MINISTRY OF HEALTH OF UKRAINE

ODESA NATIONAL MEDICAL UNIVERSITY

Faculty *Medicine*

Department *Surgery, Radiological Diagnostics, Radiation Medicine, Therapy and Oncology*

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METHODOLOGICAL RECOMMENDATIONS FOR PRACTICAL CLASSES OF THE ACADEMIC DISCIPLINE

Faculty, course Medical 6th year

Academic discipline Surgery
(name of the discipline)

PRACTICAL CLASSES

Practical class № 4

Topic: "Rules for antibiotic therapy in the prevention and treatment of surgical infection"

Approved:

At the meeting of the Department of Surgery, Radiation Diagnostics, Radiation Medicine, Therapy and Oncology of Odesa National Medical University

Odesa National Medical University

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PRACTICAL CLASSES

Practical class № 4

Topic of the practical class: 'Rules of antibiotic therapy in the prevention and treatment of surgical infection' - 2 hours

1. Relevance of the topic. The problem of prevention of postoperative purulent complications in surgery is still relevant. This is largely due to the fact that with the growing number of complex operations using modern technologies, the volume and duration of surgical interventions increases, tissue trauma and blood loss increase, which contribute to the development of postoperative infectious complications, primarily wound infections. Treatment of wound infections requires additional costs and significantly increases the patient's hospital stay.

Despite the improvement of surgical techniques and the introduction of a system of preventive measures, the incidence of postoperative wound infection during abdominal surgery remains high. For example, the number of postoperative purulent complications in elective abdominal surgery is 6-8%; while purulent complications develop in 0.8-2% of 'clean' operations, the number of wound suppurations increases to 20% in 'contaminated' or contaminated operations.

The incidence of postoperative wound suppuration in the abdominal cavity is determined by the nature of the disease, the degree of trauma of the surgical intervention and the possibility of microbial infection of the surgical wound.

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When performing a minimally traumatic laparoscopic cholecystectomy, the incidence of postoperative purulent complications is 0.6-6%, and in laparotomy cholecystectomy it increases to 5-26%. In the structure of postoperative purulent inflammatory complications, selective proximal vagotomy (SPV) operations also account for a small percentage (1.8%).

An increase in the incidence of wound purulent complications is observed after operations involving the opening of hollow organs. At the same time, the incidence of postoperative infectious complications increases significantly with gastric resection and ranges from 4 to 26%. The incidence of purulent complications remains high in liver surgery - 27-58%, and in pancreatic surgery - 40-70%. A large number (68%) of postoperative purulent-septic complications are observed in colon surgery. The most severe complication in abdominal surgery is peritonitis, the incidence of which ranges from 3 to 70%, and the mortality rate reaches 20%.

According to the reports of the CDC's National Nosocomial Infections Surveillance (NNIS) system in the United States, surgical site infection (SSI) is the third most common nosocomial infection, accounting for 14 to 16% of all nosocomial infections among all hospitalised patients. Between 1986 and 1996, hospitals conducting epidemiological surveillance of SSIs within the NNIS system registered 15523 SSIs after 593344 operations. Of this total, two-thirds of VAP occurred in the incision area and one-third in organs or cavities in the surgical access area. The occurrence of a bloodstream infection prolongs a patient's hospital stay by 10 days and increases the cost of hospitalisation by $2000. Despite significant progress

in the prevention, diagnosis and treatment of surgical infections, their development, for example, in the United States, approximately doubles the cost of hospitalisation.

Previously, the question of the feasibility of using antibiotics for prophylactic purposes in abdominal surgery was widely debated, but nowadays most researchers have come to the conclusion that this method is necessary and important. Today, antibacterial prophylaxis of postoperative infectious diseases is a common part of surgical practice for all surgeries, as well as for some clean procedures.

The prophylactic use of antimicrobials in surgery should be understood as the prevention of postoperative infectious complications by preoperative administration of drugs with a broad spectrum of antimicrobial action covering the expected pathogens in the organ to be operated on and the surgical wound. Antibiotic prophylaxis leads to a reduction in the number of postoperative suppurations and reduces the economic costs associated with the development of infection. At the same time, antibiotic prophylaxis of wound infection in elective abdominal surgery has not yet found a definitive answer to many questions.

2. Objectives of the lesson:

2.1. Learning objectives: the higher education student should learn:

1.	Define the terms antibiotic prophylaxis, antibiotic therapy, distinguish between these concepts, be able to explain the need for their use in practice; the concept of surgical site infection (SSI)	I level
2.	General principles of antibiotic prophylaxis and antibiotic therapy	II level
3.	Criteria for choosing an antibiotic for antibiotic prophylaxis, rules and methods of antibiotic prophylaxis, basic rules of antibiotic therapy for surgical infections	III level
4.	As part of the treatment process, be able to perform pre- and postoperative monitoring of major and 'secondary' risk factors for the development of signs of infection in the surgical area; identify risk factors before specific operations in a clinical practice situation; determine the causes that affect the development of infectious complications in the field of surgery	III level

2.2 Educational objectives are related to:

1. formation of a professionally significant personality of a doctor. To emphasise the achievements of the national surgical school of surgeons in the development of rules and methods of antibiotic prophylaxis in various fields of surgical activity and methods of antibiotic therapy for surgical infections;

2. to focus the attention of the higher education student on the current aspects of legal responsibility when using surgical antibiotic prophylaxis and antibiotic therapy for surgical infection.

3. Interdisciplinary integration.

Disciplines	To know	To be able to.
Previous: a/ Pharmacology	a/ Mechanism of action of antibacterial drugs; classification of antibiotics	a/ interpret the results of bacterial cultures, determine the necessary dosage and combination of antibiotics based on antibiograms
b/ General surgery	b/ the concept of inflammation; the mechanism of the inflammatory process; classification of types of inflammation	b/ clearly define the risk factors and possible specific infectious complications of a particular type of surgery
Intersubject integration: aspects of antibiotic therapy and antibacterial therapy of all surgical diseases	Groups of antibiotics, their half-life, ways of their excretion from the body in relation to the damage of organ groups in surgical diseases	Develop a program of antibiotic prophylaxis before any type of surgical intervention; develop a program of antibiotic therapy for surgical infection

3. Lesson content.

The prophylactic use of antimicrobial drugs in surgery should be understood as the prevention of postoperative infectious complications by preoperative administration of drugs with a wide spectrum of antimicrobial action. Antibiotic prophylaxis leads to a reduction in the number of postoperative suppurations, mortality, and also to a reduction in economic costs associated with the development of infection. At the same time, antibiotic prophylaxis of wound infection in elective abdominal surgery has not yet found a final answer to many questions.

The main role of antibiotic prophylaxis in surgery is to prevent infections resulting from surgery or other invasive interventions that are directly related to them, as well as to reduce the duration and cost of the patient's stay in the hospital.

Its essence is to achieve effective concentrations of the antibiotic in the area of the inflammatory process and in the operating area during its microbial contamination and to maintain a bactericidal level of the drug throughout the operation and the first 3-4 hours after surgery. This period of time is crucial for the reproduction and adhesion of microbes that have entered the wound to the host cells, which serves as a trigger for the onset of the infectious-inflammatory process in the wound.

Antibiotic prophylaxis initiated after this period is late, and its continuation after the end of the operation is in most cases unnecessary, since the prophylactic role of the antibiotic mainly consists in reducing the concentration of bacteria in the wound and preventing the adhesion of the pathogen.

In recent years, the literature has noted approaches to a standard definition of surgical site infection, which seems possible when comparing infectious complications of any

anatomical part of the body that was opened or manipulated during surgery (Tables 1 and 2) and which may be a criterion for the effectiveness of perioperative prophylactic administration of antimicrobial drugs.

Table 1. Anatomical section of the abdominal wall with areas of possible occurrence of surgical site infection

Anatomical section	Localization
1. Skin	Surgical site infection superficial incision
2. Subcutaneous tissues	
3. Deep soft tissues (fascia and muscles)	Infection of the surgical site of deep dissection
4. Organ/cavity	Infection of the surgical site of an organ/cavity

Table 2. Criteria for determining surgical site infection

I. Superficial area of surgical dissection The infection occurs no later than 30 days after surgery and involves only the skin and subcutaneous tissue in the area of the incision, and the patient has at least one of the following symptoms: 1. Purulent discharge from the external surface of the surgical incision, with or without laboratory confirmation. 2. Isolation of microorganisms from fluid or tissue obtained aseptically from the superficial incision site. 3. Presence of one of the following signs or symptoms of infection: pain or tenderness limited by swelling, redness, local fever. The surgeon intentionally opens the postoperative wound, except in cases where the wound culture gives negative results.
II. Deep infection of the surgical site of the dissection The infection occurs within 30 days of surgery in the absence of an implant or within one year of surgery in the presence of an implant at the surgical site, and there is reason to believe that the infection is related to the surgical procedure and the infection involves deep soft tissues, such as fascial and muscle layers in the incision area, and the patient has at least one of the following symptoms:

1. Purulent discharge from the depth of the incision, but not from the organ/cavity at the site of the given surgical intervention.

2. Spontaneous divergence of the wound edges, or its intentional opening by the surgeon, when the patient has at least one of the following signs or symptoms of infection: fever (>38oC), localized pain or tenderness, except in cases where the culture from the wound gives negative results.

3.Upon direct examination, during reoperation, during histopathological or instrumental (ultrasound, X-ray, CT) examination, an abscess or other signs of infection are detected in the depth of the postoperative wound.

4. The diagnosis of deep infection of the surgical site of the postoperative wound is made by the surgeon or other attending physician.

Comment:

1. An infection involving both a deep and superficial incision is recorded as a deep incision surgical site infection.
2. Infection of the surgical site of an organ/cavity that drains through an incision is recorded as a deep surgical site infection.

III. Infection of the surgical site of an organ/cavity

The infection occurs no later than 30 days after surgery in the absence of an implant or no later than one year if an implant is present at the surgical site, and there is reason to believe that the infection is related to the given surgical operation and the infection involves a deep part of the body tissues (for example, organs or cavities), other than the area of the incision that was opened or manipulated during the operation, and the patient has at least one of the following symptoms:

1. Purulent discharge from a wound drainage installed in an organ/cavity.

2. Isolation of microorganisms from fluid or tissue obtained aseptically from an organ/cavity.

3. Abscess or other signs in the depth of the postoperative wound are detected upon direct examination, during reoperation, during histopathological or instrumental (ultrasound, X-ray, CT) examination.

The diagnosis of deep infection of the surgical site after surgical wound is made by the surgeon or other attending physician.

Domestic and foreign experience shows that when performing operations, the effectiveness of antimicrobial perioperative protection depends on risk factors: the patient's condition, pre-, intra- and postoperative factors (Table 3). It should be noted that upon admission to the hospital, the patient inevitably encounters hospital strains. At the same time, with an increase in the length of stay in the hospital, the probability of replacing the patient's own microflora with hospital microflora increases. In this regard, infectious processes that develop in hospitalized patients can be caused by both community and hospital microflora.

Criteria for choosing an antibiotic for antibiotic prophylaxis

An antibacterial drug selected for antibiotic prophylaxis before surgery should meet the following criteria:

• be effective against likely dominant pathogens;

• have a half-life sufficient to maintain a bactericidal concentration of the active substance in tissues and blood throughout the entire operation and during the first hours after it;

• do not affect the pharmacokinetics of anesthetic drugs;

• do not accelerate the development of resistant pathogens;

• penetrate well into tissues in the surgical area;

• have minimal toxic and allergic side effects;

• are well tolerated by the patient;

• do not significantly affect the normal human microflora;

• be balanced in terms of effectiveness and cost.

Table 3. Reasons influencing the development of infectious complications in the field of surgical intervention.

1. Related to the patient's condition:
- advanced age; - hypotrophy; - violation of anti-infective protection (use of cytotoxic, hormonal drugs and radiation therapy); - presence of concomitant chronic diseases; - insufficiency of vital organ functions, critical condition.
2. Related to the operation:
- long stay of the patient in the hospital before the operation; - lack of appointment of antimicrobial drugs in the preoperative period; - duration of the surgical intervention;

- trauma of anatomical tissues; - excessive use of electrocoagulation; - condition of the surgical wound (presence of foreign bodies, blood clots that have necrotized tissues, insufficient or complete absence of blood circulation); - violation of the sterility of instruments and equipment.
3. Related to the features of the postoperative period: - the appointment of antimicrobial drugs after surgery after a sufficiently long period of time from the beginning of the operation; - violation of the rules of asepsis and antiseptics in the care of the postoperative wound; - the use of ineffective antiseptic agents; - violation of the drainage function of the wound exudate.
4. Associated with microflora - exogenous contamination; -endogenous contamination; - virulence of microflora that contaminated the surgical wound; - the minimum number of microorganisms that can serve as a separate link in a very complex mechanism in the development of infectious complications of the postoperative wound individually in each surgical patient.

Second-generation cephalosporin drugs (zinacef, cefoxitin, cefomandol) are considered by most researchers to be the most promising when choosing antibiotic prophylaxis in surgery. According to Culver D.H., Horan T.C. (1998), their advantages over other groups of drugs are based on the speed of bactericidal action, high activity against most pathogens of wound infections, stability against β-lactamases, ease of dosing and use, high antimicrobial activity in purulent processes, the ability to penetrate the pyogenic membrane of abscesses, minimal toxicity, low incidence of side effects and moderate cost.

The combination of second-generation cephalosporins with metronidazole or clindamycin is optimal for antibiotic prophylaxis in cases of risk of developing postoperative anaerobic infection.

Rules and methods of antibiotic prophylaxis

• In most cases, for the prevention of postoperative infection, with the correct choice of the drug, one dose of antibiotic during premedication is sufficient. The optimal regimen is a second-generation cephalosporin (zinacef 1.5 g) 30-60 minutes before the operation intramuscularly or during induction anesthesia intravenously. If necessary, the drug is administered intramuscularly in an additional 0.75 g twice with an interval of 8 hours. At a high risk of anaerobic infection, 0.5 g of metronidazole (metrogil, klion) or ornidazole (meratin) is added.

• The second dose is administered for operations lasting more than 3 hours.

• In some cases (with a particularly high risk of wound infection associated with the specifics of the intervention), it is permissible to use a course of antibiotic prophylaxis, limited to two to three doses of the drug, for no more than 24-48 hours.

• Broad-spectrum antibiotics that can be used for effective antibiotic therapy should not be used, i.e. reserve antibiotics - cephalosporins of the 3rd-4th generation, carbopenems, fluoroquinolones, ureidopenicillins).

• Bacteriostatic antibiotics - tetracycline, chloramphenicol (chloramphenicol), as well as sulfonamides should not be used.

• Dangerous use of drugs to which bacterial resistance is quickly formed - penicillin, amoxicillin, gentamicin, carbenicillin, ticarcillin, mezlocillin, azlocillin, cotrimoxazole.

• It is necessary to take into account the effect of some antibiotics on the internal environment of the body. Thus, cefoperazone, cefomandole, cefotetan, carbenicillin, piperacillin, mezlocillin, azlocillin increase bleeding, and gentamicin, when used with muscle relaxants, increases neuromuscular blockade.

Options for antibiotic prophylaxis of wound infection during various interventions in gastroenterology

Operations	Prevention schemes
hernia excision, plastic of hernia defect	zinacef 1.5 g intravenously once or cefazolin 1 g intravenously, then 8 hours later
Hernia excision for a strangulated hernia	zinacef 1.5 g IV once or Cefoxitin 2 g IV, then 1 g every 8 hours (up to 2 days) or Clindamycin 600 mg IV every 6 hours + Gentamicin 1.5 mg/kg IV every 8 hours for a maximum of 2 days
on the stomach and duodenum, including percutaneous endoscopic gastrostomy	cefazolin, cefoxitin, cefotetan, cefmetazole, ceftizoxime 1 g IV every 8 hours for 2 days or zinacef 1.5 g IV, then 0.75 g twice with an interval of 8 hours.
on the biliary tract, including laparoscopic cholecystectomy	zinacef 1.5 g IV once or cefazolin 1 g IV, then 1 g after 8 and 16 hours or ceftizoxime 1 g IV, then after 12 hours
endoscopic retrograde cholangiopancreatography	zinacef 1.5 g IV once or ceftizoxime 1 g IV or piperacillin 4 g IV
colorectal surgery	zinacef 1.5 g IV + metrogil 0.5 g IV, then after 8 and 16 hours. or cefazolin 1 g IV + metrogil 0.5 g IV, then after 8 and 16 hours.
appendectomy	Zinacef 1.5 g IV once

Basic rules of antibiotic therapy for surgical infections

• Infection of postoperative wounds is classified as nosocomial infections, where different options for empirical antibiotic therapy are possible depending on the severity of the wound infection and the time of formation of microbial resistance to antibiotics.

• For uncomplicated soft tissue infections - monotherapy.

• For complicated infections, including those with the development of septic conditions requiring repeated operations - polyantibiotic therapy.

• For traumatic wounds with signs of suppuration, combination therapy is prescribed, taking into account the leading position of staphylococci and the high proportion of microbial associations (up to 70%). Sample regimen: cefuroxime 0.75 g IV 3 times a day with lincomycin (1200-1800 mg/day).

• In acute pelvic infections (endometritis, pelvic abscesses, parametritis, phlegmons), therapy should be directed against aerobic and anaerobic components of the polymicrobial flora.

a) the combination of gentamicin with clindamycin reaches 88% effectiveness.

b) broad-spectrum penicillins - amoxiclav, piperacillin and its combined form piperacillin/tazobactam (tazocin). The latter is especially active against β-lactamase strains of enterobacteria and Bacteroides spp. - the leading representatives of the intestinal and genital tract microflora.

• In acute intra-abdominal infections resulting from failure of intestinal anastomoses, injuries to the stomach and intestines, and systemic infections, treatment is directed against mixed intestinal flora, including facultative gram-negative bacteria and anaerobes (Clostridium spp., Bacteroides spp.).

a) fluoroquinolones – norfloxacin, pefloxacin, ciprofloxacin. The availability of infusion forms of these drugs significantly increases their competitiveness, and the possibility of conducting the so-called step therapy with the transition to oral administration of the antibiotic significantly reduces the cost of treatment.

b) broad-spectrum penicillins – amoxiclav, piperacillin and its combined form piperacillin/tazobactam (tazocin). The latter is especially active against β-lactamase strains of enterobacteria and Bacteroides spp. – the leading representatives of the intestinal and genital tract microflora.

c) cephalosporins of the 3rd-4th generation intravenously, including in combination with antimicrobial drugs metronidazole (metrogil), ornidazole (meratin).

It is necessary to determine that in the pre- and postoperative period, monitoring of risk factors for surgical site infection is useful for two reasons:

– they provide the possibility of stratification by type of operation, making epidemiological surveillance data more understandable;

– knowledge of risk factors before specific operations may allow targeted measures to prevent infection.

At the same time, by assessing the risk of developing an infectious complication using a scoring system, it is possible to judge more specifically the effectiveness of antibacterial protection. The most successful idea was the stratification of the infection rate indicators of the surgical site according to the degree of microbial cleanliness of the surgical wound. This classification, which can predict the probability of wound infection, is given in Table 4.

Table 4. Degree of microbial contamination of the surgical wound depending on the type of operation

Class	Operations	Characteristic
I	"Clean"	- The wound occurs during a planned operation, which is performed in sterile conditions in compliance with the rules of asepsis and antiseptics. - There are no foci of inflammation in the surgical area. - The operation is performed without opening the empty organs of the gastrointestinal tract.
II	"Conditionally clean" or conditionally polluted	- The operation takes place when the lumen of the gastrointestinal tract organs is opened, but their contents do not fall into the operating wound.
III	Contaminated or "polluted"	- When performing the operation, it is expected that the contents of hollow organs will inevitably get into the wounds. - Operations involving perifocal foci of inflammatory infiltration in the area of the operating field. - Operations are performed with a violation of asepsis.
IV	"Dirty" or infected	- Operations are performed for purulent processes. - Perforation of highly contaminated distal parts of the colon.

4. Lesson plan and organizational structure
5.

№	The main stages of the lesson, their function and content	Learning objectives in learning levels	Control and training methods	Methodological support materials	Time min
1	2	3	4	5	6
Preparatory stage					
1.	***Organization of the lesson***				5 min.
2.	**Setting learning goals and motivating the topic**				10 min.

3.	**Control of the initial level of knowledge, skills, abilities**				60 min.
	1. Etiopathogenesis of surgical site infection	II	Level II methods	Table No. 3 demonstration	
	2. Ways of infection spreading in the body	II	1. Individual oral survey. 2. Written theoretical survey.	Level II tasks Tables, slides	
	3. Algorithm for examining patients with infectious complications of surgical intervention	II	1. Oral interview 2. Solving situational problems	Microcuration of the patient in the presence of a teacher	
	4. Interpretation of examination data- blood tests - general and coagulogram, endoscopic, X-ray, ultrasound, CT, MRI, results of bacterial cultures from wounds, blood, other fluids	III	1. Solving atypical situational tasks	Working with disease histories in the patient care process	
	6. Principles of antibiotic prophylaxis and antibiotic therapy in surgery	III	2. Appointment of patient treatment	Microcuration of the patient in the presence of a teacher	
Main stage					
4.	**Formation of professional skills and abilities**				130 minutes

	1. Master the methods of objective examination of patients with infectious complications of surgical interventions, including Infection of the surgical site	III	Practical training skills development method	Educational equipment – orientation maps	
	2. Conduct curation of a patient with surgical site infection 3. Participate in ultrasound, CT and other studies in a patient with surgical site infection or surgical inflammatory diseases 5. Apply dressing to the patient in the postoperative period and take material for bacteriological examination.	III III III	Method of developing skills in practice when working with a specific patient Professional training in solving atypical tasks b) solving laboratory problems	Atypical tasks in the form of: patient, medical history, test situational tasks, business games, dressing. Direct participation of a higher education student in the study	
Final stage					
5.	**Control and correction of the level of professional skills and abilities**	III	Control method: Individual control of practical skills	Equipment	60min.
6.	**Summary of the lesson results**				3min.
7.	**Homework, educational literature on the topic**		Oriented map of independent work with literature		2min.

6. Materials on methodological support of the lesson.

6.1. Control materials for the preparatory stage of the lesson: questions, tasks.

Questions.

1. Classification of the cleanliness of surgical interventions.
2. Diagnosis of infection in the surgical area, criteria.

3. Causes of infectious complications of surgical interventions.
4. Monitoring the bacterial profile of the area of infection in a surgical patient.
5. Surgeon's tactics and features of examining a patient with suspected infection in the surgical area.
6. Rules for conducting antibiotic therapy in a surgical patient.
7. Principles of antibiotic prophylaxis depending on the intended class of cleanliness of the operation.
8. The main role of antibiotic prophylaxis in surgery.

Situational tasks

1. Patient S., 60 years old, is being treated in the surgical department with a diagnosis of: Gallstone disease. 4 days ago, the patient underwent surgery - laparotomy, cholecystectomy. Today, the patient began to complain of increased pain in the postoperative wound area. On examination, the skin over the wound was hyperemic. What is the complication of surgical intervention?

Answer model: suppuration of the postoperative wound.

2. Patient N., 48 years old, is hospitalized in a surgical hospital with a diagnosis of strangulated umbilical hernia. She is being prepared for urgent surgery. What volume of antibiotic prophylaxis will be optimal?

Answer model: zinacef 1.5 g IV once or cefoxitin 2 g IV.

3. A patient is undergoing urgent surgery for a perforated ulcer. How long should antibiotic prophylaxis be administered?

Standard model: throughout the entire surgery and for the first 3-4 hours after surgery.

Test questions.

1. What is the goal of antibiotic therapy for surgical infections?
a) Prevention of surgical complications
b) Reduction of inflammation in the body
c) Treatment of concomitant diseases

2. Which of the following principles is key when choosing an antibiotic to treat infections?
a) Taking into account the sensitivity of microorganisms to antibiotics
b) Choosing a drug based on the patient's allergic reactions
c) Choosing the drug with the lowest cost
d) Using a broad spectrum of antibiotics without prior research
3. In which of the following conditions should antibiotic therapy be started?
a) Moderate or severe infection with clear symptoms
b) Mild infection without clinical manifestations
c) All patients after surgery
d) Only at high temperature

4. In uncomplicated soft tissue infections, the following is indicated:

a) Monoantibiotic therapy

b) Single administration of broad-spectrum antibiotics

c) Polyantibiotic therapy

d) Antibiotic therapy is not indicated in such cases

5. Frequent causes of infection in the surgical area are:

a) Presence of endogenous infection, time of operation, violation of the surgical technique.

b) Presence of somatic pathology

c) Neoplasms of various organs

d) Advanced age of the patient

6. In the case of a strangulated inguinal hernia, it is necessary to:

a) Perform urgent surgery, during induction anesthesia, perform antibiotic prophylaxis

b) Perform urgent surgery and monitor the dynamics of body temperature. In case of fever, prescribe antibiotic therapy

c) Perform urgent surgery

7. Which of the following methods is important for monitoring the effectiveness of antibiotic therapy?

a) Monitoring clinical symptoms and laboratory parameters

b) Reducing the dose of the drug

c) Using additional treatments

8. Which antibiotics should be used in the treatment of infections caused by gram-negative microorganisms?

a. Cephalosporins and aminoglycosides (if there is a bacteriological sensitivity study)

b. Penicillins and macrolides

c. Tetracycline and rifampicin

d. Fluoroquinolones and glycopeptides

9. What should be done if a patient develops an allergic reaction to an antibiotic?

a) Cancel the antibiotic and prescribe an alternative

b) Reduce the dose of the antibiotic

c) Continue treatment with this drug

d) Use antihistamines without cancelling the antibiotic

10. Which of the following side effects are the most common when using antibiotics?

a) All of the above

b) Liver toxicity
c) Adverse drug reactions
d) Allergic reactions and dysbiosis

Literature:

1. **https://www.saudedireta.com.br/catinc/tools/e_books/Oxford%20Handbook%20of%20Clinical%20Surgery,%204th%20Edition.pdf**
2. **https://www.gutenberg.org/cache/epub/17921/pg17921-images.html**
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