PHYSIOLOGY TEAM 432

LECTURE : 6

The ECG and the rhythm disturbances

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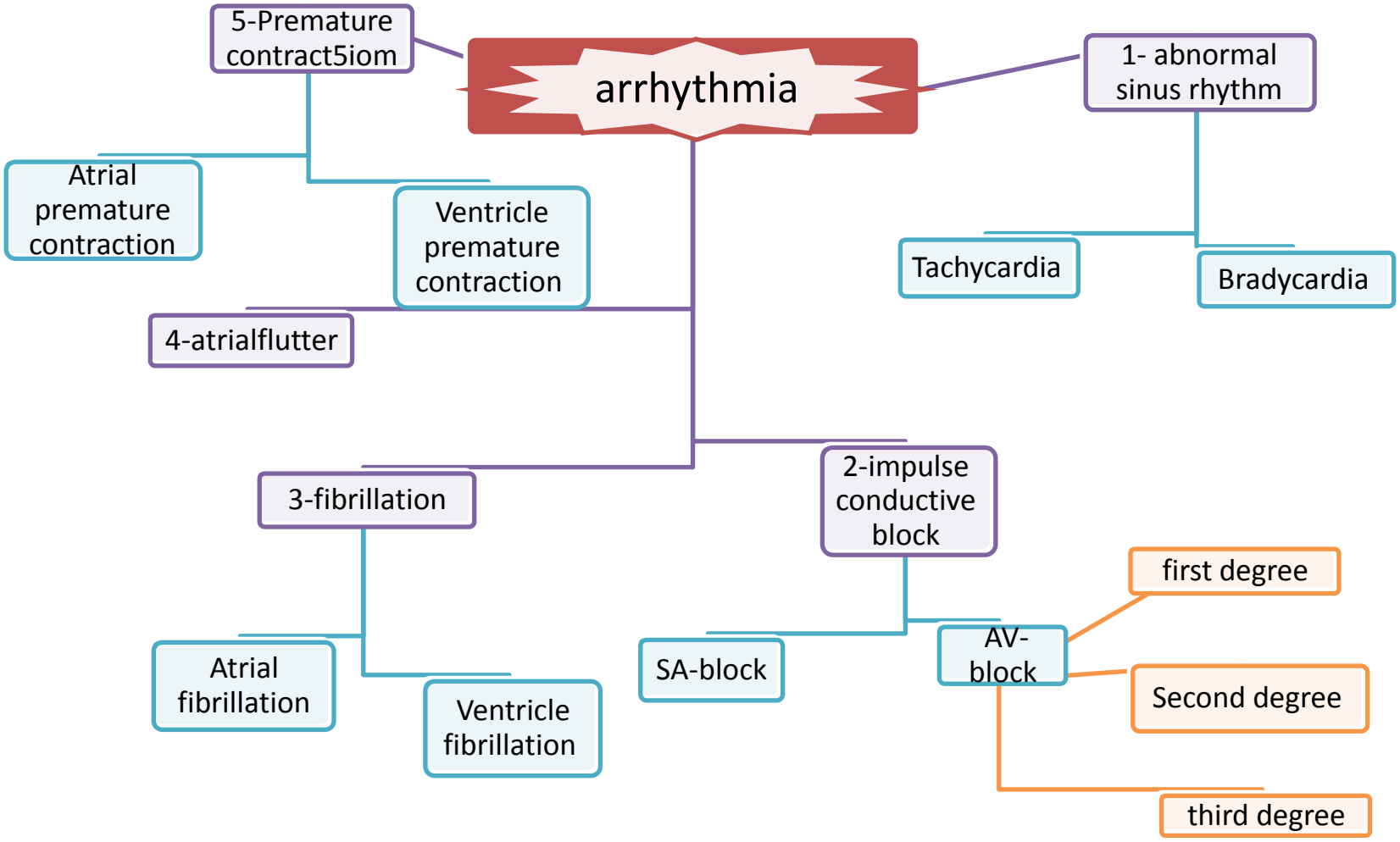
OBJECTIVES

- 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

MIND MAP


arrhythmia
5-Premature contract5iom
Atrial premature contraction
Ventricle premature contraction
4-atrialflutter
1- abnormal sinus rhythm
Tachycardia
Bradycardia
3-fibrillation
Atrial fibrillation
Ventricle fibrillation
2-impulse conductive block
SA-block
AV-block
first degree
Second degree
third degree

Normal Sinus Rhythm

We should look for these thing to decide if the heart work normally :

- Regular
- Single p-wave precedes every QRS complex
- P-R interval is constant and within normal range
- R-R interval is constant

Causes of Cardiac Arrhythmias

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 during 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

Rate above or below normal (normal heart rate 60-80)
Regular or irregular rhythm
Narrow or broad QRS complex
Relation to P waves(not precede each QRS)

1-Abnormal Sinus Rhythm

a. Tachycardia:

Feature	causes
an increase in the heart rate Heart rate > 100 beats per minute	1-Increased body temperature 2-Sympathetic stimulation 3-Inspiration 4-Drugs: digitalis

Short RR-interval due to faster heart rate

1-Abnormal Sinus Rhythm

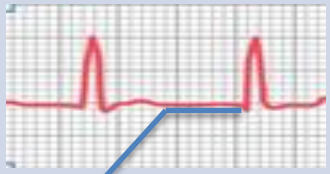
b. bradycardia:

Feature	causes
Slow heart rate < 60 beats per minute	1-Parasympathetic stimulation (vagal stimulation) 2-Expiration

2-Abnormal Cardiac Rhythms that Result from Impulse Conduction Block

a. SA- Block:

Feature	causes	ECG
When impulse from the S-A node is blocked before entering atrial muscle.	-Ischemia of the SA node -Compression of the SA node by scar formation. -Inflammation of the SA node -Strong vagal stimulation (vagal nerve have parasympathetic activity)	NO P-wave (Cessation of P wave).



No P wave

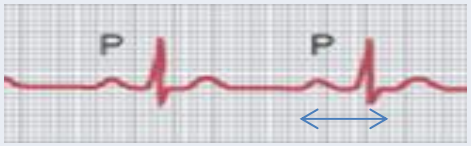
2-Abnormal Cardiac Rhythms that Result from Impulse Conduction Block

B- Atrioventricular node-Block (A-V Block) :

- When impulse from the S-A node is blocked

Types: First, second & third degree block
Causes same like S-A node, but in the place of A-V node.

Types of the A-V Block

First degree	Second Degree	Third degree
Prolong P-R interval (0.2 seconds)	P-R interval > 0.25 second •Only few impulses pass to the ventricles → atria beat faster than ventricles →"dropped beat" of the ventricles	Complete dissociation of P wave and QRS waves Atrial rate is 100 b/m Ventricular rate is 40 b/m →The ventricle escape from the influence of S-A node *Stokes-Adams Syndrome: AV block comes and goes
		

First degree	Second degree	Third degree
Prolong **P-R interval**	Some drop **P-R interval (absent) >>** In addition to Prolong **P-R interval**	Complete dissociation of P wave and QRS waves

التوصيل من SAإلى AVيأخذ وقت أطول

التوصيل من SAإلى AVيأخذ وقت أطول وأحيانا لا تصل

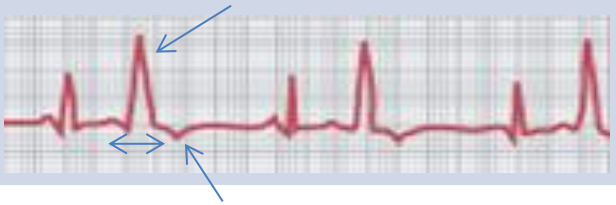
لا يوجد أي إرتباط بين P و QRS

Conduction Block

S-A BLOCK	A-V BLOCK
Impulses don't reach the atrium tissue .	-Impulses leave SA node but it can not pass to the AV node -It subdivides into (1^{st} 2^{nd} 3^{rd})
Causes: -Ischemia of the S-A node -Compression of the S-A node by scar formation -Inflammation of the S-A node -Strong vagal stimulation	Causes: -Ischemia of the A-V node -Compression of the A-V node by scar formation -Inflammation of the A-V node -Strong vagal stimulation

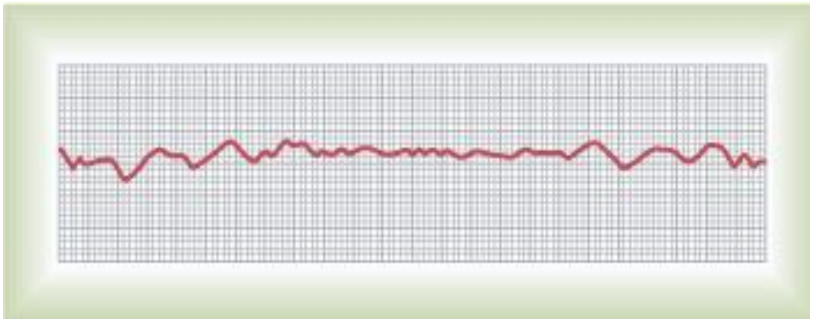
Premature contractions

Premature contraction	Causes	Ectopic foci originate in
extra systoles, or ectopic beat result from *ectopic foci* that generate abnormal cardiac impulses (pulse deficit)	**PAC:** • Ischemia • Irritation by calcified foci • Drugs like caffeine **PVC:** • Drugs like caffeine • Smoking • Sleep deprivation • Emotional irritation	• atria • A-V junction • ventricles

Premature Atrial Contractions	Premature Ventricular Contractions (PVCs)
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)
Pulse deficit if no time for the ventricles to fill with blood (because it more closer and conduct faster)	Increase QRS complexes voltage ; QRS wave from one ventricle can not neutralize the one from the other ventricle
The time between the premature contraction and the succeeding beat is increased (*Compensatory pause*) to come back to the normal 	T wave has an electrical potential of opposite polarity of QRS because of the slow conduction fibers that depolarizes first will repolarize first (T wave is inverted) 

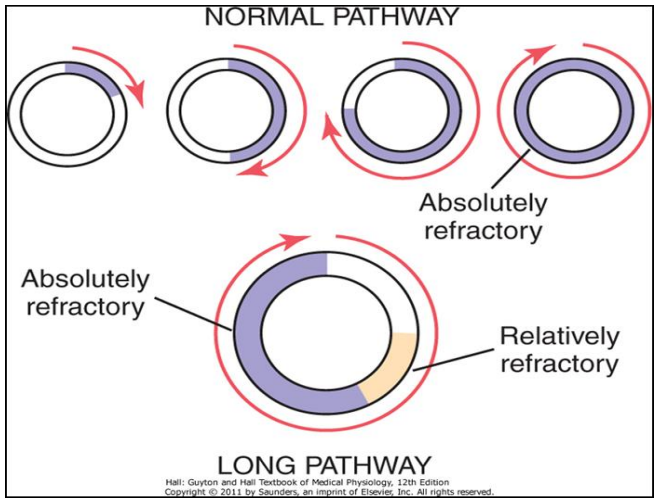
Ventricular Fibrillation

- The most serious of all arrhythmias
- Cause: impulses stimulate one part of the ventricles, then another, then itself.
- Many part contracts at the same time while other parts relax ***(Circus movement)***
  - Tachycardia
  - Irregular rhythm
  - Broad QRS complex
  - No P wave



Ventricular Fibrillation

Abnormal ventricle: “cells” of the ventricle will begin stimulation in one cell then spread to the adjacent cell and continue circus movement until it reach back to the first cell to stimulate itself again and so on.
While this happen the other part are relaxing

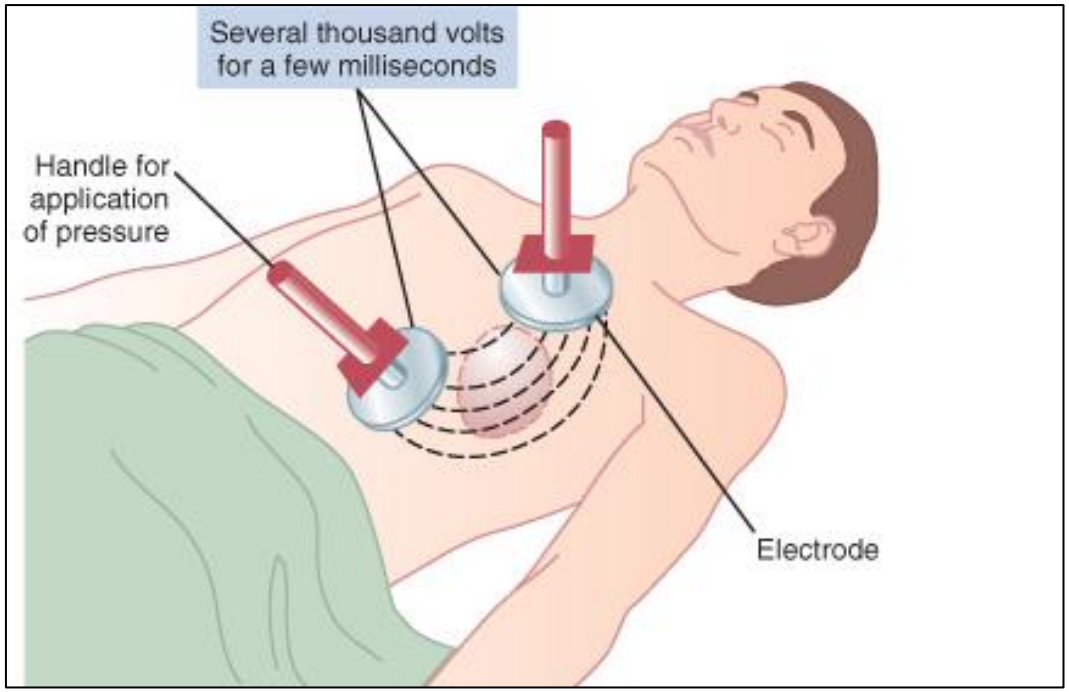


Atrial Fibrillation

- Cause: as ventricular fibrillation
- It occurs more frequently in patients with *enlarged heart*
- The atria do not pump if they are fibrillating
- The efficiency of ventricular pumping is decreased 20 to 30%
- No P wave, or high frequency of low voltage P wave
- A person can live for years with atrial fibrillation

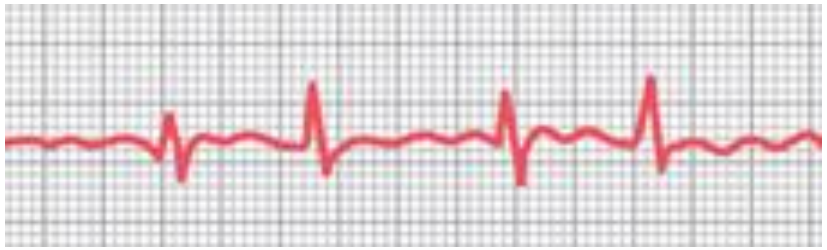
Treatment of Ventricular Fibrillation & Atrial Fibrillation

- DC shock



Atrial Flutter

- A single large wave travels around and around in the atria
- The atria contracts at high rate (250 beats/min)
- 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)
- The refractory period of the AV node causes 2-3 beats of atria for one single ventricular beat (⇑ atrial contraction)

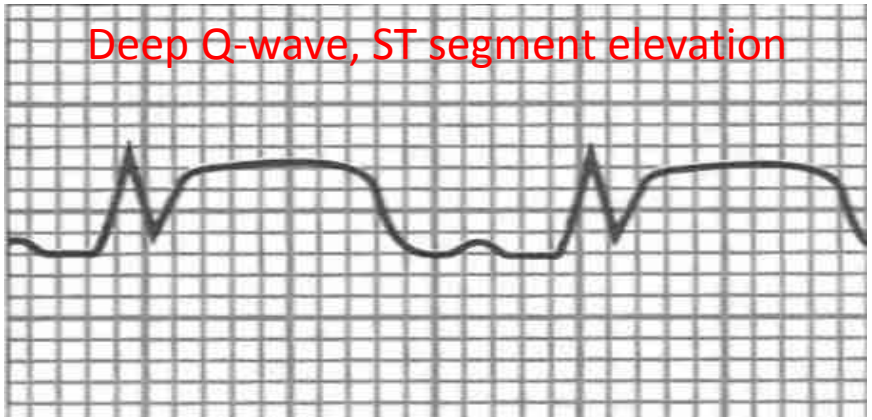


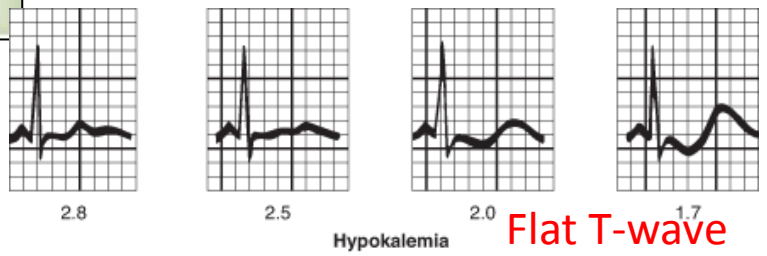
ECG Findings

Ischemia: poor blood supply to myocardial due coronary artery diseases (CAD) which is the main cause of chest pain where it happen in two forms reversible as angina pectoris and irreversible as myocardial infarction.

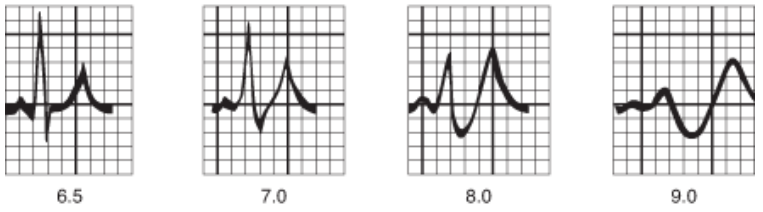
Inverted T-wave,ST segment depression

Deep Q-wave, ST segment elevation





Flat T-wave



Peaked T-wave

SUMMARY

- Regular sinus rhythm has P, QRS & T waves.
- Tachycardia: high heart rate & short R-R interval, the opposite in bradycardia .
- Conductive block in S-A & A-V nodes
- S-A block (no P wave)
- First degree AV-block prolonged PR segment(PR>0.20).
- Second degree of A-V node block (dropped beat: no QRS complexes).
- Third degree of A-V node block: no connection between PR and QRS(atria=100 contraction, ventricular=40)
  - ✓ ventricular escape: the ventricle will contract, but after a lot of atrial contractions.
  - ✓ Atrial contractions higher than ventricular ones.
- Premature atrial contraction caused by ectopic foci causing short PR Interval , pulse deficit due insufficient ventricular filling lastly a compensatory pause to normalize the contraction.
  - ✓ Caused by extra systole like coffee.
  - ✓ It depend on the place of the foci from A-V node
  - ✓ Only one beat is abnormal & there will be a compensatory pause so that the heart rate became normal again

SUMMARY

- PVCs : Caused by ectopic foci causing prolonged QRS Complex.
  - ✓ The foci is slower than purkinje fibers will cause prolong & wider QRS complexes
  - ✓ Increase in voltage because all cells will conduct the electrical impulses
  - ✓ Negative T-wave(Inverted)
- Fibrillation (contraction all the time) : Stimulation spread in circus
- Ventricular fibrillation a fatal condition causing circus movement due to stimulation of self the non-self which cause tachycardia, arrhythmia, no P-wave and Prolonged QRS.
- Atrial fibrillation (no P waves or low-voltaged) and decreased ventricular filling(20%-30%) in enlarged heart patient.
- DC removes circus
- Atrial Flutter:
  - ✓ A single large wave travels around and around in the atria
  - ✓ The atria contracts at high rate (250 beats/min)
- Angina pectoris:reversible (inverted T-wave,ST segment Depression)
- Myocardial infarction:Irrevrsible (ST segment elevation,Deep Q-wave).
- Hypokalemia (flat T-wave),Hyperkalemia (peaked T-wave)

THE END

If there are any problems or suggestions
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THANK YOU

Actions speak louder than Words