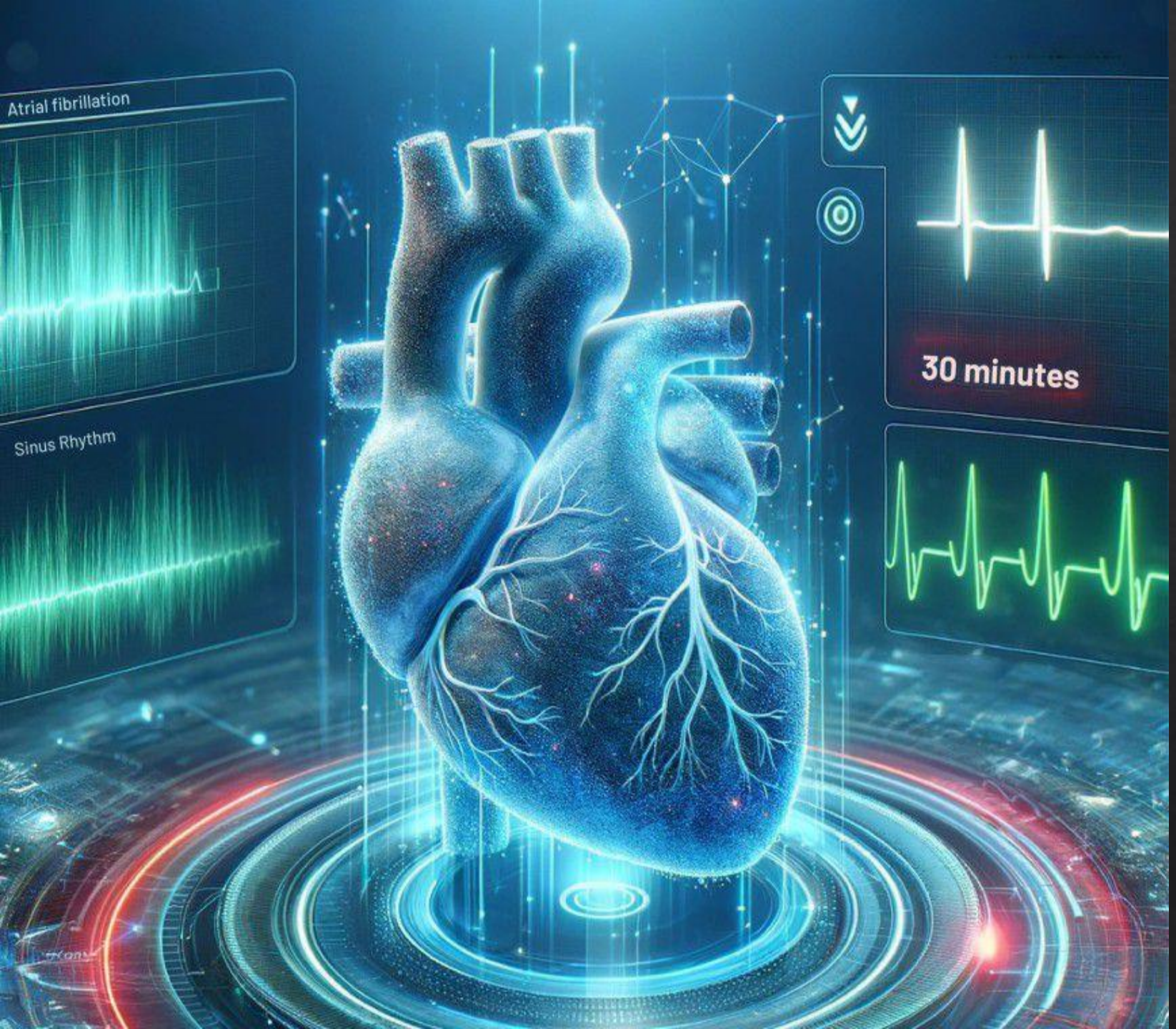
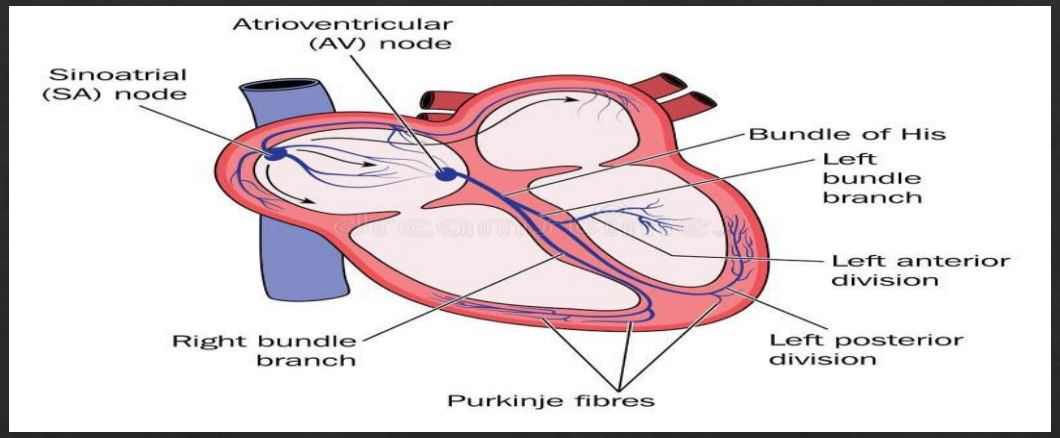


Arrhythmias

By

Dr MAHA AL SADIK

Definition: Arrhythmia is an abnormality of the cardiac rhythm or rate.



The conductin" system of the heart :

- ✓ under normal condition ,the pacemaker of the heart is Sinoatrial node(SAN)
- ✓ The cardiac impulses arises from SAN in a rate (60 - 90 beats/min)
- ✓ The impulse spreads through the walls of the atria causing them ..... to contract.
- ✓ Next ,the impulse reaches the AV node ,in which there is a delay of conduction to allow the atria to contract before the ventricles .
- ✓ Then the impulse reaches bundle of Hiss in the interventricular septum , then along the 2 bundle branches (left & right) & finally Purkinje fibers to terminate in the ventricular myocardium causing ventricular contraction.

Clinical classification of arrhythmias

Regular tachycardia :

- Sinus tachycardia.
- Paroxysmal supra-ventricular tachycardia .
- Atrial flutter.
- Ventricular tachycardia

Regular bradycardia :

- Sinus bradycardia .
- Nodal (junctional) rhythm .
- Partial heart block (1st & type II 2nd degree heart block).
- Complete heart block (3rd degree heart block).

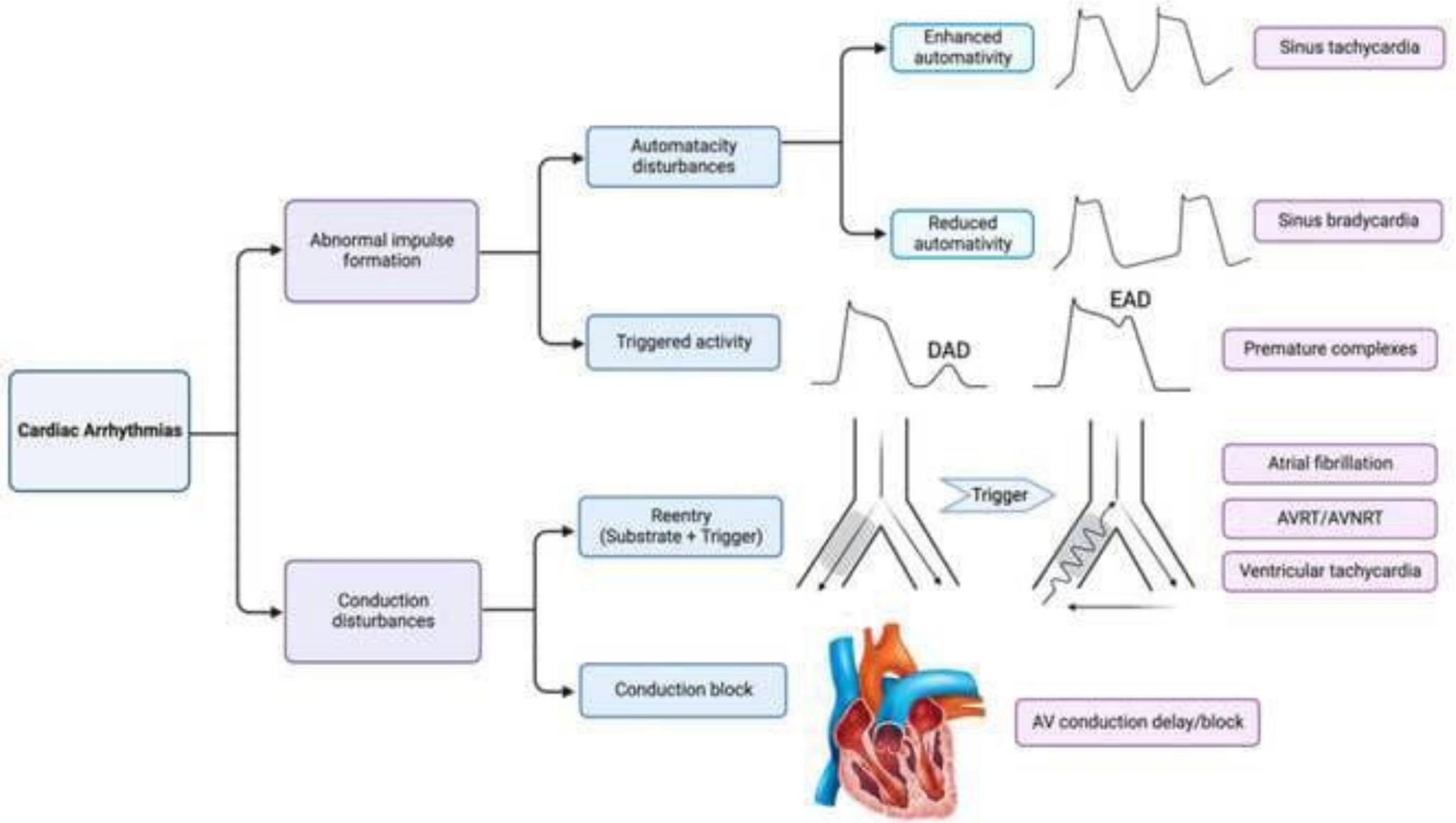
Irregular rhythm :

- Premature beats (Extrasystoles).
- Atrial fibrillation .
- Multi focal tachycardia
- Ventricullar fibrillation
- Type I 2nd degree heart block
- Bundle Branch Block

Etiology of any arrhythmia :

Tachyarrhythmia	Bradyarrhythmia
1- Myocarditis. 2- Ischemic heart disease (Myocardial infarction). 3- Rheumatic heart disease . 4- Congenital heart disease . 5- Digitalis.	
6- Sympathomimetics .	6- Sympatholytics
7- Thyrotoxicosis .	7- Hypothyroidism .

Pathophysiology of Cardiac Arrhythmia



clinicaL picture (arrhythmia schyeme)

- **Symptoms of arrhythmias:**

1- Asymptomatic

2- palpitation:

Onset:

Offset:

Duration of the disease: short in serious arrhythmias e.g. VT,CHB.

3- Manifestations of LCOP e.g : Dizziness & syncope

4- Precipitation of HF & angina.

5- Features of the cause e.g. Ml , Rheumatic heart disease, digitalis toxicity

- **Exceptions :**
- **Atrial fibrillation (AF):** add thromboembolism
- **Ventricular tachycardia (VT) :** add Sudden death .
- **Complete heart block:** add Syncope , Sudden death

Signs

- 1- **Radial pulse** :**test for ventricle**

a) **Rate :** increase (Uncountable pulse) in tachyarrhythmias, decrease in bradyarrhythmias .

b) Rhythm: regular …….irregular ……...

c) Response to carotid sinus massage (in tachy): -decrease heart rate in any tachyarrhythmia except arrhythmias that originate in the ventricle .

2 - Neck vein : (test for atrium):

- Cannon A wave in any arrhythmia containing this word: nodal, either :paroxysmal nodal tachycardia or nodal rhythm.
- Loss of A wave in atrial fibrillation.
- Occasional cannon A wave in : ventricular tachycardia & complete heart block (Atrio-Ventricular dissociation).

sinus tachycardia

- **Definition**

It is a condition in which the SAN discharges impulses faster than normal {>100 / min).

- **Etiology**

Physiological : Exercise, Emotions, Excessive coffee .

Pathological : Hypotension, Hyperdynamic circulation, Hyperthermia, Heart failure

Pharmacological : Adrenaline, Atropine .

Clinical picture

Symptoms:

The same as scheme.

Onset & offset : gradual.

Duration of the disease is usually long as the condition is mostly physiological.

Signs:

Radial pulse :

Rate: > 100 /min but usually less than 160 / min.

Rhythm: regular.

Response to carotid sinus massage : gradual decrease HR

Respiratory sinus arrhythmia: +ve.

ECG:

Rhythm: regular.

Rate: 100 -160 / min.

P waves: are normal & each P wave is followed by normal QRS.

Treatment :

Treatment of the cause.

B blockers & sedatives may be needed

Paroxysmal supraventricular tachycardia

Atrioventricular reentrant tachycardia (AVRT), Atrioventricular nodal reentrant tachycardia (AVNRT)

Definition : it is a paroxysmal condition in which there is an abnormal focus in the atrium -other than SAN - which discharges regular impulses more than SAN (150-250/min).

this abnormal focus may initiated in any area of the atria (paroxysmal atrial tachycardia) or even in AVN (paroxysmal nodal tachycardia).

- **Etiology**

Physiological : coffee , smoking.

Pathological : the same as scheme.

- **clinical picture:**

Symptoms:

The same as scheme.

Sudden onset & offset

Duration of the disease: usually long history as the condition is mostly physiological.

Duration of the attack: Variable, usually few minutes but may lasts for hours.

Signs : during the attack

- **Redial pulse :**

Rate: 150- 250 beats/min. (uncountable).

Rhythm: regular.

Response to carotid massage : sudden ↓ HR .

Respiratory sinus arrhythmia : -ve . (SAN is not the pacemaker)

- **ECG:**

P wave:

- In atrial tachycardia: deformed.
- In nodal tachycardia : absent or inverted.

QRS :

rapid , regular with normal shape.

Treatment: During the attack

- **1- Vagal stimulation :** Carotid sinus massage
- **2- Drugs** :
- Adenosine, B blockers, Ca channel blockers (verapamil), Digitalis. (IV)
- **3- If there is no response or if the patient is hemodynamically unstable:** DC cardioversion.

Atrial Flutter

Definition

- It is a condition which there is an abnormal focus in the atrium that discharges rapid regular impulses (250- 350 /min), but due to physiological block of AVN, not all atrial impulses are conducted to the ventricles - only½ .⅓,¼, ... of the atrial impulses will pass to the ventricles

Etiology: **doesn't occur in normal heart**

The same as scheme but begin with : **Mitral stenosis & thyrotoxicosis**

clinical picture:

- **Symptoms:**

The same as scheme

Sudden onset & offset .

Duration of the disease : Short, it is a transient arrhythmia between normal sinus rhythm & atrial fibrillation

Signs:

- **Radial pulse:**

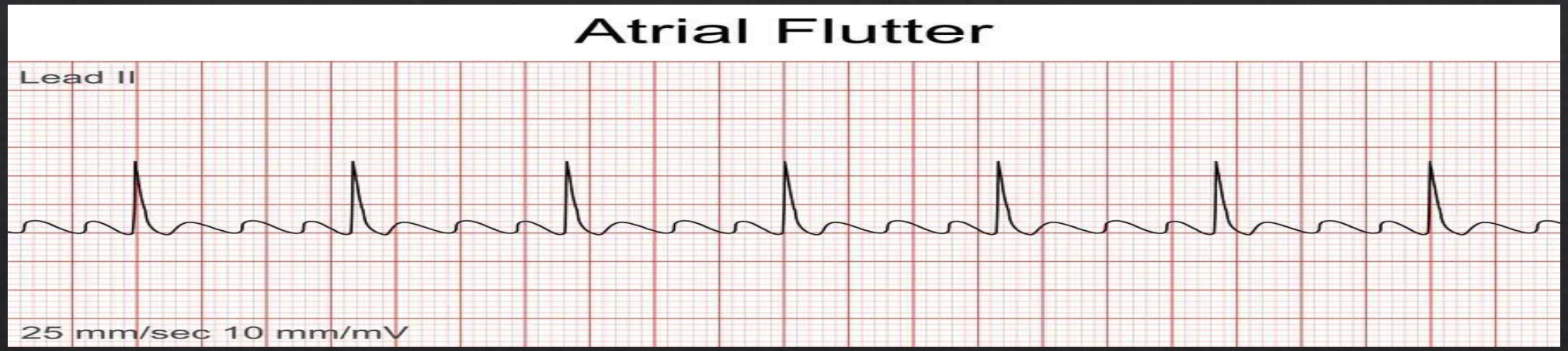
Rate: Variable according the degree of AV conduction, 150, 100, 75 beats/m.

Rhythm : regular .

Response to carotid massage: decrease HR in mathematical pattern due to AV block from 2:1 to 3:1 to 4:1 So, HR decrease from 150 to 100 to 75 beats/min.

ECG : Saw tooth appearance

- P waves : abnormal ,replaced by multiple small flutter (f) waves before each QRS
- QRS: normal, regular, at a rate of ½, ½ or ¼ the atrial rate according to AVN conduction.



Treatment:

1- Drugs: to control the ventricular rate (↓ AVN conduction)

B blockers , Ca channel blocker (verapamil) or digitalis

2- DC cardioversion: if the patient is hemodynamically unstable.

ventricular tachycardia

Definition:

It is condition in which there is abnormal focus in the ventricle that discharge impulses more than SAN (150 - 250 /min). Since the focus is in the ventricle & there is no retrograde conduction in the AVN, So ventricles will follow the ectopic focus & atria will follow the SAN (AV dissociation)

Etiology :occur in patient with established heart disease

The most common cause is ischemic heart diseases (myocardial infarction).

clinical picture :

- **Symptoms:**
  - The same as scheme

Sudden onset & offset .

Duration of the disease : short history because it is a serious condition

Duration of the attack :

sustained VT: more than 30 seconds (hemodynamically unstable)

Non sustained VT: less than 30 seconds .

Sudden death : if converted to ventricular fibrillation .

Signs:

Redial pulse :

Rate: 150- 250 / min (uncountable).

Rhythm: regular.

Response to carotid massage : no effect (no parasympathetic supply to ventricles)

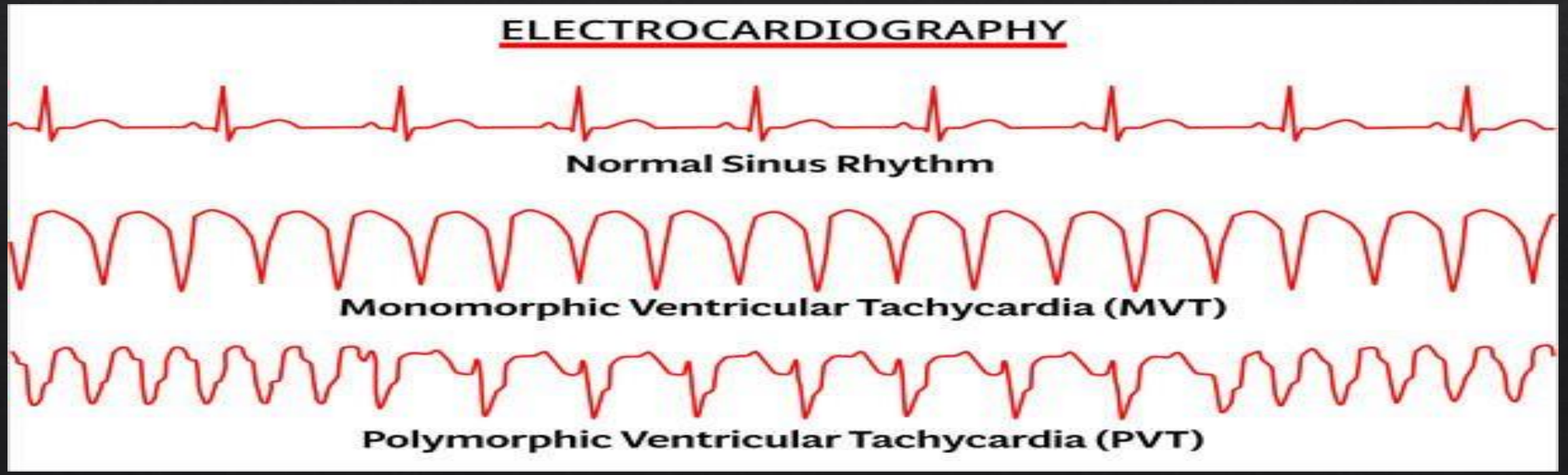
ECG:

QRS : rapid, regular & wide abnormal (bizarre) shaped.

P waves : Normal rate & shape .

May comes before or after the QRS and also may be hidden by the QRS.

No fixed relation between P waves & QRS complexes (atria ventricular dissociation)



Treatment :

◈ During the attack :

If the patient is hemodynamically unstable : Immediate cardioversion

If the patient is hemodynamically stable :

- ✓ Amiodarone {IV) : 150 mg IV over IO min & follow with I mg/min infusion for 6 hours.
- ✓ Lidocaine (IV).

Recently, amiodarone has replace a lidocaine as the antiarrhythmic drug of choice in terminating VT. Adenosine is not effective in VT.

◈ In between the attacks

Amiodarone

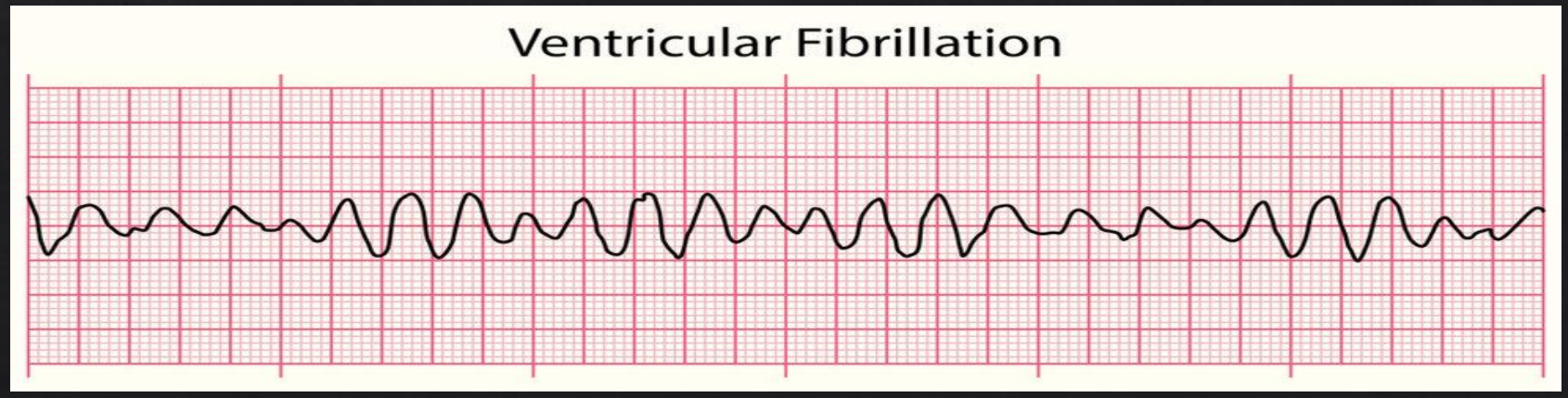
Lidocaine

B blockers

Implantable Cardioverter defibrillator (ICD) : in resistant cases

Ventricular fibrillation:

- **Definition:** Multiple foci in the ventricles fire rapidly > chaotic quivering of the ventricles and no cardiac output.
- Most episodes of V. Fib begin with VT
- **Causes:** 1. Ischemic heart diseases (most common) 2. Drug toxicity
- **Clinical features:** BP can't be measured, unconscious.
- **ECG findings:** No atrial P waves can be identified, No QRS complexes.
- **Treatment:** CPR & Defibrillation.
  Alternatives:
  A. IV amiodarone followed by DC shock
  b. Lidocaine, magnesium, and procainamide are alternative second-line treatments.



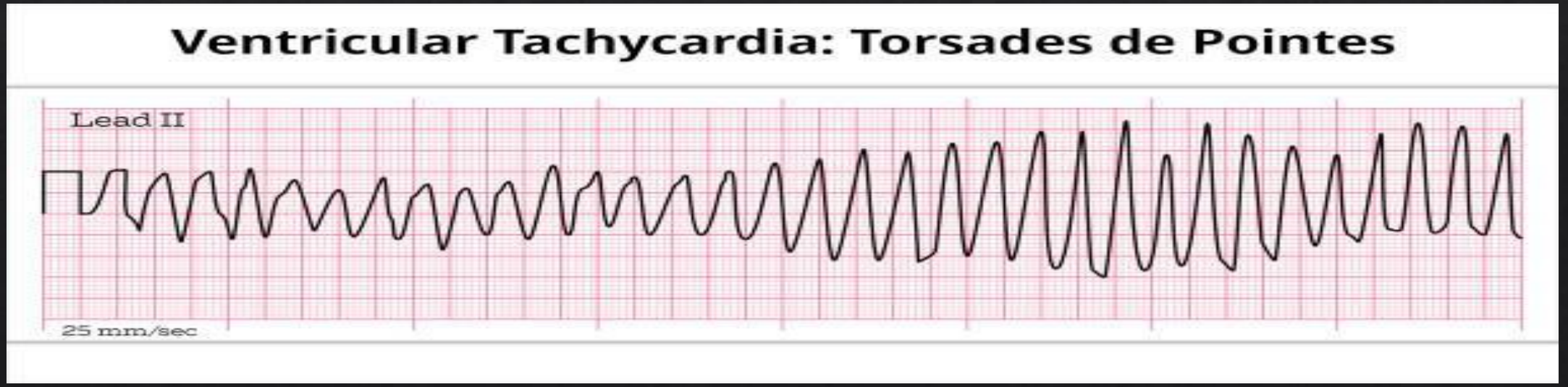
Torsade's de points : (French for twisting of the points)

- 1t is a multifocal VT characterized by QRS complexes that change in amplitude & appear to be twisting around the isoelectric line of the ECG & associated with prolonged QT interval.

AE :

Antiarrhythmic drugs & electrolyte disorders (hypokalemia , hypomagnesemia, hypocalcemia)

Treatment : Mg & ventricular pacing may be needed.



Premature beats (Extrasystoles)

Definition:

- It is an ectopic impulses arising from the atria, AVN or ventricles before the expected next beat causing what is called premature beat.

Signs:

- **Redial pulse :**

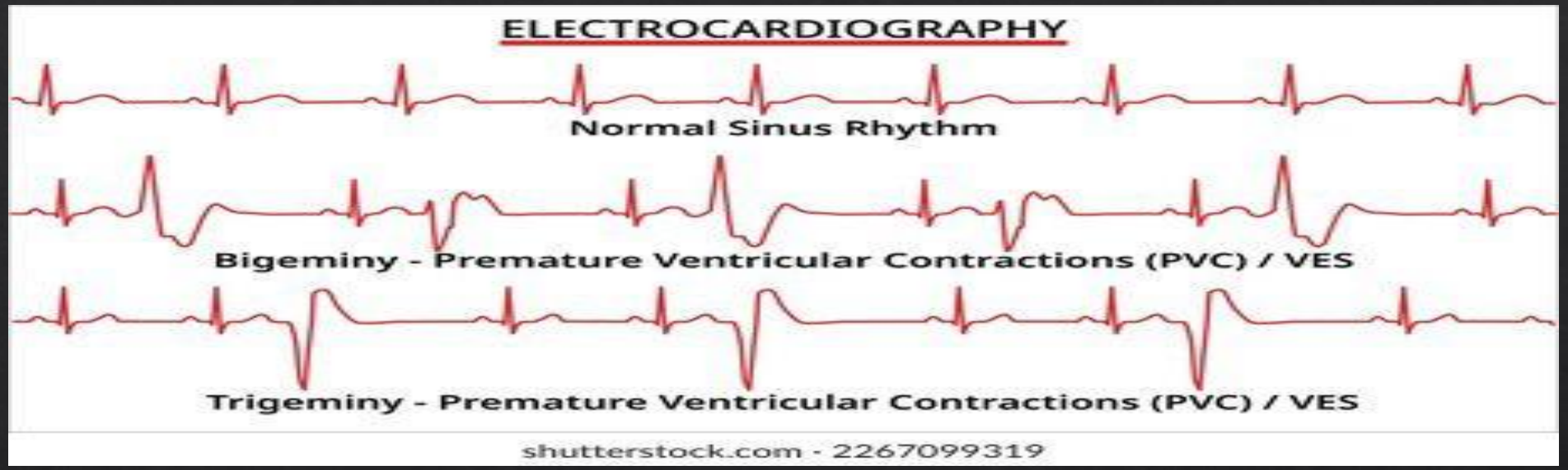
Rhythm: Occasional irregularity.

Rate : normal , tachy or bradycardia.

Pulse deficit : < 10 / min.

ECG:

ventricular premature beats are wide bizarre QRS not preceded by P wave & followed by compensatory pause.



Treatment :

1- Reassurance .

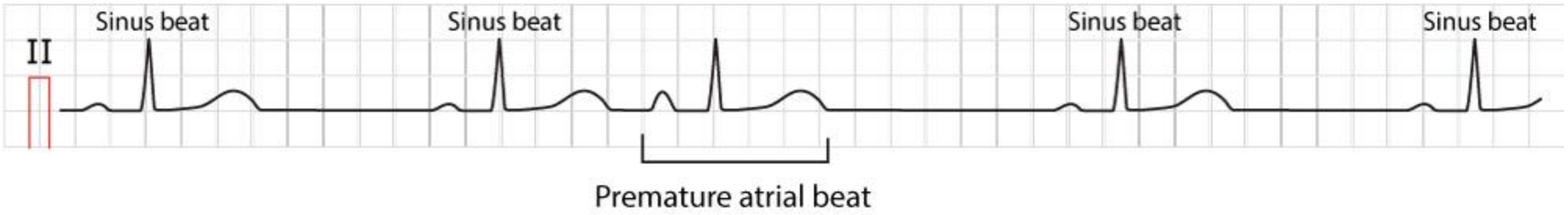
2- Treatment of the cause.

3- In chronic stable cases: Amiodarone, B blocker, Ca channel blocker or qunidine.

Premature Atrial Complexes

ECG

- **early P waves that differ in morphology from the normal sinus P wave , QRS complex is normal**



Atrial fibrillation

Definition:

It is a condition in which there are rapid irregular impulses (400-600/min) arise from the atria by multiple ectopic foci (so the atria don't contract effectively) & due to physiological delay at AVN, not all impulses are conducted to the ventricles.

Etiology:

Mitral stenosis & thyrotoxicosis .

Constrictive pericarditis & Cardiac surgery.

Lone AF (idiopathic) : especially in elderly.

Other causes : like scheme.

clinical picture

Symptoms :

- The same as scheme .
- Palpitation : rapid, irregular & may be paroxysmal or sustained
- Duration of the disease : may be long
- Thromboembolism : ineffective atrial contraction predisposes to stasis of blood and may lead to thrombosis & systemic emboli (e.g. hemiplegia)

Signs:

Redial pulse :

- Rate : usually rapid (100 - 150 /min)

may be slow as in patients on digitalis.

Rhythm:

in marked irregularity (you can't count 4 successive regular beats)

Pulse deficit (apical pulse - radial pulse) : > 10/min.

Response to carotid massage: may decrease HR due to decreased AV conduction.

ECG:

- **P wave** : absent & replaced by fibrillation (F) waves .
- **QRS**: normal in shape but irregular in rhythm.

Treatment:

the acute management of AF involves 3 strategies

1- Reversion to normal sinus rhythm:

Methods :

Electrical cardioversion.

Drugs : propafenone or amiodarone.

Indication:

Recent onset of AF.

No history of recent embolism.

No significant left atrial enlargement.

Precautions :

If the condition lasts for 48 hours or more transesophogeal echo for exclusion of presence of emboli if not available anticoagulant must be given at least 2 weeks before reversion to decrease the risk of embolization.

2- Control of ventricular rate : by B blocker, Ca channel blocker or Digitalis .

3- Prevention of thromboembolism : by anticoagulants.

CHA_2DS_2-VASc scoring system for non-valvular atrial fibrillation

	Risk factors	Score/points
C	Congestive heart failure	1
H	Hypertension	1
A_2	Age ≥75	2
D	Diabetes mellitus	1
S_2	Stroke/TIA/thromboembolism	2
V	Vascular disease (aorta, coronary or peripheral arteries)	1
A	Age 65–74	1
Sc	Sex category: female	1

Annual risk of stroke

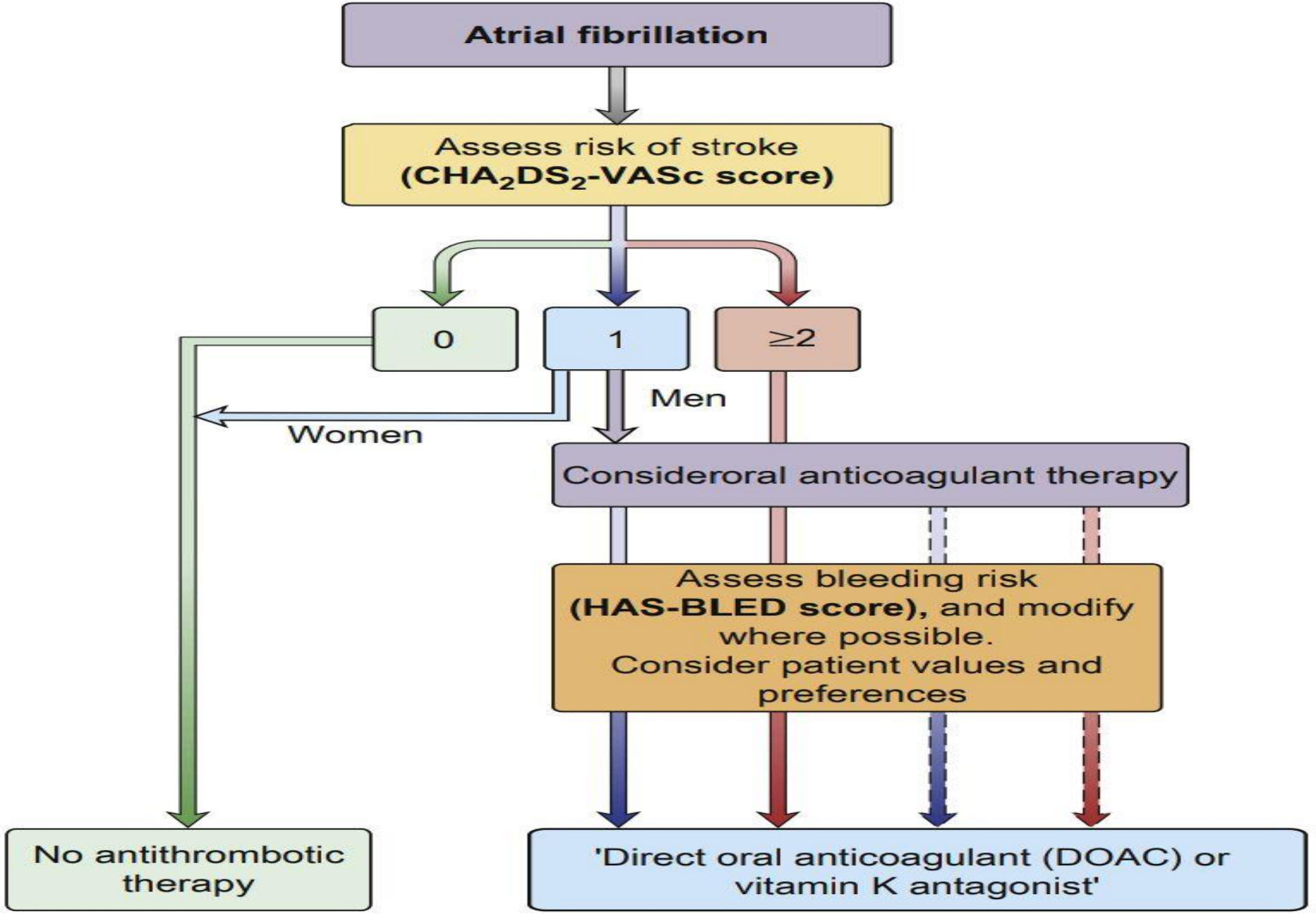
0 points = 0% risk: No prophylaxis
1 point = 1.3% risk: Consider anticoagulation in men
2+ points = 2.2% risk: Oral anticoagulant

TIA, transient ischaemic attack.

HAS-BLED score for bleeding risk on oral anticoagulation in atrial fibrillation

Clinical characteristic	Score/points
Hypertension (systolic ≥160 mmHg)	1
Abnormal renal function	1
Abnormal liver function	1
Stroke in past	1
Bleeding	1
Labile INRs	1
Elderly: age ≥65 years	1
Drugs as well	1
Alcohol intake at same time	1

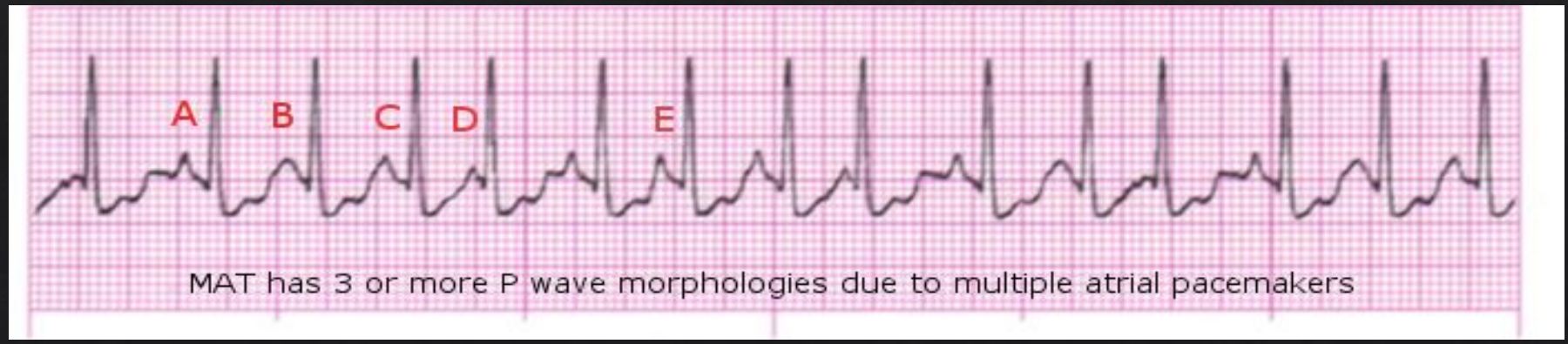
Yearly risk of developing major bleeding with anticoagulation rises with increasing score, from 1% with a score of 0 (low risk) to around >5% with a score of 3 of more (high risk).


Atrial fibrillation
Assess risk of stroke
(CHA2DS2-VASc score)
0
1
≥2
Men
Women
Consideroral anticoagulant therapy
Assess bleeding risk
(HAS-BLED score), and modify
where possible.
Consider patient values and
preferences
No antithrombotic
therapy
'Direct oral anticoagulant (DOAC) or
vitamin K antagonist'

Multifocal atrial tachycardia

- Irregular rhythm caused by presence of 3 or more atrial foci
- more commonly in patients with Hypoxia (severe pulmonary diseases like COPD)
- ECG:
  - Variable P-wave morphology and variable PR and RR intervals.

- atrial rate 100-200 bpm, 3 or more p wave morphologies.

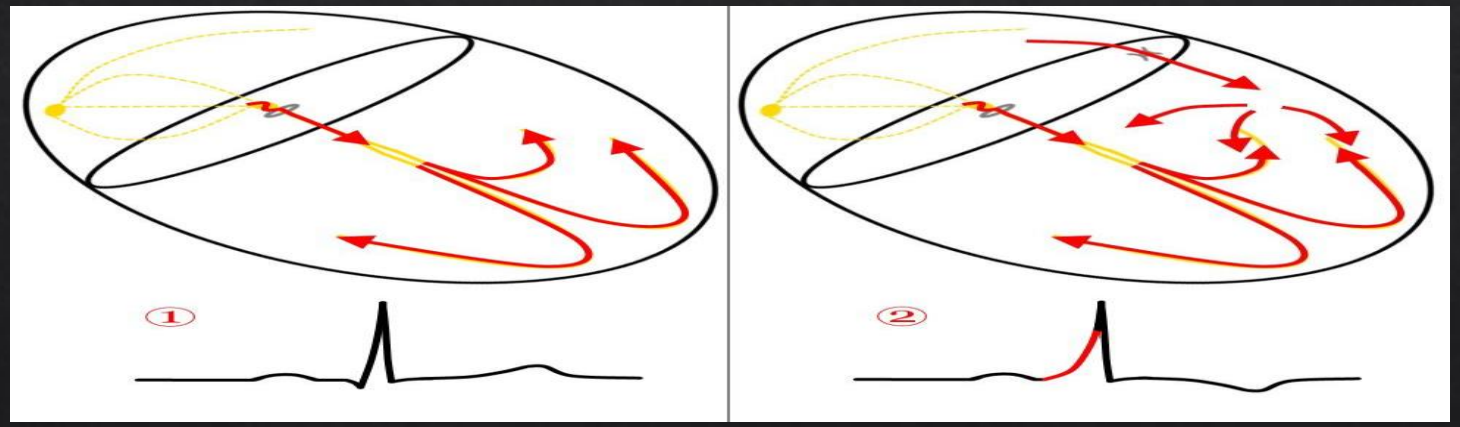


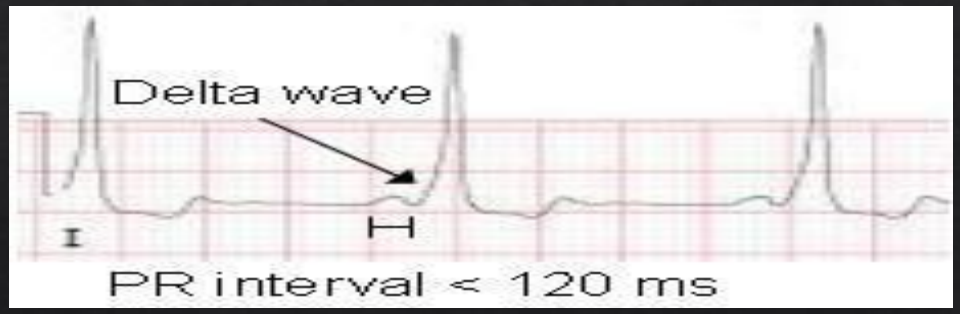
Wolf-Parkinson-White (WPW) syndrome :

- It is accessory pathway that connects the atrium & ventricle & can bypass the AVN.

So, AF is a very serious arrhythmia in these patients, it may lead to ventricular fibrillation.

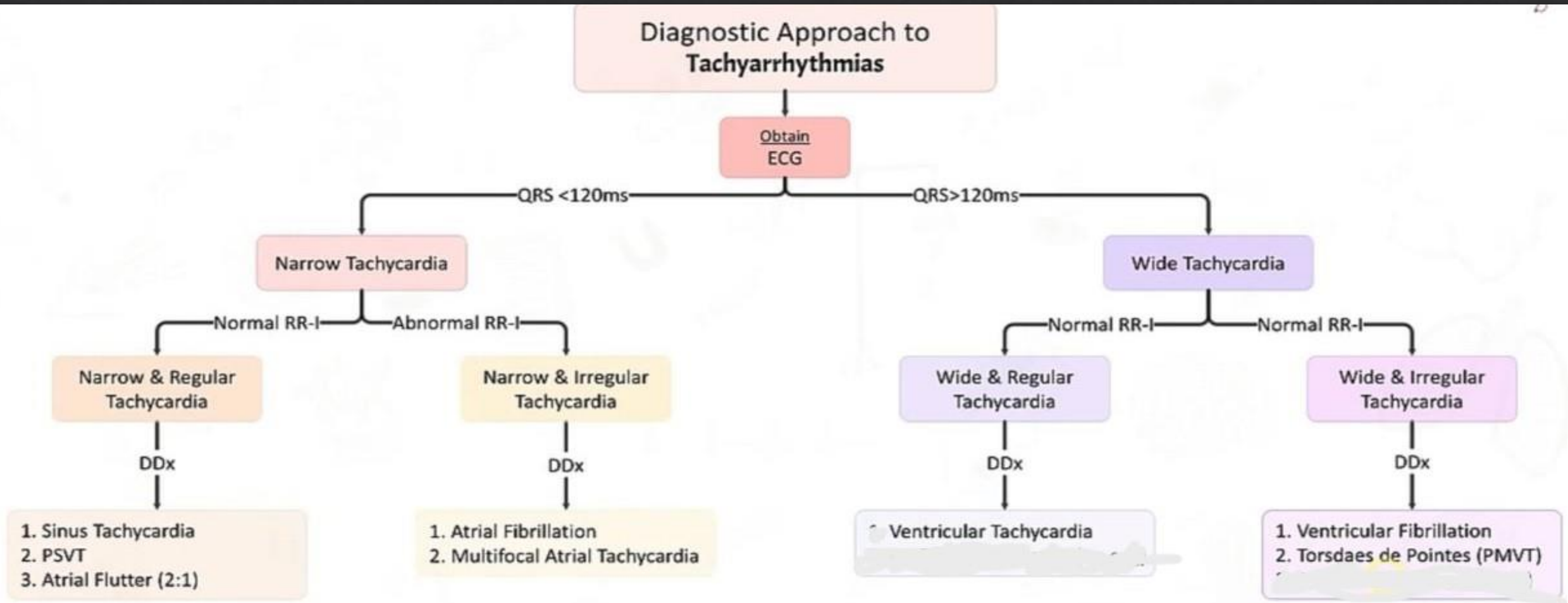
- - WPW is associated with thyrotoxicosis, mitral valve prolapse, HCM & more common in men





Treatment : Amiodarone , B blocker . Radiofrequency ablation is the treatment of choice.

- Digitalis & verapamil should be avoided (increase conduction through the accessory pathway) .


Diagnostic Approach to
Tachyarrhythmias
Obtain
ECG
QRS <120ms
QRS>120ms
Narrow Tachycardia
Wide Tachycardia
Normal RR-I
Abnormal RR-I
Normal RR-I
Normal RR-I
Narrow & Regular Tachycardia
Narrow & Irregular Tachycardia
Wide & Regular Tachycardia
Wide & Irregular Tachycardia
DDx
DDx
DDx
DDx
1. Sinus Tachycardia
2. PSVT
3. Atrial Flutter (2:1)
1. Atrial Fibrillation
2. Multifocal Atrial Tachycardia
Ventricular Tachycardia
1. Ventricular Fibrillation
2. Torsdaes de Pointes (PMVT)

sinus bradycardia

Definition: It is a condition in which the SAN discharges impulses by a rate less than 60 / min

Etiology:

- **Physiological:** During sleep, Athletes
- **Pathological:** Obstructive jaundice, Hypothyroidism.
- **Pharmacological :** B blockers, Ca channel blockers, Digitalis

clinical picture:

- **Symptoms usually asymptomatic**

Onset & offset : gradual .

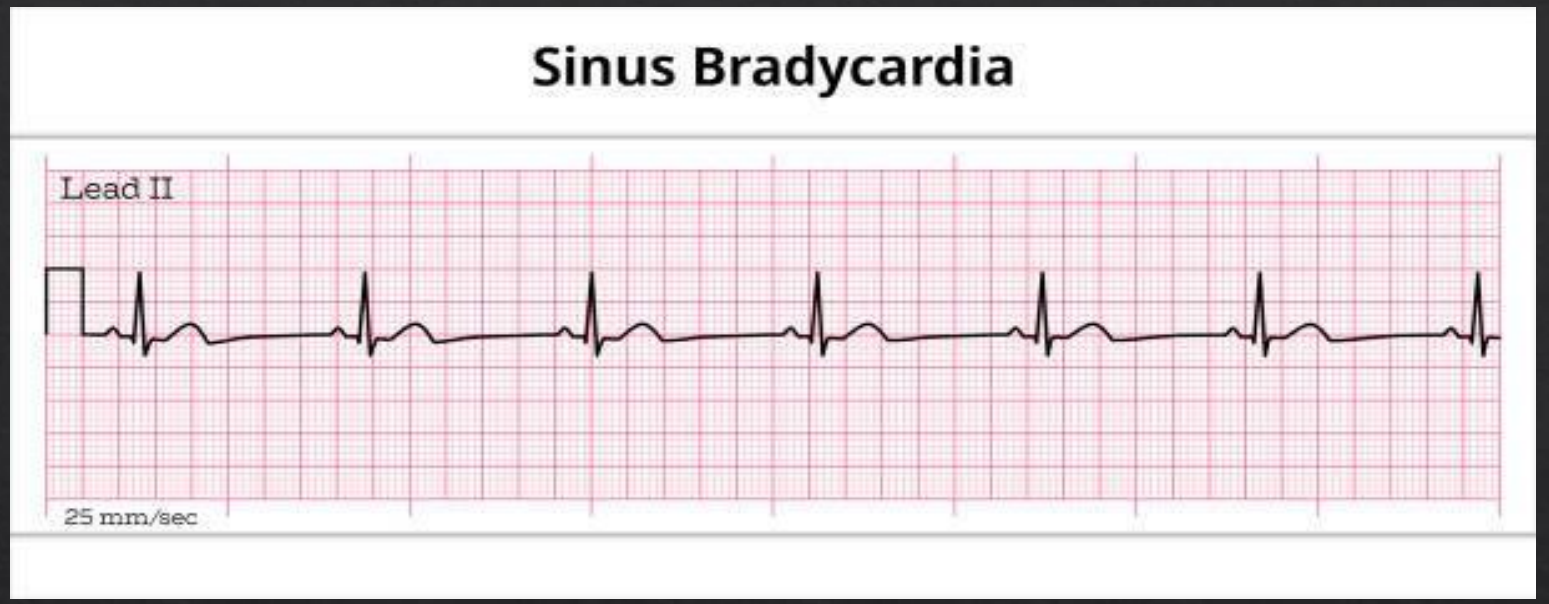
Duration of the disease is usually long as the condition is mostly physiological

- **Signs :**

Radial pulse :

Rate:< 60 /min.

Rhythm : regular.



ECG:

- Rhythm : regular.
- Rate:< 60/min.
- P waves: are normal & each P wave

Treatment :usually not needed

Treatment of the cause.

Atropine may be needed.

Artificial pacemaker may be needed in sever chronic cases or when sinus bradycardia is a part of Sick Sinus Syndrome .

Sick Sinus Syndrome (SSS)

- **Sinus node dysfunction characterized by a persistent spontaneous sinus bradycardia , patients usually elderly**
- **symptoms :** include dizziness, confusion , syncope, fatigue, CHF
-pacemaker implantation may be required

Nodal (functional) rhythm

Definition :

It is a condition in which the heart is controlled by the AVN . Here, the impulses reach the atria & ventricles in the same time .

Etiology :The same as scheme (the most common causes are digitalis & MI)

clinical picture:

- **Symptoms**

The same as scheme.

Sudden onset & offset

Duration of the disease : usually short history

Signs:

- **Radial pulse :**

Rate : slow (40 - 50 /min) .

o Rhythm : regular.

ECG:

P waves: Inverted & come approximately at the same time with QRS so may be absent

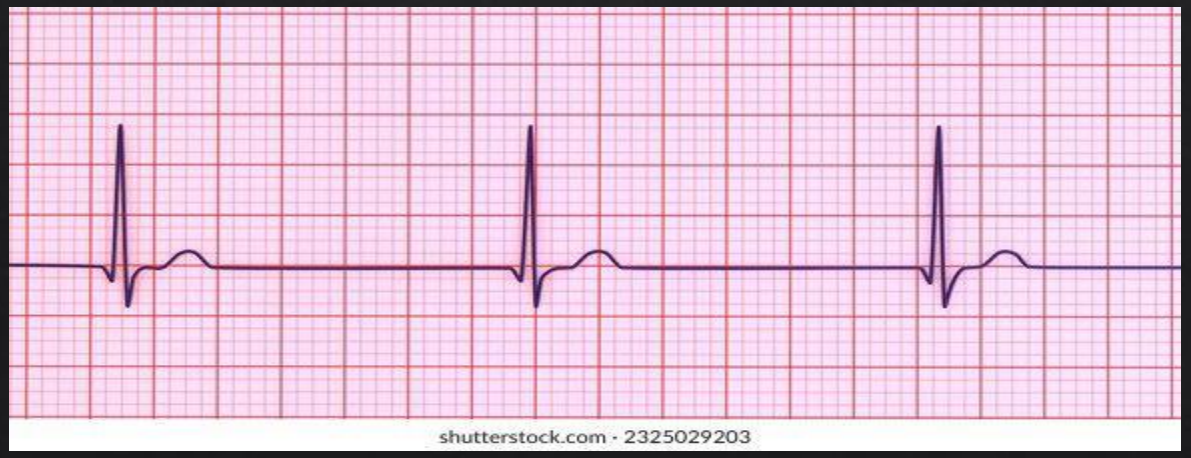
QRS: Slow, regular with normal shape.

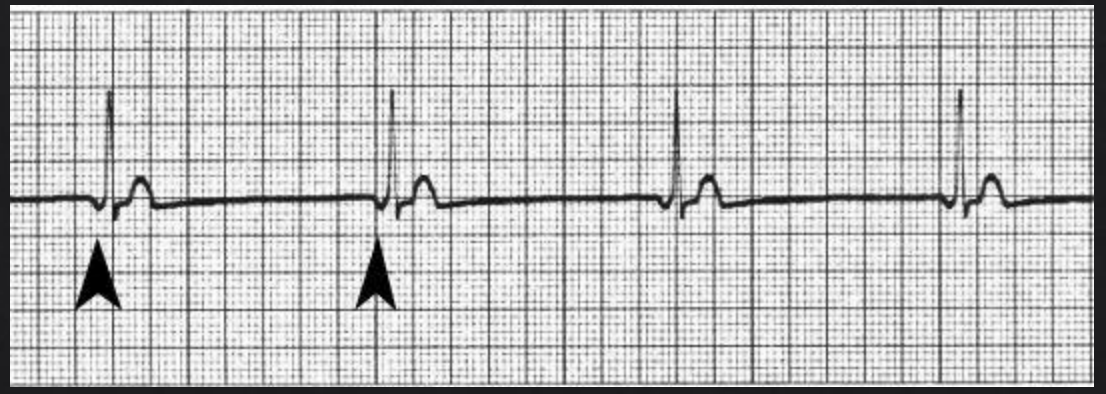
Treatment:

Treatment of the cause

Atropine.

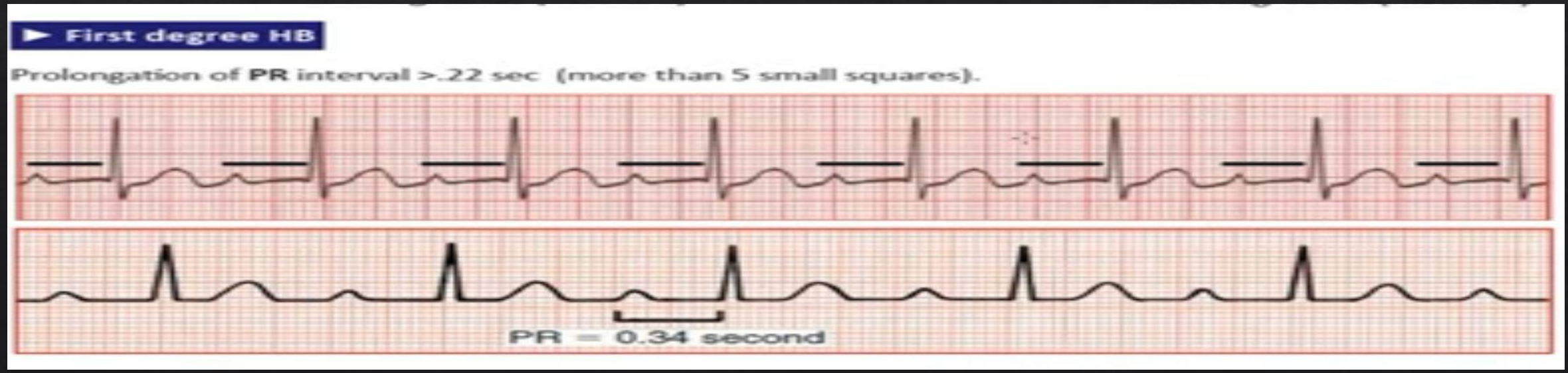
Artificial pacemaker may be needed in severe cases





Heart block

- **First degree heart block :**
- PR interval is longer than 0.2 second
- All impulses from SAN are conducted to the ventricles.
- Etiology: physiologically during sleep or pathologically as in myocarditis.
- Usually asymptomatic

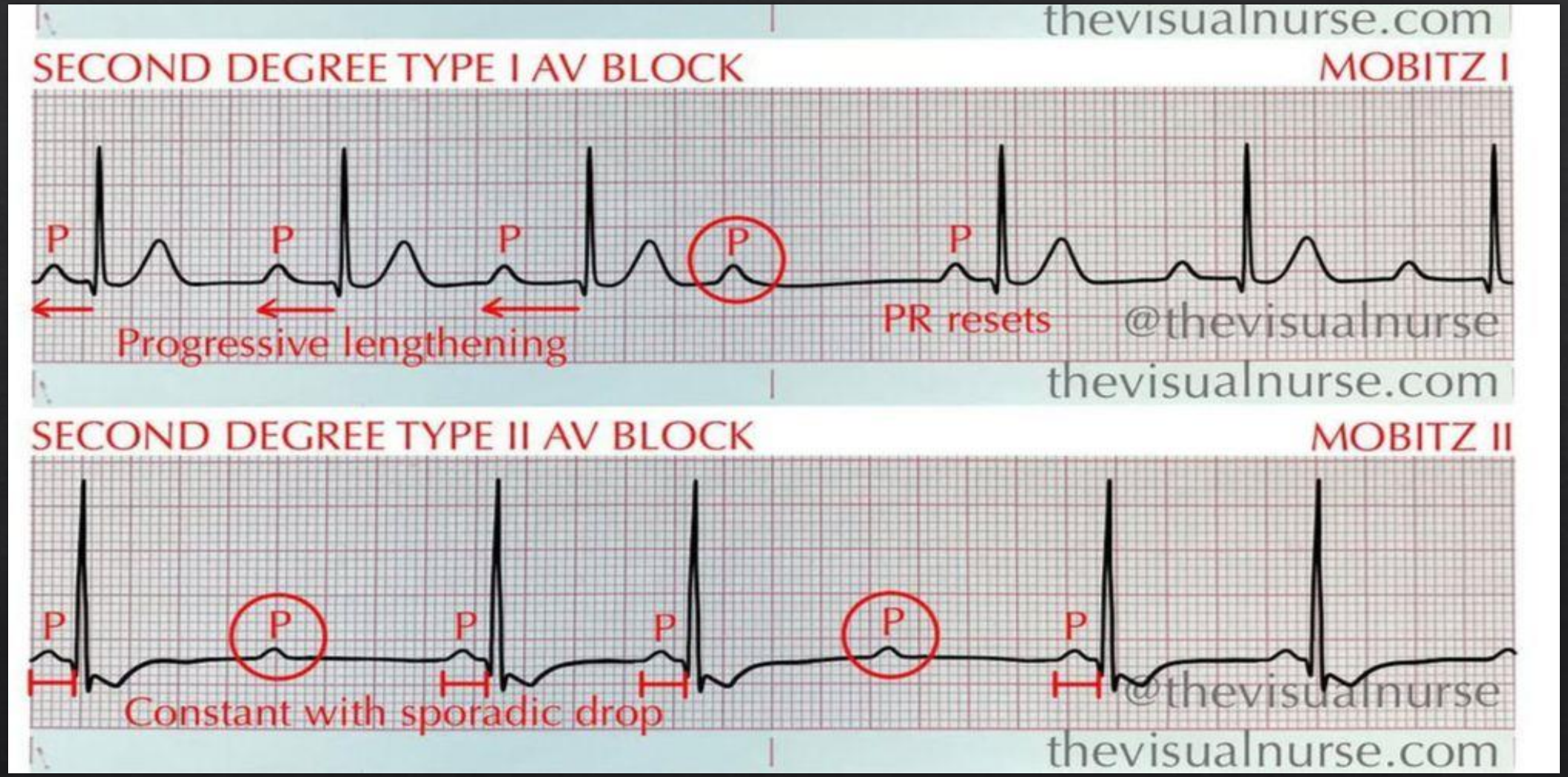


Second degree heart block

- In this condition some impulses from the atria don't reach the ventricles, this causes "dropped beats" .
- **There are two types**

Type I 2nd degree (Mobitz I , Wenckebach block) :

- Progressive prolongation of PR interval leading finally to the dropout of a QRS complex & then the cycle is repeated. (notice that there is irregular pulse).
- **Type II 2nd degree (Mobitz II)**
  The AVN transmits one impulse for each 2 ,3, 4 or more atrial impulses. This block may be fixed (e.g. 2:1 all the time) or variable (irregular).


thevisualnurse.com
SECOND DEGREE TYPE I AV BLOCK
MOBITZ I
P
P
P
P
P
Progressive lengthening
PR resets
@thevisualnurse
thevisualnurse.com
SECOND DEGREE TYPE II AV BLOCK
MOBITZ II
P
P
P
P
P
P
Constant with sporadic drop
@thevisualnurse
thevisualnurse.com

Complete heart block (3rd degree)

- In this condition all impulses from the atria don't reach the ventricles so, the ventricles will be controlled by idioventricular rhythm. Idioventricular rhythm may originate anywhere from AVN to the bundle branches or purkinje fibers. (The closer the origin to AVN, the faster the rate)

Etiology:

The same as scheme plus idiopathic fibrosis of AVN.

clinical picture:

- **Symptoms:**
- The same as scheme. 'PLUS 2S

Syncope "Adams-Stokes attacks"

Sudden death.

- **Signs:**

Redial pulse

Rate : 30-40 /min.

Rhythm: regular.

ECG:

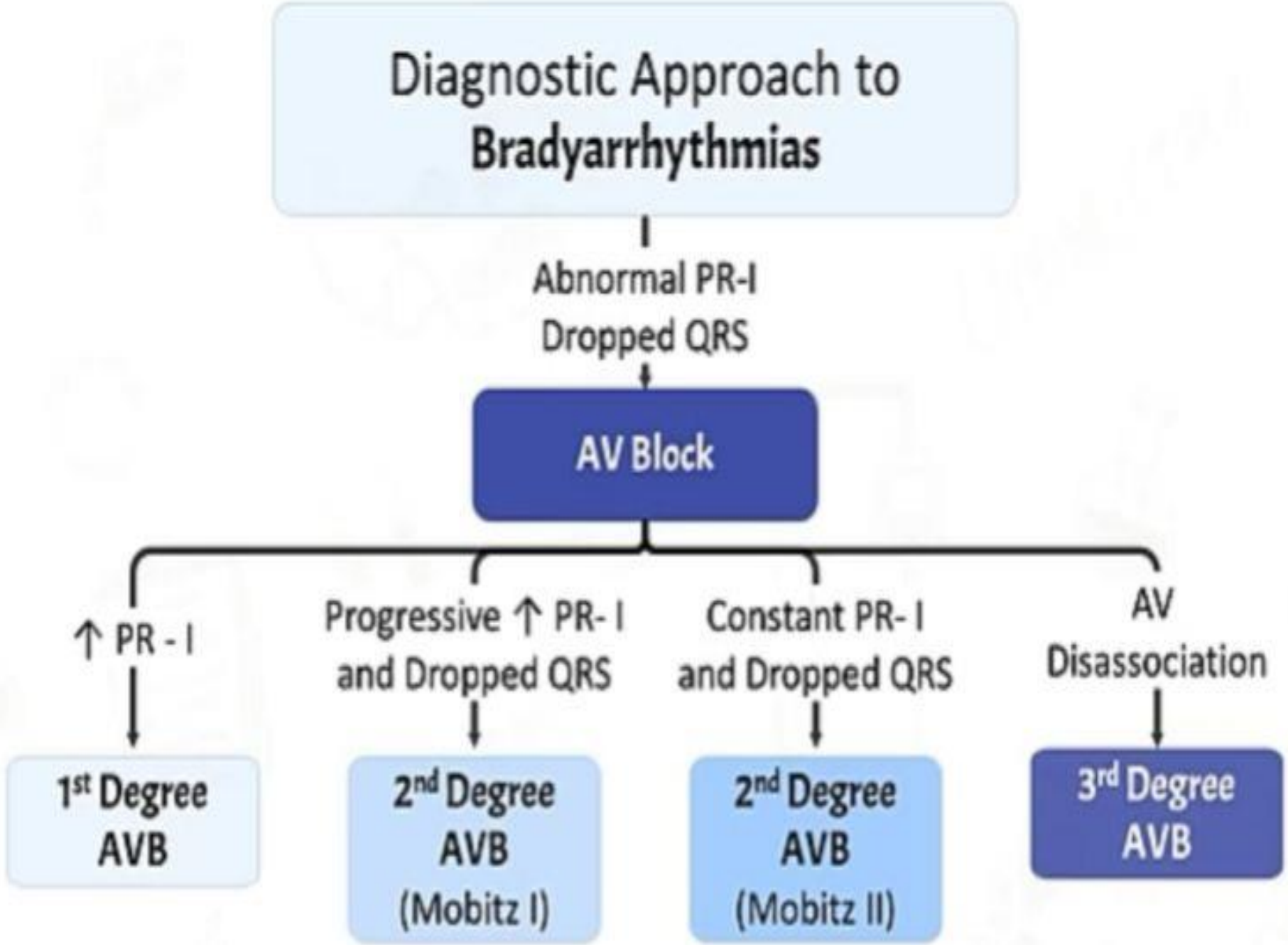
QRS : slow, regular & wide abnormal (bizarre) shaped

P waves : normal rate & shape.

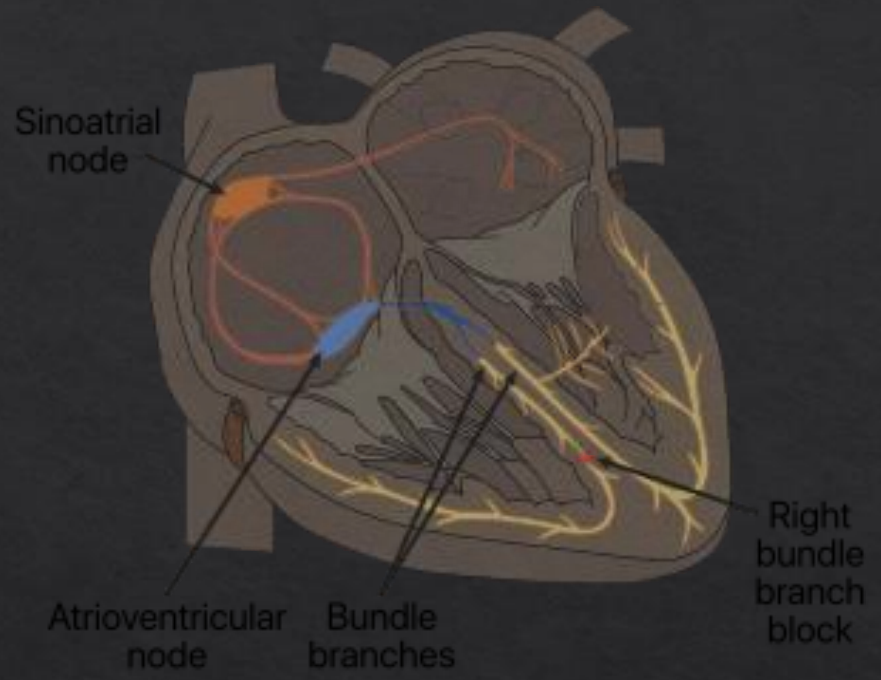
No fixed relation between P waves & QRS complexes (Atrioventricular dissociation)

Treatment:

Artificial pacemaker


Diagnostic Approach to
Bradyarrhythmias
Abnormal PR-I
Dropped QRS
AV Block
↑ PR - I
Progressive ↑ PR- I
and Dropped QRS
Constant PR- I
and Dropped QRS
AV
Disassociation
1st Degree
AVB
2nd Degree
AVB
(Mobitz I)
2nd Degree
AVB
(Mobitz II)
3rd Degree
AVB

Bundle Branch Block:

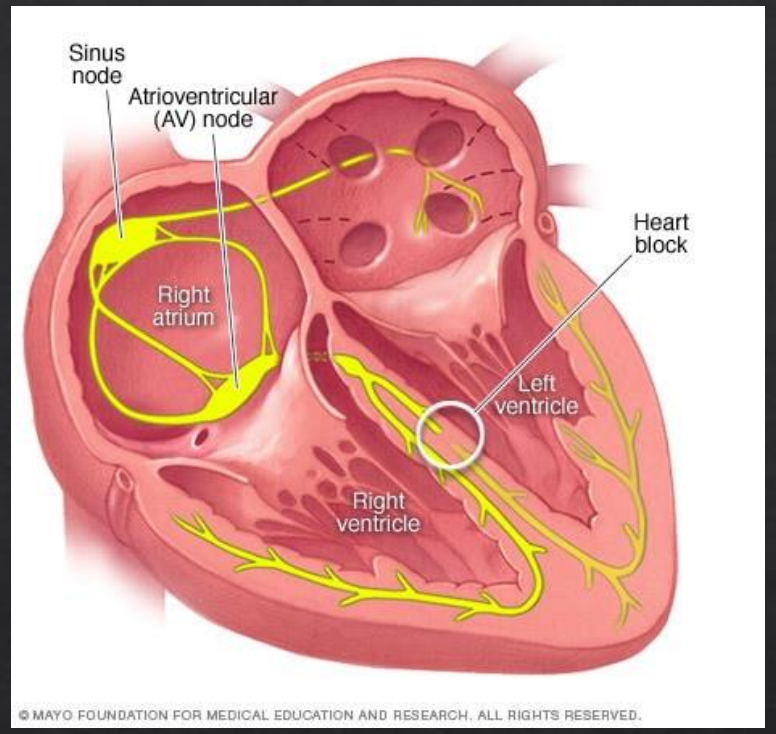


Right bundle branch block

- ECG findings:
  1. Wide QRS due to extra deflection in QRS (rapid depolarization of the left ventricle followed by the slower depolarization of the right ventricle.)
  2. M wave at V1 and W wave at V6 (**M**a**RR**o**W**)
  3. Right axis deviation
- Causes:
  1. Right ventricular hypertrophy
  2. Ischemic heart diseases

Left bundle branch block

- ECG findings:
  1. Wide QRS due to extra deflection in QRS (rapid depolarization of the right ventricle followed by the slower depolarization of the left ventricle.)
  2. W wave at V1 and M wave at V6 (**W**i**LL**ia**M**)
  3. Left axis deviation
- Causes:
  1. Left ventricular hypertrophy
  2. Ischemic heart diseases




Thank
You