

**Ministry of Health of the Republic of Belarus  
Education Institution  
"Gomel State Medical University"**

Department of Pediatrics with the course of the Faculty of Advanced Training and Retraining

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**METHODOLOGICAL GUIDELINES**

for a practical exercise  
by a teacher with students  
6th year of the Faculty of foreign students,  
trainees in speciality 1-790101 in the discipline of pediatrics

**Topic: Acute and chronic heart failure, heart rhythm disorders in children.**

Time: 7 hours

Approved at the meeting of the Department of Pediatrics with the Course of the Faculty of Advanced Training and Retraining  
(protocol №. 8 of the 14<sup>th</sup> of June 2022)

2022

## **LEARNING AND EDUCATIONAL OBJECTIVES, TASKS, MOTIVATION FOR LEARNING THE TOPIC**

### **Educational objective:**

- Formation of students' basic professional competence in the study of the discipline Pediatrics according to the curriculum

- Formation of scientific knowledge of diseases of blood circulatory system and prospects of their use in professional activity; abilities and skills necessary for work with patients of different age, knowledge of clinical displays of diseases, treatment and diagnostic measures, bases of rehabilitation and prophylaxis.

### **Educational objective:**

- Fostering in students the sense of professional responsibility of future medical worker;

- Formation of professionally important and socio-psychological qualities of the doctor's personality in the system of doctor-nurse-patient relations;

- formation of students' responsible attitude to their future professional activity.

- Formation of academic and work discipline, discussion of disciplinary issues (attendance of lectures and practical classes, unexcused absences, tardiness, debts on missed classes).

### **Objectives:**

As a result of the training session the student should

#### **know:**

- peculiarities of fetal and newborn blood circulation;
- Anatomical and physiological features of the cardiovascular system in children;

- Methods of ECG examination, Holter rhythm monitoring, CMAD, ECG drug tests;

- modern classification of congenital heart disease, rhythm abnormalities;
- necessary volume of laboratory investigations (clinical, biochemical, bacteriological, immunological) at congenital heart diseases, vegetative dysfunction.

#### **be able to:**

- collect the anamnesis correctly;
- take the pulse and measure the blood pressure on the arms and legs of the child;

- perform palpation, percussion and auscultation of the heart in children of different ages;

- record and evaluate ECG in children of various ages;
- objectively assess the state of the cardiovascular system and identify symptoms of heart failure;

- construct an examination plan (clinical, laboratory, instrumental);
- interpret the results of the examination, establish their regular correlation;
- construct an algorithm of diagnostics.

#### **possess:**

- methods of objective (palpation, percussion, auscultation) and additional (measuring, laboratory, instrumental, histological, immunological, etc.) examination

- communication skills with patients of different ages and their parents, medical personnel.

### **Motivation for learning the topic:**

- Obtained knowledge and skills during the study of the discipline Pediatrics allows to motivate students to improve theoretical and practical knowledge for the implementation of early diagnosis, treatment and complex rehabilitation measures for children with diseases of the cardiovascular system, tactics of emergency care.

### **MATERIAL EQUIPMENT**

Tables on the theme of the lesson, medical charts of hospital patients, set of hemograms, hemostasiograms, biochemical blood tests, urine tests, electrocardiograms, protocols of ECG daily monitoring, blood pressure, heart ultrasound findings, set of X-rays, tonometers, scales, stadiometer, measuring tape, task bank for independent work; selection of case studies of hospital departments.

### **CONTROL QUESTIONS FROM RELATED DISCIPLINES**

1. human anatomy.
  - Structure of the human body, its component systems, organs, tissues, sex and age features of the child body.
2. Normal physiology.
  - Normal physiological features of human organs and systems.
  - Basic principles of the formation and regulation of physiological functions.
3. Pathological anatomy.
  - Morphological changes in human organs and tissues in various diseases.
4. Pathological physiology.
  - The vital functions of the organism of an ill person, the nature and mechanisms of resistance to disease, general patterns of origin, development and outcome of diseases.
5. Pharmacology.
  - Principles of pharmacodynamics and pharmacokinetics of drugs.
  - Factors determining therapeutic efficacy, side effects and toxicity of drugs.
6. Propaedeutics of internal medicine.
  - Physical examination of patients, the basic principles of diagnosis of diseases.

### **CONTROL QUESTIONS ON THE TOPIC OF THE CLASS.**

1. Clinical, ECG diagnostics, treatment tactics for various heart rhythm disorders.
2. Emergency treatment of paroxysmal tachycardia, fibrillation, flutter, asystole.
3. Acute heart failure in children. Etiopathogenesis, clinic, diagnosis. Principles of treatment of acute heart failure in children, emergency medical care. Chronic heart failure.
4. Diseases occurring with chronic heart failure.
5. Basic therapy of chronic heart failure in children.

## **PROCESS OF THE SESSION**

### **Theoretical part**

In recent years there has been an increase in diseases of the cardiovascular system in both adults and children. Each age period has, in addition to anatomical and physiological features, its own specific response to stress and its own set of damaging effects.

Acute heart failure in childhood can develop within minutes and last several days, can be as a complication of a number of diseases and in healthy children as a result of excessive physical exertion.

Chronic heart failure develops more often with congenital and acquired heart defects.

Children have the same numerous heart rhythm abnormalities as adults. However their causes, course, prognosis and therapy in children have a number of peculiarities. Some arrhythmias have a pronounced clinical and auscultatory appearance, while others are latent and only show up on ECG.

The fight against cardiovascular diseases has long been beyond the scope of a medical problem and can only be successfully conducted with the constant involvement of paediatricians, armed with modern diagnostic tools. The qualified management of cardiac emergencies is often decisive for the outcome of cardiac emergencies.

All this dictates the necessity of knowledge of this pathology and dynamic monitoring of children of all ages.[2]

### **Practical part**

The instruction of students is carried out, the attention to the rules of the internal schedule, features of work in paediatric department №2 (profile cardio-rheumatological). The selection of patients is carried out in accordance with the theme of the lesson. During practical work the student must carry out:

- collection of complaints and anamnesis of the disease,
- clinical examination of the child,
- make a preliminary diagnosis and develop a plan of examination,
- Interpret the results of the laboratory and instrumental methods of investigation,
- Formulation of the final clinical diagnosis,
- Formulation of a treatment and rehabilitation plan,
- writing prescriptions for medicines.

### **Monitoring the learning of the topic**

#### **1. Demonstration of case studies with clinical case studies:**

- Cardiac rhythm disorder,
- heart failure

#### **2. Interpret the proposed electrocardiograms of children of different ages with abnormal rhythm of the heart.**

#### **3. Solution of situational tasks.**

##### **Task 1.**

A 13-year-old girl. Admitted to the emergency room of the children's hospital with complaints of heart palpitations, shortness of breath, and dizziness. EKG showed signs of supraventricular paroxysmal tachycardia.

Compose:

1. Plan of emergency care (dosage, multiplicity, method of drug administration).

2. Plan of examination of the child.

3. vagus test technique, contraindications

### **GUIDELINES FOR ORGANISING AND CARRYING OUT THE CSR**

**The time allocated for independent work is used by students for:**

- Studying the topics (issues) for independent study;
- problem solving;
- research and creative assignments;
- preparing thematic reports, presentations;
- completing practical assignments;
- designing information and demonstration materials (stands, posters, charts, tables, newspapers, etc.);
- compilation of thematic selection of literary sources, internet sources;
- Duty in health care organisations;
- compiling a review of scientific literature on the issues of the class.
- preparation of lectures, discussions with patients on the prevention of cardiovascular diseases and the formation of a healthy lifestyle;
- composing case studies on the topic of the class.

**The main methods for organizing independent work:**

- making a report;
- Examining topics and problems that are not covered in the class;
- preparation and participation in active forms of learning.

**The list of SRS tasks:**

- study of clinical guidelines (examination and treatment protocols) for children with heart rhythm disorders, heart failure.
- compilation of situational tasks on the topic of the class:  
heart rhythm disorder,  
heart failure,
- write out prescriptions for the main groups of drugs used in cardio-rheumatology.
- Research paper on the topic of the class.

### **GUIDELINES ON THE ORGANISATION AND IMPLEMENTATION OF THE MSDS**

**The recommended forms of GSSS organisation are:**

1. preparation of abstracts on proposed topics;
2. solving case studies on the theme of the class;
3. tests on the topic of the class.

**List of SIW tasks:**

- study of clinical guidelines (examination and treatment protocols) for children with rhythm disorders, heart failure.
- Making up situational tasks on the topic of the lesson:  
heart rhythm disorders,  
congenital heart defects,  
heart failure,
- write out prescriptions for the main groups of drugs used in cardio-rheumatology.
- Research paper on the topic of the class.

## **GUIDELINES ON THE ORGANISATION AND IMPLEMENTATION OF THE GSSS**

### **The recommended forms of MSDS organisation are:**

1. preparation of abstracts on proposed topics;
2. solving case studies on the theme of the class; 3;
3. tests on the subject of the class.

### **List of USRS tasks:**

#### **1. Prepare an essay on the proposed topic:**

- Sinus node weakness syndrome.
- Long QT interval syndrome.
- Paroxysmal tachycardia.

#### **2. Solution of situational tasks:**

##### **Task 1.**

Patient R., 17 years old, has called a pediatrician at home with complaints of palpitations, heart palpitations, accompanied by weakness and shortness of breath. The arrhythmia had been bothering him for the last six months, lasting several minutes, passing on its own when he changed his body position.

Past medical history suggests that her memory has been failing over the last few years and she has rarely seen her blood pressure rise to 160/90 mmHg. Past medical history: duodenal ulcer, focal pneumonia. Does not have any bad habits.

On examination the child was in moderate condition. Body build is correct, height - 168 cm, weight - 70 kg.

The shape of the chest was conical and breathing was free through the nose. There was noticeable pulsation of the cervical veins. BP is 17 beats per minute. On percussion the sound is clear, pulmonary, lung boundaries within normal limits. On auscultation his breathing is rigid, no rales.

Circulatory system. Boundaries of relative cardiac tautness: right side - right edge of the sternum, left side - 1 cm inside the left midclavicular line, upper side - upper edge of the third rib. On auscultation the heart tones were muffled and rhythmic. Heart rate - 112 beats per minute, pulse deficit. BP - 130/80 mm Hg.

The abdomen is soft, painless in all parts. The liver was not palpable and the Kurlov's dimensions were 9×8×7 cm.

General blood and urine tests were abnormal. The biochemical blood test shows high cholesterol levels.

ECG is recorded: P waves in all leads are absent. Between QRS complexes, small "f" waves, ventricular frequency 110-150 per minute.

Task:

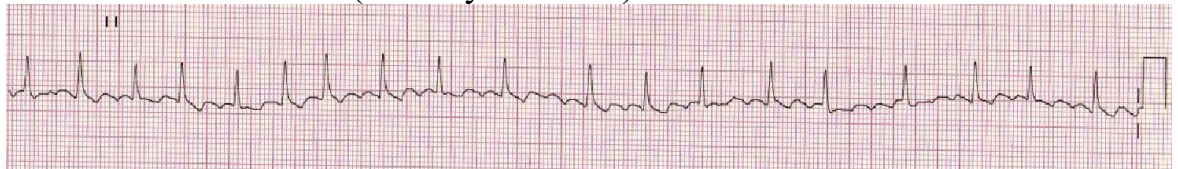
1. What is the patient's rhythm disorder?
2. With which supraventricular arrhythmias should the differential diagnosis be made?
3. What additional examinations will you prescribe for the patient? Justify your answer.
4. Is it necessary to prescribe anticoagulants in this patient?
5. List the cardiovascular and other conditions associated with atrial fibrillation. State which conditions are associated with the development of atrial fibrillation in this patient.

**Task №2.**

Patient K. 17 years old appealed to his local pediatrician because of the first palpitation attack, accompanied by tremor, weakness, and short short shortness of breath. The episode occurred about 2 hours ago, when she was under a lot of emotional stress. No previous regular check-ups had revealed any illnesses and BP was always within normal range. No abnormal findings on previous ECG. He was quite physically fit and tolerant to physical activity.

On examination: clear consciousness. Skin colour and dampness were normal. Breath sounds vesicular in the lungs, BPM 18 per minute. Boundaries of relative cordial dullness within normal limits. Cardiac tones are arrhythmic, no murmurs, heart rate 144 beats per minute, pulse 108 per minute. BP 130/80 mm Hg. Liver's not enlarged. There were no peripheral swellings. Body temperature was 36.9 ° C.

Presented ECG lead II (velocity 25 mm/s):



Assignment:

1. Suggest the most likely diagnosis.
2. Name the abnormalities seen on the ECG presented and formulate an ECG conclusion.
3. What is the leading syndrome in the clinical picture of this disease?
4. Among which similar conditions do you need to make a differential diagnosis?
5. What drugs should be administered to start the management of this emergency condition?

**Task №3.**

A 12-year-old girl was admitted with complaints of discomfort in the heart area, palpitations, which occurred after a conflict at school. Not registered at the dispensary. The child was of regular build and had satisfactory nutrition. Emotionally labile. Her skin was pale. Respiration is vesicular. Breath rate - 20 per minute. Boundaries of OST are within the age norm. Heart sounds are loud, tachycardia, heart rate - 160 per minute. Abdomen is soft, b/w. The liver is not enlarged. No edema. Stool, urination was normal.

Blood count: Er -  $4.4 \times 10^{12}/l$ ; Hb - 136 g/l; C.P. - 0.9; L -  $7 \times 10^9/l$ ; thromb. -  $280 \times 10^9/l$ ; sedimentation rate - 13 mm/hour.

ECG: heart rate - 160 per min; supraventricular paroxysmal tachycardia.

Task:

1. Formulate a diagnosis.
2. What vagus nerve stimulation options do you know.
3. Carry out emergency tactics. Write a prescription for verapamil.

#### **Task №4.**

A 15-year-old boy was admitted to the emergency room with complaints of pain. A 11-month-old boy was admitted to the hospital with complaints of shortness of breath, fatigue, perioral cyanosis while nursing. He is breastfed. Weight 8 kg. Diagnosed with CHD since birth. TYPD has had two respiratory infections and was treated as an outpatient. Condition of the child is moderately severe. Nasal discharge, sneezing. Body temperature 37.5 degrees Celsius. Skin was clean, pale. Pharynx is hyperemic. Her lungs were breathing hard, no rales. BP is 54 per minute. Boundaries of relative cardiac dullness: right - along the right parasternal line, upper II intercostal space, left - 1 cm lateral to the midclavicular line. Auscultatively, a coarse systolic murmur is heard along the left edge of the border, conducted dorsally. The heart rate is 144 per minute. The abdomen is soft, b/w Liver +3 cm. Spleen + 1 cm. Stool, diuresis without features. There was pastosity of the lower legs.

The blood count: Er -  $3.8 \times 10^{12}/l$ ; Hb - 105 g/l; CP - 0.8; L -  $5 \times 10^{12}/l$  - 0.8; L -  $5 \times 10^9/l$ ; SLE - 16 mm/hour; b - 0%; e - 4%; n - 2%; s - 18%; l - 70%; m - 6%.

General urine analysis - specific gravity 1010, leukocytes - 2-3 in p/z.

ECHO CG - perimembranous interventricular septal defect - 6 mm.

ECG - Sinus rhythm, heart rate - 144 per min. Signs of right ventricular septal defect.

Task:

1. What is your presumptive diagnosis?
2. Assess the degree of circulatory disturbance.
3. What further investigations need to be done.
4. Write a prescription for digoxin.

#### **Task 5.**

A 3-year-old girl K. was admitted to the hospital.

It is known from the medical history that the child had diffuse cyanosis of the skin and visible mucous membranes since birth. At the age of 7 days, a Rushkind procedure (closed atrioseptostomy) was performed. From 3 months of age until present she has been in a children's home.

On admission: skin and visible mucous membranes were moderately cyanotic, acrocyanosis, "drumstick" shaped fingers, "watchglass" nails, moderate chest deformity due to medially located heart hump. Boundaries of relative cardiac dullness: right 1.0 cm to the right of the right parasternal line, left - along the left axillary line, upper - II rib. Auscultatively: tones were sonorous, rhythmic, heart rate - 160 beats/min, medium-intensity systolic murmur was heard in II-III intercostal space on the left edge of the sternum, without extending beyond the heart area, accent of the second tone in II intercostal space on the left. Breath rate is 40 per 1



min, breathing is deep and noisy. The liver protrudes 3.0 cm from under the rib edge. Pastosity of the feet.

General blood count: er. -  $4.9 \times 10^{12}/l$ , Hb - 148 g/l, color - 0.9, leuk. - Blood count: er -  $6.3 \times 10^9/l$ , e-1%, p/l - 4%, s - 21%, l - 70%, m - 4%, sed rate - 3 mm/hr.

General urinalysis: colour - light yellow, urine density - 1014, no protein, glucose - none, squamous epithelium - 1-2 in n/a, leukocytes - 0-1 in n/a, no red blood cells, mucus - slightly.

Biochemical blood test: total protein - 69 g/l, CRP - negative.

Task .

1. Formulate and substantiate a preliminary diagnosis.
2. What tests need to be done to confirm the diagnosis.
3. Carry out the differential diagnosis.
4. What is the next course of action for the child.

**Test control.**

1. The heart rate (beats per 1 min) in newborns is:
  - a) 100-110;
  - б) 110-120;
  - в) 120-140;
  - г) 140-150;
  - д) 115-120.
2. high heart rate in newborns is due to:
  - a) the influence of the vagus nerve;
  - б) the influence of sympathetic innervation;
  - в) influence of the vagus nerve and sympathetic innervation;
  - г) decrease in ambient temperature;
  - д) increased neuroreflex excitability.
3. The ECG of an infant is characterized by:
  - a) deviation of the electrical axis of the heart to the right;
  - б) deviation of the electrical axis of the heart to the left;
  - в) The horizontal position of the electrical axis of the heart;
  - г) deviation of electrical axis upwards;
  - д) all answers are correct.
4. The smaller the child, the:
  - a) shorter intervals on the ECG;
  - б) sinus and respiratory arrhythmias are less common;
  - в) longer intervals on the ECG;
  - г) a widening of the QRS complex;
  - д) a decrease in heart rate.
5. The blood pressure in a 1 year old child is:
  - a) 80/55 mmHg;
  - б) 90/60 mmHg;
  - в) 100/65 mmHg;
  - г) 110/70 mmHg;

e) 100/90 mmHg.

6. The blood pressure of a 5-year-old child is:

a) 120/70 mmHg;

b) 110/70 mmHg;

c) 100/60 mmHg;

d) 80/50 mmHg;

e) 115/80 mmHg.

7. Heart rate per minute in a healthy 1 year old child:

a) 120-140;

б) 120;

в) 100;

г) 85;

д) 78.

8. Heart rate per minute in a healthy child of 5 years of age:

a) 120-140;

б) 120;

в) 100;

г) 85;

д) 78.

9. The upper limit of relative cardiac dullness in a healthy child of 10 years is at the level of:

a) second rib;

b) second intercostal space;

c) third rib;

d) third intercostal space;

e) fourth rib.

10. The left border of relative heart bluntness in a healthy one-year-old child is:

a) along the left nipple line;

b) 1-2 cm outwards from the left midclavicular line at the IV intercostal space;

c) 3 cm outside the left midclavicular line;

d) inside 1 cm from the left midclavicular line;

e) 2 cm inwards from the left midclavicular line at the V intercostal space.

11. Which of the following medications should be administered when dyspnoea cyanotic attacks occur in children with Fallo's disease:

(a) Digoxin;

b) obzidan;

c) lasix;

d) veroshpiron;

e) prednisolone.

12. The left border of relative cardiac dullness in a healthy 7-year-old child is:

a) 2 cm outward from the left midclavicular line at the IV intercostal space;

b) 2 cm outwards from the left midclavicular line at the V intercostal space;

- c) along the left midclavicular line at the V intercostal space;
  - d) 1 cm outwards from the left midclavicular line at the IV intercostal space;
  - e) 2 cm to the inside of the left midclavicular line at the V intercostal space.
13. Ventricular extrasystole is characterized by features other than:
- (a) Absence of the P-wave;
  - b) a deformed, widened ventricular complex;
  - c) discordant T waveform;
  - d) incomplete compensatory pause;
  - e) complete compensatory pause.
14. Which of the ECG waves reflects the onset of interventricular septal excitation:
- a) the P wave;
  - b) Q waveform;
  - c) T waveform;
  - d) S wave;
  - e) R wave.
15. Which ECG waveform reflects ventricular repolarization?
- a) P wave;
  - b) Q waveform;
  - c) R waveform;
  - d) S waveform;
  - e) T wave.
16. Atrial extrasystole is characterised by:
- a). premature occurrence of the P wave and QRS complex;
  - b) reversal of the polarity of the P wave;
  - c) altered QRS complex;
  - d) a complete compensatory pause.
17. ECG signs of paroxysmal supraventricular tachycardia are:
- a) an increase in HR by a factor of 2 or more;
  - b) an unchanged P wave;
  - c) the QRS complex is preceded by a P wave;
  - d) the PQ interval is normal or prolonged.

Answers:

1 - c; 2 - b; 3 - a; 4 - a; 5 - b; 6 - c; 7 - b; 8 - c; 9 - c; 10 - b; 11 - b; 12 - c; 13 - d; 14 - b; 15 - e; 16 - a; 17 - a.

### **Forms of GSSS performance control:**

1. checking and evaluating the abstract on the given topic;
2. checking and evaluating of correctness of solving situational tasks;
3. test control.

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