GUIDELINES FOR STUDENTS INDEPENDENT WORK IN THE PRACTICAL CLASSES PREPARING

<table>
<thead>
<tr>
<th>Academic discipline</th>
<th>Internal medicine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>Emergency conditions in clinic of Internal Medicine</td>
</tr>
<tr>
<td>Content module</td>
<td>Emergency conditions in clinic of Internal Medicine</td>
</tr>
<tr>
<td>Study subject</td>
<td>Curation of the patients with paroxysmal cardiac arrhythmias</td>
</tr>
<tr>
<td>Course</td>
<td>VI</td>
</tr>
<tr>
<td>Faculty</td>
<td>of foreign students training</td>
</tr>
</tbody>
</table>

Poltava 2016.
1. Actuality of the topic

**Topic actuality:**

Disorders of cardiac rhythm is one of the most dangerous pathologies of cardiovascular disease according to WHO. The incidence of arrhythmias among people of working age in Ukraine have increased in recent years. Sudden cardiac death may be the result of the variety of forms, sometimes lack of effective treatment. The incidence of sudden cardiac death in different countries is about more than 1 case per 1000 people per year. Thus, it’s very important to know the mechanisms of arrhythmias, clinical manifestations, diagnostic methods and its treatment to prevent complications.

2. The aims of the training course:

**To Know:**
- analyze the prevalence of disorders of cardiac rhythm;
- determine the etiology and pathogenesis of arrhythmias;
- classify the cardiac rhythm and analyze the typical clinical picture;
- create an individual scheme of diagnostic search, identify and propose the necessary diagnostic testing of patients with different forms of arrhythmias;

**To be able to:**
- to conduct physical examination of the patient (survey, inspection, palpation, percussion, auscultation) and justify a preliminary diagnosis;
- make a plan for additional examination of the patient with disorders of cardiac rhythm;
- justify the use of basic invasive and noninvasive diagnostic methods applied in the patients, indications and contraindications;
- interpret the results of additional research methods: blood biochemical analysis, electrocardiography (ECG), echocardiography, daily monitoring of ECG and others.
- to explain differential diagnosis and clinical diagnosis;
- know the principles of treatment, rehabilitation and prevention of cardiac rhythm disorders;

3. Basic knowledge, abilities and skills necessary for studying theme.

**Interdisciplinary integration:**

<table>
<thead>
<tr>
<th>No</th>
<th>The names of previous sciences</th>
<th>The received skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Anatomy, topographic anatomy</td>
<td>Describe the anatomical and topographical characteristics of cardiovascular system</td>
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<tr>
<td>2.</td>
<td>Normal and Pathological Physiology</td>
<td>Know the physiology of circulation and conduction system of the heart, pathophysiological basis of cardiac rhythm disorders</td>
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</tbody>
</table>
3. **Pharmacology**

To know pharmacokinetics and pharmacodynamics of drugs that are appointed to the cardiac rhythm disorders. To be able to prescribe proper treatment, calculate the dose of antiarrhythmic drugs.

4. **Propedeutics of Internal Medicine**

To master the methods of examination of the patient with disorders of cardiac rhythm (palpation, percussion, auscultation of the heart). A survey of the patient, evaluate the results obtained survey data of laboratory and instrumental methods.

5. **Intra-subject integration**

To know the signs of arrhythmia differential between themselves and other disorders of the cardiovascular system. Be able to determine the nature of cardiac rhythm disturbance, diagnose arrhythmias.

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**The contents of the topic:**

## SINOATRIAL (SA) NODE ARRHYTMIAS

### Normal Sinus Rhythm (NSR)

![ECG graph showing normal sinus rhythm](image)

- **Rate:** Normal (60–100 bpm)
- **Rhythm:** Regular
- **P Waves:** Normal (upright and uniform)
- **PR Interval:** Normal (0.12–0.20 sec)
- **QRS:** Normal (0.06–0.10 sec)

❤ **Clinical Tip:** A normal ECG does not exclude heart disease.
**Sinus Bradycardia**

- **Rate:** Slow (<60 bpm)
- **Rhythm:** Regular
- **P Waves:** Normal (upright and uniform)
- **PR Interval:** Normal (0.12–0.20 sec)
- **QRS:** Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Sinus bradycardia is normal in athletes and during sleep. In acute MI, it may be protective and beneficial or the slow rate may compromise cardiac output. Certain medications, such as beta blockers, may also cause sinus bradycardia.

**Sinus Tachycardia**

- **Rate:** Fast (>100 bpm)
- **Rhythm:** Regular
- **P Waves:** Normal (upright and uniform)
- **PR Interval:** Normal (0.12–0.20 sec)
- **QRS:** Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Sinus tachycardia may be caused by exercise, anxiety, fever, hypoxemia, hypovolemia, or cardiac failure.

**Sinus Arrhythmia**
Rate: Usually normal (60–100 bpm); frequently increases with inspiration and decreases with expiration
Rhythm: Irregular; varies with respiration
P Waves: Normal (upright and uniform)
PR Interval: Normal (0.12–0.20 sec)
QRS: Normal (0.06–0.10 sec)
♥ Clinical Tip: The pacing rate of the SA node varies with respiration, especially in children and elderly people.

ATRIAL ARRHYTMIAS

Wandering Atrial Pacemaker (WAP)

Rate: Normal (60–100 bpm)
Rhythm: Irregular
P Waves: At least three different forms, determined by the focus in the atria
PR Interval: Variable; determined by focus
QRS: Normal (0.06–0.10 sec)

Multifocal Atrial Tachycardia (MAT)

Rate: Fast (>100 bpm)
Rhythm: Irregular
P Wave: At least three different forms, determined by the focus in the atria
PR Interval: Variable; depends on focus
QRS: Normal (0.06–0.10 sec)
♥ Clinical Tip: MAT is commonly seen in patients with COPD but may also occur in acute MI.
Premature Atrial Contraction (PAC)

**Rate:** Depends on rate of underlying rhythm  
**Rhythm:** Irregular whenever a PAC occurs  
**P Waves:** Present; in the PAC, may have a different shape  
**PR Interval:** Varies in the PAC; otherwise normal (0.12–0.20 sec)  
**QRS:** Normal (0.06–0.10 sec)  
♥ **Clinical Tip:** In patients with heart disease, frequent PACs may precede paroxysmal supraventricular tachycardia (PSVT), A-fib, or A-flutter.

Supraventricular Tachycardia (SVT)

**Rate:** 150–250 bpm  
**Rhythm:** Regular  
**P Waves:** Frequently buried in preceding T waves and difficult to see  
**PR Interval:** Usually not possible to measure  
**QRS:** Normal (0.06–0.10 sec) but may be wide if abnormally conducted through ventricles  
♥ **Clinical Tip:** SVT may be related to caffeine intake, nicotine, stress, or anxiety in healthy adults.

Paroxysmal Supraventricular Tachycardia (PSVT)

**Rate:** 150–250 bpm  
**Rhythm:** Regular
**P Waves:** Frequently buried in preceding T waves and difficult to see
**PR Interval:** Usually not possible to measure
**QRS:** Normal (0.06–0.10 sec) but may be wide if abnormally conducted through ventricles

♥ **Clinical Tip:** The patient may feel palpitations, dizziness, lightheadedness, or anxiety.

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**Atrial Flutter (A-flutter)**

*Image of an ECG strip showing atrial flutter.*

**Rate:** Atrial: 250–350 bpm; ventricular: slow or fast
**Rhythm:** Usually regular but may be variable
**P Waves:** Flutter waves have a saw-toothed appearance
**PR Interval:** Variable
**QRS:** Usually normal (0.06–0.10 sec), but may appear widened if flutter waves are buried in QRS

♥ **Clinical Tip:** The presence of A-flutter may be the first indication of cardiac disease.
♥ **Clinical Tip:** Signs and symptoms depend on ventricular response rate.

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**Atrial Fibrillation (A-fib)**

*Image of an ECG strip showing atrial fibrillation.*

**Rate:** Atrial: 350 bpm or greater; ventricular: slow or fast
**Rhythm:** Irregular
**P Waves:** No true P waves; chaotic atrial activity
**PR Interval:** None
**QRS:** Normal (0.06–0.10 sec)

♥ **Clinical Tip:** A-fib is usually a chronic arrhythmia associated with underlying heart disease.
♥ **Clinical Tip:** Signs and symptoms depend on ventricular response rate.

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**Wolf-Parkinson-White (WPW) Syndrome**

*Image of an ECG strip showing Wolf-Parkinson-White syndrome.*
Rate: Depends on rate of underlying rhythm
Rhythm: Regular unless associated with A-fib
P Waves: Normal (upright and uniform) unless A-fib is present
PR Interval: Short (≤0.12 sec) if P wave is present
QRS: Wide (≤0.10 sec); delta wave present
♥ Clinical Tip: WPW is associated with narrow-complex tachycardias, including A-flutter and A-fib.

JUNCTIONAL ARRHYTMIAS

Junctional Rhythm

Rate: 40–60 bpm
Rhythm: Regular
P Waves: Absent, inverted, buried, or retrograde
PR Interval: None, short, or retrograde
QRS: Normal (0.06–0.10 sec)

Accelerated Junctional Rhythm

Rate: 61–100 bpm
Rhythm: Regular
P Waves: Absent, inverted, buried, or retrograde
PR Interval: None, short, or retrograde
QRS: Normal (0.06–0.10 sec)
♥ Clinical Tip: Monitor the patient, not just the ECG, for clinical improvement.
**Junctional Tachycardia**

- **Rate:** 101–180 bpm
- **Rhythm:** Regular
- **P Waves:** Absent, inverted, buried, or retrograde
- **PR Interval:** None, short, or retrograde
- **QRS:** Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Signs and symptoms of decreased cardiac output may be seen in response to the rapid rate.

**Junctional Escape Beat**

- **Rate:** Depends on rate of underlying rhythm
- **Rhythm:** Irregular whenever an escape beat occurs
- **P Waves:** None, inverted, buried, or retrograde in the escape beat
- **PR Interval:** None, short, or retrograde
- **QRS:** Normal (0.06–0.10 sec)

**Premature Junctional Contraction (PJC)**

- **Rate:** Depends on rate of underlying rhythm
- **Rhythm:** Irregular whenever a PJC occurs
**P Waves:** Absent, inverted, buried, or retrograde in the PJC
**PR Interval:** None, short, or retrograde
**QRS:** Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Before deciding that isolated PJC may be insignificant, consider the cause.

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**VENTRICULAR ARRHYTMIAS**

**Idioventricular Rhythm**

![Idioventricular Rhythm ECG](image)

**Rate:** 20–40 bpm  
**Rhythm:** Regular  
**P Waves:** None  
**PR Interval:** None  
**QRS:** Wide (>0.10 sec), bizarre appearance

♥ **Clinical Tip:** Idioventricular rhythm may also be called agonal rhythm.

**Accelerated Idioventricular Rhythm**

![Accelerated Idioventricular Rhythm ECG](image)

**Rate:** 41–100 bpm  
**Rhythm:** Regular  
**P Waves:** None  
**PR Interval:** None  
**QRS:** Wide (>0.10 sec), bizarre appearance

♥ **Clinical Tip:** Idioventricular rhythms appear when supraventricular pacing sites are depressed or absent. Diminished cardiac output is expected if the heart rate is slow.
Premature Ventricular Contraction (PVC)

**Rate:** Depends on rate of underlying rhythm

**Rhythm:** Irregular whenever a PVC occurs

**P Waves:** None associated with the PVC

**PR Interval:** None associated with the PVC

**QRS:** Wide (>0.10 sec), bizarre appearance

♥ **Clinical Tip:** Patients may sense the occurrence of PVCs as skipped beats. Because the ventricles are only partially filled, the PVC frequently does not generate a pulse.

Premature Ventricular Contraction (same form)

Premature Ventricular Contraction: Multiform (different forms)

Premature Ventricular Contraction: Ventricular Bigeminy (PVC every other)
Premature Ventricular Contraction: Ventricular Trigeminy (PVC every 3rd)

Premature Ventricular Contraction: Ventricular Quadrigeminy (PVC every 4rd beat)

Premature Ventricular Contraction: Couplests (paired PVCs)

Ventricular Tachycardia (VT): Monomorphic
Ventricular Tachycardia (VT): Polymorphic

Rate: 100–250 bpm
Rhythm: Regular or irregular
P Waves: None or not associated with the QRS
PR Interval: None
QRS: Wide (_0.10 sec), bizarre appearance

♥ Clinical Tip: It is important to confirm the presence or absence of pulses because polymorphic VT may be perfusing or nonperfusing.
♥ Clinical Tip: Consider electrolyte abnormalities as a possible etiology.

Ventricular Fibrillation (VF):

Rate: Indeterminate
Rhythm: Chaotic
P Waves: None
PR Interval: None
QRS: None

♥ Clinical Tip: There is no pulse or cardiac output. Rapid intervention is critical. The longer the delay, the less the chance of conversion.
**Rate, rhythm, P waves, P-R interval, and QRS: Reflect underlying rhythm.**

♥ **Clinical Tip:** Potential causes of PEA are pulmonary embolism, MI, acidosis, tension pneumothorax, hyper- and hypokalemia, cardiac tamponade, hypovolemia, hypoxia, hypothermia, and drug overdose (i.e., cyclic antidepressants, beta blockers, calcium channel blockers, digoxin).

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### ANTIARRHYTHMIC DRUGS: DOSES AND SIDE EFFECTS

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose/Metabolism</th>
<th>Side Effects and Required Monitoring</th>
<th>Selected Drug Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinidine</td>
<td>Hepatic CYP 3A4 (70%), renal (30%); Dose: sulfate—600 mg tid, gluconate—324 to 648 mg qid; Dose reduced for renal failure</td>
<td>Thrombocytopenia, Cinchonism, Pruritus, rash, QT prolongation/torsades de pointes</td>
<td>↑ Digoxin and amiodarone concentrations; Quinidine inhibits CYP 2D6 and may increase drugs metabolized by this enzyme, e.g., ↑ effect of tricyclic antidepressants, haloperidol, some β-blockers, fluoxetine, narcotics</td>
</tr>
<tr>
<td>Procaainamide</td>
<td>Mostly hepatic—rapid acetylators produce more NAPA; NAPA renally cleared; PO dose: 50 mg/kg/24 hr; IV dose: 1 g over 25 min, then 20-60 μg/kg/min infusion; Reduce dose for renal dysfunction or low cardiac output</td>
<td>Rash, fever, arthralgias, drug-induced lupus, particularly in slow acetylators, Agranulocytosis; QT prolongation/torsades de pointes</td>
<td>Procaainamide clearance reduced by trimethoprim, cimetidine, and ranitidine</td>
</tr>
<tr>
<td>Disopyramide</td>
<td>Renal, hepatic (CYP 3A4); Dose: 100-400 mg q8-12h; max dose: 800 mg/24 hr; Reduce dose for renal or hepatic dysfunction</td>
<td>Anticholinergic (contraindicated for narrow-angle glaucoma): dry mouth, urinary retention, constipation, blurry vision; QT prolongation/torsades de pointes</td>
<td>None</td>
</tr>
<tr>
<td>Propafenone</td>
<td>Hepatic: 150-300 mg q8h or sustained release 225-435 mg bid</td>
<td>Metallic taste, dizziness, SIADH, Atrial flutter, ventricular tachycardia</td>
<td>May decrease the metabolism of warfarin, increase digoxin levels</td>
</tr>
<tr>
<td>Flecaainide</td>
<td>Renal, hepatic CYP 2D6; Dose: 50-100 mg bid; max dose: 300-400 mg/day</td>
<td>Dizziness, headache, visual blurring, Atrial flutter, ventricular tachycardia</td>
<td>May increase digoxin levels</td>
</tr>
<tr>
<td>β-Blockers (selected)</td>
<td>Hepatic, renal; Only renal (atenolol, nadolol), 1V: metolol: 250-500 μg over 1 min, then 50-300 μg/kg/min over 4 min; Acebutolol, 200-600 mg bid; atenolol, 25-100 mg qd; carvedilol, 1-37.5-50 mg bid; metoprolol, 15-75 mg bid; nadolol, 20-40 mg qd; nebivolol, 5-40 mg qd; propranolol, 10-120 mg bid</td>
<td>Fatigue, depression, bronchospasm, impotence</td>
<td>Minimal, except for carvedilol and metoprolol, whose levels may be increased by amiodarone, propafenone, quinidine, fluoxetine, haloperidol, paxilline, and cimetidine</td>
</tr>
<tr>
<td>Sotalol</td>
<td>Renal: 80-120 mg bid; Max dose: 240 mg bid</td>
<td>Bronchospasm; QT prolongation/torsades de pointes</td>
<td>No significant interactions</td>
</tr>
</tbody>
</table>
4. Materials for self-training
4.1. The main terms, subjects and its introductions:

<table>
<thead>
<tr>
<th>Term</th>
<th>Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Disorders of cardiac rhythm</td>
<td>change the normal frequency, regularity and sources of stimulation of the heart, and violation of conduction and consistency between ventricular and atrial activation</td>
</tr>
<tr>
<td>2. Extrasystole</td>
<td>Premature stimulation and reduction of part or the whole heart</td>
</tr>
</tbody>
</table>
### 3. Fibrillation, or atrial fibrillation

- Very often (from 350 to 700 per minute), chaotic stimulation and reduction of atrial muscle fibers

### 4. Atrial flutter

- Considerable atrial reductions becoming more frequent (up to 200-400 per minute) while retaining the correct regular atrial rhythm

### 5. Ventricular fibrillation

- Frequent (up to 200-500 beats per minute) chaotic stimulation and reduction of certain groups of ventricular muscle fibers

### 6. Ventricular flutter

- Frequent (up to 200-300 per minute) rhythmic stimulation and reduction of certain groups of ventricular muscle fibers

#### 4.2. Self-control materials

**Questions to be answered:**
- Determination of disorders of cardiac rhythm;
- Modern views on etiology and pathogenesis of arrhythmias;
- Classification of disorders of cardiac rhythm;
- Basic clinical and laboratory syndromes in different types of arrhythmias;
- Criteria for diagnosis of disorders of cardiac rhythm;
- Differential diagnosis;
- Complications of arrhythmias;
- Indications and contraindications to the use of antiarrhythmic drugs and class I;
- Indications and contraindications to the use of antiarrhythmic drugs class II;
- Indications and contraindications for the appointment of class III antiarrhythmic drugs;
- Indications and contraindications for the appointment of class IV antiarrhythmic drugs;
- Basic principles of therapy, rehabilitation, prevention of disorders of cardiac rhythm; Weather and efficiency.

**A. The questions for self-control:**

1. Name the main aetiological factors of cardiac rhythm disorders.
2. Make the plan of additional investigation of the patient with cardiac rhythm disorders.
3. Name the main principles and ways of treatment of cardiac rhythm disorders.
B. Tests for self-control:
Questions:

What are cardiac rhythm disorders in these cases, by the given ECG data?

ECG Number 1

![ECG Image]

ECG Number 2

![ECG Image]

Recommended literature:
A. Main:
2. CURRENT Medical Diagnosis and Treatment 2012, Fifty-First Edition (LANGE CURRENT Series) by Stephen McPhee, Maxine Papadakis and Michael W. Rabow (Paperback - Sep 12, 2011)
3. Davidson's Principles and Practice of Medicine: With STUDENT CONSULT Online Access, 21e (Principles & Practice of Medicine (Davidson's)) by Nicki R. Colledge BSc FRCP(Ed), Brian R. Walker BSc MD FRCP(Ed) and Stuart H. Ralston MB ChB MD FRCP FMedSci FRSE (Paperback - Mar 11, 2010)Kumar and Clark's Clinical Medicine, 7e (Kumar, Kumar and Clark's Clinical Medicine) by Parveen J. Kumar (Paperback - Jul 2, 2009)
4. CURRENT Diagnosis and Treatment Emergency Medicine, Seventh Edition (LANGE CURRENT Series) by C. Keith Stone (May 23, 2011)

Additional literature:

Answers:
1. Rate: 200–250 bpm
   Rhythm: Irregular
P Waves: None
PR Interval: None
QRS: Wide (_0.10 sec), bizarre appearance
♥ Clinical Tip: Torsade de pointes may deteriorate to VF or asystole.
♥ Clinical Tip: Frequent causes are drugs that prolong QT interval and electrolyte abnormalities such as hypomagnesemia.

2. Rate: 150–250 bpm
Rhythm: Regular
P Waves: Normal (upright and uniform) but differ in shape from sinus P waves
PR Interval: May be short (_0.12 sec) in rapid rates
QRS: Normal (0.06–0.10 sec) but can be aberrant at times.

Methodical recommendations consisted by Kulishov S.K.