MINISTRY OF HEALTH OF UKRAINE

ODESA NATIONAL MEDICAL UNIVERSITY

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

APPROVED BY
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"2" September 2024

METHODOLOGICAL RECOMMENDATION FOR PRACTICAL CLASSES OF THE ACADEMIC DISCIPLINE

Faculty, course Medical 6th year

Academic discipline Surgery
(name of the discipline)

PRACTICAL CLASSES

Practical class № 21

Topic: "Damage to the chest organs. Diagnostic program for heart damage. The triad of of symptoms in case of heart damage. Unified clinical, diagnostic and surgical program for heart injuries"

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

Protocol № 2 of '02' September 2024

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PRACTICAL CLASSES

Practical class №21

Topic: "Damage to the chest organs. Diagnostic program for heart damage. The triad of of symptoms in case of heart damage. Unified clinical, diagnostic and surgical program for heart injuries" – 6 hours

Relevance of the topic.

Currently, heart injuries account for 5 to 7% of all penetrating chest wounds, including no more than 0.5-1% of gunshot wounds, and are among the most dangerous injuries. In stab wounds of the heart and pericardium, isolated pericardial injuries account for 10-20%. Pericardial injuries themselves are not life-threatening, but bleeding from the perforated pericardial vessels can lead to cardiac tamponade. If emergency medical care is delayed and one of the ventricles of the heart is perforated, the victims die at the accident site from blood loss, especially if the left ventricle is damaged.

Extensive injuries lead to immediate death. About 15% of victims with stab wounds and small cut wounds of the heart can live for some time even without help. Hemopericardium occurs in 53-70% of all heart wounds. The degree of tamponade is determined by the size of the heart wound, the rate of bleeding into the cavity of the cardiac jacket, and the size of the pericardial wound. Small pericardial wounds are quickly closed by a blood clot or adjacent fat and tamponade occurs quickly. It should be remembered that a large pericardial wound prevents tamponade, as blood freely flows into the pleural cavity or outside.

Mortality in cardiac injuries is associated with the nature, size, localization of the heart wound, rhythm disturbance, as well as concomitant damage to the coronary arteries, intracardiac structures and the duration of time from the moment of injury to the start of resuscitation and treatment. Attention is paid to the duration of acute cardiac tamponade and the degree of blood loss. The highest mortality rate is observed in gunshot wounds. The main causes of death in the prehospital stage: 32.8% die from massive blood loss, 26.4% - a combination of massive blood loss and cardiac tamponade, 12.7% - isolated cardiac tamponade.

In recent years, there has been an increase in mortality, which is primarily due to the severity of heart damage.

Therefore, the study of this pathology is important in the work of a doctor not only in surgical but also in general clinical practice. To this end, the student must be familiar with the issues of heart damage in order to timely conduct the necessary examination, determine the diagnosis, severity of the injury, and provide correct and highly qualified assistance to the victim.

- ***Learning objectives.***
  <u>Objectives.</u>

<u>I level</u>

• To draw the attention of the applicant for higher education to the threat of heart damage: the proportion of hemopericardium and cardiac tamponade, as well as the mortality rate depending on the treatment tactics.

• To familiarize the applicant with the etiopathogenesis of various forms of heart damage, their classification.

• To draw the attention of the applicant for higher education to modern objective methods of functional and instrumental research in thoracic surgery (ECG, radiological and additional methods - ultrasound, echocardiography, pericardial centesis, pericardiotomy, tomography (CT), spiral CT).

• To study the features of the clinical course of heart damage in open and closed chest injuries, the diagnostic program for heart damage, errors in diagnosis and management of patients.

• To familiarize the student with the triad of symptoms of heart injury;

• To familiarize the applicant with surgical methods of treatment of cardiac injuries (various types of transthoracic drainage, video thoracoscopic operations, fenestration and open surgical interventions).

• To familiarize the student with various types of complex treatment of chest injuries.

<u>II level</u>

• Higher education students should know the etiopathogenesis of heart damage;

• Higher education students should know the proportion of hemopericardium and cardiac tamponade, as well as the mortality rate depending on the treatment tactics;

• Higher education students must master modern objective methods of functional and instrumental research in thoracic surgery;

• To familiarize higher education students with the peculiarities of the clinical course of various types of heart damage;

• To provide higher education applicants with the opportunity to master surgical and complex methods of diagnosis and treatment of heart damage;

• To provide higher education students with the knowledge to properly take anamnesis in patients with heart damage;

• To provide higher education students with the ability to examine and detect heart damage;

• To provide higher education students with the ability to correctly interpret the results of modern objective methods of laboratory and instrumental research (ultrasound, radiological studies, ECHO, CT, spirography, fibrobronchuscopy, diagnostic thoracoscopy).

<u>III level</u>

• Higher education students must be able to correctly identify the components of the heart on anatomical specimens and radiographs.

- Higher education students must be able to correctly interpret the results of functional and laboratory tests, especially heart rate, blood pressure, interpret the main radiological signs that occur in heart damage;
- Higher education students should be able to determine the main etiological aspects in each individual case of heart damage;
- Higher education students should be able to identify the triad of symptoms of cardiac injury;
- Perform a complete clinical and instrumental diagnosis of this pathology;
- Fully master the skills of examination, interview, percussion, auscultation;
- Based on the information received, make a detailed preliminary diagnosis, referring to the recommendations of ICD 10.

Educational objectives

- To form a deontological understanding when working with patients with heart damage.
- Develop an understanding of the impact of risk factors for heart damage.
- Based on the material of the topic under study, develop a sense of responsibility for the timeliness, as well as the correctness and professionalism of actions towards the victim.
- To form an idea of the basis of a psychotherapeutic approach to patients with heart damage.
- Master the ability to establish psychological contact with the patient and his/her relatives.

- **<u>Interdisciplinary integration</u>**

Disciplines	**To know**	**To be able to**
Previous disciplines		
1. Norma anatomy	Structural development of the chest organs (heart, lungs, esophagus, trachea, diaphragm)	Correctly identify the components of the thoracic organs on anatomical specimens and radiographs.
2. Normal physiology	Normal indicators of gas exchange, blood pressure, basic hemodynamic parameters of small and large circulation	Correctly interpret the results of functional and laboratory tests, especially blood pressure, small and large circulation parameters.
3. Pathological physiology	Pathology of the main hemodynamic parameters of the small and large circulation circle	Interpret the results of laboratory tests and spirography, perform pneumotachometry
4. Рентгенологія	The main types of X-ray examination of the heart,	Correctly interpret the results of examination radiography,

	indications for the use of special techniques	tomography, the main signs of cardiac pathology, as well as computerized and spiral tomography
5. Propedeutics of internal diseases	Methods of physical examination of the patient, main clinical syndromes. Instrumental studies, laboratory methods of research	Examine the abdominal cavity using methods of palpation, percussion, auscultation. Interpret data from laboratory and instrumental studies.
6. Pharmacology	The main drugs that are used in the treatment of heart damage	Write prescriptions.
7. Organization of health care	Know the structure of ICD-10, have skills in navigating ICD-10	Based on the information obtained, make a detailed preliminary diagnosis, referring to the recommendations of ICD-10.
Next disciplines		
Resuscitation and anesthesiology	Methods of resuscitation in the development of complications that have developed in heart damage Intensive care	Carry out resuscitation measures in full, ensure supervision and monitoring of patients in the intensive care unit. Draw up an infusion therapy plan taking into account the patient's background and concomitant pathology.
Intersubject integration		
Suppurative diseases of the lungs and pleura	Stage of the disease, clinical picture of complications, radiological signs	Apply the knowledge gained during differential diagnosis
Damage to abdominal organs	Stage of the disease, clinical picture of complications, radiological signs	
Modern methods of surgical treatment of patients with thoracic pathology	The main endoscopic methods of surgical treatment used in thoracic pathology; indications and contraindications to them; possibilities of the method	

- **Content of the class**

Heart damage **-** penetrating wound of the chest cavity.

Penetrating wounds of the heart **-** injuries with and without damage to internal organs. Thoracoabdominal wounds, in which the diaphragm is damaged and the wound channel penetrates into the pleural or abdominal cavity, should be particularly emphasized. Thoracoabdominal wounds also include extrapleural wounds that penetrate the abdominal cavity. A separate group includes abdominothoracic wounds, in which the wound channel can pass either through both serous cavities or end extrapleural.

Non-penetrating heart wounds.

Classification of heart damage:

The division of wounds into penetrating and non-penetrating is fundamental to determining surgical tactics.

Cardiac wounds are divided into non-firearms (stab wounds, etc.) and firearms: penetrating the heart cavity and non-penetrating.

Penetrating wounds, in turn, are divided into blind and through.

Localization of wounds in relation to the heart chambers:

• left ventricular injury (45-50%),
• right ventricle (36-45%),
• left atrium (10-20%)
• right atrium (6-12%).

These, in turn, can be classified with or without damage to intracardiac structures.

The most acceptable classification of closed injuries is concussion, bruises, and traumatic myocardial infarction.

Diagnostic criteria:

In the diagnosis of cardiac wounds, the localization of the sternal wound in the projection of the heart and the degree of blood loss are decisive. An important and reliable sign of a heart injury is the localization of an external wound in the projection of the heart.

The diagnosis is based on Beck's triad and the general serious condition of the victim. Beck's triad includes a decrease in blood pressure, an increase in central venous pressure, and a deafening heart sound. It usually occurs only in severe, acute cardiac tamponade.

List of basic diagnostic measures:

- visual inspection of the chest injury;
- palpation of tissues in the area of injury in the dynamics to determine the presence of emphysema and the rate of its growth;
- chest percussion to determine the presence of pneumothorax and/or hemothorax;
- auscultation to detect lung function on the side of the lesion;
- blood pressure measurement and pulse counting;
- counting the respiratory rate (RR);
- determination of the level of consciousness.

Heart damage clinic

It should be remembered that any wound located in the projection of the heart and large vessels is dangerous in terms of possible heart injury. The following triad of symptoms should be considered as characteristic signs of heart injury

- localization of the wound in the projection of the heart;
- signs of acute blood loss;
- signs of acute cardiac tamponade.

Cardiac tamponade - a condition in which blood penetrating the pericardial cavity seems to "squeeze" the heart.

The classic clinical picture of cardiac tamponade is deafness of the heart sounds; low blood pressure with a low heart rate (and low pulse pressure); high venous pressure with swelling of the cervical veins. The degree of tamponade is determined by the size of the heart wound, the rate of bleeding from the heart into the cavity of the cardiac jacket, and the size of the pericardial wound. Small stab wounds of the pericardium are quickly closed by a blood clot or adjacent fat and cardiac tamponade occurs quickly. The accumulation of more than 100-150 ml of blood in the cavity of the cardiac jacket leads to compression of the heart, a decrease in the contractility of the myocardium.

Direct damage to the heart - is masked by concomitant rib fractures and lung damage. In these conditions, "typical cardiac symptoms" are often mistakenly ignored, which include pain in the heart, shortness of breath, palpitations, a growing feeling of weakness, dizziness, discomfort behind the sternum, a feeling of sadness and unmotivated fear of death, and noise in the head.

Tactics of emergency care:

- application of an aseptic protective dressing;
- application of a sealing dressing in the presence of an open pneumothorax;
- covering the wound with a sterile towel in the presence of a large chest wall defect with subsequent fixation with a circular bandage;

Immediate transportation of the wounded for emergency thoracotomy. Medical treatment en route is limited to life support: oxygen, artificial lung ventilation, transfusion of blood substitutes, cardiac medications. If it is not possible to quickly deliver the victim to a surgical hospital, a pericardial puncture according to Larray with a thin polyethylene catheter left in the pericardial cavity is performed.

The end of the catheter is clamped with a clamp and attached to the chest wall with a plaster. Every 15-20 minutes (or more often), blood is sucked from the pericardial cavity. In some cases, a thin catheter can be inserted through the wound and remove at least some of the blood from the pericardial cavity.

Surgical treatment of heart damage

Regardless of the type of injury and surgical tactics, the treatment of patients should follow the treatment and diagnostic algorithm, which includes:

- pain relief;
- early and adequate drainage of the pleural cavity;
- measures aimed at rapid straightening of the lungs;
- restoration and maintenance of airway patency;
- sealing and stabilization of the chest wall;

• final stop of bleeding and replenishment of blood loss;
• infusion, antimicrobial and supportive therapy.

Drug treatment of heart damage associated with closed trauma must be taken into account in the plan of complex action and consists in the administration of 0.2-1 ml of 1% atropine solutions for tachycardia and cardiac analeptics for bradycardia. Rhythm disturbances are relieved by the administration of potassium chloride (1% solution, 50-100 ml intravenously drip) and potassium orotate (0.5 g 2-3 times orally). In case of atrial fibrillation, isoptin (2 ml of 0.25% solution) and novocainamide (5 ml of 10% solution) are administered intravenously. In case of development of myocardial ischemia and hypoxia: curantil, no-shpa, eufillin.

Operations performed in case of heart damage:

- Drainage of the pleural cavity.
- Video thoracoscopy, lung decortication, bleeding control, pericardioscopy.
- Videothoracoscopy, coagulation of lung injuries, bleeding control, pericardioscopy.
- Thoracotomy, suturing of wounds of the heart, lungs and large vessels, bleeding control.

- **<u>Plan and organizational structure of the class.</u>**

№	The main stages of the lesson, their functions and content	Learning objectives in terms of mastery levels	Training and control tools	Materials for methodological support visualization of the lesson, knowledge control	The period from the total time
1	**2**	**3**	**4**	**5**	**6**
1	**Preparatory** Setting learning goals, monitoring the ascending level of knowledge and skills.	**I level** To familiarize the applicant for higher education with the etiopathogenesis of heart damage. To familiarize the applicant with various types of complex treatment of heart injuries	Tests of the rising level of knowledge, tests of rectorial control, Krok-2 tests, methodological recommendations for higher education applicants	Knowledge ascension tests, rectorial control tests, Krok-2 tests, guidelines for higher education applicants, X-rays, extracts from medical records of patients with heart damage	1 hour
2.	**Basic** Supervision of patients in the Department of Thoracic	**II and III levels** Correct interpretation of the results of functional and laboratory tests,	Determination of the treatment regimen for a patient with a chest pit injury in a specific case	A patient (or several patients) with a typical or atypical clinical picture and course of chest injuries	

	Surgery and Intensive Care by a higher education student	especially gas exchange, acid-base balance, interpretation of the main radiological signs of heart damage;	(or cases)		4 hours
3.	**Final**	Control and correction of the level of professional skills, summarizing the results of the lesson	Tests of the final level of knowledge, tests of rectorial control, tests "Krok-2", methodological recommendations for higher education applicants	Computer test program ACS - test	1 hour

- **<u>Materials for methodological support of the class</u>**
  - ***Control materials for the preparatory stage of the class.***

<u>Questions</u>

- Define penetrating and non-penetrating cardiac injuries.
- The etiopathogenesis of major cardiac injuries and complications arising from this pathology.
- Classification of heart damage.
- Name the features of diagnostic measures for heart injuries - elements of the triad of symptoms of heart injury.
- Describe the clinical picture of the most common complications of heart damage.
- Describe penetrating heart injuries.
- Describe non-penetrating heart injuries.
- Name clinical and laboratory parameters in this pathology, their dynamic changes.
- Name the tactics of the doctor in providing emergency care for heart injury.
- Therapeutic tactics, the purpose of the operation.

Test control tasks for a practical lesson on the topic:
"Damage to the chest organs. Diagnostic program for heart damage. Triad of symptoms in case of heart damage. Unified clinical, diagnostic and surgical program for heart injuries".

- The optimal access for suturing cardiac wounds is:

a) Anterolateral thoracotomy on the side of the injury;
b) Anterolateral thoracotomy on the side of the injury
c) Sternotomy;
d) Posterolateral thoracotomy on the left;
e) Left-sided thoracotomy regardless of the side of the injury.

*

• The patient received a stab wound to the left side of the chest 3 hours ago. The skin is pale. The heart sounds are deaf, tachycardia, blood pressure is 80/20 mm Hg. Pulse on the radial arteries is threadlike. There is a shortening of the percussion sound. The following diagnosis can be offered:

a) Lung injury;
b) Thoraco-abdominal wound;
c) Heart injuries;
d) Injury of large vessels of the mediastinum;
e) Pleuro-pulmonary shock.

*

• The patient received multiple stab wounds to the chest 4 hours ago. The skin is of normal colour. Pulse 92 beats per minute, satisfactory filling and tension. Blood pressure is 100/70 mmHg. There is no hemopneumothorax. The patient should be treated with:

a) Pleural puncture on the right;
b) Pleural puncture on the left;
c) Left-sided thoracotomy;
d) Primary surgical treatment of chest wounds;
e) Drainage of the left pleural cavity.

*

• The patient received a penetrating stab wound to the right side of the chest. The skin is pale. Blood pressure - 90/60 mmHg, pulse - 112 beats per minute, weak filling and tension, rhythmic. Chest radiography shows a wide level of fluid reaching the lower angle of the scapula. The treatment tactics are reduced:

a) Before drainage of the pleural cavity;
b) Immediate videothoracoscopy on the right, with prolonged bleeding - thoracotomy;
c) To pleural therapeutic punctures;
d) To intensive care only;
e) To intensive care in combination with drainage of the pleural cavity.

*

• The absolute indication for a wide thoracotomy for penetrating chest wounds is:

a) Pneumothorax;
b) Coagulated hemothorax;
c) Prolonged bleeding into the pleural cavity;
d) Penetrating chest wound;
e) Hemo-pneumothorax.

• ***Materials for methodological support of the main stage of the class:***

1. A preventive algorithm for mastering skills and abilities.

The sequence of actions in mastering skills	Instructions for implementation, criteria for of self-control
Taking anamnesis in a patient with a heart injury	Pay attention to the clinical picture, • circumstances that brought the patient to the hospital; • identify the type of injury
Objective research	• conduct a general examination of the patient, assess the condition of the skin and mucous membranes • to palpate the chest • examine the properties of the pulse • measure blood pressure • conduct percussion and auscultation of the chest and abdominal cavity
Appointment of additional methods of examination and treatment	Conduct an Rg study and a CT scan of the chest; ultrasound, ECG, ECHO
Development of a treatment regimen	Determine surgical tactics and intensive care

- Patient for supervision
- Medical history
- Rg-grams.
- ECG
- ECHO

Control materials for the final stage of the class.

Test control tasks for practical training:

1. The patient was delivered with a penetrating wound to the left sternum. Objectively: moderate severity. Pulse 120 beats per minute, blood pressure 100/60 mm Hg. On radiography: there is a small hemothorax on the left, the borders of the heart are dilated. There is no cardiac waist. ESR is 3.8 T/L. Your actions:

A. Thoracotomy.
B. Thoracocentesis.
C. Aspiration of contents from the pleural cavity.
D. Antishock treatment.
E. X-ray control in 30 minutes.

1 hour after the fight, a patient with a penetrating chest wound on the left was delivered. The condition is of moderate severity. Pale. Blood pressure 100/60 mm Hg, pulse 120 beats per minute. On radiography: small hemothorax on the left, the borders of the heart are dilated. There is no cardiac waist. ESR is 3.2 T/l. Your preliminary diagnosis:

A. Heart injuries.
B. Hydrothorax on the left.
C. Hemothorax on the left.

D. Hemorrhagic shock.
E. Lung injury.

Cardiac tamponade is indicated for:
A. Pericardial puncture.
B. Blood transfusion.
C. Diuretics.
D. Hemostatic therapy.
E. Antibiotics.

Heart injuries are indicated by:
A. All of the above.
B. Localization of the wound.
C. Sharp decrease in blood pressure, tachycardia.
D. Appearance of the patient.
E. Increased venous pressure.

With cardiac tamponade, the following are observed:
A. All of the above.
B. Lowering blood pressure.
C. Facial cyanosis.
D. Expanding the boundaries of the heart.
E. Deafness of tones.

Closed heart injury is characterized by:
A. All of these features.
B. Changes in the ECG.
C. Pain in the heart area.
D. Lowering blood pressure.
E. Increased venous pressure.

Cardiac tamponade is indicated for:
A. Pericardial puncture.
B. Blood transfusion.
C. Diuretics.
D. Hemostatic therapy.
E. Antibiotics.

Heart injuries are indicated by:
A. All of the above.
B. Localization of the wound.
C. A sharp decrease in blood pressure.
D. Tachycardia.
E. Appearance of the patient.
F. Increased venous pressure.

With cardiac tamponade, the following are observed:
A. All of the above.
B. Lowering blood pressure.
C. Facial cyanosis.
D. Expanding the boundaries of the heart.
E. Deafness of tones.

Indications for immediate thoracotomy are:
A. Hemopericardium.
B. Hemomediastinitis.
C. Pneumothorax.
D. Pneumohemothorax.
E. Shortness of breath.

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- ***Materials of methodological support for self-study of higher education applicants.***

  Orientation map on the organization of independent work of a higher education student:

Learning objectives	Instructions for the task
1. To study: etiopathogenesis of heart damage	Name the main complications of heart damage
2. Learn the classification	Know the classification
3. The main complications of penetrating heart damage	To list
4. The main complications of closed chest injuries	To name
5. Learn X-ray examination methods	Describe and comment on radiographs
6. Laboratory diagnostics	List the main diagnostic criteria
7. Study changes in cardiograms in closed and open-heart injuries	To list
8. Treatment: surgical tactics and intensive care	Determine the optimal surgical tactics, prescribe infusion therapy

Literature:

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