MINISTRY OF HEALTH OF UKRAINE

ODESA NATIONAL MEDICAL UNIVERSITY

Department of Family Medicine and Polyclinic Therapy

CONFIRMED by

Prorector for scientific and pedagogical work

_____ Eduard BURYACHKIVSKIY

September 1st, 2023

**METHODOLOGICAL RECOMMENDATIONS
FOR PRACTICAL CLASSES
IN THE EDUCATIONAL DISCIPLINE**

Faculty: international, course: 6

**EDUCATIONAL DISCIPLINE:
"ECG IN THE PRACTICE OF A FAMILY DOCTOR "**

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Approved:
At the meeting of the department of family medicine and polyclinic therapy
Odessa National Medical University

Minutes No. _1_ dated _30_/_08_/2023__.

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Practical lesson № 1-2

Topic 1: Anatomical and electrophysiological basis of electrocardiography.

Goal: to deepen, expand and specify knowledge of the properties of the heart muscle, electrophysiological processes occurring in the myocardium,linear significance of the electrocardiography method; mastering the technique of taking an ECG.

Basic concepts: Clinical significance of the electrocardiography method. Characteristics of the main properties of the heart muscle. The essence and patterns of electrophysiological processes occurring in the myocardium. ECG recording technique. Lead of a standard ECG. Additional ECG leads.

Equipment: laptop, multimedia projector.

Plan:
1. Organizational activities (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).
2. Control of the reference level of knowledge (written work, written test, frontal survey, etc.) (if necessary):

    – requirements for students' theoretical readiness to perform practical classes (knowledge requirements, list of didactic units);
    Know:
     - heart anatomy
     - characteristics of heart muscle
     - the structure of the conducting system of the heart
     - the path of conduction of excitation through the heart
     - phases of action potential development
     - standard electrocardiography technique
     - additional ECG leads
     - the main elements of the ECG curve

    – questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson.

    Question:
    1. Anatomy of the heart. Correspondence of ECG leads to heart departments.
    2. What are the main characteristics of the heart muscle that distinguish it from other muscles?
    3. What heart rate are generated by rhythm drivers of different orders?
    4. What are the indications for an ECG diagnosis?
    5. How to prepare a patient for taking an ECG?
    6. What mistakes can be made when the electrodes are applied incorrectly to the limbs?
    7. What changes on the ECG can lead to incorrect application of chest electrodes?
    8. What are the additional ECG leads and in what cases are they used? How to technically carry out ECG recording in additional leads and how to mark it on the ECG tape?
    9. What are the main elements of the electrocardiographic curve?
    10. What processes in the heart are responsible for each element of the ECG curve?
    11. What elements of an ECG curve can be defined as an isoelectric line?

3. Formation of professional abilities and skills (mastery of skills, conducting curation,

determining the treatment scheme, conducting laboratory research, etc.):
– content of tasks (tasks, clinical situations, etc.);

Task
1. Standard ECG technique. How to avoid mistakes?
2. Additional ECG leads. Assessment of the need for conducting and place of electrode placement (compilation of clinical cases by students of higher education).
3. Assess a young girl's ECG. What changes are there on this ECG? What technique of taking an ECG should be used in this patient?
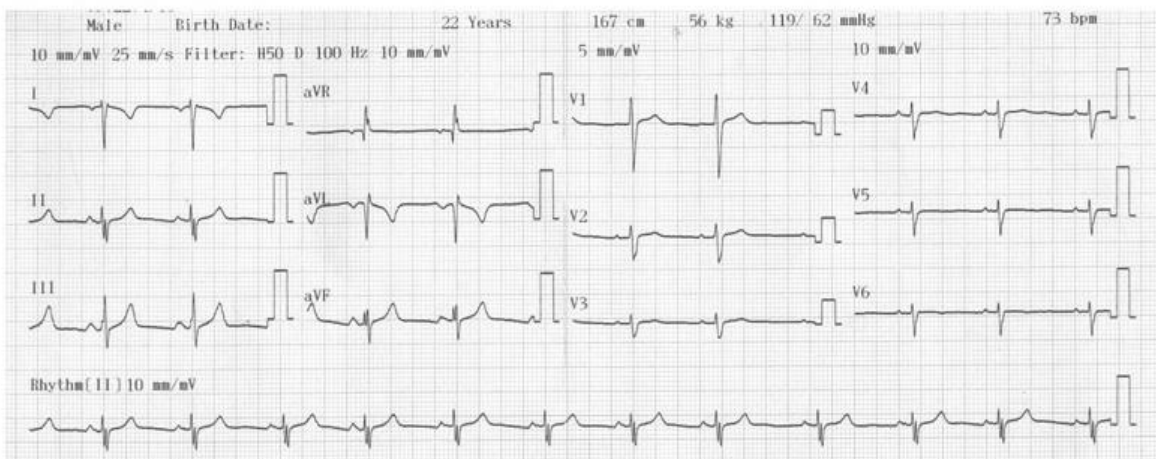
4. The ECG of a 50-year-old patient revealed a prolongation of the PQ interval. This change indicates a violation of which process? What is the norm of the PQ interval?
–
– recommendations (instructions) for performing tasks (professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

Main tasks	Instructions	Answers
Learn:		
1. Properties of cardiac muscle	Name the main properties of the heart muscle and give their brief description	
2. Conductive system of the heart	List the drivers of heart rhythm of different order, give their brief characteristics	
3. General provisions of ECG diagnostics	Name the main indications for conducting ECG diagnostics, clinical significance and patient preparation	
4. Methods of taking a standard ECG	Name the places where the electrodes are applied when recording a standard 12-lead ECG	
5. Additional ECG leads	Name the main additional leads, places of electrode application, clinical significance	
6. Elements of the ECG curve	Name what processes in the heart are reflected by each element of the ECG	

– Requirements for work results, including before registration: in case of independent preparation for a practical lesson, an indicative card for a practical lesson is filled out.

Requirements:
- to know the correspondence of each element of the ECG to electrophysiological processes in

the myocardium
- to know the correspondence of the mapping of the myocardial sections with ECG leads
- to be able to apply electrodes correctly when recording a standard ECG and an ECG in additional leads
- to know what errors in the interpretation of the ECG lead to incorrect electrocardiography technique

Applicants must observe academic integrity, namely:
- independent performance of all types of work, tasks, forms of control provided for by the work program of this educational discipline;
- references to sources of information in case of use of ideas, developments, statements, information;
- compliance with the legislation on copyright and related rights;
- provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

– control materials for the final stage of the lesson: tasks, tasks, tests, etc. (if necessary).

Test tasks
1. How many electrodes are needed to record a standard 12-lead ECG?
   A. 12 electrodes
   B. 10 electrodes
   C. 8 electrodes
   D. 14 electrodes

2. Which parts of the heart represent leads I, aVL, V5, and V6?
   A. Membrane
   B. Laterally
   C. Lower
   D. Front

3. What element of the ECG reflects the depolarization of the ventricles?
   A. Tooth R
   B. Tooth P
   C. QRS complex
   D. Tooth T

4. Which of the following is responsible for the formation of sinus rhythm?
   A. Atrioventricular node
   B. His bundle
   C. Purkinje fibers
   D. Sinoatrial node

5. What process in the myocardium reflects the P wave?
   A. Atrial repolarization
   B. Ventricular depolarization
   C. Impulse conduction from the atria to the AV node
   D. Atrial depolarization

6. Which of the following positions are true for additional posterior leads?
   A. V7 - on the left along the posterior axillary line, V8 - on the left scapular and V9 - on the left paravertebral line at the same level as electrodes V4-V6
   B. V7 – on the left along the posterior axillary line, V8 – along the left scapular and

V9 – along the left paravertebral line one intercostal space below electrodes V4-V6

    C. V7 – on the left along the posterior axillary line, V8 – along the left scapular and V9 – along the left paravertebral line one intercostal space above electrodes V4-V6

    D. V7 – on the left along the posterior axillary line, V8 – along the left scapular and V9 – along the left paravertebral at the level of the VI intercostal space

7. Which part of the heart is excited first?
    A. Right ventricle
    B. Left atrium
    C. Right atrium
    D. Interventricular membrane

8. As a result of which error when recording the ECG, the direction of the electrical axis of the heart can be incorrectly determined?
    A. Incorrect placement of chest electrodes
    B. Improper placement of electrodes on the limbs
    C. Low temperature in the room
    D. Poor contact between the electrodes and the patient's skin

9. What element reflects the electrical systole of the ventricles?
    A. ST segment
    B. PT interval
    C. QT interval
    D. QRS complex

10. Which of the following is a sign of impaired conduction of impulses through the ventricles?
    A. Shortening of segment PQ
    B. Widening of the QRS complex
    C. ST segment shortening
    D. Depression of the ST segment

4. Summing up

- checking and discussing the answers of higher education applicants
- control of the level of professional skills and abilities
- evaluation of each answer, setting of grades
- answer to possible questions
- task for the next class

5. List of recommended literature (main, additional, electronic information resources):
Basic:
1. The ECG. Made easy. Ninth edition / John Hampton, Joanna Hampton. Elsevier, 2019. 207 pages.

Additional:
1. Anatomy of the cardiac conduction system. Pacing Clin Electrophysiol / Santosh K Padala, José-Angel Cabrera, Kenneth A Ellenbogen – NIH, PubMed, Sensors (Basel), 2021 Jan; 44(1):15-25. doi: 10.1111/pace.14107. URL: https://pubmed.ncbi.nlm.nih.gov/33118629/

2. Electrocardiogram / Yasar Sattar, Lovely Chhabra – StatPearls [Internet] – Last Update: June 13, 2022. URL: https://www.ncbi.nlm.nih.gov/books/NBK549803/

Practical lesson № 3-4

Topic 2: Electrocardiogram analysis algorithm.

Goal: to deepen, expand and specify the knowledge of higher education students regarding the ECG analysis algorithm; to develop the ability to perform ECG interpretation according to the algorithm: rhythm determination, heart rate calculation, EOS determination, detection of deviations from the norm of ECG elements; teach to identify changes on the ECG in hypertrophies of the heart.

Basic concepts: Determination of the source of excitation and regularity of heart rhythm. Criteria of sinus rhythm. Determination of heart rate. Determination of the position of the electrical axis of the heart, calculation of the alpha angle. Morphological assessment of the main elements of the ECG: norms and deviations from the norm. ECG signs of atrial hypertrophy. ECG signs of ventricular hypertrophy.

Equipment: laptop, multimedia projector.

Plan:
1. Organizational activities (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).
2. Control of the reference level of knowledge (written work, written test, frontal survey, etc.) (if necessary):

– requirements for students' theoretical readiness to perform practical classes (knowledge requirements, list of didactic units);

Know:
- the path of conduction of excitation through the heart
- the principle of using a millimeter grid to determine the duration (at different speeds of the tape) and the amplitude of individual morphological elements of the electrocardiogram
- basic criteria of sinus rhythm
- methods of heart rate calculation with correct and incorrect rhythms
- norms of the duration and amplitude of individual elements of the ECG curve, as well as the causes of deviations from the norm
- methods of determining the direction of EOS, the norm and deviation from the norm
- characteristic changes of the P wave during enlargement of the atria
- characteristic changes on the ECG in ventricular hypertrophy

– questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson.

Question:
1. Which pacemaker is responsible for the occurrence of sinus rhythm and what frequency does it generate?
2. What are the criteria for normal sinus rhythm?
3. Which parameter of the ECG recording is important in determining heart rate? Name the methods of heart rate calculation.

4. Describe the visual methods of determining the direction of the EOS.
5. How does the P wave change with atrial hypertrophy?
6. What changes occur in the activity of the heart when the duration of the PQ segment changes?
7. How does the QRS complex change with ventricular hypertrophy? What are voltage and non-voltage criteria of ventricular hypertrophy?
8. What changes in the ST segment can be noted on the ECG? Violations of which processes reflect changes in the ST segment?
9. What are the characteristics of the T wave in the norm? How can the T wave change and in case of disturbances of which processes?
10. How is the U wave determined on the ECG and what are the normal signs of this wave?

3. Formation of professional abilities and skills (mastery of skills, conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
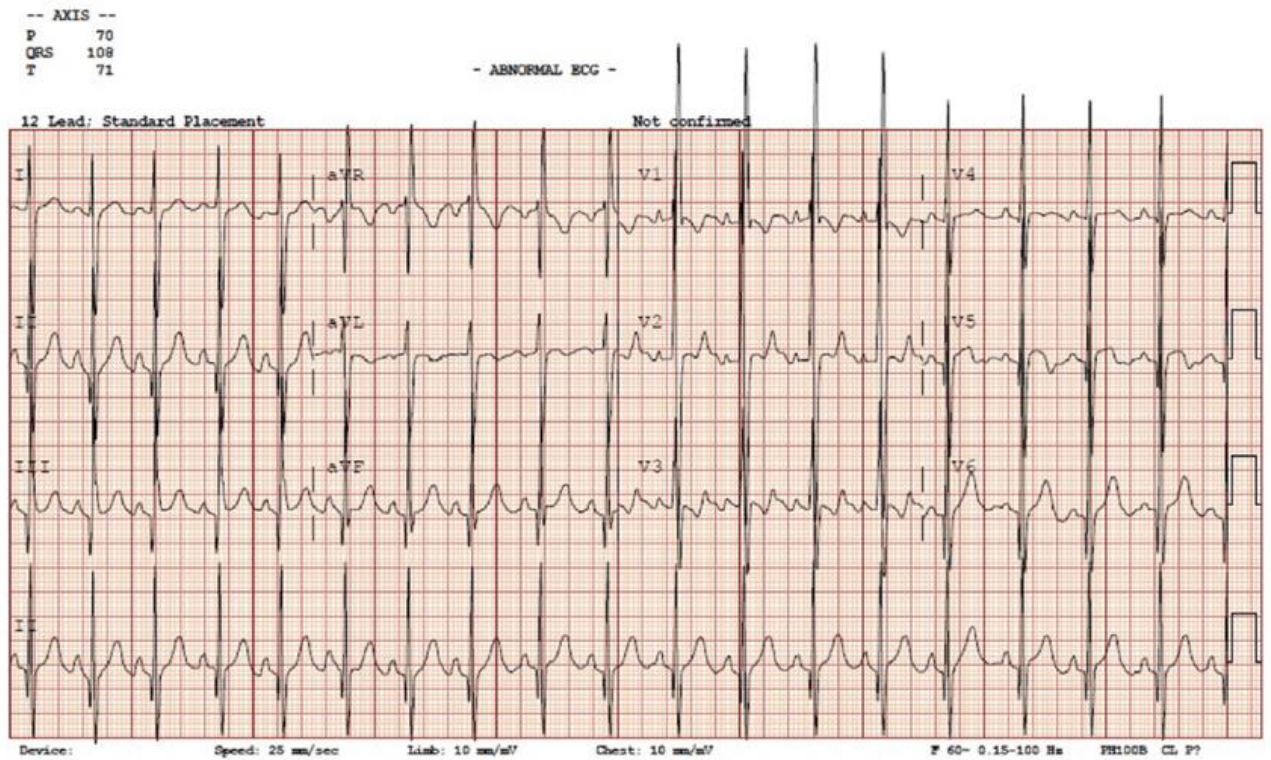   – content of tasks (tasks, clinical situations, etc.);

<u>Task</u>
1. Describe the changes noted on the fragment of daily ECG monitoring below.
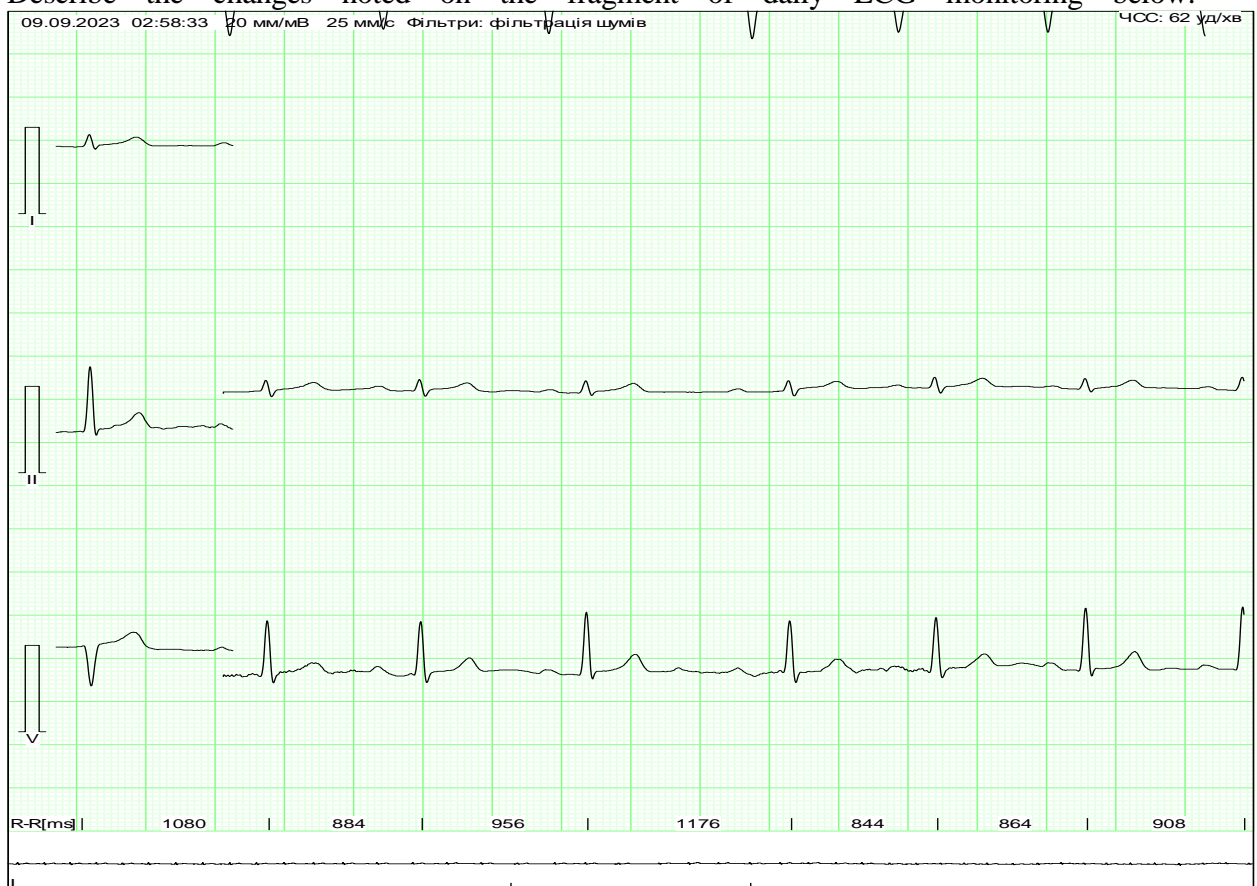
2. An ECG was taken from a patient with a congenital heart defect. Indicate what changes on the ECG indicate an increase in the size of the chambers of the heart?

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3. Describe the visual method of determining the position of the electrical axis of the heart. What position of EOC is determined on the ECG strip below?
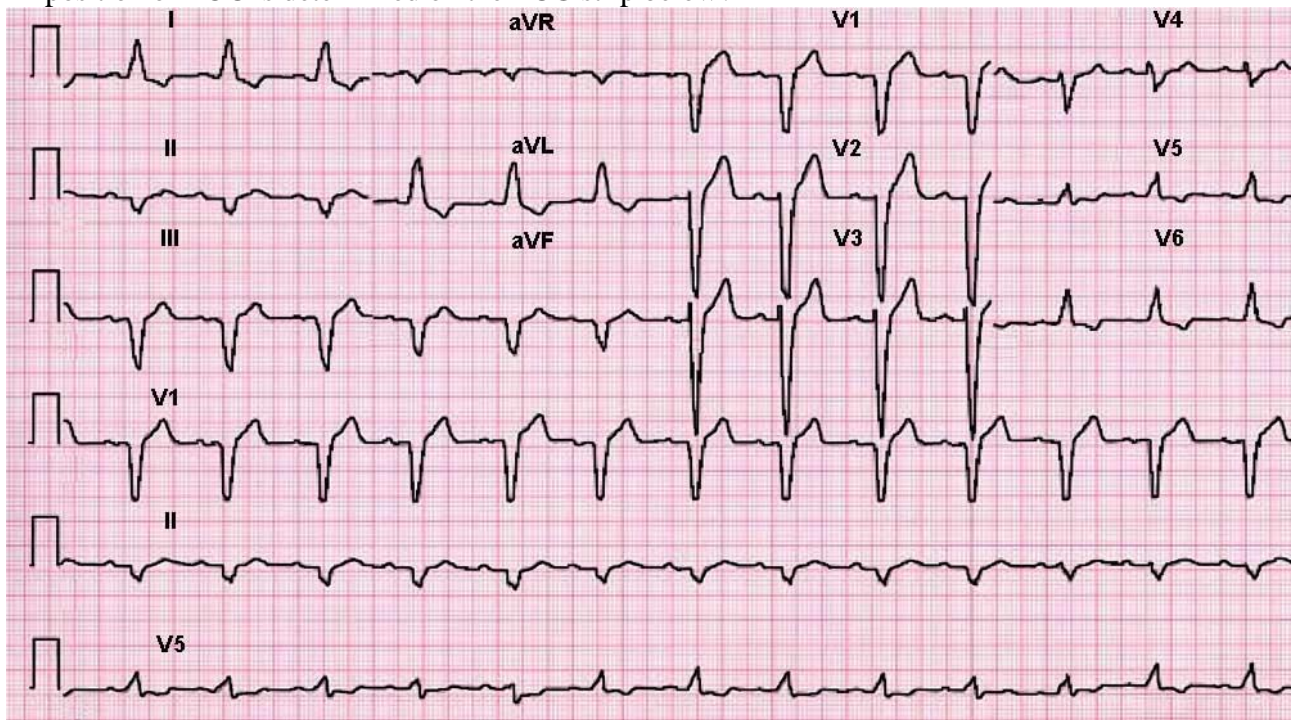
  – recommendations (instructions) for performing tasks(professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

Main tasks	Instructions	Answers
Learn:		
1. Sinus rhythm	Name the criteria of sinus rhythm	
2. Determination of heart rate	Describe the main methods of heart	

	rate calculation	
3. Definition of EOS	What are the methods of determining EOS? Describe the visual method of determining the directivity of EOS	
3. Norms of ECG elements	Give the main characteristics of ECG elements	
4. Atrial hypertrophy	Name the main changes in the P wave in atrial hypertrophy	
5. Hypertrophy of the ventricles	Name the main changes on the ECG with ventricular hypertrophy	
6. Segments, intervals	Name the main deviations from the norm of segments and intervals of the ECG and in the event of violation of which processes they occur	
T and U teeth	Name the norms of T and U waves and their main changes	

− Requirements for work results, including before registration: in case of independent preparation for a practical lesson, an indicative card for a practical lesson is filled out.

Requirements:
- be able to determine the source of excitation and heart rhythm
- to be able to calculate heart rate with correct sinus rhythm and irregular heart rhythm
- to be able to determine the direction of the EOS
- to be able to identify deviations from the norm of the main elements on the ECG
- to be able to detect signs of enlargement of the heart chambers on the ECG

Applicants must observe academic integrity, namely:
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- references to sources of information in case of use of ideas, developments, statements, information;
- compliance with the legislation on copyright and related rights;
- provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

− control materials for the final stage of the lesson: tasks, tasks, tests, etc. (if necessary).

Test tasks
1. Which of the listed reasons is the most frequent for deviation of EOS to the right?
   A. Blockade of the right leg of the bundle of His
   B. Hypertrophy of the right atrium
   C. Hypertrophy of the right ventricle
   D. Left ventricular hypertrophy

2. What is the heart rate if the RR interval is 3 large cells?
   A. 80 per minute
   B. 100 per minute
   C. 90 per minute
   D. 70 per minute

3. What can a shortening of the PQ interval indicate?

A. Slowing of the conduction of the impulse from the atria to the AV node
B. Acceleration of the conduction of the impulse from the atria to the AV node due to the additional conduction path
C. Slowing of impulse conduction in the atria
D. Tooth T

4. In which lead should the P wave be negative normally?
   A. V1
   B. aVL
   C. aVR
   D. III

5. What is the direction of EOS, if the greatest amplitude of the R wave is noted on the ECG in lead I, and in leads II and III the QRS complex is mostly negative?
   A. Deviation of EOS to the right
   B. Deviation of EOS to the left
   C. Normal position of EOS
   D. Vertical position of EOS

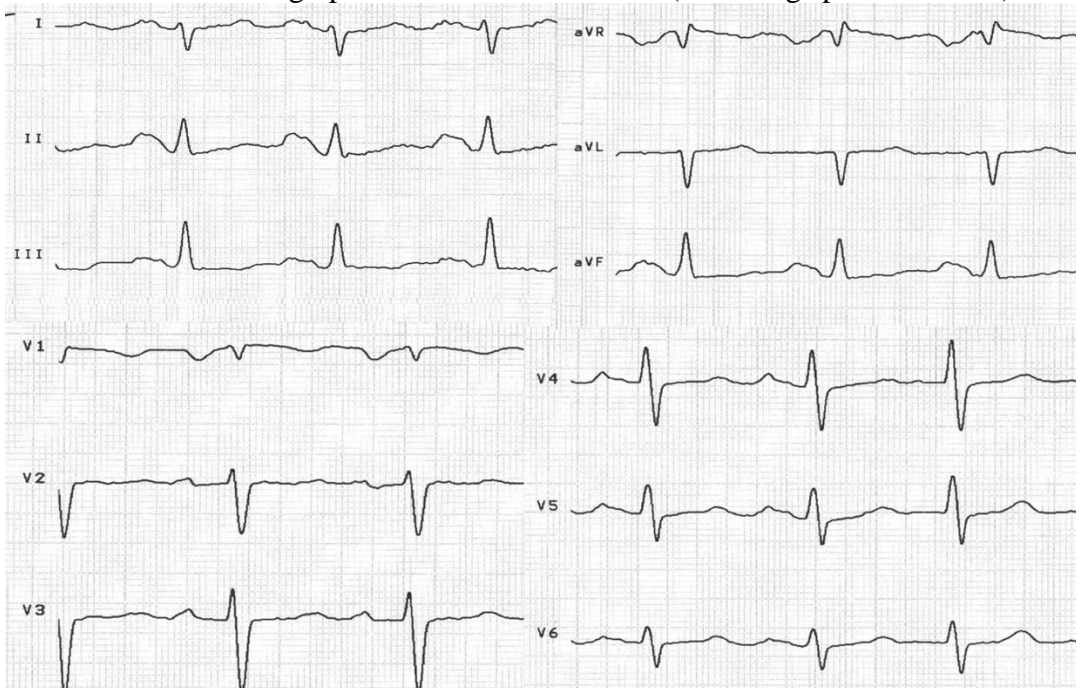6. Which of the following options describes this ECG (recording speed 25 mm/s)?
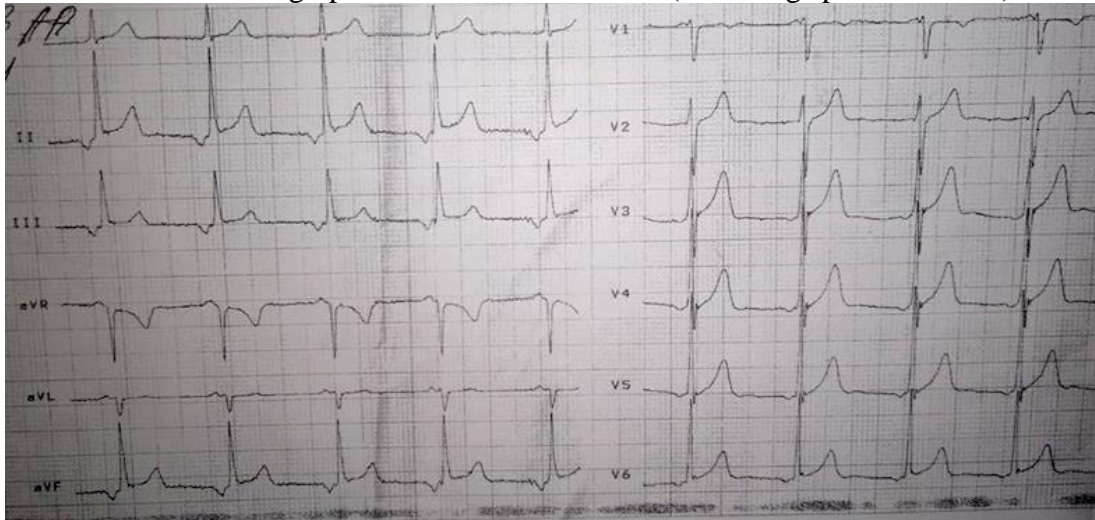
   A. The rhythm is sinusoidal, regular. Heart rate - 75 per minute. EVS is not rejected.
   B. The rhythm is sinusoidal, regular. Heart rate - 120 per minute. EVS is deflected to the left.
   C. The rhythm is non-sinusoidal, regular. Heart rate - 75 per minute. EVS is not rejected.
   D. The rhythm is non-sinusoidal, regular. Heart rate - 75 per minute. EVS is deflected to the left.

7. Which of the following options describes this ECG (recording speed 25 mm/s)?
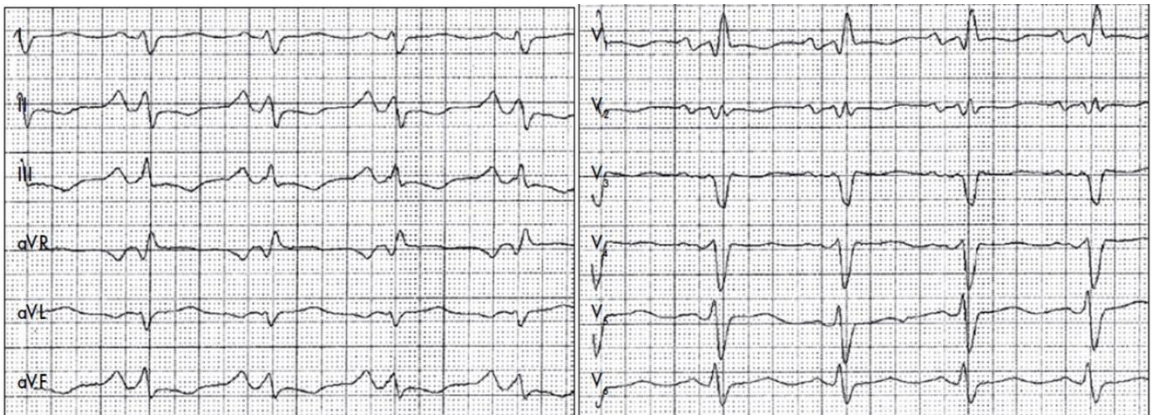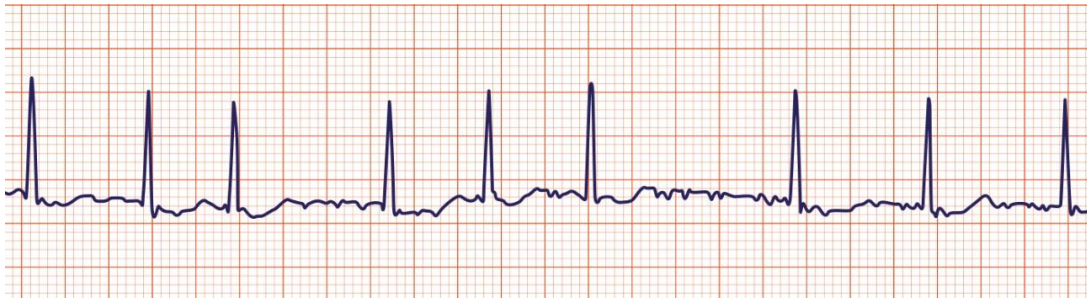
A. The rhythm is non-sinusoidal, regular. Heart rate - 75 per minute. EVS is deflected to the left. Hypertrophy of the right atrium. Hypertrophy of the right ventricle.

B. The rhythm is sinusoidal, regular. Heart rate - 60 per minute. EVS is deflected to the right. Hypertrophy of the right atrium.

C. The rhythm is non-sinusoidal, regular. Heart rate - 60 per minute. EVS is deflected to the left.

D. The rhythm is sinusoidal, regular. Heart rate - 60 per minute. EVS is deflected to the right. Hypertrophy of the right atrium. Hypertrophy of the right ventricle.

8. Which of the following options describes this ECG (recording speed 25 mm/s)?

A. The rhythm is sinusoidal, regular. Heart rate - 60 per minute. EVS is deflected to the right. Hypertrophy of the right atrium.

B. Sinus bradycardia. Heart rate - 55 per minute. EVS is deflected to the right. Left atrial hypertrophy.

C. Sinus bradycardia. Heart rate - 55 per minute. EVS is not rejected. Left atrial hypertrophy.

D. The rhythm is sinusoidal, regular. Heart rate - 60 per minute. EVS is not rejected. Left atrial hypertrophy.

9. Which of the following options describes this fragment of the ECG (recording speed 25 mm/s)?

A. The rhythm is sinus, irregular. Heart rate - 60 per minute.
B. The rhythm is non-sinusoidal, regular. Heart rate - 60 per minute.
C. The rhythm is not sinusoidal, irregular. Heart rate - 110 per minute.
D. The rhythm is not sinusoidal, irregular. Heart rate - 80 per minute.

10. Which of the following options describes this ECG?
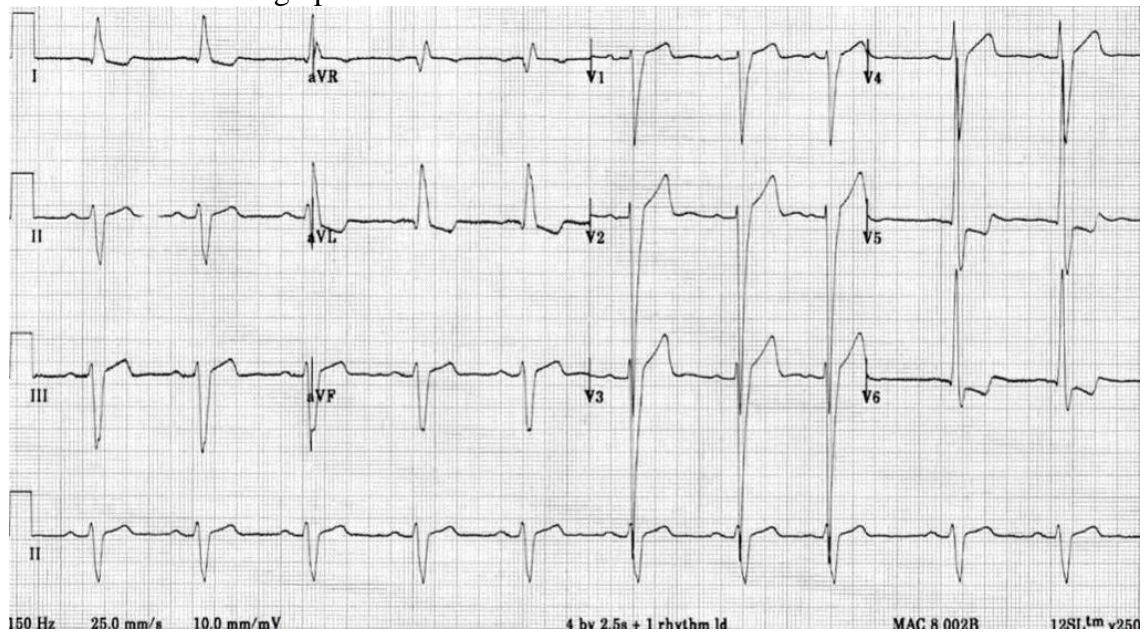
A. The rhythm is sinus, irregular. Heart rate - 65 per minute. EVS is not rejected. Left ventricular hypertrophy.
B. The rhythm is sinus, irregular. Heart rate - 65 per minute. EVS is deflected to the left. Left ventricular hypertrophy.
C. The rhythm is sinusoidal, regular. Heart rate - 75 per minute. EVS is deflected to the left. Left ventricular hypertrophy.
D. The rhythm is sinusoidal, regular. Heart rate - 65 per minute. EVS is not rejected. Left ventricular hypertrophy.

4. Summing up
- checking and discussing the answers of higher education applicants
- control of the level of professional skills and abilities
- evaluation of each answer, setting of grades
- answer to possible questions
- task for the next class

5. List of recommended literature (main, additional, electronic information resources):

Basic:
1. The ECG. Made easy. Ninth edition / John Hampton, Joanna Hampton. Elsevier, 2019. 207 pages.

2. Fred Kusumoto. ECG Interpretation. From Pathophysiology to Clinical Application. Second edition / Fred Kusumoto. Springer, 2020.

Additional:
1. Anatomy of the cardiac conduction system. Pacing Clin Electrophysiol / Santosh K Padala, José-Angel Cabrera, Kenneth A Ellenbogen – NIH, PubMed, Sensors (Basel), 2021 Jan; 44(1):15-25. doi: 10.1111/pace.14107. – Resource access mode: https://pubmed.ncbi.nlm.nih.gov/33118629/
2. EKG | ECG Interpretation Made Easy: An Illustrated Study Guide For Students To Easily Learn How To Read & Interpret ECG Strips Paperback – NEDU LLC, 2021. 156 pages.
3. Electrocardiogram / Yasar Sattar, Lovely Chhabra – StatPearls [Internet] – Last Update: June 13, 2022. URL: https://www.ncbi.nlm.nih.gov/books/NBK549803/

Electronic information resources:
1. Electrocardiogram calculators: https://en.my-ekg.com/calculation-ekg/ekg-calculations.html

Practical lesson № 5-6

Topic 3: Cardiac arrhythmias. ECG signs in ectopic heart rhythm disorders.

Goal: to deepen, expand and specify the knowledge of higher education students regarding the concept and classification of cardiac arrhythmias, electrocardiographic signs in ectopic heart rhythm disorders; to develop the skills of detecting rhythm disturbances on the ECG, extrasystoles, and their differentiation; learn to detect atrial rhythms.

Basic concepts: Definition and classification of cardiac arrhythmias. Extrasystole: definition, classification, clinical significance. ECG signs in different variants of extrasystoles. ECG signs of atrial rhythms.

Equipment: laptop, multimedia projector

Plan:
1. Organizational activities (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).
2. Control of the reference level of knowledge (written work, written test, frontal survey, etc.) (if necessary):

– requirements for students' theoretical readiness to perform practical classes (knowledge requirements, list of didactic units);
Know:
- signs of a correct heart rhythm
- types of cardiac arrhythmias
- classification of cardiac arrhythmias
- definition of the concept of "extrasystole" and the mechanism of occurrence
- the meaning of the term "post-menstrual pause"
- ECG signs of supraventricular and ventricular extrasystoles
- ECG signs of atrial rhythms

– questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson.

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Question:
1. Define cardiac arrhythmia. How can they be classified?
2. Which extrasystoles are characterized by a complete compensatory pause?
3. In which extrasystoles can the P wave be noted before the extrasystolic complex?
4. Is extrasystole always accompanied by a compensatory pause?
5. What are the main ECG signs of atrial extrasystoles?
6. What are the distinctive ECG signs of extrasystole from the AV node?
7. What are the main ECG signs of ventricular extrasystoles?
8. Will the QRS complex always be normal with supraventricular extrasystoles?
9. How does the P wave change depending on the change in the source of excitation in the atria?
10. What are non-paroxysmal ectopic atrial rhythms and what are their ECG features?

3. Formation of professional abilities and skills (mastery of skills, conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
   – content of tasks (tasks, clinical situations, etc.);

Task
1. A 54-year-old patient, who has complaints of periodic interruptions in the work of the heart, had an ECG taken. Describe what changes on the ECG this patient has and what ectopic rhythm disturbances were detected.

RHYTHM STRIP: II
25 mm/sec;1 cm/mV
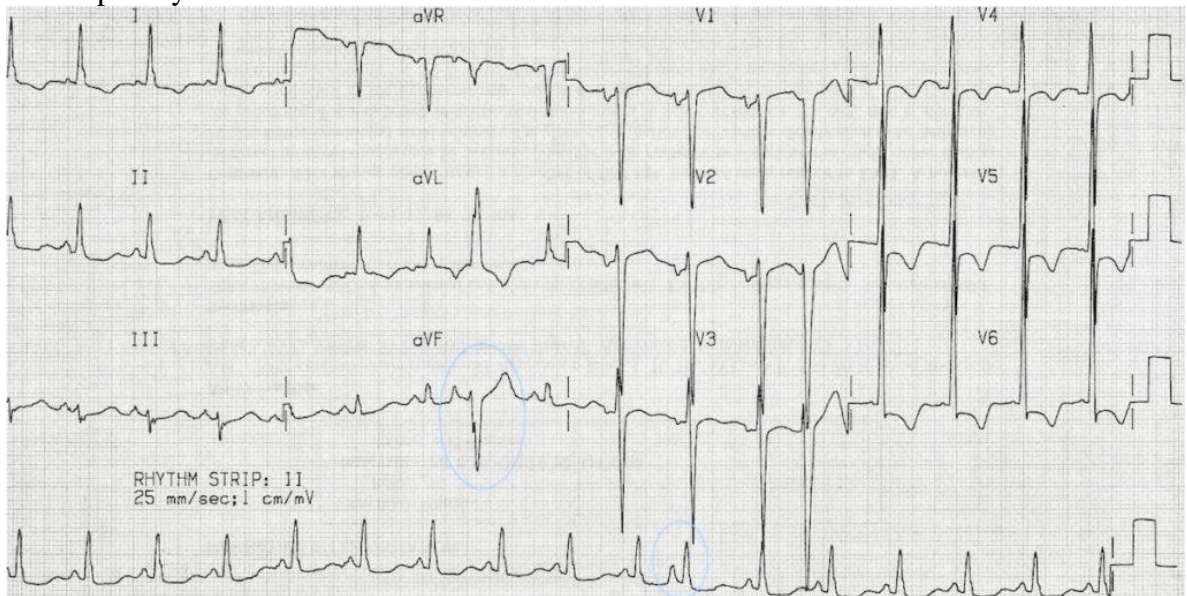
2. What type of heart rhythm disturbance is recorded on the fragment of the daily ECG monitoring? What is the source of excitement in this case?

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3. A 35-year-old patient complains of frequent interruptions in the work of the heart. Which variant of the rhythm disturbance occurs in this patient?

– recommendations (instructions) for performing tasks(professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

Main tasks	Instructions	Answers
Learn:		
1. Definition	Define the concept of cardiac arrhythmia	
2. Classification	Give the classification of cardiac arrhythmias	
3. ECG diagnosis	Describe the main ECG criteria of supraventricular and ventricular extrasystoles	
4. Differential diagnosis	Name the main differences between supraventricular and ventricular extrasystoles	
5. Non-paroxysmal ectopic atrial rhythms	Name the main forms of non-paroxysmal ectopic atrial rhythms and their ECG signs.	

– Requirements for work results, including before registration: in case of independent preparation for a practical lesson, an indicative card for a practical lesson is filled out.

Requirements:
- knowcharacteristics of correct sinus rhythm
- be able to detect ectopic rhythms
- know the ECG characteristics of extrasystoles
- be able to detect extrasystoles with normal and aberrant conduction
- to be able to differentiate supraventricular and ventricular extrasystoles

Applicants must observe academic integrity, namely:
- independent performance of all types of work, tasks, forms of control provided for by the work program of this educational discipline;
- references to sources of information in case of use of ideas, developments, statements, information;
- compliance with the legislation on copyright and related rights;
- provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

– control materials for the final stage of the lesson: tasks, tasks, tests, etc. (if necessary).

Test tasks

1. Which of the following reasons is NOT an ECG sign of correct sinus rhythm?
   A. A normal P wave precedes each QRS complex
   B. Regular rhythm with a difference between RR intervals > 10%
   C. The heart rate is equal to the automatism of the sinus node
   D. The same PQ intervals in all cardiac cycles within 0.12-0.20 s

2. What type of arrhythmia is characterized by the following signs: the presence of a positive P wave before a narrow premature QRS complex, an incomplete compensatory pause?
   A. Atrial extrasystole from an ectopic focus above the AV node
   B. Ventricular extrasystole
   C. Extrasystole from the AV node
   D. Atrial extrasystole from an ectopic focus below the AV node

3. Which of the following options describes multifocal atrial extrasystoles?
   A. Complexes arising from more than three ectopic foci; multiple morphologies of P teeth
   B. Complexes arising from two or more ectopic foci; multiple morphologies of P teeth
   C. Complexes arising from more than two ectopic foci; negative wave R
   D. Complexes arising from two or more ectopic foci; absence of R teeth

4. What type of arrhythmia is shown in the ECG fragment below?

   A. Atrial extrasystole
   B. Interpolated atrial extrasystole
   C. Interpolated ventricular extrasystole
   D. Ventricular extrasystole

5. What type of arrhythmia is shown in the ECG fragment below?

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   A. Multifocal atrial extrasystoles
   B. Ventricular trihymenia
   C. Multifocal ventricular extrasystoles
   D. Paired ventricular extrasystoles

6. What type of arrhythmia is shown in the ECG fragment below?

   A. Atrial extrasystole
   B. Interpolated atrial extrasystole
   C. Extrasystole from the AV node
   D. Ventricular extrasystole

7. Which of the following arrhythmias is NOT supraventricular?
   A. Atrial fibrillation
   B. Extrasystole from the AV node
   C. Ventricular fibrillation
   D. Atrioventricular reciprocal tachycardia

8. Which of the following arrhythmias originates from a single ectopic source from the atria outside the sinus node?
   A. Atrial fibrillation
   B. Atrial flutter
   C. Monofocal atrial tachycardia
   D. Multifocal atrial tachycardia

9. Which of the listed ECG signs does NOT refer to the description of ventricular extrasystole?
   A. Wide QRS complex ($\geq$ 120 ms) with altered morphology
   B. Discordant displacements of the ST segment and a change in the direction of the T wave
   C. Complete compensatory pause
   D. Negative P wave before the extrasystolic QRS complex

10. What type of arrhythmia is shown on the ECG fragment below (recording speed 25 mm/s)?
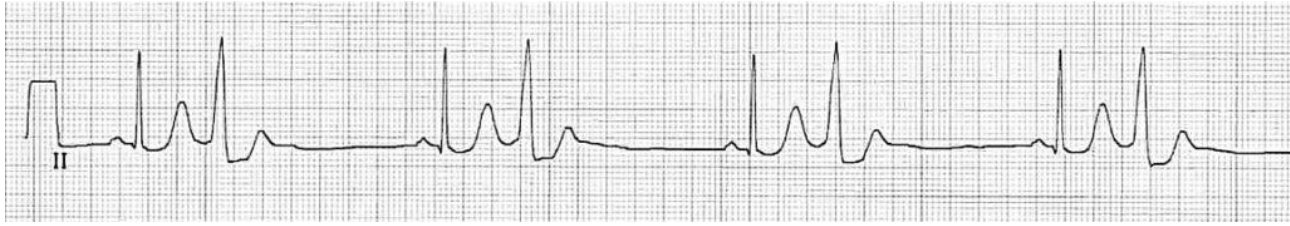
    A. Extrasystole from the AV node, bigeminia
    B. Atrial bigeminy
    C. Ventricular trihymenia
    D. Ventricular bigeminy

4. Summing up
- checking and discussing the answers of higher education applicants
- control of the level of professional skills and abilities
- evaluation of each answer, setting of grades
- answer to possible questions
- task for the next class

5. List of recommended literature (main, additional, electronic information resources):
Basic:
1. The ECG. Made easy. Ninth edition / John Hampton, Joanna Hampton. Elsevier, 2019. 207 pages.
2. The ECG Made Practical / John Hampton, David Adlam – Elsevier, 2019. 341 pages.
3. Family medicine: in 3 books. Book 1. General Issues of Family Medicine: textbook / O.M. Hyrina, L.M. Pasiyeshvili, O.M. Barna et al. Kyiv, 2016.
4. Fred Kusumoto. ECG Interpretation. From Pathophysiology to Clinical Application. Second edition / Fred Kusumoto. Springer, 2020.

Additional:
1. 150 ECG Cases / John Hampton, David Adlam, Joanna Hampton – Elsevier, 2019. 329 pages.
2. EKG | ECG Interpretation Made Easy: An Illustrated Study Guide For Students To Easily Learn How To Read & Interpret ECG Strips Paperback – NEDU LLC, 2021. 156 pages.
3. Anatomy of the cardiac conduction system. Pacing Clin Electrophysiol / Santosh K Padala, José-Angel Cabrera, Kenneth A Ellenbogen – NIH, PubMed, Sensors (Basel), 2021 Jan; 44(1):15-25. doi: 10.1111/pace.14107. URL: https://pubmed.ncbi.nlm.nih.gov/33118629/
4. Electrocardiogram / Yasar Sattar, Lovely Chhabra – StatPearls [Internet] – Last Update: June 13, 2022. URL: https://www.ncbi.nlm.nih.gov/books/NBK549803/

Electronic information resources:
1. World Health Organization. URL: www.who.int/ru/index.html.
2. European Regional Office of the World Health Organization. URL: www.euro.who.int.
3. Modern healthcare. URL: https://www.modernhealthcare.com/vital-signs-healthcare-blog
4. AHA: https://www.heart.org/
5. EHA https://www.heartassociation.eu/
6. EHA CRP: https://cpr.heart.org/en/
7. NICE: https://www.nice.org.uk/
8. PubMed: https://pubmed.ncbi.nlm.nih.gov/
9. Medscape: https://www.medscape.com/
10. NCBI: https://www.ncbi.nlm.nih.gov/
11. Electrocardiogram calculators. URL: https://en.my-ekg.com/calculation-ekg/ekg-calculations.html

Topic 4: ECG signs in paroxysmal heart rhythm disorders. Atrial fibrillation and flutter.

Goal: to deepen, expand and specify the knowledge of general issues and ECG diagnosis of supraventricular and ventricular paroxysmal tachycardias, family doctor's tactics for paroxysmal heart rhythm disorders; practice the ability to detect supraventricular and ventricular tachycardia on the ECG.

Basic concepts: Paroxysmal tachycardia: definition, classification. ECG signs of various forms of paroxysmal supraventricular tachycardia. Atrial fibrillation and flutter: definition, forms, ECG signs. Paroxysmal ventricular tachycardia, ventricular fibrillation and flutter: ECG picture. Tactics of a family doctor in paroxysmal heart rhythm disorders.

Equipment: laptop, multimedia projector

Plan:
1. Organizational activities (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).
2. Control of the reference level of knowledge (written work, written test, frontal survey, etc.) (if necessary):

   – requirements for students' theoretical readiness to perform practical classes (knowledge requirements, list of didactic units);
   Know:
     – signs of correct sinus rhythm
     – definition of the term "paroxysmal"
     – forms of supraventricular arrhythmia
     – forms of ventricular arrhythmia

   – questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson.

   Question
   1. Define the term "paroxysmal".
   2. What are the types of paroxysmal supraventricular tachycardia?
   3. What conduction pathways exist in the AV node and how does excitation pass through them normally?
   4. What features of the ECG picture can be noted in AV-nodal tachycardia?
   5. What type of SVT develops in patients with an additional pathway?
   6. What are the main ECG signs of atrial fibrillation?
   7. What are the forms of atrial flutter? Name the main ECG signs.
   8. What main ECG signs are more in favor of ventricular tachycardia than SVT with aberrant conduction?
   9. What are the main signs of polymorphic torsade de pointes?
   10. What are the main ECG signs of ventricular flutter and fibrillation? Emergency aid.

3. Formation of professional abilities and skills (mastery of skills, conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
   – content of tasks (tasks, clinical situations, etc.);

   Task
   1. A 32-year-old patient complains of periodic feelings of significant acceleration in the work of the heart, which disappear on their own. During one of these episodes, it was

possible to record an ECG. What type of arrhythmia does this patient have?
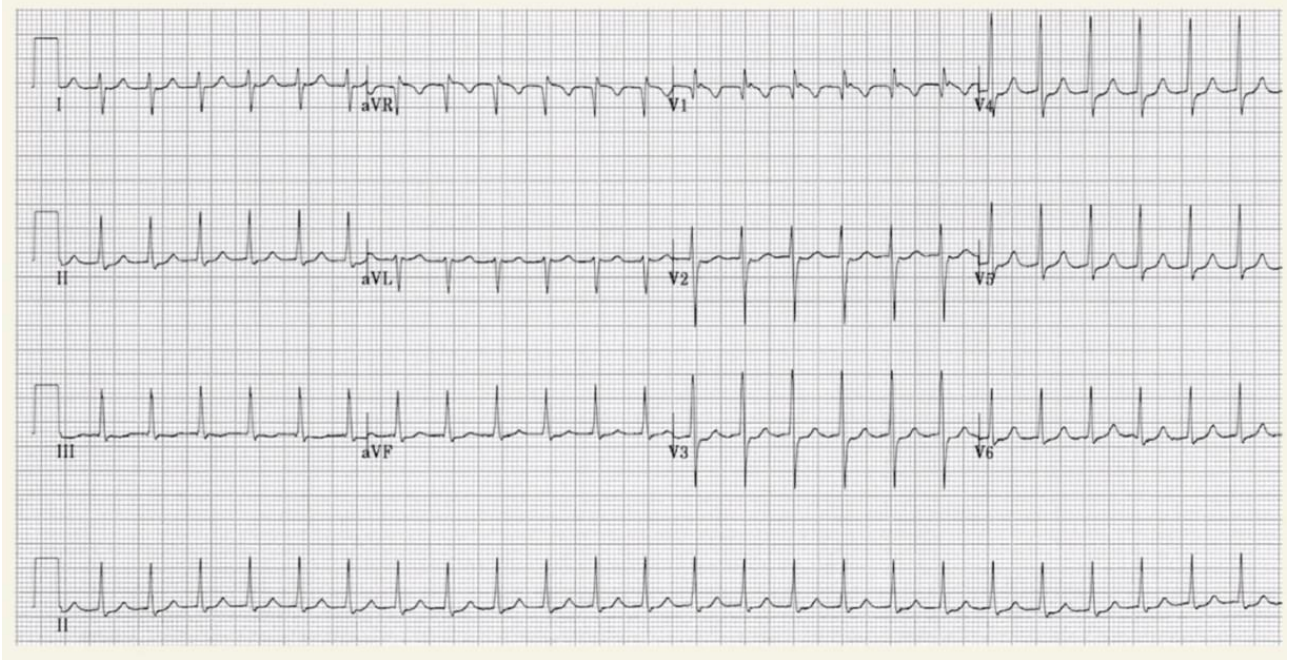
2. A 65-year-old patient complains of frequent heart palpitations. When examining blood pressure on both arms, 100/70 mm Hg. Art. Heart rate - 145 per minute. Pulse 110 per minute. An ECG was taken. There are no previous ECGs. What rhythm disturbance is most likely present in this patient?
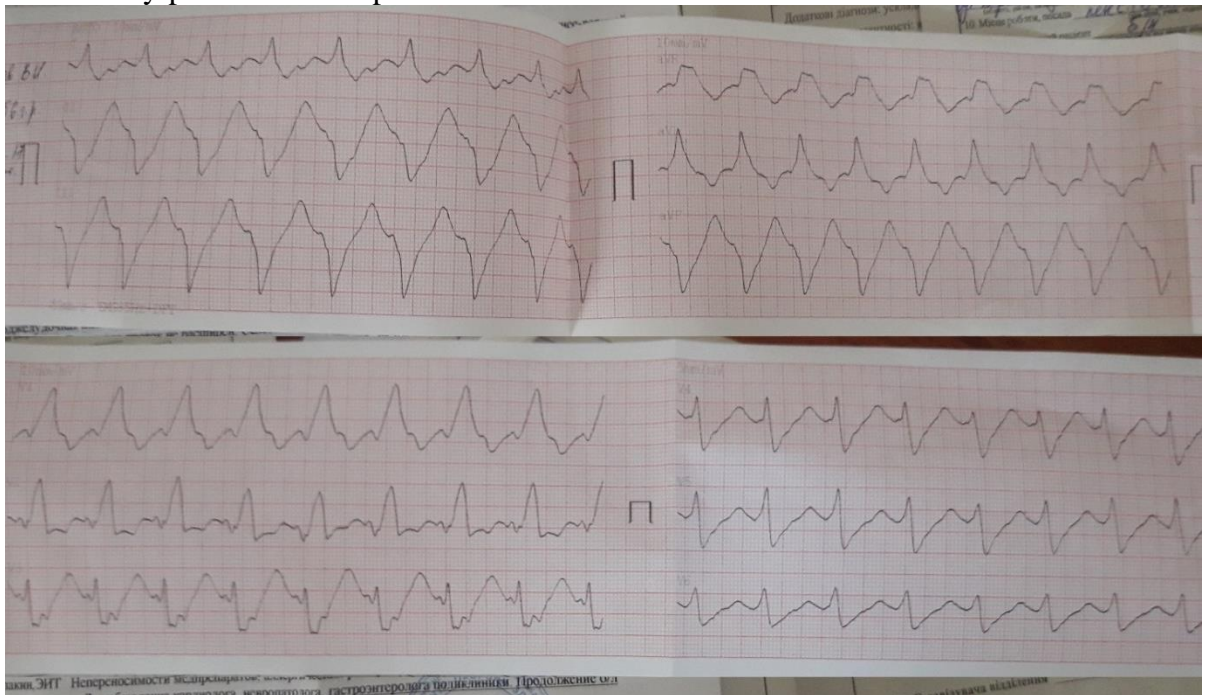
3. A 62-year-old patient, who suffered an acute cerebrovascular accident 2 months ago, had an ECG taken again. No rhythm disturbances were detected on past ECGs. What rhythm disturbance is currently present in the patient?
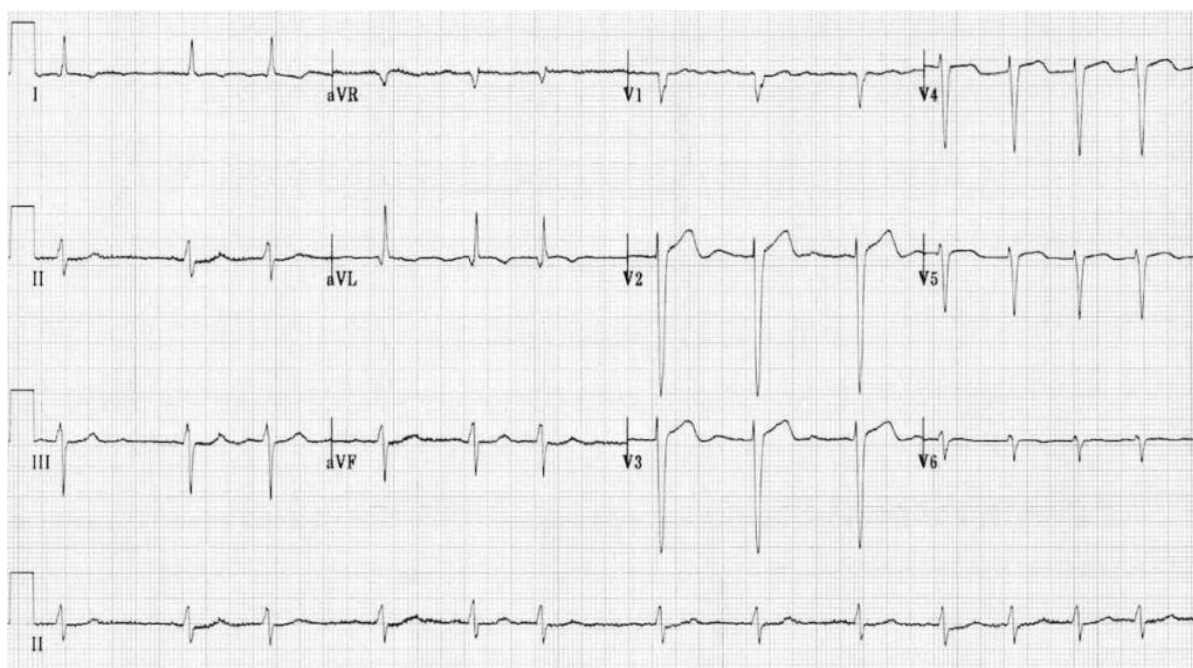
– recommendations (instructions) for performing tasks(professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

Main tasks	Instructions	Answers
Learn:		
1. Definition of concepts	Define the term "paroxysmal tachycardia"	
2. Classification	Give the classification of paroxysmal tachycardia.	
3. ECG diagnosis of SVT	Name the general ECG signs of supraventricular tachycardias and features in AVVT, AVVT and atrial tachycardias	
4. ECG diagnosis of AF and TP	Name the main changes on the ECG in atrial fibrillation and flutter	
5. ECG diagnosis of ventricular tachycardia	Name the main ECG signs of paroxysmal ventricular tachycardia	
6. ECG diagnosis of FS and TS	Name the main ECG signs of ventricular fibrillation and flutter	
7. Emergency care	Name the main approaches to providing emergency care to patients with various forms of paroxysmal tachycardia	

– Requirements for work results, including before registration: in case of independent preparation for a practical lesson, an indicative card for a practical lesson is filled out.

Requirements:
- know the definition of "paroxysmal tachycardia"
- be able to identify and differentiate supraventricular and ventricular tachycardia
- be able to detect atrial fibrillation, typical and atypical forms of atrial flutter
- be able to detect ventricular fibrillation and flutter
- know the main approaches to providing emergency care to patients with various forms of paroxysmal tachycardia

Applicants must observe academic integrity, namely:
- independent performance of all types of work, tasks, forms of control provided for by the work program of this educational discipline;
- references to sources of information in case of use of ideas, developments, statements, information;
- compliance with the legislation on copyright and related rights;
- provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

– control materials for the final stage of the lesson: tasks, tasks, tests, etc. (if necessary).

Test tasks

1. Which of the following rhythm disturbances is NOT a variant of tachycardia with wide QRS complexes?
   A. Monomorphic ventricular tachycardia
   B. Polymorphic ventricular tachycardia
   C. Atrial flutter
   D. Ventricular fibrillation

2. Which of the listed ECG changes leads to Torsade de Pointes polymorphic ventricular tachycardia?
   A. PQ segment depression
   B. Short QT interval
   C. Prolonged QT interval
   D. Depression of the ST segment

3. What rhythm disturbance is noted on the ECG below?
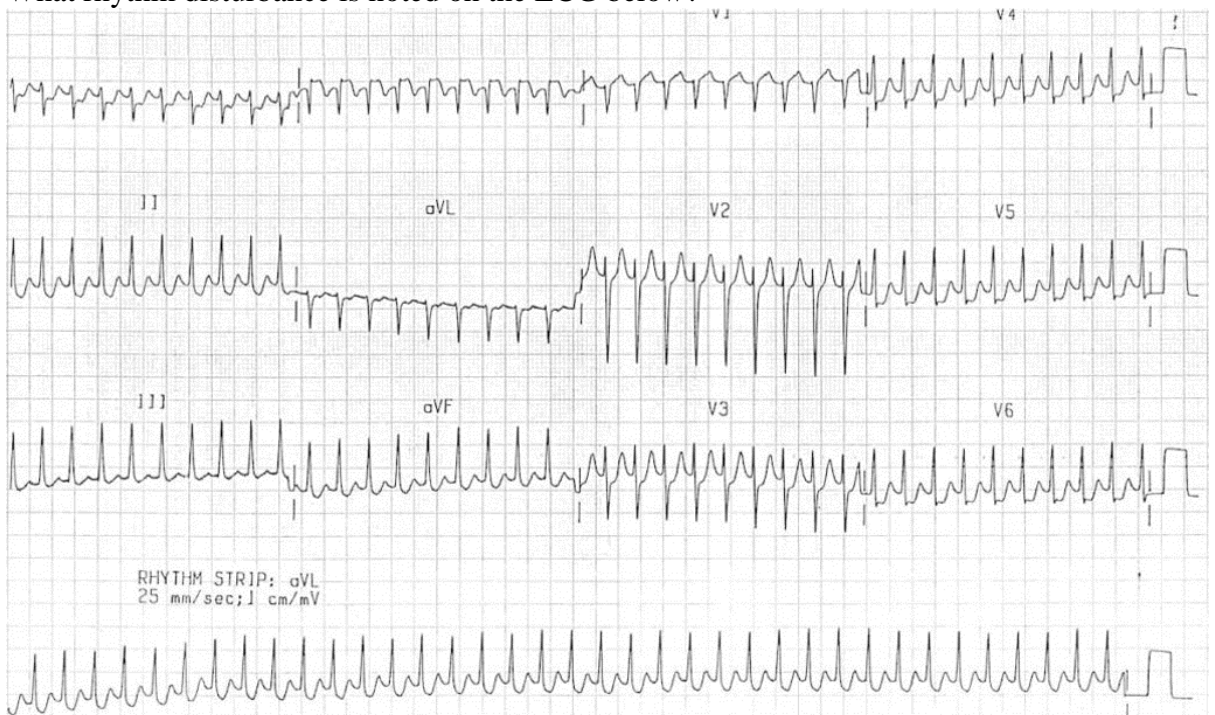
   A. Atrial fibrillation
   B. Supraventricular tachycardia
   C. Ventricular tachycardia
   D. Torsade de Pointes

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4. What changes are shown on the ECG below?
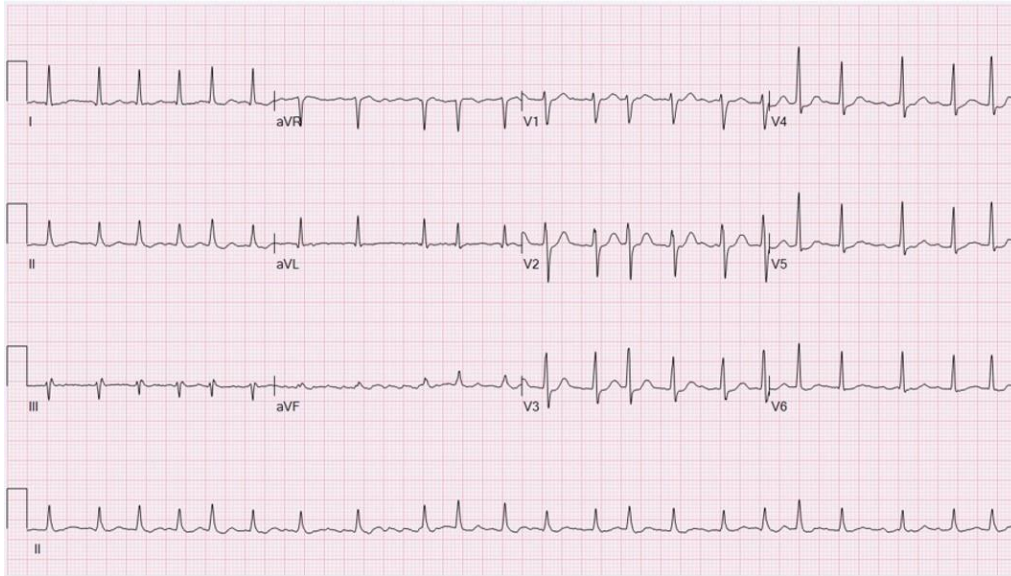
    A. Sinus tachycardia
    B. Atrial flutter
    C. Paroxysmal supraventricular tachycardia
    D. Atrial fibrillation

5. What ECG characteristic will indicate more in favor of ventricular tachycardia than supraventricular?
    A. Normal position of EOS
    B. Wide QRS complexes < 160 ms
    C. Very wide QRS complexes≥160 ms
    D. Retrograde teeth R

6. Which of the listed signs is NOT characteristic of atrial flutter?
    A. Dust-like waves instead of an isoelectric line
    B. Wide QRS complexes
    C. The rhythm of the ventricles is determined by the AV node
    D. Frequency of atrial contractions≈300 per minute

7. Which of the following signs is characteristic of atrial fibrillation?
    A. The presence of a negative P wave before each QRS complex
    B. Irregular rhythm
    C. The presence of a clear isoelectric line
    D. Very wide QRS complexes≥160 ms

8. Which of the following is characteristic of Torsade de Pointes?
    A. Heart rate over 300 beats per minute
    B. Cyclic change of the QRS axis by 180 ° every 5-20 beats
    C. Regular RR intervals
    D. Previous shortened QT interval

9. Which of the following indicates that supraventricular tachycardia is more likely than ventricular tachycardia?
    A. A wide QRS complex≥160 ms
    B. The presence of retrograde wave R
    C. Irregular rhythm

D. Change in the axis of the QRS complex

10. What type of arrhythmia is shown on the ECG fragment below (recording speed 25 mm/s)?
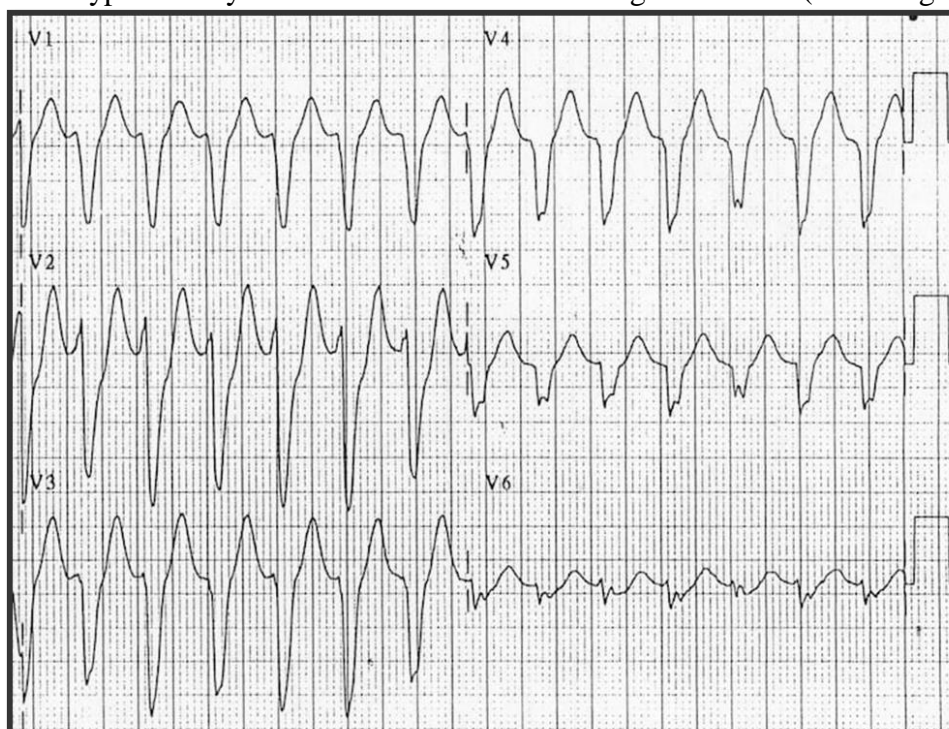
 A. Fluttering of the ventricles
 B. Supraventricular tachycardia
 C. Monomorphic ventricular tachycardia
 D. Polymorphic ventricular tachycardia

4. Summing up
- checking and discussing the answers of higher education applicants
- control of the level of professional skills and abilities
- evaluation of each answer, setting of grades
- answer to possible questions
- task for the next class

5. List of recommended literature (main, additional, electronic information resources):
Basic:
1. The ECG. Made easy. Ninth edition / John Hampton, Joanna Hampton. Elsevier, 2019. 207 pages.
2. The ECG Made Practical / John Hampton, David Adlam – Elsevier, 2019. 341 pages.
3. Family medicine: in 3 books. Book 1. General Issues of Family Medicine: textbook / O.M. Hyrina, L.M. Pasiyeshvili, O.M. Barna et al. Kyiv, 2016.
4. Fred Kusumoto. ECG Interpretation. From Pathophysiology to Clinical Application. Second edition / Fred Kusumoto. Springer, 2020.

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3. Anatomy of the cardiac conduction system. Pacing Clin Electrophysiol / Santosh K Padala, José-Angel Cabrera, Kenneth A Ellenbogen – NIH, PubMed, Sensors (Basel), 2021 Jan; 44(1):15-25. doi: 10.1111/pace.14107. URL: https://pubmed.ncbi.nlm.nih.gov/33118629/
4. Electrocardiogram / Yasar Sattar, Lovely Chhabra – StatPearls [Internet] – Last Update: June 13, 2022. URL: https://www.ncbi.nlm.nih.gov/books/NBK549803/

Electronic information resources:
1. World Health Organization. URL: www.who.int/ru/index.html.
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3. Modern healthcare. URL: https://www.modernhealthcare.com/vital-signs-healthcare-blog
4. AHA: https://www.heart.org/
5. EHA https://www.heartassociation.eu/
6. EHA CRP: https://cpr.heart.org/en/
7. NICE: https://www.nice.org.uk/
8. PubMed: https://pubmed.ncbi.nlm.nih.gov/
9. Medscape: https://www.medscape.com/
10. NCBI: https://www.ncbi.nlm.nih.gov/
11. Electrocardiogram calculators. URL: https://en.my-ekg.com/calculation-ekg/ekg-calculations.html

Practical lesson № 9-10

Topic 5: ECG signs in heart conduction disorders.

Goal: to deepen, expand and specify the knowledge of general issues and ECG diagnostics of heart conduction disorders, namely different types of heart blocks, premature arousal syndromes and approaches to providing assistance in emergency situations; to teach how to identify different variants of conduction disturbances on the ECG.

Basic concepts: Heart blocks: types, their characteristics. ECG signs of various types of conduction disorders: sinoatrial, atrioventricular, intraventricular blockade. Premature arousal syndromes: ECG signs. ECG pattern in WPW syndrome. Basic approaches to emergency care and further management of the patient.

Equipment: laptop, multimedia projector

Plan:
1. Organizational activities (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).
2. Control of the reference level of knowledge (written work, written test, frontal survey, etc.) (if necessary):

– requirements for students' theoretical readiness to perform practical classes (knowledge requirements, list of didactic units);
Know:
- types of heart block
- ECG signs of sinoatrial blocks
- ECG signs of atrioventricular blocks
- ECG signs of intraventricular blocks
- ECG signs in the syndromes of premature excitation of the ventricles
- the main onesapproaches to emergency care and further management of the patient with significant heart conduction disorders

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– questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson.

Question:
1. At what degree of AV-blockade is a gradual lengthening of the PQ interval noted?
2. What are the main ECG signs of first-degree AV block?
3. What are the main ECG signs of second-degree AV block, Mobitz I?
4. What are the main ECG signs of second-degree AV block, Mobitz II?
5. What are the main ECG signs of III-degree AV block?
6. What degree of CA blockade can be diagnosed using an ECG? What are the main ECG signs?
7. What are the main ECG signs of right bundle branch block?
8. What are the main ECG signs of left bundle branch block?
9. What are the main ECG signs of WPW syndrome?
10. What are the main approaches to the therapy of patients with AV blocks?

3. Formation of professional abilities and skills (mastery of skills, conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
   – content of tasks (tasks, clinical situations, etc.);
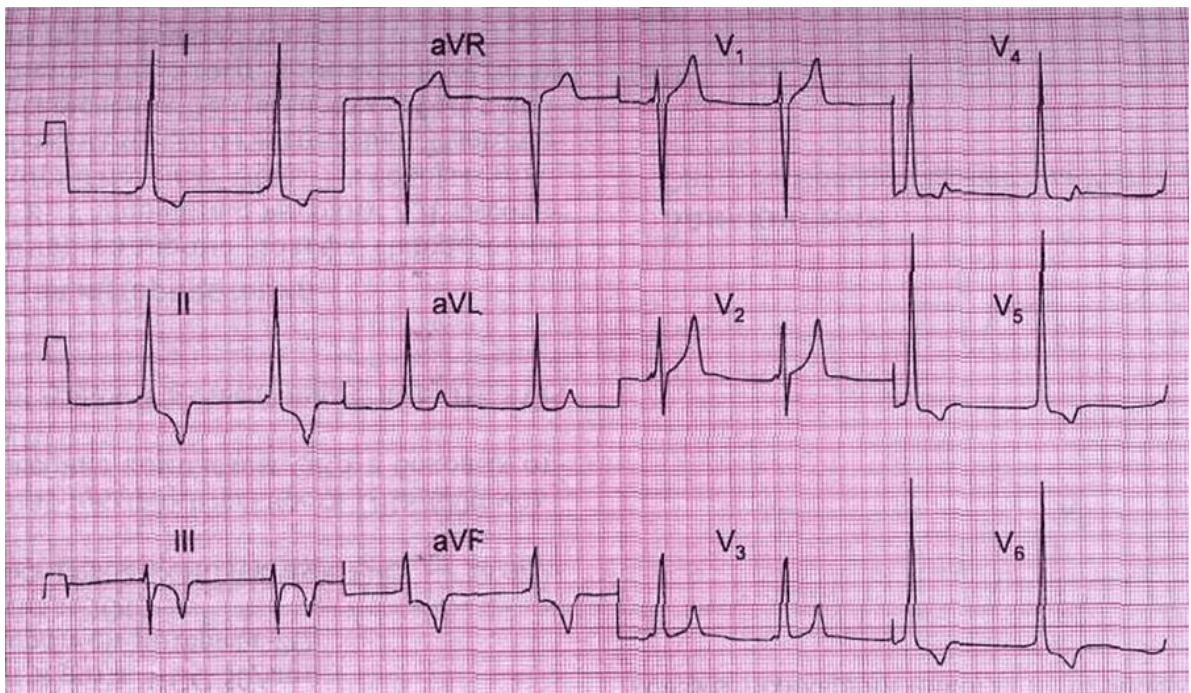
Task
1. A 45-year-old patient complains of frequent dizziness, malaise, severe fatigue, and increased blood pressure. When examining blood pressure on both arms, 170/100 mm Hg. Art. Heart rate = pulse - 40 per minute. An ECG was taken. What type of conduction disorder does the patient have? What are the recommendations for further management of the patient?
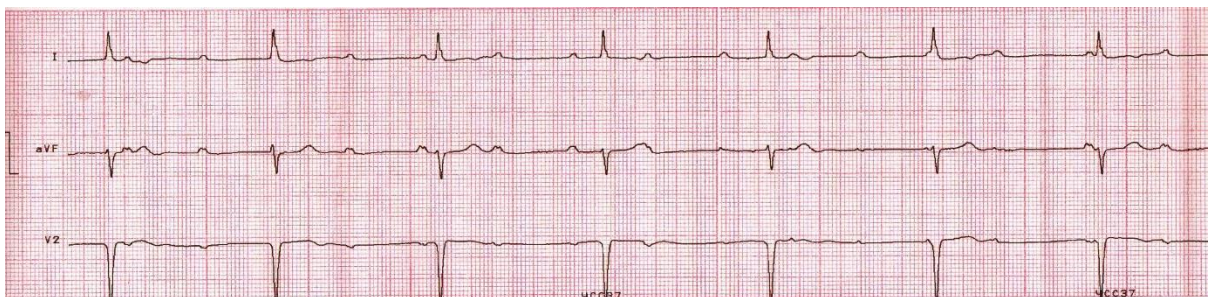
2. A 56-year-old patient had an ECG taken during a preventive examination. At the time of examination, the patient has no complaints. Compared to the past ECGs without changes. What type of conduction disorder does the patient have? What acute condition should be diagnosed if such changes are detected for the first time?
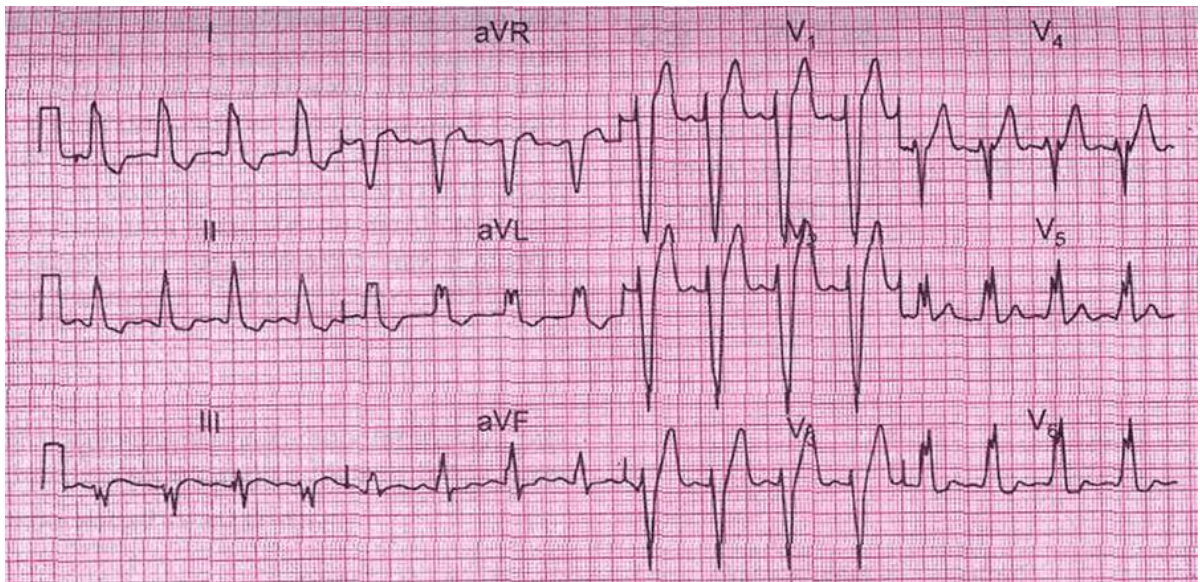
3. A 25-year-old patient complains of periodic tachycardia attacks that are not related to physical activity. The patient had an ECG. The pattern of which syndrome is shown on the ECG? What form of tachycardia is most likely to develop in this patient during the described attacks?

– recommendations (instructions) for performing tasks(professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

Main tasks	Instructions	Answers
Learn:		
1. Definition	Define the concept of "heart block".	
2. Classification	Name the classification of heart blocks.	
3. AV blockades	Name the ECG signs of different degrees of AV blockade.	
4. SA blockades	Name the ECG signs of CA	

	blockade.	
5. Blockades of the legs of the bundle of His	Name the main ECG signs of bundle branch block (BPNPPH and BLNPPH complete and incomplete, fascicular blockades).	
6. Syndromes of premature arousal	Name the syndromes of premature arousal and their ECG signs.	

– Requirements for work results, including before registration: in case of independent preparation for a practical lesson, an indicative card for a practical lesson is filled out.

Requirements:
- know the types of heart blocks
- to be able to detect AV blockades of various degrees on the ECG
- to be able to detect CA blockade on the ECG
- to be able to identify intraventricular blocks on the ECG
- to know the variants of prearrest syndromes and their ECG signs

Applicants must observe academic integrity, namely:
- independent performance of all types of work, tasks, forms of control provided for by the work program of this educational discipline;
- references to sources of information in case of use of ideas, developments, statements, information;
- compliance with the legislation on copyright and related rights;
- provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

– control materials for the final stage of the lesson: tasks, tasks, tests, etc. (if necessary).

Test tasks
1. In which type of conduction disturbance will periodic loss of the QRS complex be noted on the ECG WITHOUT progressive prolongation of the PQ interval?
   A. AV blockade of the 1st degree
   B. AV blockade II, Mobitz I
   C. AV blockade II, Mobitz II
   D. Sinoatrial blockade

2. Which of the listed criteria does NOT apply to blockade of the left leg of the bundle of His?
   A. QRS complex > 120 ms
   B. Wide monophasic R wave in leads I, aVL, V5-6
   C. Absence of Q waves in leads I, aVL, V5-6
   D. Dominant S wave in V5-6

3. Which of the listed cardiac conduction disorders CANNOT be diagnosed using ECG diagnostics?
   A. AV blockade of the 1st degree
   B. CA-blockade of the 2nd degree
   C. AV-blockade of the 3rd degree
   D. CA-blockade of the 1st degree

4. Which of the listed criteria does NOT apply to blockade of the right leg of the bundle of

His?

    A. QRS complex > 120 ms

    B. RSR' in leads V1-V3

    C. A wide, deep S wave in leads V1-V3

    D. Corresponding discordance (ST-segment depression and/or T-wave inversion) in leads V1-V3

5. What pathology is most likely indicated by the changes shown in the ECG fragment below?
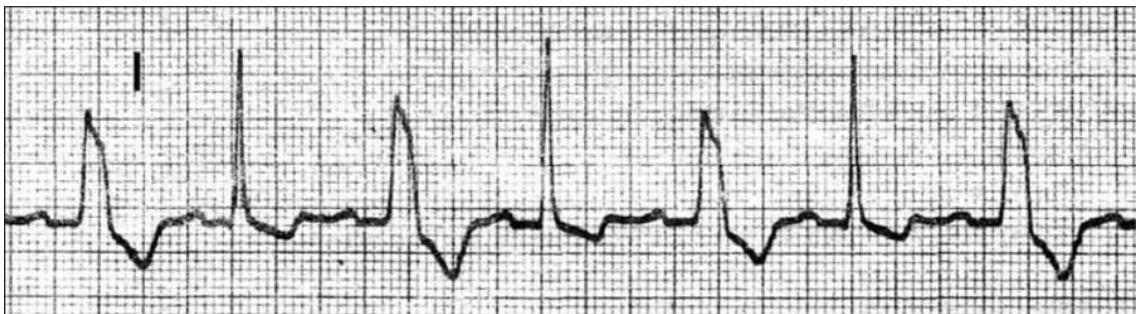

    A. Ventricular bigeminy

    B. Interpolated ventricular extrasystole

    C. Intermittent blockade of the left leg of the bundle of His

    D. Excessive bigeminy

6. What pathology are indicated by the changes shown in the ECG fragment below?

    A. Blockade of the left leg of the bundle of His

    B. Left ventricular hypertrophy

    C. Hypertrophy of the right atrium

    D. Blockade of the right leg of the bundle of His

7. For which of the listed pathologies are the changes displayed on the ECG fragment below characteristic?
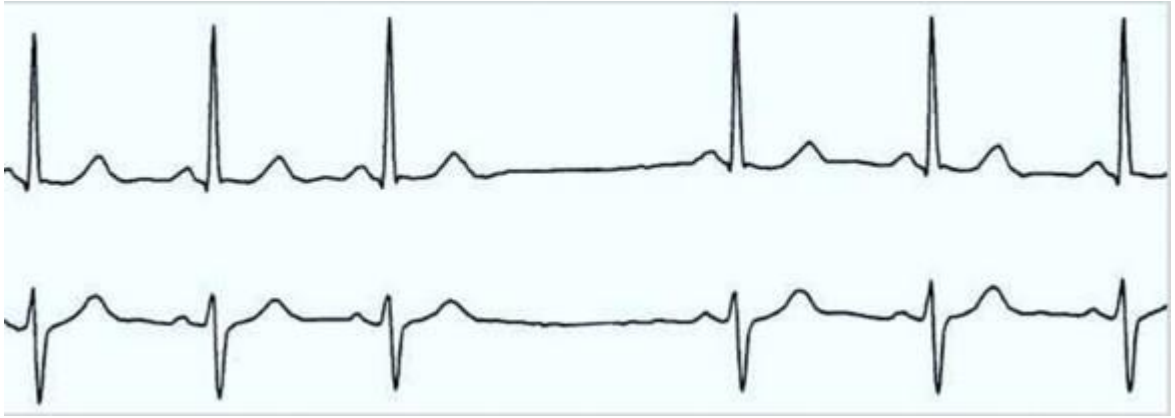
    A. AV-blockade of the 3rd degree
    B. CA-blockade of the 2nd degree
    C. AV-blockade II degree, Mobitz II
    D. Atrial extrasystole

8. What conduction disorder is characterized by a delay in the continuous conduction of the impulse from the atria to the ventricles?
    A. CA-blockade of the 2nd degree
    B. AV blockade of the 1st degree
    C. AV nodal rhythm
    D. AV-blockade II degree, Mobitz II

9. Which of the following is characteristic of AV-blockade II, Moyuitz I?
    A. The PQ interval is the shortest immediately after the collapse of the QRS complex
    B. The R-R interval progressively shortens with each beat of the cycle
    C. The PP interval is the longest immediately before the QRS complex collapses
    D. The RR interval remains relatively the same

10. Which of the following does NOT apply to ECG but WPW syndrome?
    A. PQ interval < 0.12 sec
    B. The presence of a delta wave
    C. Expansion and deformation (due to the delta wave) of the QRS complex
    D. Concordant changes of the ST segment and T wave

4. Summing up:
- checking and discussing the answers of higher education applicants
- control of the level of professional skills and abilities
- evaluation of each answer, setting of grades
- answer to possible questions
- task for the next class

5. List of recommended literature (main, additional, electronic information resources):

Basic:
1. The ECG. Made easy. Ninth edition / John Hampton, Joanna Hampton. Elsevier, 2019. 207 pages.
2. The ECG Made Practical / John Hampton, David Adlam – Elsevier, 2019. 341 pages.
3. Family medicine: in 3 books. Book 1. General Issues of Family Medicine: textbook / O.M. Hyrina, L.M. Pasiyeshvili, O.M. Barna et al. Kyiv, 2016.
4. Fred Kusumoto. ECG Interpretation. From Pathophysiology to Clinical Application. Second edition / Fred Kusumoto. Springer, 2020.

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1. 150 ECG Cases / John Hampton, David Adlam, Joanna Hampton – Elsevier, 2019. 329 pages.
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3. Anatomy of the cardiac conduction system. Pacing Clin Electrophysiol / Santosh K Padala, José-Angel Cabrera, Kenneth A Ellenbogen – NIH, PubMed, Sensors (Basel), 2021 Jan; 44(1):15-25. doi: 10.1111/pace.14107. URL: https://pubmed.ncbi.nlm.nih.gov/33118629/
4. Electrocardiogram / Yasar Sattar, Lovely Chhabra – StatPearls [Internet] – Last Update: June 13, 2022. URL: https://www.ncbi.nlm.nih.gov/books/NBK549803/

Electronic information resources:
1. World Health Organization. URL: www.who.int/ru/index.html.
2. European Regional Office of the World Health Organization. URL: www.euro.who.int.
3. Modern healthcare. URL: https://www.modernhealthcare.com/vital-signs-healthcare-blog
4. AHA: https://www.heart.org/
5. EHA https://www.heartassociation.eu/
6. EHA CRP: https://cpr.heart.org/en/
7. NICE: https://www.nice.org.uk/
8. PubMed: https://pubmed.ncbi.nlm.nih.gov/
9. Medscape: https://www.medscape.com/
10. NCBI: https://www.ncbi.nlm.nih.gov/
11. Electrocardiogram calculators. URL: https://en.my-ekg.com/calculation-ekg/ekg-calculations.html

Practical lesson № 11-12

Topic 6: ECG signs of coronary blood supply disorders.

Goal: to deepen, expand and specify the knowledge of general issues and ECG diagnostics for disorders of the coronary blood supply, the concept of "acute coronary syndrome" for the higher education seeker; learn to identify signs of AMI on the ECG and carry out differential diagnosis.

Basic concepts: The main ECG signs of ischemia, damage and necrosis of the myocardium. The concept of "acute coronary syndrome" (ACS). ECG signs in ACS without ST segment elevation and with ST segment elevation. Modified Sgarbossa criteria. Topical diagnosis of myocardial infarction, use of additional leads. Vasospastic angina pectoris, differential diagnosis.

Equipment: laptop, multimedia projector.

Plan:
1. Organizational activities (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).
2. Control of the reference level of knowledge (written work, written test, frontal survey, etc.) (if necessary):

    – requirements for students' theoretical readiness to perform practical classes (knowledge requirements, list of didactic units);

    Know:

- heart anatomy
- blood supply of the heart
- changes in the myocardium that occur with blood supply disorders
- correspondence of standard ECG leads to heart departments
- additional ECG leads and their correspondence to heart departments
- the concept of "acute coronary syndrome"
- ECG signs of ACSACS without ST segment elevation and with ST segment elevation
- determination of vasospastic angina, ECG signs, differential diagnosis with AMI

– questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson.

Question
1. What are the differences between myocardial ischemia, damage and necrosis?
2. What are the main clinical signs of acute coronary syndrome?
3. What pathologies are related to acute coronary syndrome?
4. Name the main ECG characteristics of acute coronary syndrome without ST segment elevation.
5. Name the main ECG signs in acute myocardial infarction with ST segment elevation.
6. Describe the evolution of changes in the ECG pattern in acute ST-elevation myocardial infarction.
7. In which leads will changes be noted in case of anterolateral localization of a myocardial infarction?
8. In which leads will changes be noted when the myocardial infarction is localized in the right ventricle?
9. In which leads will changes be noted when the myocardial infarction is localized in the lower parts of the heart?
10. Define vasospastic angina and describe the changes on the ECG.

3. Formation of professional abilities and skills (mastery of skills, conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
– content of tasks (tasks, clinical situations, etc.);

Task
1. A 65-year-old patient with a primary diagnosis of type 2 diabetes complains of aching pains in the heart area that have been bothering him for 2 hours. When using nitroglycerin under the tongue, the patient noted a significant decrease in blood pressure. An ECG was taken. What is the most likely diagnosis for this patient? In which additional leads should the patient's ECG be taken?
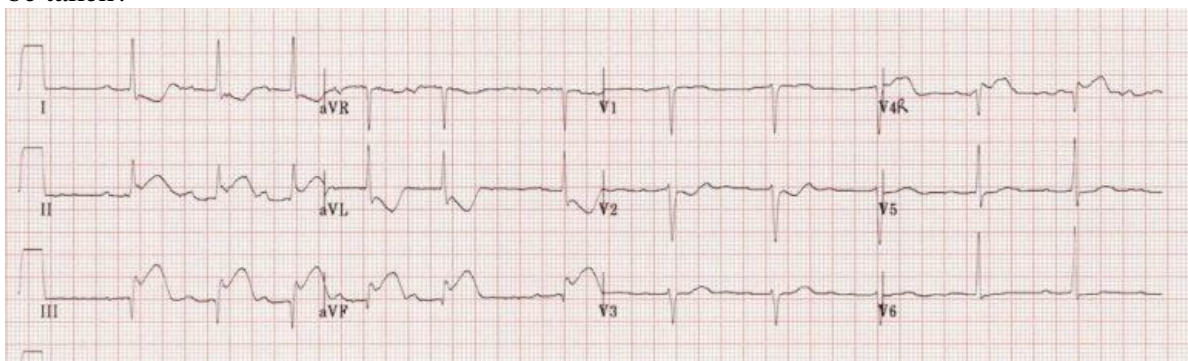
2. A 67-year-old patient came to the family doctor with a complaint of a short-term pain syndrome in the area of the heart a few hours ago, which stopped after a few minutes at rest. An ECG was taken. What changes are detected on the ECG and what condition do they

characterize? What are the further recommendations for this patient?
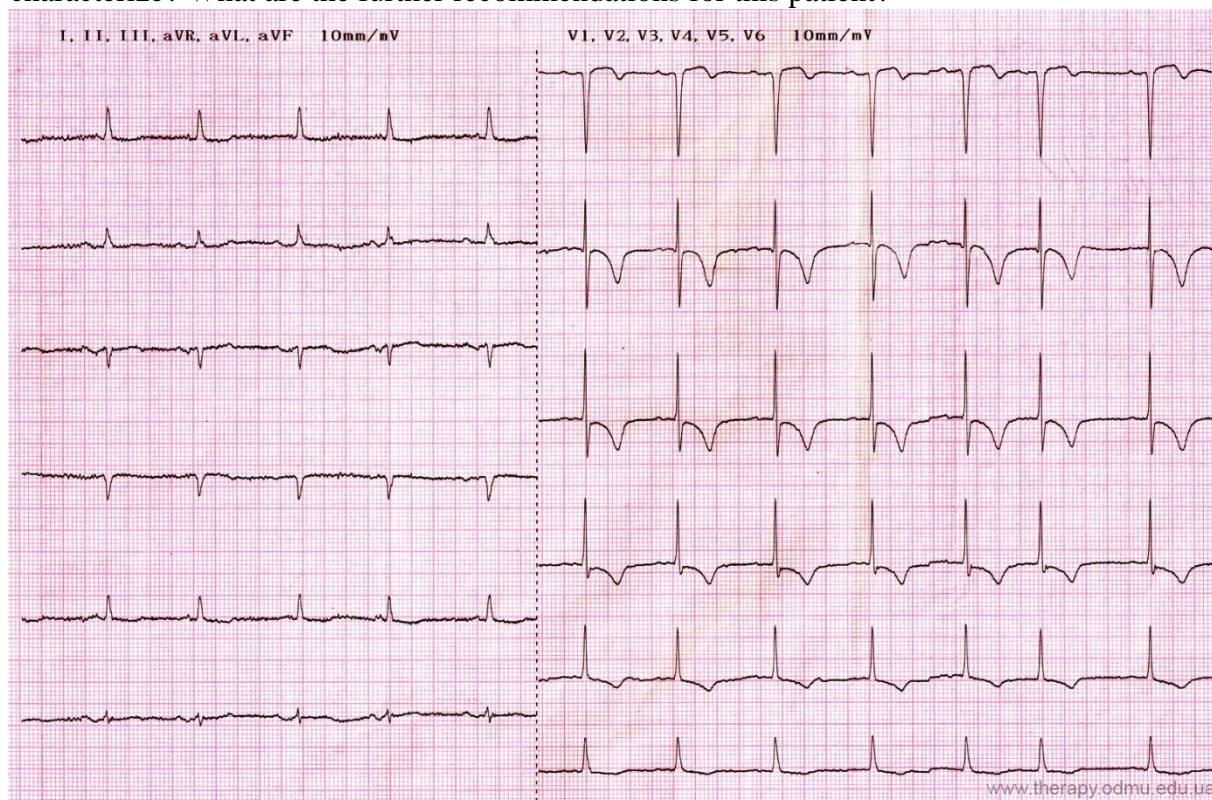
– recommendations (instructions) for performing tasks(professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

Main tasks	Instructions	Answers
Learn:		
1. Definition	Define the terms "ischemia", "damage", "necrosis" in relation to the heart muscle.	
2. Clinical picture	Describe the clinical picture of acute coronary syndrome, vasospastic angina.	
3. ECG diagnosis	Name the main ECG signs of acute coronary syndrome without ST segment elevation and with ST segment elevation.	
4. Evolution of ECG signs in AMI	Describe the evolution of changes in the ECG pattern in acute ST-elevation myocardial infarction.	
5. Topical diagnosis of AMI	Name the main and additional ECG leads, in which changes are noted at different localizations of MI.	

– Requirements for work results, including before registration: in case of independent preparation for a practical lesson, an indicative card for a practical lesson is filled out.

Requirements:
- know the characteristics of acute coronary syndrome
- to be able to detect signs of acute myocardial ischemia on the ECG
- know additional ECG leads and criteria for their use
- to be able to recognize AMI of different localization on the ECG

Applicants must observe academic integrity, namely:
- independent performance of all types of work, tasks, forms of control provided for by the work program of this educational discipline;

34

- references to sources of information in case of use of ideas, developments, statements, information;
- compliance with the legislation on copyright and related rights;
- provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

– control materials for the final stage of the lesson: tasks, tasks, tests, etc. (if necessary).

<u>Test tasks</u>

1. In which of the listed leads is T-wave inversion a variant of the norm?
   - A. III, aVR and V1-V3
   - B. II, aVR and V1
   - C. III, aVR and V1
   - D. III, aVR and V5-V6

2. Which of the listed criteria does NOT apply to the modified criteria of Sgarbossa (2012)?
   - A. ≥ 1leads with concordant elevation of ST on≥ 1mm
   - B. ≥ 1leads from V1 - V3 with concordant ST depression on≥ 1mm
   - C. ≥ 1lead where ST elevation is present on≥ 1mm under the condition of its pronounced discordance:≥25% of the amplitude of the previous S wave
   - D. ≥ 1 leads fromV5 - V6 with oblique ascending depression of the ST segment by 1 mm

3. Which of the listed criteria is characteristic of a lower myocardial infarction?
   - A. ST segment elevation in leads I, aVL, V5-V6
   - B. ST segment elevation in leads II, III, aVF
   - C. Reciprocal depression of the ST segment in aVF lead
   - D. Gradual development of the Q wave in leads I, aVL, V5-V6

4. What amplitude of ST elevation in the posterior leads is sufficient to establish the diagnosis of posterior MI?
   - A. ≥ 2.0 mm
   - B. ≥ 1.5 mm
   - C. ≥ 0.5 mm
   - D. ≥ 2.5 mm

5. What standard ECG lead directly reflects the right ventricle?
   - A. V2
   - B. III
   - C. V1
   - D. aVF

6. Which of the diseases listed below does NOT belong to acute coronary syndrome (ACS)?
   - A. Myocardial infarction without ST segment elevation
   - B. Unstable angina
   - C. Myocardial infarction with ST segment elevation
   - D. Vasospastic angina pectoris

7. What standard leads would you see changes in a posterior MI?
   - A. II, III, aVF
   - B. V1-V3
   - C. V4-V6
   - D. I, aVL

8. Which of the following ECG criteria are the main ones for acute coronary syndrome without ST segment elevation?
    A. Flattening or inversion of the T wave and pathological Q wave
    B. ST-segment depression and T-wave flattening or inversion
    C. The ST segment is unchanged, a high pointed T wave
    D. Depression of the ST segment, high double-humped T wave

9. In what cases can T-wave inversion be considered a sign of acute myocardial ischemia?
    A. A minimum of 1 lead with a dominant R wave is present (R/S ratio >1)
    B. Inversion up to 1 mm
    C. Present in ≥ 2 consecutive leads with a dominant R wave (R/S ratio >1)
    D. It is present on old ECGs

10. Which of the signs is NOT one of the classic signs of an acute myocardial infarction?
    A. High sharp T waves and ST elevation
    B. A gradual decrease in the amplitude of the R wave
    C. T wave inversion in 1 standard lead
    D. Development of pathological Q wave and T wave inversion

4. Summary:
- checking and discussing the answers of higher education applicants
- control of the level of professional skills and abilities
- evaluation of each answer, setting of grades
- answer to possible questions
- task for the next class

5. List of recommended literature (main, additional, electronic information resources):
Basic:
1. The ECG. Made easy. Ninth edition / John Hampton, Joanna Hampton. Elsevier, 2019. 207 pages.
2. The ECG Made Practical / John Hampton, David Adlam – Elsevier, 2019. 341 pages.
3. Family medicine: in 3 books. Book 1. General Issues of Family Medicine: textbook / O.M. Hyrina, L.M. Pasiyeshvili, O.M. Barna et al. Kyiv, 2016.
4. Fred Kusumoto. ECG Interpretation. From Pathophysiology to Clinical Application. Second edition / Fred Kusumoto. Springer, 2020.

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3. Anatomy of the cardiac conduction system. Pacing Clin Electrophysiol / Santosh K Padala, José-Angel Cabrera, Kenneth A Ellenbogen – NIH, PubMed, Sensors (Basel), 2021 Jan; 44(1):15-25. doi: 10.1111/pace.14107. URL: https://pubmed.ncbi.nlm.nih.gov/33118629/
4. Electrocardiogram / Yasar Sattar, Lovely Chhabra – StatPearls [Internet] – Last Update: June 13, 2022. URL: https://www.ncbi.nlm.nih.gov/books/NBK549803/

Electronic information resources:
1. World Health Organization. URL: www.who.int/ru/index.html.
2. European Regional Office of the World Health Organization. URL: www.euro.who.int.
3. Modern healthcare. URL: https://www.modernhealthcare.com/vital-signs-healthcare-blog

4. AHA: https://www.heart.org/
5. EHA https://www.heartassociation.eu/
6. EHA CRP: https://cpr.heart.org/en/
7. NICE: https://www.nice.org.uk/
8. PubMed: https://pubmed.ncbi.nlm.nih.gov/
9. Medscape: https://www.medscape.com/
10. NCBI: https://www.ncbi.nlm.nih.gov/
11. Electrocardiogram calculators. URL: https://en.my-ekg.com/calculation-ekg/ekg-calculations.html

Practical lesson № 13-14

Topic 7: ECG diagnosis of disorders of repolarization processes.

Goal: to deepen, expand, and specify the higher education student's knowledge about the causes and main ECG signs of violations of repolarization processes; learn to identify signs of repolarization disorders for various reasons on the ECG.

Basic concepts: Causes and main general signs of disturbance of repolarization processes on the ECG. Main characteristics and ECG pattern in early repolarization syndrome, prolongation and shortening of the QT interval, Brugada syndrome. Peculiarities of ECG signs in pericarditis.

Equipment: laptop, multimedia projector.

Plan:
1. Organizational activities (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).
2. Control of the reference level of knowledge (written work, written test, frontal survey, etc.) (if necessary):

– requirements for students' theoretical readiness to perform practical classes (knowledge requirements, list of didactic units);

Know:
- correspondence of the repolarization process to ECG elements
- causes of repolarization disorder
- characteristics of early ventricular repolarization syndrome
- characteristics of elongated and shortened syndromes QT interval
- method of calculating the corrected QT interval
- characteristics of Brugada syndrome
- features of ECG signs in pericarditis

– questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson.

Question:
1. What elements of the ECG curve reflect the processes of ventricular repolarization?
2. Does the QRS complex change in early ventricular repolarization syndrome?
3. Name the main ECG signs of early ventricular repolarization syndrome that distinguish it from pericarditis.
4. What formulas are used to calculate the adjusted QT interval?
5. What QTc values indicate long and short QT syndrome?

6. What type of tachycardia can develop in long QT syndrome and what are its possible consequences?
7. What are the main causes of long QT syndrome?
8. What characteristics are necessary to make a diagnosis of shortened QT interval if the QTc is <360 ms?
9. What ECG changes are characteristic of Brugada syndrome?
10. Name the ECG signs of pericarditis.

3. Formation of professional abilities and skills (mastery of skills, conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
   – content of tasks (tasks, clinical situations, etc.);

Task
1. Patient P., 56 years old, complains of a short-term episode of loss of consciousness. At the time of inspection, there are no complaints. An ECG was taken. What is the likely cause of the loss of consciousness? What anamnesis data should be collected from the patient? What pathologies should be differentially diagnosed?
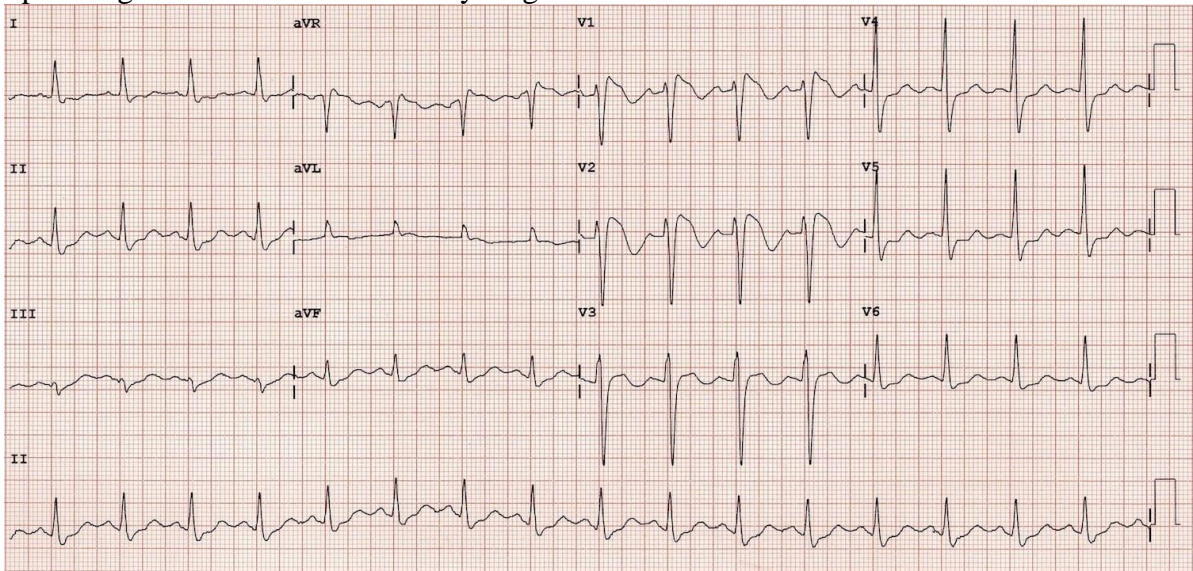
2. Patient K., 54 years old, complains of chest pain of moderate intensity, a feeling of interruptions in the work of the heart, general weakness, lack of appetite. The exact duration of such a condition cannot be determined by the patient. During the physical examination, muffled heart sounds, otherwise within normal limits. An ECG was taken. What changes are determined on this ECG? What is the previous diagnosis?
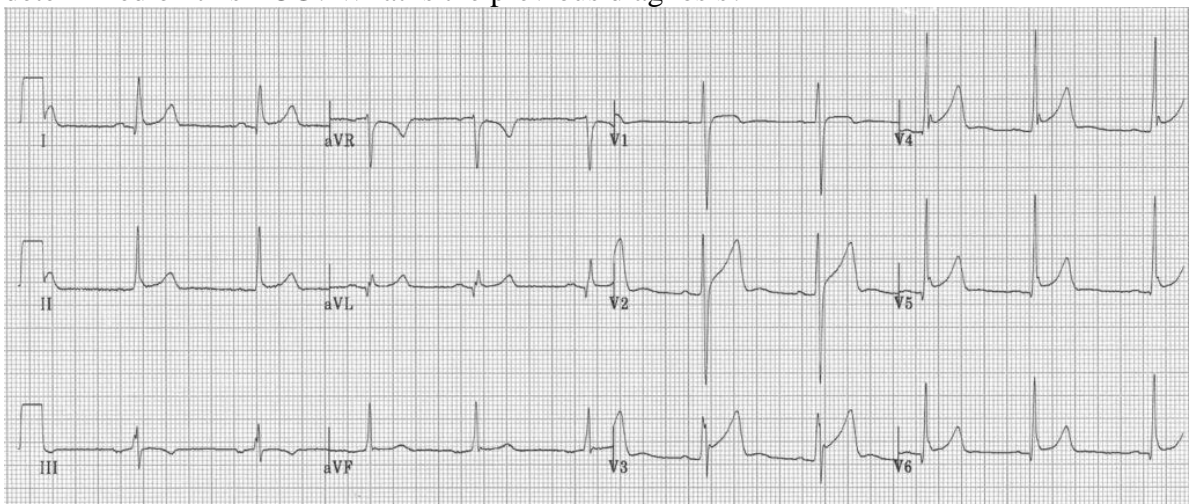
– recommendations (instructions) for performing tasks(professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

Main tasks	Instructions	Answers
Learn:		
1. The process of ventricular repolarization	Name the main ECG signs in case of violation of ventricular repolarization processes.	
2. Syndrome of early ventricular repolarization	Name the main ECG signs of early ventricular repolarization syndrome.	
3. Syndromes of prolonged and shortened QT	Name the main characteristics necessary for making a diagnosis of prolonged QT, shortened QT.	
4. Brugada syndrome	Name the main ECG changes and general characteristics that are necessary for the diagnosis of Brugada syndrome.	
5. Pericarditis	Name the main ECG signs of pericarditis.	

– Requirements for work results, including before registration: in case of independent preparation for a practical lesson, an indicative card for a practical lesson is filled out.

Requirements:
– to be able to identify changes characteristic of early ventricular repolarization syndrome on an electrocardiogram
– be able to measure the intervalQT and calculate the adjusted QT
– be able to identify changes characteristic of Brugada syndrome, carry out differential diagnosis
– be able to recognize the main signs of pericarditis on the ECG

Applicants must observe academic integrity, namely:
• independent performance of all types of work, tasks, forms of control provided for by the work program of this educational discipline;
• references to sources of information in case of use of ideas, developments, statements, information;
• compliance with the legislation on copyright and related rights;
• provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

– control materials for the final stage of the lesson: tasks, tasks, tests, etc. (if necessary).

Test tasks
1. Which of the listed signs is characteristic of early repolarization syndrome?
   A. ST segment elevation with upward convexity in standard leads
   B. A notch on the descending knee of the R tooth
   C. Wide symmetrical T wave
   D. Point J is on the isoline

2. What QTc value is associated with an increased risk of developing potentially life-threatening torsades de pointes?
   A. > 460 ms

B. > 500 ms

C. > 400 ms

D. < 360 ms

3. For which pathology are the changes shown in the ECG fragment below most characteristic?
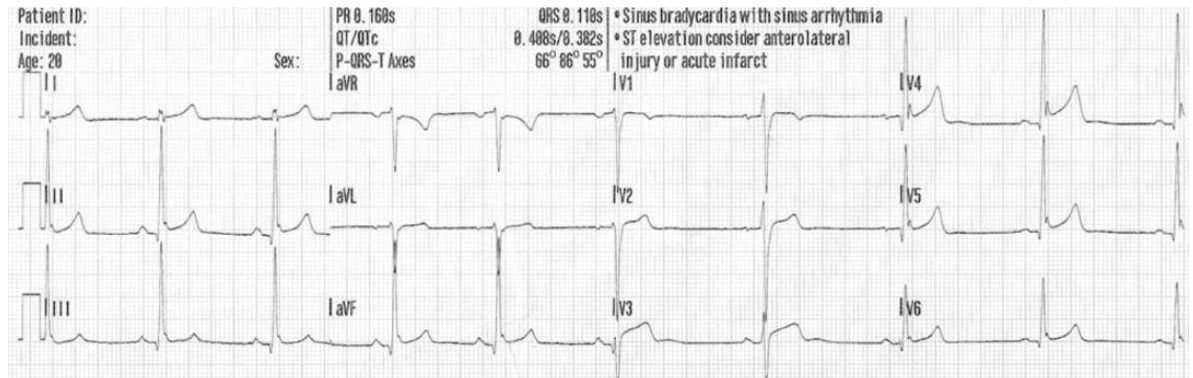
A. Vasospastic angina pectoris

B. Syndrome of early ventricular repolarization

C. Pericarditis

D. Hypothermia

4. At what duration of QTc is the syndrome of shortened QT interval diagnosed?

A. ≤340 ms

B. <360 ms

C. ≤400 ms

D. ≤330 ms

5. Which of the listed ECG signs are characteristic of the 1st type of Brugada syndrome?

A. ST segment elevation ≥2 mm in ≥1 lead V1 or V2, ST segment turns into a negative T wave

B. Saddle-shaped elevation of the ST segment ≥2 mm, positive or biphasic T wave

C. Saddle-shaped ST elevation <1 mm, the ST segment turns into a negative T wave

D. Elevation of the ST segment ≥2 mm must be in 3 leads V1, V2 and V3, the ST segment turns into a negative T wave

6. Which of the following ECG signs is characteristic of pericarditis in contrast to early ventricular repolarization syndrome?

A. ST segment elevation

B. PQ segment depression

C. Negative T wave

D. Oblique ascending depression of the ST segment

7. What formula is used to correct the QT interval according to the heart rate at a heart rate of 60-100 per minute?

A. Bazett's formula

B. Frederick's formula

C. Sagi's formula

D. Lorentz's formula

8. What changes are shown in the ECG fragment below?
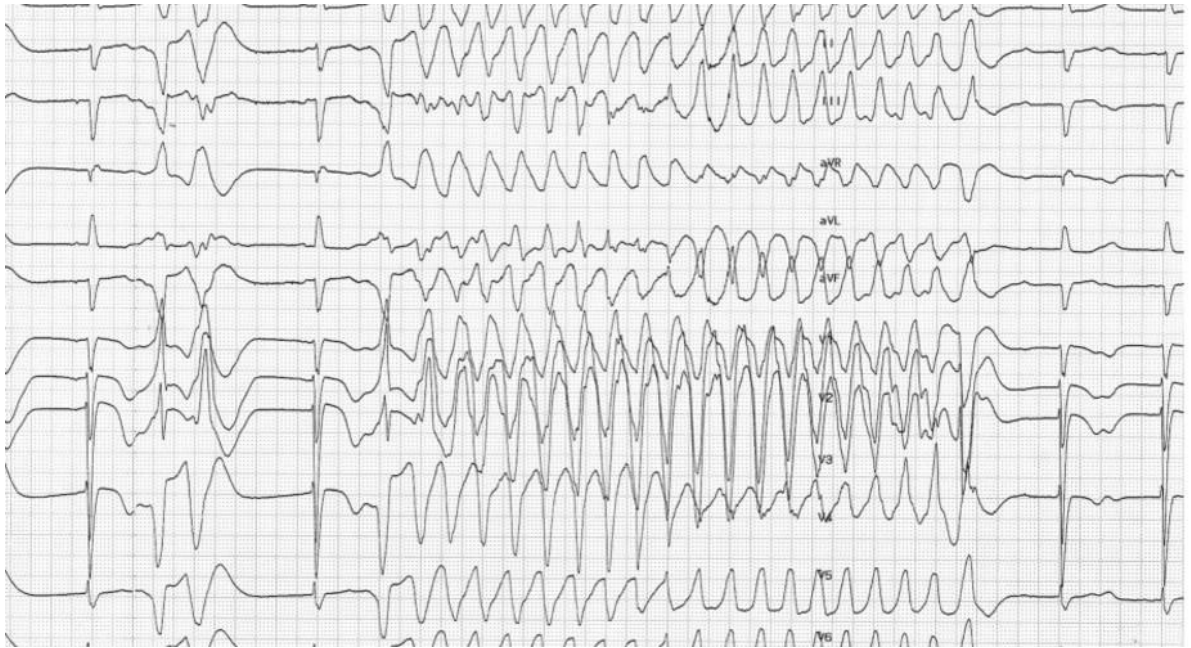
A. Monomorphic ventricular tachycardia
B. Fluttering of the ventricles
C. Ventricular fibrillation
D. Polymorphic ventricular tachycardia

9. Which of the listed ECG signs is NOT characteristic of ventricular tachycardia of the pirouette type?
   A. Previous prolonged QT interval, especially in the last cardiac contraction preceding the onset of the arrhythmia
   B. The frequency of ventricular contractions is from 160 to 250 beats per minute
   C. Regular RR intervals
   D. Cyclic change of the QRS axis by 180 ° every 5-20 beats

10. For which of the listed pathologies are the changes shown on the ECG below the most characteristic?
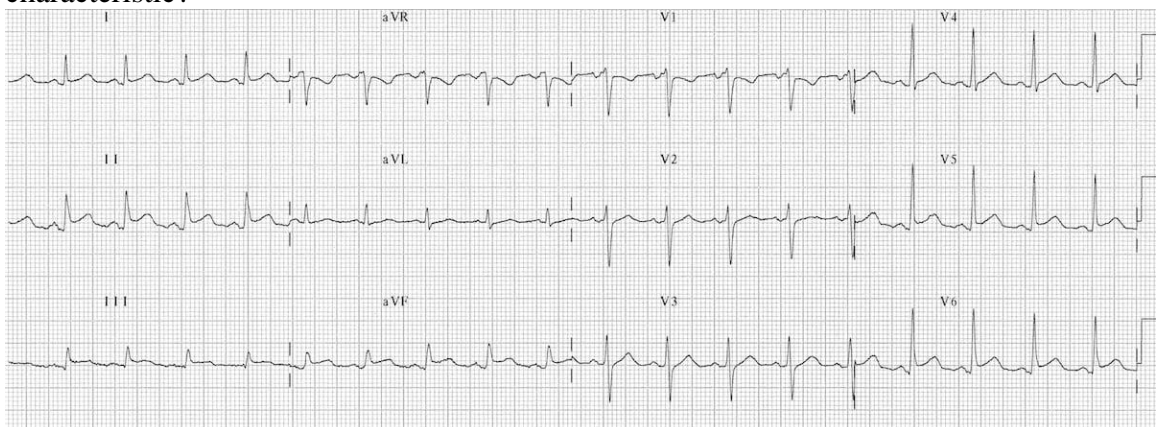
   A. Syndrome of early ventricular repolarization
   B. The most acute stage of anterior myocardial infarction
   C. Pericarditis
   D. Brugada syndrome

4. Summing up
   - checking and discussing the answers of higher education applicants
   - control of the level of professional skills and abilities

- evaluation of each answer, setting of grades
- answer to possible questions
- task for the next class

5. List of recommended literature (main, additional, electronic information resources):
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4. Electrocardiogram / Yasar Sattar, Lovely Chhabra – StatPearls [Internet] – Last Update: June 13, 2022. URL: https://www.ncbi.nlm.nih.gov/books/NBK549803/

Electronic information resources:
1. World Health Organization. URL: www.who.int/ru/index.html.
2. European Regional Office of the World Health Organization. URL: www.euro.who.int.
3. Modern healthcare. URL: https://www.modernhealthcare.com/vital-signs-healthcare-blog
4. AHA: https://www.heart.org/
5. EHA https://www.heartassociation.eu/
6. EHA CRP: https://cpr.heart.org/en/
7. NICE: https://www.nice.org.uk/
8. PubMed: https://pubmed.ncbi.nlm.nih.gov/
9. Medscape: https://www.medscape.com/
10. NCBI: https://www.ncbi.nlm.nih.gov/
11. Electrocardiogram calculators. URL: https://en.my-ekg.com/calculation-ekg/ekg-calculations.html

Practical lesson № 15

Topic 8: ECG changes in extracardiac pathology.

Goal:to deepen, expand and specify knowledge of changes on the ECG in case of extracardiac pathology by the student of higher education; learn to interpret electrocardiograms with existing ECG signs of extracranial pathology.

Basic concepts:ECG with electrolyte disturbances. ECG changes in pulmonary embolism. Peculiarities of changes on the ECG in case of acute disturbance of cerebral blood circulation.

Changes on the ECG as a result of the influence of the autonomic nervous system, with hypothermia.

Equipment:laptop, multimedia projector.

Plan:
- Organizational activities (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).
- Control of the reference level of knowledge (written work, written test, frontal survey, etc.) (if necessary):

  – requirements for students' theoretical readiness to perform practical classes (knowledge requirements, list of didactic units);

  Know:
  - variants of electrolyte disturbances
  - effect of electrolytes on the work of the heart
  - main ECG signs in various electrolyte disorders
  - ECG signs characteristic of overloading the right ventricle of the heart, in particular in PE
  - possible changes on the ECG with intracranial pathology
  - ECG changes during hypothermia
  - features of the influence of the autonomic nervous system on the work of the heart

  – questions (test tasks, tasks, clinical situations) to check basic knowledge on the subject of the lesson.

  Question
  1. In which electrolyte disorders is the prolongation of the QT interval noted on the ECG?
  2. In which electrolyte disorders can inversion of the T wave be noted on the ECG?
  3. In which electrolyte disorders can high pointed T waves be noted?
  4. What electrolyte disorders can lead to a delay in the conduction of excitation from the atria to the ventricles?
  5. In which electrolyte disorders is the shift of the ST segment relative to the isoline noted?
  6. What ECG signs can be noted in patients with hypothermia?
  7. What ECG signs characterize the Mc-Jean-White syndrome in PE?
  8. What are the general ECG signs in the development of PE?
  9. What ECG changes can be noted in the formation of cerebrocardial syndrome in patients with HPMC?
  10. How do changes in the regulation of the autonomic nervous system affect the ECG picture?

3. Formation of professional abilities and skills (mastery of skills, conducting curation, determining the treatment scheme, conducting laboratory research, etc.):
   – content of tasks (tasks, clinical situations, etc.);

Task
1. Patient P., 57 years old, suffered acute cerebrovascular accident about a month ago. For the last 2 days, the patient's relatives have noted short attacks in which he has tremors in the face, trunk and limbs, inhibition, the skin becomes cool, the pulse increases (according to the pulse oximeter to 120-130 per minute). Review the patient's ECG. What changes are noted on this ECG? What is the likely cause of such attacks in the patient?
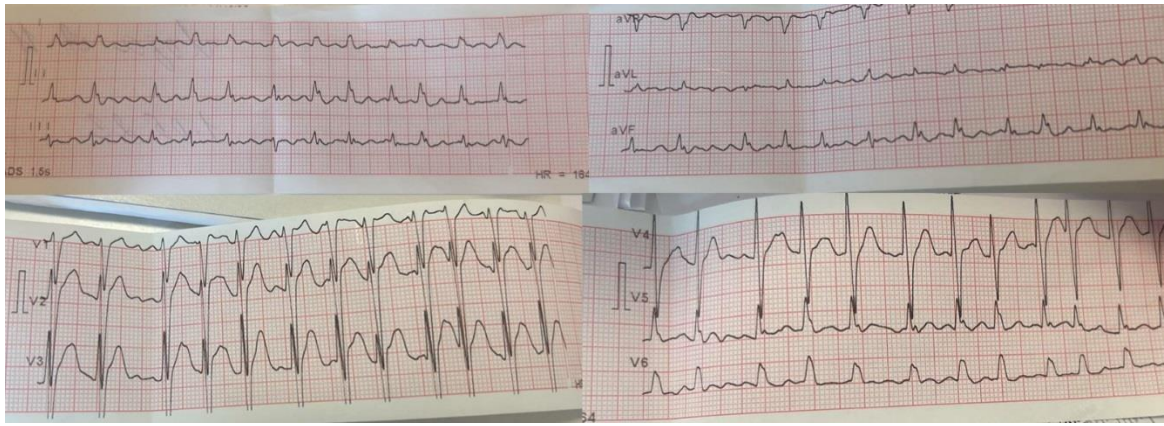
2. Patient V. 48 years old. has complaints of shortness of breath, chest pain, dry cough. She considers herself sick for 2 days, the onset is sudden. During a physical examination, blood pressure is 90/50 mm Hg. st., heart rate - 110 per minute, CHDR - 27 per minute. What are the changes on the ECG of this patient? What is the previous diagnosis?
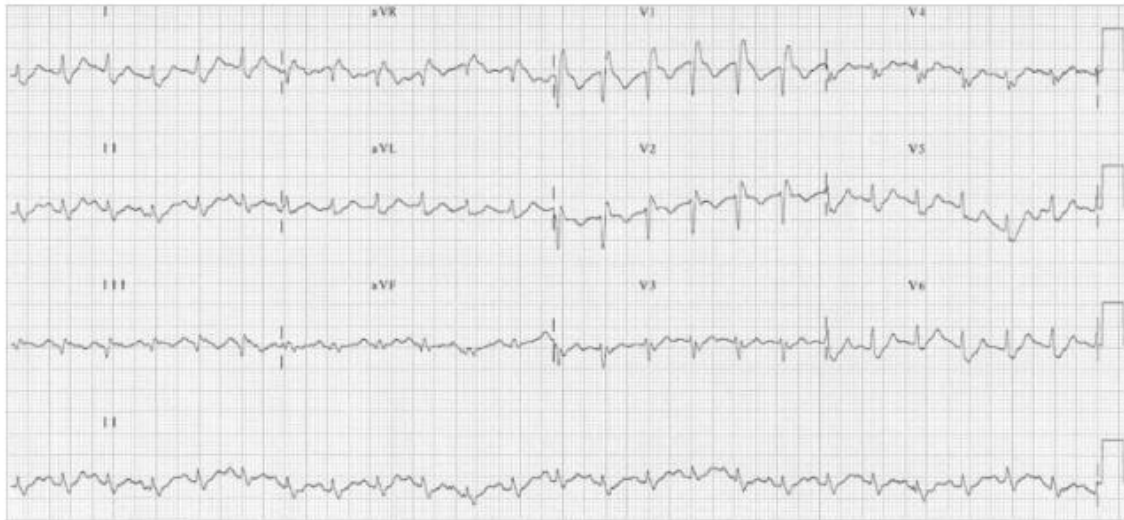
– recommendations (instructions) for performing tasks(professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

Main tasks	Instructions	Answers
Learn:		
1. Hyperkalemia	Name the main ECG changes noted in hyperkalemia.	
2. Hypokalemia	Name the main ECG changes noted in hypokalemia.	
3. Hypercalcemia	Name the main ECG changes noted in hypercalcemia.	
4. Hypocalcemia	Name the main ECG changes noted in hypocalcemia.	
5. Changes in the level of magnesium in the blood	Name the main ECG changes that are noted when the level of magnesium in the blood changes.	
6. Hypothermia	Name the main ECG changes noted in hypothermia.	
7. BODIES	Name the main ECG changes noted in PE.	
8. The influence of the	Name the main ECG changes that are	

autonomic nervous system on the cardiovascular system	noted when there are changes in the regulation of the central nervous system.	
9. HPMK and cerebrocardial syndrome	Name the main ECG changes that are noted during the development of cerebrocardial syndrome in patients with HPMC.	

– Requirements for work results, including before registration: in case of independent preparation for a practical lesson, an indicative card for a practical lesson is filled out.

Requirements:
- to be able to identify changes on the ECG, which are determined in case of electrolyte disturbances
- be able to recognize signs of hypothermia on the ECG
- know and be able to detect signs of right ventricular overload on the ECG
- know the ECG changes that can be determined during an acute intracranial process

Applicants must observe academic integrity, namely:
- independent performance of all types of work, tasks, forms of control provided for by the work program of this educational discipline;
- references to sources of information in case of use of ideas, developments, statements, information;
- compliance with the legislation on copyright and related rights;
- provision of reliable information about the results of one's own educational (scientific) activity, used research methods and sources of information.

– control materials for the final stage of the lesson: tasks, tasks, tests, etc. (if necessary).

Test tasks
1. Which of the listed signs is characteristic of hyperkalemia?
   A. Inversion of T waves
   B. High sharp teeth T
   C. Pronounced U teeth
   D. Shortening of the PR interval

2. What ECG sign is noted in hypokalemia?
   A. High sharp teeth T
   B. Reduction of the PQ interval
   C. Shortening of the QT interval
   D. Pronounced U teeth

3. What ECG changes are registered in Mc-Jean-White syndrome, which is observed in 60-70% of cases of PE?
   A. The appearance of the Q wave in the III standard lead with a simultaneous increase in the amplitude of the S wave in the I standard lead and the inversion of the T wave in the III
   B. The appearance of the Q wave in the I standard lead with a simultaneous increase in the amplitude of the S wave in the III standard lead and the inversion of the T wave in I
   C. The appearance of a Q wave in the III standard lead with a simultaneous increase in the amplitude of the S wave in the I standard lead and an increase in the amplitude of the T wave in III

45

D. The appearance of the Q wave in I-III standard leads with a simultaneous increase in the amplitude of the S wave in the III standard lead and the inversion of the T wave in III

4. What ECG signs are noted in hypokalemia?
    A. Inversion of the T wave, lengthening of the PQ interval, pronounced U wave
    B. High sharp T wave, prolongation of the PQ interval, pronounced U wave
    C. High sharp T wave, shortening of the PQ interval, pronounced U wave
    D. Inversion of the T wave, prolongation of the PQ interval, negative U wave

5. Which of the listed ECG signs is NOT characteristic of hypothermia?
    A. Osborne waves
    B. Tachysystolic form of atrial fibrillation
    C. Prolongation of PQ, QT intervals
    D. Ventricular extrasystoles

6. Which of the following ECG signs is characteristic of hypocalcemia?
    A. Elevation of the ST segment
    B. Possible development of Torsade de Pointes
    C. Shortening of the QT interval
    D. The appearance of the Osborne wave in severe hypocalcemia

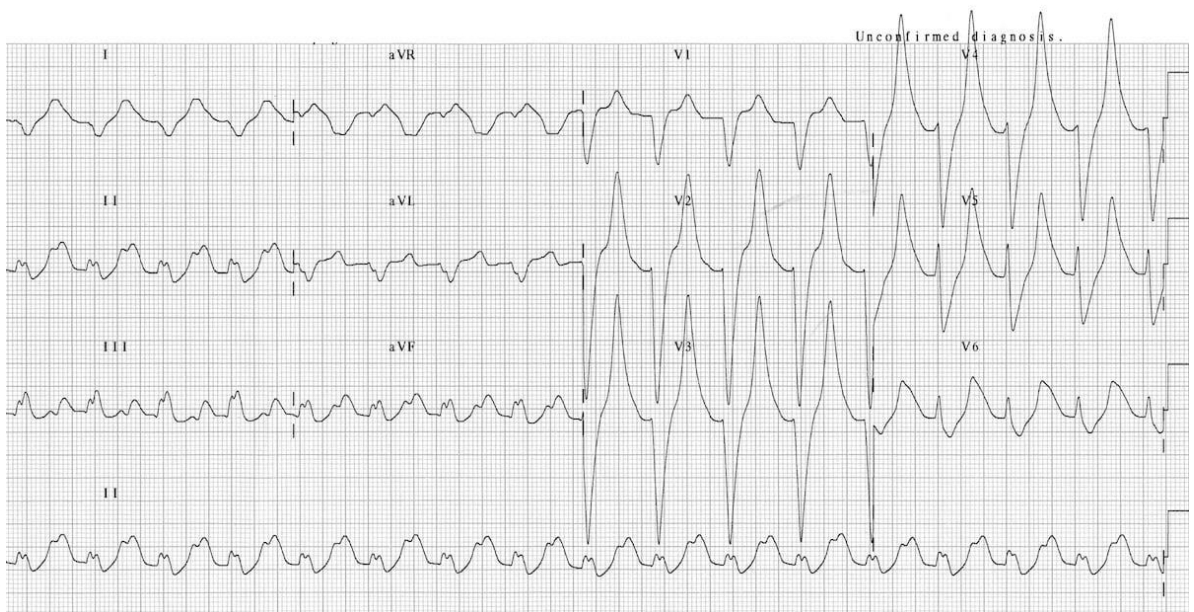7. For which electrolyte disorder are the changes shown on the ECG below characteristic?
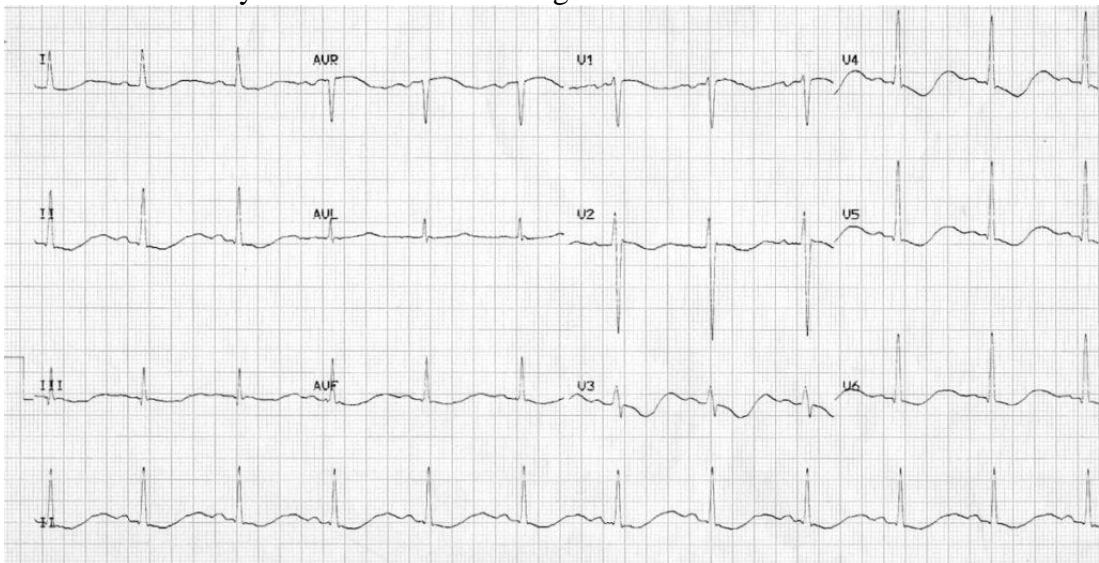
    A. Hypercalcemia
    B. Hypokalemia
    C. Hyperkalemia
    D. Hypocalcemia

8. Classic signs of which pathology are noted on the ECG shown below (recording speed 25 mm/s)?
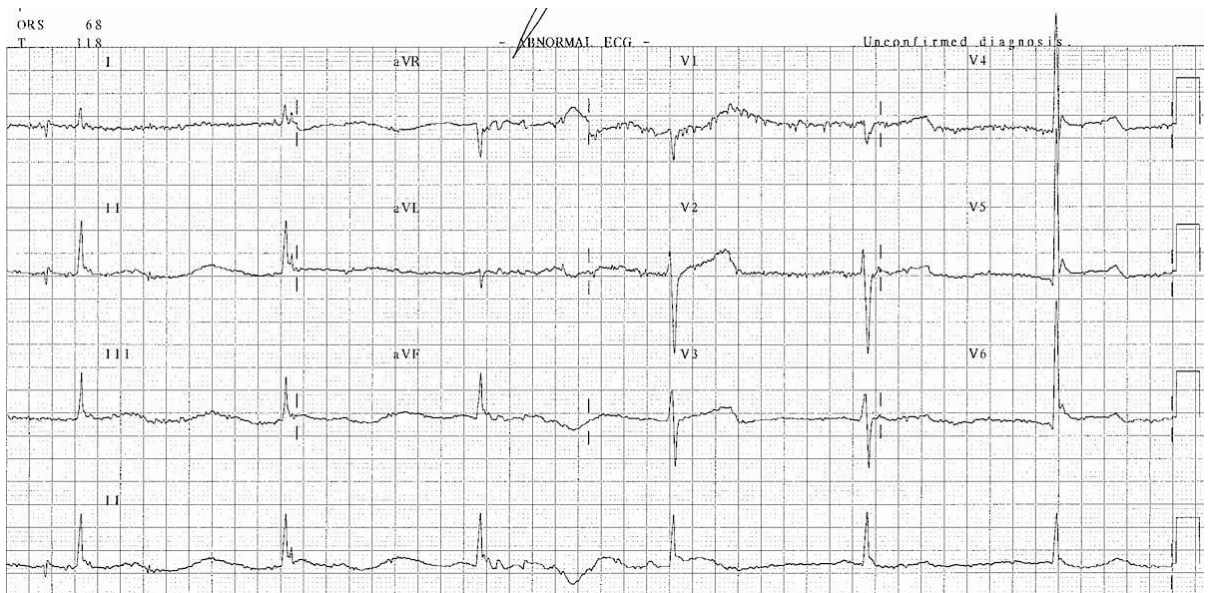
A. Hypokalemia
B. Syndrome of early ventricular repolarization
C. Hypothermia
D. Hypercalcemia

9. What electrolyte abnormalities are most likely present in the patient with the following ECG?

A. Hypercalcemia
B. Hypokalemia
C. Hyperkalemia
D. Hypocalcemia

10. For which of the listed pathologies are the changes shown on the ECG below the most characteristic?
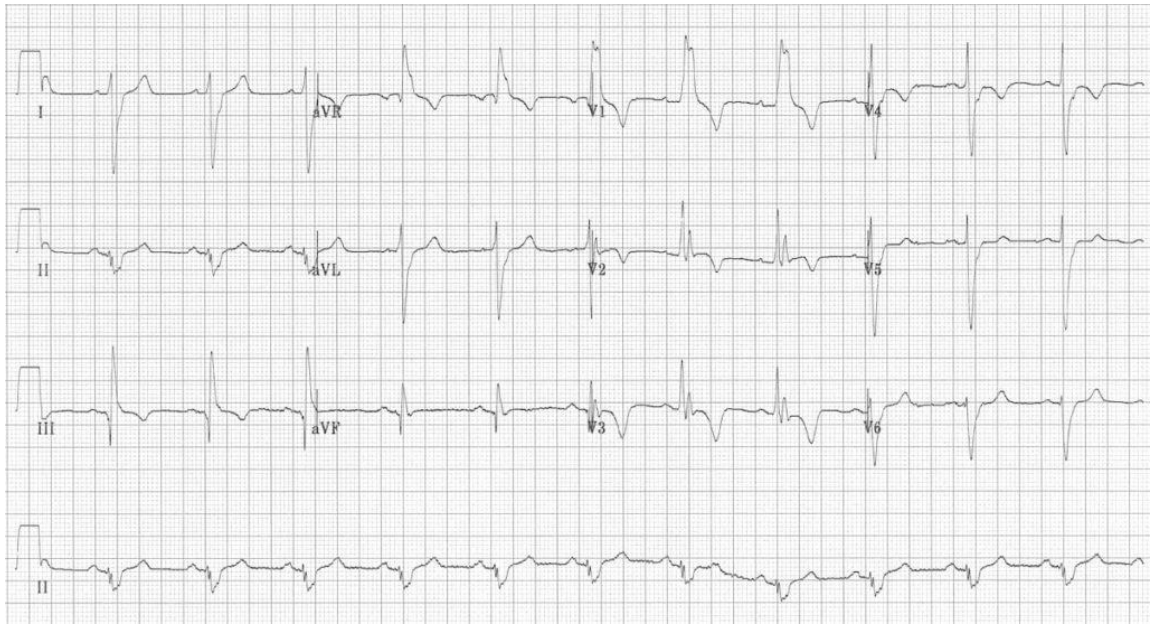
        A. The most acute stage of STEMI
        B. BODIES
        C. Hypercalcemia
        D. Hypokalemia

4. Summing up
 - checking and discussing the answers of higher education applicants
 - control of the level of professional skills and abilities
 - evaluation of each answer, setting of grades
 - answer to possible questions
 - task for the next class

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 4. Electrocardiogram / Yasar Sattar, Lovely Chhabra – StatPearls [Internet] – Last Update: June 13, 2022. URL: https://www.ncbi.nlm.nih.gov/books/NBK549803/

Electronic information resources:
 1. World Health Organization. URL: www.who.int/ru/index.html.

2. European Regional Office of the World Health Organization. URL: www.euro.who.int.
3. Modern healthcare. URL: https://www.modernhealthcare.com/vital-signs-healthcare-blog
4. AHA: https://www.heart.org/
5. EHA https://www.heartassociation.eu/
6. EHA CRP: https://cpr.heart.org/en/
7. NICE: https://www.nice.org.uk/
8. PubMed: https://pubmed.ncbi.nlm.nih.gov/
9. Medscape: https://www.medscape.com/
10. NCBI: https://www.ncbi.nlm.nih.gov/
11. Electrocardiogram calculators. URL:
    https://en.my-ekg.com/calculation-ekg/ekg-calculations.html