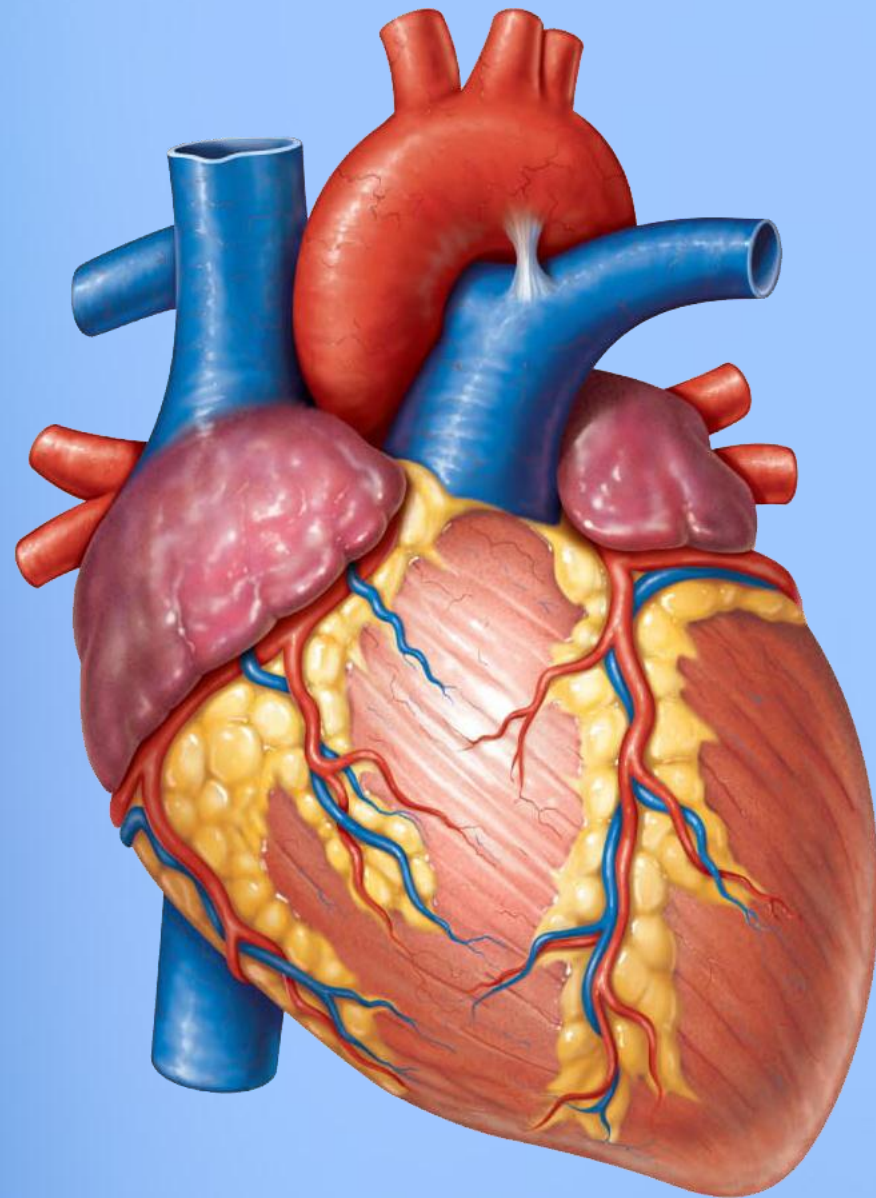


6

ARRHYTHMIAS



Cardiovascular Block

Contact us: pht433@gmail.com

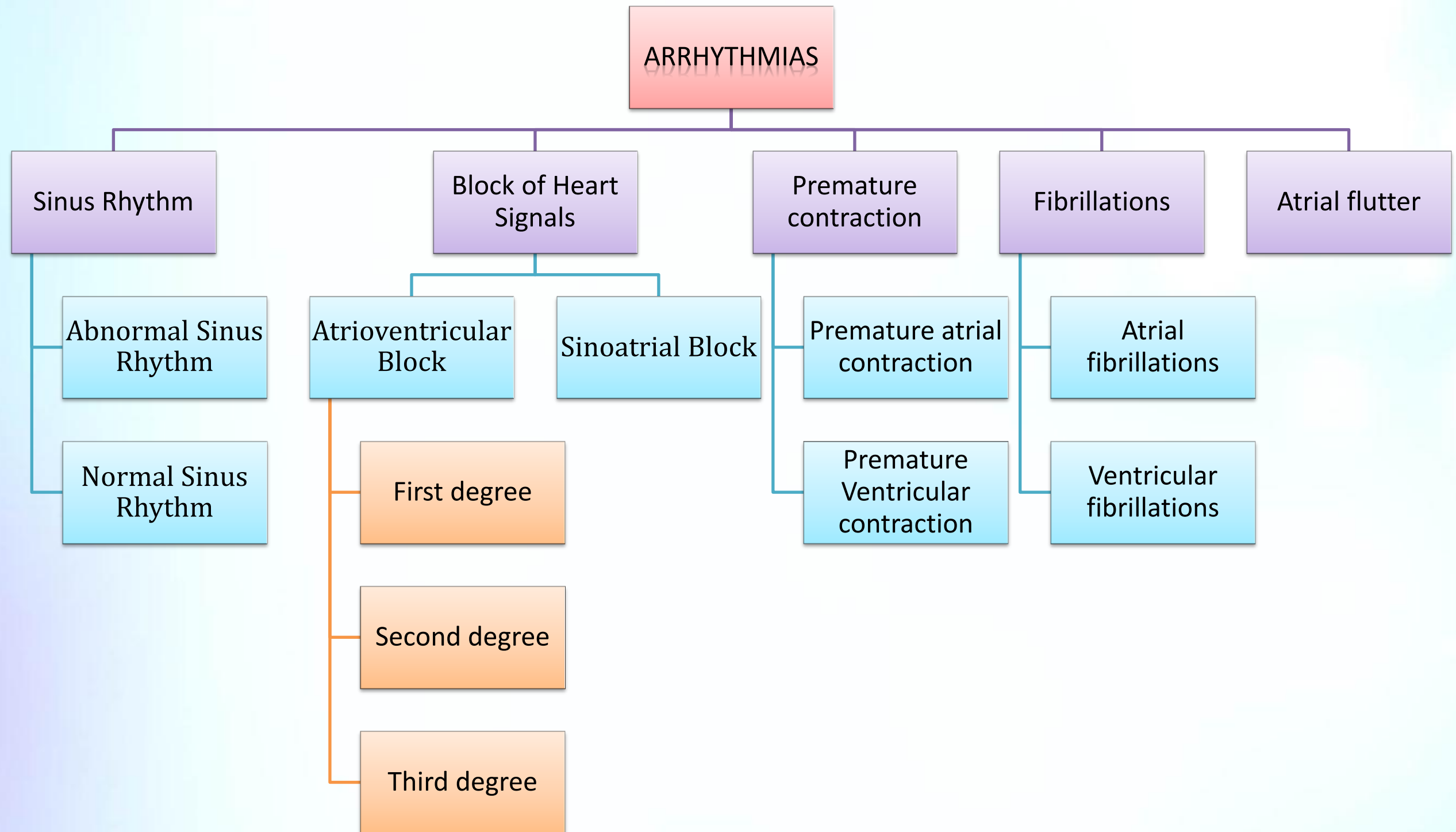


@PhysiologyTeam



Pht433@gmail.com

Mind Map



Objectives

- Describe sinus arrhythmias
- Describe the main pathophysiological causes of cardiac arrhythmias
- Explain the mechanism of cardiac block
- Explain the origin of an ectopic foci
- Enumerate the common arrhythmias and describe the basic ECG changes

Arrhythmias

Some of the most distressing types of heart malfunction occur not as a result of abnormal heart muscle **but because of abnormal rhythm of the heart**. For instance, sometimes the beat of the atria is not coordinated with the beat of the ventricles, so the atria no longer function as primer pumps for the ventricles.

The causes of the cardiac arrhythmias are usually one or a combination of the following abnormalities in the rhythmicity-conduction system of the heart:

1. Abnormal rhythmicity of the pacemaker.
2. Shift of the pacemaker from the sinus node to another place in the heart.
3. Blocks at different points in the spread of the impulse through the heart.
4. Abnormal pathways of impulse transmission through the heart.
5. Spontaneous generation of spurious impulses in almost any part of the heart.



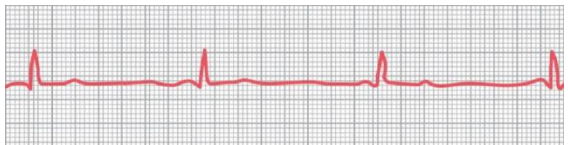
There are 3 mechanisms can cause arrhythmias :

- 1- Increase or decrease Automaticity
- 2- Ectopic Foci **“triggered automaticity”**
- 3- Re-entry **“circus movements”**



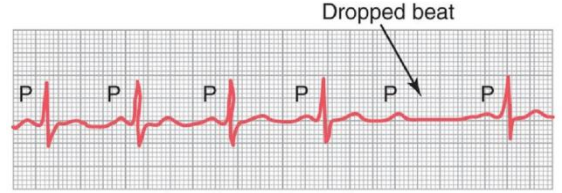
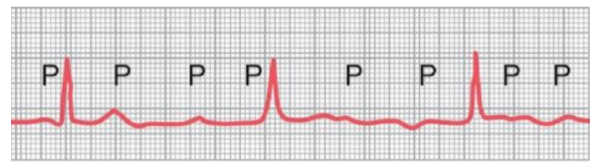


<http://www.youtube.com/watch?v=9m52j00TyTw>

Sinus Rhythm

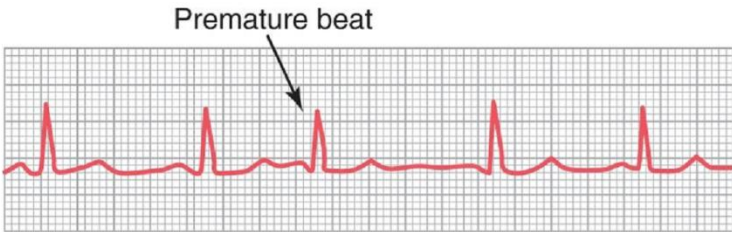
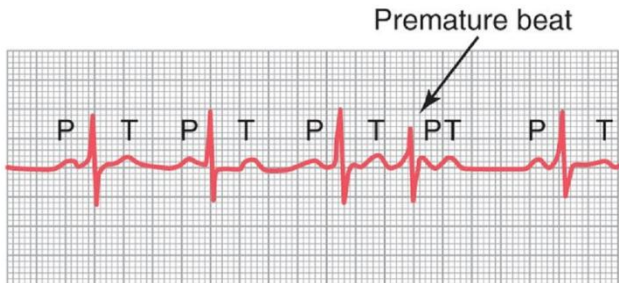
	Normal Sinus Rhythm	Abnormal Sinus Rhythm	
Type	Normal	Tachycardia	Bradycardia
Heart beats	60 – 90 beats/min.	faster than 100 beats/min. “Decrease R-R interval”	fewer than 60 beats /min “Increase R-R interval”
Features	<ul style="list-style-type: none"> Regular narrow-complex rhythm Each QRS complex is preceded by a P wave 	Intervals between QRS complex <u>decreased</u> Caused by : <ol style="list-style-type: none"> 1- increased temperature 2- stimulation of heart by the sympathetic nerves 3- some drugs (digitalis) 	Intervals between QRS complex <u>increased</u> Caused by : <p>vagal stimulation (parasympathetic effect)</p>
Example			

Block of Heart Signals Within the Intracardiac Conduction Pathways

	Sinoatrial Block (SA node blockage)	Atrioventricular Block (AV node blockage)		
Type	_____	First degree	Second degree "Dropped beat"	Third degree "Ventricular Escape or Stokes-Adams Syndrome"
Features	<p>There will be no more signal from SA nodes. New signal will appear from AV node and go to ventricles</p> <p>ECG shows QRS-T complexes only (NO P WAVE)</p>	<p>The blockage will delay impulses reach from SA node to AV node</p> <p>ECG shows prolonged P-R interval (up to 0.2 sec) (incomplete block).</p>	<p>The blockage will stop the signal every 2-3 rhythms</p> <p>ECG shows dropped beats and prolonged P-R interval (up to 0.25 sec) (incomplete block).</p>	<p>Complete dissociation of P wave and QRS waves</p> <p>ECG shows dissociation between P waves (originated from SA node) and QRS-T complexes (originated from AV nodes or bundles) (complete block)</p>
Example				
Causes	<ul style="list-style-type: none"> -Ischemia of the SA node and AV node - Compression of the SA node and AV node by scar formation -Inflammation of the SA node and AV node -Strong vagal stimulation 			

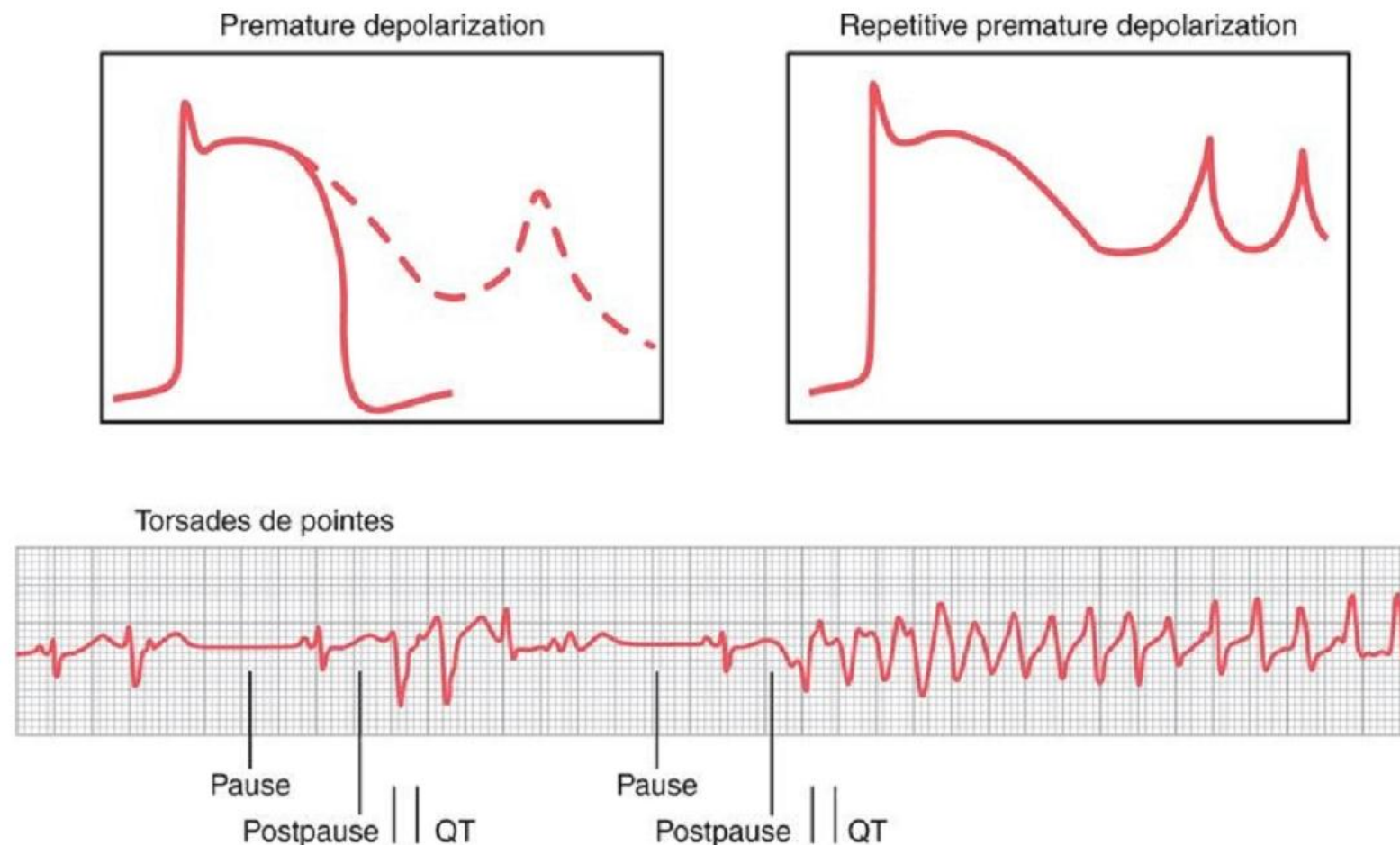
Premature contraction

A premature contraction is a contraction of the heart before the time that normal contraction would have been expected. This condition is also called **extrasystole, premature beat, or ectopic beat**.

	Premature Atrial Contractions	Premature Ventricular Contractions
ECG	Short P-R interval depending on how far the ectopic foci from the AV Node (more close foci will lead to faster conduction)	Prolong QRS complex ; impulses are carried out with myocardial fibers which have slower conduction rate than Purkinje fibers (very fast)
Features	<ul style="list-style-type: none"> - Pulse deficit: if no time for the ventricles to fill with blood (because it more closer and conduct faster) - Compensatory pause: The time between the premature contraction and the next beat is increased <u>to come back to the normal</u> 	<ul style="list-style-type: none"> - T wave inverted: T wave has an electrical potential of opposite polarity of QRS because of the slow conduction fibers that depolarizes first will repolarize first - Increase QRS complexes voltage: wave from one ventricle can not neutralize the one from the other ventricle
Example		

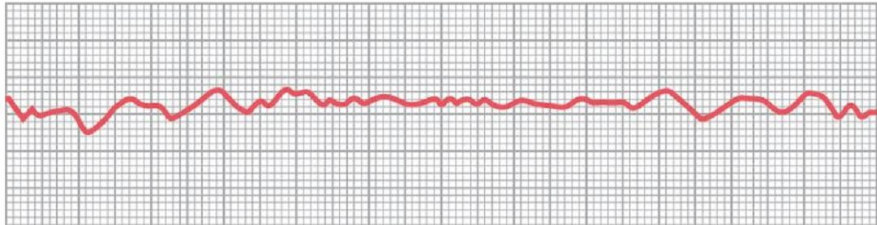
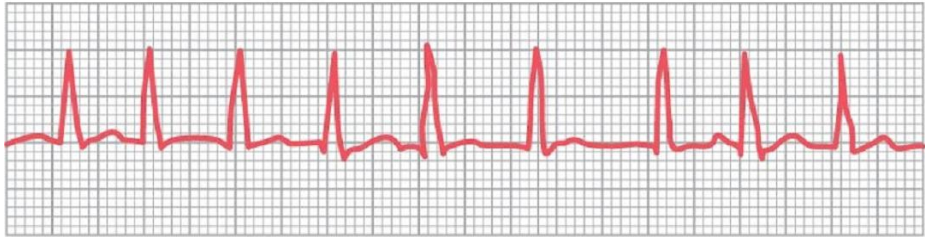
Long QT syndrome (LQTS)

Cause: delayed repolarization of ventricular muscle increases a person's susceptibility to develop ventricular arrhythmias called torsades de pointes, which literally means "twisting of the points."

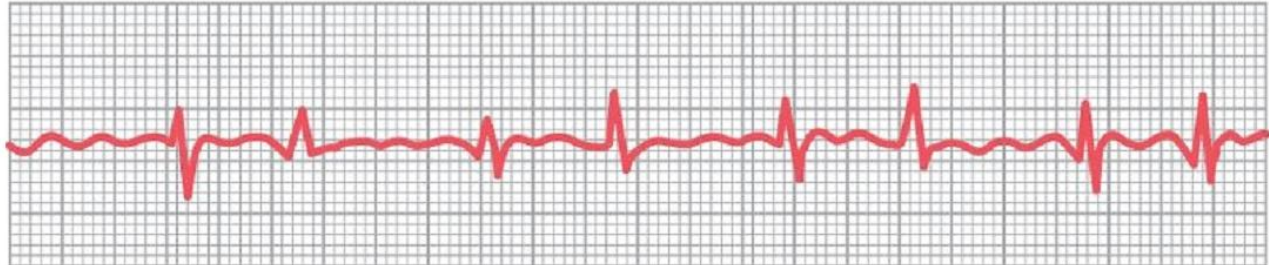


1. The congenital forms of LQTS are rare disorders caused by mutations of sodium or potassium channel genes.
2. The acquired forms of LQTS that are associated with plasma electrolyte disturbances, such as hypomagnesaemia, hypokalemia, or hypocalcemia, or with administration of excess amounts of antiarrhythmic drugs such as quinidine or some antibiotics such as fluoroquinolones or erythromycin that prolong the Q-T interval.

Ventricular and Atrial fibrillations

	Ventricular Fibrillation	Atrial Fibrillation
Cause	<ul style="list-style-type: none"> - Impulses stimulate one part of the ventricles or atria, then another, then itself. - Many part contracts at the same time while other parts relax (Circus movement) 	
Features	<ul style="list-style-type: none"> - Tachycardia - Irregular rhythm - Broad QRS complex - No P wave - Treated by : Electroshock Defibrillation (within 1 to 3 min or die) 	<ul style="list-style-type: none"> - Tachycardia - Irregular rhythm - The efficiency of ventricular pumping is decreased - No P wave or low voltage
Example		

Atrial Flutter

What is the different between Atrial flutter and fibrillation?	in atrial flutter the electrical signal travels as a single large wave always in one direction around and around the atrial muscle mass. While in atrial fibrillations in many directions .
Cause	One area of the atria is contracted and another one is relaxed, the amount of blood pumped by the atria is slight (70% of blood will move passively)
Features	<ul style="list-style-type: none">- The atria contracts at high rate (200-350 beats/min)- The refractory period of the AV node causes 2-3 beats of atria for one beat
Example	 An ECG tracing on a standard grid showing atrial flutter. The rhythm is characterized by a regular, rapid atrial rate (approximately 250-350 bpm) with a sawtooth pattern of P waves. The QRS complexes are narrow and occur at a regular interval, typically 2:1 or 3:1 AV conduction.

Other factors cause arrhythmias

<p>Ischemia A- reversible B- Irreversible</p>	<p>A- <u>Inverted T wave</u> <u>ST segment depression</u></p> <p>B- <u>ST segment elevation</u> <u>Deep Q wave</u></p>	<p>Reversible: angina pectoris Irreversible: myocardial infarction</p>
<p>Potassium A- Hyperkalemia B- Hypokalemia</p>	<p>A- Tall peaked T wave B- flat T wave</p>	<p>-----</p>

Summary

Causes of Arrhythmia:

- Abnormal rhythmicity
- Shift of pacemaker
- Blocks of the impulse
- Abnormal transmission
- Spontaneous generation of impulses

Sinoatrial Block

- No atrial contraction
- Ventricles pick up impulse usually from A-V node.

Atrioventricular Block

- Prolonged P-R - First Degree
 - Delay more than 0.2 seconds
- Second Degree Block
 - P-R Delay from 0.25 to 0.45
 - Sometimes cannot stimulate ventricles to contract
- Third degree block
 - Complete block of impulse to the ventricles
 - Ventricle picks up impulse from A-V node or A-V bundle.

Premature Atrial contractions

- Compensatory pause.
- Can be normal in healthy people.

Premature Ventricular contractions

- QRS prolonged
- High QRS voltage, because impulse does not neutralize opposite polarity of the ventricles
- T polarity opposite from QRS (T is inverted in ECG)

Long QT syndrome

- Increased risk of **torsades de pointes**
- Caused by abnormal plasma electrolytes (eg: Hypocalcemia and hypokalemia)

Atrial fibrillation

- Waves of depolarization impulses, causing some part of the atria to contract while the others are already on refractory periods.

Atrial Flutter

- Single wave that keep circulating in the atria.

Questions

Q1) Arrhythmia occurs due to ?

Abnormal rhythm of the heart.

Q2) Which are the 3 mechanisms that can lead to arrhythmia ?

1- Increase or decrease Automaticity.

2- Ectopic Foci “triggered automaticity”.

3- Re-entry “circus movements”.

Q3) Intervals between QRS complex increased in (A) ? and why (B) ?

(A) : Bradycardia.

(B) : Because of vagal stimulation (parasympathetic effect).

Q4) ECG in Sinoatrial node blockage will show ?

1- Absence of P wave.

2- Presence of QRS-T complexes.

Q5) Complete dissociation of P wave and QRS waves can be observed in ?

In A-V node Blockage (3rd degree which is VENTRICULAR ESCAPE).

Questions

Q6) ECG shows prolonged P-R interval in which degree of AV block ?

1st degree and 2nd degree

Q7) What is the definition of extrasystole ?

It is a contraction of the heart before the time that normal contraction would have been expected.

Q8) The acquired forms of LQTS that are associated with ?

1- Plasma electrolyte disturbances.

2- Administration of excess amounts of antiarrhythmic drugs such as quinidine.

3- Some antibiotics such as fluoroquinolones or erythromycin that prolong the Q-T interval.

Q9) Ventricular fibrillation can be treated (NOT Pharmacologically) by ?

Electroshock Defibrillation (within 1 to 3 min or die).

Q10) What is the difference between Atrial flutter and fibrillation?

In atrial flutter the electrical signals travel along large wave with only 1 direction, while in atrial fibrillation the signals travel along multiple directions.

MCQS

1-When a patient loses blood and passes into a state of shock which nerve will reflex:

- A-Vagal stimulation
- B-Sympathetic stimulation

2-Most effect of sinus bradycardia:

- A-Sympathetic trunk
- B-Vagal stimulation
- C-Toxic condition of the heart
- D-Increase body temperature

3-When a P-R interval increased and the interval is prolonged, the without further complication in ECG findings. The patient may have?

- A-First degree incomplete
- B-second degree incomplete
- C-third degree incomplete
- D-electrical alternant

4-When the conduction is poor in A-V node. the ventricle has been escaped, patient is have:

- A-First degree incomplete
- B-second degree incomplete
- C-third degree complete
- D-electrical alternant

5-Which one of these is depending on how far an ectopic foci from the AV Node :

- A- Premature Atrial Contractions
- B- Premature Ventricular Contractions

6-Delayed repolarization of ventricular muscle increases a person' s susceptibility to develop ventricular arrhythmia:

- A-Short QT syndrome
- B-torsades de pointes
- C-Premature Ventricular Contractions
- D-ectopic beat.

7-electrical signal travels as a single large wave always in one direction:

- A-atrial flutter
- B-atrial fibrillations

8-Waves of depolarization impulses, causing some part of the atria to contract while the others are already on refractory periods:

- A-Premature Atrial Contractions
- B-atrial flutter
- C-electrical alternant
- D-atrial fibrillations

Ans: 1-B, 2-B, 3-A, 4-C, 5-A, 6-B, 7-A. 8-D,