

**Ministry of Health of Ukraine**

Bogomolets National Medical University

**GUIDELINES**

to practical classes for students

Educational discipline: EQ 25 Pediatrics with children's infectious diseases.

Field of knowledge: 22 "Health care"

Specialty: 222 "Medicine"

Pediatrics Department № 2

**APPROVED**

at the meeting of Pediatric Department № 2 of 26.08 2024, protocol №1

Reviewed and approved by Cycle Methodical Commission on

Pediatric Disciplines 29.08.2024 Protocol №1

**Topic:** Differential diagnosis of cardiac arrhythmias and conduction in children. Emergency care of paroxysmal arrhythmia and Adams-Stokes syndrome in children.

## **Competences.**

The student should **know:**

- The subject field of pediatrics (prevention, diagnosis and treatment of diseases in children of various ages) and to understand professional activity (GC4): **causes, mechanisms of development, diagnosis and assistance to children of various ages with heart rhythm and conduction disorders.**
- examination methods and management tactics of children of different ages with heart diseases accompanied by heart rhythm and conduction disturbances.

**be able:**

- • Collect data on the patient's complaints, medical history, life history according to the standard patient survey scheme, according to the established algorithms, conduct and evaluate the results of the physical examination of children of various ages with heart pathology accompanied by heart rhythm and conduction disorders (extrasystoles, paroxysmal tachycardia, atrial fibrillation, atrioventricular blocks). (PLO1)
- • Evaluate information about the diagnosis, applying a standard procedure based on the results of laboratory and instrumental studies of children of various ages with heart pathology. (PLO2)
- • Identify the leading clinical symptom or syndrome. Establish the most likely or syndromic diagnosis of the disease. Assign a laboratory and/or instrumental examination of a sick child. Carry out differential diagnosis of diseases in children of different ages. Establish a preliminary and clinical diagnosis in children of various ages with heart rhythm and conduction disorders. (PLO3)
- • Determine the principles and nature of treatment of heart diseases accompanied by heart rhythm and conduction disorders in children of different ages. (PLO4)
- • Determine the tactics of providing emergency medical care for paroxysmal rhythm disturbances and Morgana-Adams-Stokes syndrome in children of various ages. (PLO5)
- • Provide emergency medical care for paroxysmal rhythm disturbances and Morgagni-Adams-Stokes syndrome in children of all ages. (PLO6)

**The student must be able to:**

- • Ability to collect medical information from children of various ages with heart pathology and analyze clinical data (PC1)
- • Determine the necessary list of laboratory and instrumental studies and evaluate their results in children of various ages with heart rhythm and conduction disorders (PC2)
- • Establish a preliminary and clinical diagnosis of heart pathology in children of various ages (PC3)
- • Determine the principles and nature of treatment of heart diseases accompanied by heart rhythm and conduction disorders in children of different ages (PC4)

**The student must demonstrate:**

- Ability to apply knowledge in practical situations (GC 3).
- The ability to work in a team (GC 7).
- Ability to interpersonal interaction (GC 8).

**The student must have the following skills:**

- Collect medical information about the patient and analyze clinical data (PC1).
- Provision of emergency medical care in outpatient and inpatient settings (PC8)

- Performing medical manipulations (PC10)

(Note: GC – general competences, PC – professional competences, PLO – program learning outcomes)

**The purpose is didactic:**

- To ensure that students learn the etiopathogenesis, diagnosis and differential diagnosis of heart diseases in children.
- Control the degree of assimilation of the algorithm for providing medical care for heart rhythm and conduction disorders and emergency care for paroxysmal rhythm disorders and MAS syndrome.
- Form students' skills and abilities to assess the child's condition; determination of treatment tactics and provision of emergency care; appointment and follow-up.

**Equipment:** dolls, phantoms, documentation (stories of an inpatient f.003, history of child development, f.112), medicines, instructions, tools for parenteral administration of medicines, textbooks, manuals, handbooks, methodical recommendations, algorithms for performing practical skills. Academic journal, student's workbook.

**Lesson plan and organizational structure**

<b>The name of the stage</b>	<b>Description of the stage</b>	<b>Levels of assimilation</b>	<b>Time, 5.5 academic hours</b>
1. <b>Preparatory</b>	1.1. Organizational issues. 1.2. Individual oral survey. 1.3. Formation of motivations 1.4. Control of the initial level of knowledge: Testing; checking home preparation for classes, workbooks; pre-audit independent work of students	B B	<b>15-20%</b> <b>40 min</b>
2. <b>Basic</b>	2.1. demonstration of a thematic patient by the teacher; 2.2. independent work - curation of patients (collection of anamnesis, objective observation, identification of symptoms, formation of syndromes, putting forward and working out hypotheses regarding the preliminary	C	<b>60-65%</b> <b>170 min</b>

	<p>diagnosis, drawing up an examination and treatment plan);</p> <p>2.3. clinical examination of the patient with the participation of the teacher.</p> <p>Differential diagnosis, assessment of clinical data, results of laboratory and instrumental studies, treatment.</p> <p>2.4. Acquisition and practice of practical skills.</p>	C  C, D	
3. The final stage	<p>3.1. control and correction of the final level of training (situational, problematic tasks)</p> <p>3.2. general evaluation of the student's educational activity, work analysis.</p> <p>3.3. Informing students about the topic of the next lesson, detailing homework: repetition of topics from the subject and materials of interdisciplinary integration; tasks from the workbook for SR.</p>	C	<b>20%</b> <b>40 min</b>

### Test tasks for independent processing of the topic

#### 3.4 Tasks for independent study of the topic

**Task 1.** A 15-year-old girl complains of pain in the heart area of a prickly nature, a feeling of palpitation. Heart rate - 64-79 beats / min. The pulse on the radial artery is arrhythmic. The boundaries of the heart corresponding to the age norm. Auscultatory: heart tones are sonorous, arrhythmic in a horizontal position. CBC and urine tests are normal. On the ECG: against the background of sinus rhythm complexes are recorded that have a two-phase P preceding the normal QRS complex, PQ interval 0.12 sec., RR interval between the specified complex and the next sinus rhythm complex <2 RR sinus complexes. The normal position of the ST segment. On echocardiography - without pathology, Ejection fraction - 65%

What arrhythmia causes clinical manifestations in this child?

- A. Atrial extrasystole
- B. Wandering atrial pacemaker
- C. Sick sinus syndrome
- D. Ventricular extrasystole
- E. Atrial ectopic rhythm

**Correct answer:** A. Atrial extrasystoles must be distinguished from premature ventricular contractions (PVCs). Careful scrutiny of the electrocardiogram for a premature P wave preceding the QRS will either show a premature P wave superimposed on, and deforming, the preceding T wave, or a P wave that is premature and has a different contour from that of the other sinus P waves.

Atrial premature complexes usually reset the sinus node pacemaker, leading to an incomplete compensatory pause

**Link:** Robert Kliegman, Bonita Stanton, Joseph St. Geme, Nina Schor. Nelson Textbook of Pediatrics. 20th Edition. 2016 Elsevier Saunders. p. 2253.

**Task 2.** A 14-year-old girl was brought to the hospital with complaints of palpitations, general weakness, and presyncope condition. This heart attack appeared suddenly at school. Similar complaints were observed earlier, but were short in time, and disappeared without treatment. The child is anxious, her skin is pale, cold to the touch. Heart rate up to 200 beats/min. Auscultatory: heart tones of satisfactory sonority, rhythmic, accelerated. The boundaries of the heart corresponding to the age norm. On the ECG: P wave is positive, partially superimposed on the previous T wave, RR intervals are equal, the QRS complex is not changed.

What arrhythmia causes clinical manifestations in this child?

- A. Atrial fibrillation
- B. Atrial nonparoxysmal tachycardia
- C. AV nodal nonparoxysmal tachycardia
- D. Paroxysmal VT
- E. Paroxysmal SVT

**Correct answer E.** SVT is characterized by an abrupt onset and cessation; it may occur when the patient is at rest or exercising. Attacks may last only a few seconds or may persist for hours. The heart rate usually exceeds 180 beats/min and may occasionally be as rapid as 300 beats/min. If the attack is prolonged, precordial discomfort and heart failure may occur. SVT is usually manifested as a narrow QRS complex.

**Link:** Robert Kliegman, Bonita Stanton, Joseph St. Geme, Nina Schor. Nelson Textbook of Pediatrics. 20th Edition. 2016 Elsevier Saunders. p. 2254.

**Task 3.** An 8-year-old child, previously operated on for a congenital heart defect, was hospitalized in the cardiology department. Complaints of general weakness, dizziness, short-term loss of consciousness, shortness of breath. An objective examination revealed bradycardia, heart rate 46 beats/min. The boundaries of the heart are shifted to the left. Enlarged liver, swelling in the extremities. On the ECG: the intervals of PP and RR are constant, but it is impossible to detect patterns between the appearance of P and the QRS complex, QRS complexes of the usual form, 0.12 s wide. S-T segment level is changes.

Determine the pathological condition of this child

- A. AV dissociation with carditis
- B. Carditis, AV block of II degree
- C. Adams-Stocks attack, AV block of III degree
- D. Adams-Stocks attack, SA block
- E. Autonomic crisis with arrhythmia, panic attack

**Correct answer C** Complete AV block is also seen in patients with complex congenital heart disease and abnormal embryonic development of the conduction system. In 3rd-degree AV block, no impulses from the atria reach the ventricles. An independent escape rhythm is usually present. The P waves and QRS complexes have no constant relationship. Some patients have episodes of exercise intolerance, dizziness, and syncope (Stokes-Adams attacks)

**Link:** Robert Kliegman, Bonita Stanton, Joseph St. Geme, Nina Schor. Nelson Textbook of Pediatrics. 20th Edition. 2016 Elsevier Saunders. p. 2260.

**Task 4.** A 10-year-old child was hospitalized in the intensive care unit in serious condition. The child is excited and anxious, complains of pain in the heart, palpitations. His history is complicated

with the underlying thyrotoxicosis. On examination: heart rate 116 per minute, the boundaries of the heart are expanded to the left, you hear irregular and varying in intensity heart rate, systolic murmur at the Erb point. The pulse deficit is defined on arteria radialis. On the ECG: heart rate 100-140 per minute, no P waves; complexes of normal morphology are fast and irregular; in II, III, V1, V2 leads ff with a frequency of 350–450 per 1 min.

What is the cause of the pathological condition in the child?

- A. Paroxysmal SVT
- B. Atrial fibrillation
- C. Atrial flutter
- D. Atrial ectopic rhythm
- E. Paroxysmal VT

**Correct answer B**

Atrial fibrillation characterized by the absence of clear P waves and irregularly irregular ventricular response. The rate of atrial excitation is 400-700 /min usually, and present as the irregular, rapid undulations (F waves). Atrial fibrillation may be seen in older children with rheumatic mitral valve stenosis. It is also seen rarely as a complication of atrial surgery, in patients with left atrial enlargement secondary to left AV valve insufficiency, and in patients with WPW syndrome. Thyrotoxicosis, pulmonary embolism, pericarditis, or cardiomyopathy may be suspected in a previously normal older child or adolescent with atrial fibrillation.

**Link:** Robert Kliegman, Bonita Stanton, Joseph St. Geme, Nina Schor. Nelson Textbook of Pediatrics. 20th Edition. 2016 Elsevier Saunders. p. 2257.

**Task 5.** A 12-year-old child complains of a sudden heart attack, severe weakness. Pulse frequent, weak filling; the ECG shows the absence of P waves, the QRS complex is dilated, deformed, discordant T wave, heart rate - 145 beats/min. What is the first aid in this case?

- A. Valsalva maneuver
- B. Enter adenosine intravenously
- C. Enter digoxin with glucose solution intravenously
- D. Enter lidocaine intravenously
- E. Cardiac pacing

Correct answer **D**. Although some children tolerate rapid ventricular rates for many hours, this arrhythmia should be promptly treated because hypotension and degeneration into ventricular fibrillation may result. For patients who are hemodynamically stable, intravenous amiodarone, lidocaine, or procainamide are the initial drugs of choice.

**Link:** Robert Kliegman, Bonita Stanton, Joseph St. Geme, Nina Schor. Nelson Textbook of Pediatrics. 20th Edition. 2016 Elsevier Saunders. p. 2257.

**Tasks**

1. A 12-year-old child complains of chest pain, palpitations, shortness of breath, and dizziness associated with physical exertion. HR=100 beats/min. Objectively: pale skin, frequent breathing, decreased blood pressure. On the ECG: increase in heart rate, shortening of P-Q, Q-T intervals, sharpening of the R wave. Establish a diagnosis. Conduct differential diagnosis with paroxysmal tachycardia.

*Right answer:* Sinus tachycardia. With sinus tachycardia, the heart rate increases by 20% of the age norm. On the ECG the QRS complexes are not changed.

*Link:* Nelson Textbook of Pediatrics, 2-Volume Set (Nelson Pediatrics) 21st Edition by Robert M. Kliegman MD, Joseph St. Geme MD, 2020, 5932 p

2. A 6-year-old child in critical condition has the following ECG data: frequency of atrial contractions (P waves) up to 250 per minute, lack of isoline between P waves, ventricular contractions are frequent but rhythmic, the frequency of ventricular contractions in relation to atrial contractions can be 1:2, 1:3, 1:4. Establish a diagnosis.

*Right answer:* Atrial flutter. The described clinical picture and ECG data correspond to the diagnosis of atrial flutter (fibrillation).

*Link:* Pediatrics: textbook/O.V.Tiazhka [et al.]; ed. by:O.V. Tiazhka ; National O. O. Bohomolets medical university. - 3th ed. reprint. - Vinnytsya : Nova Knyha Publishers, 2018. - 544 p.

## **Recommended Literature**

### **Fundamental:**

1. Nelson Textbook of Pediatrics, 2-Volume Set (Nelson Pediatrics) 21st Edition by Robert M. Kliegman MD, Joseph St. Geme MD, 2020, 5932 p.
2. Pediatrics : textbook/O.V. Tiazhka [et al.]; ed. by:O.V. Tiazhka ; National O. O. Bohomolets medical university. - 3th ed. reprint. - Vinnytsya : Nova Knyha Publishers, 2018. - 544 p.
3. Pediatrics [Text]: national textbook / T. O. Kryuchko [et al.] ; ed. by.: T. O. Kryuchko, O. Y. Abaturov ,2nd ed. revised. - Kyiv: Medicine Publishing, 2017. - 208 p

### **Additional**

1. Pediatric physical examination : textbook for students of higher educational institutions / O. V. Katilov [et al.] ; рец. L. M. Bulat [et al.]. - Vinnytsya : Nova Knyha, 2018. - 504 p.
2. Neonatal and Pediatric Guidelines for Arrhythmia Management What the Neonatal and Pediatric Critical Care Nurse Needs to Know Cecilia St. George-Hyslop, M Ed, RN, CNCCP(C), The Hospital for Sick Children, Toronto, Canada Candace Morton, MSN, CPNP-PC/AC, Children's Hospital of Wisconsin Elizabeth Daley, BA, BSN, RN, CCRN, Children's Hospital of Los Angeles.
4. Irregular heart rhythm (arrhythmias) in children. Author: Andrew D Blaufox, MD. UpToDate. last updated: Feb 15, 2022.  
<https://www.uptodate.com/contents/irregular-heart-rhythm-arrhythmias-in-children>
5. Cardiac Arrhythmias. Clinical GuidancePaediatric Critical Care.  
<https://www.evelinalondon.nhs.uk/resources/our-services/hospital/south-thames-retrieval-service/cardiac-arrhythmias.pdf>
6. Types of Arrhythmia in Children. American Heart Association  
<https://www.heart.org/en/health-topics/arrhythmia/about-arrhythmia/types-of-arrhythmia-in-children>.

### **Questions for student self-preparation for practical training:**

1. Determination of heart rhythm and conduction disorders
2. Etiology and pathogenesis of cardiac arrhythmias and conduction in children.
3. Classification of cardiac arrhythmias and conduction in children.
4. The main clinical signs of arrhythmias in children.
5. The main criteria for the diagnosis of arrhythmias in children.
6. Etiology and classification of extrasystole.

7. ECG characteristics and clinical significance of supraventricular and ventricular arrhythmias in children.
8. Principles of treatment of extrasystole in children.
9. Etiology and classification of atrial fibrillation in children.
10. ECG characteristics and clinical significance of atrial fibrillation in children.
11. Principles of treatment of atrial fibrillation in children.
12. Etiology and classification of complete atrioventricular block in children.
13. ECG characteristics and clinical significance of complete AV blockade in children.
14. Morgan-Adams-Stokes attack: etiology, clinical significance.
15. Morgan-Adams-Stokes attack: ECG characteristics and emergency care.
16. Paroxysmal tachycardia: etiology and ECG characteristics.
17. Paroxysmal tachycardia: principles of treatment

Guidelines composed by associate professor of the Pediatrics Department №2 Chernii O.F.