haemolytic jaundice, sometimes it is called haemolytic shock. The basis of its development is the conflict of the Rh-factor with the Rh-factor — antibody, thus haemolysis of the erythrocytes of the patient and the donor occurs. The clinical picture develops rather quickly and is similar to the clinical picture of haemotransfusion of another group. Successful treatment consists in exchange haemotransfusion, i.e. bloodletting with the following injection of Rh-negative blood which does not contain antibodies.

Active replacement of the lost blood can lead to such complications as citrate intoxication and homologous blood syndrome. Citrate intoxication develops when a significant amount of preserved blood is entered at one time. Hypotension, tachycardia, spasms are found. The reason is in intoxication of an organism by sodium citrate. For prevention of this complication, for every 500 ml of preserved blood 10 ml of a 10% solution of calcium chloride are entered. During liquidation of large blood loss it is necessary to use heparinized blood or direct haemotransfusion.

The homologous blood syndrome develops if for some period of time (days, weeks) a significant amount of blood for liquidation of anemia and blood loss replacement. The basis of this syndrome is the development of incompatibility between leukocytic and thrombocytic antigens. The clinic is thrombocytopenia, leukopenia, the development of DVS-syndrome in different organs and systems of an organism. DVS is a syndrome which is characterized by the development of thromboses against a background of bleedings and depending upon the place of occurrence give the clinical picture of acute renal, hepatic or lung insufficiency (bulked lung) or sharp infringement of blood circulation in the vessels of the brain (haemorrhage with cerebral ischemia) are found. The homologous blood syndrome is the reason for high lethality. For prevention of its development during liquidation of large blood loss, washed erythrocytes need to be used for anemia instead of preserved blood.

Thus, blood carries out a very important function in a person's organism and can be used for treating many diseases. Clinical efficiency of haemotransfusion is generally recognized. haemotransfusion had a long period of studies of blood properties, mechanisms of action in an organism. It should be applied in surgical practice everywhere, but it is necessary to adhere to indications and contraindications of haemotransfusion and to precisely carry out the rules of technique of haemotransfusion.

Lecture IX

ANAESTHESIA

Evidences, which reached us, prove that attempts of fighting with pain (anaesthesia) were made in the far past too. So, in IV–III centuries AD in Egypt and later in Greece and Rome, China and India, the extracts of mandragora, belladonna, etc. were applied. During the Renaissance and later during the process of illness mechanism investigation, the operative methods of treatment began to use more often. Nevertheless, the more surgeons were managed with tissue dissection, the more complications arose, and frequently operations resulted in the patient's death. Now we know that the cause of these deaths consists in pain shock. In those times at the operational room of one of the London hospitals a bell was sounded to try to muffle the cries of the patients being operated on.

Lev Tolstoi in his novel "The war and peace" describes an operation at that time:

"In the ward there were three tables. Two were occupied, and prince Andrey was put on the third. On the nearest table a Tatar, probably a Cossack juging by his uniform, was sitting. Four soldiers held him. The doctor in glasses was cutting something on his brown, brawny back.

Ah, Ah, Ah! — as the Tatar grunted and suddenly lifting up his black, snub-nosed face, grinned with white teeth, started tear away, twitch and shrill. On the other table where people crowded, a big, stout person was lying on his back with his head thrown back. Some medical assistants pushed hard on the chest and held him down. The white, big, stout leg quickly and frequently, not ceasing, twitched with feverish trembling. This person convulsively sobbed and choked...

The doctor in glasses, wiping off his hands, approached prince Andrey... bent down over the wound, palpated it and sighed. And then he gave someone a sign. And unbearable pain in the stomach forced prince Andrey to lose consciousness. When he regained consciousness, the broken bones of the hip had been taken out, torn skin was cut off and the wound was sutured up. His face was sprinkled with water". Anestesia was not used.

The attempts to struggle with pain were undertaken by Avicenna, Larrey, A. Pare. Sometimes there were severe methods: bloodletting, cross-damping of the carotids, cooling the place of operation. The recommendations to use opium, hemp and decoctions of other herbals for the removal of pain were offered in the handwritten manuscripts of XV–XVI centuries in the Kiev Russia.

There was a paradoxical situation — knowing that the patient could recover after surgical treatment, the surgeons started being afraid to carry out operations with high death rates.

Together with the development of anatomy, biochemistry, chemistry, medical biology the application of surgical methods of treatment were forced to develop.Achievements in engeneering and science assisted surgeons to adjust to situation.

In the XI century the operational anaesthesia appears. Using Cordus's supervision of the role of ether, doctors made attempts to use it for narcosis.

In 1844 Wells used nitrogen oxide, which was being investigated by Kolton for its demonstration of a sleepy effect during an operation. But after the first operation the failures occured. Wells was made fun of and his attempts were rejected. Unrecognized Wells committed suicide. The true date of birth of anesthesiology — the science of fighting against pain — is considered October, 16, 1846. On this day, Warren removed a tumour from the submaxillar area under ether narcosis in a Boston hospital. Then the avalanche of discovering substances which have anesthetic effect rolled. The drugs began to be used in the clinic. In 1847 Simpson suggested chloroform, in 1879 Anrep — cocaine, in 1902 Kravtsov — gedonal. In 1899 Bir suggested to inject the anesthetic into the spinal channel. In 1905 Einhorn suggested to use novocain; in 1942 Griffit — myorelaxants.

Certainly, every anesthetic has positive and negative properties. Cocain was very toxic, chloroform narcosis caused a lot complications. Clinical physicians studied each substance, course of the disease and in time eventually it was determined that special doctors should perform anaesthesia. In 1937 in England Makintosh created a school for new specialists — anaesthesiologists.

Depending upon the anesthetic, the ways of its introduction, depth of pain sensitivity removal, modern anesthesiology distinguishes general and local anaesthesia.

General anaesthesia (narcosis) is a condition when reactions to operational traumas are absent or reduced with a loss of consciousness.

Under narcosis the function of the brain cortex is turned off, areflexia, and absence of sensitivity are observed. During this period the function of the oblong brain is not disturbed, spontaneous breathing and the work of the heart are kept. Narcosis is divided into inhalation (anesthetic is given through the respiratory tract) and non-inhalation — anesthetic is given beyond the respiratory ways.

If narcosis is achieved with one preparation, it is called mononarcosis, if with several ones, it is called mixed narcosis. If narcosis is performed by anesthetics given with several ways, it is called combined narcosis.

The mechanism of narcosis development has some explanations which show the concept of the narcosis theory. These theories change, supplemented during studying the course of narcosis. Today there are the following theories of narcosis:

a) the lipoid theory — suggested by Overton, consists in an ability an anesthetic to dissolve in fats. Penetrating into the cells of the brain, where there is a lot of lecithine and cholesterol, they cause sleep;

b) the adsorption theory — suggested by Traube, explains the adsorption of narcotic substances on the surface of cells, which results in delay of enzyme processes and produces sleep;

c) the Veber's permeability theory is based on an ability of anesthetics to penetrate through the membrane of a cell and to change its colloid-osmotic properties;

d) the Varburg's asphyxia theory — anesthetics disturb the oxidation processes in the brain cells. Cells lose an ability to intake oxygen, cellular dyspnoe occurs;

e) the Miller's water crystal theory — crystallohydrates are formed in the cell under the influence of anesthetics — the resistance of the cellular membrane changes and a block is formed from carrying through synapses, which produces anaesthesia;

f) 20 modern theories have appeared today thanks to works of chemists and biophysics, which come to a change in the oxidation processes in brain cells, infringements of calcium ions concentration. The assumption that anesthetics strengthen the emission of morphine-like substances — endorphine, has appeared;

g) neuroreflector theory — based on the work of Sechenov, Pavlov, Ukhtomsky and Vvedensky on the activity of the central nervous system, Batrak suggested a theory based on the changes in the inhibitory and stimulating processes, and the changes in the function of the reflex arch. This theory does not eliminate all the previous ones but explains the clinical course of narcosis more completely.

Inhalation Narcosis

Different substances which are entered into an organism through the respiratory ways are applied in this kind of narcosis.

Liquid anesthetics:

a) ether for narcosis — a liquid which quickly evaporates, has a wide range of therapeutic action. It is kept in orange glass bottles because under the action of solar beams it can decompose;

b) halothane — 4 times more active in comparison with ether. It should be dosed out precisely and it requires oxygen;

c) methoxyflurane (penthran) — less toxic, does not decompose under the action of light, intensively accumulates in fatty tissue, capable of strengthening the action of relaxants;

d) enflurane (entran) — have significant relaxant action, but when a patient is coming out of narcosis he may faint, have a fever, headaches;

e) isoflurane (foran) — stronger than other inhalation anesthetics, depresses breathing, weakens muscles and strengthens the action of relaxants. While coming out of narcosis, excitation can be observed;

f) chlorethyl — the range of therapeutic action is narrow, overdosage is frequently observed. It can be applied for short-term narcosis;

g) trichlorethylene is not used as narcosis for long operations; it has many side effects (oppression of heart function, liver).

Gaseous narcotic substances:

a) nitrous oxide — inert, colorless gas. It causes superficial anaesthesia, therefore it is combined with ether or halothane. It is always combined with oxygen. Sleep comes in 2–3 min;

b) cyclopropane — colorless gas with a typical odour. Because in a mixture with oxygen and air it is explosive, a precise doze ratio is necessary. It is applied seldom.

Equipment and Methods of Carrying out Inhalation Narcosis

Anesthetics are given through the respiratory ways, applying an equipment which works by the follow methods:

Open method — the patient inhales the anesthetic from a device and exhales it into the surrounding atmosphere of the operational room.

Semi-open method — the anesthetic is inhaled from a device isolated from the environment and exhaled into the surrounding atmosphere.

Closed method — the anesthetic is inhaled from a device and is either partially exhaled into the surrounding atmosphere or only into a device where there is a carbonic gas absorber — soda lime.

Today either mask or endotracheal intubation narcosis are used.

Narcotic apparatuses are of different forms and modifications: Po-1; Po-2; Po-6, etc. They have an inhalation anesthetic vaporizer, respiratory bag, connecting tubes, and masks. Modern devices are equipped with system for artificial lung ventilation. At the operating room there is a narcosis table with a set of medicines, intubation tubes, defibrillator, etc.

Stages of narcosis

There are 4 stages of the course of inhalation narcosis:

I stage (analgesia) — occurs 3–5 min after the beginning of narcosis, pain sensitivity decreases and consciousness is depressed up to dissappearence. In this stage it is possible to perform small surgical operations, as a rule, such as opening of abscesses or processing superficial wounds.

II stage (excitation) — occurs 6–8 min after the beginning of narcosis, accelerated breath, ABP increases, hyperemia of the skin, pupils are dilated, but react to light, motoric and speach excitation are observed, consciousness is absent.

III stage — excitation is replaced with gradual sleep. Consciousness is lost, muscles relaxed, breath is leveled, pulse is stabilized and the patient does not react to pain and touch.

According to the deapth of the sleep, including the removal of pain sensitivity, the III stage is divided into 4 levels.

IV stage — awakening or overdosage.

Control over the course is conducted by the following parameters: pulse, ABP, breath, pupil reaction and also eye reflexes.

Endotracheal Narcosis

In 1847 under experimental conditions M. I. Pyrogov applied the anesthetics through the trachea. Today, the technique of endotracheal narcosis is developed and on occasion endobroncheal intubation is performed.

Intubation narcosis has a number of advantages in comparison with mask narcosis.

It interferes the tongue swallowing, reduces the danger of aspiration and allows to apply relaxants and control the respiration. During intubation the artificial lung ventilation is carried out, which reduces the possiblity of pneumonia occurrence.

During the introduction of the intubation tube, it is necessary to follow some rules: determine length and diameter of the intubation tube, before intubation it is necessary to conduct an introductory intravenous narcosis. Artificial lung ventilation (ALV) is carried out with the help of respirators for artificial ventilation or a respiratory bag. Today the automatic narcosis devices are also used.

Muscle Relaxants

Modern narcosis is combined with the introduction of relaxants which relax the muscles. Their application considerably reduces the amount of anesthetics and creates conditions for artificial lung ventilation.

Relaxants are divided into 2 groups: depolarizing (make a stable depolarization of the synaptic membrane) and non-depolarizing (connects with the post-synaptic membrane structures and block the opportunity of their interaction with acetylcholine). Non-depolarizating relaxants are mostly used. Their action comes quickly, on the average in about 3–5 min and the duration of the action is from 20 up to 45 min.

Tubocurarine chloride, diplazin, arduan, anatruxoni and dioxonium belong to this group.

The action of the depolarizing relaxants (lysthenon, dithylin, myorelaxin) lasts for 4–5 min.

Complications of Inhalation Narcosis

Complications can occur in any anaesthesia. They can appear during narcosis or after it. During narcosis complications are observed in connection with side actions of the anesthetic, malfunction of the narcosis equipment, ignoring safety measures or underestimation of accompanying diseases.

During narcosis complications with the respiratory and cardiovascular systems can happen. Therefore, the anesthesiologist should determine the condition of these systems, choose the anesthetic and appoint its dose while considering the time and volume of operation before it. It is necessary to remember that M. I. Pyrogov said that there is one step from narcotic sleep to death.

The rhythm and conduction infringements, cardiac arrest, thrombembolia, lung oedema can be observed on the side of the cardiovascular system.

Ventricular fibrillation, mostly observed during narcosis, can be the reason of cardiac arrest. Arterial pressure falls or is not determined, pupils dilate and bleeding in the wounds ceases. Sometimes at the beginning of narcosis the rhythm failure in the cardiac activity is observed — specially in chloroformic and fluoroatan narcosis. The direct or indirect massage of the heart, intracardiac introduction of adrenaline, atropine, calcium chloride and sometimes electric defibrillation are conducted in case of cardiac arrest. Arrhythmia, which occurred, a drop in pressure can be connected with insufficient depth of narcosis or an extensive operational trauma. It is necessary to deepen narcosis, stop the operation for a while.

Pulmonary oedema can develop due to weakness of left ventricle activity. It is necessary to remove mucous from the lumens of the bronchial tubes, strengthen heart activity by the introduction of heart glycosides, corticosteroids and diuretics.

In respiratory infringement it is necessary to assume acute hypoxia. This complication arises because of faulty equipment, disruption between the ratio of entered anesthetics and oxygen, respiratory standstill. Cyanosis of the mucous, dark blood in the wound may be observed. There are a number of reasons which can result in hypoxia. The reflex reason is a reaction to the anesthetic, resulting in laryngo- or bronchospasm. The action of the anesthetic should be removed by using spasmolytics. Laryngo- and bronchospasms are severe complications, which are hardly removed and rather frequently can be the cause of death. Asphyxia can be caused by mechanical factors — most often vomitive masses, which gather into the lumens of the bronchial tubes. Sometimes during narcosis regurgitation is observed — gastric and intestinal contents get into the nasopharynx due to return peristalsis. That is why washing of the stomach should be done before the introduction of narcosis and a stomach probe should be entered for the period of narcosis.

The most severe type of hypoxia is toxic, which results from overdosage of anesthetics. It is sometimes difficult to estimate the condition of the patient during narcosis, because decrease in pressure, breathing, pupils and reflexes can change according to the severity of the disease, in particular, bacterial intoxication.

Sometimes, if respiratory volume is not taken into account, a significant amount of carbonic gas can accumulate in the blood, causing hypercapnia.

While awakening (coming out of narcosis) motoric excitation, vomiting can occur, which can lead to traumas, asphyxia, etc. The postoperative period is always accompanied by changes in metabolism. The depth of these changes depends not only on the time of narcosis but also the extent of the operation, the presence of infection or pathology of the main organs and systems. The patient needs a certain period for metabolism restoration, that is why this period is called postoperative disease. It has several phases:

1. The phase of adrenergic and cortical activity increase. It lasts for 1–3 days. During this phase the amount of daily diuresis and quantity of water in the organism decreases. Deficiency of potassium is observed both on account of aldosteronum, and due to the reduction of protein. In its turn, the potassium deficiency results in atony of the GIT and a decrease of muscle tone and the respiratory functions. Acidosis is observed. Respiration is accelerated. With vomiting the potassium deficiency and hyperventilation can result in alkalosis.

Correction of alkalosis is conducted by the Astrup formula.

2. Phase of adrenergic and cortical activity decrease is observed on the 4th–8th day. Thus diuresis amplifies, sodium is excreted with urine, the excretion of potassium decreases.

3. Phase of anabolism occurs on the 8th–14th day and during this phase there is levelling in the nitrogenous balance, improvement in metabolism (carbohydrate, proteins, mineral).

4. The phase of fat accumulation usually occurs after the 14th day and manifests in the body weight increase.

NON-INHALATION NARCOSIS

It is possible to achieve anaesthesia not only by respiratory introduction. There are intravenous, intramuscular, subcutaneusly, intraperitoneal, per rectum methods.

Intravenous narcosis is applied most often. This way of introduction has been investigated for a long time, even Pyrogov tried to give ether. In 1902 M. P. Kravtsov discovered hedonal and this narcosis received the name “Russian narcosis”. Today there are many preparations for intravenous narcosis. They are subdivided into several groups:

1. Derivatives of barbituric acids — hexenalum, thiopentalum-natrium; distributed in ampoules and powder; before application they should by diluted.

It’s necessary to note that while using these preparations there is no phase of excitation, patients quickly calm down. But it is necessary to remember that these substances are strong drugs, nevertheless their analgesic action is of little significance. They depress the respiratory center; therefore they cannot be applied without devices which control respiration.

2. Steroid anesthetics are altezinum, viadrilum. They have no toxic action on the liver, easily endured by patients, can be used with all inhalation and non-inhalation anesthetics, but they have a weak analgesic action.

3. Propanididum (or sombrevinum) — propyl ether from phenyl acid. Sleep comes quickly, but anaesthesia lasts for 3–5 min. It is necessary to carefully use it for patients who suffer from allergies because it can become a cause of anaphylactic shock.

4. Ketamin (ketalor, kalipsol) — derivative of cyclohexane: narcosis quickly comes and lasts for 30–40 min. Narcosis occurs on the first level of the III stage of narcosis. Sometimes it can provoke spasms, therefore it is impossible to give to patients who suffer from epilepsy and psychomotor excitation.

5. Ethomidat (radennarcon) — narcosis comes quickly and lasts for 10 min., sometimes it serves as the reason for convulsive twitching in certain muscles. It shows a good effect in combination with other anesthetics.

6. Sodium hydroxybutyrate or GABA. It has a weak analgesic action; narcosis comes 10–15 min after introduction and lasts for 2–4 h. It cannot be applied during myasthenia.

Neuroleptanalgesia is a modern non-inhalation narcosis offered by de Castro in 1959. The essence of it consists in the association of actions of neuroleptics and analgesia.

The following preparations are applied in this narcosis:

a) droperidolum — possible to enter intravenously and intramuscularly, duration of effect is 3–7 h. It has a smoothing, relaxing action;

b) fentanyl is narcotic analgesic. It is 100 times stronger than morphine in analgesic action. I/v introduction. The effect comes in 2–3 min, but lasts almost 1.5 h;

c) thalamonal is a combination of droperidol and fentanyl in one bottle.

Ataralgesia is narcosis which combines sedative, tranquilizing and analgesic means. Palfium, dipidolor, fentanyl, pentosacinum are mostly used as analgesic means; sibazon (diazepam), relanium, etc. — as sedative means.

There are standard techniques for ataralgesia:

a) combination of sibazonum, dipidolor and muscle relaxants and nitrogen oxide with oxygen;

b) combination of seduxen and palfium and nitrogen oxide with oxygen;

c) combination of seduxenum and fentanyl.

Central analgesia is a variant of multicomponent anaesthesia, which is achieved due to the introduction of large doses of analgesics, which influence the CNS with a change in the conducting pain signals. Morphine or fentanyl are applied as anesthetics.

After the loss of consciousness with the help of ketalar and seduxen with the inhalation of nitrogen oxide with oxygen, morphine is given with the calculation of 3 mg per 1 kg or fentanyl — 3–6 mg per 1 kg. Analgesia is kept for 4–6 h. Sometimes morphine and fentanyl are combined with promedol, dipidolor.

Anaesthesia like that is used for extensive operations on organs of the thorax, traumatic shock, as well as operations with the application of artificial blood circulation.

Controlled Hypotension

Attempts to operate on patients under the conditions of decreased arterial pressure have been known for a long time. In old treatises, it is described that patients with hypotension tolerate the surgical intervention easier. If earlier people resorted to bloodlettings, today there is a number of medicines which block ganglia of the VNS:

pentamin, bensohexonium, harphonad, sodium nitroprussid. Their introduction provokes hypotension, which is especially important in neurosurgical and vascular operations. These preparations can be applied in other operations as well, if there is arterial hypertension. Contraindications to controlled hypotension are acute coronary insufficiency, blood loss, glaucoma, insult.

Artificial Hypothermia

Decrease in the body temperature as a whole or on a local site has been used since ancient times. J. D. Lorray and M. I. Pyrogov marked a decrease in pain sensitivity during hypothermia. Bigelou widely introduced this method into clinic. First, the local hypothermia was applied, and in due time the general one.

Cooling the patient begins after his introduction into deep narcosis by the application of neuroleptics and muscular relaxants. The patient is immersed into a cold bath or is edged with ice blisters. Last years, special hydrosuits are used or cooled liquids are passed through the stomach of the patient. During operations on the cardiovascular system the application of cooling blood in a system is widely used (so-called extra-corporal hypothermia). As a rule, the body temperature is reduced to 30–33°C (superficial hypothermia) or 20–25°C (deep hypothermia).

Surgical treatment concludes with bringing the patient out of hypothermia with the help of active warming (hot-water bottle, mattress) or massive thermal wrappings.

Such a method is allowable only with the presence of good equipment and individual patient care.

Artificial Hybernation

Any operation demands corresponding reaction of an organism, increase in metabolism. In nature some animals fall into a winter sleep, and their vital activity being supported against a background of significant decrease in metabolism. It appears that a condition of anabiosis is possible in clinic, which allows the introduction of a number of lytic mixtures, which consist of neuroleptics, ganglioblockers. Most often it is a combination of aminazine, isopromethazine, and lidol. The body temperature decreases to 2–7°C. Supplementing narcosis with this method, a more adequate response of an organism to operational trauma is achieved.

Local Anaesthesia

Fight against pain can occur not only with the help of the above-stated methods, which come to the loss of consciousness. It can be combined with the loss of pain sensitivity at the operation site. Even Anrep, and then Einhorn, suggested the use of cocain and novocain for entering into nervous trunks or plexus. Since then different ways of introduction of different preparations and their toxic action have been studied; the technique of introduction and clinical efficiency were developed.

Today a number of preparations for local anaesthesia are known:

a) novocain — a preparation which is applied as 0.25%, 0.5%, 1%, 2%, 5% solutions. The solutions are prepared from Novocain powder and in sterile vials or ampoules are delivered to the hospitals. Tolerability of this preparation is high; however it is necessary to carry out tests for sensitivity because sometimes it can be the reason of allergic reactions. The doses of different preparations are different depending upon the concentration — from 500 ml of a 0.25% solution up to 5 ml of a 2% solution;

b) adhering to certain doses and ways of introduction, sovacaine, cocaine, lidocaine, trimecaine, celnovocain are used. As a rule, they are given as solutions hypodermically, intramuscularly, peri- and endoneurally.

Depending upon the way of introduction the following kinds of local anaesthesia are distinguished:

— surface (contact), or greasing anaesthesia. Mostly, it is action on mucous membranes. This kind of anaesthesia is mostly used in the ear-nose-throat clinic, ophthalmology and in different endoscope examinations. A 1–3% solution of cocaine, or 0.25–3% solution of dicaine, or 2–5% solution of novocain or lidocain are most often applied;

— infiltration anaesthesia is the method of infiltration of tissues with anesthetics. At the site of the expected operation, a solution of novocain (formation of “citric crust”) is given intradermally and further by layers they infiltrate tissue according to their incision. The anesthetic is given linearly according to the course of opening or rhomboidally.

O. V. Vishnevsky developed infiltrative anaesthesia, techniques of performance and effectiveness. As an anesthetic agent for anaesthesia, a 0.25–0.5% solution of novocain is applied, or sometimes it is given together with adrenaline or lidocain — this strengthens the effect of anaesthesia;

— block (regional) anaesthesia — with this anaesthesia the flow of pain pulses is disrupted by the introduction of the anesthetic into a nerve (endoneural) or around it (perineural) or into the neural plexus. Thus sensitivity below the place of introduction is switched off. As a rule, with this purpose a 1–2% solution of novocain or lidocain is applied. Block anaesthesia is used during operative interventions (extremities, thorax) and in stomatology;

— intraosseous anaesthesia is applied during operations on extremities. The extremity is lifted up and a tourniquet is applied, then in the spongiform substance of the bone, a needle is stuck and through it a 0.25% solution of novocain with an amount from 50 up to 150 ml is entered. This is a type of internal anaesthesia. In modern practice it is applied seldom.

Spinal, Peridural and Sacral Anaesthesia

This kind of anaesthesia is connected with the introduction of anesthetic into the subarachnoidal, peridural or sacral cavity. Solutions of sovocain, novocain, lidocain with concentration of 1–2% are used. The techniques of its conduction demand practice because introduction of anesthetic can cause complications, which should be avoided.

During spinal anaesthesia the patient usually sits on the operational table. The patient inclines forward; spine as much as possible is bent. The spinal canal is punctured between the III and IV lumbar vertebra. Some liquid is deleted, mixing it in a syringe with the anesthetic, and then the mixture is entered into the spinal canal. Then, the patient is put on the operational table with the head lifted. During peridural anaesthesia the dura mater is not punctured, and the anesthetic is given into the peridural cavity.

During sacral anaesthesia, the anesthetic is entered into the sacral canal. Depending upon the way of introduction the removal of pain sensitivity occurs on different levels (a certain segment of the spine is switched off). During this anaesthesia, it is possible to operate on the lower extremities, organs of the pelvis and abdominal cavity.

It is necessary to remember that with different kinds of local anaesthesia there are different kinds of complications. First of all, there may be damage to the nerves and the occurrence of paresis and paralyses. With the violation of technique and sterility hematomas can appear, tissue can be infected. During spinal anaesthesia hypotension or respiratory standstill, if the anesthetic numbs the top segments of the spinal cord, can be observed. Sometimes during this anaesthesia, weakness in the lower extremities, elements of muscular atrophy can be observed for a long time. Nevertheless, greatest disadvantage of local anaesthesia is the preservation of consciousness, that is why it is not applied during operations on children and people with hyperexcitability of the nervous system. The mentioned circumstances make local anaesthesia the method of choice today.

Lecture X

SURGICAL OPERATION

Mechanical action on tissues and organs with medical or diagnostic purpose is called an operation.

For many decades, an operation was a source of intolerable pain and danger of death that forced patients to refuse it, frequently even under direct threat to life. Different, even complex, operations were performed long ago, even before the aseptic era and the application of anaesthesia.

All operations are divided into bloody during which the integrity of the skin and mucous membranes, muscles and other tissues, and also various organs of the body is broken and bloodless during which the external integument is not damaged. An example of a bloodless operation is the repositioning of a dislocation. In addition, medical and diagnostic operations are distinguished.

Biopsy, punctures of pleural and abdominal cavities, articulate, spinal and other endoscopic examinations (cystoscopy, bronchoscopy, esophagoscopy, gastroscopy, thoracoscopy, laparoscopy, etc.) belong to **diagnostic operations**. The definition or specifications of the diagnosis with the help of this or that operative method provides obligatory previous application of all other diagnostic methods. Diagnostic laparotomy offers a certain risk, and used only when there is no other resort.

Medical operations can be radical, when injured organs or tissues are cut or removed (abscess, appendectomy, stomach resection, cholecystectomia, etc.).

Radical operations can be extended and combined. For example, if a stomach tumour has spread onto the surrounding tissue, simultaneously spleen removal, resection of a part of the liver, etc. are done.

Palliative operations do not liquidate the reason of the illness but facilitate the condition of the patient. For example, if a tumour closes a lumen of the intestines and there is no opportunity to radically remove it, they resort to bringing the intestinal loop onto the anterior wall of the stomach with its following dissection.

Depending upon the urgency of performance the following operations are distinguished:

— emergency;

— urgent;

— elective.

Emergency operations are carried out immediately within first 2 h after establishment of the diagnosis (appendicitis, perforation ulser stomach, strangulated hernia, and intestinal obstruction). In some cases, operations are performed within the nearest minutes because of vital indications (acute bleeding, tracheostomy).

Urgent operations are carried out during the first days after being hospitalized in connection with the fast development of process which can make the patients inoperable (malignant tumours, etc.).

Elective operations are carried out at any time after a 2–3-day preparation.

Operations can be one, two- and multiple-staged. Most operations are carried out in one stage (appendectomy, stomach resection, etc.). If the condition of the patient is defined as severe, and the extent of the operation is big and the degree of risk increases, the operation is divided into two or more stages. For example, apendicular infiltrate, tumour of the large intestines with the intestinal obstruction, the Filatov's graft.

Operations are divided into 4 groups:

1) clean;

2) conditionally clean (opening of the gastrointestinal tract (GIT));

3) contaminated (the entering of the contents of cavitary organs into the wound);

4) dirty, or primarily-infected.

The indications to an operation are absolute, relative and vital. The latter are determined because of direct threat to the patient's life.

Absolute indications — if treatment of the disease is possible by only operative way.

Relative indications have, for example, elective operations, which are possible of temporarily delaying without harm to the health of the patient. With the same disease, depending on the urgency, the indications for the operation can be vital, absolute or relative. For example, with a complicated ulcer of the duodenal the indications for the operation can be vital (profuse bleeding which does not stop), or absolute (stenosis), or relative (in these cases, if not all methods of conservative treatment have been used).

The surgeon is obliged to think over the plan of operation and make a pre-operational epicrisis in which the following is marked:

— justified diagnosis;
— indication for the operation;
— plan of the operation;
— type of anaesthesia.

In a surgical operation three main stages are distinguished:

1) The preoperative period and preparation of the patient for the operation.
2) Features of the operation course.
3) Intensive supervision and care for the patient in the post-operative period.

If these requirements are kept the positive effect of surgical intervention is guaranteed.

The preoperative period is the interval from the moment of hospitalization of the patient or visit to the polyclinic till the start of the operation.

The general task of the preoperative period is maximal reduction of danger from the operation. During the preoperative preparation the surgeon can take into account all possible dangers from the operation and use a number of preventive measures.

At the preoperating period the surgeon is obliged to execute a number of tasks, such as:

1. Determine the diagnosis, indications and contraindications for the operation and choose the optimum way of surgical intervention and method of anaesthesia.
2. Find complications of the basic disease and accompanying illnesses.
3. Determine the condition and degree of infringement of respiratory, circulatory, liver, kidney functions.
4. Conduct a complex of medical actions which assist to improve the disturbed functions, decrease the arterial pressure, conduct oral cavity, and tonsils sanation for prevention of possible infection.
5. Create functional reserves of an organism, increase its immunological forces.

6. Conduct psychological preparation of the patient in order to avoid of the nervous stress.

The duration of the preoperative period depends upon the character of the disease, general condition of the patient, degree of urgency of the operation and the extent of operative intervention. For emergency operations (bleeding, acute appendicitis, perforated stomach ulcer, etc.) the preoperative period is reduced to a minimum and only elementary actions are used.

At the preoperative period the surgeon must expect complications, which can arise during the operative intervention for in time prevention. During preparation for an operation the preventive actions against complications are used, correction of activity of the damaged organs is carried out with the purpose of increasing their functional reserves.

In cases of elected operations the remote, nearest and immediate preoperative periods are distinguished. For example, at the remote period the patient preparation (sanatorium treatment) is carried out. During the nearest period (7–15 days) the general condition of somatic systems is normalized and during immediate patient preparation, sanitary processing, and urinary bladder contents evacuation is carried out.

Direct preoperative actions are distinguished, which are necessary to be used in the preparatory period (water baths, shaving hair, clyster, bladder emptying) and also **specific measures** for the preparation to operations of a certain kind (evacuation of gastric contents with stenosis, colon lavage before its resection, etc.).

The following actions belong to preoperative preparation:

— normalization of the mental condition of the patient;

— stabilization of the general somatic conditions;

— local preparation.

Psychological preparation. The skill of the doctor to remove and smooth over mental trauma assists in the preparation of the patient for operation and the postoperative course. The medical staff is obliged to spare the nervous system of the patient during the whole treatment period. In the postoperative period the value of contact between the doctor and patient in particular increases. The ability of the doctor to convince the patient of recovery and favorable outcomes of operation and treatment gives the patient new forces. In case of severe uncurable diseases (malignant tumours) the doctor intentionally hides the truth from the patient, otherwise the patient loses his last hope for recovery, and the disease starts to progress.

General somatic preparation. In the preoperative period special attention should be given to the changes in the circulatory, respiratory systems and also the activity of parenchymatous organs with the purpose of their correction.

Liquidation of anemia has a great value. Patients with haemoglobin amount less than the norm by 25–40% tolerate operation worse. In such cases, before the operation, repeated haemotransfusions (250–500 ml) are carried out, haemopoietic organs are stimulated, full-value diet and multi-vitamins are appointed. For preventive measures of thrombosis and embolism, the prothrombin index is determined, and if needed anticoagulants are appointed.

During 5–10% of all operations, in particular on the abdominal and chest cavities, respiratory damage and pulmonary complications appear in patients who before the operation already had pathological disorders in the respiratory organs. Therefore before the performance of elective operations it is necessary to liquidate inflammation in the nasal cavities, acute and chronic bronchitis, pleuritis and pneumonia. Contraindications to an operation are acute rhinitis, bronchitis and also promoted lung emphysema. During the preparation of the GIT long starvation are not desirable, as well as the use of laxatives and a repeated colon lavage, because this brings acidosis and changes in the acid-base condition, reduces the tone of the intestines and assists in stagnation of blood in the vessels of the mesentery. As a result, severe intoxications, vomiting, meteorism and oliguria can develop. Therefore, food should be limited only the evening before the operation.

An important role in patient preparation is sanitation of the oral cavity, removal of carious teeth. The stomach before operation should be emptied.

In gastric bleeding it is not recommended to empty the stomach before an operation. A cleansing oedema is necessary to use because of the absence of independent evacuation; an exception is made with operations on the large intestines and perineum.

It is very important to increase the reserves of glycogen in the liver for an increase of its function. The patient should use full-value food; he is given glucose, vitamin C, B_{12}, methionine, lipocain.

Local preparation. In the preoperative period it is necessary to carefully examine the patient's skin. If inflammation is revealed on the site of the planned operation or nearby, the operative intervention is cancelled if there is no vital indications. Before an operation it is desirable to appoint a bath, change underclothes. At the day of the operation it is necessary to prepare the operational field — repeatedly wash it with soapy water and shave the hair.

The postoperative period is the time from the end of the operation to the moment when the patient's work capacity is restored. The recovery period is no less important, than the surgical operation.

The postoperative period is divided into three phases:

1) Early phase — first 3–5 days after the operation;

2) Late phase — 2–3 weeks after the operation;

3) Remote phase — till a working ability is restored.

Smooth or normal postoperative period and postoperative period with complications are distinguished.

Changes which are observed in the postoperative period can normalize during several days. In 90% of the cases the patients that are operated on have infringement of the carbohydrate metabolism with hyperglycemia and glucosuria which disappear in 3–4 days.

In the postoperative period acidosis can occur as a result of violation of the acid-base balance in the blood. Preventive measures of acidosis are early feeding, introduction of glucose and insulin.

Violation of protein metabolism is accompanied by an increase in the blood of residual nitrogen hypoproteinemia, an increase in globulin fractions. The development of hypoproteinemia causes an increase in bleeding during the operation. It can be compensated for with a full-value diet with high contents of fiber, blood and plasma transfusions.

Violation of the water-electrolyte metabolism also is important in the postoperative period. The first days after the operation are characterised by a decrease in chlorides, which is compensated by the introduction of Ringer solutions, hypertonic solutions of sodium chloride and potassium.

Disorders of the water-electrolyte metabolism should be subject of individual correction within first postoperative days. About 2.5–3 l of liquid a day should be given.

Changes of blood structure are noted at the postoperative period. In this case leukocytosis is the organism's normal response to the protein disintegration products absorption. The reasons for anemia are blood loss during the operation, accelerated disintegration of erythrocytes after haemotransfusion, which is eliminated by haemotransfusion and erythrocyte mass. In 75% of patients the viscosity of blood increases, which in turn increases globulin fractions and dehydration of an organism, which makes danger of thromboses and embolism formation.

The intoxication which occurs in connection with pathology of the parenchymatous organs, GIT and endocrine systems is treated with different solutions (isotonic solution of sodium chloride, haemodesum, Ringer solution, 5–40% solution of glucose) are applied.

The activation of patients after operation is very important, in particular the elderly. It is done with respiratory exercises and physiotherapy exercises.

Violation of functions of vital organs and systems in the postoperative period are possible both in the early and late stages. As anesthetizing means 50% analgin, 1–2% promedol, omnopon, morphin, neuroleptics (droperidol, haloperidol), and medical narcosis are applied. If sleep disorders are observed the barbiturates are appointed.

Cardiovascular system disturbances manifest in heart attacks, acute cardiac and vascular failure, thrombosis, embolism can be observed. Cardiac glycosides (strophanthin, corglykon, digoxin), substances which tone up peripheral circulation (strychnine, caffeine, ephedrine, dopaminum), coronarolytics (nitroglycerine), diuretics (lasix), oxygenotherapy, for thromboses — anticoagulants are applied.

Respiratory complications include acute respiratory insufficiency — bronchitis, tracheitis, pneumonia, pleuritis, atelectasis, abscess of the lungs. Incomplete ventilation of the lungs has great value in the development of pneumonia. For prevention of respiratory complications it is necessary to avoid overcooling the patient in the operational hall, bath and other rooms. They give careful care to the patient, respiratory gymnastics, appoint antibiotics, mustard plasters, inhalations, etc.

Complications of urinary organs manifest by a delay in urination (ischuria), reduction in the amount of urine (oliguria, anuria), pyelitis or inflammation of the urinary bladder (cystitis). Postoperative oliguria and anuria have a neural-reflex origin or are connected to a damage of the renal parenchyma. A bilateral paranephral blockade, stimulation of diuresis (lasix, manitol, aminophyllin), haemodialysis and haemosorption are conducted. Ischuria occurs mostly after operations on the pelvic organs. Thus, the bladder is overfilled and the patient is recommended to drain it in a sitting or standing position. A hot-water bottle can be put on the urinary bladder, if necessary, catheterization is done. For the treatment of pyelitis and cystitis, antibiotics and means for disinfection of the urinary tract (urotropin, furodonin, furozolidon, nevigramon, etc.), and physical procedures are used.

In the postoperative period as a reaction to an operational trauma, shock, unconsciousness, collapse can occur. Mechanisms of their development and treatment in details are stated in the section "Traumatology".

Terminal Conditions

Research concerning the revival of an organism was carried out in XVII century by the well-known anatomist and physiologist P. V. Postnikoff. Further Ye. Mukhin, M. Uspensky, and A. Philomafitsky (XVIII century) worked out this problem. For the last 40 years in the Research Laboratory on General Resuscitation under the management of prof. V. A. Negovsky the theoretical bases of the problem of terminal conditions were developed.

There are following terminal conditions:

1. Pre-agony condition.
2. Agony.
3. Clinical death.

In addition, shock of the III–IV degrees belongs to the terminal condition too.

The **pre-agony condition** is characterized by confused consciousness, paleness of the skin, acutely pronounced acrocyanosis.

Spasm of the peripheral vessels results in deep hypoxia, acidosis and metabolism disorder. Eye reflexes are kept, shallow breathing, threadlike pulse, ABP is not determined.

Agony is characterized by the absence of consciousness, areflexia, pronounced acrocyanosis. Pulse is hardly determined on the carotid arteries, tones of the heart are muffled, bradycardia. Breathing is rhythmic, shallow, and spasmodic. Pupils start to dilate; maximal dilatation occurs 90 s after the start of anoxia of the brain.

Clinical death: respiratory and cardiac activity is absent. The pupils are dilated and do not react to light. The organism passes into a condition of minimal vital ability which lasts 5–6 min, during this period cells of the CNS die. In 5–6 min clinical death passes into biological, during which biological processes in the organism completely stop.

Intensive therapy during terminal conditions should be directed on the restoration of functions of vital organs and reduction of hypoxia of tissue.

There are the following complex methods of treatment during terminal conditions:

1. Chest massage (direct and indirect).
2. Artificial lung ventilation.
3. Intra-arterial haemotransfusion.
4. Defibrillation of the heart.
5. Auxiliary artificial blood circulation.

Resuscitation departments are organized in all large hospitals. They are located near operation blocks, equipped with systems for the patients condition observation (monitoring systems) and also have an express-laboratory. The personnel in these departments are of high-skilled.

The primary goal of resuscitation and intensive therapy is mobilization of vital organs and normalization of their functions in patients with damages, acute blood loss in the early postoperative period after extensive traumatic operations. The bases of these violations are changes in haemodynamics, respiration, metabolism as well as the body temperature. In connection with this, special attention is given to diagnosis of circulatory insufficiency (monitoring systems, method of radionuclide researches, haemodilution, etc.), acute respiratory insufficiency (determined by change in the functions of external respiration, gas structure of the blood, acid-base status), violation of the water-electrolyte metabolism, function of the liver and kidneys, changes in the blood coagulation system. A differentiated approach to pathogenetic therapy of vital functions disturbances allows to decrease the incidence of complications and lethal outcomes in connection with surgical intervention and different critical states which arise in surgical patients.

Units of intensive therapy are intended for postoperative patients who demand intensive supervision for several hours and days before they are transferred to common wards.

Lecture XI

TRAUMATOLOGY

The action of external agents on the organism (mechanical, thermal, radiation, mental, etc.) is referred to as a trauma, which follows with anatomic and functional violations in organs and tissues accompanied by local and general reaction of an organism.

Kinds of traumatism:

1. Traumas of a non-industrial character:

a) transport (railway, automobile, tram);

b) household;

c) sports;

d) others (traumas as a result of natural accidents).

2. Industrial traumas (industrial and agricultural).

3. Deliberate traumas (household traumas, ill-intentioned attacks, suicide attempts).

Depending upon the kind of agent causing the damage, traumas are divided into *mechanical, electric, radiation, mental, operational,* etc.

The division of traumas according to the character of damage has great value — they can be *open* and *closed*. In open damages the gaped wounds of the skin or mucous membranes may show. Microbes can penetrate through the wound of the skin or mucous, promoting the development of early or late complications.

Penetrating injuries, when internal organs (stomach, thorax, skull, joints) can be affected and non-penetrating ones are distinguished.

With a *simple trauma* only one kind of tissue is injured, with a complex one — different tissues are damaged, for example, the skin, muscles and bone.

The trauma is *homogeneous* if it is caused only by one factor. If the trauma was caused by many factors, for example mechanical trauma together with a burn, it is combined, and simultaneous damage to different systems (concussion and broken shin bone) is called a joint trauma.

Traumas can be direct and indirect (damages which develop at a distance from the causative agent action).

Traumas can be *single* and *multiple* (polytrauma). Usually traumas are *acute*. However in some cases it is possible to speak about *chronic*, caused by the harmful influence of professional factors.

In patients with severe traumas the symptoms develop very quickly, the condition frequently is serious, quite often it is worsened by traumatic shock. Thus the surgeon should quickly specify the diagnosis and submit the necessary help. While gathering the anamnesis and objective examination of an injured patient, some circumstances require special attention, in contrast to the usual investigation of the surgical patient.

Firstly, the appearance of a damaged area does not always tell about the severity of the damage.

Secondly, not always trauma the symptoms of which are obvious threatens the life of the patient. Diagnosis of multiple traumas in patients who are unconscious, in serious shock or alcoholic intoxication is especially difficult.

Thirdly, the serious general phenomena can be observed in trauma (shock, acute anemia, traumatic toxicosis) which are necessary to estimate and render a corresponding aid to the patient.

In case of severe traumas, where the patient's life is under threat, first of all it is necessary to provide emergency care, and then start gathering the anamnesis and perform the complete examination of the patient.

While examining the patient it is necessary to find out the complaints, how he felt at the moment of the trauma and after it, which aid he obtained. It is necessary to determine accompanying diseases.

While examining the patient it is necessary to examine in detail the damaged area to specify the diagnosis and get previous representation on the character of the trauma, appoint methods of treatment and expect for possible complications.

CLOSED INJURIES TO SOFT TISSUE

Closed injuries to soft tissues are divided into blows, distortions and ruptures, concussions and compression. Closed damages of soft tissues and organs located in cavities are observed.

Blow is an injury to tissues and organs without infringement of the skin integrity as a result of fast and short-term action from the injuring factor on any area of the body.

The mechanism of a trauma can be various, for example, falling down on an object or impact.

The severity of the damage is determined by two factors:

1. Character of the injuring agent, its weight, consistence, speed of action.

2. Type of damaged tissues (skin, muscles, fat, bones), their physical condition.

The *clinical picture* is characterized by pain, swelling and violation of the function of the injured organ or area. As a result of a large force action in touching direction the displacement of the skin from the underlying tissues can be observed. Shock or paralysis of the area innervated by a definite nerve can occur as a result of big nerves bruise; contusion of the joint causes infringement of its function, of thorax and lungs — hypodermic emphysema.

Treatment. The task of treatment during the first period after contusion is to stop the haemorrhages in tissues. The damaged organ needs rest, a raised position. They apply cold, a squeezing bandage. On the 2nd–3rd day, when the damaged vessels have formed clots, warm, physiotherapeutic procedures are administered for the resolving of haemorrhages. With the presence of hematoma — suction and introduction of antibiotics.

Distortions and Ruptures

Distortions are damage to soft tissues which is caused by a force which strains but does not disturb the anatomic structure of the tissue. However, if in such trauma mechanism the working force overcomes the tissue resistance, a **rupture** of the ligament, fascia, muscles, tendons, nerves etc. occurs. Clinically rupture of the ligament is accompanied by strong pain, violation of movements, haemorrhages into soft tissues and swelling in the joints. As a result of haemorrhages the fluctuation can be determined during palpation.

Treatment consists in rest, imposing of squeezing bandages, long-term immobilization of the joint. After the resolving of the haemorrhages from the 3rd week it's possible to begin cautious active movements, massages, medical exercises. In slow resolving punction is performed and antibiotics are given.

Ruptures — complete and incomplete — happen seldom, generally as a result of strong and fast muscle contractions, while lifting weights.

Clinically they appear with strong pains, haemorrhages, hypostasis, and restriction of mobility.

Treatment. With an incomplete rupture — immobilization, rest, cold, then warm, physio-procedures. With a complete rupture — operation with the following immobilization for 2–3 weeks.

Concussion results in significant infringements of tissue and organ functions.

Long-term and strong vibration of the upper extremities firstly causes infringement of their functions, and then result in morphological changes in the muscles, nerves, bones, which are the reason for the development of sclerotic processes, restriction of working ability (vibrating disease).

Compression is observed with damage to vital organs (the heart, the brain, the lungs).

Traumatic toxicosis is a special kind of damage, which is an original syndrome observed during long compression of a large area of soft tissues, mostly the extremities, with general and local phenomena. It occurs during landslides, earthquakes, bombardments, railway accidents. The syndrome appears after the removal of the compressing weights. The detailed description of this syndrome was made by A. Ya. Pitel (1941), M. M. Yelansky (1950).

The extremity released from the pressure is pale with cyanotic spots. The pulse on it is not palpated, sensitivity is lost, and movement is not possible. In 3–5 h the picture of severe shock with violation of CNS functions — excitation, fear, anxiety and then apathy, drowsiness, damage to haemodynamics develop. Plasmorrhea and toxic damage of the liver and kidneys occurs. In severe cases degenerative changes in the kidneys and liver can occur — oliguria, hematuria, protein, cylinders in urine, anuria, uremia, hypostasis of the brain, lungs. On the 3rd–5th day the extremity swells, becomes dense, paralyses develops. After death during dissection severe degenerative changes in the kidneys, degeneration and fatty degeneration of the liver, hypostasis of the brain, lungs, etc. are observed.

The following is important in the pathogenesis of the syndrome:

1. Damage of the CNS (shock, hypostasis of the brain, etc.).
2. Absorption of toxins, uric and phosphoric acids and potassium from soft tissues.

3. Violation of the hepatic-renal barrier functions.

4. Violation of haemodynamics (increased permeability of vessel walls with output of plasma into intertissue cavities), trophic disturbances.

5. Ischemic necrosis of the muscles.

Treatment. The basic tasks concerning liquidation of traumatic toxicosis are following:

1. Decrease in necrosis of the muscles.

2. Decrease in intoxication.

These tasks are solved with the help of the following actions:

1. The damaged extremity is cooled with ice to reduce traumatic hypostasis and slit the skin and fascia to reduce the compression of the muscles. In severe cases the extremity is amputated to save the patient's life.

2. Bromides, hydrochloride, atropine, glucose, novocainic blockade are applied to prevent shock and angiospasms.

3. Alkaline reserve of the blood is restored by intravenous introduction of 20–25 g of soda and 3 l of isotonic solution; the patient is appointed plenty of fluids.

4. They strengthen diuresis with the help of diuretic preparations.

5. The basic role in struggle against intoxication during traumatic toxicosis belongs to methods of extracorporal detoxification. From the very beginning the regional perfusion of the injured extremity under a tourniquet for reducing endotoxification is conducted. Haemodialysis, haemofiltration (to liquidate acute renal insufficiency), haemosorption, plasmosorption, plasmapheresis (for fighting against acute hepatic insufficiency) are used after the trauma as soon as possible.

General Phenomena in Trauma

Traumatic damages, as well as other pathological processes, are accompanied by general signs on the part of the central nervous system and other organs and systems subordinated to its regulating influence. Such pathological conditions are clinically observed.

Unconciousness is a sudden and temporary brain ischemia, which is expressed by loss of consciousness and sensitivity infringements.

The reason for unconciousness is neuro-psychological moments, which through the neuromotor center cause reflex contraction of the peripheral blood vessels and brain vessels.

Unconciousness can happen as a result of fright, fear etc., consequently, paleness, nausea, ringing in the ears, blackness in the eyes cold sweats, dilation of pupils, pulse decrease, shallow breathing, pale mucous and integuments are observed.

Treatment. The patient should lay with raised legs, loosened clothes, and good inflow of fresh air. The patient is given steam from liquid ammonia to inhale; the face is moistened with cool water; when the patient regains consciousness, it is necessary to give him valerian drops, coffee, wine.

Collapse is a temporary condition of acute cardiac weakness and a decrease in vascular tone that unexpectedly appears and is accompanied by a decline in all vital functions.

Collapse is observed with bleedings, septic and infectious diseases, poisoning, narcosis, sharp pains.

The clinical picture of collapse is similar to the clinical picture of shock. It is necessary to remember that with shock the phenomena of oppression of the nervous system prevail.

Symptoms: paleness that suddenly appears, cyanosis, small, frequent pulse, shallow breathing, decrease in blood pressure, cold sweat, drop in the body temperature, cold extremities and muscular relaxation, consciousness is kept.

Treatment. They remove the reasons for collapse, increase cardiac activity and the centers of the oblong brain. With blood loss, haemotransfusion, isotonic solution are administered; they give the patient hot tea, coffee; enter camphor, caffeine hypodermically.

Shock is a severe general condition of the patient, which is expressed by the oppression of the nervous system and all physiological systems.

At the beginning of the XVIII century, a French doctor H. Le Dran described the basic features of traumatic shock and regularly used the term "shock" in his works.

At the beginning of the XIX century P. Savenko (1834) correctly defined shock as severe damage to the central nervous system of the patient.

M. I. Pyrogov gave a classical description of the clinical picture of shock and proved that shock should be considered as a special condition. He allocated erectile and torpid phases and determined the ways of shock prevention and treatment.

I. M. Sechenov, I. P. Pavlov, M. S. Vvedensky, etc. made a contribution to the understanding of phenomena taking place in an organism during shock.

The following is at the basis of the shock classification:
1. After the reasons of development:
a) traumatic;
b) operation;
c) haemotransfusional;
d) psychological and anaphylactic shock.
2. After the severity of clinical exhibitings:
a) severe, moderate and mild;
b) I degree — with maximal arterial blood pressure of 90 mmHg
II degree — ABP of 90–70 mmHg
III degree — ABP of 50–70 mmHg
IV degree — ABP is lower than 50 mmHg.
3. After the time of development:
a) primary — at the moment of damage or just after it;
b) secondary — some hours after the trauma, when neuro-reflex violations worsen by intoxication, diffusion of products of tissue disintegration, additional trauma.

The erectile phase of shock develops at the moment of trauma, short-term. It is characterized by the presence of motoric and mental excitation of the patient. This phase passes into torpid, characterized by the oppression, inhibition of the nervous system and sharp decrease in all vital finctions of an organism.

Clinical picture. M. I. Pyrogov gave the classical definition of the clinical picture of erectile and torpid phases of shock.

Acute motoric and lingual excitation appears as coarse shouts, unmotivated, inexpedient movements: the patient is unsettled, jumpy, without paying attention that may render harm to himself. Dilatation of the pupils, red face, strained, the arterial blood pressure is increased. The erectile phase of shock is similar to narcotic intoxication or excitation.

Pyrogov also described the torpid phase of shock, which is characterized by an expressive decrease in the reaction to stimuli, slackness, apathy, decrease in reflexes, and suppression of the functions of the central neural system (CNS) with preservation of consciousness.

Sharp deterioration in the activity of the cardiovascular system, paleness, frequent pulse, decrease in the body temperature, dullness of cardiac tones and decrease in blood pressure, which is the leading symptom of shock, and also blood coagulation, violation of metabolism and functions of all organs and systems, function of the kidneys (anuria), and oxygen starvation of the tissue are marked.

The diagnosis is easy to determine by the clinical picture, but with multiple damages differential diagnosis is frequently complicated. It is necessary to study carefully the anamnesis and symptomatology, which will help determine the correct diagnosis.

There are the following theories of shock development:

1. The toxic theory (Kenu), according to which severe violations in the organism are caused by poisoning with products of tissue disintegration, basically from the muscles. Intoxication causes trichangiestesia and increase in their permeability, which results in the plasma exit into the tissues and congestion of the blood in the capillaries of organs. Therefore, the blood volume decreases, which becomes the reason for cardiac standstill.

2. The vascular-motor theory (Kreil), according to which trauma causes a reflex paralysis in the peripheral vessels, that results in a decrease of ABP and congestion of the blood in the venous system. Blood circulation in the vital organs is damaged.

3. The Henderson's acapnia theory explains the development of shock by the carbonic acid reduction in the blood caused by hyperventilation during pain. It results in the infringement of blood circulation, congestion of the blood and the development of acidosis in the tissue.

The neuroreflex theory is the most convincing, proven by experimental and clinical data.

Shock is the organism's reaction in which the supreme parts of the CNS take part directly. Experience testifies that the severity of shock is determined not only by extent of trauma but also it localization. It is connected with amount of receptors on the injured area and in tissue, as well as the extent of additional factors participation, which deepen shock (cooling, exhaustion, fatigue, sleeplessness, anemia).

The basic tasks in shock liquidation

1. Termination of the stream of nervous pulses from the periphery to the center. This task is carried out with the help of novocainic blockades (sympathetic, paranephral, underperiosteal).

2. Reduction of excitability of the CNS by the creation of absolute rest, morphine, bromides, alcohol administration.

3. Fight with factors which worsen the course of shock. Large doses of solutions of glucose, blood substitutes, inhalation of oxygen, haemotransfusion, plasma, potassium chloride are introduced to fight against toxemia, anoxemia, plasm- and blood loss.

4. Fight against the consequences of shock, restoration of damaged functions, haemodynamic infringements (cardiac substances, heating, haemotransfusion, plasma, blood substitutes).

All means should be conducted simultaneously and vigorously.

BONE FRACTURES AND DISLOCATIONS

Classification of Fractures

Fracture is a partial or complete infringement of integrity of the bone, caused by high-speed force, accompanied by damage to soft tissue.

Depending upon the origin, fractures are divided into congenital and acquired. Each of these groups, in turn, is divided into open and closed, and congenital fractures are divided into traumatic and pathological.

Intrauterine fractures are observed seldom: generally in connection with inferiority, fragility of bones of the fetus. *Acquired* fractures are caused by external forces, muscular contraction or in connection with pathological process in bone tissue.

Open fractures are accompanied by damage to the integrity of soft tissues and integuments.

In closed fractures the skin and mucous are intact and serve as a barrier for the penetration of an infection.

Traumatic fractures happen as a result of the action of mechanical force. After the mechanism of force application, they are divided into fractures as a result of direct blow, compression, bending, twisting and abruption of bones.

In *direct* blow a traversal fracture with the displacement of peripheral fragments is observed. Compression results in a compression fracture of vertebrae after bending or falling. With bending there can be oblique or traversal fractures.

The twisting of a bone with one end fixed results in the development of coiled (spiral) fracture.

Fragmented fractures are observed during sharp and strong muscular contraction, more often during attempts to stay on the feet while falling.

After the localization of the damage, fractures are divided into *epiphyseal*, *metaphyseal* and *diaphyseal*. According to the direction of the line of damage — into *traversal*, *angular*, *longitudinal*, *spiral*, *fragmental*.

Fractures may be complete and incomplete. Simple, complex and combined fractures are distinguished, as well as single and multiple.

Morphological Changes in Different Terms after the Fracture. Formation of Bone Callous

The pathological changes in fractures and their kniting can be divided into three periods:

a) changes directly connected with trauma, aseptic inflammation development;

b) the period of osteogenesis;

c) the period of transformation of the bone callous.

At the moment of the fracture and during the first days on the area of the trauma haemorrhages, destruction of the connective tissue of bones, development of aseptic inflammations and hypostasis are marked. Leukocytes migrate to the damage zone, inflammatory exudation is observed.

The more the tissue is damaged in fracture the more extent of manifestation of such phenomena. Aseptic inflammation results in resolving the damaged tissue.

Simultaneously with clearing the area of fracture from dead cells and tissue, the process of osteogenesis takes place, which during the first two weeks results in the formation a callous.

The bone callous is formed by reproduction of periosteum cells of the bone marrow, haversian canal and connective tissue. Each of these sources of osteogenesis results in the development of a special layer of the bone callous. A bone callous consists of several layers.

The periosteal (external) callous develops from periosteum cells, enveloping the bone ends from the outside, like a muff.

From the 2nd day on the fracture place the proliferation of cells on the side of the cambial layer of the periosteum begins. Up to the 3rd–4th day there are already plenty of embryonic cells (fibroblasts, chondroblasts), young again formed vessels and osteoblasts. These osteoblasts are the main cells which form new bone tissue.

Osteogenesis takes place by way of direct development of the bone callous from ossiform tissue or previous formation of cartilage.

The endosteal, or internal, layer of the bone callous develops from endosteum cells of the bone marrow of peripheral and central bone fragments. Young cells, filling in the defect between the bone fragments, merge into a single endosteal layer of the bone callous.

The intermediary, or intermediate, layer of the bone callous develops from cellular elements of the haversian canal of bone fragments and occupies an interval between periosteal and endosteal layers. The better the reposition the smaller the layer, i.e. the denser the bone fragments adjoin to each other.

The paraoseal layer of the callous develops from tissue, which surrounds the fracture site. The greater destruction around the tissues the more it is pronounced.

The subsequent development of the bone callous occurs by two ways:

1) direct formation of the bone callous and ossiform tissue;

2) previous formation of hylin or fibrous cartilage from ossiform tissue, which further turns into bone.

It is proved that in a good stitching of the fragments and their full immobility, the direct formation of the bone callous from ossiform tissue takes place as a rule, but in their incorrect position the cartilage development is observed more often. So, fibroblasts transfer into osteoblasts and even into bone cells.

The terms of accretion (consolidation) in bone fractures are different. The formation of the primary bone callous, that is the connecting of bone fragments with ossiform tissue, occurs during 4–5 weeks. Then lime salts are deposited in the ossiform tissue, which starts the process of the secondary bone callous, proceeding from 5–6 weeks to several months depending upon the kind of the bone.

Simultaneously with osteogenesis and calcium salts deposits in ossiform tissue, the architectural reorganization of the bone callous begins: the osteoblast diffuses the ends of the bone fragments and the surplus of bone callous, renews the bone marrow canal, bone balks. Architectural reorganization is a process which can last for years.

Clinical Picture of Fractures

The clinical picture of fractures is very diverse and not always well pronounced. The basic symptoms of fracture are as follows:

1. Pain is felt at once after the fracture; it fades during rest and increases during any movement of the extremity; pain is not the main symptom of fractures because it also occurs in blows and strains.

2. Violation of motor function is not always a typical symptom for fracture; a very characteristic sign, for example, for fracture of the lower extremities is if the patient cannot stand on them after the trauma.

3. Deformation on the fracture site sometimes is sharply pronounced, but can be undistinguished, and it can be revealed only on the roentgenogram; deformation is connected with displacement of fragments.

The following kinds of displacement are distinguished:

— displacement under an angle when the axes of the fragments form an angle at the fracture site; the angle depends upon the direction of the fragments;

— lateral displacement is observed when the fragments split in the direction of its diameter;

— displacement by length; longitudinal shifting — the most often type of displacement when one fragment is shifted along another one;

— displacement by periphery occurs as a result of a turn of one of fragments, more often peripheral, around its long axis.

4. Mobility of fragments along the bone is a true attribute of a fracture. It is well pronounced in diaphyseal fractures.

5. Crepitation and abnormal mobility of fragments are determined if the bone is fixed with one hand above and the second hand below the fracture site and cautiously move in the opposite direction. The bone crunch is heard (crepitation).

First aid in fractures is the beginning of treatment, because it prevents such complications as shock, bleeding, and infection. In closed fractures the basic task of first aid is the prevention of subsequent shifting of the bone fragments and traumatizing tissue. Transport immobilization — imposing a transport splint is performed.

Besides the latter, in open fractures it's necessary to prevent infection by imposing aseptic bandage.

Principles of Treatment, Reposition and Immobilization

The basic task of treatment of fractures is restoration of anatomic integrity of the injured bone and physiologic function of the injured organ.

Hyppocrates (more than 2 thousand years ago) applied reposition and unmovable splints. The main aim of fractures treatment is anatomic restoration of the integrity of the bone. In the 50s of the previous century M. I. Pyrogov used plaster bandages for the treatment of fractures. The study of the results of using plaster bandages proved that a long placement of the extremities in plaster provides accretion of bones, but not always restors the function of the injured extremity. Muscular atrophy, rigidity, joint immobility were observed.

Modern treatment of fractures is directed on the restoration of the anatomic structure and physiologic functions of the fractured bone. For reaching this purpose it is necessary to use consistently the following actions:

1. Reposition of bone fragments.
2. Keeping them in the correct position for accretion — immobilization (fixation).
3. Acceleration of the processes of accretion (consolidation).
4. Restoration of the function of the injured organ (rehabilitation).

Functional treatment with the application of physiotherapy exercises is used for rehabilitation of the injured organ; improvement of the general condition of the patient (nutrition, vitaminization, haemotransfusion).

Reposition. Reposition of fragments should be performed immediately after the fracture and before the development of traumatic hypostasis and reflex contraction of muscles. Bone fragments should be precisely put in correct position.

Fixating or immobilization of bone fragments in the correct position is carried out by different methods:

— plaster bandage;
— stretching;
— operation.

The traction method is widely applied for the treatment of fractures because it allows to safe definite movement in joints and muscular function with keeping immobilization of bone fragments. At this method the extremities are not compressed by a bandage which does not hinder blood circulation and accelerates the formation of a bone callous, prevents atrophy, decubitus, etc. The extremity completely is accessible for examination and supervision, and movement begins from the first days of treatment.

Disadvantage of this method: it requires the patient to stay in bed, which hinders X-ray control.

The method is carried out with the help of emplastic or skeletal traction.

Technique of Plaster Traction

The skin of the injured extremity is processed with spirit; the lateral surfaces are wiped with glue and a sticky plaster or pieces of flannel with the width of 6–8 cm are put on, then as a loop are thrown over the joint and paste to the external surface, afterwards redressed.

With applying plaster traction it is necessary to take into account the following features:

a) it should be applied within the first hours after the fracture before the occurrence of muscular retraction and traumatic hypostasis;

b) strips of the sticky plaster are attached to the whole segment of the extremity irregardless of the level of fracture, that provides even muscular relaxation;

c) joints remain mobile, which makes early movements (starting on the 2nd–3rd day) possible.

Skeletal traction is carried out with the help of a metal spoke which is driven through the bone, holding the bone with a stirrup. This technique allows to use a significant weight (up to 16 kg) to stretch muscles and repose fragments; driving the spokes through the tubercular of the tibia.

Spokes are driven through the bone with special drills and then an arch with apertures where the twine is attached is fixed to the spoke. After fixing the extremity to the Beller's, Chaklin's or Bogdanov's splint, the weight of which is determined by the degree of muscular development (hip — 8–14 kg, shin — 4–8 kg) is suspended to the twine.

The operative method allows to provide the reposition and fixation of bone fragments.

Such methods of fragments fixation are applied in surgical treatment: suturing together of fragments by silk or other suturs (basically, in pediatric practice), metalosteosynthesis (fixation with metal plates, beams, screws; intramedullar osteosynthesis with the help of hinges), fixation with bone glue, ultrasonic welding of bones, compression-distraction osteosynthesis with the help of special devices — by G. Ilizarov, O. Gudushauri, etc.

Dislocation

Dislocation is an abnormal shifting of articulate surfaces in relation to each other. If the articulate surfaces cease to collide, dislocations considered as complete, partial collisions — incomplete or subluxation. Dislocations are usually accompanied by breaks in the joint capsule and the exiting of one articulate surface through this break. Depending upon the injured joint they can be dislocations of the humeral joint, etc.

It is considered that dislocations occur mostly in the bone which articulate surface is located distal concerning other bones, which take part in the formation of the definite joint. Dislocations of vertebrae are exceptions, in this case it is considered that the upper vertebra is dislocated in relation to the lower one.

Congenital dislocations, which occur in the uterus, and acquired, which develop as a result of a trauma (traumatic dislocation) or pathological in the joint (pathological dislocation) are distinguished. Acquired traumatic dislocations are observed in 80–90% of the cases.

The *pathological picture* — dislocations are accompanied by a rupture in the joint capsule, the ligamentous apparatus, tendons, nerves and large vessels, etc.

Clinical picture. Questioning the patient allows to find out circumstances of trauma, mechanism of damage, presence of pain in the joint that amplify during movement.

Numbness of the extremity occurs when a nerve is compressed. Deformation of the joint is marked. The diagnosis of a dislocation is proven by X-ray examination.

Treatment. The patient requires the urgent qualified care. First aid is imposing a transport splint or fixing bandage, the patient should be given sedatives and immediately directed to the hospital. Repositioning is easier and the results are better if it is carried out during the first hours after a trauma. The 2–5-day dislocations are hardly cured, and in 3–4 weeks operative intervention is necessary.

Repositioning of the dislocations should be carried out under anaesthesia. The necessary condition for fast repositioning of the dislocation is complete muscular relaxation, which is achieved by anaesthesia. The application of rough physical force results in additional damages of the joint capsule and the dislocation relapses development (habitual dislocation), frequently observed in humeral and mandible joints.

For restoration of normal anatomic relations in the joint some methods of dislocations reposition based on muscular relaxation of the joint site and transposition of the dislocated articulate surface with application of movements, characteristic to each joint, are applied. They are as if repeat in opposite order movements which occur during a dislocation of an injured joint.

The *Koher's method* consists of 4 stages:

1st stage. Bending the injured hand at the ulnar joint with bringing the shoulder to the thorax.

2nd stage. The hand is extended downwards with simultaneous rotation of the shoulder.

3rd–4th stages. The hand is lifted upwards and at the same time they rotate the shoulder while putting the hand on the healthy shoulder.

The Janelidze's method is based on physiologic muscular relaxation as a result of exhaustion of an injured extremity by weight. Immediately after repositioning a control X-ray picture is taken. The extremity is fixed for 6–10 day in a functionally favourable position by a bandage and further the complex of medical exercises is indicated.

Pathological dislocations are the result of degenerative pathological processes, which result in the destruction of a capsule and tendons (tuberculosis, tumour, etc.).

CLOSED INJURIES TO THE SKULL, THORACIC AND ABDOMINAL ORGANS

Closed Injuries to the Skull

Closed injuries to the skull, thoracic and abdominal organs are allocated into a separate group in connection with the original clinical picture and severity of the prognosis. Symptoms are determined by the kind and severity of the trauma as well as by the physiologic features of the injured organ. In many cases external attributes of the trauma are absent, and it is known only from the anamnesis. Sometimes on the contraty — with the presence of pronounced external damages (wounds, hematoma, etc.) the internal organs, locating at the trauma site, do not suffer.

The brain trauma is frequently observed. Its main reasons — street and transport accidents. Hippocrates, in due time, described the symptoms and medical policy in case of the brain trauma.

In 1575 A. Pare gave a complete description of brain concussion and at the end of the XVIII century L. Pti determined three kinds of brain damages: concussion, contusion and compression.

In 1986 a new classification of the clinical forms of damage to the skull and brain was established:

1. Brain concussion.
2. Contusion of the brain of the mild degree.
3. Contusion of the brain of the moderate degree.
4. Contusion of the brain of severe degree.
5. Compression of the brain against a background of its blow.
6. Compression of the brain without the accompanied contusion.

Peculiarities of the brain reaction to trauma consist in fast increase in venous pressure with the development of hypostasis and brain substance swelling.

Brain concussion is the most often kind of closed trauma. The brain tissue during a concussion suffers a little.

Anemia of the brain and small dotted haemorrhages, hypostasis of the brain are observed at autopsy. As a result of a trauma lymph and blood circulation of the brain, as well as function of the synapses are damaged.

Clinically the brain concussion manifests itself as loss of consciousness at the moment of the trauma, which can be short-term or lasts several hours or days. Retrograde amnesia (when the events which took place directly before the trauma disappear from the memory) is observed. At this time the patient does not react to anything, does not come into contact. The patient is pale, shallow breathing, weak pulse. The pupils are usually constricted and do not react to light, skin and tendon reflexes are weakened and do not appear. In severe cases vomiting is possible, involuntary urination and defecation.

After the severity of clinical signs three degrees of brain concussion are distinguished. In mild cases consciousness comes back to the patient in some minutes, and he orientates quickly enough with his surroundings. With moderate traumas, loss of consciousness is longer, and the patient regains gradually, frequently through the excitation period. In most severe cases the patient is unconscious for some days and regaining full consciousness occurs slowly. Having regained consciousness the patient complains of headache, nausea, vomiting. The body temperature is dicreased. In severe cases these complaints can last for a long time, sometimes years.

Treatment. Strict bed regimen for 2–3 weeks is appointed. The patient is allowed to get up after all complaints disappear. In order to reduce the intracranial pressure and hypostasis of the brain, hypertonic solutions (30–50 ml of a 40% solutions of glucose, 20–50 ml of a 10% solution of sodium chloride, 10 ml of a 40% solution of urotropin, 5–10 ml of a 25% solution of magnesium sulfate), rheogluman (10 ml/kg), diuretics (lazex, furosemide — 2–6 ml) are given daily. If there is no improvement in several days a lumbar puncture is conducted, which reduces the intracranial pressure and promotes the improvement of the patient's subjective condition. Dexamethasone (4 mg) is introducted into the subarachnoidal cavity. In addition, a spinal puncture is desirable for diagnostic purposes: the presence of blood in the liquor specifies contusion of the brain, subarachnoidal haemorrhages or fracture to the skull basis.

Contusion of the brain is a more serious trauma, accompanied by infringement to the integrity of the brain substance on a limited site.

Pathologic-anatomically small haemorrhages directly in the brain substance as well as softening and necrosis are observed.

Clinical course. At the moment of blow the patient loses consciousness for a long time. The patient's complaints are the same as for brain concussion but more pronounced. The temperature is increased. Neurological symptoms are observed. They can be accompanied by disturbances to mimic, sight, speaking, sensitivity, movements and coordination. Symptoms of damage to the craniocerebral nerves are more often observed. In the spinal liquid a small amount of blood can be found.

Three degrees of contusion can be distinguished — mild, moderate, severe. The treatment for brain contusion is the same as for concussions; however, bed regimen is longer — up to 1 month.

Brain compression is the result of pressure from bone fragments on the brain in case of fracture to the skull as well as intracranial haemorrhages.

Intracranial bleeding occurs in 80% of the cases with damage to the middle artery of the cranial membrane or its branches, and in the other 20% — venous sinuses, branches of vena jugularis or bones of the skull. Symptoms of brain compression can be caused by small hematomas. Blood can accumulate above it (epidural hematoma), or under the dura mater (subdural hematoma), as well as in the brain tissue — intrabrain (intracranial) hematoma.

Clinical course. At the first moment of the trauma the victim does not lose consciousness (or unconsciousness is temporary), after the trauma the patient can walk or even start to work. Headaches quickly disappear, then renew, increase and become frequently intolerable.

At the same time with the headaches there is nausea, dizziness and balance infringement. It is shallow breathing, pulse is slowed, but of good filling. On the side of the compression — the pupils are dilated, and on the whole opposite side — paralysis, reflexes disappear. Consciousness is vague or absent. If the patient is not rendered medical care, terminal status develops, then death comes.

Treatment. Only an urgent operation can save such patients. It is necessary to do cranial trepanation, if necessary ligate the injured vessel, evacuate the hematoma and remove bone fragments which can entail brain compression. The localization of the hematoma is specified with the help of angiography or computer tomography, and electroencephalography is applied for determination of the brain damage. The condition of the patient improves already during the operation. Further patients are treated as for a brain contusion.

In brain compression such complications as meningitis, arachnoiditis, abscess of the brain, traumatic epilepsy can develop; constant headaches, dizziness, more or less pronounced mental retardation may appear.

Injuries to the Thorax and Thoracic Organs

In traumas to the thorax concussion, contusion or compression of the chest wall are distinguished; at the same time closed ruptures of the lungs and bronchial tubes, damage to the heart and large vessels can be observed.

Thorax concussion is observed seldom, usually as a result of the blast action. Thorax concussion is compensated due to its elasticity. Despite this, sometimes there are damages of the organs located in it, especially the heart.

Clinical picture. The revealing of heart concussion is complicated, because clinically it is very similar with traumatic shock. Just after the trauma the patient is pale or cyanotic skin and mucous is observed, dyspnea, cold sweat, and also haemodynamic disturbances, in severe cases numerous petechia appear on the face, conjunctiva, anterior chest wall and organs of the mediastinum (traumatic asphyxia syndrome) and primary cardiac arrest can occur.

Treatment. Bed regimen is indicated, half-sitting posture. Antishock substances, oxygen therapy are applied. It is necessary to be ready for cardiac fibrillation.

Contusion and compression of the thorax are frequently accompanied by ribs fracture, blood vessels rupture and pleura damage and lungs rupture, which can further result in such complications as pneumothorax, haemothorax and hypodermic emphysema.

Pneumothorax is an accumulated air in the pleural cavity. It compresses the lungs and shifts the mediastinum to the healthy side. Usually pneumothorax is unilateral and more often develops after ribs fracture, lungs pleura and rupture. However, it may happen spontaneously.

Open, closed and tension pneumothorax are distinguished.

Clinical picture. As plenty of air can compress the lungs and shift the mediastinum and the heart to the opposite side, pronounced subjective and objective symptoms are observed. With severe pneumothorax dyspnea, cyanosis, accelerated pulse, pleuropneumonal shock can appear. Smoothing of the intercostals, arch-like expansion of the thorax and restricted respiratory movements on the injured side are typical. During percussion pronounced box-like sound appears, during auscultation — weakened respiration.

Treatment. With closed pneumothorax a puncture during which the air is removed from the pleural cavity is conducted. The puncture method is applied in the case of tension pneumothorax. If the puncture is not effective, it is necessary to conduct drainage of the pleural cavity. The external end of the drainage with a fixed valve from a finger of a rubber glove (by the type of an underwater drainage) is put into a receiver with an antiseptic solution (Bulau drainage). It is better to use active drainage with the help of a pump.

Hemothorax is blood congestion in the pleural cavity; it can develop during closed and open fractures.

Clinical picture. With mild haemothorax the blood flows down into pleural sinus and usually does not cause special complaints from the patient, even objective symptoms are absent.

With large and total pneumothorax the lung is completely compressed, the mediastinum is shifted to the opposite side, significant infringements of haemodynamics and respiration occur. Dyspnea, cyanosis, accelerated pulse of weak filling, decrease in arterial pressure are observed. During percussion acute obtusion is determined, during auscultation — significant weakening in respiration. X-ray examination reveals the level of liquid and in total haemothorax even a homogeneous dark patch is found. The pleural puncture confirms the diagnosis.

Treatment. The blood from the pleural cavity needs to be removed immediately (puncture or drainage of the pleural cavity), otherwise in due time coagulation occurs and infection of the blood.

If the blood loss through the siphon pleural drainage is larger than 1 l a day and the bleeding proceeds, it must be stopped by an emergency thoracotomy.

CLOSED INJURIES TO THE ORGANS OF THE ABDOMINAL CAVITY

The results of a blunt trauma to the stomach or the lower part of the thorax are closed damages to the organs of the abdominal cavity. The reasons for such traumas are blow or push to the stomach, falling, road and transport accidents, etc.

The character of the damage depends not only upon the kind and force of the injuring agent but also upon other circumstances — elasticity of the abdominal cavity, muscular tone and the amount of fat, degree of filling of the cavity organs.

Clinical picture. After the blunt trauma of the stomach more or less pronounced shock is usually observed.

In case of damage to the cavitary organs (stomach, small and large intestines, biliary and urinary bladder) a clinical course of acute inflammation of the peritoneum — peritonitis develops in patients at the beginning of the disease.

Treatment. An emergency operation is necessary. They remove the source causing peritonitis. If the diagnosis is late, peritonitis develops, the clinical picture of neglected diffuse peritonitis accompanied by meteorism, atony of the intestines, hiccups, vomiting develops; in several days the intoxication grows and the patient dies. For the treatment of patients with peritonitis, the department of general surgery at the Odessa State Medical University suggests a complex of actions, which consists of peritoneal lavage, peritoneal dialysis, haemosorption, lymphosorption, intubation of the intestines, forced diuresis.

Damage to the parenchymatous organs (the liver, the spleen, the kidneys) is very dangerous because of intracavitary bleeding. Already in the onset of the disease the symptomatology of acute anemia prevails. During palpation the stomach is painful, pressure of the muscles of its walls appears, and moderate symptoms of peritoneal irritation are observed. During percussion — obtusion in the lower parts of the stomach and in upper ones — thympanitis. Bleeding from the parenchymatous organs stops independently very seldom, therefore the operation is necessary to stop it.

Damage to the liver is usually stitched or tamponed with the big omentum (sometimes resection), the spleen is removed.

Organs of the abdominal cavity or retroperitoneal organs, can be damaged with fractures of the ribs or pelvic bones. Blow with damage of the ribs can cause ruptured kidneys, liver and spleen, and in case of a fractured pelvis, bone fragments can wound the urinary bladder wall. Severe traumas can become the reason for even more dangerous thoracic-abdominal injures.

With suspicion of damage to the genitalia, liver or spleen an emergency laparotomy is necessary because a delay can lead to fatal consequences.

Lecture XII

WOUNDS

Wound (vulnus) — is the mechanical injury to the integrity of the skin or mucous membrane. Wounds belong to the most often injuries in war and peace time. The problem of wounds treatment is one of the main and according to its condition the conclusion about the level of medicine development is made.

The clinical picture of a wound is determined by local (infringement of the integrity of tissue, gaping of wounds, bleeding and pain) and general attributes (acute anemia, shock, infection).

There are different classifications of wounds. After the character of a damaging agent the following kinds of wounds are distinguished:

1. Cut wounds — caused by a sharp object, linear-shaped and characterized by gapes, even edges and plentiful bleeding.
2. Chopped wounds — caused by a sharp massive object such as a sabre, axe and unlike to incision wounds they are accompanied by contusion and smashing of soft tissue.
3. Contused wounds are caused by a blunt object or occur during a fall and the compression of tissue, characterized by uneven jagged edges and significant damage of the surrounding tissue.
4. Smashing and lacerated wounds are characterized by necrosis of soft tissue, frequently infected, insignificant bleeding.
5. Pricked wounds result from a prick by a sharp object, damage to soft tissue is insignificant, but because of the depth the vital organs can be injured — the heart, the large vessels, the lungs.
6. Gunshot wounds are the result of the actions of a bullet or missile splinters; frequently accompanied by injury to large vessels, nerves, vital organs, thus the combination of two damaging factors is observed: mechanical and thermal; heavy forms of purulent, anaerobic infections frequently develop in fire wounds.

7. Bitten wounds are the result of human or animal bites, it frequently suppurates; animal bites can cause rabies or rat illness.

8. Poison wounds form as a result of poisonous snake or scorpion bites or poisonous military substances entering the wound or industrial poisons.

9. Excoriations and scratches are the most superficial damage to tissue, and have a favorable course.

10. Mixed wounds are wounds which had influence of poisonous military substance or radiation; radiation trauma is frequently combined with the radiation illness development.

After the reasons of damage the wounds are divided into *operational* and *accidental*. Depending upon the cavities of the body the wounds are divided into *penetrating* and *non-penetrating* (with or without damage of internal organs). After the anatomic features the wounds are subdivided as follows: wounds of soft tissue, the wounds with damage to vessels, nerves, tendons, internal organs. After the number of damages to one patient wounds are divided into single and multiple. Damage to several organs bordering two or several anatomic sites are considered as combined trauma.

It is possible to classify wounds by their anatomic localization: wounds to the neck, head, hips, thorax, stomach, etc.

The spreading of wounds according to the extent of infection has special value — aseptic and infected. Only postoperative wounds are considered as aseptic. Other wounds are considered infected, because at the moment of injuring the microorganisms could be on the skin or on the injuring object. The development of wound infections is accompanied by many clinical symptoms of general and local character. The earliest general symptoms are deterioration in the patient's health condition and an increase in the body temperature. The character of the temperature curve depends upon the organism's reaction and virulence to infections, massiveness of infection and abundance of the process, delay in pus discharge, occurrence of new purulent cells. Generalization of infection is accompanied by hyperthermia and a change in the character of the temperature curve. An important symptom is fever, connected to the massive entrance of microbes into the blood, their toxins and products of tissue disintegration. Fever testifies to the presence of un-drained purulent cells, the appearance of putrefactive infections or the septic condition of the patient.

The progressing of infection in the wound is accompanied by infringement of the function of the nervous system (headache, sleeplessness and inhibition), cardiovascular system (tachycardia, disturbances of the cardial rhythm), respiratory system (dyspnea, shallow breathing). Pulse acceleration with decreased body temperature is an adverse symptom which testifies of progressing infections in wounds and a decrease in immune protection. Infringements of the liver function (in particular desintoxication) and the kidney function (albuminuria, oliguria) are marked. The patient complains of dryness in the mouth, nausea. Changes of the general character are expressed to different extent. With mild forms of banal purulent infection in wounds they are insignificant, in severe cases the endotoxic shock, which can cause the death of the patient, develops.

Local changes in the wound depend both upon the degree of posttraumatic destruction of tissue and the activity of the microbic flora. The greatest changes are marked in smashing-lacerated wounds and gunshot wounds.

Usually a day after bacterial pollution of the wound, a pyoinflammatory process appears precisely. The bottom of the wound and its contents gets dirty-grey, the edges of the wound are dense and swollen. The skin under the hypostasis zone becomes hyperemic, hot when touched and painful during palpation.

Pain in the wound amplifies with infringement of discharge outflow (pulsating pain). The wound excretion, its color, smell, consistence, amount depend upon the kind of microbic agent. Necrotic tissue in the initial phase of inflammation is usually densely fixed to the bottom and edges of the wound, their amount during the adverse course of the process can grow due to secondary necrosis. Aggrevation of inflammation signs (pain, hypostasis, and hyperemia) are adverse prognostic symptoms and testify to the progress of a purulent process.

In case of a favorable wound process course, 3–5 days after the trauma, inflammatory demarcation of nonviable tissues, which then reject and lysed in the wound, occurs. At the same time, clearing of the wound from microbic flora takes place. The inflammatory reaction gradually ceases, the wound process passes into the period of reparation with clinical attributes of the granulation tissue appearance in the wound. Healthy granulations are bright-pink, their surface is glossy, easily bleeds with insignificant damage. Infiltration of the edges of the wound is considerably reduced, discharge from the wound, which becomes serous, decreases. Granulation tissue is the morphofunctional barrier (granulation roll), created on the wound site against harmful environmental influence. Healthy granulation tissue prevents the penetration of infection, diffusion of toxins and products of tissue disintegration, limits the loss of proteins and ions.

Disturbance of the character of granulations (languid, cyanotic or grayish-red), decrease in their growth, and increase in the amount of wound discharge are extremely adverse signs. They are evidence of the activation of primary wound florae or the presence of superinfection, as well as a decrease in the immune status. The probability of generalization of infection (sepsis) is not excluded. Clinical picture of damage of the granulations barrier function is in increase in the volume of the local inflammatory process with a renewal of pyoresorption fevers (deterioration of health condition, increase of pain in the wound, left shift leukocytosis, lymphopenia, increase in the leukocytic index of intoxication, acceleration of the erythrocyte sedimentation rate — ESR).

In order to choose the correct treatment policy of wounds, the surgeon should correctly estimate the character of damage, phase of the wound process. The wound process is a set of biological phenomena which consistently develop in the wound. The pathogenesis of the wound process depends on the phase-like course, unity of individual phases and transition of one phase into another one. Despite the fact that numerous works are devoted to the study of the wound process pathogenesis, a standard classification of the wound process is not established yet. The most widespread ones are the following.

For a long time in clinical practice I. G. Rufanov's (1954) classification prevailed. According to this classification the wound process course consists of two phases:

I phase (phase of *hydration*) — transition of gel into sol, cleansing of dead tissue from the wound;

II phase (phase of *dehydration*) — granulation, tissue regeneration.

For the last years among clinical physicians the most popular is G. I. Kuzin's classification (1977), according to which three basic phases of the wound process course are distinguished.

I phase — *inflammation*, subdivided into two periods — the period of changes and period of purification of the wound from necrotic tissue;

II phase — *regeneration or proliferation* — granulation tissue formation;

III phase — *reorganization* of the scar.

The first phase of acute inflammation, or hydration, is characterized by hyperemia of the wound tissue, blood vessels dilating and their permeability disturbances. Stasis and thrombosis in vessels are observed. Tissue is saturated with liquid, there is much wound discharge.

Metabolism disorder is observed in the wound, processes of aerobic and anaerobic glycolysis prevail. As a result, the amount of insufficiently oxidized products of metabolism (lactic, pyroracemic acid) increases in the wound, acidosis occurs. There is a relative reduction in the amount of calcium, but the amount of potassium, carbon dioxide as well as tissue hypoxia increases.

Leukocytes and phagocytes migration amplifies; the release of necrotic tissue, toxins and disintegration products begins. This is promoted by the phagocytal and fermental activity of cells. Auto- and heterolyzates also take part in the autolysis processes. Clinical changes are observed in the wound: pain, swelling, infiltration, rise of temperature, infringements of organ functions.

In the second phase — regeneration — regenerative processes prevail, exudatation is reduced. Therefore this phase is also called dehydratation.

Blood circulation improves in tissue and the contents of oxygen increases, hydroxyl ions and calcium increase, the amount of hydrogen ions and potassium decreases.

Therefore metabolism is normalized and acidosis is reduced. The opening of the wound is filled with young connective tissue; cicatrix starts to form. With the beginning of dehydration, the pain, temperature, swelling and infiltration decrease. The wound is cleansed from wound discharge and necrotic tissue, granulation tissue is formed in it and there are attributes of epithelization of the wound edges. Clinically these phases are divided one from another not so precisely. It is possible to observe frequently the processes characteristic for both phases. However, the prevalence of a corresponding process allows a clinical physician to verify the phase and appoint corresponding treatment.

Any damage to the tissue causes a complex of biochemical reactions both in the wounded cell and in different organs and systems of the entire organism.

The basis of metabolism of the wound process is infringement of metabolism, resulting from a trauma. The earliest display of reaction to a trauma is an increase in the permeability of capillaries, which enables albuminous components of plasma to penetrate into the intravascular space, which causes infiltration of the injured tissue and blockade of nutrients and oxygen entering into the intercellular space and cells. Therefore, the earliest infringement of metabolism in the wounded cell is the transition to anaerobic type of glucose decomposition.

In early phases there is a decrease in the respiratory factor, increase in anaerobic glycolysis and autolysis of tissue. Anaerobic glycolysis is the energy source, necessary for developing wound inflammations, processes of biosynthesis, connected to regeneration of cellular elements and tissue. Thus glucose is actively used and lactic acid collects, therefore there is acidic shift (pH). An increase in acidity in the wound is caused not only by the increase in formation of lactic acid and other organic acids of the Krebs cycle, but also the congestion of blood circulation in the dilated vessels which causes the congestion of carbonic acid.

Under the conditions of an acidic medium tissue exchange is broken, osmotic pressure increases, the activity of fermental processes changes. With acidic reaction bactericidal properties of tissue colloids moderately increase. A significant decrease in pH, connected with intensive infectious-inflammatory process in the wound, gets a negative value — vital activity is broken and cells die.

The development of wound inflammation and the damage of tissue results in the accumulation of potassium in tissue. An increase of the contents of potassium in the wound exudate, lymph and blood results in the infringement of the normal ratio of electrolytes (sodium, potassium, calcium). A certain relation between the growth of the concentration of H-ions, potassium ions and the intensity of pyoinflammatory process is marked. When the inflammation starts decreasing, the contents of potassium, sodium and chlorides decrease, and the concentration of calcium increases. For each phase of the wound process, an increase in the activity of certain groups of enzymes, specific to the certain period of healing, is typical. For example, the phase of wound inflammation begins because of vascular reaction, during which vasoactive substances increase including proteolytic enzymes.

The level of vasoconstrictor substances (dofamine, noradrenaline, adrenaline, kinin) is regulated by transferase, and their surplus is neutralized by monoaminooxydase.

Approximately 6–9 h after damage to the central zone of the wound focus necrotization of tissues and cells, the early attribute of which is the reduction or disappearance of enzyme activity, begins.

An increase in enzyme activity in the wound occurs not only due to the activation of enzyme systems, but also as a result of increase of enzymes concentration, which come from blood plasma, migrating leukocytes and local cellular elements. A great amount of enzymes, which promote the destruction and removal of components of tissue disintegration from the wound release from granules in the extracellular space with the destruction of neutrophilic leukocytes. At the same time, in one-nuclear cells the high activity of glucose-6-phosphate dehydrogenase is marked, which is the initial stage of the pentosophosphate cycle, connected with phagocytosis and the antibacterial action of oxidizing reactions. The regeneration phase begins with the epithelium cells migration. Energy for this process to a certain extent depends upon the ATPase enzyme activity. The mitotic reaction is always preceded by the activation of DNA synthesis. An increase in mitotic activity is accompanied by an increase of oxidation in the citric cycle with the participation of oxidoreductase. The fibroblasts, responsible for the synthesis of polysaccharides and collagen, have the maximal activity in the regeneration phase.

In the reorganization phase (formation of a scar), which begins approximately on the 12th–14th day of the wound process, the activity of the majority of enzymes is reduced, and then completely stops. Thus, changes in metabolism during the healing process are expressed by different types of enzyme reactions of catabolic and anabolic character.

Clinical picture classification of the wound process bases on the clinical criteria, which reflect the essence of each phase (B. M. Datsenko and co-authors, 1995). According to this three consecutive phases: purulent-necrotic, granulation tissue, new epithelium are distinguished.

Wound healing is a regenerative process that reflects the organism's reaction to trauma. Healing process is influenced by many factors.

Wound regeneration is slowed down as a result of damage to blood vessels and nerves, the presence of blood clots and foreign bodies, necrotic tissue, due to development of virulent microflorae. General factors influence negatively the healing process: insufficiency of the liver and renal function, hypovitaminosis, diabetes, deficiency of organism's immune protection.

There are two kinds (primary strain and secondary strain) of healing.

The following conditions are necessary for primary healing: smooth viable wound edges, their dense cohesion, absence of foreign bodies in the wound, necrosis cells and microflora.

Secondary healing is observed when there are no conditions for primary healing: presence of necrosis of the wound edges, gaping, clots, and foreign bodies. Wound microflora plays an important role. Secondary healing is characterized by pyesis and granulation tissue formation. In the phase of acute inflammation, or hydration, processes of alteration prevail in the wound, suppuration takes place. The wound is filled with pus, the edges are swollen, hyperemia, there are cells of necrotic tissue, only single sites of granulation, which appear basically on the 3rd, sometimes 8th–10th day are observed.

Pus is inflammatory exudate, which contains neutrophilic leukocytes, bacteria, remains of destroyed cells. Depending upon the kind of microflora the color, consistence and amount of purulent excretion change. For wound treatment the bacteriological investigation of the purulent exudate (release of clean culture and definition of antibiotic sensitivity to microflora) have great value. A significant amount of granulation tissue usually appears in the second phase — during regeneration (dehydration). Its formation is predetermined by an increase in the growth of blood capillaries, which, reaching the wound edges, don't connect like with primary strain healing, but form loops. In the loops of capillaries, fibroblasts are placed, which due to intensive division, produce collagen fibers. At the same time epithelizaiton of the wound edges occurs.

Six layers are distinguished in the granulation tissue at histologic exam. The superficial leukocytic-necrotic layer contains leukocytes, cellular detritis and microbes. Under this layer, the layer of vascular loops is located, where there is a significant amount of polyblasts and collagen fibers. The third layer is the layer of vertical vessels (fibroblast, amorphous intermediate substance). The following three layers: maturating layer, layer of horizontal fibroblasts and fibrous. The basis is the layer of the mature fibrous connective scar. The granulation tissue is a barrier that separates the internal medium of an organism from external influence. It is very sensitive, weak mechanical trauma (rubbing by a gauze tampon) causes its damage and bleeding.

At the third phase of healing there is reorganization of the connective tissue scar (fibrosis tissue) and processes of epithelizaiton and healing come to an end.

With secondary healing a wide and uneven scar is formed. Sometimes it becomes keloid-dense, thickened, painful, gets red. The reason for keloids formation is neutrophic and endocrine disorders, insufficiency of local blood circulation. Frequently ulcers, which do not heal for a long time and can become malignant in some cases, develop on the keloid scar.

A number of methods of objective estimation of the wound process course are applied in the clinical practice. A change in the sizes of the wound can be supervised by planimetric methods. The sizes of a wound are measured with the help of sterile cellophane which outlines its contours (L. M. Popova's method) or polyethylene (T. P. Ziryanov's method). Bacteriological control over the course of the wound process is obligatory and includes the determination of the kind of pathogenic organism, its sensitivity to antibiotics and quantitative estimation.

The simplest method of determining the pathogenic organism with the help of bacterioscopy in smears-prints of the wound exudate with the coloring by Romanovsky—Gymsa. To get a full idea of microorganisms in the purulent wound, it is necessary to investigate not only the prints but also to make inoculation of the medium. It makes possible at the same time to identify deep microflora and determine the amount of pathogenic organisms in 1 g of tissue (level of bacterial insemination).

The level of bacterial insemination in the wound is a very important parameter in the doctor's practice because it allows to objectively estimate the qualities of surgical treatment, make prognosis of the course of the pyoinflammatory process, control the terms of putting in secondary stitches, conduct comparative estimation of the efficiency of different medicamentous means, which are applied for the local treatment of wounds. As a rule, effective surgical treatment of the wound results in a decrease in the level of bacterial insemination of the wound (10^2–10^3 by 1 g of tissue). The increase in the amount of bacteria in the wound (10^5–10^6 by 1 g of tissue) is an adverse sign and testifies to sepsis development.

In order to determine the antibiotic sensitivity of microflora, usually a disk antibioticogram inoculation on the Petri's cup with agar with the following application of standard paper disks moistened with solutions of different antibiotics are used. Microbes are considered resistant to the examined antibiotic if the zone of growth inhibition is less than 15 mm, sensitive — if the zone of inhibition is from 15 up to 25 mm and highly sensitive if this zone is over 25 mm.

Cytologic exam of the wound exudate has an important diagnostic value and characterizes the changes in the structure of cellular elements of the wound exudate depending upon the phase of wound process and the character of healing.

Clinically, the method of wound prints according to G. P. Pokrovska — M. S. Makarov and the method of superficial biopsy of the wound according to G. F. Kamayev are widespread. Both microflora, and cellular elements (leukocytes, connective tissue cells, and epithelium and the character of phagocytosis in the wound are taken into account in the cytogramm. Other methods are applied to study the wound process: the method of color thermography, the polygraphic method of defining partial pressure of gases, the electrothermometry method, the method of exam of wound electropotentials, the ultrasonic echolocation method. With the help of the echolocation method it is possible to determine the stage of inflammatory process. The quantitative methods of controlling the course of the wound process allows to objectively estimate different techniques of purulent wounds treatment.

Treatment of wounds is carried out with taking into account the biological processes, which take place. The purpose of treatment is to renew the primary form and function of the injured organs and tissue. The treatment of aseptic and purulent wounds is different. When treating aseptic wounds, the main demand is rest for the injured site and preventive measures of entering and developing an infection (painting the edges of the sutured wound with solutions of iodine, iodonatum, jodopyronum, spirit and closing it with a sterile gauze bandage, it is possible to apply antiseptic aerosols which harden on the wounds as a covering). With extensive postoperative wounds in order to stop lymphorrhea and bleedings in the opening in some cases active drainage of the wound is applied (according to Redon or the three-ampoule system).

All accidental wounds are infected. First aid for infected wounds consists of applying aseptic isolating bandage for preventive measures of subsequent infection during transportation, stoppage of bleeding (compression bandage, applying a tourniquet and the use of antishock actions — introduction of analgetics, drugs). Specialized help for these wounds consists of an operation with primary surgical debridement of the wound (PSD) within first 48 h after the injury. The best results of PSD are conducted during the first 8 h after the injury.

Theoretically and experimentally carrying out PSD was proven by O. O. Tcharukovsky (1836) and P. Fridrikh (1898). The purpose of PSD is to prevent the wound infection and create favorable condition for healing by transforming any wound into a incised wound and its suturing for primary healing. PSD can include the following components: toilet of the wound, suturing of the wounds, removing nonviable tissue, removing foreign bodies, haemostasis, and renewal of broken anatomic tissue interrelations. The terms for performing PSD have essentially great value; it should be executed as soon as possible. Depending upon the term of the PSD performance it can be: early — the first day after the wound, delayed — the second day, and late — after 48 h. After treatment of the operational field and anaesthesia, the edges, walls and bottom of the wound they incise with a scalpel; remove all damaged tissue, foreign bodies, rags, bone fragments and clots of blood which are free. After incision off the polluted and necrotic tissue, tools and gloves are changed, careful haemostasis and suturing the wound by layers is conducted.

PSD on different sites of the body have different peculiarities. They do not incise the vessels, nerves, or periosteum. They spare the muscles as much as possible, deleting only nonviable sites (dark, which do not contract with irritation by tweezers, do not bleed). It is necessary to be careful when treating damaged tendons. Joint cavities are closed. It is necessary to drain the wounds, especially the deep ones. Late surgical debridement (after 48 h) consists in simple cleansing the wound from dirt, pieces of the object which wounded, foreign bodies and removal of necrotic tissue. They do not incise the tissue within the limits of healthy sites. They incise and drain recesses, infected hematomas and abscesses, provide conditions for drainage of wound discharge.

Closing the wound and renewing the broken anatomic interrelations completes PSD. Depending upon the terms of conducting operation, there are different kinds of placed suturs. If PSD is carried out during the first 8 h after the trauma, primary suturs are imposed. The wound should be closed starting with the deep layers in order not to form free cavities, where excretion can accumulate. At suturing of deep wound it is necessary to enter a rubber or polyvinylchloride tube into it for antibiotic lavage and whenever possible create active aspiration of the wound discharge (rubber bulb, etc.). With late terms of carrying out PSD (after 24–48 h) and the presence of contraindications concerning placing primary sutures (danger of developing anaerobic infections) a retention suture is placed or they solve the problem about placing delayed sutures — primary or secondary sutures.

The primary delayed suture (tied or retention suture) is imposed on 3rd–5th day after PSD if there is no wound abscess.

Early secondary sutures are placed with the presence of infectious complications in the wound in 8–15 days with the disappearance of inflammation, the development of granulation tissue. They are placed on a granulating wound without incising the granulations.

Late secondary sutures are placed in later terms (15–25 days) when there is granulation and scar tissue, and the healing of wounds occurs slowly. Incision of the edges of the wound and the scar tissue of all depth (secondary surgical debridement) is carried out before suturing.

The principles of local treatment of purulent wounds should correlate with the stage of the wound process. In the first phase of inflammation (hydration) hypertonic solutions of different antiseptics, which have dehydration effect (10% solution of sodium chloride, 25% solution of glucose, 30% solution of urea, and 1–5% solution of boric acid) receive wide application.

Proteolytic enzymes (trypsinum, chymopsinum, chymotrypsin, terrilytin, elastomesenterasa, etc.), which have pronounced necrotic, inflammatory action, reduce antibiotic stability and virulence of microbes in the wound, also receive wide application. Last years, immobilized proteolytic enzymes (connected to the tissue matrix that gives an opportunity to create their constant concentration in a wound) are more widely applied. In order to fight with infection in the wound, antibiotics are applied with taking into account account the antibioticogram and sensitivity of a patient's organism. It is necessary to prefer antibiotics which are entered directly into the wound (gramicidin, polymyxin, chloramphenicol, etc.).

With antibiotic-resistant strains, reserve antibiotics (cephalosporins, thienam, etc.) as well as such antiseptics as ethonium, chlorhexidine, rocal, dioxydine, sulfamilon, chlorophylipt, furagin, solaphur are usually applied last year. Water-soluble ointments with a polyethylene oxide basis — levosin, levomycol, dihydroxycol, 10% ointment of acetate mafenid, iodopionic ointment, haniphurin — meet the requirements of complex action in the first phase of the wound process. Polyethylene oxide forms complex compounds with antimicrobic preparations, increasing 20–60 times their action and providing their penetration into the depth of the damaged tissue. In the first phase medicamentous treatment is widely supplemented with physical methods of treatment: active draining the wound, laser therapy, treatment in gnotobiologic isolators, application sorption (carbon sorbents or non-tissue carbon materials placed on the wound), ultrasonic irradiation of wound, solux, diadynamical currents, magnetotherapy, ionophoresis with different antiseptics and regeneration stimulators.

In the second phase of the wound process, local medicamentous therapy should be directed on the stimulation of regenerative processes, protection of granulation tissue from damage and prevention of reinfection of the wound with hospital infection. With this purpose, vanillin, dogrose oil, ointment on a vaseline-lanolin basis with antibiotics, olasol-methyluracil ointment received wide application. It is possible to apply Vishnevsky ointment. Effective stimulators of the regeneration process are such preparations as combutecum, alginor. In the third phase of the wound process, the same therapy as for the second one is applied.

Medicamentous therapy prevails with the treatment of small wounds. With the treatment of large wounds, medicamentous therapy is combined with surgical treatment and modern physical methods.

While treating wounds, methods of general action on the organism in patients with endotoxicosis, infringements of the immune status and homeostasis have great value.

Immunotherapy of wound infection should be carried out according to concrete parameters of the immune status and should be directed on replenishing the deficiency of certain parts of immune protection.

Passive (replacement) and active immunotherapy are distinguished. The transfusion of fresh-citrate donor blood, introduction of hyperimmune plasmas (antistaphylococcal, anti-blue-pus), specific antibodies (antistaphylococcal, anti-blue-pus, anti-influenzal), bacteriophage, leukocytic mass, interferon are applied as replacement immunotherapy.

For active immunotherapy, the introduction of auto-vaccinations (made of wound microflora), staphylococcal anatoxin, different immunodepressants. As synthetic immunomodulating factors, levomysol (decaris), prodigiosan are applied. Natural immunomodulating factors, received from the thymus of an animal (tactivin, thymalin, thymogen, timosin) or from the bone marrow (B-activin or myelopeptide) are more specific.

Homeostasis correction is of great value — normalization of protein metabolism (high-caloric diet, protein preparations and blood substitutes, anabolic hormones).

For correction of endotoxicosis, which develops with generalized infection, methods of extracorporate detoxification of an organism, which neutralizes toxins in the blood or lymph, have recently received wide application. They are haemosorption, plasmosorption, plasmapheresis, lymphosorption. They are applied, basically, with hepatic insufficiency development.

With acute renal insufficiency development against a background of wound infection, haemodialysis, haemofiltration, haemodiafiltration are applied.

Lecture XIII

BURNS, ELECTROTRAUMA, FROSTBITE

BURNS

Burn (combustio) is damage to the organism tissue as a result of local action of high temperature, chemical substances, gamma rays, X-rays, ultaviolet rays, ionizing radiation.

Classification

1. After the circumstances of injury, industrial, household, wartime burn are distinguished.

2. After the character of the acting factor, there are:

— thermal burns, the important role belongs to the temperature of influence, time of contact to a hot object, thermal conductivity of the object contacting to the skin (air, water steam, the boiled water, open flame, a metal subject, etc.), humidity of an environment, condition of the skin and an organism of the patient as a whole.

— chemical burns, which are formed as the result of acids, alkalis getting on the skin and mucosa.

— electric burns are characterized by additional affecting the internal organs by the electromagnetic field.

— beam burns are caused by infrared, ultraviolet and gamma rays, X-rays radiation.

3. After the localization, there are burns of functionally active parts of the body, immobile parts of the body, the face, hairy part of the head, the upper respiratory ways, perineum.

4. The classification of burns after the depth of injury, which is used now, was accepted in 1961 at the XXVII All-Union Congress of Surgeons. According to it there are four degrees:

— the I degree burn is characterized by damage of the level of the epidermis and manifests itself with hyperemy, oedema of the skin, pain. In some days the upper layer of the epidermis dries up, rucks up, shells up.

— the II degree burn is characterized by damage of all epithelium with formation of the thin-walled blisters filled with a transparent serous liquid due to dilation of capillaries and infringement of their permeability. Independent epithelizatin occurs by the 10th–12th day.

— the IIIa degree is characterized by necrosis of all the epitelium, superficial layers derma and accompanied by formation of thick-walled blisters and superficial dry light — brown or soft white-grey eschar. The burn heals due to growth of granulations and epithelization from the hair bulbs, ducts of sebaceous and sudoriferous glands, edge epithelization on the part of a healthy skin.

— the IIIb degree is characterized by necrosis of all layers of the derma together with hair bulbs, sebaceous and sudoriferous glands with transition to hypodermic tissue with formation of a dense dry eschar of brown color at a flame burn or damp necrosis at scalding with boiled water, steam, etc. Independent healing of a wound comes by cicatricial pull off, regional epithelization.

— IV degree is characterized by necrosis of the skin and deep tissues (hypodermic tissue, muscles, bones) with formation of a brown or black eschar of various density and thickness.

Burns of I, II, IIIa degrees belong to superficial, and IIIb, IV — to deep. It is very important. With superficial burns an independent healing is possible, and with deep ones — is not. In the West a V-degree C. Kreibich's classification is usual where the IIIb degree is named IV, and correspondingly the IV degree turns into V.

The question on early diagnosis of the burn depth remains the basic question in combustiology. The presence of hyperemia, blisters, eschar, necrosis foci allow to determine preliminary depth of the skin damage and the burn degree. For differential diagnosis of burn degrees the methods of definition of infringement of blood circulation and sensitivity are used, special dyes and fermental preparations are applied: the method of pressing, tetracyclinic fluorescence, thermometry, definition of pain sensitivity by procking, application of 90° spirit, hair epilation, painting of tissue by Van—Gieson, dying skin sampling with solution of diphosphopiridinnucleotidphosphatase.

5. Classification of burns according to the area of defeat in not important for estimation of damage severity and choice of the treatment plan. The human skin surface area makes 15,000–21,000 cm^2. Many schemes have been created for definition of the burn area. The most popular methods are as follows:

— the “method of the nine” which has been suggested by A. Wallace in 1951. According to it the area of the basic parts of the body makes 1–2 nines (9% from all the surface of the body): the head, the neck — 9%; the anterior surface of the body — 18%; the posterior surface of the body — 18%; the upper extremity — 9%; the lower extremity — 18%; the perineum — 1%. At children the ratio of the mentioned parts of the body to the general surface is different and varies with the age.

— in 1953 I. I. Glumov has suggested to determine the area of the burn, comparing it with the area of the palm of the victim, which makes 1% of the surface of the body (the rule of the palm).

— in 1949 B. N. Postnikov has suggested to apply a sterile gauze or cellophane on the burnt surface, on which the contours of the burn are put. Then the contour of the burn is transfered to a millimetric paper, they calculate the absolute area of damage and relative one in percentage of the general surface of the body.

— various forms of stamps with the image of the person, divided into squares are applied for definition of the area of defeat and the documentation. G. D.Vilyavin has suggested to designate the area of the burn of the anterior and posterior surface of the body with various colors in dependance on depth of injury.

Thus, the severity of burn is determined by depth (degree) of burn, the area of burn in percents and localization of burn. In 1939 Yu. Yu. Janelidze has suggested, and V. V. Vasilkov and V. O. Verkholetov have added the formula of burns definition, according to which the burn is characterized by fraction, which have the area of damage in numerator (in brackets — percent of deep burns), and burn degree in denominator. In front of the fraction the etiological factor (thermal burn, chemical or beam), and after the fraction the basic zones of injury (the head, the neck, the trunk, etc.) are indicated.

Definition of prognosis at thermal injury of an organism is an important point in burns treatment. The most simple methods of definition of prognosis for burns are following:

— the rule of the hundred: the age of the patient in years and relative size of the burn surfaces in percents are summed up. If the sum makes 60 and less — the prognosis is favorable, 61–80 — the prognosis is rather favorable, 81–100 — the prognosis is doubtful, 100 and more — the prognosis is unfavorable. The rule is applied only for adults.

— the Frank's index is obtained at addition of the superficial burns area with the triple area of deep ones: if the sum makes 30 and less — the prognosis is favorable, 31–60 — the prognosis is rather favorable, 61–90 — the prognosis is doubtful, 91 and more — adverse.

Burn disease is a set of clinical symptoms, general reactions of an organism and dysfunction of internal organs at thermal damages of the skin and underlying tissue.

At superficial burns of more than 15–25% of the surface of the body and deep burns of more than 10% burn disease signs develop.

During the burn disease course four periods are distinguished: burn shock, acute toxaemia, septicotoxaemia,reconvalescence.

1. *Burn shock* is a pathological process which develops at extensive thermal defeats and in dependence on the area and depth of the burn, duly and adequate therapy can proceed till 72 o'clock. Specific features of burn shock are absence of bloodloss, pronounced plasma loss, haemolysis, renal dysfunction that causes pathogenetic mechanisms of its development and the changes occuring in an organism.

According to the clinical picture three degrees of burn shock are distinguished:

— I degree is observed at burns of 15–20% of the surface of the body. It is characterized by strong pains in the injured sites, excitation of patients, moderate tachycardia up to 90 beats per min, the normal or slightly increased arterial pressure. Development of oliguria and haemoconcentration is possible;

— II degree develops with damage of 21–60% of the surface of the body and is characterized by fast increase of letargy, adynamia, tachycardia 100–120 beats per min, hypotension, fall in the body temperature, thirst, dispeptic phenomena, reduction diuresis, pronounced haemoconcentration (Ht grows up to 60–65%) with development of metabolic acidosis;

— III degree develops with injury of more than 60% of the surface of the body. The condition of the patient is very severe, the consciousness is confused, letargy comes, sopor. The puls is threadlike, arterial pressure is decreased below 80 mmHg, shallow breathing. There is paresis of the gastrointestinal tract. Dysfunction of organs and systems which is dangerous for life develop and first of all — the kidneys. Ht exceeds 70%, hyperpotassemia, acidosis rise.

2. *Acute burn toxaemia* replaces the shock stage, but can develop independently, takes place for 10–15 days. Fast absorption of ac-

tive substances from the burn zone takes place: histamine, serotonine, prostaglandins, toxins — glycoproteids with antigen specificity, lipoproteids, oligopeptids. Proteolitic enzymes activate. The products of erythrocytes haemolysis, fibrinolysis have toxic action. The manifestation of toxaemia is fever with temperature peaks up to 38–40°C, pallor of the skin, tachycardia, hypotension, weakness, nausea, vomitting.

Disturbances of the central nervous system, cardio-vascular activity, renal functions with proteiuria, microhaematuria — down to acute renal insufficiency are observed. The clinical analysis of blood reveals anemia, high left-shift leukocytosis. Increase in transaminases activity, hypoproteinemia, hyperbilirubinemia are typical in biochemical analyses of blood.

3. *Septicotoxaemia* is shown in 10–14 days after the burn. The basic pathogenetic factor of the septicotoxaemia is resorption of the products of tissue disintegration and vital activity of microorganisms with development of infectious complications.

The *clinical course* of septicotoxaemia depends on the character of the wound process phase. In the first phase (from the beginning of eschar tearing away to full cleansing of the wound) the general condition of patients is severe: broken sleep, pronounced irritability, tearfulness, bad appetite. Attributes of purulent intoxication are observed: fever, tachycardia, weakness. Anemia, leukocytosis with left shift, sometimes eosinophilia, lymphocytopenia continue to increase. Attributes of toxic hepatitis, pyelonephritis are typical.

In the second phase (the phase of granulations down to full healing of burn wounds) various complications develop: pneumonia, acute ulcers of the gastrointestinal tract (Kurling's ulcer), burn exhaustion, generalization of infection — burn sepsis.

4. *Reconvalescence*. With liquidation of a burn wound the lost functions of the cardio-vascular system, urinary system, parameters of red blood, leukocytes, protein structure of blood begin restoring.

Treatment of burns is a rather uneasy problem.

First aid. The depth of damage, the further disease course depend on how fast and correct the first aid is rendered.

The order of measures at rendering the first aid is as follows: to prevent the thermal agent influence on the skin; to cool injured sites; to apply an aseptic bandage; to anesthetize and begin antishock actions.

Local treatment of burns. Treatment of burn wounds can be conservative and operative. Conservative treatment is a unique and final method at superficial burns. At deep burns operative restoration of the lost integument is necessary.

1. The primary toilet of the burn surface is carried out at the limited surface without shock signs with observing aseptic rules, sparing, with application of narcotics or narcosis and consists in treatment of the skin around the injured place, removal of exfoliating epidermis, alien bodies, treatment of burn surface with a 3% solution of peroxide hydrogen. Large blisters are incised and emptied. In this case the exfoliating epidermis plays a role of an original biological bandage.

2. Conservative treatment is carried out by the closed or open way.

The closed way is based on application of bandages with various medicinal substances and carried out with taking into account the depth of injury and presence of purulent inflammation. Superficial burns as a rule heal with epithelization, and formation of rough scars is possible only with development of pronounced purulent inflammation.

With deep burns local treatment is directed on acceleration of necrotic tissues rejection. Bandaging is carried out in a day under narcosis with application of damp bandages with antiseptics. Since the 7th–8th day sparing bloodless necrectomy is conducted, necrolytic therapy (travaza, 40% salicylic ointment, benzoic acid) is applied. After eschar rejection, the bottom of the wound is granulation tissue. Independent closure of the defect is possible with insignificant injury. In most cases skin plasty is necessary.

With the open method of treatment the drying up action of the air is used, treatment of the burn surfaces is conducted by antiseptics with coagulative properties (a 5% solution of potassium permanganate, brilliant green), the wound remaining open. This method is applied in conditions of the controlled abacterial environment in special wards, boxes.

3. Surgical treatment is applied at deep burns as follows:

— necrotomy which is indicated with formation of dense circular necrosis and is carried out without additional anaesthesia as a section on all the depth untill blood drops appear;

— early necroectomy with closing the defect with the skin transplant is a big surgical intervention and it is necessary to observe under adequate anaesthesia in terms of 3–5 days after the burn with the tangential or one-staged method with closing the wound defect by the method of free skin grafting or vascular pedicle grafting;

— delayed skin grafting is carried out 2–4 weeks after the burn when the wound is covered with granulations without pathogenic microflora.

Now in closing burn wounds the following ways are applied:

1. Local tissue grafting.

2. Free skin grafting as full-thickness skin transplantation and accordion grafting.

3. Accordion grafting on an nutritive leg: Italian grafting, grafting according to V. P. Filatov, accordion grafting on a vascular pedicle with microsurgical technique application.

4. Application of cultivated allofibroblasts — multilayered cellular structures from cells of the embryos which have been brought up on special nutrient mediums.

5. Provisional biological closing the defect in order to prevent the loss of plasma, prevention of infection development, stimulation of regional epithelization with the use of the cadaveric skin or the donor's one (allodermoplasty), the skin of calfs, pigs (xenodermoplasty), synthetic materials (polycaprolacton, hydron), synthetic skin (epigard, sincaver, aeroplast-special).

The general treatment of burns. The following components of the general treatment at burns are distinguished:

1. Struggle against pain, which consists in the patient's rest, applying bandages, introduction of non-narcotic analgesics, sedative preparations, neuroleptics, narcotic analgesics.

2. Treatment of the burn shock is carried out according to the general rules of antishock therapy and is directed on elimination of pain, maintenance of the system haemodynamics, improvement of perfusion, compensation of the plasma loss and correction of the function of the damaged organs.

Narcotic analgetics in a combination with antihistamine preparations and sedative means, neuroleptics are applied for struggle against pain.

Elimination of hypovolemia and compensation of the plasma loss is reached by introduction of plasma, albumin, protein, blood substitutes (polyglucin, rheopolyglucin, hecodez, rheosorbilact).

Corticosteroids, dopamine, cardiotonic means, cardiac glycosides (strophantin, corglucon) are applied under indications.

Aminophylline, dopamine are applied for improvement of tissue and organ perfusion. Contrical, trazilol, rheopolyglucin, rheomacrodes, heparin and its low-molecular fractions, trental, curantil are applied for stabilization of microcirculation and correction of rheologic properties of blood.

Correction of function of the damaged organs in the shock phase first of all is directed on the respiratory sistem: breathe of the moistened oxygen, intubation of the trachea, under indications — tracheostomy.

3. Treatment of acute toxaemia consists in infusion and desintoxication therapy, treatment of acute renal insufficiency, correction of acidosis.

Infusion therapy makes up the blood volume (BV), loss of protein and electrolytes of blood by way of components and preparations of blood usage, and as blood substitutes.

Desintoxication therapy is attained by application of low-molecular colloidic solutions, plasma, osmotic diuretic (manitol), lasix. Metabolic acidosis demands introduction of a 4% sodium bicarbonate solution.

4. Treatment in the septicotoxaemia stage proceeds after the principles of toxaemia treatment with addition of antibacterial preparations, which are appointed to all patient with deep burns of more than 10% of the body surface. Antibiotics are administered with taking into account the kind and sensitivity of microorganisms.

Stimulation of the immune system is an integral part of infectious complications treatment: transfusion of plasma, active immunization with staphylococcal anatoxine, passive immunization with antistaphylococcal plasma and γ-globulin, vitamins, roncoleukin — recombinant human interleukin-2, causing proliferation of lymphocytes and stimulation of cellular and humoral immunity.

Radiation Burns

Radiation burns arise at influence of different beam energy: ultraviolet ray, X-ray, α-, β-, γ-rays. Thus, besides of local changes, which have received the name "radiation burns", in a patient's organism under the influence of X-ray, α-, β-, γ-rays develop specific general symptoms, typical for radiation disease (nausea, weakness, hypotension, vomitting, leukopenia, thrombocytopenia, anemia).

Dilation of capillaries and stasis of tissues take place, degenerate changes in the nerve endings. Hypostasis and destruction of growth layer, hairy follicles, sudoriferous and sebacous glands. With big doze development of deep tissue dry necrosis is possible.

Clinical picture. The radiation burn course is divided into three phases:

— primary reaction, which appears in some minutes after influence of radiation energy by hyperemia, hypostasis and pain in the injured site as well as general symptoms: weakness, headache, nausea, vomitting, which take place within several hours.

— the latent period during which no local or general symptoms are observed;

— the period of necrotic changes is characterized with hyperimia, condensation, oedema (induration of the skin). Hair falls out, teleangioectasias develop, blisters with a serous liquid, erosion and radiation necrotic ulcers with a low degree of regeneration or full absence of any tendency to healing appear. General symptoms have the extensive picture of radiation disease: weakness, nausea, vomiting, anemia, leukopenia, thrombocytopenia, bleedings and secondary infection develop.

Treatment. If radioactive substances hit on the skin it is necessary to wash them out with water as soon as possible or incise the injured skin and hypodermic tissue.

The presence of the latent period during which it is possible to perform plastic operations should be taken into account at treatment.

After development of alterative changes treatment of the necrosis is conservative by the general principles (bandages with antiseptics, proteolytic enzymes, water-soluble ointments). The skin grafting is carried out seldom and subsides in the remote period after clinical displays of radiation disease.

Correction of general symptoms is carried out according to general treatment of radiation disease: high-caloric diet, immynostimulators, stimulators of haemopoiesis, anabolic hormones, vitamins, transplantation of the bone marrow.

ELECTROTRAUMA

Electrotrauma is a complex of changes in an organism under the action of the electric field, the source of which can serve the atmospheric and technical electricity.

Injury by the electric current occurs owing to direct contact with current-carriers and arc contact at ionization of air between the person and a source of the current.

Under the influence of the electric current in an organism the complex of changes develops under thermal action and general biologic influence. Voltage above 36 V and force of a current more than 0.1 amper (A) are considered to be dangerous to the person (force of the current of 0.5 A is fatal).

Thermal action of the electric current depends on force of current and voltage, time of contact, the area of contact, resistance of tissue.

The maximal changes are observed at the place of entrance and exit of the current — "signs of the current". Deep necrosis is observed with injury of the muscles, the bones: detachment of the muscles, tunelistion, haemorrhages, dissolution of phosphorus salts and dystrophic changes in bones.

Action of electric field is shown by change of ions concentration and infringement of charged particles polarization, formation of units from uniform elements of the blood. Thus, it is important to take into account the way of the current through the body — "the loop of the current". If it passes through the heart, the brain, the condition which threatens to life can develop, down to clinical death.

Clinical picture. With injury by the electric current the local (electroburns) and the general (electrotrauma) symptoms are distinguished.

The electric current signs arisen at injury are characterized by small (diameter up to 2–3 cm) but deep sites of dry necrosis of round or line form with traction in the center and raised edges, absence of hyperemia and pain, with attributes of metallization. Necrosis rejection proceeds for a long time, secondary necrosis as a result of spasm and thrombosis of vessels, down to gangrene development can be observed.

The general symptoms depend on severity of electrotrauma and changes on the part of cardiovascular (bradycardia, arytmia, dull cardiac tones, cardiac fibrillation), respiratory (disturbances of rhythm and depth of breath, asphyxia) and the central nervous system (fatigue, dizziness, loss of consciousness, infringement of sight, weariness, excitation, presence of paresis, paralyses, neurites).

With development in some cases of so-called "mors putativa" resuscitation measures are carried out down to occurrence of cadaveric regidity.

Treatment. First aid consists in the stoppage of influence of the electric current, resuscitation measures under indications, applying dry aseptic bandages on the injured area, delivery of the patient to the hospital.

Local treatment consists in early necroectomia. After necroectomia bandages with antiseptics and proteolytic enzymes are used. Amputations are made under indications. Skin grafting is carried out seldom and in late terms after full rejection of the necrotic tissue.

The general treatment is similar to treatment at thermal burns.

FROSTBITE

Frosbite — is a set of clinical symptoms arisen under influence of low temperatures and manifested as necrosis and reactive inflammation of the tissue.

Aetiology. The basic etiologic factor of frosbite is long-term influence of low temperature on the tissue of the body of the person which action is aggravated with burdening factors.

Humidity and wind, pressure of tight shoes, massive blood loss, shock, cardiovascular function decompensation, physical fatigue, alcohol abusing, alimentary exhaustion, obliterating diseases of extremities, diabetic angiopathy, diseases of the veins, accompanying traumas of extremities, repeated stay of the victim in conditions of low temperature refer to burdening factors.

Pathogenesis. Local mechanisms of necrosis formation and general changes in an organism under the action of low temperatures are distinguished.

Local changes in tissues occur already at the temperature of +8°C as the termination of oxyhaemoglobin dissociation — blood does not give oxygen to tissues, and then there is a full infringement of blood circulation because of angiospasm. After warming there is paretic dilation of the vessel, stasis, infringement of the blood circulation, aggregation of uniform elements and thrombosis. It promotes deep necrosis formation.

The general symptoms during frosbites are connected with adsorption of disintegration products from the necronic tissues area and adding infection.

General cooling (freezing), a severe pathological condition of an organism begins with decrease in the body temperature up to 34°C and proceeds in three phases:

— the 1st phase is the phase of adaptive reactions. The body temperature is 34–31°C. The changings taking place in the central nervous system and blood circulation system are irreversible.

— the 2nd phase is the phase of stupor. The body temperature is 31–29°C. This phase is characterized by the further inhibition of the nervous system function.

— the 3rd phase is the phase of fading of vital signs and comes at the temperature below 29°C and is characterized by the further inhibition of the basic functions of an organism, spasms, regidity and can lead to death.

Classification. After the depth of injury four degrees of frosbite are distinguished:

I degree is characterized by moderate hyperemia and an oedema, absence of blisters and skin necrosis. The patients complain of moderate pains, feeling of burning. Recovery comes in 5–6 days.

II degree is characterized by necrosis of all epitelial layers as blisters with the transparent liquid, pronounced pains, paresthesias. Recovery comes in 2–3 weeks.

III degree is characterized by necrosis of the whole skin thickness with possible transition to the hypodermic tissue. Against a background of pronounced hyperemia and oedema there are necrosis foci and blisters with haemorrhagic contents. After rejection of necrosis in 2–3 weeks the wound surface is full of granulations. Healing occurs according to the rules of secondary healing of the wound.

IV degree is characterized by necrosis of the whole depth of all extremity tissues. Local changes consist in development of dry or humid gangrene. With the absence of infection the demarcation line forms in 2 weeks giving an opportunity to perform necroectomia or amputation.

Clinical picture and diagnosis. The course of frostbites is divided into the pre-reactive (latent) and the reactive period.

The pre-reactive (latent) period lasts from several hours to about a day, the tissues are in the condition of hypothermia. The patients complain of sensation of cold, paresthesias. The affected sites are white.

The reactive period begins after warming the injured sites. There are pains, cyanosis of the skin, increase in oedema, paresthesias and hyperesthesias come. The extent and depth of the pathological process are difficult to define within the first week after frostbite and only in later terms the attributes corresponding to a certain degree of frostbite form.

Scintigraphy with Tc^{99}, capillaroscopy, skin electrothermometry, thermography, rheovasography, dopplerography, angiography are applied for definition of depth of injury.

The pain is absent or insignificant and the general condition can be satisfactory during the pre-reactive (latent) period.

The reactive period is characterised by toxaemia and septicotoxaemia with typical clinical signs which have been touched in detail in the section devoted to thermal burns.

Treatment. First aid to the patient with frostbite consists in elimination of cold action, gradual warming of the injured parts of the body in the bath with the room temperature water or by rubbing with spirit, vodka. The patient should put on warm clothes, take hot drink, analgesic means.

In the pre-reaction (latent) period they continue gradual warming of the tissues, use spasmolytics (no-shpa, papaverin), desagregans (aspirin, trental), preparations of rheologic action (rheopolyglucin), anticoagulants (heparin), analgetics. They struggle against shock and symptomatic correction of the decompensanted vital functions of an organism down to rendering resuscitation actions. The antibiotic prophylaxis and emergency prophylaxis of tetanus are necessary to carry out.

General warming of an organism and the therapy started in the pre-reactive period are carried out in the early reactive period. With the presence of toxaemia and septicotoxaemia introduction of electrolytes, desintoxicants, blood substitutes, preparations of the blood are indicated. Antibiotics, immunomodulators are used for prophylaxis and treatment of infectious complications.

Local conservative treatment in the reactive period is carried out according to the principles of treatment of purulent or granulating wounds: toilet of the wound, humid-drying bandages with antiseptics, application of fermental preparations for removal of necrosis. After cleansing the wounds oitment bandages are applied.

Surgical treatment, which is applied at frostbites of III–IV degrees, consists in necrotomy, necrectomy, amputations, regenerative and reconstructive operations.

Necrotomy is carried out at the end of 1st week without anaesthesia with the subsequent application of bandages with antiseptics, trying to transfer of necrosis in dry with the advent of a precise line of demarcation.

Necrectomy is carried out in 2–3 weeks within the limits of the necrosis zone.

Amputation is carried out after final subside of inflammatory process with formation of the stump by some centimeters proximal of the demarcation line.

Regenerative and reconstructive operations are observed in the remote terms.

Lecture XIV

NECROSIS. GANGRENE

NECROSIS

Necrosis is a local mortification of the tissue. The reason for local mortification of the tissue can be direct damage to tissue by any traumatic factor, insufficient nutrition of the tissue as a result of infringement of blood circulation, metabolic diseases, damage to the nervous system.

External factors, which injure tissues, can be the following:

a) mechanical factors (blows, compression, ruptures, wounds, etc.);

b) thermal factors (burns and frostbite);

c) electric factors (electrotrauma);

d) chemical factors (concentrated acids and alkalis, other caustics and organ secretions);

e) toxic factors (microbic toxins);

f) radiation energy (burns by X-ray radiation and radioactive burns).

Nutrition insufficiency of tissue can cause such infringements of blood circulation:

a) acute cardiac failure;

b) embolism of vessels;

c) long spasms or obliteration of blood vessels (Raynaud's disease, Buerger's disease, obliterating endarteritis, obliterating atherosclerosis, nonspecific aortoarteritis);

d) rupture and compression of vessels (wound to the main vessels, their compression while squeezing in the hernial gates or any type of strangulated intestinal obstruction, compression by hard plaster bandages or long-term tourniquet application);

e) infringement of the coagulation system of blood by hypercoagulation and rheological properties of the blood;

f) infringement of the integrity and structure of the intima of the blood vessels (thromboses and inflammations of the arterial and venous walls, atherosclerosis).

Insufficiency of tissue nutrition can be observed with metabolic diseases, for example, diabetes, scorbutus. Infringements of tissue nutrition and trophics are observed with damage to the nervous system (tumor, neurosyphilis, syringomyelia), and also with damages to the head and spinal cord and peripheral nerves.

In the occurrence, development and progress of necrosis big role is played both by the general anatomic and physiological features of an organism and local ones. The degree of the organism's reactance, hypovitaminosis, and accompanying diseases belong to general features of an organism. The local ones include the structure type of the vascular system (main or collateral), type of development of infringements of blood circulation, presence of pathological changes in the vessels, presence of microbes and their toxins at the necrosis area.

Necroses can develop in different organs and tissues; they are classified by their aetiology, depth of injury and the clinical course:

a) according to aetiology — specific and nonspecific;

b) according to the depth of the damaged tissue — superficial, deep, total;

c) according to the clinical course — dry, humid.

Nonspecific necrosis is the result of wounds or long compression of blood vessels and tissues, extensive burns, surgical infection, trophic changes (bed sores, ulcers), thromboses and embolisms. Specific necrosis is the result of atherosclerosis, obliterating endarteritis, syphilis, endocrinal pathologies (diabetes).

Necrosis can be coagulational (dry), as observed with burns by concentrated acids, and liquefactive (humid), observed with radiation burns. Obvious attributes of necrosis arise 4–6 h after the tissue dies. Dead tissue, under the influence of proteolytic enzymes rejects. If the necrotic masses are located on the body surface after rejection, an ulcer is formed. With extensive and deep necrosis, tissue disintegration and diffusion of toxic products can lead to acutely pronounced intoxication, the development of toxic shock and the death of the patient.

GANGRENE

Gangrene is one of the forms of necrosis, predetermined by infringement of blood circulation and the development of dead tissue. The most often reason for the development of gangrene is acute or chronic arterial insufficiency. Dry, or coagulative, and humid gangrene are distinguished.

Dry Gangrene

Dry gangrene affects the extremities more often. It is characterized by fast drying of dead tissue without infection and it appears mummification of dead tissue. The tissue quickly becomes dehydrated and dries up, turning brown or blue-black.

The necrosis process is limited and usually does not progress. Histologically in the tissue coagulative necrosis with the disintegration of the cellular nucleus, erythrocytes, leukocytes and settlement of protein in the plasma is marked. Clinically in the initial stage, strong ischemic pains in the extremities more distal from the damage, as a rule, are observed. The extremity becomes pale and is cold to the touch; the skin gradually gets a marble look.

Superficial and deep sensitivity becomes dull and then completely disappears; the function of the extremities is broken. Pulse on the peripheral arteries is not determined. If at the same time with occlusion of the main vessel there is resistant spasm of the collaterals, the necrosis zone becomes more extensive. Further a demarcation shaft, which limits the living tissue from the dead ones, develops. The dead tissue comes off, and at the demarcation line the connective tissue cells multiple, the leukocytes accumulate and granulations form. The border between the alive and dead tissue goes deeper, untill the necrotic area rejects, after which there is a granulating wound, which slowly heals. As a result of the mummification of dead tissue during dry gangrene, absorption of toxic substances of tissue disintegration is not significant and intoxication does not occur. The general condition of the patient is good. In order to prevent the occurrence of local complications, the infection of dead tissue and the transition of dry gangrene into humid during redressing, it is necessary to strictly follow the rules of aseptics. The extremity is immobilized, dry bandages are applied, physiotherapeutic procedures (quartz irradiation) are conducted. Necrectomy, i.e.

surgical removal of necrotic tissue, as well as amputation of the extremity is necessary to postpone until the occurrence of a demarcation shaft is in full view. If gangrene is caused by direct damage of tissue, necrectomy is necessary to conduct behind the demarcation line. If gangrene developed as a result of infringement of arterial blood circulation, the amputation of the extremity is conducted considerably more proximal, i.e. within the borders of absolutely viable tissue with good blood supply. In order to prevent the development of dry gangrene, early diagnosis and treatment of blood vessels diseases, which can lead to the development of necrosis and gangrene (thromboses, obliterating endarteritis and atherosclerosis) have crucial importance. It is necessary to improve blood circulation, promote the development of collaterals, and liquidate the spasm of blood vessels. It is necessary to conduct in due time reconstructive operations on vessels to normalize the blood supply of the extremities.

Humid gangrene

Humid gangrene is also a kind of necrosis. It develops mainly in obese, pastous patients as a result of acute infringement of blood circulation. Purulent or putrefactive infection frequently accompanies humid gangrene. The development of humid gangrene is also promoted by hypostases, which results from cardiac failure, renal diseases and diabetes.

With humid gangrene, the dead tissue does not dry up and become a good nutrient medium for infection. Putrefactive (protruding) disintegration of tissue develops, which is quite often accompanied by anaerobic infection (gas gangrene).

When the dead tissue breaks up, it turns into a wet dirty mass of grayish-green color with an unpleasant odour. Intensive absorption of the disintegration products, which quickly results in severe intoxication leading to the death of the patient, is observed. With humid gangrene the demarcation line is not formed, the process spreads quickly to the external tissue. The extremities become pale, cold to the touch and then cyanotic-red dots appear; the epidermis exfoliates and blisters, filled with bloody, stinking exudate, form; hypostasis of tissue sharply increases. Severe pain occurs in the damaged extremity. The mentioned above local phenomena are accompanied by systematic intoxication. The patient's face becomes grey; tongue is dry; pulse is of weak filling and pressure; the arterial pressure is low, complete apathy and high temperature of hectic origin is observed.

The course of diabetic gangrene is especially severe. Patients with diabetes have decreased resistancy and tissue regenerative properties and increased susceptibility of an organism to pathogenic organisms of pyo-septic infection. Because of this, patients with diabetes easily get secondary inflammations, and the wounds regenerate very badly. Humid gangrene can damage different organs and as a result the clinical picture is diverse. It depends upon the type of tissue, the character and localization of the damaged organ. Gangrene of internal organs occurs only as humid gangrene and is accompanied by symptoms of peritoneal irritation and peritonitis development. Pulmonary gangrene has its own clinical signs.

The treatment for humid gangrene is directed on fast elimination of damaged cells, struggle against intoxication and infection, correction of metabolism infringement.

Necrectomy with humid gangrene is not effective because it does not improve the patient's condition, does not liquidate the source of intoxication. With gangrene of the abdominal organs, emergency laparotomy, the removal of the damaged organ and sanitation of the abdominal cavity, is done. Broad-spectrum antibiotics, sulfamidin and nitrofuran preparations, antiseptics, vaccines and serum, immunomodulators are applied to struggle against infection. For struggle against intoxication all the available methods of intra- and extracorporal detoxification are used: introduction of great amount of crystalloids (isotonic solution of sodium chloride, 5–10% solution of glucose), haemotransfusion, plasma, albumin, haemodesum and other blood substitutes, lactosol, low-molecular polyglucin in combination with cardiac and diuretic substances (technique of forced diuresis). It is necessary to apply also haemosorption, plasmosorption, ultra-violet irradiation of blood (UVIB). Along with the therapist-endocrinologist, correction of the carbohydrate metabolism disorders are conducted for patients with diabetes.

DECUBITUS

Decubitus is a version of necrosis. This is dystrophic, ulcer-necrotic changes on the skin, fatty hypodermis and soft tissue down to the bones, which develop as a result of infringement of microcirculation caused by compression.

Compression occurs on areas of the coccygeal bone, scapula, heals, etc. Decubitus occurs in weakened patients, especially with damages to the spinal cord, in the postoperative period when patients are immobile in bed for a long time. Decubitus forms gradually, imperceptibly. First, the patients complain of feeling of compression and pain. The first attributes of decubitus is pale skin with redness following. Then it is joined by cyanosis; hypostasis develops; the epidermis exfoliates; blisters, filled with serous-hemorrhagic exudate, form. Soft tissue dies down to the periosteum. The skin dies; necrotic tissue separates and forms a deep purulent wound, the bottom which is the periosteum of the next bone. An infection can lead to the development of sepsis and the patient's death.

Preventive measures against decubitus have crucial importance. Such patients should be turned over every 2 h and left in that position for some minutes. It is necessary to watch and change regularly bed linen and underwear; there should be no wrinkles in the bed linen. It is necessary to re-make the bed 2–3 times a day. It is necessary to watch daily the cleanliness of the integuments, wash areas where decubitus form often with warm water, then wipe it with a tampon moistened in a 10% solution of camphor spirit, with rotary movements rub and massage them. The skin on the maceration sites should be washed with cold water and soap, diligently dried, wiped with spirit and powdered. Under the pelvis and sacrum they put a rubber circle covered with a film, and under heals and elbows — cotton-gauze circles. Seriously ill patients are put on special porolon or mattresses, which are filled with water or air.

Sometimes in the medical practice it is possible to observe a so-called internal decubitus, for example, dead vein walls as a result of the presence of dense catheter in it for a long time for intravenous introduction of medicines or dead internal organ body walls, which underwent compression by a dense drainage tube. Preventive measures for the above-stated internal decubitus consists in that dense catheters and drainage tubes shouldn't remain in patient's organs for a long time.

It is much more difficult to treat decubitus, which formed, than prevent its formation. Decubitus are treated with a concentrated solution of potassium permanganate, powder with streptocide and rubbed with brilliant green or water solution of methylene blue. The surface of the decubitus should be covered with aseptic bandage and a 10% streptocide ointment or a 1% streptocide emulsion. It is necessary to apply physiotherapy (UV-rays, quartz). When necrosis is restricted, the line of demarcation forms; the dead tissue is surgically removed, i.e. necrotomy is conducted, or they are melted with proteolytic enzymes (trypsin, chymotrypsin). This treatment is joined with applying bandages with hypertonic solutions (10% solution of sodium chloride). After cleansing the wound, various ointment bandages are used with antiseptics, stimulating therapy (hemotransfusion, plasma, protein blood substitutes), and if necessary — surgical treatment — skin transplantation (autodermoplastic).

ULCERS

Ulcer is a defect of the skin or mucous membrane, formed as a result of necrosis tissue. After the dead tissue rejection, the defect takes a long time to heal, which results in the formation of an ulcer. The principal cause of ulcers is a sharp decrease in regeneration processes, predetermined by the general condition of the patient or the accompanying diseases or metabolism illnesses. Tissue anemia and trophic changes in tissue play an important role in their formation.

The reasons for ulcers are the following:

1. Infringement of arterial blood circulation (thromboses, embolism, severe angiospasm), venous blood circulation (varicose dilation, superficial and deep thrombophlebitis, arteriovenous fistulas), as well as lymph circulation disorders.
2. Changes in the vessel walls during atherosclerosis, obliterating endarteritis, the Raynaud's disease, and syphilitic aortitis.
3. Traumatic damages of various genesis — mechanical, thermal, chemical, electric, radiation.
4. Infections — purulent, putrefactive, specific (tuberculosis, syphilis, leprosy) and mycotic (actinomycosis, blastomycosis, epidermomycosis).
5. Disorders of metabolism processes (diabetes, scurvy, blood diseases, anemia).
6. Neurotrophic disorders (with traumatic damages and radicular tumours of the spinal and peripheral nerves, syringomyelia and progressive paralysis).
7. Benign and malignant tumours, which are inclined to be covered by ulcers (sarcoma, lymphogranulomatosis).

First, necrotic cells with dead tissue, microbes are formed with purulent discharge. Around this cell, a granulation shaft develops, which changes into dense connective tissue, and around the ulcer nonspecific inflammation is observed. The formation of an ulcer occurs against a background of signs of pronounced trophic infringement. Its appearance and sizes can be diverse, the form — from round or extended to any shape. The edges of the ulcer can be both smooth and even or uneven, jagged, pale or cyanotic. The bottom of the ulcer usually is raised or crateriform, filled with a muddy liquid, granulation tissue and necrotic cells. Ulcers, which border a dense layer of connective tissue, are called callous ulcers. Ulcers can sometimes be covered by fungoid hypergranulations.

Ulcers can cause different complications, for example: secondary bleeding from erosive blood vessels, accompanied by infection, penetration, i.e. germination of an ulcer into adjoining organs, or perforation of an ulcer into the cavity or a neighboring hollow organ. With the healing of extensive ulcers, scars can form, which deform the organ and break its function. Malignant regeneration, a so-called malignancy of ulcers, which sharply change the clinical displays, medical policy and the prognosis of each individual case, is possible. Healed ulcers are inclined to recur.

Treatment of ulcers should be complex, directed on the elimination of the basic disease, i.e. etiologically directed. Conservative means are applied more often for treatment of external ulcers: bed regimen, immobilization of the extremity in the raised position, careful skin care, physiotherapeutic actions (ultra-violet irradiation). It is necessary to follow all aseptic rules. In the initial stage, bandages with hypertonic solutions are applied on the ulcer; proteolytic enzymes are used for complete cleansing of the ulcer from pyo-necrotic mass and infection. After the ulcer is cleansed, bandages with ointments and antiseptics are applied. Hypergranulations are cauterized with a 10% solution of silver nitrate (argentum nitricum); delete with the help of a sharp Volkmann's curette; the extremity is immobilized with a zinc-gelatinous bandage, consisting of zinc-gelatinous glue and bandage. Zinc-gelatinous glue contains 3 parts of zinc oxide and 3 parts of gelatin, 5 parts of glycerin and 9 parts of water. Before the usage, the mixture is warmed, put on the extremity, and dressed with a soft bandage.

Besides of local treatment of ulcers, it is necessary to conduct general therapy, directed on the stimulation of immune-biological and reparation processes in an organism. With this purpose they apply full-volume, rich in vitamins meal, immunomodulating factors, protein preparations and blood substitutes, physiotherapy exercises, etc.

When conservative actions fail, they apply operative methods of treatment, which provide the cleansing of an ulcer from pathologically changed granulations and circular scars. If the tissue defect is formed, it is covered with a skin transplant or regional skin grafting on a wide pedicle is conducted.

Atherosclerotic ulcers arise in aged persons. They are mostly located in the lower third of the shin and on the feet. They are small, round or oval. The granulations are languid, pale; the edges of the ulcer are flat, dense, and uneven. Pronounced signs of chronic arterial insufficiency are observed.

Varicose-trophic ulcers are big and more often located on the internal area of the bone. The ulcers are usually deep, the neighboring tissue is dense and sclerotic, the skin has dark spots, during palpation — not very painful. Ulcers are always incorporated with varicose dilation of superficial veins on the legs, which are the basic diagnostic attributes for the formation of ulcers. Ulcers which appear against a background of chronic venous insufficiency after thrombophlebitis of deep veins on the legs, are called post-thrombophlebitic. They can be of huge sizes, located on the internal surface of the shin or circular as a cuff surrounding the whole shin. The skin of the shin around the ulcer is pigmented, swollen, dense, acute sclerotic (indurative cellulitis).

For treatment of varicose-trophic ulcers — their faster cleansing and closing — along with hypertonic and proteolytic enzymes, vacuuming with the help of special vacuum-devices, as well as treatments in special aerotherapeutic installations (ATI) have been successfully used in our clinic. Treatment of ulcers in ATI occurs under certain conditions — temperature, humidity and sterile air, which pass through special antibacterial filters.

With varicose-trophic ulcers after their closing, surgical treatment is necessary — removal of the delated superficial veins and suturing the perforated veins, normalizing venous circulation in the legs. If it is impossible to conduct surgical treatment, the varicose nodes are thrombosed by entering phlebosclerotic substances (66% solution of glucose, varicocidum).

Radiation ulcers result from the action of ionizing irradiation — during radiation therapy or casual irradiation. The formation of necrosis is preceded by changes on the skin — pigmentation, bright red teleangiectasia, hair loss, atrophy. Then necrosis with the formation of a trophic ulcer, occurring deep with a round or oval form and twisting edges, occurs. Around the ulcer, the zone of sclerotic hypodermis and atrophied skin is found. If the ulcers cover a tumour, a dense infiltrate, which enters the depth, is found, is not displaced during palpation, soldered with the surrounding tissues and organs, where the ulcer is located. The ulcer is thickened, dense, tuberous, uneven edges; the bottom is covered with necrotic tissue; sites of growths on the edges of the ulcer, which testify to the continuing active growth of the tumour, are frequently observed. With suspicion of malignancy, i.e. malignant regeneration of the ulcer, it is necessary to conduct a biopsy — incision of the edge of the ulcer for following histologic exam, that will determine subsequent medical policy.

For effective treatment, it is necessary to know and take into account the ulcer formation pathogenesis. Treatment should be pathogenetic, i.e. directed on the trophic normalization of tissue and the basic pathological processes, which entails the ulcer formation. Fortifying therapy also has great value in the complex treatment of ulcers: vitamin therapy, full-value nutrition, the use of anabolics and normalization of metabolism processes. For fixing a positive effect in the patient, it is necessary to recommend sanatorium treatment. The use of hydrosulphuric, radonic mineral baths, and mud baths improves the tissue trophic and normalizes blood and lymph circulation, which is effective preventive measures of ulcer relapses.

FISTULA

Fistula is an abnormal pathological duct in tissues, a narrow channel covered with epithelium or granulations, and which connects an organ, a natural or pathological cavity with the organ's surface or with each other. If the channel connects a hollow organ or whith any cavity with the superficial covers, it is an external fistula. If the pathological duct connects hollow organs, it is an inner fistula. The latter should be distinguished from anastomosis, applied artificially with medical purpose.

Fistulae are divided into congenital, resulting from infringement of embryogenesis (defects of development), and acquired, resulting from trauma, tumours, inflammatory diseases. Fistulae are also a result of operative intervention which ended with the artificial formation of an external fistula and is an intermediate or final stage of the surgical treatment. For example, imposing gastrostomy, entero- and colostomy, cystostomy.

After the structure fistulae are divided into tubular, the walls of which are covered with granulations, and labia-shaped — the walls are covered with epithelium. Tubular, or granulating, fistulae are covered with granulation tissue from the inside along the whole length of the channel; they have a tendency to close independently. Labia-shaped, or epitheliated, fistulae are covered with epithelium, which directly pass into the epidermis of the surrounding integument. Such fistulae are not inclined to close independently and require surgical treatment.

Fistulae are also distinguished according to the type of discharge: mucous, purulent, uric, biliary, feces, salivary, liquor. In the fistula's secretion pathological elements, which help determine the diagnosis (microbacteria tuberculosis, actinomycosis, bone sequestrations, malignant cells) can be found. The secretion from the fistula, getting on the skin, can cause its irritation, maceration and formation of ulcers, observed with duodenal, small intestinal and pancreatic fistulae.

Every external fistula has external skin orifice, channel and an internal orifice. Some fistulae have no channel, because the wall of the organ can reach the level of the skin or even to stick above it, forming a lip.

Labia-shaped fistulae can be complete if the contents of the organ, for example the intestines, discharges outside, and incomplete if the contents of the organ only partly discharge through the fistula opening. For the development of labia-shaped fistula and its functioning, the eperon, which forms as a result of the posterior back wall of the intestine falling into the opening of the fistula, has crucial importance. The length of the fistula duct depends upon the thickness of the tissue through which the fistula passes, mobility of the organ, its displacement by the pathological process, presence of accretions between organs. The skin orifice of the external fistula can be of various size and form. Most often external fistulae are single, but may be plural. The formation mechanism of plural fistulae is the following: near the already existing single fistula numerous paths containing the pus, which results in the formation of multiple abscesses, which then break to the outside and form plural fistula. Actinomycosis is a disease where primarily-plural fistulae are more often formed.

The fistula clinical course consists of local and general symptoms. Local symptoms are the presence of the fistula, its localization, character of discharge, skin maceration around the external orifice, structure of the channel. General symptoms are those of the basic disease which is the reason for fistula, such as trauma, defects of development, illness.

A patient with a fistula is examined by the general plan: complaints of the patient on the presence of the fistula, character and amount of discharge, dependence on meal, defecation and urination. It is necessary to take into account anamnestic data — the fistula occurrence time (congenital or acquired) and reason for its occurrence (trauma or result of an operation). It is necessary to examine carefully the fistula, find its localization, structure (tubular or labia-shaped), type and amount of discharge. Laboratory and instrumental study of the fistula is conducted. It is necessary to use color indicators to establish the diagnosis. The patient is given a solution of dye to drink, for example, methylene blue, and the time of its appearence in the fistula should be marked. This method of diagnosis helps to determine the height of the fistula, which is especially important with a fistula of the esophagus, stomach, and duodenum.

While examining a patient with a fistula, "X-ray" methods — fistulography — are important. The liquid contrast substance is entered to the fistula through a thin catheter; the X-ray pictures are taken. On the roentgenograms they determine the localization and direction of the fistula path, presence of discharge, detect the organ that the fistula, its level, and possible pathological changes in its wall.

With the suspicion of the inner fistula, i.e. fistula of the internal organs, it is necessary to conduct radiopaque study of the esophagus, stomach, small and large intestines. With this purpose, barium or the other radiopaque substance is entered into the organ cavity and its overflow through the organ's wall into the surrounding tissue, cavities or outside is determined.

Today for diagnosis of fistulae, specification of their localization, and sizes, endoscopic methods of study, such as gastroscopy, colonoscopy, bronchoscopy, cystoscopy, etc., based on the usage of fiber optics and optical paths, are widely used. Endoscopes may be entered through natural apertures inside any hollow organ and to carefully examine its wall. In some cases, an inner fistula can be found during an operation, performed for this or that disease.

Treatment of patients with external fistula is based on the following principles:
— local therapy;
— general therapy;
— operative therapy.

Local therapy — the treatment of a wound, protecting the surrounding tissue from the action of the fistula discharge. For this purpose physical means — ointments, pastes, powder (Lassar's paste, glues BF-2, BF-6, polymerized film, silicone pastes), which are applied near the external apertures of the fistula to prevent contact with the skin and to promote discharge adsorption are used. Chemical means, prevention of skin irritation by neutralizing the enzymes secreted from the fistula, are used. With this purpose inhibitors of proteolytic enzymes (contrical, Gordoxum, Trasylolum, zymophren, etc.) are used. Mechanical ways of protecting the skin are directed on significant reduction or termination of fistula discharge with the help of special adaptations, such as pelotives, obturators or vacuums-devices. The sanitation of purulent fistulae is conducted with the help of constant washing with antiseptic solutions. Granulating tubular fistula can be closed independently after eliminating the cause of its arising — removing the ligatures, bone sequestration, and terminating the fistula discharge. The epitheliated fistulae never close independently and require surgical treatment — suturing the organ entrance, and sometimes resections of the given organ. Artificial fistulae are formed for improving the patient's condition with the purpose of feeding him or discharge of the contents or secretion from the organ. These fistulae can be temporary or permanent. The temporary fistulae are closed surgically after the improvement of the patient's condition. The inner artificial fistulae are interorgan anastomosis and are applied for a long time or for the whole life.

Lecture XV

SURGICAL INFECTION. ACUTE PURULENT INFECTION OF THE SKIN, CELLULAR SPACES

Infection in surgery occupies one of leading places concerning lethality and determines the essence of many inflammatory diseases and postoperative complications. Last years, an increase in the incidence of pyoinflammatory diseases and postoperative purulent complications, which is connected both to the spreading of antibiotic-resistant strains of microflora and to the increase in complexity of operative interventions (operations on the heart, the esophagus, the lungs, the brain, organ transplantation, etc.), has been observed. Infringement of the immune status of patients is predetermined by many factors: allergies, influence of harmful ecological factors of the environment (increased background of radiation in connection with failures on the atomic power stations, pollution of water, the use of poor-quality products with high contents of agricultural chemicals, pesticides, etc.) has special value in the purulent infection spreading.

Classification of Surgical Infection

Depending upon the ethiology: staphylococcal, streptococcal, pneumococcal, collibacillosis, pseudomonas aeruginosa, gonococcal, anaerobic asporous, claustrid anaerobic, mixed and other kinds of infection are distinguished.

After the localization of the infectious process: surgical infection of the skin and hypodermis, infection of the skin on the skull and its contents (brain, membranes), purulent infection of the thorax and organs (lungs, mediastinum), infections of the peritoneum and abdominal organs, damage to the pelvic organs, infection of the bones and joints.

According to the extent of the clinical picture manifestation, acute and chronic forms are distinguished. Acute surgical infection depending upon the infectious agent and character of the clinical picture is divided into purulent, putrefactive, nonspecific anaerobic (gas gangrene), specific anaerobic (tetanus, diphtheria).

Chronic surgical infections are divided into nonspecific and specific (tuberculosis, syphilis, actinomycosis). Each of the listed forms can run with the prevalence of local signs (local surgical infection) or systematic phenomena with a septic course (systematic surgical infection).

Aetiology and Pathogenesis of Surgical Infection

Now the basic agents of purulent infection are staphylococcus, *E. coli.* Staphylococcus takes the central place among the agents of purulent infection; it is observed (up to 80%) both in monoculture and in associations with *E. coli,* streptococcus, fungi, etc.

Prominent features of a staphylococcal infection are fast occurrence of antibiotic-resistant strain, significant toxic influence on the organism due to toxins and enzymes (staphylohemolysin, staphyloleukolysis, plasmocoagulase), high virulence, ability to migrate and form metastatic abscesses.

Wide-spread in the pre-antibiotic era, aerobes (streptococcus, gonococcus, and pneumococcus) seldom cause purulent infection today; they are excreted, basically, in association with other microflora. *E. coli* takes the second place (47%) in the aetiology of purulent processes; it can exist in aerobic and anaerobic conditions, frequently forms associations with staphylococcus and streptococcus, especially in the pathology of the abdominal organs.

Sources of purulent infection can be saprophytes (protei, pseudomonas aeruginosa), widely spread in the environment, on skin and mucous membranes. They have special value with the decrease in immunity, extensive traumas (burns), may be the cause of sepsis.

Last years after the introduction into the clinical practice of special microbiological methods and nutrient mediums, it was proved that in the aetiology of pyoinflammatory diseases a significant role is played by aclostrium (asporous) anaerobes, which were not revealed by common methods. They consist of Gr-positive (peptococcus, peptostreptococcus, lactobacills) and Gr-negative (bacteroids, fusobacteria, campylobacteria) types.

Peculiarity of anaerobic aclaustrium infection is its fast progressiveness and spreading to the areolar tissue with the prevalence of necrolysis processes and endogenic intoxication. Aclaustrium anaerobes are excreted during wound infection of the abdominal cavity, peritonitis, pelvic abscesses, paraproctitis, and abscess of the lungs.

Many factors influence the pathogenesis of purulent infection development. The most important ones are infringement of the skin or mucous membrane trophic at the entry of infection, the condition of the organism's protective forces, microflorae virulence. Microbes will not penetrate an organism through undamaged skin or mucous membranes. Even an insignificant trauma of the skin promotes microbic invasion into the organism. The conditions of blood and lymph circulation of the given area have special value. Purulent processes develop less often on the head and face (due to dense blood vessel network) than on other areas of the body. An important role is played by "local" immunity of the tissue. For example, the perineum area, as a result of constant action of microbes and their toxins, has a significant skin resistance to microbic invasion. Damage to the skin and mucous membranes promotes the penetration of microflora, but their division and growth take place only in 6 h. The principles of primary surgical processing of infected wounds are based on this fact. The presence of nutrient medium (haemorrhages, dead tissue) in the injured zone promotes to the development of infection.

An important factor in the pathogenesis is microflora virulence and its resistance to antibiotics. Toxic microbic substrata (hemolysin, leukocidin, necrotoxin, etc.) along with enzymes (plasmocoagulase, hyaluronidase) operate on the cell penetration and the entire organism. The spreading and development of the inflammatory process during microbic invasion are determined by the interrelation between the amount and virulence of microflora, which gets to an organism, with the immune forces of an organism.

With a big doze of virulence of the microflora and weak protective forces of an organism, there is fast development of the inflammation and even generalization of the process (sepsis). With the reverse ratio, the inflammatory process localizes and stops.

The organism reacts to the penetration of infection with local and systematic signs — pain, hypostasis, infringement of function, hyperemia, venous stasis, and increase in temperature. Hyperergetic, normergic, hypergic and anergic forms of inflammation are distinguished.

Hyperergetic reaction is characterized by a rough course with the development of significant hypostasis, necrolysis, sharp deterioration of the general condition (intoxication, hyperthermia, hypotension). *Normergic* inflammation is accompanied by moderate tissue hypostasis, favorable course with non-pronounced general reaction of the organism. *Hypergic* reaction is expressed by vague general and local symptomatology: local process, subfebrile temperature. The inflammation is quickly stopped; it is observed during non-pronounced immune status, frequently does not require therapy, and completes spontaneously.

Anergic reaction occurs during sharp decrease in the immune status, in the case of long usage of antibiotics or hormonal preparations. An extensive neglected purulent process with significant destruction without hyperemia and hypostasis of the skin, a so-called "sac of pus" is observed. Besides, the general protective reaction is sharply reduced (non-pronounced leukocytosis, leukopenia, secondary immunodeficiency phenomena).

The organism's general reaction to microbic invasion appears as symptoms of intoxication (headache, weakness, fever, tachycardia, hypotension, encephalopathy) and changes in the blood (leukocytosis, increase in the ESR, left shift of leukocytes, hypoproteinemia, increase in immunoglobulin, growth in the phagocytar activity). In the case of infection spreading, the intoxication phenomena progress, infringements of the detoxification organs functions (acute hepatic or renal insufficiency) occur, decrease in the immune status (decrease in the leukocytic activity, phagocytosis, immunodeficiency phenomena occur).

Modern Methods of Treating Pyoinflammatory Diseases

It is reasonable to combine general and local kinds of treatment. Local therapy is directed on fighting against microflora and correcting the course of the wound process. The action on microflora is achieved with antibiotic therapy and antiseptics.

Antibiotic therapy should be carried out with due regard for microorganism's sensitivity and the macroorganism's reaction. Before using antibiotics it is necessary to identify the microflora in the wound and determine the antibiotic-sensitivity (pure culture, antibioticogram). The microflora's sensitivity is mostly determined with the antibioticogram disk (if the zone of growth delay is less than 15 mm in diameter — sensitivity; from 15 up to 25 mm — resistance; if it is more than 25 mm — high resistance). It is possible to use an express-method to determine sensitivity without the excretion of a pure culture by using indicators (2.6-dichlorophenolindophenol, red blood salt) with the help of phase-contrast microscopy. In order to prevent complications (rash, anaphylactic shock) it is necessary to conduct for all the patients the skin test before using antibiotics. Patients with medical allergies should be carried out sequentially the over-skin, scarification and skin tests.

Antibiotics are appointed in sufficient dozes (many doctors prefer the dozes higher than therapeutic), some preparations with taking into account synergism and for a short time (4–5 days) with the following check of the antibioticogram and change of the preparation to prevent the occurrence of antibiotic-resistant or antibiotic-dependant strains of bacteria. Antibiotic therapy is applied parenterally. A few preparations are entered locally into the wound, because a majority of them inactivate in the acidic medium of inflammation. Intravenous, intraarterial and endolymphatic ways of introduction prevail, which provides effective concentration of antibiotics in the pathological focus.

Last years, antibiotics of the second generation are mostly used: semisynthetic penicillin (ampicillin, carbenicillin, ampiox), cephalosporin, aminoglycoside, semisynthetic tetracycline. Antibiotics of the first generation (benzylpenicillin, streptomycin, chloramphenicolum, tetracycline) are almost not applied, because of wide spreading of antibiotic dependance as a result of mutagen action on microflora. In order to prevent the complications it is necessary to follow the rules:

1) antibiotics are applied in large doses;

2) they combine antibacterial preparations and antibiotics which have different mechanisms and spectrum of action, as well as combine the ways of introduction.

Among chemical antibacterial preparations, sulfanilamides, mainly of long action, are applied (sulfapyridosin, sulfadimethoxin, sulfalen), preparations of sulfanilamides with derivatives of diaminopyrimidin (bactrim, biseptol). Besides, the derivatives of quinoxaline are applied (dioxydinum, chlorhexidin gluconate), which take effect on resistant antibiotic strains, microflorae. Such derivatives of nitrofuran as furacilinum, kalium furagin are applied in the treatment of pyoinflammatory diseases.

The action on the course of the wound and purulent processes, first of all, begins with surgical methods: early removal of the infection foci, incision and rational drainage of the abscesses, it is better to use active methods of drainage. Proteolytic enzymes are applied successfully on the hydration phase for necrolysis (trypsin, chymotrypsin, plasmin, papain, ribonuclease, desoxyribonucleasa) which have proteolytic, anticoagulant and dehydrational effects. Cleansing the wounds of pus, necrotic masses, and the occurrence of granulations during treatment with proteolytic enzymes happens 1.5 times faster than with traditional methods of treatment. It allows the application of an early secondary suture, autodermoplasty. For the last years physical methods of treatment of purulent surgical infection have become widespread: treatment by laser, ultrasound, ultra-violet irradiation of wounds, diodynamical currents. Focused laser rays are used (quantum generators on carbonic gas or argon), and non-focused rays (helium-neon). The first ones are applied as a surgical scalpel for incision of abscesses and removing necrotic mass. Thus, the bactericidal action (reduction of microbes in wounds, decrease in the pathogenicity of microflora) is pronounced. The non-focused therapeutic laser (helium-neon) also corrects the bactericidal action, promotes early cleansing of necrolysis from the wound and the occurrence of granulations. Ultrasound is successfully applied too. Bactericidal property of ultrasonic waves is predetermined by physical, chemical, and biological processes (cleansing of pus and necrotic tissue from a wound, action on microflora and stimulation of physical processes in the patient's organism).

The greatest effect of ultrasound is with gram-negative flora *(Pseudomonas aeruginosa, E. coli)*. Methods of systematic action on purulent infection consist of transfusion and disintoxication therapies, as well as immunological methods.

Disintoxication therapy is directed on absorption of toxins from the damaged site, dilution, binding and removing the toxins from the circulatory system. A decrease in absorption of toxins from the infection focus is achieved by surgical methods (wide sectioning, necretomy, drainage, active aspiration), as well as continuous irrigation with antiseptic solutions and antibiotic therapy. In order to dilute and remove toxins, blood substitutes with desintoxication actions are used (haemodes, neohaemodes, rheopolyglucin), albuminous preparations (albumin, albuminous hydrolysate), colloidal solutions with the total amount of 4–5 l a day. In order to remove toxins, intensified diuresis, peritoneal dialysis, and haemodialysis are used.

Adsorption of toxins is successfully carried out by methods of extracorporal detoxification (hemosorption, plasmosorption, plasmapheresis, lymphosorption, haemofiltration, xenospleen application, xenoliver). The destruction of toxins is promoted by such methods as oxygenotherapy, hyperbaric oxygenation, ultra-violet irradiation of the blood.

Immunotherapy for purulent infection is pathogenetically justified, because to a certain extent secondary immunodeficiency develops, which can worsen the patient's condition by using antibiotic therapy. Immunotherapy consists in the application of the substitute therapy and immune correction. Haemotransfusions, hyperimmune serums (antistaphylococcal, anticollibacillary, etc.), gamma-globulin, staphylococcal anatoxin, and bacteriophage, which are applied for sepsis, peritonitis, i.e. in the case of a severe purulent infection with its generalization, are used as substitute therapy. With a chronic infection staphylococcal anatoxins, *Pseudomonas aeruginosa* and *Proteus vaccines*, which allow the creation of a local active immunity, are used. Synthetic (prodigiosan, methyluracil, decaris, levamizol) and natural immune stimulators (preparations of the thymus — tactivin, thymalin, timosin; the bone marrow — myelopeptide and so forth) are applied as active immune therapy, besides of vaccines and anatoxins.

PURULENT DISEASES OF THE SKIN AND SUBCUTANEOUS FAT

Furuncule, anthrax, hydradenitis, abscess, phlegmon, and erysipelatous inflammation belong to diseases of this group. Purulent diseases of the skin and subcutaneous fat have two stages of development: the infiltration stage and the abscess stage. Treatment is carried out according to the stage of the disease. Conservative methods are applied at the I stage: antibiotic therapy, physiotherapy (UV-rays, solux, quartz, dry heat), desintoxication therapy. At the II stage with the development of an abscess operative methods are applied (cutting, drainage), treatment of purulent wounds. It is supplemented with antibiotic and antiseptic therapy, desintoxication therapy and if necessary — immunotherapy.

Furuncule is an acute purulent inflammation of the hair follicle and surrounding tissue. The preceded factors are pollution of the skin, avitaminosis, metabolic disorders (for example, diabetes). The direct reason — a repeated trauma to the skin.

Localization: the forearm, the back of the hand, the neck, the buttocks. Basic attributes: itching, pain, redness, hypostasis of the skin, subfebrile temperature. In the I stage (2nd–3rd day) — around of hair a small pustule with inflammatory infiltration like a nodule forms. In the II stage (3rd–7th day) on the top of the infiltration necrosis (black speck) appears, purulent disintegration of the infiltration as a core occurs. Pus discharge is observed, the purulent wound after cleansing is full of granulations. Further, a whitish scar is formed. Complications: thrombophlebitis, thrombosis of the venous sinus of the brain (with the localization on the upper lip), basal meningitis, sepsis.

Formation of multiple furuncules is called *furunculosis*, a systematic disease. It develops in weakened patients with infringement of the immune status, metabolism illnesses (diabetes, etc.). Treatment of a furuncule is determined by the stage of the disease. With the infiltration stage conservative therapy is applied: broad-spectrum antibiotics, rubbing with spirit, brilliant green, dry heat (hot-water bottles, UV, quartz, solux). With the abscess stage (3–8 days) — incision of the abscess and subsequent treatment of the purulent wound. With furunculosis, treatment is supplemented with autohemotherapy, immunotherapy (staphylococcal anatoxin, vaccine, thymus preparations, decaris).

Carbuncule is acute extensive pyonecrotic inflammation of several hair follicles and sebaceous glands with necrosis formation on the skin and subcutaneous layer. The reasons are the same as for furunculosis. The disease is promoted by: hypovitaminosis, exhaustion, metabolic diseases (adiposity, diabetes). The localization is the same as for furunculosis. The *clinical picture* is characterized by systematic and local semiology. At the I stage, a sharply painful infiltration with crimson skin that covers the hair saccule and sebaceous glands is observed; there are several apertures, through which pus discharges. During the II stage, the apertures merge, forming a defect on the skin, lots of pus discharge, necrosis reaches the subordinate fascia. Systematic phenomena: the temperature is up to 39–40°C , attributes of intoxication (headache, nausea, vomiting, sleeplessness, sometimes delirium). Complications: lymphangitis, lymphadenitis, thrombophlebitis, thrombosis of the venous sinus of the brain, meningitis (localized on the upper lip and face), sepsis. Treatment depends upon the phase of the process. During the I phase — conservative therapy like for furunculosis. Antibiotic therapy should be carried out intravenously in combination with sulfanilamide. Surgical treatment begins in 3 days if conservative therapy was inefficient. Incisions on the abscess are done x-like while removing the necrotic tissue. The following treatment is carried out by the principle of treating purulent wounds (drainage, local application of antiseptics, proteolytic enzymes, etc.).

Hydradenitis — acute purulent inflammation of the sudoriferous glands. Localization: underarm, genital and perianal areas, in women — the nipples area. Reasons and assisting factors for the disease: sweating, untidiness, eczema. During the I stage — a dense painful nodule covered with unchanged skin. During the I stage — a purple-reddish nodule with fluctuation; milky pus discharges through the small aperture. The merging of several inflammatory infiltrations is possible. Hydradenitis is seldom accompanied by intoxication, frequently has sub-acute and long-term course. Treatment: during the I stage — conservative therapy similar to treating furunculosis. During the II stage — incision and treating the purulent wound. With a long-term course autohemotherapy in small dozes can be applied.

Abscess is a limited accumulation of pus in tissues and organs. Reasons: injections, wounds, penetration of infection during medical measures (hypodermic, intramuscular injections), and purulent hematomas. Abscesses can develop around foreign objects. Their agents can be diverse microflora. However, more often — staphylococcus, streptococci, *E. coli*, *Protea*. Abscesses occur in cavities of purulent inflammation (furuncule, anthrax, hydradenitis, lymphadenitis, etc.). With superficial abscesses, hyperemia of the skin, swelling, fluctuation are observed over them. The clinical disease is accompanied by pain (mostly pulsating), attributes of intoxication, fever, tachycardia, headache, weakness, left-shift leukocytosis. The peculiar feature of the abscess is a pyogenic membrane — the inner wall, covered with granulation tissue, that precisely separates the pyogenic abscess from the healthy tissue. Abscesses should be distinguished from hematomas, spinal tuberculosis, aneurysms, and vascular tumours. The diagnosis of deeply located abscesses, especially internal organs', is difficult. Computer tomography, roentgenography help in diagnosis. Treatment is surgical. Incision, removal of necrotic tissue, drainage (preferably — active), subsequent treatment is conducted similar to a purulent wound.

Phlegmon is an acute extensive purulent inflammation of the areolar tissue (hypodermic, intermuscular, retroperitoneal). Unlike to abscesses, with phlegmons the process is not limited but spreads to the areolar tissue. The phlegmon is an independent disease, but can be a complication of purulent processes (anthrax, abscess, sepsis). Purulent, pyo-hemorrhagic, and putrefactive forms of phlegmons are distinguished by the character of the exudate. Depending upon the localization, phlegmons can be epifascial or subfascial (intermuscular). Special localizations are distinguished: paranephritis, paracolitis, paraproctitis. The clinical course is characterized by inflammatory infiltration without precise borders with the following softening, high fever, intoxication, chills. Complications: lymphadenitis, erysipelas, thrombophlebitis, sepsis, purulent arthritides, purulent meningitis.

During the initial stage, conservative treatment (antibiotics, plenty of liquids, cardiac substances, dry heat, solux) is carried out. With the formation of abscesses — incision and drainage. In specialized hospitals active surgical management is applied — wide incision of the dead tissue, drainage with active aspiration. With extensive phlegmons, complicated by sepsis, hyperbaric oxygenation and other kinds of extracorporal detoxifications (hemosorption, plasmosorption, plasmapheresis) are applied. After incision of the extensive phlegmons, it is possible to apply aerotherapeutic apparatuses (ATV-3, ATV-5) with regulated abacterial medium.

Erysipelatous inflammation is acute purulent damage to the skin (occasionally mucous membranes), which are often caused by haemolytic streptococcus. Erysipelas is a version of the organism's reaction to microflora with allergic reorganization: acute or latent infection, endogenic completing factor, allergic reaction, skin trophic damage, transition of the infection into the latent form. The clinical course is progressing with the prevalence of systematic intoxication phenomena (headache, vomiting, fever, tachycardia). Local changes have a phase course. The following clinical forms of erysipelas are distinguished: erythematous, bullous, phlegmonous, necrotic. These phases turn one into another. The erythematous form is characterized by redness with pronounced precise border between the healthy and damaged sites ("tongues of fire"), pronounced itching and hypostasis of the skin. The bullous form is characterized by the occurrence of blisters in the redness zone with yellowish or haemorrhagic exudate. Deeper damage with the occurrence of a phlegmon (phlegmonous form) or necrosis of the skin (necrotic form) is observed if purulent infection accompanies. Localization: the extremities, the scrotum, the penis, the face. Erysipelas can be crawling (with gradual spreading to the next area) or migrating (wandering) — consecutive damage to different parts of the body. Complications: development of severe toxemia, purulent damage to mucous membranes, tendons, muscles, joints, thrombophlebitis.

Treatment is conducted depending upon the form. With erythematous form they appoint antibiotics, sulfanilamides, ultra-violet irradiation (sub-erythematous and erythematous doses). With the bullous form, the blisters are incised open, processed with spirit, and suspensions or ointments with antibiotics are applied. With phlegmonous or gangrenous forms, the congestion of pus are opened; the wound is drained; the necrotic tissue is deleted. Desensitized means are also applied (dimedrol, suprastin, calcium chloride, roentgenotherapy in small doses), immunotherapy can be applied (antistreptococcal vaccine), especially for the migrating recurrent forms.

Erysipeloid is a crawling erythema of the skin, or pig erysipelas. It is caused by the pig erysipelas bacillus *(Erysipelothrix rhusiopathiae)* during contact with sick animals (workers of meat-packing plants, farms suffer from it), it is possible to catch it while processing raw meat or fish. It is characterized by serous inflammation of all layers of the skin with hyperemia, hypostasis, pronounced itching. It is accompanied by lymphostasis and lymphangitis. Localization: fingers, hands. The patient's general condition usually does not change. Erysipeloids can relapse and migrate to other fingers.

Treatment. Antibiotic therapy, application of specific serums, ultra-violet irradiation, roentgenotherapy.

Purulent Diseases of Cellular Spaces and Organs

Mediastinitis is a purulent inflammation of the connective tissue of the mediastinum.

Aetiology and pathogenesis. Causative agents are more often staphylococcus, enterobacteria, less often anaerobes. Reason: damage to the esophagus by foreign objects or during endoscopy, purulent complications after operations on the esophagus, the lungs, the heart. Less often: lymphogenic or from the oral cavity (carious teeth, tonsils).

Clinical picture. Diagnosis of mediastinitis is complex, because the clinical course is frequently hidden behind the primary process, the source of the disease (pneumonia, phlegmon of the neck, damage to the esophagus).

Limited (abscesses) and extensive (phlegmons) processes are distinguished. After the type of the agent: purulent and putrefactive. Mediastinitis has the course without precise symptoms against a background of pronounced intoxication (fever, temperature up to 40°C, fever, tachycardia, hypotension). Pain behind the sternum is the most pronounced symptom. For anterior mediastinitis, pains in the sternum and behind it, their amplification during sternum percussion, while leaning the head backward, and swelling of the neck are typical.

During posterior mediastinitis, pains are typical between the scapulas, in the back, in the epigastric area. With wounds to the esophagus, pains occur during swallowing. In cases of anaerobic or putrefactive processes emphysema of the mediastinum is detected radiologically. Hypodermical emphysema is determined during palpation of the neck.

With the purpose of reducing the pain, patients take a compelled position (sitting or semi-sitting with the head leaned forward).

Compression of the neurovascular formations (the aorta, the pulmonary artery, the vagus and diaphragm nerves, sympathetic fulcrum) is a very severe complication. As a result, hoarseness, hiccups, vomiting, paroxysmal coughs, dyspnea may occur. Purulent mediastinitis is necessary to distinguish from pneumonia, pleurisy, pericarditis, tumours of the mediastinum, tubercular spots. Computer tomography, radiography, esophagoscopy and mediastinoscopy are applied with this purpose.

Treatment should begin with antibiotic therapy (semisynthetic penicillin, aminoglycosides, cephalosporins. With the presence of attributes of abscesses and putrefactive inflammation surgical treatment (mediastinotomy) is carried out. Taking into account high lethality of the disease, today there are many indications to an operation. With anterior mediastinitis, the incision is made above the sternum and in the fossa under the sternum (under the xiphoid process). The cervical mediastinotomy by B. I. Razumovsky (incision along the internal edge of the *m.sternocleidomastoideus* while accessing the periesophageal space, the anterior mediastinum) is widely applied. Posterior mediastinotomy is carried out by I. I. Nasilov's method (incision on the back parallel to the spinal column with additional two horizontal incisions on the ends, which allows to find the orifice and after the ribs incision to make incision of mediastinitis behind the pleura). It is very important during surgical treatment to provide active aspiration of the pus with flowing washing (two-opening drainage tubes, an aspirator with a dilution rate of 50–100 mmH_2O).

For washing the cavity they use antiseptics (dioxydine, dimexide, furacilin), proteolytic enzymes (trypsin, chymotrypsin). Intra- and extracorporal detoxification, haemotransfusions, desintoxication with blood substitutes are methods widely used to fight against intoxication.

Paranephritis is purulent inflammation of the renal cortex.

Aetiology and pathogenesis. Causative agents are more often staphylococcus, *E. coli*, less often — saprophytes and anaerobes. Reason: direct bringing of the infection during acute or chronic processes in the kidneys (purulent nephritis, pyelitis, abscess), less often — lymphogenic way during purulent processes in the abdominal organs.

Clinical picture. In the initial stages of the disease, the diagnosis is difficult to determine, because the clinical course consists mostly of systematic semiology (indisposition, fever, headache) and non-pronounced local attributes (pain in the back, swelling, tissue hypostasis). Pain seldom has a precise localization. Later, the pain is more precisely located, irradiates into the leg (especially during crawling abscess along the big lumbar muscle and the psoas-abscess formation). Painful inflammatory infiltration of dense-elastic consistence in the lumbar area (sometimes in the right subcostal area by the edge of the rectal muscles) is determined. When lying on the stomach, lateral curvature of the lumbar department of the spine with the deviation of the line of the spinous process towards the healthy side, smoothed contours on the corresponding half of the back, pressure of the muscles of the back are marked. The disease is accompanied by pronounced changes in the urine: leukocyturia, hematuria, cylindruria. Paranephritis should be distinguished from phlegmons of the retroperitoneal cavity, retroperitoneal acute appendicitis.

Treatment should begin with antibiotic therapy (semisynthetic penicillin, aminoglycosides, cephalosporins). With the first attributes of abscess (hectic fever, pulsating pains) lumbotomy with wide incision of the abscess is carried out. In the postoperative period, washing the abscess, active aspiration are conducted. With the phenomena of generalization of the infection and endotoxicosis, intra- and extracorporal detoxication methods are widely used.

Paraproctitis is a purulent inflammation of the perirectal tissue.

Aetiology and pathogenesis. Disease is caused by mixed microflora (staphylococcus, enterococcus, E.coli, anaerobes). It is observed more often in men. The disease is caused by cracks in the rectum area, inflammation of haemorrhoidal nodules, damage to the rectal mucosa, skin scretches.

Clinical picture. Two forms of the course are distinguished: diffuse (phlegmon of the pararectal area) and limited. Phlegmon of the pararectal tissue is characterized by a very severe course (fast spreading, necrosis of tissue, pronounced intoxication), observed during gunshot wounds, cancer of the rectum, uric phlegmons.

Limited paraproctitis can be observed in the following forms: hypodermic, ischiorectal, submucosal, pelviorectal, retrorectal. The hypodermic abscess, as a rule, is around the anus. Swelling, hyperemia of the skin, difficulty and pain during defecation are determined. Ischiorectal paraproctitis has a much more severe course (high temperature, fever, intoxication). Thus, the process spreads around the rectum to the prostate gland and pelvis. During palpation of the rectum painful infiltration is determined. Submucosal abscess is usually located in the submucous layer of the rectum above anorectal lines. During palpation painful hypostasis of the abscess in the anus area is determined. Unlike to hypodermic abscess the pain is less intensive. Pelviorectal abscesses is a rare form of paraproctitis; the abscess is located, as a rule, above the pelvic floor. In contrast to other forms the onset of the disease has an asymptomatic course.

Retrorectal abscesses are formed as a result of the infection bringing into the lymph nodes; it is located behind the rectum; it is also asymptomatic in the beginning, then the process can go down into the ischiorectal area with the development of a phlegmon. Paraproctitis generally completes with the formation of intestinal fistulae.

Treatment. In the infiltration stage, conservative therapy is applied (antibiotics — semisynthetic penicillin, aminoglycosides, cephalosporin, liquid diet to delay defecation). With a phlegmon or abscess, urgent surgical treatment is indicated. A simicircular incision is made, step 2 cm back from the external sphincter of the rectum. At submucosal abscesses the abscess incision is made from the side of the rectal lumen. With anaerobic paraproctitis wide incisions while removing the necrotic tissue is shown. In the postoperative period, washing with antiseptic solutions (hydrogen peroxide, dioxydin), proteolytic enzymes, sedentary baths with antiseptic solutions are used.

Parotitis is an inflammation of the parotid glands. The infection is brought from the oral cavity moving through the excretory duct of the parotid gland or by hematogenous or lymphogenous way. It occurs in weakened patients during general infection or extensive operations with pronounced dehydration or bad care of the oral cavity. Causative agents: staphylococci and streptococci. Limited abscesses in the glands are formed or phlegmon of the glands occurs with spreading into the external cellular tissue. These patients frequently have purulent oedemas on the neck, temporal area.

Clinical picture. In the parotid area there is swelling, acute pain during palpation. It is accompanied by deterioration of the general condition (fever, rise in temperature to 39–40°C, complicated swallowing and chewing).

In the area of swelling there is redness of the skin, fluctuation. Hypostasis passes to the soft palate, neck, cheeks, submaxillary area. In some patients, paresis of the optical nerve occurs. The abscess can move to the outside with the formation of fistulae through which sequestrations of dead parenchyma leave. Grave complications can be generalization of the infection (sepsis), causing high lethality.

Treatment. In the initial stages antibiotics are used (semisynthetic penicillin, aminoglycosides, cephalosporins), thermal procedures (warming compresses, solux), careful sanitation of the oral cavity (rinsing with antiseptic solutions, massage of the oral mucosa).

With an abscess surgical treatment is indicated — removing the purulent cells from the gland and creating good conditions for draining the pus. Incision of the abscess should be carried out on the area of greatest fluctuation taking into account the direction of the basic branches of the optical nerve (in parallel to them). They dissect the skin and gland capsule, further with a dressing forseps or finger open the abscess in the parenchyma, without damaging the optical nerve branches. Further they drainage, wash the wound with antiseptics, proteolytic enzymes. Local antibiotics, water-soluble ointments (levosin, levomecol, dioxicol, etc.) are used. Abundant drinking, full-value diet, vitamin therapy, protein preparations.

With parotitis grave complications are possible: bleeding from the gland vessels or carotid artery with purulent oedemas, development of a phlegmon in the peripharyngeal space, deep phlegmons of the neck.

Mastitis — inflammation of the mammary gland tissues. Lactational mastitis of breast-feeding women, mastitis neonatorum and mastitis of puberty are distinguished.

Aetiology and pathogenesis. Causative agents: staphylococcus and enterobacteria. Ways of infection: cracks in the nipple, intracanalicular (in feeding women), hematogenous, lymphogenous (with endogenous infections). Assisting factors: galactostasia, bad care of the breast during feeding.

Clinical picture. According to the course, acute and chronic forms are distinguished. Acute mastitis is mainly lactational. Chronic mastitis is seldom; they are the consequence of wrong treatment of acute processes or specific damage (tubercular, syphilitic). According to the clinical picture acute mastitis has the following forms: serous, infiltration, abscess, phlegmonous, gangrenous. Basically, these are phases of one process which can pass to each other.

The serous form of mastitis is characterized by the rise in the temperature up to 38–39°C , diffuse hypostasis and pain in the breast. Any swelling of the glands with a rise in temperature should be considered as serous form. The subsequent progress of the process with wrong treatment results in the infiltration form. Sharp painful infiltration with indistinct contours, with hyperemia of the skin above it appears in the mammary glands; axillary lymph nodules are increased, painful. Pain in the glands increases; headaches, sleeplessness, weakness are marked.

Changes in the blood: increase in leukocytosis ($10–12 \cdot 10^9$/l), increase in the erythrocyte sedimentation rate (ESR) (30–40 mm/h). With ineffective therapy the abscess phase occurs. Restricted infiltration and the presence of fluctuation, occurrence of pulsating pains in the glands are marked. General phenomena increase: fever with the rise in the temperature up to 39–40°C, increase in leukocytosis ($15–20 \cdot 10^9$/l), increase in the ESR (50–60 mm/h). Abscesses in the gland can be located in different places: under the nipple (subareolar), inside the mammary gland (intramammary), behind the mammary gland (retromammary). Retromammary localization frequently is the consequence of other inflammatory processes (osteomyelitis of the ribs). The subsequent deterioration of the general condition with septic phenomena (repeated fever, increase in the ESR and increase in left-shift leukocytosis, lymphopenia, eosinophilia) results in the phlegmonous form. The mammary gland is increased and swollen, sharp pain, hyperemia of the skin, nipple is pulled in, areas of multiple fluctuations in the gland, acute dilation of the hypodermic veins, lymphangitis phenomena are observed.

The gangrenous form of mastitis develops as a result of thrombosis of the mammary vessels, characterized by the most severe course with intoxication phenomena (temperature of 40°C, tachycardia up to 120 per min, hypotension, headache). Significant changes in the blood: with left-shift leukocytosis up to 25 thousand/l, increase in the ESR up to 60–70 mm/h. The hypochromic anemia phenomena are observed. The gland is sharply increased, pastose, painful. The skin above it is pale-green or dark blue-crimson, with sites of blisters and areas of necrosis. The regional lymph nodes are increased, painful. Complications: development of sepsis.

Treatment is carried out depending upon the phase. With serous and infiltration forms, conservative therapy is administered: breast feeding is not stopped and promote the liquidation of galactosaria (manual or with device expression of breast milk), antibiotic therapy (semisynthetic penicillin, aminoglycosides, macrolides, cephalosporins), physiotherapy (solux, ultrasound, UV-irradiation, novocain, electrophoresis). It is possible to apply retromammary novocain blockades with antibiotics. With the abscess form, surgical treatment is done. It is necessary to make incisions depending upon the localization of the abscesses: with subareolar — semilunar, with intramammary — radial incisions according to the direction of the lactic ducts, with retromammary — an arch-like incision along the skin fold under the gland.

Patients with phlegmonous and gangrenous forms require urgent surgical treatment (some radial incisions in length of 8–10 cm, removing the necrotic tissue, drainage, washing with antiseptics). Treatment is supplemented with infusion therapy (antibiotics, haemotransfusions and blood substitutes, immunity stimulators), as well as disintoxication (hemosorption, hyperbaric oxygenation).

Lecture XVI

ACUTE PURULENT INFECTION OF THE SEROUS CAVITIES, VESSELS, BONES, JOINTS. PUTREFACTIVE INFECTION

PURULENT INFLAMMATION OF THE SEROUS CAVITIES

Purulent meningitis — inflammation of the brain membranes caused by purulent microflora (staphylococcus, streptococcus, E.coli, pneumococcus). Purulent meningitis, as a rule, is a secondary process caused by penetration of microflora into the subarachnoidal space during traumas to the skull (fracture to the calvarium or basis) or during purulent diseases of the ear, nose and paranasal sinus, brain abscess burst. Hematogenous or lymphogenous bringing of the infection is less often observed.

Clinical picture. According to the course meningitis is divided into traumatic, otitic, hematogenous, lymphogenous. The disease symptoms are intolerable headaches, high temperature, rigidity of the occipital muscles, positive Kernig's symptom, nausea, vomiting. Impairment of consciousness (inhibition) down to full loss is observed. The characteristic pose of the patient — lies on his side with legs pressed against the abdomen and the head leaned back. Hypertension of the skin sensitivity and increase in tendon reflexes are marked. Along with the changes in the blood (leukocytosis — left shift, increase in ESR) a big diagnostic value has the data from the spinal puncture: liquid flows out under high pressure (400–500 mmH_2O) and contains a significant amount of protein, leukocytes, bacteria. The disease course is characterized by fast deterioration of the patient's condition, growth of intoxication. Lethality is from 50 to 70%.

Treatment. The earlier treatment the more successful results. In the early stage, conservative therapy is indicated: repeated lumbar punctures, endolumbar antibiotic therapy. Along with antibiotics, antiseptics, sulfanilamides (preparations of metronidazole, dioxydine, etazol, sulfalen) are entered intravenously, intra-arterially. Surgical treatment provides an early exposure of the focus of the inflammatory process and removes purulent exudate (incision of the paranasal sinus, purulent mastoiditis, brain abscesses, and infected wounds of the skull).

Purulent pleurisy. Purulent pleurisy or pleural empyema — inflammation of the pleura caused by pyogenic infection (staphylococcus, streptococcus, pneumococcus, enterobacteria). As a rule, it is a secondary process. It develops during burst of the abscess of the lungs, pneumonia complicated by the abscess, traumas to the thorax, costal osteomyelitis. Less often the infection is brought by the hematogenous (sepsis, deep phlegmons, hematogenous osteomyelitis) or the lymphogenous way (appendicitis, cholecystitis, pancreatitis). There are different classifications of acute pleural empyema:

1) after the causative agent (staphylococcus, streptococcus, diplococcus, etc.);

2) after the location of pus (free — total, moderate, mild; sacculated — multichamber, one-chamber);

3) after the pathoanatomical characteristic (purulent, putrefactive);

4) after the clinical course (septic, severe, moderate, mild).

Clinical picture. Displays of purulent pleurisy accumulate on the attributes of the basic disease (pneumonia, abscess of the lungs, etc.). The clinical picture is characterized by the occurrence of strong stabbing pain in the thorax, which amplifies during cough and breathing. Increase in the body temperature up to 39–40°C, occurrence of dry cough, dyspnea, cyanosis of the skin. The patient takes a bent position; the damaged side is delayed during breathing; intercostal spaces are smoothed; vocal tremor is weakened. In the initial stages, pleural friction rubbing, diminished breath sounds are determined. With the accumulation of pus in the pleural cavity, the clinical picture becomes precise. With the help of percussion and auscultation, attributes, which specify the accumulation of liquid in the pleural cavity, the height of its level, and the shift of the mediastinum appear. The line of dullness in the back is usually higher, in front — lower (Damoiseau's line). Higher than the dullness in the paravertebral zone, a clear pulmonary sound is determined (Garland's triangle), which corresponds to the contour of the lung. With significant accumulation of liquid, the mediastinum shifts to the healthy side, which is determined as a blunt triangular form from below the vertebrae (Grocco—Rauchfuss's triangle).

During radiological examination, homogeneous shadow of the pleural cavity, the level of liquid, and the shift of the mediastinum are determined, and with the presence of a putrefactive process — an air bubble above the liquid. The pleural puncture allows to determine the character of the exudate and conduct bacteriological research. During sacculated processes, thoracoscopy with following drainage of the accumulated pus is conducted for diagnosis sometimes.

Treatment is begun with therapy of the primary process (pneumonia, abscess of the lungs, etc.). All methods of treating empyema have the purpose of providing evacuation of the exudate, spreading the lungs and reducing intoxication. The methods of treatment are divided into closed and open. Closed: repeated punctures of the pleural cavity, entering drainage through a small puncture (cut) with constant aspiration of exudate. After removing the pus, washing with antibiotics the pleural cavity has negative pressure, which promotes the decomposition of the lungs. Constant aspiration of exudate can be carried out with the help of the Subbotin—Peters's triampullary systems by or a water-jet vacuum pump. The pleural cavity is washed out with antiseptics (furacilin, dioxydine, chlorhexidin) with the following introduction of proteolytic enzymes (for the lysis of fibrin, dense pus) and antibiotics taking into account the sensitivity of microflora.

With the development of massive accretions (sacculated processes) and the presence of fibrin masses, the efficiency of the closed methods of treatment is not high. They resort to the open method — thoracotomy with wide opening of the pleural cavity, evacuation of pus and fibrin clots, liberation of the lungs from accretions (decortication), resections of the damaged segments or a part of the lung (with gangrene) with following pleural drainage. Along with surgical methods, detoxication of an organism (intra- and extracorporal methods), immune and antibiotic therapy (intravenous, endolymphatic introduction) are widely used.

Purulent pericarditis is a purulent inflammation of the pericardium, very seldom primary (tubercular, gonococcal), more often secondary. It develops as complication of the heart wound or as the result of lymphogenous bringing of infection during different diseases (purulent pleurisy, pulmonary abscess, rheumatism, scarlet fever, phlegmon, osteomyelitis). Causative agents: staphylococcus, streptococcus, tubercular bacillus, etc.

Clinical picture. Attributes of general intoxication and phenomena connected with the difficult work of the heart as the result of the accumulation of inflammatory secretion in the cardiac sac. High temperature, facial cyanosis, swelling of cervical veins are marked. The patient is disturbed with pain of compressing character behind the sternum, dyspnea, and attacks of palpitation. The patient takes a compelled position (semi-sitting). With percussion the heart borderlines are dilated. With auscultation in the early stages — pericardial friction rub, and with the presence of exudate — acute dullness of the cardiac tones. Radiological exam reveals an intensive triangular enlargement of the cardiac shadow with the disappearance of the weist of the heart. An auxiliary method of diagnosis is the exploratory puncture of the pericardium. The intoxication phenomena, changes in the blood (left shift leukocytosis, increase in ESR) join early. Lethality is high because of complications (cardiac weakness as the result of adhesions between the myocardium and pericardium, sepsis).

Treatment. With the help of a functional bed, the patient is put in a semi-sitting position; cardiac substances, antibiotics, antiseptics are given. There are two methods of local treatment: conservative-surgical (repeated punctures of the pericardium to remove the pus) and surgical (pericardiotomy). For conducting the puncture of the pericardium, today the safest is the Marfan's method (a needle is injected near the basis of the xiphoid process to the left at the place of junction with the cartilage of the VII rib). The pus is aspirated from the pericardium and antibiotics are entered (semisynthetic penicillins, cephalosporins). With the absence of effect after carrying out 3–4 punctures and the deterioration in the patient's condition they resort to pericardiotomy — openning of the cardiac sac and creation of a constant drainage of the pus. With adhesive pericarditis and the development of the stone heart phenomena, pericardectomy (resection of the pericardium) is indicated.

Purulent peritonitis — inflammation of the serous covers of the abdominal cavity, caused by diverse microflora (*E. coli*, staphylococci, streptococci, pneumococci, mixed infection). Peritonitis, as a rule, is a secondary process, which develops as a complication of diseases of the abdominal organs (pyesis, gangrene, perforation) or their wounds, as well as the result of infection of the abdominal cavity during surgery. Less often the infection penetrates the abdominal cavity hematogenously or lymphogenously.

Peritonitis is divided:

1) after the aetiology: E.coli, staphylococcus, streptococcus, mixed, and also nonspecific and specific (tubercular);

2) after the mechanism of occurrence: perforational, traumatic, postoperative, hematogenous, cryptogenic;

3) after the type of exudate: serous, serous-fibrinous, purulent, putrefactive;

4) after the prevalence of the process: local (limited), diffuse (spread), general;

5) after the phase of the process: reactive phase (1st day), toxic phase (2nd–5th day), terminal phase (after the 5th day);

6) after the clinical displays: acute and chronic.

Local peritonitis is damage to a certain area of the peritoneum with restriction from free abdominal cavity by adhesions, accretions, internal organs. Diffuse (spread) peritonitis is characterized by the spreading of the process into the abdominal cavity without precise borders, affecting different parts of the abdominal cavity. *General peritonitis* is an inflammatory process of the entire abdominal cover.

Clinical picture. Taking into account secondary peritonitis, attributes of the disease, as a rule, accumulate on the clinic of the primary process. The very first attribute is pain in the stomach, intensity of which can be different: dull, gradually increasing, and during perforation of a hollow organ — acute, knife-like. Localization of the pain can be different and depends upon the prevalence of the process (appendicitis, cholecystitis). During diffuse or general peritonitis, the pain spreads onto the anterior abdominal wall and becomes constant. These attributes of peritoneal irritation appear early: nausea, vomiting, swelling of the stomach, pressure of abdominal muscles, Shchotkin—Bluberg's symptom. The given symptoms are characterized by pain increase during palpation of the stomach, at the moment of sharp lifting the hands from the abdominal wall. Strain of the stomach muscles is a very typical symptom that appears already on the initial phase of peritonitis. With local processes, it is determined above the center of damage, during diffuse and poured peritonitis — on the whole anterior abdominal wall. Expressiveness is different, including "disk-shaped belly" with perforation of hollow organs.

Spread forms of peritonitis are characterized by paresis of the GIT that appears as a decrease or full absence of peristalsis, meteorism, swelling of the belly, retention of gases and urination. Vomiting in the initial phase is characterized by stagnant contents, and in the terminal — faecal. Effusion appears in the abdominal cavity, especially with spread forms, which appears during percussion (dull sound in the sloping areas) and palpation (fluctuation with significant amount of free liquid). In the aged patients, signs of peritonitis are frequently vague. For specification of the diagnosis, additional methods of inspection are applied: radiological, ultrasonic, "searching" catheter method during laparocentesy, laparoscopy, endoscopy. With peritonitis, endotoxicosis is observed too early, the basic pathogenetic moment of which is adsorption of a significant amount of metabolism toxic products, microbic toxins into the blood from the abdominal cavity. Endotoxicosis grows progressively in time, starting from the 2nd day of the disease, and is the main cause of high lethality (in the terminal stage — up to 60%). Endotoxicosis causes significant infringement of the function of vital organs: the heart (pronounced tachycardia of 100–140 per minute, hypotension, decrease in the color index, acrocyanosis), the lungs (dyspnea, stagnant pneumonia, hypostasis of the lungs), the liver (hepatopathy, parenchymatous jaundice phenomena), the kidneys (nephropathy, oliguria, anuria, uraemia), the brain (encephalopathy, headaches, sopor, intoxication delirium). Because vomiting in the terminal stage, significant infringement of the acid-base condition (metabolic acidosis), desiccation are observed.

The patient's appearance in the terminal stage, described by Hyppocrates, is very characteristic. The patient takes a compelled position, bent at the knee and hip joints. Features of the face are sharp, hollow eyes, grey skin, dry mucous, dry tongue with fur. The abdomen does not participate in respiration. Peritonitis can be complicated by the development of sepsis, the formation of abscesses of the abdominal cavity (subphrenic, subhepatic, interintestinal), eventration of the intestines, intestinal fistula, which considerably influence the outcome of the disease. Nevertheless, the principal cause for high lethality (with spread forms of peritonitis) is endotoxicosis with the development of multiple organ failure syndrome (MOFS).

Treatment. If diagnosis of peritonitis is confirmed, the patient is subject to emergency surgical treatment (within 2–3 h). Contraindications to the operation: pre-agonal condition with acute haemodynamic infringements. The peritonitis treatment should be complex and include the following actions:

1) liquidation of the source of peritonitis and action on the microflora;

2) endotoxicosis therapy.

In non-pronounced diagnostic cases before the operation it is not recommended to apply drugs, antiemetic substances, siphon and cleansing clysters, which can worsen the patient's condition. Operative help mostly consists of median laparotomy, which allows examining the abdominal organs for revealing and liquidating the source of peritonitis (suturing the perforating ulcers, appendectomy, removing the biliary bladder, etc.). After liquidating the source of widespread forms of peritonitis, they remove the exudate and wash the abdominal cavity with antiseptic solutions. The operation is completed with introducing through certain counterapertures into the abdominal wall polyvinylchloride (rubber) drainages to the areas of possible exudate accumulation (subphrenic or subhepatic space, right and left iliac sites, pelvic cavity). The wound median is sutured tightly. In pronounced cases of peritonitis, they apply open management of the median wound with liquid sutures (laparostomy), which gives an opportunity for dynamic control over the process condition in the abdominal cavity.

With limited peritonitis after removing the exudate, peritoneal lavage is not conducted in order not to entail spreading the infection into the abdominal cavity. Thus the cellular inflammation is drained. With general peritonitis in the postoperative period for reduction of intoxication and infecting the abdominal cavity, many surgeons apply constant or fractional washing of the abdomen with antiseptic solutions (peritoneal dialysis). The entering of antiseptics is conducted through top drainages, and the removing — through lower ones (5–10 l of solution).

Liquidating the intestinal paresis has great value when fighting endotoxicosis. With the purpose of liquidating the paresis they apply medicamentous (neostigmine methylsulfate, eserin, kalymin, pituitrin, etc.) and intestinal electric stimulation, warming the abdomen (solux), hypertonic clysters. In order to reduce the paresis and intoxications they remove the contents of the GIT (intestinal decompression). Intestinal decompression is carried out by introducing perforating one- and two-opened tubes (2–3 m in length) through the mouth to the level of the empty intestines. It is usually carried out during the operation. With progressive peritonitis, operative ways of intestinal decompression are used (enterostomy, appendicostomy, colostomy).

In order to influence the abdominal microflora, they apply antiseptics (dioxydine, chlorhexidine, dimexide, biseptol) and antibiotics with taking into account the microflora sensitivity (polysynthetic penicillin, aminoglycosides, cephalosporin). The way of introduction is intraperitoneal, intravenous, intraarterial, endolymphatic. For endotoxicosis correction and with the purpose to normalize homeostasis, besides of peritoneal irrigation and dialysis, they apply intracorporal detoxification: forced diuresis (lazex, manitol), haemoinfusion and endolymphatic detoxification (haemodes, polymisin formation, albumine), enterosorption (sorbents, carbovit), and intravascular laser irradiation of the blood. With deep forms of endotoxicosis with hepatic and renal insufficiency, extracorporal methods of detoxification are indicated: ultra-violet irradiation of the blood, lymphosorption, haemosorption, plasmosorption, plasmapheresis, emodialysis, haemofiltration, hyperbaric oxygenation. With widespread forms taking into account infringements to the immune status and the development of secondary immunodeficiency, they apply replaceable immunotherapy (fresh-citrate donor blood, gamma-globulin, hyperimmune plasma, leukomass) and immunity stimulators (decaris, daucifon, thymalin, T-activinum, timogen, myelopeptide).

Phlebitis, thrombophlebitis. *Phlebitis* is an inflammation of the venous wall, during the phenomena thrombogenesis is called thrombophlebitis.

Aetiology and pathogenesis. It is caused by diverse microorganisms, more often staphylococci. Damage to the venous wall can occur during the presence of neighboring inflammatory processes (erysipelas, phlegmon) or the infection is brought through the blood or lymph by the unleashed cells. Change in the vascular wall, chemical compound of the blood, delay in blood circulation and infringement of the coagulation system have crucial importance.

More often the veins of the lower extremities are affected. Thrombophlebitis is observed twice as often in women. First inflammatory infiltration of the vascular wall, which results in vascular spasms, occurs. It, in turn, promotes the delay of blood circulation, and the formation of a blood clot. The spasm, thrombosis of the veins results in the increase in pressure in the veins and capillaries that causes an increase in vascular permeability and hypostasis of the extremities.

Clinical picture. Thrombophlebitis of the deep and hypodermic veins is distinguished. By the clinical course: acute, subacute and chronic stages of thrombophlebitis.

Acute thrombophlebitis of the deep veins of the hip is characterized by strong pain along the way of the vascular bunch, increase in temperature (39–40°C), and the development of hypostasis of the extremity. The skin on the sick extremity is shiny with a cyanochroic marble shade, cold to the touch as compared to the healthy one. As a result of spasm in the main arteries, the pulse on the damaged extremity is absent or less than on the healthy one. During acute thrombophlebitis of the hypodermic veins, pronounced morbidity along the veins, hyperemia of the skin as a cord or separate inflammatory infiltrations are marked. Acute thrombophlebitis can transform into purulent one with the occurrence of numerous abscesses and phlegmons by the damage course, deterioration in the general condition (fever, intoxication), in case of an abscess burst into the blood system septicopyemia arises. More often acute thrombophlebitis transforms into subacute or chronic forms. Thus, the general condition suffers a little, infiltration is determined along the veins, with loading — morbidity and hypostasis of the legs.

After thrombophlebitis course, chronic venous insufficiency develops (hypostasis of the shin and feet, etc.), joined by trophic failure (dryness and pealing of the skin, varicose ulcers). It is especially necessary to allocate migrating thrombophlebitis (Buerger's disease) during which mainly the superficial veins of the upper and lower extremities are involved. The process is frequently accompanied by endarteritis. Mainly young men are affected. The general condition suffers a little. Along the superficial veins, less-painful nodules appear with hyperemia of the skin and swelling. The process can last for years, periodically recurring.

Treatment for thrombophlebitis, basically, is conservative. Therapy should be directed on decreasing the hypercoagulation phenomena, acting on blood clots and improving microcirculation of tissue. With this purpose they apply anticoagulants of direct and indirect actions (heparin, dicumarin, phenilin, syncumar), thrombolytic means (streptokinase, fibrinolysin, trypsin, chymotrypsin, thrombolytin), preparations which improve microcirculation and reduce aggregation of erythrocytes, thrombocytes (rheopolyglucin, haemodes, haemplasmin, trental).

With the acute process, the patient is appointed strict bed regimen with raised legs, warm and physiotherapy (solux, UV irradiation), ointment bandages on the damaged legs during the formation of a blood clot. With unsuccessful conservative therapy (ascending septic thrombophlebitis in varicose veins), they resort to surgical treatment. Legation, incision of veins along the veins with removing the damaged area (venectomy), removing a blood clot (thrombectomy), transplantation and plastic operations on the veins belong to surgical treatment. With limited purulent thrombophlebitis, incisions with opening the vein are applied and treating by the type of purulent wound or removing the damaged vein.

Lymphangitis is a secondary inflammation of the lymphatic vessels, which occurs as a complication of pyoinflammatory diseases (furuncule, anthrax, abscess, phlegmon, panaritium, infected wound). Causative agents: staphylococci, streptococci, *E. coli*, proteus. Microorganisms from the inflammation focus penetrate into the lymphatic capillaries and farther with the lymph flow — into larger lymphatic vessels and lymph nodes.

Clinical picture appears locally (pain, local rise in temperature, swelling, reddening) and generally (fever, headache, sweating, general weakness, increased leukocytosis). Local displays depend upon the type of the vessel. With reticular lymphangitis, pronounced hyperemia of the skin, similar to erysipelatous but without precise borders is marked. With stem lymphangitis — hyperemia as separate strips from the inflammation focus to the regional lymph node zone. The lymph nodes are affected early in the process — regional lymphangitis occurs. Complications: phlegmon, abscess, thrombophlebitis, sepsis.

Treatment should be directed on the liquidation of the primary focus (lancing of abscesses, drainage). A damaged leg is in a raised position, sometimes immobilized. Antibiotic therapy is appointed with taking into account the kind of microflora and its sensitivity.

Lymphadenitis — inflammation of the lymph nodes occurring as a complication of different purulent diseases and specific infections (tuberculosis, actinomycosis, plague, etc.).

Acute and *chronic*, *specific* and *nonspecific* lymphadenitis are distinguished. The infection gets from purulent or specific cells through the lymphatic or blood vessels to the lymph nodes. The primary process is seldom observed during wounds or infected lymph node. Depending upon the exudate character, it can be serous, haemorrhagic, fibrinous, or purulent. Purulent processes result in the destruction of node's tissue and transition of the inflammation to the surrounding tissue with the development of adenophlegmon.

Clinical picture for nonspecific lymphadenitis is characterized by painfulness and increase in the lymph nodes, headaches, weakness, indisposition, and rise in the body temperature. In the initial stages, pain in the regional lymph nodes, which are dense, painful, not adhered with the surrounding tissue, is marked; and the skin above them is not changed.

With destructive processes (purulent form) the pain has an acute character; the skin above the lymph nodes is hyperemic; the nodes merge together and with the surrounding tissue. With an adenophlegmon, dense infiltrations with softening cells are determined. Intoxication phenomena join: fever, tachycardia, headache, weakness. With putrefactive adenophlegmon, in the damage zone crepitation is determined during palpation.

Complications: thrombophlebitis, spreading of pus onto the areolar tissue with the development of phlegmons (retroperitoneal, mediastinitis, etc.), purulent fistulae, sepsis.

Treatment depends upon the phase of the process. In the initial stages (infiltration) treatment is conservative: rest, antibiotic therapy taking into account the microflora, treatment of the basic focus of infection (cutting abscesses, phlegmons, drainage), dry heat (ultra high waves, solux, warming compresses). With abscess lymphadenitis — surgical treatment (cutting the abscess or adenophlegmon with following drainage and treatment like for purulent wounds). The treatment for specific lymphadenitis is determined by specific therapy of the basic disease (tuberculosis, actinomycosis).

Bursitis is inflammation of the mucous sacs. Mucous sacs are limited connective tissue sacs, covered with endothelium, which produces sinovial liquid. Bursas form in many places, but basically on areas of continuous pressure and skin friction, fascia, muscles, and bone protrusions. Causative agents of purulent bursitis are more often staphylococci and streptococci, less often specific bursitis (gonococcal, tubercular, pneumococcal). The infection penetrates by the lymphogenous or hematogenous way. More often purulent inflammations of the mucous sacs of the ulnar, humeral and knee joints are observed. Generally, it is explained by the patient's profession (miners, engravers, carriers, etc.) and constant trauma of the mucous sacs.

Clinical picture consists of systematic and local symptoms. The occurrence of painful swelling according to the location of the mucous sacs, swelling and local increase in temperature is evidence of bursitis. Along with the local signs of purulent bursitis, a rise in temperature and leukocytosis, weakness occur. The diagnosis of bursitis is not complex with superficial localization of mucous sacs. It is necessary to distinguish bursitis from arthritis: with bursitis movements in the joints are kept. With chronic bursitis, the bursa is filled with serous contents; the walls of the bursa are sharply thickened.

Treatment. In the initial stages of the disease for exudate resorption they apply dry heat, ultra high waves, bandages with Vishnevsky ointment, immobilize the leg. With pyesis, a puncture with sucking out the pus and antibiotics introduction are carried out. With unsuccessful therapy, the sacs are cut open; they delete the pus and further treat as a purulent wound. With chronic bursitis, remove the mucous sacs without incision its opening.

Tendovaginitis is inflammation of the tendinous sheath. Causative agents (staphylococci, mixed flora) penetrate during wounds or as the result of inflammation spreading from the surrounding tissue.

Clinical picture. Tendovaginitis is characterized by the occurrence of pain, inflammatory infiltration by the course of the tendinous sheath. To reduce pain, the patient fixes the extremity (finger) in a half-bent position. Hyperemia of the skin above the damaged area, rise in temperature are observed. If the process progresses as a result of vascular constrictions which nourish the tendon, necrosis of the tendons can develop; purulent fistulae form.

Treatment. In the initial stages rest, immobilization, application of antibiotics and physiotherapy (ultra high waves, solux, magnetotherapy) are indicated. With the development of pyesis, the suppurative focus is opened with following washing and drainage.

Arthritis is inflammation of the joint.

Aetiology. Arthritis can result from different reasons. Such kinds of arthritis are distinguished: traumatic, infectious, dystrophic, endocrine, anaphylactic. More often purulent arthritis, the causative agents of which (staphylococci, pneumococci, enterobacteria) penetrate into the joint during a trauma or from other cells (osteomyelitis, phlegmon), less often with the hematogenous way with sepsis, thrombophlebitis.

Clinical picture depends upon the morphological changes in the joint. First serous or fibrinous synovitis, which can further turn into panarthritis and phlegmon of the articulate capsule, develops. The process can spread to the next bones with the occurrence of osteoarthritis (purulent fistula, sequestrations). Local symptoms: pain, swelling. The compelled position of the extremity depends upon the reflex muscular contraction. The extremity is fixed in such position (half-bent, retracted, pronation, etc.), during which the capacity of the joint is maximal. As a result of an increase in exudate, the contours of the joint are smoothed, there is fluctuation. With damage to the knee joint, balloting patellar is determined. Reddening, swelling of the skin, local rise in temperature on the damaged joint are observed. With dry forms (fibrinous), deforming arthrosis, ankylosis of the joints can develop. With purulent osteoarthritis, the articulate ligaments and cartilages are damaged, therefore incomplete dislocations and full dislocations can occur. The systematic intoxication phenomena appear (fever, encephalopathy, delirium). Frequently hematosepsis or septicopyemia develops.

Treatment depends upon the process phase, type of exudate. In the initial stages, they apply extremity immobilization, physiotherapy (ultra high waves, solux, ionophoresis, magnetotherapy), punctures of the joint with the introduction of antibiotics into the cavity. With the development of purulent arthritis, incision the joint (arthrotomy) and washings with antiseptics are administered. Further, washing the joint with antibiotics and antiseptics (dioxydine, chlorhexidine, dimexide) are indicated. Antibiotic therapy, haemotransfusion and protein blood substitutes, desintoxication with therapy during the development of endotoxicosis and sepsis (hyperbaric oxygenation, haemosorption, plasmapheresis, etc.) add to it.

With the destruction of the bones' articulate ends and with the absence of effect from the applied treatment they carry out a resection of the joint with the creation of ankylosis. With threat to the patient's life in case of sepsis, panarthritis with extensive destructions in the joint, amputation of the extremity is performed.

Osteomyelitis is inflammation of the bone tissue that covers all the bone elements (bone marrow, compact layer, periosteum). Depending upon the causative agents of osteomyelitis are divided into nonspecific (caused by pyogenic microflora) and specific (syphilitic, tubercular, brucellosis). The infection can penetrate hematogenously or exogenously. Depending upon the ways of penetration osteomyelitis is distinguished as hematogenous and non-hematogenous. Non-hematogenous osteomyelitis is subdivided into:

1) traumatic;
2) gunshot;
3) osteomyelitis, which occurs during the spread of purulent inflammation to the bone from adjacent tissues or organs.

According to the clinical course: acute, chronic, primary-chronic, atypical forms of osteomyelitis are distinguished.

Each form of osteomyelitis has prominent features of the clinical course.

Pathological anatomy — changes in the bone during osteomyelitis can begin in the bone marrow, less often — internal layers of the periosteum. Hyperemia, hypostasis of the bone marrow, development of phlegmon causes the penetration of an infection into the compact layer of the bone and periosteum. With the development of purulent infiltration of the periosteum and sub-periosteum abscesses, the nutrition of the bone is sharply broken, resulting in necrosis and rejection of bone areas (sequestration). Bone sequestration is located in the sequestral cavities where there are products of autolysis, pus. Pus from the sequestral cavities, sub-periosteum abscesses, destroying the periosteum, can go between muscles, forming phlegmons, soft tissue abscesses, spreading to the next joint. With pus breaking out the fistula such ducts form through which pieces of dead bone, purulent secretion discharge. Extensive necrosis of the bone tissue can result in pathological fractures. With the development of sequestration and fistula, the process turns into the chronic form; its duration depends upon the size of the bone area rejected.

Parallel to the destruction processes, bone regeneration as osteoblastic processes (thickening of the periosteum, bone tissue, obliteration of the bone marrow cavity) occurs.

Acute haematogenous osteomyelitis is observed more often in children and teenagers. It is caused by pyogenic microbes. The damage covers mainly long tubular bones (hip, humeral, tibia). The infection from the primary cell (furuncule, anthrax, carious teeth, tonsillitis, phlegmon, panaritium, etc.) is carried by the blood current to the bone marrow where it causes inflammation.

The following factors play a role in the development of osteomyelitis:

1. Peculiarities of blood supply to bones in children.
2. Biological and immune features of the organism.

For the diaphysis the main type of blood supply is characteristic, metaphysis and epiphysis have independent arterial systems like intertwined network of fine vessels and capillaries.

A number of theories of the pathogenesis of hematogenous osteomyelitis exist.

The Lexer's theory (1894), taking into account the features of blood supply of tubular bones in children, explains the development of osteomyelitis as the result of embolism from the branches of the metaphysic arteries with bacterial emboli from the primary cell. But, the value of the organism's reactance is completely ignored.

S. M. Derezhanov (1940) proved that osteomyelitis develops only in sensibilized organisms and has the course of hyperergic inflammation. Products of protein disintegration, infectious diseases, etc. can cause organism's sensitization. Favorable factors for the development of osteomyelitis can be avitaminosis, exhaustion, previous infections, trauma to the bone.

Clinical picture. Depending upon the speed of development of the pathological process, clinical displays and prevalence of local purulent foci, according to the Krasnobayev's classification, three forms of hematogenous osteomyelitis are distinguished:

1) toxic;
2) septicopyemic;
3) local.

With the toxic form, the phenomena of septic intoxication prevail. The process has a lightning course, causes the patient's death frequently before any changes. The consciousness is confused, delirium, symptoms of irritation of the brain membranes, fever (39°C and higher), headache, vomiting. The person is pale; eyes are sunken; lips and mucous are cyanotic; the skin is dry with an icteric shade. Hypotension, tachycardia, dyspnea, bronchopneumonia phenomena are observed.

With septicopyemic form, local purulent-destructive changes quickly occur; there are different foci in different bones at the same time; pyemic cells can appear in other organs and tissues (the lungs, the liver). With the local form, during the first days of the disease, intoxication symptoms (fever, weakness, headache, nausea, vomiting, increased leukocytosis) are accompanied by pain in the legs, which are insignificant in the onset of the disease. The localization is difficult to find, only with the development (1–2 days) of hypostasis of local tissue, infiltration of the skin the site of the greatest painfulness by palpation can be determined. Heel or elbow palpation causes strong pain on the damaged site. The extremity is in a compelled half-bent position. At the end of the first week in the center of the painful swelling the skin becomes crimson, there is fluctuation; a sub-periosteal abscess, an intermuscular phlegmon form. The intermuscular phlegmon can independently break through with the formation of fistula. With the grave course, a phlegmon results in purulent arthritis, periarticulary phlegmon and sepsis.

An early radiological symptom of osteomyelitis is the symptom of the pealing periosteum — a thin linear shadow, above the shadow of the cortical layer of the bone. Changes in the metaphysis appear radiologically as a darkening of the bone structure; osteoporosis phenomena (different sites of thinning and condensing). The typical radiological picture (presence of sequestral cavities, sequestrations, fistula) appears on the second month of the disease. In order to determine the diagnosis, bone puncture, osteomedulography, fistulography are applied.

Treatment depends upon the stage of the process. In the infiltration stage (up to 2 months) basically, conservative therapy is applied: immobilization, antibiotics (semisynthetic penicillin, aminoglycosides, cephalosporins), sulfanilamides, antiseptics (nitrofurane, metronidazole). Antibiotics are entered intramuscularly, intraarterially (regional perfusion), intraosseously, subperiostally. Subperiostal or intrabone introduction of antibiotics is carried out by micropunching the bone with the help of special needles and microirrigators, which enable the creation of high concentrations of antibiotics in the center of the damage, as well as at the same time, delete the pus and wash out the wound. With grave cases, they apply trepanation of the bone with the following washing out. In progressive cases with the presence of phlegmons, they are opened with the following continuous washing out with antibiotics and antiseptics.

Radical operations (sequestrotomy) are performed in the chronic period with precise restriction of the sequestration. A difficult task for the surgeon after sequestrotomy (removal of dead tissue, incision of the sinus tracts) is the liquidation of the residual cavity in the bone. There are about 60 methods of liquidation of sequestral cavities in the bones (sealing with paraffin, plastic, preserved cartilaginous tissue, bone alo- and autotransplantation, etc.). However, the majority of them are ineffective.

Methods with the application of transplants with blood vessel are effective. Recent years autotransplantation of bone-muscle-skin orifice has become very effective with the help of microvascular technique.

Non-hematogenous osteomyelitis. They include traumatic, gunshot, post-operative osteosynthesis, during the inflammation spread to the bone from the surrounding tissue (for example, with phlegmon). The infection is brought by the exogenous way from the environment. Many factors play a role in the incidence of traumatic osteomyelitis: degree of pollution of soft tissue and bone fragments, late primary surgical processing, organism's reactance, microflora's virulence, character of fracture (detrital).

Clinical picture. The development of osteomyelitis is usually preceded by the trauma (fracture) with the phenomena of soft tissue and infected wounds with pyesis within the next few days (rise in temperature, deterioration in the general condition). Occurrence of pain repeatedly on the fracture site or on the whole extremity testifies to the development of osteomyelitis. Thus, hyperemia of the skin, hypostasis of soft tissue, and significant purulent secretion from the wound are observed. The formation of purulent fistulae on the fracture site gives basis to suspect the development of osteomyelitis. Radiological changes arise a while after the trauma: osteoporosis, small cavities with soft sequestrations, usuration of the ends of the bone fragments. With gunshot osteomyelitis foreign objects are found (bullets, fraction, splinters from shells). Restriction of the destructive changes of bones only in the zone of the bone fracture is characteristic. The peculiarity of traumatic osteomyelitis in contrast to hematogenous is less pronounced systematic phenomena as a result of the nonunion of fragments; an artificial joint frequently forms. The acute period turns into the chronic with the formation of a purulent fistula with little secretion.

Treatment of non-hematogenous osteomyelitis is carried out by the same principles as for hematogenous. Surgical treatment is indicated to remove sequestrations, necrotic bone fragments, foreign objects, opening purulent fistulae. With the presence of a fracture which hasn't not healed and osteomyelitis an economical freshening of the bone fragments with their repositioning is conducted. The method of immobilization of fragments is extrafocal compression osteosynthesis. With the inefficiency of treatment of the basic joint after the liquidation of osteomyelitis, resection of the bone is carried out within the limits of healthy tissue with simultaneous autotransplantation of the bone.

Primary-chronic osteomyelitis. These are rare forms of hematogenous osteomyelitis during which the disease from the very onset has an atypical course and appears in the chronic form. Atypical forms are Brodie's abscess, Garré's sclerosing osteomyelitis, Ollier's albuminous osteomyelitis.

Brodie's abscess is a version of subacute hematogenous osteomyelitis. It is characterized by dull whining pains in the legs, especially at night. Radiologically in the spongy layer of a bone near the joint a round cavity appears. When incision an abscess filled with pus with little virulent microbes is found. Treatment is surgical: bone trepanation, removing the pus with the following sealing of the cavity in the bone.

Garré's sclerosing osteomyelitis begins subacute, with typical night pains in the legs, moderate rise in temperature and leukocytosis. The peculiar feature of the process is a sharply pronounced progressing sclerosis of the damaged bone and small sites of colliquation of the bone tissue. As a result of sclerosis, the diaphysis thickens spindle-shaped, the bone marrow cannel is completely sclerous. Treatment basically is conservative: antibiotics (lincomycine, semisynthetic penicillin), physiotherapy (electrophoresis with trypsin, ultra high waves, mud applications, and baths).

Ollier's albuminous osteomyelitis is caused by little virulent microflora (streptococcus, staphylococcus). The disease has a subacute course with minor alterations (small infiltration of soft tissue with non-pronounced hyperemia of the skin). The peculiarity of this form is the following: serous liquid rich in mucin accumulates in the osteomyelitis focus instead of pus. The languid course sometimes is complicated with destruction of the skin with the formation of sequestrations or secondary infection.

Treatment is surgical (cutting the focus, currettage of the granulations).

Panaritium is purulent inflammation of the tissue on the fingers. The causative agents: staphylococcus and mixed flora, which penetrate into the tissue through fine traumas (injections), foreign objects (prickle, splinters of glass), after manicures. According to the anatomic principle the following classification of panaritium is distinguished: cutaneous panaritium, subcutaneous panaritium, tendovaginitis (tendon), articular panaritium, subungual panaritium, paraungual panaritium, nail-wall panaritium, bony panaritium, pandactylitis.

Cutaneous panaritium is the result of microtraumas, located under the epidermis both on the palmar and back surface of the fingers, within the limits of one phalanx. Characteristic: formation of purulent blisters with pealing of the epidermis and local hyperemia of the skin. Pains are not strong, the clinical course is favorable, without pronounced general phenomena. Treatment: surgical. Exfoliated epidermis is incised, and panaritium is treated as a purulent wound. In the initial stage, they apply spirit compresses, hot baths.

Subcutaneous panaritium is the most often form of panaritium with overwhelming damage to the palmar surface of the fingers. Because of the features of structure of the hypodermic tissue of the palm (cavernous) it tends to quickly transit into the bony form. Clinically it appears as two phases: infiltration and abscess. Infiltration appears within the limits of one phalanx. Pain is pulsating, pulling, hyperemia of the skin is non-pronounced; the patients protect the finger. In the abscess phase, fluctuation is difficult to find because the connective tissue membranes in the hypodermic tissue limit the spreading of the process on the periphery. The character of pain helps to find it (constant, pulsating which deprives the patient of rest and sleep). With compression of the vessels, purulent exudate disrupts blood circulation; therefore dry necrosis of the hypodermic tissue is possible.

Treatment. In the infiltration phase treatment is conservative: antibiotics, sulfanilamides, physiotherapy (hot baths, spirit compresses). In the abscess phase, the abscesses are opened with Klapp's linear-lateral incisions, which are conducted on the edge of the lateral and palm surfaces of the finger within the limits of the phalanx. The incisions are connected among themselves with the help of a hypodermic tunnel by incision the tendinous membranes. It enables the opening of all abscesses. The incisions are drained with a rubber strip (but not gauze drainage) for sufficient outflow of the pus and prevention of the sticking of skin wounds and formation of another abscess. On the nail, incision of an abscess is conducted with a stick-like cut.

The incision used earlier as “fish jaws” is not desirable, because it damages the nerve endings, and tactile sensitivity is lost. The incision of abscesses can be carried out under narcosis or under local anaesthesia according to Oberst—Lukashevich. In the postoperative period — treatment is like for purulent wound (local antibiotics, antiseptics, proteolytic enzymes, ultra high waves, UV irradiation).

Paronychia — inflammation of the nail wall, which occurs with microtraumas (agnails, damage during a manicure). Reddening, swelling, and painfulness of the nail wall are typical. When pressing on the nail, pus discharges from under the edge of the nail wall. Frequently the process proceeds long without a pronounced reaction.

Treatment is conservative in the initial stage: baths, spirit compresses. With the accumulation of pus, under block anaesthesia, wedge-shaped, P-like pair of lateral incisions on the back surface of the nail (depending upon the localization) are conducted.

Subungual panaritium — develops when foreign objects (thorns) get in the nail bed, as a result of punctured wounds or pyesis of hyponychial hematomas. The development of purulent inflammation under the nail is characteristic. It is accompanied by pulsating pain, visible accumulation of pus under the nail plate. With the rupture of pus to the outside it can form purulent fistula. Treatment: surgical. With located forms of subungual panaritium it is necessary to limit the resection of the nail plate. With complete exfoliating of the nail plate, the latter is removed with the purpose of draining the suppurative focus and treating the purulent wound.

Tendinous panaritium (tendovaginitis) usually arises secondary as a complication of subungual panaritium with unsuccessful therapy. It is characterized by a deterioration in the general condition, occurrence of pulsating pain on the whole finger, uniform hypostasis of the tissue on the finger from smooth interphalanx sulcus. The finger looks like sausage, in a half-bent position. An attempt to unbend the finger causes sharp pain, during bending the pain abates. It is one of the characteristic symptoms. Dangerous tendovaginitis are on the 1st and 5th fingers, because of the possible drift of the infection onto the forearm, occurrence of V-like phlegmons. Treatment in the initial stage consists in puncturing the tendinous vaginas for draining the exudate and introduction of antibiotics. If inefficient, it is necessary to resort to an urgent operation. A delay concerning the operation is dangerous, because the tendon, deprived of blood as a result of compression of the vessels with exudate, quickly perishes. Thus the flexing function of the finger will be lost, though it is possible to stop the inflammatory process. Incision of the inflammatory cell is conducted with Klapp's incisions on the anterior-lateral surface of the finger with the following drainage with rubber drainages and treatment with local antiseptics.

Bony panaritium is osteomyelitis of the phalanxes occurs as the result of wrong or late treatment of subcutaneous panaritium. With small incisions of subcutaneous panaritium, preconditions for deep infection spreading to the finger bone are created. The pain is dull, constant; the pus discharge from the wound does not stop, sometimes with fine bone sequestrations. The phalanx thickens club-shaped, sharply painful during palpation; the function of the hand is reduced. On the roentgenogram osteoporosis, destruction and sequestration of the phalanxes are found.

Treatment: a combination of antibiotic therapy (local and systematic) and surgical. Wide lateral incisions according to Klapp and the removal of necrotic hypodermic tissue with the rubber drainage are conducted. In grave cases, they remove the large sequestrations.

Articular panaritium occurs as a complication of subcutaneous or bony panaritium. Sometimes, it is the consequence of the infection bringing from wounds to the joints. Strong pains which amplify during bending the finger are typical. The joint is spindle-shaped, hypostasis and hyperemia of tissue are most of all pronounced on the posterior surface of the finger. Joint puncture reveales a muddy liquid. During grave cases destruction of the capsule and pathological dislocation are possible. Purulent fistulae form. There is destruction of the articular surfaces on roentgenograms. Treatment in the initial stage: joint puncture, liquidation of exudate and introduction of antibiotics. Immobilization of the finger is indicated. With the presence of pus in the joint, arthrotomy with two parallel incisions with the following draining and washing are done. Sometimes amputation of the finger with destruction of the joint and significant destruction of the bones is conducted.

Pandactylitis is a purulent inflammation of all tissues of the finger. Frequently, it is the result of the wrong treatment of bony, articular and tendinous panaritium. The disease develops gradually. The clinical picture consists of combination of all kinds of purulent damage to the finger. It has a severe course; it is accompanied by pronounced intoxication (headache, fever and leukocytosis), regional lymphadenitis. Pain in the finger is intolerable. The finger is sharply thickened, deformed, dark blue-crimson. The inflammation occurs with dry or damp necrosis. There are multiple purulent fistulae with grey granulations. With the presence of virulent infections, the inflammation frequently spreads to the hand.

Treatment is surgical (wide lateral incisions according to Klapp). It is necessary to try to save the fingers though, as a rule, with panaritium the finger contracture develops. For the prevention of the generalization of the infection, they resort to exarticulation of the finger.

PUTREFACTIVE (PUTRID) WOUND INFECTION

Aetiology. The putrefactive infection develops only in the wound where there is dead tissues, which are subject to putrifactive disintegration as a result of vital activity the putrefactive bacteria. Complications can occur from extensive severe wounds of the soft tissue, open fractures, gunshot wounds, and bed sores. The putrefactive infection seldom occurs independently; usually it joins Claustrid anaerobic or aerobic infection. Non-Claustrid anaerobic putrefactive infection is caused by: bacteroid, peptococcus, fusobacteria that generally saprofited on the mucous membrane of the GIT, respiratory ways, and female genitals.

Today the idea is established that 90% of surgical infections have an endogenous origin. As the most part of normal microflora are anaerobes, the anaerobic and mixed (anaerobic-aerobic) infections make up one of the most significant categories of pyoinflammatory diseases. An especially big role they play in surgery of diseases and complications in stomatologic, thoracic, abdominal, gynaecologic clinics and with certain infections of soft tissues. Experience testifies that the majority of infections which take place with the participation of anaerobes are not monomicrobic. More often they are caused by the association of anaerobes or the combination of anaerobes with aerobes (Staphylococci, E.coli).

Clinical picture. Putrefactive infection is independently observed rather seldom, usually it joins an already advanced anaerobic or purulent (aerobic) infection. Hence, the clinical picture of the wound complications is not frequently clear and merges with the clinical picture of anaerobic or purulent infection. Among the general symptoms, it is necessary to distinguish the following: oppression of mentality, drowsiness, decrease in appetite, development of anemia. The occurrence of sudden repeated fever is an early general sign of putrefactive disintegration in the wound. The major and constant attribute is the presence of sharp unpleasant odour of exudate. A bad odour is predetermined by flying sulphurous compounds (hydrogen sulphide, methyl mercaptan, methyl thiomethane) — products for the vital activity of putrefactive bacteria. The second attribute of anaerobic damage is putrefactive character of the wound. The center of damage contains dead tissues as unstructured detritis with a grey or grey-green color, sometimes with black or brown sites. These cells seldom have a cavity form, limited to correct contours, more often they have a chimerical form or fill intertissue cracks.

The color of the exudate also has peculiarities. It is usually gray-green, quite often brown. The coloring is not homogeneous; it contains small droplets of fat. With big accumulation of pus in the tissue, the exudate, as a rule, is liquid, but with damage to the muscles it is scanty, which diffusely impregnates tissues. With aerobic suppuration the pus has dense consistency, more often yellow or white color, homogeneous, without an odour. A characteristic attribute of anaerobic infections is gas formation.

The reason for gas formation is that during anaerobic metabolism, hydrogen, nitrogen, methane, which dissolve badly in water release. Gas formation causes crepitation during palpation of the damaged site, the presence of gas blisters in the exudate.

In differential diagnosis, radiological methods of research have great value. With putrefactive infection, the level of gas formation is low. In contrast to it with gas (claustridial) gangrene, gas spreads quickly, immense beyond the limits of the wound and into the muscular layer. Dirty-green spots appear at a significant distance from the wound on the skin as a result of haemolysis. In the initial stage when the putrefactive infection joins, during examination of the wound frequently it is impossible to find the presence of hypostasis, crepitation, gas formation, purulent swelling. External attributes of damage to tissue frequently do not correspond to extensive deep damages — hyperemia of the skin may be absent, which does not induce the surgeon to well-timed and extensive surgical operation of the focus of injury. Dry and dead tissue, the occurrence of a dirty-green or brown film, discharge of muddy exudate with a small amount of gas blisters, the presence of an awful (ichorous) odour from the wound — characteristic attributes of the adding putrefactive infection. The putrefactive infection spreads onto the hypodermic tissue, then onto the interfascial spaces, causing necrosis of the fascia, muscles, and tendons. The development of a putrefactive infection in the wound can have three clinical forms (P. M. Napalkov):

1) with the prevalence of shock phenomena;
2) with a rough progressing course;
3) with a vague course.

The first two forms run have the phenomena of significant general intoxication (fever, chills, decrease in arterial pressure, encephalopathy, and the development of renal and hepatic insufficiency).

The diagnosis of putrefactive infection should be based upon the features of clinical and microbiological diagnosis of the exudate. The causative agents are not frequently determined by routine methods of bacteriological investigation. Bacteroids quickly perish with the presence of oxygen, the material for exam is to be taken with caution and urgently delivered to the laboratory. It is not allowed to contact the material with oxygen. The growth of the bacteroids on nutrient mediums is slow; the answer comes in 72 h and more. Microscopy of native material (exudate smears, stained by Gram) and gas chromatography belong to the simple and fast ways of identifying anaerobes. The method of gas chromatography is based upon the chromatographic definition of specific chemical substances of anaerobes vital activity products (volatile fatty acids: propionic, valerian, capron and others).

The *treatment* for putrefactive infections should consists of the following:

a) creation of grave conditions for the development of microflora (removal of dead tissues, wide drainage of the abscesses, antibacterial therapy);

b) detoxification therapy (methods of intra- and extracorporal detoxication);

c) correction of homeostasis and immune status of the organism (correction of systematic and organ infringements, immune therapy and immune correction).

With the presence of a putrefactive infection in the wound, they remove the damaged tissues. As a result of the anatomic localization, prevalence and other features of an infection, the achievement of radical results (removing the damaged tissue) is not always possible. In such cases, the operation has a palliative character and consists of a wide incision of the suppurative focus, removal of the necrotic tissues, draining the wound with the purpose of removing the exudate and local acting upon the microflora with different antiseptic substances. For prophylaxis of spreading putrefactive process onto the healthy tissue limiting incisions are performed.

The irrigation or constant perfusion of wounds with solutions of hydrogen peroxide, potassium permanganate, and sodium hypochlorite is expedient in the treatment of anaerobic infections. Sodium hypochlorite is prepared before use by electrolysis with a 0.9% solution of sodium chloride. Hydrophilic ointments on polyethylene oxide basis (levosin, levomacol, dihydroxycol, maphenid, sulfamilon) are very effective. Ointments on a hydrophylic base provide good adsorption of exudate and fast clearing of the wound. They apply hyperbaric oxygenation, but in some cases (with the presence of aerotolerance) a decrease in the effect of this method is observed.

The majority of bacteroids are resistant to antibiotics, therefore antibiotic therapy is necessary to carry out under obligatory control of the antibioticogram. Chemotherapy of putrefactive infection consists of effective antibiotics (thienam, lincomycin, rifampicin), preparations of metroimidazole (metronidazole, metragil, tinidasol).

The complex of measures on correcting homeostasis and detoxification should be determined individually for each patient according to the clinical course (rough septic course or languid, vague).

With a rough septic course, they begin with intracorporal methods of detoxication: haemoinfusion and endolymphatic therapies (introduction of haemodes, neoheamodes, albumin with disaggregants against a background of forced diuresis). They apply UV-irradiation, applicational sorption (placing carbon fibrous sorbents, immobilized enzymes in combination with antibiotics on the wound). With the development of the phenomena of hepatic insufficiency they use haemosorption, lymphosorption, plasmapheresis, plasmosorption.

In case of renal insufficiency, the method of choice is haemodialysis, haemodiafiltration.

Correction of immune status infringements with a putrefactive infection (especially with the development of septicopyemia) consists of transfusion of fresh-stabilized blood and the application of artificial (decaris) or natural immune correctors (thactivin, thymalin, thymogen).

Lecture XVII

SEPSIS. ENDOTOXICOSIS IN SURGERY. DETOXIFICATION OF ORGANISM

SEPSIS

Sepsis — general nonspecific infection of an organism, caused by different agents and occurring against a background of a changed organism's reacttivity irrespective of the agent, is characterized by the same clinical picture similar to endotoxicosis phenomena and poly-organ disorders.

Sepsis should be examined as the gradual development of local suppurative focus, when generalization of the infection takes place in the hematogenous and lymphogenous ways. The lethality with sepsis is high and according to different authors ranges from 40 to 60%, and in the case of septic shock it reaches 85%.

Pathogenesis of sepsis is considered by the interaction of three factors:

1. The causative agent.
2. Primary focus.
3. Organism reactivity.

Causative agents of sepsis can be almost all the pathogenic and conditional-pathogenic microorganisms. Frequently, they are staphylococci, streptococci, Pseudomonas aeruginosa, Proteus bacteria, anaerobic flora, bacteroids.

Generally the basic agent of sepsis is staphylococcus, the second one is E.coli, especially in the case of peritoneal and gynaecologic sepsis. The kind of agent, its biological properties (production of exo- and endotoxins), virulence, sensitivity to antibiotics, antiseptics determine the features of the clinical picture of sepsis. For example, staphylococcal, bacteroidal (anaerobic) sepsis, as a rule (95% of the cases), is accompanied by the development of secondary metastatic abscesses. Streptococcal, Pseudomonas aeruginosa sepsis has the course similar to hematosepsis with pronounced endotoxicosis without the formation of secondary metastatic abscesses.

With sepsis, there is always an entrance gate and a primary focus of infection. The entry of infection, or place where the infection occurs, is damaged tissue. The primary focus is considered the site of inflammation, occurring at the site where the infection appeared and is the source of its generalization. The primary focus, as a rule, coincides with the entry of infection. Very seldom it arises at some distance from the place of infection penetration, for example, suppurative lymphadenitis and phlegmon, as the result of attrition of the foot skin. The primary foci during sepsis can be different wounds, local suppurative processes (furuncule, anthrax, phlegmon, mastitis, osteomyelitis), destructive diseases of the internal organs with the development of empyema of the pleura, peritonitis.

In the primary focus that contains plenty of dead tissue, blood clots, bacteria divide rapidely. The microbe's exo- and endotoxins damage the walls of the wound, new vessels, resulting in thromboses, increase in the vascular wall permeability, increase in necrosis processes. All this causes infringement or full destruction of the granulation shaft of the inflammatory focus, increase in the permeability of toxins and microbes into the general blood flow (bacteriemia).

The infection spreads from the center of damage hematogenously or lymphogenously or simultaneously. The hematogenous way is characterized by the development of thrombophlebitis, periphlebitis, thrombembolism and frequently the formation of secondary suppurative metastatic foci. The lymphogenous way of spreading is observed less often because the lymph nodes are a filtering barrier for the infection. The primary focus during sepsis is not only a reservoir of the infection but renders the sensitizing action on the patient's organism.

A patient's organism reactivity has crucial importance in the development of sepsis. Sepsis develops as the result of exhaustion of the antiinfectious immunity under the influence of the primary focus. As a result of the action of a significant amount of agents and their toxins, destruction of tissue, infringement of regional blood circulation in the primary focus, there is a temporary relative deficiency of protection factors (opsonin, phagocytes). It results in uncontrolled increase in microbes in the penetration areas (infection entry) and the development of the suppurative process. With insufficient mobilization of immune protection factors in the primary focus there is an exceeding in the allowable ratio of microbe-phagocytes, causing destruction of the phagocytes and the beginning of the secondary immunodeficiency development. With an increase in the duration of this process, the superfluous amount of antigenes and microbic toxins leave the borders of the primary focus. Thus, factors of natural resistency and specific immune response are oppressed. Thus, with sepsis there is a deficiency of factors of immune protection, which now are not capable of restricting the damaging action of microbes and toxins on the basic physiologic systems of an organism.

The reaction of a person's organism to the sensitization of microbic antigene during sepsis can be different:

1. Normergic with the prevalence of the inflammation phenomena, the clinical picture is characterized by the presence of secondary metastatic abscesses.

2. Hyperergic with the prevalence of destructive-degenerative changes in the tissue, rapid course with the endotoxicosis phenomena, allergy and toxic shock.

3. Anergic (hypergic) is characterized by languid inflammatory reaction with a decline in the reactive forces of an organism.

One of the leading factors, which determines the course of sepsis, is toxinemia (microbic toxins, products of tissue disintegration) which results in the development of the intoxication syndrome (endotoxicosis) with severe infringements of the function and morphology of vital organs and systems (cardiovascular and respiratory systems, liver, kidneys, haemopoietic organs, etc.).

Classification. Many classifications of sepsis are suggested. The basic ones are as follows:

I. According to the type of the causative agent: staphylococcal, streptococcal, colibacillar, anaerobic, bacteroidic, mixed, etc.

2. According to the source: wound, postoperative, therapeutic, cryptogenic.

3. According to the localization of the primary cell: gynaecologic, otogenous, dontogenous, urological, umbilical and so forth.

4. According to the acuteness of the clinical picture: lightning, acute, subacute, relapsing, chronic.

5. According to the time of development: early (till the 14th day from the moment of damage) and late (after the 2 week from the moment of damage).

6. According to the character of reaction of an organism to the bacterial antigene: hyperergic, normergic, allergic (hypergic).

7. According to the clinical-morphological attributes: hematosepsis (without metastasises), septicopyemia (sepsis with purulent metastasises).

Clinical picture. The clinical picture of sepsis is very diverse and depends upon many conditions: etiological moments, type of agent, organism's reaction. In some cases, it is very difficult to determine the diagnosis of sepsis. The diagnosis of sepsis should be based upon the following parts: revealing the primary focus, set of typical clinical features, data from blood inoculation (haemoculture).

First of all, sepsis should be distinguished from pyo-resorptive fever. Pyo-resorptive fever is a transitive phase from local suppurative process to sepsis, observed at any localization of suppurative foci and characterized by the general reactions of an organism (fever, chills, intoxication), occurring against a background of absorption of tissue disintegration products from the purulent cell.

Unlike to sepsis, with pyo-resorptive fever after radical therapy of the suppurative focus (incision, drainage, removing the source of infection) the general phenomena start to disappear, remaining for 7 days. During the blood exam, as a rule, bacteriemia is absent.

Pyo-resorptive fever by extent of general phenomena always corresponds to the severity of damage in the local focus. At last, recently in clinic, the test for determining the bacterial level by 1 g of tissue was successfully applied. With pyo-resorptive fever, the bacterial level, as a rule, is lower than 10^5 microbes/1 g of tissue.

When determining the diagnosis of sepsis, a set of most often signs are used. The character and frequency of clinical semiology are resulted in the table.

The primary focus is one of the basic symptoms of sepsis. With its development, in the primary focus, alternative processes prevail (anemic wound, secretion is insignificant, purulent, frequently ichorous, almost undeveloped granulation tissue).

The majority of surgeons believe that there is sepsis in surgery without the infection entry and practically always is secondary, i.e. develops with the presence of a primary focus of infection (wound, purulent local process, operative intervention, etc.). The exam of the bacterial level by 1 g of tissue taken by the way of biopsy of the primary or metastatic focus helps in the diagnosis of sepsis. A number of researchers (M. I. Kuzin, V. M. Kostyuchenok, V. M. Buyanov) proved, that the seeding of 10^5 of cells and more by 1 g of tissue is critical and is evidence of the rapid development of infection in the wound and possible generalization. For patients with acute sepsis (75% of the cases) the critical level (10^5 cells by 1 g of tissue) of primary and metastatic foci appeared to be increased (V. M. Kostyuchenok, A. M. Svetukhin).

Table

Clinical symptomatology of sepsis (according to B. I. Dmytriyev, 1999)

Symptoms	Revealing, %
Primary focus	100.0
Fever	
hectic	30.8
remittent	49.1
wavy	17.5
Tachycardia	
90–100 beats/min	16.6
100–110 beats/min	21.6
> 110 beats/min	61.6
Toxic nephritis	
oliguria	64.1
anuria	20.8
azotemia	63.3
Toxic hepatitis	
liver enlargement	79.1
jaundice	48.3
Spleen enlargement	47.5
Toxic infringements of the	
CNS encephalopathy	95.0
sopor	39.1
coma	9.1
delirium	5.8
Toxic damage to the lungs	
dyspnea	81.6
pneumonia	69.1
Pyemic focus	45.0
Anemia (erythrocytes — $3.68–1.0 \cdot 10^{12}$)	92.5
Left shift leukocytosis	89.1
Increase in ESR	
> 30–50 mm/h	50.0
> 60 mm/h	46.6
Hypoproteinemia (general protein in blood serum > 60 g/l	62.5
Haemoculture (positive blood inoculation)	70.8
Thrombophlebitis	35.8
Peripheral edema	29.1
Toxic-allergic syndrome	18.3
Septic shock	13.3

Fever is one of the most significant attributes of the infection generalization. Rhythmic type of fever is mostly observed in patients with septicopyemia phenomena. Hectic fever with a constant rise in temperature up to 38.5–39°C testifies to unfavourable progressing of the process, observed in patients with septic shock, frequently with a lethal outcome. Wavy fever with a low level of increased temperature is observed in the subacute course of sepsis, characteristic for therapeutic sepsis and certain patients with gynaecologic sepsis. The temperature reaction is absent in patients with hyporeactive course of sepsis.

Hemodynamic infringements are closely connected to the depth of metabolic disorders, severity of endotoxicosis, extent of hypovolemia. Haemodynamic infringements with the generalization of infection are pronounced by a decrease in ABP, color index, tachycardia, reduction of blood volume, infringement of the contracting function of the myocardium.

One of the most characteristic and constant attributes of toxic injury of the myocardium during sepsis is tachycardia, which increases with the growth in endotoxicosis, frequently kept even with the normalization of temperature. Sometimes, infringements of blood circulation during sepsis can have a rapid course with the development of the clinical picture of septic shock. Thus, acute arterial hypotension is observed, tachycardia changes to bradycardia with arrhythmia, impairment of consciousness (coma), severe respiratory insufficiency, such as respiratory distress-syndrome, functional infringements of the liver and kidneys (oliguria, anuria) develop.

Infringements of the renal function, such as toxic nephritis, frequently worsen the clinical course of sepsis, causing oliguria with azotemia phenomena, change in urine (proteinuria, leukocyturia, erythrocyturia, cylindruria), development of peripheral hypostases. The subsequent progressing of the process with transition into anuria and the development of acute renal insufficiency have a decisive influence on the prognosis and lethality for this group of patients. Infringements of the electrolytic balance and acid-base structure of the blood, which cause hyperkalemia, hyponatremia, the occurrence of metabolic acidosis or alkalosis, are closely connected to toxic nephritis phenomena.

Toxic hepatitis — one of the characteristic symptom-complex. It causes both the liver enlargement and its dysfunction: jaundice, hyperfermentemia transaminases, alkaline phosphatase, lactate dehydrogenase, infringement of the protein-synthetic function (hypoproteinemia, disproteinemia). Acute hepatic insufficiency can develop sometimes.

Infringements of the blood coagulating system during sepsis manifest itself very brightly in the disseminated intravascular coagulation syndrome (DIC). In development of DIC-syndrome during sepsis, two phases are found:

1. Hypercoagulation with the activation of plasma fermental systems. It causes thrombophlebitises, spontaneous migrating thromboses.

2. Hypocoagulation with the exhaustion of coagulation mechanisms. It causes emigration or profuse bleedings, microcirculation blockade in organs ("shock lung", acute renal and hepatic insufficiency, infringement of brain circulation).

Respiratory insufficiency during sepsis is the result of intoxication and direct action of microflora on the lung parenchyma (septic pneumonia, abscesses). Toxic damage of the pulmonary tissue causes dyspnea, phenomena of hyperhydration of the lungs, occurrence of septic pneumonias, development of respiratory distress-syndrome.

Toxic damage of the CNS appear the first days after generalization of the process, such as encephalopathy (headache, annoyance, depression, apathy, sleep disorders). Progressing endotoxicosis and accompanying toxic damages of the liver and kidneys can result in the development of deep mental infringements (coma, intoxication delirium).

Changes in the peripheral blood is an important diagnostic and prognostic criterion of sepsis. Changes in the red blood appear as hypochromic anemia, anisocytosis, poikilocytosis, decrease in the color index, increase in ESR.

Characteristic changes in the white blood: increased leukocytosis, toxic granularity of leukocytes, left shift of neutrophilic formula (occurrence of young, immature forms of leukocytic forms in the peripheral blood). Expressiveness of leukocytosis depends upon the character of the organism's reactivity, kind of a pathogenic organism. Especially high leukocytosis is observed with staphylococcal sepsis, less pronounced — with gram-negative sepsis. Pseudomonas sepsis is characterized by leukopenia more often, especially with progress of the process. Leukopenia is frequently observed in the terminal stage of endotoxicosis, during septic shock. Normalization of the amount of leukocytes with the decrease in endotoxicosis is a favorable attribute, which testifies to efficient therapy. Enlargement of the spleen is a frequent symptom of sepsis, which reflects a toxic action of microflora and the development of degenerative changes in the organ, that is evidence of a decrease in the detoxification functions.

Bacteriemia — one of the basic symptoms which confirm the diagnosis of sepsis. Blood inoculation during sepsis do not always reveal bacteriemia. According to different authors (V. Ya. Shlapobersky, I. G. Rufanov, M. I. Kuzin, Yu. Ya. Belokurov, A. M. Torbinsky) the per cent of revealed bacteria ranges from 22 up to 87. In order to improve the results of haemoculture many factors are important: choice of optimum nutrient mediums, carefulness of technique performance, numerous inoculations, whenever possible at the height of fever attack. With a negative blood inoculation with nonclaustrid forms of anaerobes are not identified as a rule. It requires special conditions of identification, expensive equipment, which is still inaccessible for practical public health service (A. P. Kolyesov, M. I. Kuzin, P. M. Tchuyev) are not identified.

Sepsis is accompanied by pronounced endotoxicosis, the level of which is estimated by general-toxic tests: toxic metabolites of the blood (kreatinine, urea, residual nitrogen, etc.), medium-molecular oligopeptides, paramecin test, leukocytic index of intoxication, hematological index of intoxication, etc.

After the depth of infringements and the level of possible compensatory reactions, the condition of the detoxification organs (liver, kidneys) endotoxicosis during sepsis can be divided into three degrees of severity (A. M. Torbinsky):

I degree — compensation;

II degree — subcompensation;

III degree — decompensation.

The estimation of the severity of endotoxicosis has important practical value, because it allows the application of optimum methods of detoxification. The development of sepsis and the progress of endotoxicosis results in radical infringements of the cellular and humoral parts of the immune system, causing the occurrence of secondary T-immunodeficiency, decrease in phagocytosis (decrease in the phagocytal activity of leukocytes, decrease in the level of complement, accumulation of circulating immune complexes).

Treatment of sepsis should consist of the following major factors:

1) action on the primary cell;
2) correction of homeostasis infringements;
3) complex detoxification therapy.

Action on the primary and metastatic foci provides active surgical policy: wide incision, necretomy, flowing washing with active aspiration of the secretion (vacuum-devices), application of ultra-violet and laser action, treatment under abacterial conditions (abacterial therapeutic device-3 (ATD-3), ATD-5, etc.); application of hyperbaric oxygenation (different types of pressure wards).

Action on agents organisms is done with rational antibiotic and antiseptic therapy. Antibiotic therapy is conducted under the obligatory control of an antibioticogram and blood inoculation (every 4–5 days). Antibiotics are applied in maximal dozes, entered intravenously, intraarterially, endolymphatically. More often semisynthetic penicillin (Ampicillin, Carbenicillin), aminoglycosides (kanamycin, gentamycin, sisomicin, amikocin), cephalosporins (cefamezin, kefzol, claphoran), imipenem (thienam) are applied. Combine antibiotics with antiseptics (dioxydin, furagin, flagylum, metranidasole), sulfanilamide (etazole, sulfalen, biseptol). Thienam is the mostly effective.

Correction of homeostasis infringements includes actions directed upon the normalization of parameters of constancy for the organism's internal environment: haemodynamics, protein, water-electrolyte, acid-base balances, coagulation system, immune status, improving the detoxification functions of systems and allocation of toxins (liver, kidneys, lungs, intestines).

Correction of haemodynamics is carried out under controlled haemodilution with the application of blood substitutes, colloidal and crystalloid solutions (olyglucin, rheopolyglucin, lactosil, trisil, acesil, Ringer—Lock's solution, Darrow's solution), disaggregants (trental, complamin, bensohexon, rheopolyglucin). In order to improve rheology of the blood and correction of the DIC-syndrome along with disaggregants they apply heparin, inhibitors of proteolytic enzymes (contrical, gordox), chilled plasma, fibrinolytic active plasma (FAP).

In order to correct hypoproteinemia and disproteinemia they apply dry native, chilled plasma, albumine, protein, albuminous hydrolysate, amino acid solutions.

In order to correct the water-electrolyte and acid-base balance infringements they apply electrolytic solutions (N1 and N2), Darrow's solutions, panangin, calcium gluconate, sodium bicarbonate, as well as inhibitors of proteolysis and anabolic hormones (nerobol, retabolil).

Correction of the immune status during sepsis is conducted by passive immune therapy and active immune correction. Passive (replaceable) immune therapy is carried out by repeated transfusions of fresh-stabilized blood (fresh-citrate, heparinized), the application of hyperimmune (antistaphylococcal, antipseudomanal) plasma or gamma globulin, interferon, bacteriophage. Active immune correction is carried out with preparations of the thymus (thactivin, timosin, thymalin, thymogen), bone marrow (mielopeptide, β-activin), synthetic immune correctors (decaris, dauciphon) taking into account the degree of developing secondary immunodeficiency.

The therapy directed on improving the function of the detoxification systems is conducted: the liver (vitamins of group B, C, methionine, legalon, aecenciale), the kidneys (forced diuresis), the lungs (oxygen tent, pressure ward, artificial ventilation lung (AVL) during septic shock), intestines (intubation, electrostimulation, enterosorption).

Correction of endotoxicosis during sepsis should be conducted concerning the basic liquid mediums of an organism (blood, lymph) at the same time, taking into account the extent of endotoxicosis. Detoxification therapy should be directed upon strengthening the function of the basic detoxification organs (the liver, the kidneys, the lungs, the intestines) with compensated infringements of their function, in case of subcompensation or decompensation — partial or full replacement of their functions.

During compensated infringements, the application of intracorporal methods of detoxification, haemoinfusion, endolymphatic detoxification (haemodesum, neoheamodesum, albumine against a background of forced diuresis), enterosorption (carbovit, enterosorf), application sorption (activated carbon fibrous materials), intravascular laser irradiation of the blood (ILIB), ultra-violet irradiation of the blood will be effective.

With deep forms of endotoxicosis (II–III stage) intracorporal methods of detoxification are ineffective. They should be supplemented by extracorporal detoxification taking into account the mechanism of action and most pronounced detoxification effect. With acute hepatic insufficiency, haemosorption, lymphosorption, plasmosorption, plasmapheresis are applied, which models to a ceratin extent the detoxification function of the liver. Haemodialysis, haemofiltration, and haemodiafiltration (application of "artificial kidney" devices in different operating modes) are especially indicated with acute renal insufficiency. Realization of complex detoxification gives an opportunity to considerably improve the results of treatment and reduce lethality rate, especially with deep forms of endotoxicosis (from 65–80% up to 35%).

Treatment of patients suffering from sepsis should be carried out in departments of intensive therapy and resuscition, equipped with modern diagnostic and medical equipment for extracorporal detoxification.

ENDOTOXICOSIS DURING PURULENT SURGICAL PATHOLOGY

Principles and Methods of Correcting Endotoxicosis

Endogenous intoxication syndrome is the principal cause of death in patients suffering from purulent infection. Endotoxicosis during a purulent surgical pathology has a complex aetio-pathogenesis, which includes impairment of the majority of organs and systems of an organism. Displays of endotoxicosis during purulent infection can arise against a background of significant damages of tissue (burns, frost bite, syndrome of long compression, extensive traumas with necrosis of the soft tissue), destructive purulent diseases of the internal organs (pancreatitis, cholecystitis, appendicitis, etc.), as well as against a background of infringement of the natural detoxification systems (renal, hepatic insufficiency).

According to modern views, aetio-pathogenesis of the intoxication syndrome during purulent infection consists of the following basic central factors:

1. Metabolic infringements in the primary focus of infection under the action of microbic toxins and enzymes.
2. Infringements to the barrier functions of tissues and organs as a result of basic changes in haemodynamics and microcirculation, resulting in toxemia.
3. Infringement of the system of binding and transporting toxic substances from tissue to the excretory organs.
4. Infringement to the detoxification systems of an organism.
5. Infringement to the system of toxins allocation from an organism.

The factor of the primary focus is determined by the action of microflora as a result of the tissue hypoxia development with infringement to metabolism against a background of traumatic or inflammatory destruction of tissue. Pathogenic properties of the agents of purulent infection are predetermined by proteolytic, necrotic, plasmocoagulation action of bacterial exo- and endotoxins, bacterial enzymes. It results in infringement of endocellular homeostasis, development of infringements of cellular metabolism, change in the permeability of cellular membranes and, consequently, allocation of toxic products into the interstitial space and liquid mediums (blood, lymph).

In the primary focus of infection, pronounced infringements of metabolism processes are marked. As a result of the infringement of digestion of fats and carbohydrates, protein-dependant energetic exchange arises when the basic energy source for cells are amino acids. It results in sharp activation of proteolysis in tissue and blood, disintegration of protein structures of the vital organs. Hypoproteinemia develops, which leads to disorders of synthesis of proteins necessary for regeneration, haemostasis, and immune protection.

In blood and tissues, medium molecular oligopeptides, so-called meddle-size molecules (MSM), which are the intermediate products of proteolysis, accumulate. The structure of substances which enter the pool of MSM is very diverse: glycopeptides, nucleopeptides, oligocarbohydrats, etc. Medium -size molecules have a whole spectrum of negative action on an organism: oppression of erythrogenesis with the occurrence of anemia, oppression of gluconeogenesis and DNA synthesis, infringement of processes of tissue respiration with suppression of mitochondria functions. The MM has cytotoxic and immunodepressive action (oppression of phagocytar activity of leukocytes, delay in formation precipitate of lymphocytes).

The definition of MSM is an extremely informative test of endotoxicosis during different diseases, which are accompanied by increased proteolysis against a background of generalization of infection (peritonitis, pancreatitis, sepsis, extensive traumas, burns). It gives an opportunity to authentically determine the depth of endotoxicosis, estimate the prognosis and efficiency of the applied therapy. An essential role in the pathogenesis of endotoxicosis is infringements of the lipid metabolism, in particular peroxide oxidation of lipids (POL). During pathology, the antioxidant system frequently suffers, resulting in the accumulation in the organism of highly toxic products of POL (aldehydes, ketone, fatty acids, oxidations), i.e. lipid peroxidation syndrome develops. Damage to the membrane lipids, lipoprotein, swelling and destruction of mitochondria and lysosomes, inactivation of enzymes, infringement of cellular division and phagocytosis are observed. The marked metabolic infringements (proteolysis, peroxidation of lipids) promote the entering of a significant amount of vasoactive substances (catecholamin, kinin, histamine, serotonin, etc.) into the circulating blood, resulting in significant changes in the blood circulation, microcirculation. Vasoactive substances promote dilatation of the peripheral vessels, increase in permeability of the vascular wall, suppress tissue respiration and oxidizing phosphorylation. It worsens endotoxicosis. Infringements of tissue microcirculation amplify as a result of aggregation of erythrocytes, increase in blood viscosity, delay of blood circulation and deposition of blood in tissues. These infringements can lead to the development of disseminated intravascular coagulation syndrome (DIC-syndrome). The DIC-syndrome causes acute functional insufficiency of vital organs (lungs, kidneys, liver, brain), which can cause lethal consequences.

Infringements of the system of bending and transport of toxins to sites of allocation from the organism (the kidneys, the gasterointestinal tract (GIT), the lungs, the skin) have great value in the development of endotoxicosis. This system consists of transport (gastrointestinal tract) and the binding function of erythrocytes, protein, plasma (albumen, antibodies), buffer blood systems. Erythrocytes are capable of adsorbing endotoxins, biological amines, medium molecules on the surface. Oppression of erythrogenesis and destruction of erythrocytes under the action of bacterial toxins, occurrence of anemia considerably reduce the erythrocytes' transport function of toxins.

The detoxification effect of albumin is predetermined by the formation of easily dissociated bonds with molecules of many organic and inorganic compounds, thus, the toxic properties of the transported toxins decrease. Besides, albumin causes natural haemodilution and improves tissue microcirculation. Infringements of albuminous exchange during purulent infection (hypoproteinemia, hypoalbuminemia) considerably reduce the transport and detoxification function of plasma, promote the increase of endotoxicosis. A significant role in detoxification is played by the buffer blood system intended for the preservation of acid-base balance between the blood and interstitial liquid. The accumulation of significant amounts of un-oxidized products of metabolism in the blood and tissue during the generalization of infection promotes the occurrence of infringements of buffer systems (metabolic acidosis, alkalosis).

The central organ of detoxification is the liver, which carries out the transformation of toxic substances into nontoxical metabolites due to processes of oxidation, hydrolysis, renewal, conjugation which occur in hepatocytes. Kupffer's cells provide clearing of the blood from bacteria, toxins, immune complexes, products of disintegration. During the generalization of infections under the action of microflora, toxic and destructive damages of the hepatic parenchima, which causes hepatic insufficiency and a decrease in the detoxification functions, are observed. It has crucial importance for the liquidation of endotoxicosis and the prognosis of the disease.

Functional hepatic insufficiency such as toxic hepatopathy is observed approximately in 80% of the patients with sepsis. It appears as intrahepatic cholestasia with jaundice phenomena, infringements of hydrocarbonic exchange and fermental function (hyperglycemia, hyperfermentemia transaminase, lactadehydrogenase, alkaline phosphatase), infringements of protein-synthetic function of the liver (hypoproteinemia, hypoalbuminemia, prothrombinopenia). Infringements of the coagulation system and the development of the DIC-syndrome are closely connected with damage to the liver.

For the correction of endotoxicosis, normal functioning of the systems removing the toxins from the organism (kidneys, lungs, GIT) has great value. The kidneys take the central place in the system removing toxins from the organism. Infringements of renal function sharply worsen endotoxicosis during the generalization of infection not only as a result of the accumulation of toxic products, but also through the disorders of homeostasis regulation (ionic blood structure, acid-base balance). With sepsis, two kinds of acute renal insufficiency (ARI) can develop: prerenal and renal. Prerenal ARI is predetermined by infringements of haemodynamics (vasodilation, reduction of filtration efficiency as a result of renal ischemia), it has a reverse nature and renews with the normalization of haemodynamics. Renal ARI develops on the basis of toxic damage or direct microbic action on the renal parenchyma (glomerulonephritis, pyelonephritis) with the development of nephropathy. Clinically it appears as infringement of diuresis (oliguria with conversion into anuria), change of urine structure (proteinuria, cylindruria, bacteriuria). Decrease in osmotic clearance, clearance of free water and sodium are observed on this background (azotemia, hypercreatinemia, increase in the contents of medium molecules in the blood and urine).

Progressing oliguria, development of anuria result in the occurrence of respiratory distress-syndrome (RDS), or "shock lungs", characterized by hyperhydration of pulmonary tissue (hypostasis lung), acute respiratory insufficiency and hypercapnia. Thus, arterial anoxemia and general anoxemia of organs and tissues grow.

During sepsis, there can be toxic damage to the GIT (stress ulcers of the stomach and intestines, intestinal bleeding, paralytic impassability), resulting in a decrease in the allocation of toxins through the intestines, and endotoxicosis can worsen.

The marked infringements of the detoxification systems and systems removing toxins during the generalization of infection frequently incorporate with each other, i. e. polyorgan insufficiency syndrome (POIS) occurs, giving high lethality rate. It is quite obvious that treatment of endotoxicosis with purulent infection should be carried out in a complex taking into account the difficult aetio-pathogenesis with simultaneous action on the basic parts of this process. Only complex detoxification with correction of homeostasis can change the vicious circle of endotoxicosis formation and reduce lethality rate. For successful correction of endotoxicosis with purulent infection it is necessary to follow the main principles:

1. Detoxification should be carried out concerning the basic mediums of an organism (blood, lymph).

2. Detoxification therapy should be the directed upon strengthening the function of basic organs of detoxification and excretion (the liver, the kidneys, the intestines, the skin) with compensated infringements of function, partial or full replacement of their functions in case of subcompensated and decompensated infringements. With compensated infringements, the application of intracorporal methods of detoxification (hemoinfusion detoxification, endolymphatic therapy, enterosorption, application sorption, laser therapy) is effective enough. Detoxification of the blood and lymph during the light degree of endotoxicosis is conducted effectively by the introduction of detoxification substances into the blood or lymphatic system (haemodesum, neohaemodesum, albuminum, polydesum). Detoxification is possible to carry out against a background of controlled haemodilution — forced diuresis with the application of saluretics and osmodiuretics — lasixum, manitol). Application of enterosorption gives an opportunity to strengthen the detoxification effect by the sorption of toxins which excrete through the intestinal tract. For enterosorption activated coal (granulated sorbents, such

as carbovitum, etc.), preparations of polyvinylpyrolidone (enterodesum, enterosorpt) are used.

Application sorption is mainly applied with the presence of volumetric wounds, burns (coal sorbents such as carbovitum or carbon fibrous materials). It promotes the sorption of toxins and microorganisms on the wound surface, reduces the degree of bacteria in the wounds, promotes its fast clearing from necrotic mass and development of granulations. At the same time last years laser therapy (intravascular laser blood irradiation, irradiation of wounds with unfocused helium-neon laser) is used.

With deep forms of endotoxicosis (subcompensation or decompensation of detoxification systems) intracorporal methods are ineffective. It is necessary to supplement them with extracorporal detoxification with taking into account the mechanism of action and therapeutic effect. With this purpose, the methods of clearance of the blood (hemosorption), plasma (plasmosorption), lymph (lymphosorption) by passing it through columns with coal sorbents are widely applied. Plasmapheresis is effective enough — division of blood into uniform elements and plasma with the following injection of uniform elements and donor plasma instead of removed toxic ones. With acute hepatic insufficiency, haemosorption, lymphosorption, plasmosorption, plasmapheresis are indicated, which model to a certain extent the detoxification function of the liver. With renal insufficiency, haemodialysis with the application of "artificial kidneys" is applied. Thus, the blood is cleared from low-molecular compounds with the help of selective diffusion through membranes made of cellophane, cellulose, and other materials. Azotemia is reduced, infringements of acid-base balance is corrected. The haemodiafiltration method is even more effective, during which two processes unite — dialysis with the removal of low-molecular compounds (urea, kreatinine) and haemofiltration with the removal of medium molecular compounds. Haemofiltration is a way of clearance through semipermeable membranes by convection due to high transmembrane pressure.

The given methods of detoxification with the application of photodynamic therapy (ultra-violet blood irradiation, intravascular laser irradiation of blood) are supplemented. Methods of tissue hypoxia correction with hyperbaric oxygenation (HBO) in pressure wards received wide application.

Lecture XVIII

ACUTE ANAEROBIC NONSPECIFIC AND SPECIFIC INFECTION

Anaerobic infection is a number of diseases which, as a rule, arise in a wound, caused by microbes which develop during anaerobic conditions. The typical features of this infection: weak inflammatory reaction, tissue hypostasis, dead tissue, formation of gas in tissue, significant intoxication.

More often this infection is a complication of battle wounds. In the course of its history it had different interpretations, described in literature as "hospital gangrene", "gas gangrene," "malignant hypostasis", "bronze mallow", "blue gangrene", etc.

Concerning the clinical picture of open fractures Hyppocrates gave the description of a fatal complication with strong hypostasis of tissue and jaundice and, as a rule, with fatal outcome.

Describing the death of prince Romadanovsky in a letter to Alexander Menshikov, his son represented this complication as follows: "Yesterday prince Romadanovsky died from print disease. Anton's fire appeared on the leg. Enormous fever was upon the whole body and the leg began to swell, the swelling almost reached the moon within two days". Dupuytren (1815), Velpeau (1844), Pyrogov (1848) described this disease in details in the XIX century.

In 1835 Mezanov allocated this disease into an independent illness and named it a lightning gangrene. It is known that anaerobic infections is more often observed during the war. According to Terebinsky's data during the World War I the gas infection affected 7–8% of the wounded. In the English army at this time, about 1,115 amputations were done. In the Russian army, there are 200,000 of people suffered from this infection, according to Burdenko's data. During the Great Patriotic War — 0.2–0.3% of the wounded had gas infection. In the peace time this complication is also observed but much less often.

Sources of the causative agent of anaerobic infections are the intestines of mammals and people, microbes excrete into the environment, locate in the upper layers of ground and can appear with the pollution of the wound. A number of conditions are necessary for their development, first of all oxygen-free space, formed during "blind" wounds, lacerations, and also the presence of glycogen; because of this anaerobic infection appears more often with damage to muscles. It is known that 90% of wounds contain anaerobic agents. However, with the absence of conditions for their growth clinical signs are not observed.

Today it is considered that agents of anaerobic infection are bacteria of the genus Clostridium, so-called clostridium anaerobic infections. Representatives of the genus Clostridium, dangerous and pathogenetic for people are the following: Cl. Perfringens (types A, B, C, etc.), Cl. Edematiens (types A, B, C, etc.), Cl. Septicum, Cl. Hystoliticum.

Each kind of an agent of anaerobic infections has qualitative and structural features, and also has a certain action on a person's organism.

Cl. Perfringens are observed more often, causing gas formation. The agent's toxins have proteolytic, haemolytic, glycogenolytic action. The pathoanatomical picture appears as necrosis of tissue, especially muscular, porosis of vessels and expressive interstitial hypostasis of the connective tissue, oppression of red blood growth.

Today the following classifications are used:

1. **After the speed of spreading:**

a) lightning;

b) acute.

2. **After the pathoanatomical picture:**

a) emphysemic;

b) hydropic;

c) phlegmonous;

d) necrotic;

e) mixed.

3. **After the depth of the process:**

a) epifascial;

b) subfascial.

From the moment of entering the wound to the clinical displays of anaerobic infections, as a rule, several hours or 1–2 days up to 7 days pass.

The incidence of various has a wide range. The hydropic form is observed in 37.7%, mixed forms — in 29.2%, emphysemic forms — in 19.7%, the necrotic form — in 9.3% of the cases, phlegmonous — in 7.1%.

More often the anaerobic infection is caused by damage to the muscles of the extremities. In due time, M. I. Pyrogov described the development of this infection: "the damaged part without any attributes of reaction dies within first 24–28 h after the injury. The skin is flushed, gases quickly develop, a rattle during palpation. The wounded weakens, and sometimes does not complain of pain, he is pale with a yellowish shade, anxious, cloudy eyes, cold sweat, small, quivering, frequent pulse and hiccups, which shows that death is close".

Today in the clinical picture of anaerobic infection local signs are distinguished — growing bursting pain in the wound, edema, which spreads upwards on the legs. First the skin is pale, and then it gets a dark-purple. The wound is dry; insignificant secretion, unpleasant odour, pronounced necrosis of the muscles (color of cooked meat), a crunch of the tissue in places where gas (crepitation) has accumulated is determined during palpation. The general picture appears as paleness, accentuation of features of the face, frequent pulse (120–140 beats per minute), high temperature. Arterial pressure decreases. Patients are euphoric. Decrease in haemoglobin and erythrocytes is observed; diuresis decreases.

Many clinical physicians describe a characteristic specific putrefactive odour which spreads through the air. Victor Hugo describes his visit to Onore Balzac. It is known that O. Balzac suffered from hydrops: having wounded his leg with a table, he felt relief, because from the wound a lot of tissue liquid flew out. However, later anaerobic infection developed in the wound. Having visited the patient, Victor Hugo described his condition: "I called, a house maid appeared and lead me to the living-room, we came to Balzac's bedroom. I heard ominous snoring. An intolerable odour came from the bed. I lifted the blanket and took Balzac's hand. It was wet from sweat. He did not answer my handshake. When I arrived home, I found a few men and told them: Sirs, Europe is now losing a genius".

Besides of the clinical picture, the diagnosis is based on radiological exam, which reveals the presence of gas in the tissue. More often bacteriological methods are used.

Smear-prints, sometimes inoculation of wound excretion on the Kit—Taroci medium is used, and also hyaluronidase and lecithinase are determined in the wound excretion. However, all the methods of diagnosis lag behind clinical displays by the hour factor, that is why in the clinic treatment is started when anaerobic infection in the wound is suspected, without waiting for laboratory confirmation.

Aggression of clostridium toxins has been investigated in details by employees of the faculty of microbiology of our university. The essential contribution was made by the works of prof. S. N. Minevrina, A. V. Tselukha, etc. It is proved that aggression of clostridium toxins increases during the combination of several kinds of agents both anaerobic and aerobic. That is why it is necessary to not allow the development of purulent process in the wound.

Treatment of anaerobic infection includes some components. It is specific therapy. Antigangrenous serums, containing 30,000 IU (10,000 IU against Cl. Perfringens, Cl. Edematiens and Cl. Septicum) are applied. The dose — 30,000 IU is applied for preventive measures, during treatment 10–15 preventive doses are used. Serum is entered intravenously. Recently it is considered that numerous complications of serotherapy make it inexpedient to enter antigangrenous serum. However, being based upon experience of the clinic, we consider this idea to be erroneous. The application of hyperbaric oxygenation is effective. Sessions of hyperbaric oxygenation are conducted 2–4 times a day with the pressure of 2.5–3.0 atm. It is necessary to apply also antibiotics (penicillin group) and to combine them with tetracyclin and erythromycin.

Surgical treatment consists of duly surgical processing of the wound with the opening of blind pockets, removal of dead tissues, washing of the wound with hydrogen peroxide, kalium permanganate, boric acid. Patients should be isolated in case of the development of anaerobic infection. The material which is applied for dressings, is burnt, the wound is widely opened (incisions). More often amputation of the extremities is conducted. With anaerobic infection, the amputation is done in the "guillotine" type, i.e. do not form a stump and do not sew up the wound. It is necessary to actively carry out nonspecific therapy which consists in the methods of detoxification and stimulations of the parenchymatous organs function. They transfuse blood, blood substitutes, stimulate diuresis, carry out vitamin therapy, and apply cardiac drugs.

Unfortunately, modern complex therapy not always gives positive results, and today the rate ranges from 20 up to 30%.

Last years, due to M. I. Kuzin's and B. M. Kostyuchenko's works, microbiologists established that anaerobic infection is caused not only by clostridia but also by a whole group of non-clostridium anaerobes: gram-negative bacilli of the bacteroid family and fusobacteria, gram-positive cocci of the peptococcum and peptostreptococcus family, gram-positive asporous bacilli.

Under usual conditions these agents are in the oral cavity, intestines. For a long time they could not be released, because when they collide with air they quickly perish. In clinic non-clostridium pathogenic organisms frequently complicate the wound process and cause a number of diseases: phlegmons of the subcutaneous fat with injury foci, the tissues around the wound are saturated with serous-bloody brownish liquid with an unpleasant odour. The process spreads more deeply, damaging muscles against a background of toxemia, growing edema and disintegration of muscles. It increases because of local thrombogenesis of fine vessels, inflammatory reaction is insignificant.

Diagnosis is difficult, however, recently thanks to gas-liquid chromatography it is possible to find crotonic, oil, valerian and other fatty acids, in the surrounding tissue which form during anaerobic infections and are absent during purulent. Treatment of anaerobic non-clostridium infection includes surgical interventions such as wide incisions (removing) necrotic tissue, antibiotics usage: lincomycin, siptomisin, metronidazole, etc. It is necessary to carry out detoxification. Unfortunately, lethality rate is high during this infection and ranges within 16–60%.

ACUTE SPECIFIC ANAEROBIC INFECTION

Tetanus, anthrax, wound diphtheria and rabies belong to anaerobic infection.

Tetanus is observed more often in surgical practice. The disease was described in ancient times. Tetanus was known still by ancient hindus. It was described by Hyppocrates, who lost his son because of tetanus, and only in 1884 Monastirsky and Nicolaer found its causative agents.

The **agent of tetanus** is revealed in war conditions, but in peace time it is also observed. During the Great Patriotic War tetanus was marked in 6–7 cases in 10,000 wounded. M. I. Pyrogov considered that during the Crimean and Caucasian wars (1854–1858) the tetanus incidence ranges from 0.3 up to 0.6%.

The agents of tetanus — Cl. tetani — as saprophyte is in the intestines of animals (sheep, horned cattle) and people. When excrements enter the ground, it can be kept for a long time in the surrounding environment. With dust it gets to the skin, and then to the wound. It does not require special conditions and can develop under the blood crust from 4 days to 4–5 months.

Cl. tetani intensively divides and releases exotoxin, which contains tetanospasmin and tetanohemolysin. The toxin gets into the central nervous system through the perineural spaces, damaging the anterior grey substance of the spinal cord, causes tonic and clonic muscle spasms. Tetanohemolysin destroys erythrocytes.

According to the place of the infection entering different kinds of tetanus are distinguished:

— wound;

— burn;

— postinfection;

— postoperative;

— postnatal, etc.

According to the character of spreading and localization:

— local tetanus

— generalized tetanus.

According to the clinical course:

— acute tetanus;

— chronic tetanus;

— vague tetanus.

The *clinical picture* of tetanus appears as general weakness, rise in the body temperature, uncertain pains, and then convulsive muscular contraction follows at the wound site or old scars. Further there is damage to the chewing muscles — masticatory spasm and mimic muscles as a smile — "sardonic smile", convulsive contractions spreads to muscles which surround the wound, and then to muscles of the whole thorax — the patient is curved as an arch, from time to time leaning on the bed by the heals and occiput (opistotonus). The frequency of the convulsive attacks increases. The process spreads to the respiratory muscles, asphyxia occurs, during this the muscles can rupture, bones can fracture, atelectasis of the lungs can occur.

Treatment of patients with tetanus is carried out in specialized resuscitation department and contains the following measures: centralization of the tetanus toxin, elimination of spasms, lung ventilation, as well strengthening and symptomatic therapy. The patient is given intravenous or intralumbar antitetanic serum in the dose of 100,000–150,000 IU daily, as well as muscle relaxants. Artificial lung ventilation is carried out by the method of tracheotomy or tracheostomy. Introduction of great amount of liquids — vitamins, parenteral nutrition are carried out.

Thus, surgeons during treatment of tetanus are consulting physicians, but they are responsible for preventive measures of this disease.

Preventive measures of tetanus may be elective and emergency.

Elective preventive measures begin at an early age with the observance of certain terms. Immunization of children is conducted with adsorbed diphtheria, tetanus toxoids and pertussis vaccine, and immunization of adults — tetanus anatoxin. Immunization is started at 6–7 months of age and continues till 15 years. Elective preventive measures for adults are conducted during excavations and for service men.

Emergency preventive measures are carried out with the infringement of the skin, burns and frostbites, abortions and operations on the large intestines. Emergency preventive measures contain the introduction of tetanus anatoxin 1.0 ml, 3,000 AO antitetanic serum. They enter by the scheme. Nonspecific preventive measures of tetanus are primary surgical processing of wounds.

Anthrax is an acute specific pathology. It belongs to especially dangerous infections because of high contageousness. The disease is caused by the anthrax bacillum which is capable of forming spores. It is very resistant to conditions of adverse environment. It can be kept for decades in the ground. Source: animals — sheep, cattle. Earlier this illness was named illness of furriers because a person could catch it from animal skin and also by eating their meat.

Treatment is carried out by doctors-infectionists. However, it is necessary to remember this disease because in clinic it can appear as a furuncule, and also damage the intestines and lungs, stimulate tumoural process. Malignant carbuncle locates on open surfaces of the body; the focus is black, pronounce oedema, weak pain syndrome, but the top is surrounded with two lines of fine blisters filled with an amber color liquid. Any operative interventions are impossible. Treatment is conducted with specific serums and antibiotics.

Diphtheria. There can be diagnostic mistakes with acute disease for diphtheria. The pathogenic organism — the Löffler bacillus — can develop in the wound, thus, its toxin results in significant morpho-functional changes in the cardiac muscle, cortex of the adrenal glands, kidneys. With treatment no antiseptics, except for specific serum, work. That is why it is important to remember that wound diphtheria presents in the wound grey films, soldered with surrounding tissues. When attempting to remove them there are dot bleedings. Thus, during the treatment of tetanus, diphtheria of wounds and sibirea surgeons are not the leading doctors, but for the introduction of preventive measures for tetanus and determining differential diagnosis of sibirea and diphtheria surgeons need to have corresponding knowledge.

Rabies. Surgeons are responsible for preventive measures of one more disease — rabies. It is caused by virus as a result of a bite from a wild animal or pets with rabies. The disease is connected to damage to the CNS by the rabies virus. In clinic general intoxication prevails, the patient cannot swallow, accept food and water as a result of pharyngospasm, the development of spasms and paralyses is observed. The prognosis is adverse, lethality reaches 100%.

Prophylaxis consists in gamma-globulin and antirabic vaccine according to special schemes.

Lecture XIX

CHRONIC SPECIFIC SURGICAL INFECTION

The chronic specific surgical infection is caused by specific agents and has a vague clinical course. Surgical tuberculosis, actinomycosis, bone-joint syphilis, lepra, brucellosis, tularemia, leishmaniosis belong to the chronic specific surgical infection. All these diseases are characterized by development of specific granulomas.

SURGICAL TUBERCULOSIS

Tuberculosis of joints and bones, tuberculosis of lymph nodes, serous cavities, intestines, urine and genitals tracts, and also some forms of pulmonary tuberculosis belong to the group of surgical tuberculosis. At treatment of these forms the surgical method is applied.

Aetiology and pathogenesis. The agent of tuberculosis is Bacillus tuberculosis.

Infection occurs through respiratory ways by the air-drop way, through the digestive tract by the infected meat-milk products, by swallowing sputum (self-infection), through the damaged skin, mucous, ulcers, decubitus, infected placenta.

Specific granuloma (tubercular tubercle) forms as the result of infecting, in which a specific caseosis (curdle) necrosis takes place in future. Tubercular tubercles join and form a tubercular focus, in which caseous disintegration of tissue occurs or salts of calcium deposit and the connecting tissue grows. If resistance of an organism is high, incapsulating of the focus takes place. With low resistance of an organism the Bacillus tuberculosis can spread by contactic, lymphatic, haematogenic ways. The lymph nodes are the basic barrier on the way of infection spreading. There are huge packages of the lymph nodes. Haematogenic way of the tubercular process generalization results in formation of the secondary foci in the distant organs and tissues, which is typical for surgical tuberculosis.

Tuberculosis of Bones and Joints

Aged people suffer from tuberculosis of bones and joints, mostly with injury to the thoraco-lumbar part of the spinal cord, hip and knee joints.

Patho-anatomic picture. The bone tuberculosis is characterized by occurrence of a specific osteomyelitis (osteitis), a high degree of a sensitization and allergization of the patient. Metaphysis and epiphysis of the tubular bones with caseous disintegration of tissue are mostly affected. The cavities with soft sequestrations form in the bone (a piece of melting sugar), and inflammation reaction takes place in the surrounding tissues.

The primary osteitis (pre-arthritis form) and the secondary arthritis (arthritis form) with the involvement of joint cavity are distinguished in the bone tuberculosis.

With tubercular damage to vertebrae (tubercular spondylitis) the spongy substance of vertebrae is subject to fast caseous necrotic disintegration with formation of cold abscess. A destroyed vertebra covers the underlaying one, and the hump forms. The cold abscess can spread down to inguinal region and appears as protuberance and swelling in the inguinal region, in the region of the upper third of the anterior surface of the hip. The skin colour above is usual, local temperature is normal. At the abscess puncture Micobacteria Tuberculosis are revealed in its contents.

With tuberculosis of joints the process involves the adjoining spongy layer of the bone. Synovial, fungous bone forms of an articulate tuberculosis are distinguished.

The synovial form is characterized by increased exudation from the synovial membranes of the joint which can resolve completely or fibrin deposit takes place, that results in restriction of movements in a joint.

The fungous form arises at growth of granulation tissue from the synovial membranes, which fills the joint cavity, grows into the joint's capsule, surrounding tissue, the bone. The joint enlarges. The skin above it is pale, thin. The joint's slit narrows.

The bone form of surgical tuberculosis appears as primary osteitis against a background of reactive inflammation of the joint of the infiltrative character and is accompanied with increasing contracture, development of fistulae, pathological dislocations, secondary infection.

Clinical picture. With surgical tuberculosis local symptoms are observed: pains, restriction of function, deformation of the injured extremities or infringement of bearing, atrophy of muscles, which appear long time after the moment of infecting and depend on reactivity of an organism, age of the patient, localization of the focus.

The pain is the result of irritation of the nerve endings with inflammatory infiltration, or toxic influence. The pain is constant or alternating, increases at loading on the zone of damage.

Restriction of function of the injured extremity or the vertebral column are observed at the initial stage of development of surgical tuberculosis as sparing of the injured extremity or the vertebral column at tubercular spondylitis. The compelled position of the extremity leads to steady articulate contractions.

Restriction of function, intoxication result in the infringement of nerve trophism: muscular atrophy develop, sclerosis of the skin and subcutaneous tissue, oedema. The skin fold with the subcutaneous tissue on the side of injury is thicker (the Alexandrov's symptom).

Deformation in the injured extremity, changes of joint's contours appear in later terms.

The liquid accumulation in the joint manifests itself as fluctuation (balloting of the patella of the injury knee joint).The joint is spindle-shaped pale, thin skin. In neglected cases fistulae can burst, from which liquid, pus, flakes of fibrin, products of caseous disintegration of tissue, fine bone sequestrations discharge.

The general symptoms in the initial stage of the disease are vague: subfebrile temperature, weakness, anemia. Secondary infection joins, development of purulent complications is accompanied with deterioration of general condition, raising of the temperature and ESR, strong pains, leukocytosis. In the remote period organs and systems are involved (amyloidosis of the parenchymatous organs), miliary tuberculosis, steady deformations of joints and vertebral column can develop with shortening of the extremities, breaching of the bearing, appearing of paresis and paralyses.

Diagnosis and differential diagnosis. Various radiological exams (fluorography, X-ray, computer tomography, ultrasonotomography), bacteriological exam of the secretions, the specific Mantoux test play an important role while establishing the diagnosis.

Surgical tuberculosis should be differed from nonspecific osteomyelitis, syphilis of bones and joints, bone tumours, infectious (gonorrhoea, typhus, scarlatina, influenza), posttraumatic, rheumatic, endocrine arthritises.

Treatment. In treatment of surgical tuberculosis early diagnosis has great value.

The surgical tuberculosis is treated in the specialized antitubercular hospitals, sanatoria, clinics. Medical actions are divided into general and local.

The general treatment is directed at increase of organism resistance, its immunobiologic properties and activation of regenerative processes. Full-value feeding, fresh air, solar radiation (heliotherapy), labour therapy, physiotherapy exercises, application of preparations of blood, chemotherapeutic means have special value.

Antibacterial therapy of the surgical tuberculosis consists in prescription pf canamycin, streptomycin, para-aminosalicylic acid (PAS), phthivasid, rifadin, ethambutol, bepask, tubasid, salusid. The dosage and treatment mode are established for each individual case.

Local therapy consists in conservative and operative actions.

Conservative local treatment consists in revealing bones and joints, maintenance of rest due to immobilization by the method of extension, applying the plaster bandages which they change each 4–6 weeks with stage redressation. At tubercular spondylitis the patient is placed in a plaster bed for 1–2 years, with the subsequent application of a plaster corset or special plastic clamps. In the post arthritic period physiotherapy is prescribed, with the presence of fistulae — laser therapy.

Puncture and opening of an abscess, joint resections, amputations, bone-joint plasty, orthopaedic operations are applied.

Punctures are used with the diagnostic and medical purpose, watching for that the needle was entered from up to down, and after the injection the channel closed and fistula didn't appear.

Lancing of abscess is combined with necroectomy and removal of infiltrated soft tissue with the subsequent washing a cavity by rifadin, PASA.

Bone resections are carried out after abatement of the active tubercular process. Operation is completed by plasty of the bones and joints with the use of allotransplantats, endoprosthesis. Amputation is indicated with full disintegration of bones and joints with the threat of sepsis development.

Tubercular Lymphadenitis

The tuberculosis of lymph nodes belongs to rather often manifestation of tubercular damage of an organism, both primary and secondary. It is caused by pathogenetic mechanisms of the disease development.

With tuberculosis of bronchial lymph nodes infection occurs by the air way, mesenteric lymph nodes — through the digestive organs, cervical lymph nodes — by the lymphatic or haematogenic way, through the mucous membrane. Feature of a tuberculosis of lymph nodes is plurality of their damage with conglomerates formation.

Clinical picture. The disease has chronic course with rather satisfactory general condition, subfebrile temperature. The disease is of a season type — in the summer the lymph nodes decrease, in the winter — increase. With damage of the cervical lymph nodes, necrosis in the injured nodes with plural fistulae, through which white-grey pus and grains of the necrotic mass discharge, can be observed. The anemia, accelerated ESR, leukocytosis, lymphacytosis are revealed in the blood analyses.

The differential diagnosis is necessary to carry out with banal lymphadenitis, actinomycosis, lymphagranulomatosis, lymphasarcoma, cancer metastasises to the lymph nodes of the neck. Specific tests for a tuberculosis, puncture biopsy play an important role in diagnosis.

All standard techniques of the tubercular process treatment mentioned above are used for the tubercular lymphadenitis treatment.

Surgical treatment is indicated with complications caused by tubercular lymphadenitis. At compression of the vital blood vessels, nerves, respiratory ways with enlarged lymph nodes exterpation of the lymph nodes conglomerate are made with application of the specific antibacterial preparations in the pre- and postoperative period.

ACTINOMYCOSIS

Actinomycosis is the chronic specific infectious disease, characterised by development of dense infiltrations in which specific druzen are found out.

Aetiology and pathogenesis. The causative agents of the disease are special fungi *Actinomyces israeli*, Gr+ microorganisms from the group of *Fungi imperfecti*, and also *Actinomices naestundii* and *Arachnia propionica*. These agents are met in stalks of cereal cultures, other plants and are widely spread in the nature. While inhaling the dust containing in these fungi, gets to the lungs, with the saliva — to the gastrointestinal tract.

In tissues fungi form druzen in the center of which the interwaved threads are visible, which pass in the mace-shaped endings in the external zone. Under favorable conditions druzen merge in uniform dense infiltration.

Clinical picture. Like in any infectious disease, actinomycosis has the incubatory period, which lasts from several weeks to several months. More often the infiltrations are located in the region of the lower jaw, the neck, are subject for disintegration with formation of plural fistulae from which pus with an impurity of druzen discharge. The skin around the fistulae becomes dark blue, purple.

In case of injury of the lungs perifocal pneumonia, lungs abscesses, secondary bronchoectasis develop in their lower lobes. The process can pass to the wall of the thorax, the diaphragm with formation of intercostal fistulae.

Among the organs of the abdomenal cavity the blind gut is mostly affected. The formation of induration in the right ileac region reminds the appendicular infiltration and soon the fistula forms on the anterior abdominal wall.

Differential diagnosis. Actinomycosis should be differed from tubercular lymphadenitis, malignant and benign tumours. For establishment of the diagnosis the intracutaneous tests and serologic reactions with actinolysate are carried out. The pus is investigated for presence of druzen.

Treatment. Treatment of actinomycosis should be complex and long-term. Antibiotics, iodide preparations, X-ray, transfusion of blood components, specific actinolysate are applied. The actinolysate is entered intracutaneously or intramuscularly according to the method of G. R. Suteyev and D. I. Asnin two times a week after the scheme starting with 0.5 ml, increasing the doze by 0.1 ml up to 2.0 ml (20–25 injections for the course, which can be repeated in 2–3 months. Surgical removal of dense infiltration is made if it is possible.

SYPHILIS

Syphilis is a venereal disease caused by pale spirochete (treponema pallidum) of spining forms, the sizes of 5–15 microns, facultative anaerobe.

Infection is transmitted basically by the sexual way. The direct way of infection through the skin injury, blood and its components transfusion and indirect one (household) are possible.

Getting in an organism of the person, treponemas settle in the regional lymph nodes.

Diagnosis of syphilis is carried out by microscopic way and serologic method — the Wassermann's reaction.

Syphilis is characterized by staged course.

In 5–8 days after infectioning the primary syphilis declares itself by formation of the hard chancre (inflammatory response of the mucosa or the skin on inoculation of spirochetes), exudation, infiltration with lymphocytes and macrophages of the injured site, proliferation of the connective tissue, necrosis of the epithelium, regional lymph nodes enlargement. Hard chancre, or the primary syphilis, spontaneously disappears in 2 weeks without a trace. Lymphadenitis disappears in a month.

The second period of the disease (secondary syphilis) comes in 1.5–2 months. The secondary syphilis is the manifectation by general damage of an organism and declares itself by weakness, fever, headache, general lymphadenopathy, pains in the whole body, enlargement of tonsils, local syphilides — rashes on the skin, mucous membrane of the mouth, vagina, conjunctiva. The wide condylomas and indurative keratosis form around the genital organs and anus as a result of chronic irritation by discharge.

The tertiary syphilis is consequence of secondary syphilis and develops in 3–4 years after it, sometimes — later. The morphological substratum of the tertiary syphilis is formation of gumma, in the internal organs. Gumma is the proliferative-necrotic form of the limited inflammation as granuloma, caused by spirochaetemia. Syphilitic gummas are subject to disintegration. The necrosis of superficial gummas causes formation of deep ulcers, which will penetrate into the thickness of soft tissues and bones with danger of development of secondary infection, formation of deep necrosises, which after healing leave rough cicatrices, which deform the skin surface. The flat and tubular bones are damaged causing periostitis, osteitis, osteomyelitis in the tertiary period of syphilis.

The syphilitic periostitis is accompanied by significant osteoblastic periostic reaction of locally limited type with formation of painful nodes in the periosteum and deformation of the bones. The osteitis is accompanied by focused destruction of the bones with formation of small sequestered and significant periosteal reaction.

The syphilitic osteomyelitis is characterized by focused necrosis, sequestration of bones, acute osteoblastic periostic reaction with its ossification and calcification, obliteration of the bone medullary cannel, and the bone (for example the shin bones) looks like a deformed formation. It is enaburation of the bones.

Clinically tertiary syphilis of bones manifests itself by night pains in the bones, insignificant infringement of function of extremities, loss of sensitivity.

The differential diagnosis should be made with bone tuberculosis, chronic osteomyelitis, malignant osteosarcomas.

Treatment of syphilis is specific: antibiotics, in particular preparations of penicillin. Destructive changes in bones are treated by the surgical way with application of various plastic orthopaedic operations.

Lecture XX

PARASITOGENIC SURGICAL DISEASES

About 150 kinds of worms and their germs can parasitize in a person's organism. Only some of them have value in surgical practice.

Echinococcosis is a disease of animals and people, caused by echinococcus. In home animals — sheep, goats, cows, pigs — it parasitizes as a blister form, and dogs, wolves, jackals, foxes that eat these animals, are infected and become a source of infection for people. Echinococcosis is spread in zones of intensive animal industry.

The worms' eggs, after they have got into the person's intestines, release from their membrane, which ejects the germ and penetrates the intestinal wall, and later — the blood and lymphatic vessels. By the v. porte system, it is brought to the liver, where up to 60–70% of the parasites start to develop. Others penetrate into the large blood circulation and lungs where up to 10–15% of the germs are held. Less often the parasite gets in the left auricle and ventricle, then again in the large blood circulation where the germs can be taken to any organ: kidneys, spleen, muscles, thyroid gland, the genitals, etc. Thus, the liver is most often damaged — 75%, lungs — 15%, less often other organs and tissues.

At the fixation place the germ looses its hook and starts to develop in a new form — hydatidosus, or blister. Echinococcus blister is a cystomic hollow formation. The cyst has a chitinous membrane filled with a transparent white or opalesced liquid. The blister grows slowly — in 1 month the diameter increases by 1 mm. The cyst can reach enormous sizes. Increasing, it compresses and atrophies the surrounding tissues, which, in its turn, causes aseptic productive inflammation and the formation of a fibrous capsule.

On the internal surface of the chitinous membrane, in a so-called germinal layer, new (daughter) blisters and scolex are formed. In the daughter blisters new generations of scolex — daughter blisters develop. The formation of daughter blisters can occur on the external surface of the chitinous membrane by their budding and the formation of a new cyst. Each of the numerous blisters and isolated scolex are potentially dangerous concerning infection. If during an operation the contents of the blister get on tissue, it is necessary to expect the spread of the process. Independent destruction of echinococcus is seldom marked — suppuration of the cyst, calcareousness of its capsule.

There are no pathological signs of an echinococcus cyst, frequently it reaches enormous sizes asymptomatically, grows very slowly for 10–20 and even almost 40 years.

The *clinical course* of echinococcus disease has three stages:

1. Asymptomatic — begins with the larva (oncosphere) getting into tissue and till the occurrence of the first clinical displays.

2. Stage of clinical displays — predetermined by the pressure of the cyst on the surrounding tissues and organs.

3. Stage of complicated echinococcosis: perforation, breaking of the cyst into the hollow organs, abdominal cavity, pleural cavity. All this is accompanied by the pain syndrome. In case of suppuration of the echinococcus cyst, at the site of swelling the pain amplifies, fever, intoxication, disgusting sweating are observed.

If the cyst compresses vital organs ascites, mechanical jaundice, parasthesia can occur. With the breaking of the cyst into the bronchial tube — a lot of sputum is released containing echinococcus blisters and fragments of the chitinous membrane. With damage to the bones pathological fractures, dislocations, infringements of joint functions, formation of fistulae are observed.

Diagnosis. Isotopes accumulation defects in the zone where the cyst is located are determined on the scanning image. Radiologically one or multichamber formations, sometimes with a level of liquid or site of calcification in the damaged zone appear. Auxiliary displays are enlargement, shift, and deformation of the organ.

Angiographically the vascular pattern becomes vague till the avascular zones is observed. During ultrasonic exam the formation, filled with liquid, is determined. During the computer exam — cyst formations in the organ.

Laboratory: eosinophilia is revealed in the blood, positive specific skin allergic test — the Casoni's test (0.2 ml diagnosticum are entered). However, in 10–20% of the patients this reaction is absent.

Recently the Casoni's test is not used because of pronounced sensitization of an organism (it can even cause anaphylactic shock) and low diagnostic value (in 20% of the cases there can be erroneous results). Today in diagnosis, the agglutination reaction (the Fisherman's reaction), safe and informative, is applied.

Treatment of echinococcosis is mainly surgical — radical echinococcectomy, removal of the cyst with the capsule or with a part of the organ. If it is impossible to remove the parasite, an open echinococcectomy, preventing the spread scolex into the tissue, is conducted. The contents are deleted; the chitinous membrane and a part of the fibrous membrane are incised. The cavity is processed with antiseptics having a specific action (formalin, hypertonic solution of sodium chloride with hydrogen peroxide) and drainage. In order to reduce the cavity, the capsule is sometimes sutured.

Human alveococcosis is a disease with primary damage of the liver by larva (alveolar or multichamber echinococcosis).

Basic hosts for the helminth — arctic fox, fox, dog, cat (the intestines are parasitized by the stitch helminth).

The larval stage takes place in the organism of rodents (mice, muskrats) and humans. Arctic foxes, foxes, dogs, cats are infected when eating mice containing the parasite in their intestines; the parasite reaches sexual maturation and release oncospheres. A person is infected by using foods and water, while removing infected animal's skin, as well as during contact with pets — dogs, cats. From the intestines, the larvas get into the liver where they grow. Metastasing occurs in the lungs and brain. By their appearance, the nodes remind porous cheese, and small cavities with putriform contents are observed in their layer. In case of suppuration abscesses in the liver, cholangitis arise. The disease develops for a long time. Primary signs of the disease can be cholangitis, mechanical jaundice, metastasises of alveococcosis in the lungs and brain. Tumourous formations in the liver can reach significant sizes therefore the liver increases, becomes dense, but pain is not present. In order to establish the diagnosis allergic tests are taken into account (eosinophilia, the Casoni's test and hemagglutination with latex, which yields positive results in 70–75% of patients).

For diagnosis roentgenography, angiography, tomography, radionuclide scanning, echography, computer tomography, as well as roentgenography of the thorax and neurologic examination are used.

Treatment: hepatic resection together with the node is conducted, other tissue is infiltrated with antiparasitic solutions (0.1% solution of trypaflavin — 20 ml). Levamisol, mebendazol are used in antiparasitic therapy.

Preventive measures of echinococcosis, alveococcosis consist in strict following the epidemiological mode, the infected organs of animals should be eliminated. It is necessary to prevent contact with dogs, especially for children who do not understand the danger of infection and the consequences. Veterinary supervision for service dogs is important.

Ascariasis is intestinal helminthiasis. The causative agent: round ascaride helminth; source of infection — people. The worms' eggs, excreted with excrements, mature in the ground. With polluted vegetables, fruit, dirt they enter the digestive tract. Through the mucous membranes of the small intestines the larvae go deep into v. porta and penetrate the liver and further get to the lesser circulation. In the lungs the larvae leave the vessels, go deep into the bronchioles, then into the bronchial tubes, pharynx, with sputum enter the stomach and intestines where they reach sexual maturity. Ascariasis can lead to complications, which require surgical treatment.

Intestinal impassability develops with the obstruction of the intestinal orifice by parasites. The clinical picture is similar to obturation obstruction. In case of inefficiency of conservative treatment, surgical intervention is conducted: they separate the ball of ascaride and move them to the orifice of the large intestine with following dehelminthization.

Ascariasis of appendicitis has no specific displays. Ascarides in the appendix are an operational find.

Ascariasis of the liver and biliary ways is observed seldom, the parasite gets through the papilla and cause congestion of bile secretion. The clinical picture is characterized by mechanical jaundice, purulent cholangitis, hepatic abscesses. Retrogradic cholangiography, ultrasonic exam, computer tomography assist in determining the diagnosis.

Treatment is surgical: cholecystectomy, choledochotomy, removal of the ascarides and external drainage of the biliary ways, opening and draining the hepatic abscess.

Ascariasis of the pancreas develops when ascarides fill the bile excretion tract. It appears as chronic indurative or acute pancreatitis.

During ascaride perforation of the GIT organs the clinical picture of peritonitis develops.

Postoperative complications of ascariasis are predetermined by the migration of ascarides after the operation.

Taking into account the severity of surgical complications of ascariasis, inspection of patients on the eve of an elective operation is indicated; in case of revealing ascariasis dehelminthization is conducted.

Opisthorchosis is helminthiasis of the hepatobiliary systems and pancreas. The causative agent of opisthorchosis is siberian or feline opisthorchis. Basic hosts are people, cats, dogs, foxes, white foxes. The intermediate host is carp fish (ide, roach, bream, etc.).

Helminths' eggs get in to water with excrements and are swallowed by mollusks, where they turn into larva which enter the water and actively get in the body of fish, where encyst in the muscles and the hypodermic tissue. The use of unthoroughly fried and salted fish that contain helminth germs, results in the infection of a person. In the liver the helminths cause the development of necrotic and dystrophic processes. The most often complications — purulent cholangitis with the formation of hepatic abscesses. Chronic opisthorchosis frequently results in liver cancer. Damage to the pancreas by opisthorchosis can entail acute pancreatitis, and chronic damage leads to pancreatic cancer. Pathological symptoms are not observed, therefore the diagnosis is determined on the basis of clinical and specific methods of examination, the presence of helminth eggs in the duodenal contents.

Treatment. Dehelminthization is conducted on the eve of the operation and after it. Chloxilum (chloroparaxinolum) is appointed according to a special scheme as an antihelmintic means.

Amebiasis is a disease caused by amoeba with prevailing ulcer damage to the large intestines, possible hematogenous dissemination of the agent into the internal organs (the liver, the lungs, the brain, etc.) with the development of abscesses. The disease is spread in tropical countries. The basic source of infection is people who excrete the cysts of amoebas with feces. The cysts of amoebas which get in the digestive tract result in the development of the disease. In the large intestine, the amoeba get in the submucous layer, necrosis (ulcers) develops around them. Through the vessels, the amoebas get in the blood and spread into other organs (liver, lungs, etc.) where they cause the formation of abscesses. Ulcers in the intestines can perforate causing peritonitis.

The *clinical picture* of amebiasis of the intestines is similar to the picture of bacterial dysentery; it is characterized by general symptoms of intoxication (fever, weakness, indisposition), often defecation with slime and blood.

The diagnosis is confirmed when amoebas are revealed in feces, and with the help of specific serological reaction. In case of intestinal perforation the diagnosis is determined on the basis of the clinical picture of peritonitis, but with severe intoxication symptoms of irritation of the peritoneum are pronounced poorly. With gangrene of the intestines they resort to its resection with the formation of colostoma. If the opening can be sutured, they do it and nothing more. Sometimes amoeboid colitis comes to an end with the development of amoebic granuloma — around the ulcer an inflammatory infiltration is formed. By the morphological structure this is chronic productive inflammation with eosinophilic infiltration and necrosis of cells. The cecum and the ascending colon are more often damaged. Colonoscopy and determining amoebas in stool play an important role in diagnosis. Amoebic granuloma results in obturation obstruction. *Treatment* is conservative. In case of inefficiency of conservative treatment and complications they resort to surgical treatment.

Appendicitis during amebiasis is predetermined by the development of specific ulcers. Characteristic attributes are not present.

The disease can have signs of intestinal bleeding.

Treatment is conservative with obligatory application of antiamebic preparations. Surgical treatment is introduced only with vital indications (in case of inefficiency of therapeutic means), as well as resection of the bleeding intestine is conducted.

Hepatic abscesses is the most often complications of amebiasis, observed in 2–10% of the cases. These abscesses do not have a pyogenic membrane because their contents irritate the tissue. The contents is pus with a haemorrhagic coloring without an odour. The accompanied secondary infection gives an odour to the purulent contents and change color. The clinical picture is similar to hepatic abscesses: intoxication, pain, enlargement of the liver, icterus. Radiological, radioisotope exam, ultrasonic and computer tomography, amoebas presence confirm the abscess diagnosis.

Treatment should be complex and include antiamebic, antibacterial and disintoxication therapy. The main method of treatment is punctuation with the removal of the contents and introduction of antibacterial and antiamebic preparations. With its inefficiency they resort to operative intervention (opening, drainage and corresponding conservative treatment).

Metastasing of amoebas to the lungs causes pneumonia and abscess of the lungs. The clinical picture is similar to that one for any microflora. To treat the abscess they apply bronchial sanation, with the absence of a positive effect, a puncture of the abscess with the aspiration of the pus with introduction of medical products is carried out.

Amoebic abscess of the brain is observed seldom. Treatment: antiamebic and antibacterial preparations, and removal of the abscess together with the capsule.

With the presence of all kinds of amebiasis complex treatment with obligatory application of antiamebic means is carried out: Emetinum, metronidazole (trichopol, flagyl), chingamin (delagil) according to certain schemes stated in the course of the infectious diseases. Preventive measures of surgical complications of amebiasis consists in general epidemic actions and active treatment of patients with amebiasis of the intestines.

Filariasis is the general name for helminthiasis caused by filaria. Wuchereriosis and brugiosis have got the greatest value in surgery. They are characterized by damage to the lymphatic system. Filariasis is widespread among the population of tropical countries: Africa, South America, Southern Asia. The helminthes parasitize the lymphatic vessels and nodes. Their larvas are in lymph and blood, source of invasion — sick person, monkey, dog, and cat. The larvae are transmitted by mosquitoes of the family Anophelex, Kulex, etc. The development of microfilariasis lasts for 8–35 days. The growth and development of the helminths in the lymphatic vessels results in infringement or full termination of lymph flow in vessels. Lymphostasis results in elephantiasis.

Clinical picture. Fever, headache, general weakness. Lymph nodes are dense, painful, lymphatic vessels look like dense cords of red color, painful during palpation.

Lymphangitis spreads from the proximal parts to the distal. The primary focus of inflammation is absent. Lymphangitis precedes the increase of the axillary and inguinal lymph nodes. At different sites of the body, a stratching rash like urticaria, appears. Gradually the inflammation decreases, and in some months or years renews. In 2–7 years the secondary stage — lymph vessels varicosis, lymphostasis, ruptured vessels, lymphorrhea begin. The lymph nodes are sharply enlarged. The accompanied secondary infection results in the development of phlegmons, abscesses. The third stage of the disease is characterized by development of elephantiasis, more often on the legs, breast, and vulva.

The diagnosis is determined on the basis of the clinical picture and revealing microfilaria in the blood.

Treatment. During the initial stages: antiparasitic therapy — ditrasine citrate (baroside, tetrazine) a dose of 0.1 g three times a day for 7–10 days. The control over treatment is carried out if the microfilarias are found in the blood. If necessary, the treatment is repeated. With the presence of secondary infection antibacterial therapy is appointed. Abscesses, empyema pleuras, peritonitis are subject to surgical treatment. With elephantiasis the changed tissue is completely incised with following dermaplasty. Surgical treatment is necessary even if the parasites are not found in the blood. If they are revealed again, dehelminthization and then surgical treatment are conducted.

Paragonimiasis is a disease caused by helminths which damage mainly the lungs and brain of a person. It is observed in the Far East (China, Japan, Korea, Philippines), as well as in Africa, South America. The causative agent: trematode. Basic host: people, cats, dogs, pigs, tigers, mongoose. Additional hosts: fresh-water crabs and crayfish.

The eggs excrete with sputum, less often with excrements, get in to the water, in 4 weeks larva come out, penetrate into the body of mollusk and turn into cercaria. The cercaria leave the mollusk and penetrate the body of crabs or crayfish where encystment occurs. The usage of crabs or crayfish which are insufficiently thermally processed results in infection. In the small intestine immature paragonimuses leave metacercaria and, perforating the intestinal wall, penetrate into the free abdominal cavity, move towards the diaphragm and through it get into the lungs, where they settle and mature. Around the parasite inflammation takes place with growth of connective tissue cysts, filled with pus, parasites and their eggs. Retropulmonary forms of paragonimiasis result from hematogenous metastases from the lungs in case of destruction of pulmonary tissue and vessels. In the brain, multiple cysts are observed.

The clinical picture of paragonimiasis is determined by the period of deepening, migration and development of the parasite. First the abdominal syndrome is observed, characterized by enteritis, phenomena of acute stomach, acute hepatitis. The rooting of the parasite in the lungs has clinical displays, such as bronchopneumonia, acute bronchitis, haemorrhagic pleurisy. Later there are such symptoms as pain in the chest, paroxysmal cough in the morning with purulent sputum, pneumorrhagia, fever. During auscultation rattles are determined, more often wet. Frequently pulmonary bleedings, dyspnea occur. Intoxication causes tachycardia, dystrophic changes in the myocardium, neurologic semiology — headache, dizziness, fatigue.

Paragonimiasis of the brain appears as meningitis or meningoencephalitis which develops against a background of pulmonary paragonimiasis. The basic symptoms — significant headache, convulsive epileptic attacks with full or partial loss of consciousness, dizziness, narrowing of the visual field and decrease in visual acuity. Laparoscopic or during laparotomy haemorrhagic, fibrinous and fibrinopurulent effusion is marked; during microscopic exam immature forms of helminths are observed. It is necessary to take into consideration the anamnesis — the use of meat, crabs, crayfish, paragonimiasis dwelling in the epidemic place. These patients' sputum has a chocolate or bright red color, viscous; microscopic exam reveals a congestion of parasites eggs. In the blood: eosinophilia, frequently lymphocytosis, hypochromic anemia. The intradermal test with special antigene is positive, great itching, lymphangitis. Radiological exam reveals more often small or large blister-like, linear, ring-shaped, diffuse shadows in the middle area of the lungs.

With paragonimiasis of the brain the clinical picture, brain symptoms, laboratory exam, epidemiological parameters allow to determine the correct diagnosis. The topographical diagnosis is determined on the basis of radiological and angiographic investigations.

Treatment is conservative — Bithiolum internally for 10 days in the dose of 30–40 mg/kg of weight a day 2–3 times. Inefficiency of conservative treatment, repeated pulmonary bleedings, progressing exhaustion, and constant pneumorrhagia are indications to surgical treatment (pulmonary resection). With damage to the brain, indications for surgical treatment (removal of the cyst) are increase in mental and neurologic symptoms, inefficiency of conservative treatment.

Fascioliasis is helminthiasis with damage of the hepatobiliary system. It is observed in France, Cuba, in our country it is rare. The causative agent: fasciola hepatic. Constant host: people, big and small horned cattle, pigs, horses. Intermediate host: mollusk, small leaches. From the helminth's eggs which are in water, larvae leave and penetrate the mollusk. The larva which develops in the mollusk's body enters the water, where it encapsulates. From the reservoir the larva gets into an organism and locates in the biliary tract, the gallbladder, rarely in other organs. Fasciola hepatic which parasitizes in the biliary tract, damages the epithelium. Such conditions are favorable for the penetration of purulent microflora, which, in turn, causes cholecystitis, hepatic abscesses, cholangitis, mechanical jaundice, which require surgical treatment. Patients with fascioliasis display attributes of an inflammatory disease of the gallbladder and channels. During an operation on the biliary tract and in the cavity of an abscess it is possible to find fasciola hepatic. Surgical intervention is carried out traditionally, antiparasitic treatment is carried out with the help chloxil or emetine hydrochloride.

Lecture XXI

ONCOLOGY

Oncology (from Greek *oncos* — tumour) is a science which studies aetiology, pathogenesis, clinical course, diagnosis and treatment of tumours. Synonyms: blastoma, neoplasm.

Tumor is a pathological formation that spontaneously arises in different tissues and organs and is distinguished by polymorphism of structure, isolation, progressive unlimited growth. Tumours are in the group of most widespread diseases.

According to the data of WHO more than 5 million people annually die from malignant tumours, from them 1.4 million — in Europe in industrially advanced countries. The morbidity with malignant tumours in the world exceeds 6 million. Today malignant tumours occupy the second place for the death rate after cardiovascular diseases. Among all tumours cancer makes up 65%. By frequency, among cancer of different localization lung cancer (42.6%), stomach cancer (29.9%) prevail for men. Among the reasons for death from malignant tumours, breast cancer and genital cancer are the leading for women. By data of WOHP in 2,000, more than 10 mln of people needed a special treatment for malignant tumours annually. It is possible to explain the morbidity growth because the increase in life expectancy of people in economically advanced countries, influence of cancerogenic substances in the environment, increase in amount of population and improvement of diagnosis.

Aetiology and pathogenesis. Today there is no unique theory for the origin of tumours. Among the existing theories physicians draw their attention to the following:

1. The theory of irritation suggested by R. Virkhov. According to this theory the reason for tumours is long action of irritating substances on tissue resulting in reorganization of cellular structures, cellular polymorphism and their progressing and unlimited growth.

2. The theory of embryonic origin, offered by Kongheim. According to this theory, a tumour arises from embryonic cells, which during the time of embryonic development did not take part in the construction of an organ, were not subject to differentiation, i.e. remained in germinal condition. Then as a result of the action of any chemical or mechanical stimuli they start to divide impetuously, forming a tumour.

3. Virus-immune-genetic theory suggested by L. A. Zilber. According to this theory, the growth of a tumour is caused by specific viruses. It is known about their existence. Experimental models of oncological diseases are created in animals. When these viruses get in cells, oncogenes are formed that break the normal regulation of cellular division. Cancerogenic factors which operate on the cell in a chemical or physical way strengthen the activity of viruses.

4. Recently the polyaetiologic theory of malignant tumours, which recognizes multiple reasons for the occurrence and development of neoplasm, received the greatest recognition: action of cancerogenic substances, long action of physical and chemical stimuli, genetic factors, influence of tumoural viruses.

Depending upon the tissue where the tumour develops epithelial, connective, muscular, vascular, nervous, bone, cartilaginous and mixed tumours are distinguished. According to the morphological features and tumoural growth in an organism the tumours are divided into benign and malignant.

Benign tumours are characterized by the presence of a capsule separating them from the surrounding tissue; they usually do not cause complaints, grow slowly, do not sprout into surrounding tissue. With localization of benign tumours in internal organs, the clinic of mechanical compression of these organs is observed. Superficially located benign tumours during palpation are mobile, not connected with surrounding tissue, painless, usually elastic consistency. The contours of tumours are easily determined, regional lymph nodes are not increased. These tumours do not recur after radical removal; they also do not give metastasises. By the histologic structure they differ little from the tissue from which they occurred. The following tumours belong to benign: epithelial — adenoma, from muscular tissue — myoma, from connective tissue — fibroma, from nerve tissue — neurinoma, from fatty tissue — lipoma, from vascular tissue — angioma, from cartilage — chondroma, from bone tissue — osteoma.

Tissue and cellular atypism is typical for **malignant tumours**. They completely differ from the initial tissue by structure and function. Their cells are immature with many mitosis, roughly divide. The important feature is biochemical atypism. If in healthy tissue metabolism occurs by the type of tissue respiration with end-products of CO_2 and water, in malignant tumours — by the type of anaerobic or aerobic glycolysis with the accumulation of acids from the Crebs cycle in an organism. It is an uneconomical way of metabolism, which results in weight loss, intoxication and cachexia.

In the early stages of the disease patients almost never complain of pain, but there can be a feeling of heaviness, presence of a foreign object. Characteristic for the oncological anamnesis is continuous escalating of symptoms. The anamnesis of the disease with malignant tumours, as a rule, happens short, but it is necessary to remember that if the tumour arises against a background of chronic inflammatory process the anamnesis can be long-term.

Objective inspection of patients with tumours is based upon usual methods of clinical study, i.e. exam, palpation, percussion and auscultation. Great value is the revealing of certain symptoms characteristic for tumoural growth during the patient's examination. The "plus tissue" symptom is typical for proliferative through the lymphatic and blood vessels in different organs of the body. After removing malignant tumours they can recur.

Features of malignant tumours in contrast to benign ones is their property to influence the general condition of an organism, to cause cancer intoxication, appearing as anemia, weight loss, exhaustion. Malignant tumours from epithelial tissue are referred to as cancer, from connective tissue — sarcoma. Patients with cancer make up 95% of patients with malignant tumours and 5% — patients with sarcoma.

Sarcomas are more malignant than cancer, because their metastasis is hematogenous. Thus, remote metastasises appear early, resulting in the death of the patient.

Special attention should be paid to so-called pre-cancerous diseases. In general it is known that the development of malignant tumours can be preceded by chronic diseases, repeated traumas to tissue. Such diseases are trophic ulcers and fistula which do not heal for a long time, chronic stomach ulcer, anacid gastritis, polyps of the GIT, mastopathy, cervical erosion, papilloma, congenital pigmentary spots, etc. The doctor should have oncological vigilance concerning these patients. These patients should be under constant supervision, regularly, no less than once every six months be examined and surveyed by a doctor.

Endoscopes, designed with the use of glass-fiber optics, so-called fibroendoscopes (fibrotic bronchoscope, fibrogastroduodenoscope, thoracoscope, fibrocolonoscope, etc.) received wide application during early diagnosis of tumours of the hollow organs or cavities of the body. They allow not only to find tumours but also take tissue samples for histologic exam.

With the revealing of atypical polymorphic cells, the malignant character of the tumour is specified, which considerably improves early diagnosis and results in early radical treatment. Endoscopes allow the taking of tissue smears and conducting their cytologic exam. The rinsing waters, exudate from the cavities, sputum, discharge from the vagina or breast, smears from ulcers, etc.

Radiological exam, which allows to determine not only the presence of a tumour but also its localization and prevalence, tumoural deformation of hollow organs and changes in their function, occupies a leading place in diagnosis. Besides of usual radioscopy and radiography, now for diagnosis of tumours tomography and kymography (an instrument for recording the flow and varying blood pressure within the blood vessels) of organs and tissue and also contrast research of vessels (cavo- and aortography, selective angiography) are applied. For the diagnosis of tumours of parenchymatous organs, endocrine glands and blood vessels radioisotope diagnosis with the application of isotopes for registration of radiation of radioactive isotopes entered into an organism and preparations made on their basis, for example, technetium, albumine, thallium have special value.

Recently in the diagnosis of tumours special methods of examination, for example, computer tomography (CT), position emission tomography (PET), ultrasonic research, based on the account of different protective properties of tissue of different density are widely applied. These methods are especially valuable in revealing tumours in parenchymatous organs, brain and heart. Now immunological methods of diagnosis of tumours have also been developed and improved. They are directed on the definition of macromolecules of antigens connected to the tumour (alpha-fetoprotein, alpha-2.4-fetoprotein, canceroembryonic antigen), isoenzymes, ectopic hormones and monoclonal antibodies (M-protien) as endocellular, and on the surface of cells or in liquid environments of an organism.

Complex examination of patients with the application of special methods of research allows the finding of tumours at an early stage of development and thus considerably improves the results of treatment and prognosis with this pathology.

Classification of Malignant Tumours

With the revealing of oncological diseases in patients, the doctor should determine the prevalence of tumour, which predetermines the plan of treatment. With this purpose N. N. Petrov suggested to distinguish 4 stages of growth of malignant tumours:

I stage — tumour is localized, diameter up to 2 cm, locates only in that layer of the organ where it occurred, does not extend into the next layers of the organ. Lymph nodes are damaged, metastasises are not present.

II stage — tumour has a diameter from 2 up to 5 cm, extends into the next layers of the organ, but does not leave its borders, closely located regional lymph nodes are damaged, but metastasises in other organ systems are not present.

III stage — tumour has a diameter from 5 up to 10 cm, extends in all layers of the organ, including the serous membrane, disintegration of the tumour can be observed, regional and remote lymph nodes are damaged, there are some metastasises in other organ systems.

IV stage — tumour has significant sizes, extends in the neighboring organs, multiple metastasises in certain organs and lymph nodes.

This classification takes into account the degree of tumoural spreading according to three basic attributes: sizes of tumour (T-tumour), presence of affected lymph nodes (N-modules, lymph nodes) and presence of metastasises (M-metastasises). In connection with this, it is called the classification according to the TNM system.

The symbol T characterizes the presence and sizes of a tumour and has the following stages: T0 — the primary tumour is not determined; T1 and T2 — a tumour of small sizes, diameter up to 5 cm, possible radical operation; T3 — tumour with a diameter from 5 up to 10 cm, seldom an extended operation is possible; T4 — the tumour envades the neighboring organs and damages their function, symptomatic treatment, if necessary — palliative operation is only possible.

The symbol N characterizes damage to regional lymph nodes: N0 — lymph nodes are not palpated; NX — there are no authentic data on lymph nodes; N1 — there are metastasises in regional lymph nodes; N2 — metastasises in lymph nodes of the second generation; N3 — damage to remote lymph nodes.

The symbol M means the presence of remote metastasises in other organ systems: M0 — absence of attributes of remote metastasises; MX — there are no data on the presence of remote metastasises; M1 — there are remote metastasises.

Criterion T for a tumour has its features. For example, for intestinal cancer T1 means that the tumour occupies only a part of the intestinal wall; T2 — the tumour occupies half of the intestinal loop; T3 — the tumour damages all the intestine, narrows its opening and causes the phenomena of intestinal impassability; T4 — the tumour circular narrows or obstructs the intestinal opening, causing total intestinal impassability.

For breast tumour: T1 — tumour with a diameter up to 2 cm, not connected with surrounding tissue; T2 — tumour with a diameter from 2 up to 5 cm, connected with the skin, gives a "lemon peal" symptom, predetermines retraction of the nipple; T3 — tumour with the size from 5 up to 10 cm, connected with the skin and fixed to the chest wall; T4 — tumour with a size of 10 cm, with damage to tissue of the chest wall or its disintegration.

The same is typical for damage to regional lymph nodes: for breast cancer the axillary and subclavical lymph nodes, for tongue cancer — submaxillary, for stomach cancer — lymph nodes of the small and large omentum, for uterine cancer — the lymph nodes of the parametrium and pelvic tissue.

Histologic classification which characterizes the degree of the hollow organ's wall invasion is applied for malignant tumours to the hollow organs and marked by the criterion "P".

P1 — cancer infiltrates only the mucous membrane; P2 — the cancer damages both the mucous and submucous membrane; P3 —cancer spreads to the subserous layer; P4 — the tumour infiltrates the serous layer and goes beyond the borders of the organ's wall.

Separately the classification according to the degree of malignancy is marked by the criterion "D": D0 — nonmalignant tumour; D1 — tumour is half-malignant or potentially malignant (basalioma, adenomas of the bronchial tubes, cranyopharyngioma, chondroma, hemangiotelioma); D2 — carcinoma in situ, pre-invasive tumour going through the noninfiltrating phases of development; D3 — a malignant tumour characterized by penetrating invasion, infiltration with infringement to the adjacent tissue, dissemination of tumoural cells and metastasises.

The reliability of a certain diagnosis of malignant tumour with the help of the applied techniques is pronounced by criterion “C”. The following degrees are distinguished: C1 — diagnosis is determined exclusively on the basis of clinical methods of research; C2 — special methods of diagnosis were applied, for example fibrogastroscopy; C3 — diagnosis is determined after diagnostic surgical intervention; C4 — after radical removal of a tumour with following histologic research; C5 — after pathoanatomical examination.

After establishing the diagnosis and stage of malignant process, the doctor should determine the clinical group the given patient belongs to.

The following clinical groups of oncological patients are distinguished:

Group 1a — suspicion of cancer. Patients of this group should be hospitalized; they are subject to careful examination with the purpose of excluding or confirming the given diagnosis.

Group 1b — patients with pre-cancerous diseases. Patients of the given group should be subject to active prophylactic medical examination. Systematic control with special methods of examination (radiological, endoscopic, cytologic, etc.) is applied.

Group 2 — patients who are subject to special methods of treatment (surgical, radiation, chemotherapy).

Group 3 — practically healthy people who received a full course of radical treatment. They are on dispensary watch, they are given a course of preventive antirecurring treatment. During the first year control examination of such patients are carried out 4 times, for the second year — twice, the next years — 1 time. If during the control examination there are relapses or metastasises of the tumour, the patients are transferred to the 2 group.

Group 4 — patients with widespread process in which special treatment is impossible to conduct, they are given symptomatic treatment.

Treatment for benign tumours is only surgical. The tumour is removed surgically together with the capsule. It is inadmissible to leave the capsule, because it can cause a relapse of the tumour. Surgical treatment of benign tumours is a radical way of therapy, does not give relapses and provides full recovery for the patients. The removal of benign tumours is conducted in cases if the tumour breaks the organ function, causes cosmetic defects, is a pre-cancerous disease or suspicious of becoming a malignant tumour.

Patients with malignant tumours require urgent treatment. There are such methods of treatment for malignant tumours as surgical, radiation, chemotherapy and hormonal-therapeutic.

The basic method of treatment of malignant tumours is surgical, combined with radiation or chemotherapy. Such kinds of complex treatment are called combined. The combination of surgical treatment with radiation can be carried out as pre- or postoperative irradiation, for example, with breast, cervical, ovarian cancer. Combination of irradiation with chemotherapy is possible, for example, for patients with myeloma and lymphogranulomatosis. Surgical treatment is not conducted only in those cases if the disease can be reliably cured with radiation or medical methods, for example, lip cancer. Contraindications for surgical treatment of a malignant tumour are its nonresectablity that is the condition which excludes the opportunity of radical surgical intervention in connection with metastasises.

Operations which are applied in the treatment of malignant tumours are divided into radical and palliative.

When performing a radical operation the surgeon should adhere to such requirements:

1. **Ablastic operations** — a malignant tumour should be removed within the limits of healthy tissue, as much as possible receding from visible borders of the tumour, in uniform block with regional lymph nodes. It is inadmissible to injure a tumour to prevent possible implantation of tumoural cells in healthy tissue. With this purpose during an operation it is necessary to change gloves and surgical toolkit. The ablastic operation should be carried out in the certain sequence. The operation is started at some distance from the tumour and at once blood and lymph vessels are ligated in order to interrupt ways by which tumoural cells can spread to other tissues and organs.

2. **Antiblastic actions:**

a) physical antiblastics — during the operation they use an electroknife, apply diathermy, cryogenic therapy, laser, ultrasound;

b) actinic antiblastics — irradiation with X-rays of the tumour site before an operation and during the postoperative period;

c) chemical antiblastics is disorganization and destruction of tumoural cells during an operation with 96% ethyl spirit, a solution of formaldehyde, regional perfusion and intra-arterial introduction of antiblastic preparations.

With neglected tumours of the III and IV stages with remote metastasises and pronounced intoxication radical operations are impossible. In these cases palliative operations can be executed, which are directed on the elimination of complications caused by tumours, without action on the tumour.

Radiation therapy in the treatment of malignant tumours is applied isolatedly or in combination with surgical, chemo-therapeutic and hormone therapy. Radiation therapy is based on selectively high sensitivity to radiation of little differentiated tumoural cells, which intensively divide. Ionizing radiation causes radiolysis of water resulting in metabolism infringement in tumoural cells. As a result of radiation therapy HO^-, H^+, H_2O_2 ions which destroy chromosomes of tumoural cells, their cellular membranes and power systems are formed. Malignant lymphomas (lymphosarcomas), tumours or the haemopoietic systems (myelomas), as well as certain forms of epithelial tumours are especially sensitive to radiation therapy. However, the pronounced formation of metastasises and relapses of tumours reduce the effect of radiation therapy in the mentioned malignant tumours. Radiation therapy is frequently combined with surgical treatment; it is applied for breast cancer, cancer of the uterus, lung, and intestinal cancer. Radiation therapy is conducted with X-ray irradiation, gamma irradiation with isotopes of cobalt, caesium, iridium, beta-irradiation with radioactive gold, phosphorus, directed streams of elementary particles (electrons, protons). The efficiency of radiation therapy is not identical for different tumours, and the course of irradiation frequently should be repeated several times. The dose of irradiation is determined by the oncologist together with radiologist. Radiation therapy can cause side effects and complications. They are connected to a decrease in the patient's organism reactivity and his immunity, with suppression of haemopoietic organ function, nausea, bad appetite, sleep disorders, palpitation and leukopenia. At the later period changes of the skin (inflammation and erythema) with the formation of trophic ulcers and necrosis can be observed. In the focus of irradiation careful care of the skin, application of dermaprotectors (skin protecting means) are necessary. During the course of irradiation it is necessary to constantly supervise the blood picture for revealing and correction of anemia and leukopenia.

Chemotherapy of malignant tumours is frequently combined with radiation therapy, especially in cases of recurring tumours, as well as at the late clinical stages. The medical therapy, applied with the purpose of creating antineoplastic effect is divided into chemo- and hormone therapy according to the type of action. Chemotherapy provides mainly direct cytotoxic influence on tumoural cells. Hormonal therapy is directed, mainly, for the regression of a tumour that has reached through artificial inductive shift in the organism's hormonal balance.

Antineoplastic preparations used now are classified as follows:

1. *Alkaloid compounds*

a) iprite-like substances (ethylamine chloride). Embihin, novembihin, dopan belong to them. These preparations are applied for lymphogranulomatosis, lymphoid leukosis, lymphosarcoma and reticulosarcoma. Sarcolysine is applied for seminoma, especially for the presence of metastasises, reticulosarcoma, Ewing's sarcoma, myeloma, malignant angioendotelioma.

Cyclophosphanum is applied for breast, ovarian and lung cancer, lymphogranulomatosis and lymphosarcoma. Cyclophosphanum has a wide antineoplastic effect, has softer action on thrombocytopoiesis as compared with other analogues;

b) ethylene imine: thiophosphamidum, thioTEF, benzoTEF are used for breast, ovarian and lung cancer.

Dipinum, thiodipinum are used for leukosis, lymphogranulomatosis and hypernephroma.

2. *Ethers of disulphonate acids*

Myelosan has a pronounced action for leukemic forms of chronic myeloleukemia, but quickly becomes unable to function.

Myelobromol is similar to myelosan, but in connection with different action mechanism it is more effectively and capable than myelosan.

3. *Antimetabolites*

Mercaptopurin is used for acute and subacute leukosis, active chronic myeloleukemia, reticulosis, chorionepythelioma of the uterus.

Methotrexate is applied for lymphogranulomatosis, lung, breast cancer.

Flurourasil, phthorafur are applied in the treatment of patients with cancer of the rectum, sigmoid and large intestines, for stomach cancer, including inoperable and recurrent breast cancer, cancer of the pancreas and ovaries.

4. *Antineoplastic antibiotics*

Dactinomycin is applied for acute and subacute leukosis, active chronic myeloleukemia, reticulosis, chorionepythelioma of the uterus, retinoblastoma, rhabdomyosarcoma.

Mytomycin is applied for breast, stomach cancer and cancer of the large intestines.

Olivomycin is applied for testicle tumours (seminoma, teratoblastoma, embryonic cancer), reticulosarcoma, tonsillar and other tumours.

Rubomycin hydrochloride is applied for chorionepythelioma, lymphogranulomatosis, acute leukosis, reticulosarcoma and neuroblastoma.

Bruneomycin is applied for lymphogranulomatosis, chronic lymphoid leukosis, Wilms tumour, neuroblastoma, reticulosarcoma, lymphosarcoma.

Adriamycin is applied for squamous cancer of the mucous membrane of the oral cavity, nasopharynx, throat and esophagus, cancer of the penis, ovarian and testicle teratoblastoma, lympho- and reticulosarcoma, lymphogranulomatosis, acute leukosis, breast, lung cancer, neuroblastoma, Wilms tumour, cancer of the thyroid gland and bladder.

5. *Alkaloids*

Vinblastin is applied for lymphogranulomatosis, lymphosarcoma, reticulosarcoma, myeloma.

Vincristin is applied for acute leukosis, reticulosarcoma, neuroblastoma, Wilms tumour, and also in complex treatment of lymphogranulomatosis, myeloma, breast cancer.

Colchamin is applied for skin cancer (including as 0.5% ointments) and in combined treatment of esophagus cancer.

The above-stated chemotherapeutic means are applied internally and externally, but frequently as injections — intramuscular, intravenous and intra-arterial. They are also entered in cavities, in tumoural tissue: on the extremities — by regional perfusion, and for tumours of internal organs — by long-term intravenous perfusion.

Chemotherapy of malignant tumours is divided into systematic and regional. Systematic chemotherapy allows the introduction of antineoplastic preparations by any of the mentioned ways, considering their general action on the tumour, its metabolism, thus taking into account features of pharmacokinetics.

Regional chemotherapy is based upon the introduction of preparation solutions with high concentration directly in the tumoural tissue by perfusion or partially (intra-arterial or endolymphatic infusion).

Chemotherapy is usually applied as a method of treatment of primarily widespread forms, relapses and metastasises of malignant tumours. It can be used also for preventive measures of progressive latent subclinical tumoural cells, which remain after radical surgical treatment. Such chemotherapy, a component of complex combined treatment, is called additional, or adjuvant.

In the clinical practice treatment can be carried out by one preparation — monochemotherapy or a combination of several preparations — polychemotherapy.

Hormonal therapy is applied for tumours of the hormone-dependant organs, for example, breast or prostate cancer more often. The sexual hormones slow down the growth of a malignant tumour.

Immunotherapy is applied to activate immune mechanisms of an organism during the postoperative period, as well as after radiation and chemotherapy. In order to increase the specific immunity they apply levamisol, zymosan, prodigiosan, interferon. Passive immunization is carried out with antilymphocytic serum, immunoglobulin, isolated antibodies, complement.

Tumours of the Connective Tissue

1. **Fibroma** is a mature tumour of the connective tissue, consists of separate bunches of fibers, between which connective-tissue cells are placed. The more connective cells, the softer the consistence of the fibroma. Mixed forms are frequently observed, which form with the participation of other tissues, for example, neurofibroma, fibromyoma, fibrolipoma. Fibromas can be isolated or multiple (fibromatosis). Treatment is only surgical.

2. **Lipoma** consists of fatty tissue, bunches of connective tissue are placed here and there. Lipomas have a pronounced connective-tissue capsule. If they are multiple, this phenomenon is called lipomatosis. Treatment is sirgical — the lipoma is removed together with the connective-tissue capsule.

3. **Chondroma** consists of mature cartilage cells, usually connected with the bone, formed in cartilaginous parts of fingers and toes more often. Treatment consists in radical removal of the tumour.

4. **Osteoma** consist of cells of mature bone tissue, develops in metaphyseal part of long tubular bones and in the ribs. Large osteomas can entail functional infringements and pain syndromes. Treatment is surgical.

Sarcoma (from Latin *sarcos* — meat) is a malignant tumour consisting of immature connective tissue cells. The section is pale and looks like fish tissue, grows quickly, infiltrates and damages surrounding tissue. It metastize early, and relapses after operative removal. Metastasises are spread in the hematogenous way therefore they appear in different tissues and organs. Histologic exam reveals different kinds of sarcoma: round cell, spindle cell, malignant giant cell tumour, etc. Sarcomas are mostly observed at the young age; the younger patient, the worse the prognosis. Osteosarcomas develop in long tubular bones, in pelvic bones and skull. They can develop in the bone marrow (central or myelogenetic) or in periostis (peripheral or periosteal). Osteosarcoma progresses very quickly and in short time gives numerous metastasises.

Muscular, Blood Vessel, and Nerve Tumours

1. **Myoma** is a benign tumour which consists of muscular cells. tumours which consist of smooth muscles are called leiomyomas, and from transverse-striped muscles — rhabdomyomas. Usually myomas are limited from surrounding tissue by a well advanced capsule. Multiple myomas are quite often observed. Treatment is surgical.

2. **Angioma** is frequently observed and quickly grows at children's age. Hemangioma is a benign tumour of blood vessels; lymphangioma is a tumour of lymphatic vessels. After the structure hemangioma is divided into capillary, cavernous (with the cavity) and cirsoid. Treatment is surgical, for large hemangiomas: stage-by-stage. Irradiation, cryotherapy, suturing or insertion of the leading vessels are applied for treatment. These tumours frequently recur. Lymphangiomas are observed less often, located on the lips, cheeks, neck, joints of the hands. After the structure: cystic and cavernous. Treatment is surgical, radiation therapy and electrocoagulation are also used.

3. **Glioma** is a tumour of the brain or spinal cord which develops from neuroglia cells. Depending upon the cellular elements and extent of their maturity, different kinds of glioma are distinguished: medula-, ganglio-, spongio-, astro-, oligodendroglioma. Even if the tumour is benign by structure, its localization can cause very serious and life-threatening infringements, irritation and compression of the brain or spinal cord. It can result in the patient's death.

Treatment: only operative and should be provided as soon as possible.

4. **Neurinoma** (synonyms: lemoma, lemoblastoma, neurilemoma) is a tumour of the peripheral nerves. It can be formed in the radix of the spinal cord, develops from Schvann membrane. Unlike to other benign tumours it is clinically accompanied by sharp pain. Treatment is surgical.

5. **Ganglioneuroma** (synonyms: ganglioma, cympaticocytoma) is a benign tumour which develops from elements of the sympathetic nervous ganglia, more often the abdominal and chest parts. Treatment is surgical.

Benign Epithelial Tumours

1. **Papilloma** (synonym: papillar tumour) origins out of pavement and transitional epithelium and acts above its surface as a papilla. It locates on the head, back, axillary area, near the anus, but it can be formed also in the bladder and intestines. Treatment is surgical — removing the tumours within the limits of healthy tissue with obligatory histologic exam, because malignancy is possible. Papilloma of the mucous membrane is cauterized by electrocoagulation.

2. **Adenoma** is a tumour which consists of fibroepithelial tissue and has a glandular structure. Depending upon the kind of gland papillary, cystic, tubular and alveolar adenomas are distinguished. More often these tumours are formed in the breast, testicles, kidneys, less often on the skin or mucous membrane. Treatment is surgical. It can become malignant.

3. **Dermoid** (synonyms: dermoid cyst, cystic teratoma) is a tumour which consists of the remainder of the embryon ectoderm. Usually it forms a cavity filled with fatty masses and other epidermal formations. More often dermoids settle in the coccyx, but it can locate above eyebrows, near the nose, on the neck and in the anterior mediastinum. Dermoid cysts frequently suppurate, forming abscesses and fistula, which do not heal. Treatment is surgical — removing within the limits of healthy tissue.

Malignant Epithelial Tumours

Cancer (synonym: malignant epithelioma) — develops from germinal or glandular epithelium, consists of connective-tissue stroma in which blood and lymphatic vessels locate, and parenchyma, formed from epithelial cells. If the tumour consists of large epithelial cells, it is called medullary cancer. If the connective-tissue stroma prevails, the tumour is called scirrhous carcinoma, and if glandular cells prevail — adenocarcinoma. Cancer can develop in all tissues and organs where there are epithelial formations, but more often it is observed in the stomach, uterus, breast, on the skin and in the lungs.

The formation of cancer begins with the occurrence of atypical epithelial cells, after that the connective-tissue elements of the stroma multiply. Cancer quickly invades the surrounding tissue and metastazes in to the lymph nodes. Metastasises are usually spread lymphogenously. The clinical picture of cancer depends upon the localization and stage of the process. Treatment of cancer is basically operative, but at the same time quite often other methods of treatment are also applied, for example: radiation therapy, chemotherapy and hormonal therapy.

Radical operation with keeping to ablastics and antiblastics is carried out only in the I and II clinical stages of cancer, in the III clinical stage it is hardly conducted, and in the IV clinical stage — generally impossible. In these cases they carry out symptomatic treatment, which is supplemented with radiation and chemotherapy and also palliative operations.

For rendering oncological help to the population special oncological services, structure which includes scientific research institutes, republican, regional and city oncological clinics, as well as oncological cabinets in each district clinic are organized. The task of oncological clinics is qualified treatment of patients with tumours and pre-cancerous diseases, preventive medical examination of the population, work with the statistical data and organizational-methodical management of oncological services, as well as improving the professional skill of the medical personnel and anticarcinogenic propagation among the population. An increase in the oncological vigilance of general practitioners, which first meet this pathology, should be given special attention.

Lecture XXII

DEFECTS OF DEVELOPMENT. PLASTIC SURGERY

Congenital abnormalities of the organism's development, during which its functions are damaged or impossible, are called maldevelopments. Those malformations, which deform the external form of a body, especially if they at the same time reduce viability of an individual, are named congenital malformations.

Small deviations from the normal type of the organism structure, which are on the verge of physiologic variations, are named anomalies.

A majority of people with heavy congenital malformations require surgical treatment. Duly operative intervention for some defects is the only means for rescuing the life of the patient.

Congenital malformations are known from ancient times, some rough infringements of body form drew attention to themselves during the prehistoric period. A number of the facts prove it. Rock paintings made many millennia ago represent twins which "conjoined". In the Babylon's cuneiform (3800–2000 B.C.), which is translated and published by the British museum in 1870, there is the table with 62 kinds of congenital malformations. It is known, that XI and XII dynasties pharaons (2400–1780 B.C.) were sick with pes equinovarus. In the main text of the Talmud edited in II centure B.C. a list of more than 100 kinds of congenital malformations is given.

Before the development of such disciplines as embryology and comparative anatomy, the occurrence of congenital malformations was explained by their paranatural origin, coupling with animals (hybrid theory), coupling during menses time, "maternal impressions", that is unexpected and strong impressions of the pregnant woman. The latter theory was supported by many scientists not only of ancient times but also during the Renaissance, for example, Paracelsus and Ambruas Paré. The most outstanding philosopher Aristotle recommended to guard pregnant woman against unpleasant impressions and surround her with beautiful objects that will promote the beauty of the child. Despite the fact that Aristotle proved the absurdity of the “hybrid theories”, there are documents that up to the XVII century in Denmark and America there were cases of execution of women who gave birth to children with congenital malformations and who were accused in coupling with animals or the devil. However, already in those days there were materialistic approaches concerning treatment of congenital malformations. Hippocrates explained the occurrence of some congenital malformations by mechanical influence on the uterus (trauma, compression).

Johan Meckel Jr. (1781–1833) gave especial contribution to the development of the doctrine about malformations. He described a significant amount of malformations, which were known before, created classifications for the malformations, tried to explain the reasons and mechanism of their formation. Meckel concluded that the majority of malformations are not whims of nature but consequences of damaged normal development of body, that to a certain extent is the recurrence of phylogenesis.

Genetic science considerably enriched our knowledge about the aetiology and pathogenesis of congenital malformations and expanded opportunities of their prevention. Direct transfer of some congenital malformations from parents to children was known even in ancient times. However, scientific proof of the genotype theory began only in the XX century, namely after the second discovery in 1890 by De-Frieze, Korens and Chermak of the basic laws of heredity of G. Mendel. In the beginning in 1955 about 1,500 hereditary diseases and congenital malformations became known. Genetic means of researches have got the widest application after the discovery of chromosomal aetiology of some already known syndromes (Down’s, Klinefelter’s, Shereshevsky—Terner’s) in 1959.

The study of questions concerning malformations proves that each deviation from the normal organism structure needs to be studied from two sides: how it arose and why it occurred. Comparative and experimental fetology answer these questions.

The reasons of occurrence of congenital malformations can be internal (endogenic) and external (exogenic). Endogenic reasons:

a) changes in the hereditary structures (mutation);

b) over-matured sexual cells;

c) age of parents.

Mutations can occur on the genic, chromosomal and genome levels. Genic mutations are connected to changes in the internal structure of certain genes and predetermine transformation of one kind of allele into another. With chromosomal mutations the following can occur:

a) interchromosomal exchange of segments;

b) doubling of the chromosomal site;

c) breaking of the chromosomes with the loss of a part of the chromosomal material.

Genome mutations are a change in the amount of chromosomes. An increase in the amount of chromosomes is observed more often, less often — reduction. Genome mutations are accompanied by changes in the phenotype of the fetus and can result in involuntary abortion or chromosomal illnesses like Down's, Edwards', etc.

External reasons for the occurrence of congenital malformations can be divided into four groups:

a) physical factors;

b) chemical factors;

c) infectious-inflammatory factors;

d) mental factors.

Physical factors: radiation influence. There is no direct proof concerning the doses of ionizing irradiation received by the modern person. However, in experiments on mammals it is proved that ionizing irradiation is the reason for many congenital malformations. The similar effect for a person is not excluded.

Mechanical factors which cause congenital malformations are as follows: amniotic conjoins, superfluous uterus pressure or a tumour on the developing fetus, in the case of oligoamnios or a large myoma.

Chemical factors include adverse influence of alcohol, lead, mercury, nicotine, benzene, chloroform, deficiency or reduction of magnesium salts, iron, iodine in the organism, insufficiency of vitamins A, D, E, B_1, C, as well as hormones. Insufficient supply of an organism with oxygen has great value.

Infectious-inflammatory factors are infections in early terms of pregnancy: rubella, measles, epidemic parotitis, infectious hepatites, smallpox, poliomyelitis, etc.

Negative factors, which influence the development of the fetus and cause congenital malformations, are long absence of pregnancy, artificial abortion, as well as tuberculosis, syphilis and other diseases.

During war the amount of deformities increases, which is a mental factor for the occurrence of congenital malformations.

In different countries the frequency of congenital malformations ranges from 1 for 83 newborns to 1 for 1587 newborns, i.e. on the average 1 congenital malformations for every 213 newborns. In the same country the amount of congenital malformations depends upon race. In America the people of the white race have the incidence of congenital malformations 2 times as much than for the black race (5.72— in whites and— 3.17 in negros for 1,000 newborns). Congenital malformations of the auricle for people of the yellow race are observed more often than for the black race and is even more often than for white people.

Classification of Congenital Malformations and Anomalies

It is accepted to distinguish single congenital malformations which concern infringements of development of one organism and double (multiple) deformities, which consists in infringement of development of two and more fetuses which are in the uterus at the same time.

There are distinguished the following groups of **single anomalies**:

a) anomalies of the sizes of the entire organism or certain organs: underdevelopment (hypogenesis, hypoplasia) or absence (agenesis, aplasia) of an organ or tissue; superfluous development of an organ or tissue (hypergenesia, hyperplasia);

b) anomalies of the amount of organs both in growth (polydactyly), and reduction (bidactyly);

c) anomalies of the form (talipes);

d) anomalies connected with the stopped development of organs, preservation of atavistic attributes, accretion or narrowing in unusual places: atresia, or stenosis of the anus; nonunion in corresponding zones of the developing fetus (brain hernias);

e) anomalies of localization — reverse accommodation of organs (heterotopia) — heart, appendix, liver, etc.;

f) Anomalies connected to infringements of genital development (true or artificial hermaphroditism).

Double (Multiple) Anomalies

If full division of a germ has taken place, monoovular twins develop and deliver. In case of incomplete division of two primary stria double anomalies arise. The embryos appear conjoined in variable positions (merging of the head, upper, middle or lower parts).

If the foetuses are identical in size, they are called symmetric; if one of them is more or less underdeveloped and connected with another, completely developed fetus, the anomaly is asymmetric (for example, amorphous — shapeless anomaly, or polymelia, when only some extremities remained from the foetus which grew together with the other normal foetus.

Double anomalies are distinguished according to the way of cytotrophy:

a) autositic — each fetus has an independent system of blood circulation;

b) omphalositic — each fetus nourishes through umbilical vessels;

c) parasitic — one of the fetus (parasite) has no independent blood circulation, thus on the body of the quite developed fetus there is another, less developed fetus.

According to the degree of viability and life expectancy:

1) organisms which perish during the early germinal period;

2) organisms viable during the intra-uterine period but are not capable of independent existence after birth (some malformations of the heart and the lung, GIT diseases, majority of the double anomalies;

3) organisms which are born quite viable and can continue to live after birth (anomalies of the extremities, partial giantism, etc).

In 1975 at the XXIX World Assembly of Public Health Services, the classification was adopted the basis of which is anatomical-physiological principle of dividing a person's body into the systems of organs:

A. Congenital malformations of organs and systems:

1) malformations of the CNS and sense organs;

2) malformations of the face and neck;

3) malformations of the cardiovascular system;

4) malformations of the organs of digestion;

6) malformations of the osteomuscular system;

7) malformations of the urinary system;

8) malformations of the genitals;

9) malformations of the endocrine glands;

10) malformations of the skin and its derivatives;

11) malformations of the afterbirth;

12) other malformations.

B. Multiple congenital malformations:

1) chromosomal syndromes;

2) genic syndromes;

3) syndromes which are predetermined by exogenous factors;

4) syndromes of uncertain aetiology;

5) multiple malformations of non-specified aetiology.

The amount of congenital malformations reaches more than 1,500, in this lecture we shall concentrate our attention only on those observed more often and give some examples from each anatomic system.

The part of congenital malformations in the CNS makes more than 30% from all malformations observed in children. Anencephalia is the absence of the brain, bones of the arch of the skull (acrania) and soft covers of the head. With congenital malformations of development of the arch of the skull, brain and its membranes, brain hernias occur. Depending upon the contents, brain hernias are divided into four groups:

a) meningocele is a tumour-like formation is the medulla membranes filled with liquid;

b) encephalocele — the tumour contains brain tissue, arachnoid and vascular membranes;

c) cephaloma — extrusion of the changed brain substance;

d) encephalocystocele is a tumour which like the brain tissue, contains spinal liquid.

Brain hernias are placed in typical places: in the front of the nose bridge (anterior brain hernia), posterior, below or above the occipital protuberance (posterior brain hernia — superior if higher occipital protuberance, and inferior if below it). Apertures in the bones are usually round with smooth and shiny edges. They are always smaller than the basis of the extrusion. Extrusions, as a rule, have a round form, elastic consistency, frequently fluctuate. When pressed on, it decreases, pulsates. An overwhelming amount of children with brain hernias die soon after birth as a result of meningitis or oedema of the brain.

Treatment: in the case of small hernias operation is indicated — they expose the basis of the extrusion, tie it, delete all of the extruding tissue and carry out plasty of the defect in the skull cavity.

Atelocephalia — absence of the big hemispheres and subcortex nuclei — severe defect of development, which is seldom observed.

Nanocephalia — reduction in the mass and sizes of the brain (more than 5 cm).

Macrocephalia (megalocephalia) — unusual increase in mass and size of the brain frequently accompanied by oligophrenia.

Hydrocephalia — congenital oedema of the brain, superfluous accumulation in the ventricular system or arachnoid space of spinal liquid accompanied by atrophy of the brain substance.

Defects of Development of the Face and the Neck

Infringements of development of the face, the auricle and the neck are diverse according to both aetiology and incidence and severity degree. Some of them are accompanied by only cosmetic defects (for example, double lip) or remain absolutely imperceptible (epicant), others lead to severe functional infringement in the neonatal period, causing high lethality in children. Defects of this group combine with infringements of development of other systems organs, the living prognosis depends upon their severity.

Deformities of the face occur, mainly, as the result of normal accretion of the clefts stopping in the germ, which take place at this period. Accretion occurs, as a rule, on the second month of the intrauterine life.

Cleft lip or hare lip is observed in one of 2,500 newborns. It can be unilateral or bilateral. Unilateral cleft can be on the right or left (more often on the left). Treatment is surgical. Different plastic operations are applied depending upon the defect. Operations can be performed 2 days after birth, but more often six months after birth.

Macrostomia — abnormally large size of the mouth; can be unilateral or bilateral. It is accompanied by hypersalivation. Treatment — sewing together the corners of the mouth.

Palatoschisis — cleft palate, “wolf mouth” can be full (cracks in the soft and hard palate), partial (only in the soft or only in the hard palate), midline, uni- or bilateral, through or submucous. There is 1 case in 1,000 newborns. The reason is delayed accretion of maxillary processes and vomer.

Treatment depends upon the severity, presence of other defects, includes not only surgical treatment (correction) but also regular dispensary supervision of the children’s doctor and the logopedist and if necessary other experts (neuropsychiatrist, otolaryngologist). Cleft palate in children at the age of up to 6 months is corrected with obturator, plastic operations are carried out for children of 3–6 years old.

Congenital vascular tumours of the face and neck — hemangioma and lymphangioma are frequently observed.

Hemangioma — purple-red, sometimes cyanotic color spots or tumours.

Lymphangioma — clinically appears as tumescence which sometimes reaches enormous sizes. The skin above the tumour is thin and a colorless liquid appears through it.

Congenital defects of the auricles are observed seldom, 1–2 cases in 10,000 newborns. These isolated infringements of development have rather small clinical value. The infringements of development of the auricle with syndromes range from deformations and infringements of the relief to rough deforming dysplasias and aplasias.

Congenital Defects of Development of the Neck

Short neck — truncation of the neck usually occurs on account of flattening of vertebrae corpus or intervertebral cartilages. It is observed with many chromosomal diseases.

Congenital muscular wryneck — shortenning of the sternocleidomastoid muscle because of focal fibrosis; therefore the child's head has an inclination to the damaged muscle. The reasons are unknown. Defect occurs often — 12% of all defects of the support-motor system. Treatment is surgical in early childhood.

Median cysts and fistulae of the neck are cavities from the remainder of the thyrolingual passage. They locate under the skin at the site of midline of the neck, between the thyroid cartilage and lingual bone. Size of the cysts is 1 cm.

Lateral cysts of the neck locate along the edge of the posterior belly of the digastric muscle or along the anterior line of the sternocleidomastoid muscle. Lateral cysts of the neck form from the nonreduced remainders of 2 branchial cleft and pharyngeal recess.

Defects of the Thorax

Full cleft of the sternum is observed seldom, combined with the heart prolapse.

Extrusion of the sternum does not cause the change in the organs of the thorax and is not subject to surgical treatment.

Absence or superfluous amount of ribs has no clinical displays and is more often diagnosed casually.

Defects of Development of the Thoracic Organs

Heart and vessel diseases is a group of the most widespread defects, which totals tens of nosological forms. Incidence: 6–10 cases in 1,000 newborns.

Acardia is the absence of the heart. It is observed only in asymmetric free twins.

Cardiac ectopia is accommodation of heart outside of the chest cavity. Cervical, abdominal and extrasternal ectopia are distinguished. The latter makes up 51.2% of all cardiac ectopia. Abdominal ectopia usually has an asymptomatic course, other defects result in death.

Dextracardia — heart location on the right. It is observed in inverse location of all internal organs and is a rare isolated defect.

Coarctation of the aorta — narrowing of the isthmus of the aorta. 1 case in 6,500 newborns is observed. This defect is twice as often in men than in women. Coarctation of the aorta appears as hypertension of the upper part of the body and hypotension of the lower one. First attributes are observed at the age of 10 months. Treatment is surgical with full correction of the defect.

Aortic stenosis. The narrowing can be observed both at the valve level and at the initial department of the left ventricle, less often — higher than the valves.

Defect of interatrial membranes is one of the most widespread heart diseases: 1 case in 1,000 newborns. It is observed in women more often than in men.

Three-chambered heart with one general atrium is the absence of the interatrial membrane. Enough rare and usually lethal defect which is connected to other heart and large vessels diseases. Treatment is surgical.

Fallot's tetrad — stenosis of the pulmonary trunk, high defect of the interventricular membrane with the diameter of 2 cm, dextroposition of the aorta. The fourth component of the defect is hypertrophy of the right ventricle. Clinical displays: cyanosis (amplifies with years), dyspnea, rough systolic noise in the second and fourth intercostal on the left. Prognosis is unfavourable. More often children die at the early age from infringements of blood circulation in the brain, but sometimes live 20–30 years. Treatment is surgical.

Fallot's triad — valval stenosis of the pulmonary artery connected to the interatrial membrane defect and hypertrophy of the right ventricle.

Transposition of vessels — the aorta comes out from the right ventricle, the pulmonary arteries — from the left one. With the absence of shunts (defects of the membrane, open arterial passage) the defect is not compatible with life. Prognosis is unfavourable. Children die under the age of one. Treatment is surgical.

Anomalies of the valves are generally the compound components of complex congenital heart diseases. Foraminous valves, valves with recesses, as well as increase and decrease in the amount of apertures of valves are not accompanied by haemodynamic infringements. Aplasia of the apertures of the semilunar valves, especially the aorta, is more often observed.

Defects of Development of the Respiratory System

Defects of the throat are not frequent and appear generally as infringements of development of the cartilaginous structures (thyroid cartilage, epiglottis), such as aplasia, hypoplasia, infringements of accretion, etc.

Tracheomegalia is an increase in the trachea, mainly because of an expansion of its aperture. Treatment: conservative.

Pulmonary agenesia (aplasia) — absence of the lung and the main bronchial tube. It occurs more often in boys. Left-side agenesia is observed twice as often than the right-side one. Treatment is symptomatic.

Pulmonary hypoplasia is a rather uniform reduction of pulmonary mass and volume.

Bronchogenic (disontogenic) cysts — round cavities of different sizes separated from the surrounding pulmonary tissue. The most often lung defect. Cysts can be solitary and multiple.

Congenital diaphragmal hernias is a moving of the abdominal organs into the chest cavity. It can be true or artificial (more often). In case of artificial hernias the hernial bag is absent. Treatment is surgical, with the presence of artificial hernias — emergency.

Defects of Development of the Digestive Organs

In the esophagus **atresia** is observed, which is usually accompanied with the formation of **tracheoesophageal fistula**. The following defects may develop:

a) two segments, which blindly come to an end;

b) one segment, that comes to an end blindly, and the second, which opens into the trachea;

c) two segments, which open into the trachea;

d) anastomosis between the trachea and esophagus.

These defects are accompanied by aspiration pneumonia.

In the stomach stenosis of the pylorus (pylorostenosis) is observed more often.

In the intestines stenosis and atresia, single or multiple, form. More often they locate in the duodenum and at the place of transition from the ileum into the cecum, as well as at the distal areas of the rectum. Full or partial doubling of the intestines both the small and large, and doubling of the appendix are occasionally observed.

Dolichosigma is a congenital prolongation of the intestine without its expansion. The sigmoid colon, as a rule, forms 2–3 additional folds and more.

Megasigmoid is a frequent defect (Hirschsprung's disease). This expansion and hypertrophy of a part of the colon, generally the sigmoid, is connected to its peristalsis infringement. Treatment is surgical, consists in removal of the aganglionic zones and pathological changed expanded sites located above the site.

Two defects of development of the intestines are connected with the preservation of the embryonic structures. It is hernia of the umbilical cord and fistula at the navel area. With partial preservation of passage, Meckel's diverticulum forms. It is similar to a glove's finger and exits from the ilea at a distance of 25 cm and more from the Bauhin's valve.

Congenital defects of development of the biliary tracts consist of an **unusual position of the gallbladder and its size**, occurrence of **cysts of the common biliary tract** and atresia or stenosis of one of the biliary tracts. The latter is connected with intrauterine hepatitis therefore biliary cirrhosis of the liver takes place.

Anorectal anomalies are observed in 0.25–0.66% of the cases, twice as often in girls than in boys. The following anorectal anomalies are distinguished:

1. Ectopia of the anus (perineal and vestibular).
2. Congenital fistulae in the sexual and urinary systems or in the perineum in the case of normally developed anus.
3. Congenital narrowing of the anus, rectum, anus and rectum at the same time; occurs more often in boys.
4. Atresia:

a) simple;

b) with fistulae in the sexual or urinary system;

c) casuistics (congenital cloaca, atresia and doubling of the rectum).

Defects of Development of the Urinogenital System

Defects of development of the urinogenital system are frequently observed. They make 30% all cases of congenital defects. Anomaly of the amount of kidneys can appear bilateral arenia (renal agenesia), that is the absence of kidneys. Boys are more often affected. The child has a characteristic face ("Potter face"): widely placed eyes, low placed big ears, thick nose, insignificant epicant.

Unilateral arenia is the presence of one kidney. It can have a normal structure or have defect of development: dysplasia, hypoplasia, ectopia, doubling. Clinically these defects appear accidentally or in the case of disease of one kidney.

The additional kidney has a normal structure with a separated excretion and vascular system. Usually it is smaller in size and placed below the normal kidney.

Anomalies of position, form and orientation of the kidneys are as follows:

— dystopia (ectopia) — abnormal location of the kidney. With simple dystopia the kidney is placed on the same side but in an unusual place, with cross — it is shifted to the midline with a crossing of the ureter. Dystopia is necessary to differentiate from nephroptosis, during which the renal artery leaves from the usual place, and the ureter has a normal length. Accretion of the kidneys can be symmetric and asymmetric; they can grow together at the upper, lower and different poles. Horseshoe, biscuit-like, L- or S-like kidneys form. This defect is observed twice as often in men. Practically all accretion of the kidneys are malrelated.

Anomalies of the renal structure are as follows:

a) renal dysplasia can be simple and cystomic, after the localization — cortical, medullar, cortico-medullar; after the spreading — focus, segmentary and total, uni- or bilateral;

b) renal polycystosis is a congenital defect characterized by multiple cysts in the renal parenchyma with the absence of dysplasia.

Agenesia of the urinary bladder is a defect which results in death.

Doubling of the bladder — anomaly which is seldom observed.

Diverticula of the bladder is extrusion of its walls which come to a blind end. Diverticula are single and multiple.

Extrophy (ectopia) of the bladder is a congenital crack of the bladder and abdominal wall. The posterior wall of the bladder which is covered with a velvety mucous membrane extrudes through the defect in the abdominal muscles to the outside. The opening of the ureter is gaping.

Patent urachus — an open passage of the alantois:

a) patent urachus from the navel to the bladder with a urinary fistula which opens into the navel;

b) urachus obliterated in the umbilical segment; defect has no clinical displays;

c) partially patent urachus with an obliteration of the ends and open middle area (cyst urachus).

Treatment for a total patent urachus is surgical during the first days and months of life.

Hypospadia — the lower crack of the urethra. One case in 300 newborn boys is observed. There are distinguished 5 forms of this defect: “hypospadia without hypospadia”, coronal, penile, scrotal and perineal. For all forms of hypospadia the curvature of the penis, shift of the external aperture of the urethra are typical. Depending upon the form the external aperture can be placed on the penis from the bottom surface of the caput to the perineum. In the case of perineal and scrotal forms, the scrotum splits, cryptorchism, wide pass to the urethra, reminding the entrance to the vagina, are observed. It can lead to erroneous determining the patient’s sex. In 8–10% of the cases, hypospadia is accompanied with hermaphroditism. Treatment is surgical.

Epispadia — top crack of the urethra. It is accompanied with curvature of the penis, its pulling up and retraction into the surrounding tissue.

Aphalia (agenesia, aplasia) of the penis is a very rare defect (one case in 30 million newborns). Thus, the ureter opens into the rectum or on the skin of the perineum.

Macrophallus — increase in the penis — defect that is seldom observed. Sexual glands, as a rule, are not changed.

Microphallus — sharp shortening of the penis. It is accompanied by short corpus cavernous and a small caput, cryptorchism.

Phimosis is congenital narrowing of the prepuce, preventing its being drawn back over the glans. It is complicated by balanoposthitis, formation of concrements, ulcers and sores of the prepuce. Treatment is conservative and surgical during the neonatal period.

Paraphimosis — pinching of the prepuce. This defect is a complication of phimosis. Treatment consists in urgent operation.

Cryptorchism — delay in the testicles lowering into the scrotum. If one testicle does not lower — **monorchism**, with total absence of the testicles — anorchism. Complication of these defects: infertility. Treatment is surgical: lowering the testicle into the scrotum up to 2–3 years of age.

Congenital defects of female genitals are frequently observed.

Vaginal atresia (lumbar membrane of the vagina) is combined with atresia of the anus, different urinogenital fistulae and anomalies of the urinary system.

Anomalies of the uterus:

a) cervical agenesia is observed seldom;

b) agenesia of the uterus — full absence of the uterine corpus with normal female karyotype — observed extremely seldom, it appears during sexual maturing in connection with amenorrhea.

Hypoplasia of the uterus (rudimentary uterus, infantility). There are three degrees of anomaly: germinal uterus (length up to 3 cm); infantile (3–3.5 cm) and teenage (5–7 cm). The uterus thus has a superfluous forward bend and a conic cervix. This defect is accompanied by menstrual cycle disorders and infertility.

Doubling of the uterus (bifurcation of the uterus) — the cervix and the both vaginas are grown together.

The double uterus is characterized by the presence of two separated uteruses, each of which joins the corresponding part of the doubled vagina.

Saddle-shaped uterus is the defect where the bottom of the uterus does not have a usual rounding. Anomaly of the ovaries is characterized by their absence (agenesia), underdevelopment (hypoplasia), infringement of development (dysgenesis). Absence of two ovaries (anovaria) is described only in nonviable fetuses. It's usually accompanied with underdevelopment of the genitals.

Artificial hermaphroditism is discrepancy between structure of the gonads and the structure of the external genitals.

Artificial male hermaphroditism — the patients have testicles, but the external genitals are formed by the female type. Three forms of anomaly are distinguished:

a) feminism where the patients have female type of constitution;

b) virilism or masculinism; type of constitution is masculine;

c) eunuchoidism (eunuchoid type of constitution) — absence of the development of breast and secondary pilosis.

Artificial female hermaphroditism — patients have ovaries, and external genitals develop by the masculine type. More often attributes of female hermaphroditism are observed in cases of pronounced hyperplasia of the cortex of the adrenal glands. Treatment — hormonal, should be appointed as soon as possible.

True hermaphroditism (ambisexuality, bisexuality) — presence in one organism of sex cells of both sexes, and also two sexual systems. *Treatment:* hormonal and operative, depending on the desire of the patient.

Defects of Development of the Locomotor System

According to the International Classification and Nomenclature of the Constitutional Diseases 5 basic groups of skeletal diseases are distinguished:

1. Osteochondrodysplasia — infringement of growth and development of the cartilage or bone.
2. Distosis of the bones.
3. Idiopathic osteolysis — lisis of bones with secondary deformations.
4. Chromosomal aberrations with unusual skeletal anomalies.
5. Primary metabolic defects (infringement of metabolism).

An **increase in the amount of vertebrae** is observed in the lumbar and sacral areas of the backbone more often.

Additional sphenoidal vertebrae or half-vertebrae. The defect is characterized by the presence of lateral or posterior additional half-vertebrae observed in the thorax part of the backbone more often.

Patent (aplasia) vertebrae arculus with aplasia of the spinous process (spina bifida).

Kyphosis — curvature of the spine, with backward convexity. It can be total or local.

Lordosis — curvature of the spine with convexity looking anteriorly.

Flat back — obturated physiologic curvatures of the spine.

Scoliosis — lateral curvature of the spine which combines with its torsion.

Anomalies of the ribs are observed seldom. Aplasia or additional ribs are mostly met.

Anomalies of the Extremities

Reduction defects consist in the stoppage of formation or insufficient formation (insufficient growth) of the skeleton parts.

Cross-section reduction defects of the extremities (congenital amputations). Observed at any level of the extremity: shoulder, hip, forearm, shin, wrist, fingers and phalanxes. Distal part of the extremity (below the amputation) is absent completely. Treatment depends upon the level of amputation and consists in prosthetics.

Cross-section terminal aplasia (hemimelia, extromelia) — absence of the distal part of the extremity (amputation type) at any level: hemibrachia — absence of the forearm, achyria — hands, apodia — foot, adactylia — fingers, oligodactylia — several fingers, aphalangia — phalanxes.

Focomelia (seal-like extremities) — full or partial absence of the proximal parts of the extremity. 3 forms are distinguished: proximal — aplasia of the humeral or femoral bone; distal — aplasia of the bones of the forearm, shin; full — aplasia of all of the long tubular bones. Hands or feet in this case are attached directly to the trunk, reminding a seal's fin.

Amelia — full absence of the extremities. Absence of both upper extremities — abrachia, one of the upper extremities — monobrachia, both of the lower extremities — apous, one of the lower extremities — monoapous. Treatment is with the help of prosthetics.

Splitting of the hand, foot (ectrodactylia, chelate hand, chelate foot, lobster hand) — aplasia of certain central components of the hand, foot with the presence of deep sulcus instead of absent bones.

Monodactylism — presence of one finger on the hand or foot.

Polydactylia — increase in the amount of fingers on the hand or foot.

Syndactylia — incomplete reduction or absence of reduction of the interdigital membranes.

Syrinomelia (sympodia, symmelia, caudal regression syndrome) — merging of the lower extremities. Both soft tissues and bones can merge.

Congenital talipes (internal talipes) — stable adducting-bending rigor contraction of the feet, which is connected with congenital underdevelopment and shortened internal and posterior groups of ligaments, corresponding flexors and muscular tendons, as well as with infringements of muscular synergism. The process is usually bilateral. Basic clinical attributes: equines (plantar bending of the foot at the ankle joint), supination (returning of the plantar surfaces of the foot with lowering of the external edge as support), adduction (reduction of the anterior part of the foot) increase in the arch of the foot (empty foot); flat feet — flat arches — frequent congenital defect.

Horse foot — rigor contraction of the ankle joint in position of superfluous plantar bending; therefore during walking resistance falls on the fingers and the heads of the metatarsal bone. Treatment consists in manual correction of the foot within the first days after birth, massage and bandaging with soft bandage into the right position. At 5 years the closed correction of the foot (redressment) is performed and to keep it in the correct position a plaster bandage is applied. If conservative measures fail, they carry out surgical treatment on the tendons of the feet or resort to sphenoidal or crescent resection of the bones. These operations are carried out upon the end of bone growth.

PLASTIC OR RESTORATIVE SURGERY

Plastic surgery has existed since the ancient times and corrects, mainly, defects which disfigures a person. In historical documents there is a certificate concerning application of tissue transplantation with the purpose of correcting face defects. More than 8 thousand years ago in ancient Egypt operations concerning the nose restoration were carried out. In the book of the outstanding Indian scientist Sushruta who lived in 1000 B.C., is written about plasty of the nose by taking a skin orifice on the pedicle from the forehead or cheek and returning it to the place of defect. This kind of plasty is called “Indian plasty”. That time the cases of rhinoplasty in Rome, Greece, Egypt are described. The reason for developing skin graftings in ancient people, apparently, was the custom of incision off noses in criminals and prisoners of war.

In Europe plastic surgery began to develop during the Renaissance. In Italy in 1450 a military doctor Branka started to carry out rhinoplasty with the help of local tissue (skin of the forehead, cheeks). His son Antony transferred a flap on the pedicle from the distant sites. He used the flap on the pedicle from the skin of the shoulder. The method is known as “Italian plasty”. In 1802 M. I. Pyrogov suggested osteoplastic operation and developed the method of creating a functioning stump in case of amputation of the foot. In 1865 R. K. Shimanovsky published in Kiev a manual on skin grafting. In 1872 S. M. Yanovich-Chainsky offered a way to transplant skin process in a site of granulation. V. P. Filatov offered the method of skin grafting with the help of tubed pedicle flap, which is widely spread. The works on plastic surgery: M. V. Sklifosovsky, M. M. Petrov, A. A. Limberg, M. A. Bogoraz, M. M. Blokhin, etc are well known.

The plastic surgery uses a number of methods for eliminating defects due to which the organs restore. Depending upon the fact whether the own tissue is transferred into the organism, or it is taken from a donor, whether it is foreign for the living organism, the following kinds of plasty are distinguished:

— **autoplasty** — transplantation of tissues taken from the same patient. During autoplasty the tissue can transfer on the body with preservation of the nutritious pedicle with a parent basis (involuntary plasty), or is transferred on another place completely from the distant sites of the body (free plasty);

— **isoplasty** — transplantation of tissues or organs which are taken from monoovular twins. Tissues and organs of such twins are genetically rather similar, therefore tissue restoration occurs as well as with autoplasty;

— **homoplasty** — transplantation of tissues and organs from one person to another one. Thus, as a rule, it is carried out in a free way;

— **heteroplasty** — transplantation of tissues and organs taken from individuals of another kind. For example, from an animal to people (xenoplasty);

— **alloplasty** — if the transplanting tissue is not of animal origin (metal, synthetic materials).

Depending upon the kind of transplanting tissue, skin, muscular, tendinous, nervous, bone, cartilaginous, vascular and organ plasty are distinguished. Different kinds of tissues and organs can be combined also: skeletal-muscular plasty, liver or pancreas transplantation, etc.

Tissue Incompatibility and Ways of its Prevention

During tissue and organ transplantation from one person to another the real engraftment never takes place. The main difficulties during transplantation are not because of shortage of operative technique (recently it has become perfect and surgeons are able to replace almost whole complexes of organs), but they consist in the immunological nature of each individual which genetically differs from another. Exceptions are only monoovular twins. Allo- and xenogenic transplants as a result of protective immunological reactions are rejected by the recipient's organism. Certain chemical structural parameters, by which the donor and recipient's cells differ, are usually responsible for this rejection. They are called transplantation antigens or antigenes of tissue incompatibility. Antigens of blood groups erythrocytes and leukocytes belong to them. The latter make the main complex of antigenes of tissue incompatibility — HLA system in a person (human leukocyte antigen). The cytotoxic action of T-killers is directed on these antigens.

Genetic researches concluded that transplantation antigens of a person have 5 locuses — serologically they are determined as A, B, C — and lymphocytes, determined as D and DB. Antigens of every locus are allelic; their inheritance is carried out codominant according to Mendel's laws. Each individual can have only two antigens of one locus. For homozygous individuals for every locus one transplantation antigen is necessary. The existence of dense couplings during inheritance is proved. Crossing-over is observed seldom.

Locus A supervises the inheritance of 20 antigens, locus B — 42, locus C — 8, locus D — 12, sublocus DB — 10 different antigens.

Statistical probability of reliability that two unrelated individuals can be identical is too small (about 1%). For close relatives this chance is a little higher and reaches 25% for sisters and brothers.

The weaker the compatibility of HLA — antigens of the donor and recipient — the stronger the pronounced protective reaction — reaction of rejection in a recipient. The success of transplantation of organs and tissues depends first of all upon true choice of the donor by transplantation antigens, that is typing of these antigens. Today there are three methods of type:

1) leukoagglutination reaction;
2) lymphatic test;
3) mixed leukocytes reaction.

Prevention of incompatibility of tissues and organs is carried out by three basic directions:

1. Selection of the donor and recipient according to isoserological properties. But compatible pairs are observed one in some tens of thousands, which troubles the choice.

2. Changes in immunobiological reaction of the recipient to transplant. It is necessary to remember that oppression of the protective immune reaction results in weakening and destruction of the transplant from the simplest infection, for example flu. There were attempts to irradiate the recipient. However, the rejection was not observed only with the dose causing radiation sickness. The application of different chemical, biological and hormonal (steroid) hormones does not result in the necessary effect, they only prolong the life term of the transplant, without providing engraftment.

3. Influence of different factors on transplant causes weakening of inverse reaction of the corresponding organism and reduces its antigenic properties. The transplantation of low-differentiated tissue (cornea, bone, cartilage, fascia) occurs better than transplantation of complex tissue with intensive metabolism. Many means have been applied to reduce the antigenic properties of transplants (irradiation, action of various chemical substances, etc.), but the best results have been received with the application of the lyophilic drying method. It is marked that tissue taken from corpses (which are in the "existance" stage), have less pronounced properties and yield the best results. But the organs received from an alive donor heal better.

Skin transplantation is the most significant department of plastic surgery. Autoplasty is applied more often. There are two kinds: flap coverage of the wound and free skin grafting.

Flap coverage of the wound — the skin flap on the pedicle, which nourishes it, together with fatty tissue in which blood vessels pass which supply the flap are found. The flap's skin should be wide, unbent without superfluous tightness, uncompressed by a bandage. The most simple kind of skin grafting is **freshening** and **tighting** the edges of the wound. For this purpose additional incisions are made, a triangular, oval and other kinds of flaps are created, which are transferred on the nutritious pedicle.

Plasty on the pedicle is applied when the tissue placed nearby is not enough. Skin flaps are taken near the defect, or transferred from distant sites of the body (hand, breast, neck, etc.).

For cheiloplasty and meloplasty they apply Joseph's, Esser's, Lexer's methods (they are applied seldom because of the formation of additional scars). The "Italian" method of plasty on the pedicle is justified. On the shoulder or forearm they cut a tongue-like flap. The wound under the flap is sutured, the hand is brought to the face and the flap is sutured to the tissue of the nose. After healing, the pedicle is separated and a necessary organ is developed.

Bridge-like flap plasty according to G. V. Sklifosovsky and Zontag. The flap has nutritious legs. This kind of plastic yields good results, but is limited concerning application.

Plasty according to V. P. Filatov. They cut the flap on the abdomen, buttock and suture as a tube. One of the ends is squeezed for 5–10 min, so that the blood circulation comes from the opposite end. Then they cut one end, suture in the site of anatomic snuffbox on the hand. After healing the flap is moved to the defect and sutured. In 3 weeks the flap is separated from the anatomic snuffbox and placed above the defect. The length of the flap should not be greater than 10 cm. With the help of this method plasty of the nose, lips, cheeks, ears is conducted; it is applied for “wolf mouth”, noma, etc. For rhinoplasty it is possible to use also “four legged flap”. For plasty of ears auto- and homocartilage are implanted into the Filatov’s tube flap. The Filatov’s tube flap is applied for plasty of the esophagus, vagina, urethra, etc. Wide recognition of this method is received in plasty of trophic ulcers and extremities stumps which do not heal. The defect of this method consists in significant thickness of the flap and heterogeneity of the skin color.

Free Skin Grafting

The most simple methods of free skin transplantation are Reverden’s, Yanovich—Tchainsky’s methods: with a razor they cut slices of the skin with the size of 2–5 mm together with papillary layer and place them on the granulating surface.

The flap method according to Tirsh is as follows — the flaps of the skin are placed on the surface of preliminary deleted granulation. Above a dry bandage is applied or this place is put in the ATU isolator.

The method of plasty with the help of a perforated flap. They take a skin flap, make perforating apertures in a chessboard order, then suture the flap. Recently plastic skin flaps taken with a dermatome (manual, electric, pneumatic, etc.) are applied.

Skin homoplasty is applied for patients with burns in which it is impossible to carry out autoplasty because of the extent of injury. For homoplasty they use both fresh and preserved transplants.

Xenoplasty. For this kind of plasty generally pig skin is used. In our clinic xenoplasty is used even for patients with wounds that do not heal for a long time, for patients with diabetes. Usually such pig skin flap rejects, but the defect considerably decreases in size and subsequently epithelizes fast.

Bone Tissue Transplantation

Transplantation of the bone can be carried out on a nutritious pedicle from soft tissue and as free transplanted auto-, homo- and heterotransplants.

Involuntary bone plasty for the first time was executed by M. I. Pyrogov during osteoplastic operations of the shin with the application of the heel for support purposes. Autograft for free bone plasty is taken from the tibia more often.

Homoplasty of the bones is applied after lyophilization or fast freezing at the temperatures of –70 ...–196°C . Such a bone is preserved at the temperature of –25 ...–30°C . Such a bone graft stimulates the regeneration of the recipient's bone and resolves in 2–3 years.

Bone marrow transplantation is applied as autoplasty and homoplasty. With autoplasty the bone marrow is taken a couple of days before the operation or irradiation. It is preserved by the method of freezing. After irradiation with hypoplasia of the bone marrow they defreeze the transplant and replace it to the same patient. It is better to enter bone marrow intercostally even during homoplasty, which is widely applied for radiation sickness.

Myoplasty

Myoplasty is widely used to stop bleedings from parenchymatous organs (the liver, the kidneys). They use the rectus abdominus muscles, etc. They seal up the medulla membrane sinus, osteomyelitic cavities.

Tendon Grafting

This plasty is applied mainly with autotendons for regenerating the ligamentous apparatus of the joints, for example, cruciate ligaments of the knee joint.

Plasty of the Fascia

The wide fascia of the hips, which can close defects of anterior abdominal wall during central hernias, defects of the diaphragm, esophagus are used more often for plasty of fascia. Strips of fascia are used for strengthening the anus, etc.

Plasty of the Omentum

The big omentum is used to close the wounded parenchymatous organs which bleed, for closing big perforating apertures of the stomach and duodenum, for the creation of vascular organic anastimosis, with cirrhosis of the liver and obliterating endarteritis of the lower extremities.

Peripheral Nerves Grafting

Four kinds of operations are used:
1) neurolysis;
2) neuroraphia;
3) neurotization;
4) nervous trunk grafting.

The case when the damaged nerve is united end to end by applying perineural stitches made of thin silk is ideal. If it is impossible to connect the ends of the nerve, they resort to transplants usage, mostly homoplasty.

Angioplasty

There are many means of sewing vessels together. All of them are directed on preventing the narrowing of apertures of vessels and the occurrence of a blood clot in it. In clinics quite often sewing devices that allow to sew an aperture of a vessel from 2 up to 15 mm are used. To replace the defect they apply auto-, homo-, or allografts. It is better to use a vein in the case of autoplasty. Lister and N. O. Bogoraz conducted the vein transplantation for the first time in clinic. But it is necessary to remember that veins have valves, therefore veins should be turned around. Recently arterial shunts are used, that is applying roundabout vascular anastomosis.

Organ Transplantation

The thyroid gland transplantation was carried out for the first time by Schiff and Kocher in 1883. With the absence and insufficient function of the gland, people are transplanted free pieces from another person resulting in excitation of the glands vital activity in the recipient. It is better to transplant the glands on a vascular pedicle; the parathyroid glands, ovaries, pancreas and other endocrine organs can be replaced.

Today due to the development of microsurgery and technical training of surgeons, qualitative anaesthesia there appeared opportunities concerning the transplantation of not only isolated organs but also whole complexes of organs (heart with lungs, liver with pancreas, etc.).

Renal transplantation have been carried out already for a long time. There is an evidence that a transplanted kidney lives in a recipient's organism more than 10 years, especially if the donor is a monoovular twin.

Due to the wide development of vascular surgery and application of artificial blood circulation apparatuses there is an opportunity for the heart transplantation operations. Some thousand of operations have been carried out already in the world. But the problems concerning the legal laws arise. In fact, for good results it is necessary to transplant a "beating" heart. Therefore, when getting a heart from the donor it is necessary to have the relatives' written approval.

Microsurgions transplant the fingers, the hand, the suture torn off upper and lower extremities with positive remote results.

Alloplasty in Surgery

For the first time in 1542 Vesalius renewed circulation in the artery with the help of a cane tube. Today in vascular surgery various artificial vessels of lavsan, teflon, dacron and other synthetic materials are very widely used. Over 50 years traumatologists successfully connect bones with the help of metal nails, screws, stirrups, wires, silk, kapron, etc. Orthopedists apply artificial joints, vascular surgeons — heart valves, etc.

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Видані попередніми роками підручники і посібники з курсу загальної хірургії здебільшого втратили актуальність з тих чи інших проблем. Організація навчального процесу на засадах кредитно-модульної системи за новою навчальною програмою із загальної хірургії потребує наявності нових навчально-методичних посібників.

У цьому навчальному посібнику викладені англійською мовою матеріали лекційного курсу з урахуванням новітніх досягнень хірургії.

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