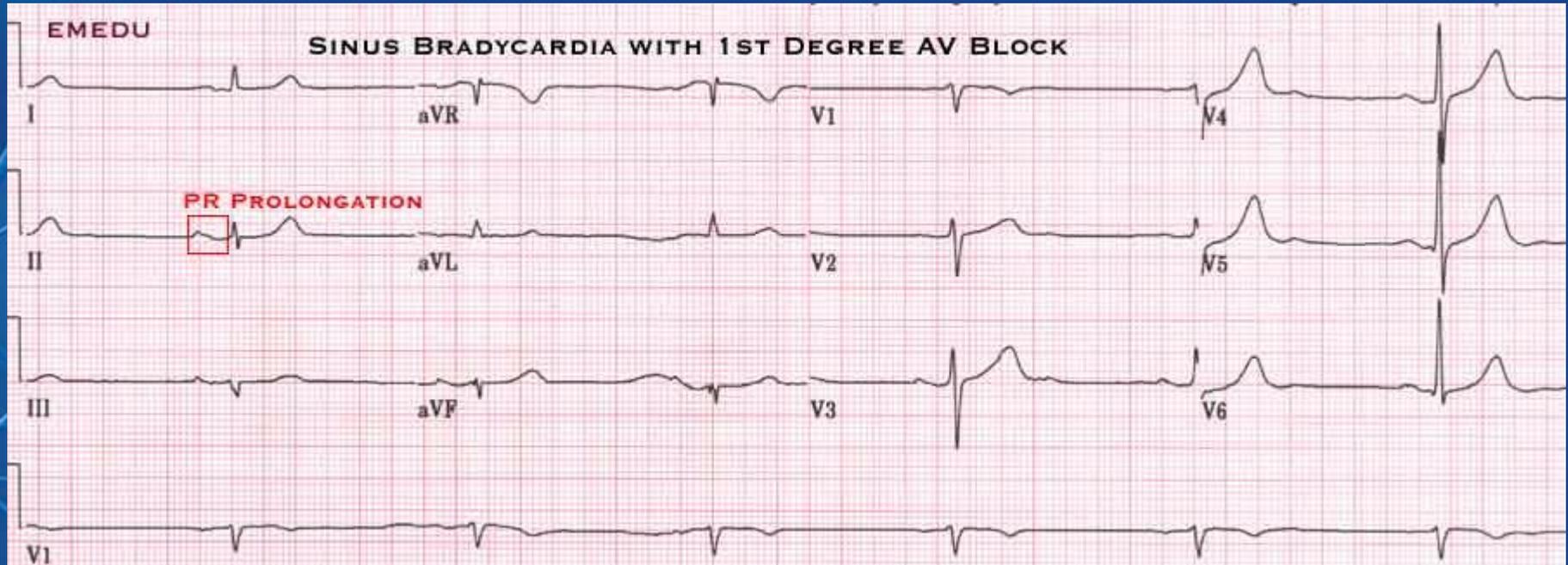




# **Bradyarrhythmias**

**Prof Akram Saleh, MD,FRCP  
Consultant Invasive Cardiologist**

# What are the abnormalities?



# Bradyarrhythmias: Heart rate < 60 bpm

## Sinus Bradycardia

Physiological variant due to strong vagal tone or atheletic training.

Common causes:

### Extrinsic causes;

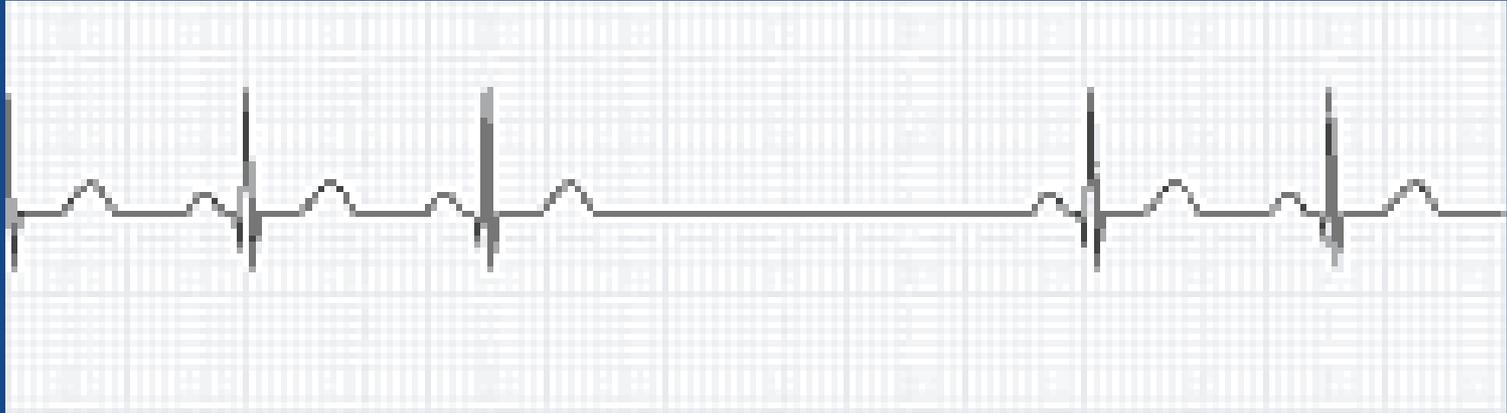
**Drug therapy with beta-blockers, digitalis and other antiarrhythmic drugs.**

Hypothermia, hypothyroidism, cholestatic jaundice and raised intracranial pressure.

### Intrinsic causes;

Acute ischaemia and infarction of the sinus node (as a complication of acute myocardial infarction). Chronic degenerative changes such as fibrosis of the atrium and sinus node (sick sinus syndrome).

# Sick Sinus Syndrome



**Conduction problem with no junctional escape during sinus pause**

**Diagnose with ECG or Holter. If inconclusive, need electrophysiologic testing.**

**If asymptomatic, leave alone. If symptomatic, needs pacemaker.**

# Table 7. Common Potentially Reversible or Treatable Causes of SND

Acute myocardial ischemia or infarction
Athletic training
Atrial fibrillation
Cardiac surgery <ul style="list-style-type: none"> <li>• Valve replacement, maze procedure, coronary artery bypass graft</li> </ul>
Drugs or toxins* <ul style="list-style-type: none"> <li>• Toluene, organophosphates, tetrodotoxin, cocaine</li> </ul>
Electrolyte abnormality <ul style="list-style-type: none"> <li>• Hyperkalemia, hypokalemia, hypoglycemia</li> </ul>
Heart transplant : Acute rejection, chronic rejection, remodeling
Hypervagotonia
Hypothermia <ul style="list-style-type: none"> <li>• Therapeutic (post-cardiac arrest cooling) or environmental exposure</li> </ul>
Hypothyroidism
Hypovolemic shock
Hypoxemia, hypercarbia, acidosis <ul style="list-style-type: none"> <li>• Sleep apnea, respiratory insufficiency (suffocation, drowning, stroke, drug overdose)</li> </ul>
Infection <ul style="list-style-type: none"> <li>• Lyme disease, legionella, psittacosis, typhoid fever, typhus, listeria, malaria, leptospirosis, Dengue fever, viral hemorrhagic fevers, Guillain-Barre</li> </ul>
Medications* <ul style="list-style-type: none"> <li>• Beta blockers, non-dihydropyridine calcium channel blockers, digoxin, antiarrhythmic drugs, lithium, methyl dopa, risperidone, cisplatin, interferon</li> </ul>

# Sinus Node Dysfunction

1. Sinus node dysfunction is most often related to age-dependent progressive fibrosis of the sinus nodal tissue and surrounding atrial myocardium leading to abnormalities of sinus node and atrial impulse formation and propagation and will therefore result in various bradycardic or pause-related syndromes.

# HEART BLOCKS

## 1- ATRIO-VENTRICULAR BLOCK (AV):

1<sup>ST</sup> degree

2<sup>nd</sup> degree

3<sup>rd</sup> degree

## 2- BUNDLE BRANCH BLOCK (BBB):

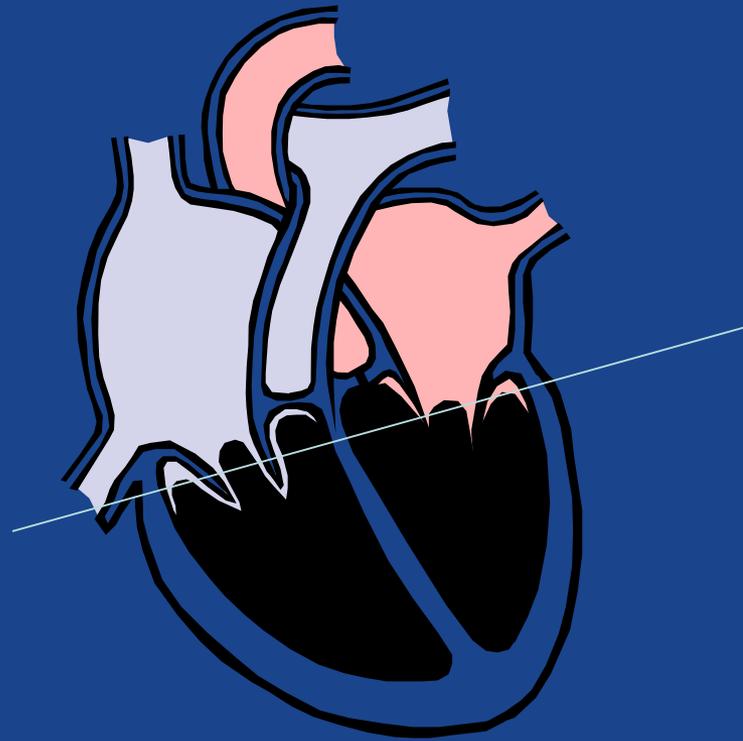
1- Left BBB

2-Right BBB

3- Hemiblocks

*AV blocks occur when there is a Partial or Complete interruption in the electrical conduction flow between the atria and ventricle.*

*The sinus node is functioning appropriately but the impulse is not able to reach it's destination – the ventricle - in what has been identified as the normal sequence of events.*



# Table 9. Etiology of Atrioventricular Block

Congenital/genetic	Vagotonic-associated with increased vagal tone
<ul style="list-style-type: none"> <li>• Congenital AV block (associated with maternal systemic lupus erythematosus)</li> <li>• Congenital heart defects (e.g., L-TGA)</li> <li>• Genetic (e.g., SCN5A mutations)</li> </ul>	<ul style="list-style-type: none"> <li>• Sleep, obstructive sleep apnea</li> <li>• High-level athletic conditioning</li> <li>• Neurocardiogenic</li> </ul>
Infectious	Metabolic/endocrine
<ul style="list-style-type: none"> <li>• Lyme carditis</li> <li>• Bacterial endocarditis with perivalvar abscess</li> <li>• Acute rheumatic fever</li> <li>• Chagas disease</li> <li>• Toxoplasmosis</li> </ul>	<ul style="list-style-type: none"> <li>• Acid-base disorders</li> <li>• Poisoning/overdose (e.g., mercury, cyanide, carbon monoxide, mad honey)</li> <li>• Thyroid disease (both hypothyroidism and hyperthyroidism)</li> <li>• Adrenal disease (e.g., pheochromocytoma, hypoadosteronism)</li> </ul>
Inflammatory/infiltrative	Other diseases
<ul style="list-style-type: none"> <li>• Myocarditis</li> <li>• Amyloidosis</li> <li>• Cardiac sarcoidosis</li> <li>• Rheumatologic disease: Systemic sclerosis, SLE, RA, reactive arthritis (Reiter's syndrome)</li> <li>• Other cardiomyopathy-idiopathic, valvular</li> </ul>	<ul style="list-style-type: none"> <li>• Neuromuscular diseases (e.g., myotonic dystrophy, Kearns-Sayre syndrome, Erb's dystrophy)</li> <li>• Lymphoma</li> </ul>
Ischemic	Iatrogenic
<ul style="list-style-type: none"> <li>• Acute MI</li> <li>• Coronary ischemia without infarction—unstable angina, variant angina</li> <li>• Chronic ischemic cardiomyopathy</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Medication related</b> <ul style="list-style-type: none"> <li>○ Beta blockers, verapamil, diltiazem, digoxin</li> <li>○ Antiarrhythmic drugs</li> <li>○ Neutraceuticals</li> </ul> </li> <li>• Catheter ablation</li> <li>• Cardiac surgery, especially valve surgery</li> <li>• TAVR, alcohol septal ablation</li> </ul>
Degenerative	
<ul style="list-style-type: none"> <li>• Lev's and Lenegre's diseases</li> </ul>	

# ***The AV Blocks***

- ♥ ***Sinus Mechanism with 1st Degree AV Block***
- ♥ ***2nd Degree AV Block***
  - ♥ ***Type I (Mobitz I or Wenckebach)***
  - ♥ ***Type II (Mobitz II)***
- ♥ ***3<sup>rd</sup> Degree AV Block (Complete Heart Block)***

# ***The AV Blocks***

♥ *Sinus Mechanism with 1st Degree AV Block*

♥ *2nd Degree AV Block*

♥ *Type I (Mobitz I or Wenckebach)*

♥ *Type II (Mobitz II)*

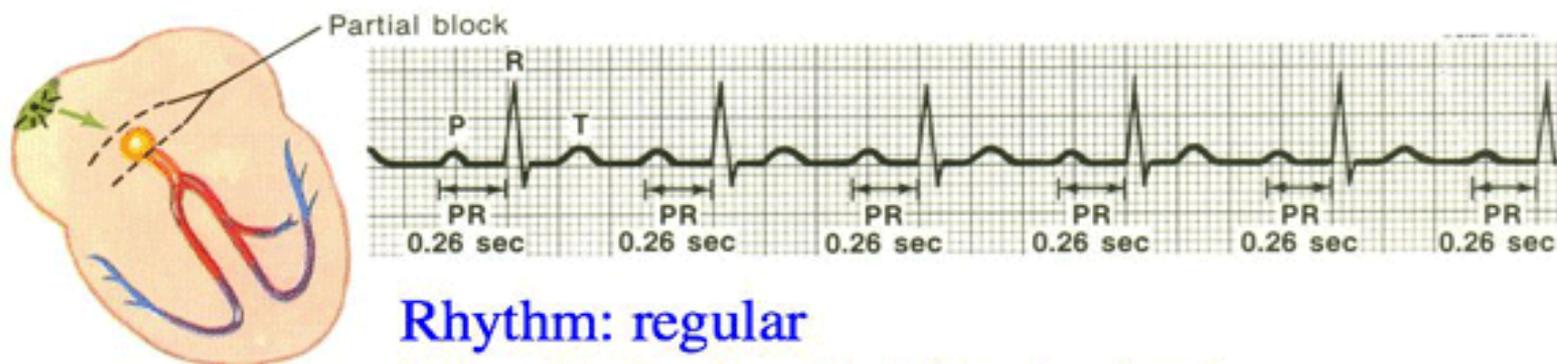
♥ *3<sup>rd</sup> Degree AV Block (Complete Heart Block)*

♥ *Severity is measured in degrees.*

# AV Blocks

1. 1<sup>st</sup> degree heart block: AV conduction is excessively slowed.
2. 2<sup>nd</sup> degree heart block: AV conduction is incompletely (occasionally) blocked
3. 3<sup>rd</sup> degree heart block: AV conduction is completely blocked.

# 1° AV Block



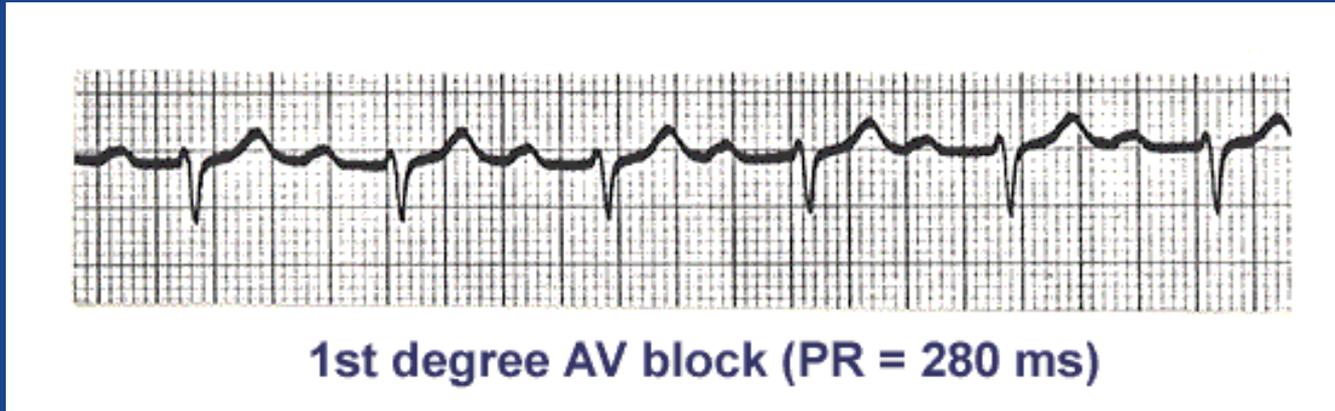
Rhythm: regular

Rate: (that of underlying rhythm)

**PR is > than .2 seconds**

QRS: usually normal

# First Degree AV Block

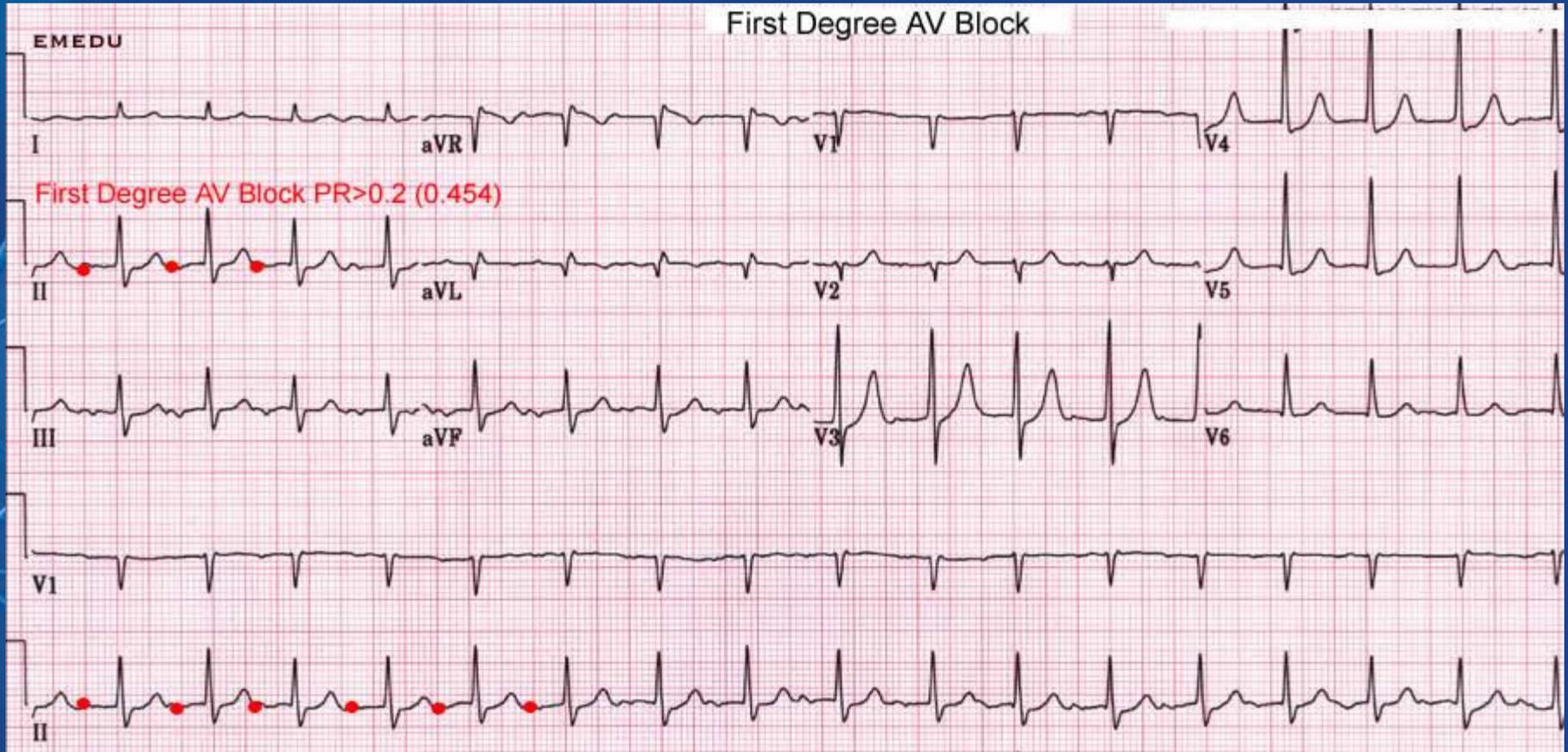


Delay at the AV node results in prolonged PR interval

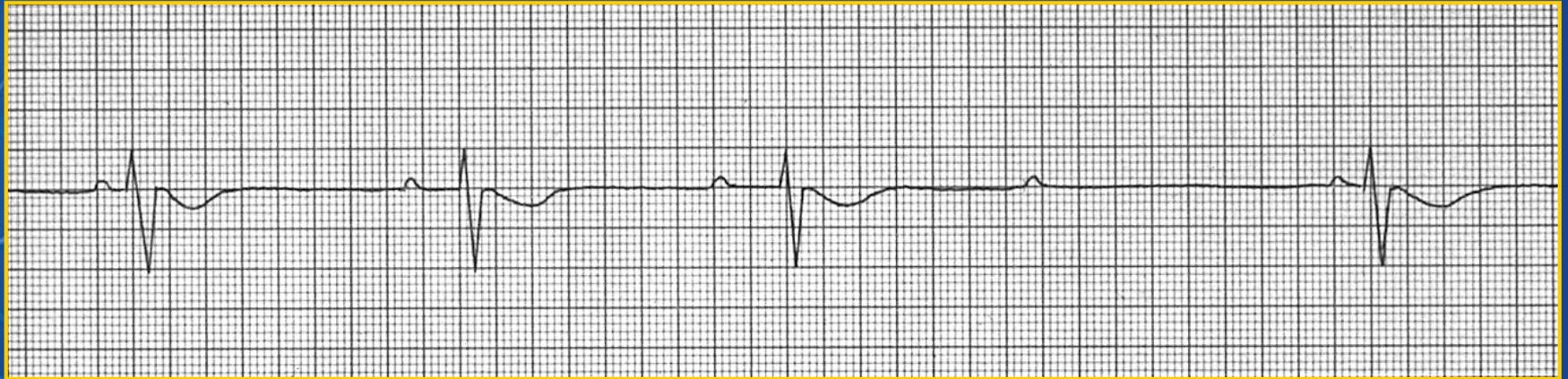
**PR interval > 0.2 sec.**

**Leave it alone**

# 1<sup>st</sup> Degree AV block



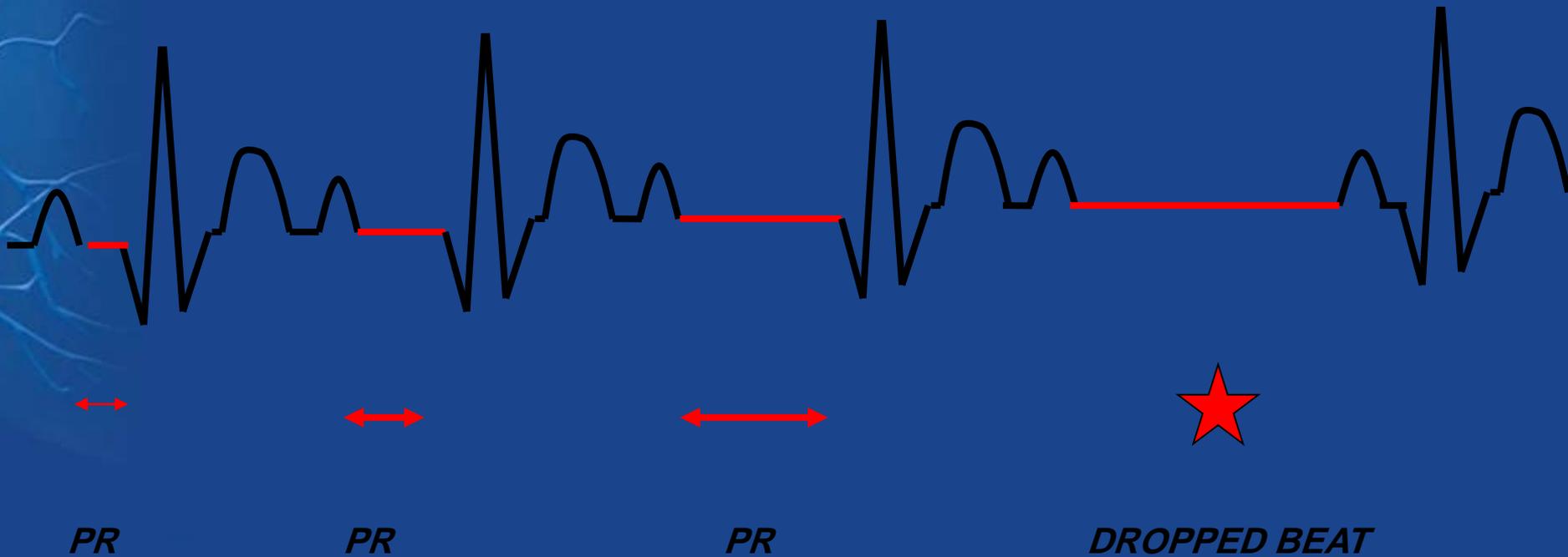
# *SECOND DEGREE A-V BLOCK (MOBITZ I OR WENCKEBACH)*



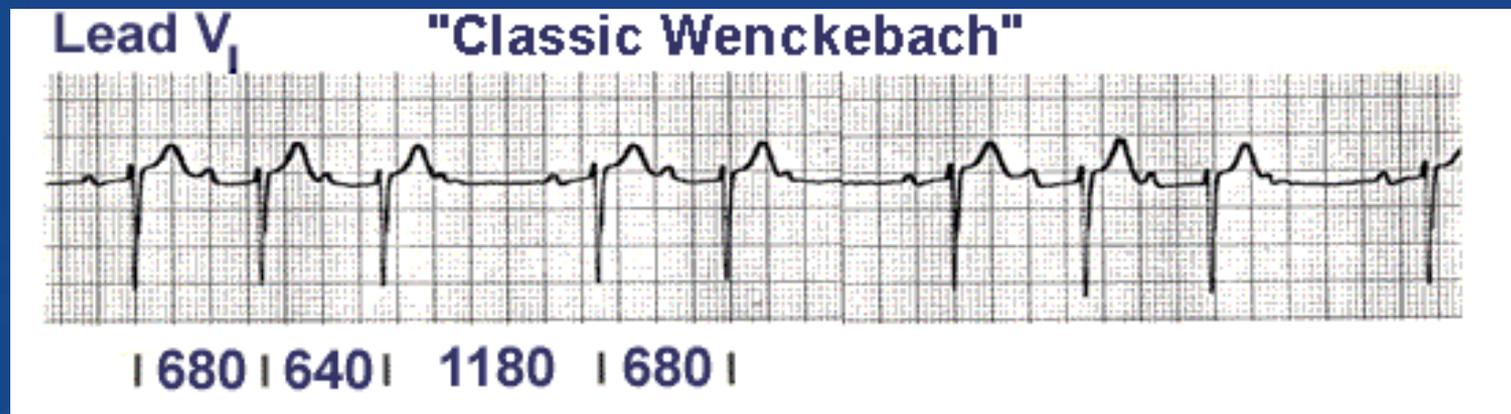
# Second Degree Heart Block (2°) Mobitz Type I (Wenkebach)



# *Second Degree Heart Block (2°) Mobitz Type I (Wenkebach)*



## Second Degree AV Block Type 1 (Wenckebach)

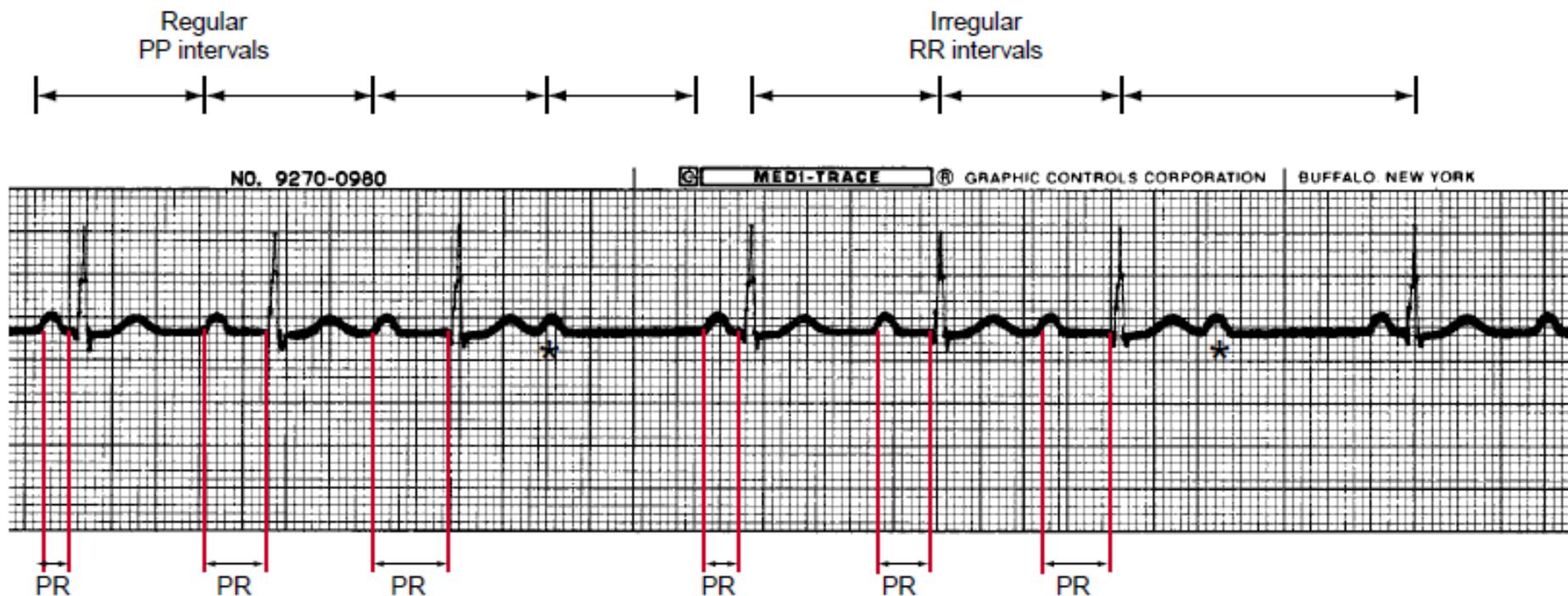


Increasing delay at AV node until a p wave is not conducted.

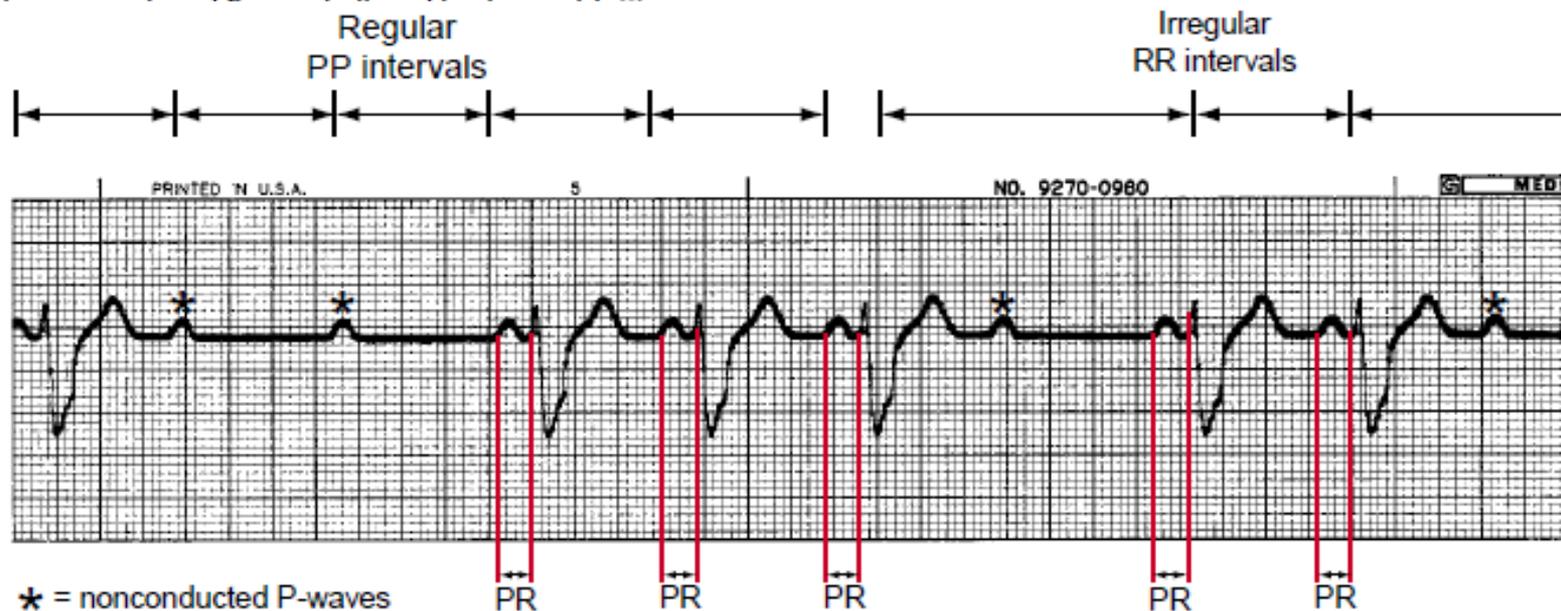
Often comes post inferior MI with AV node ischemia

**Gradual prolongation of the PR interval before a skipped QRS. QRS are normal!**

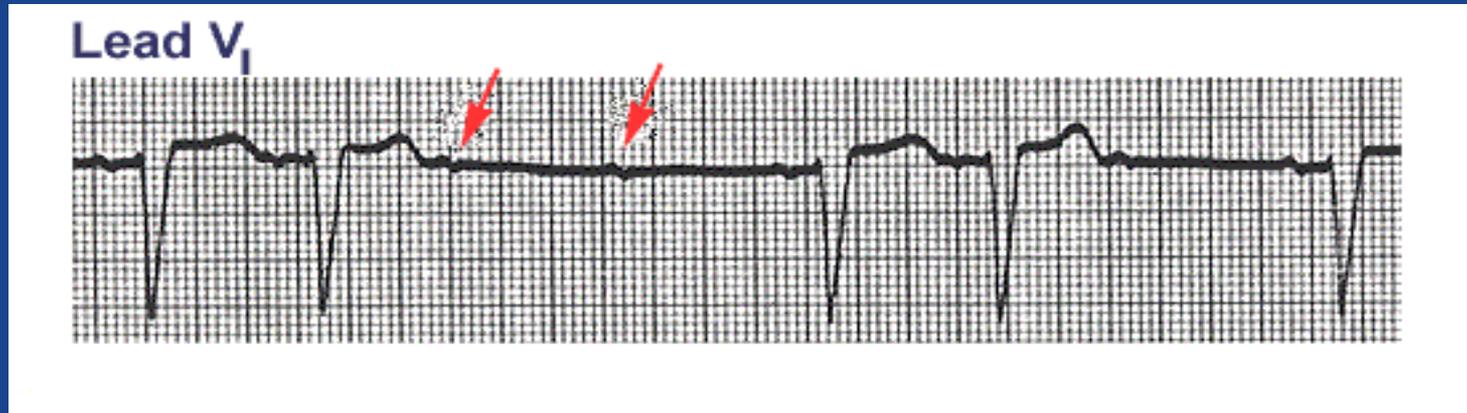
**No pacing as long as no bradycardia.**



**FIGURE 27-21** Sinus rhythm with second-degree AV block, type I in lead II. Note progressively longer PR durations until the



## Second Degree AV Block Type 2



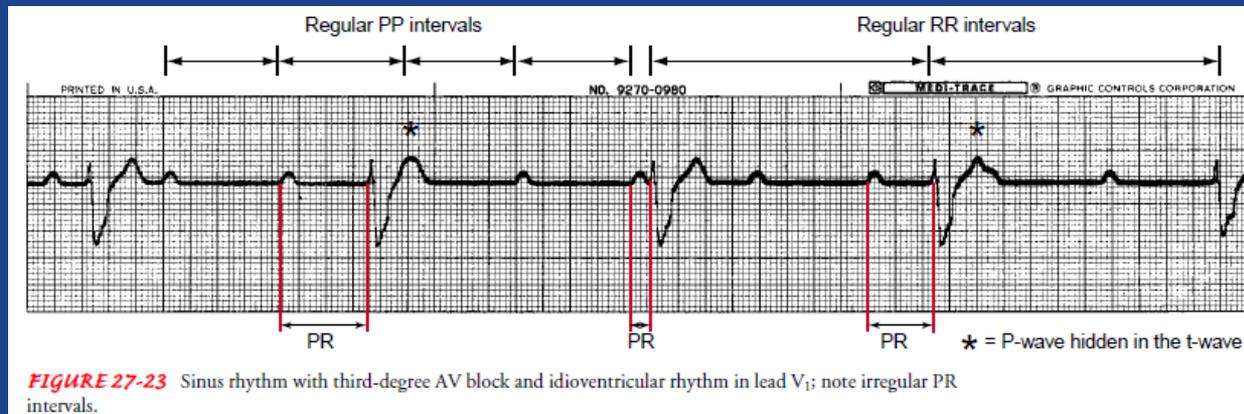
**Diseased bundle of HIS with BBB.**

**Sudden loss of a QRS wave because p wave was not transmitted beyond AV node.**

**May be precursor to complete heart block and needs pacing.**



# Third Degree AV Block



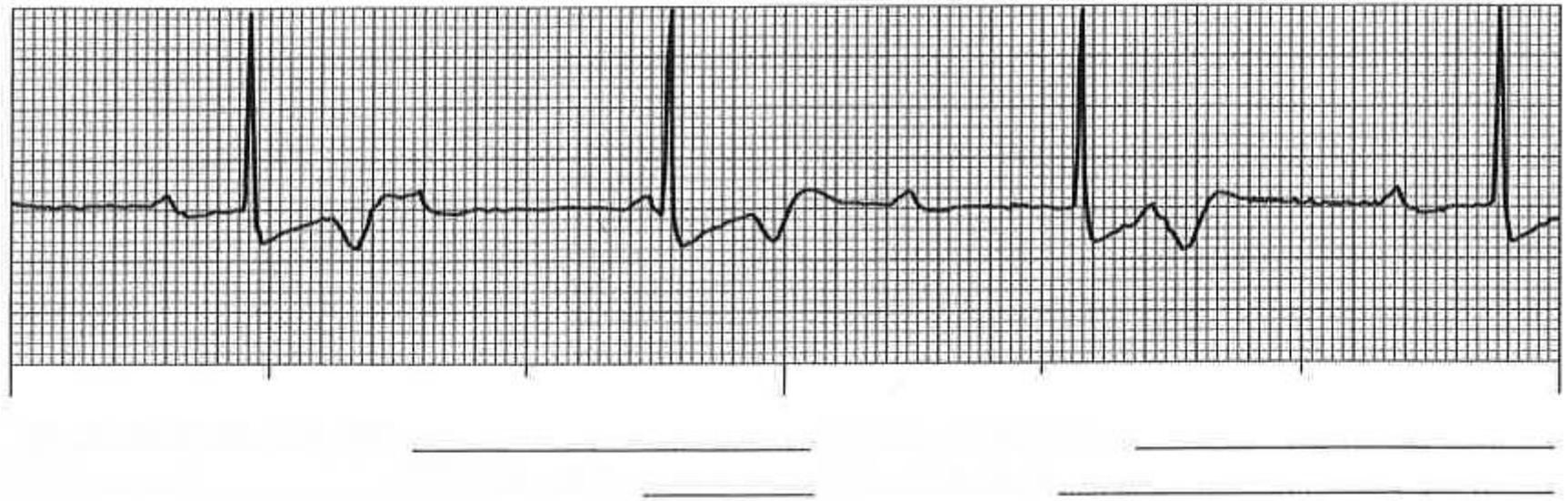
Complete heart block where atria and ventricles beat independently AND atria beat faster than ventricles.

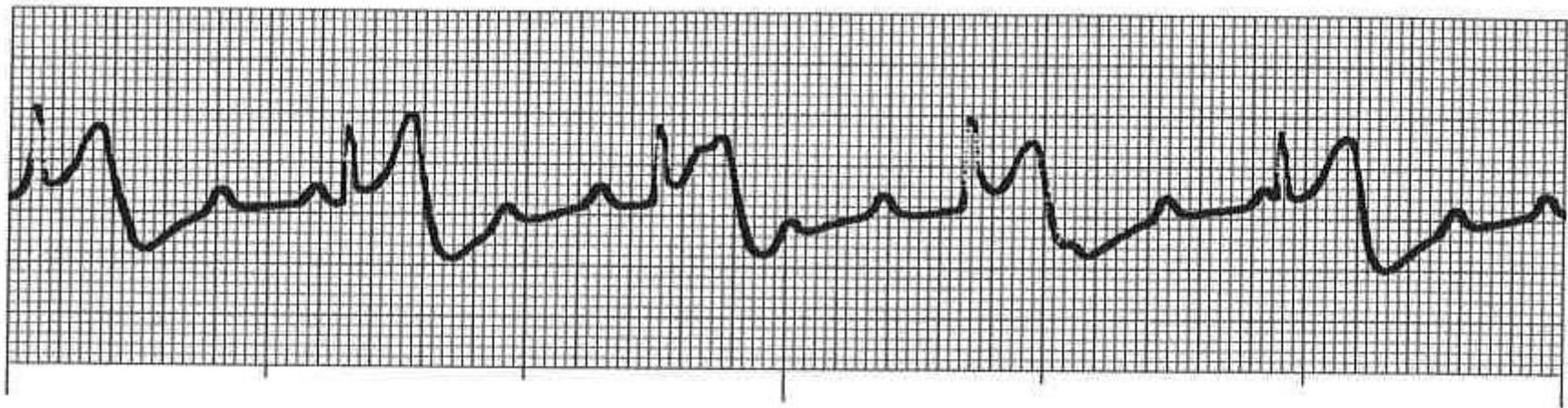
**Must treat with pacemaker.**

### Third Degree (complete) AV Block



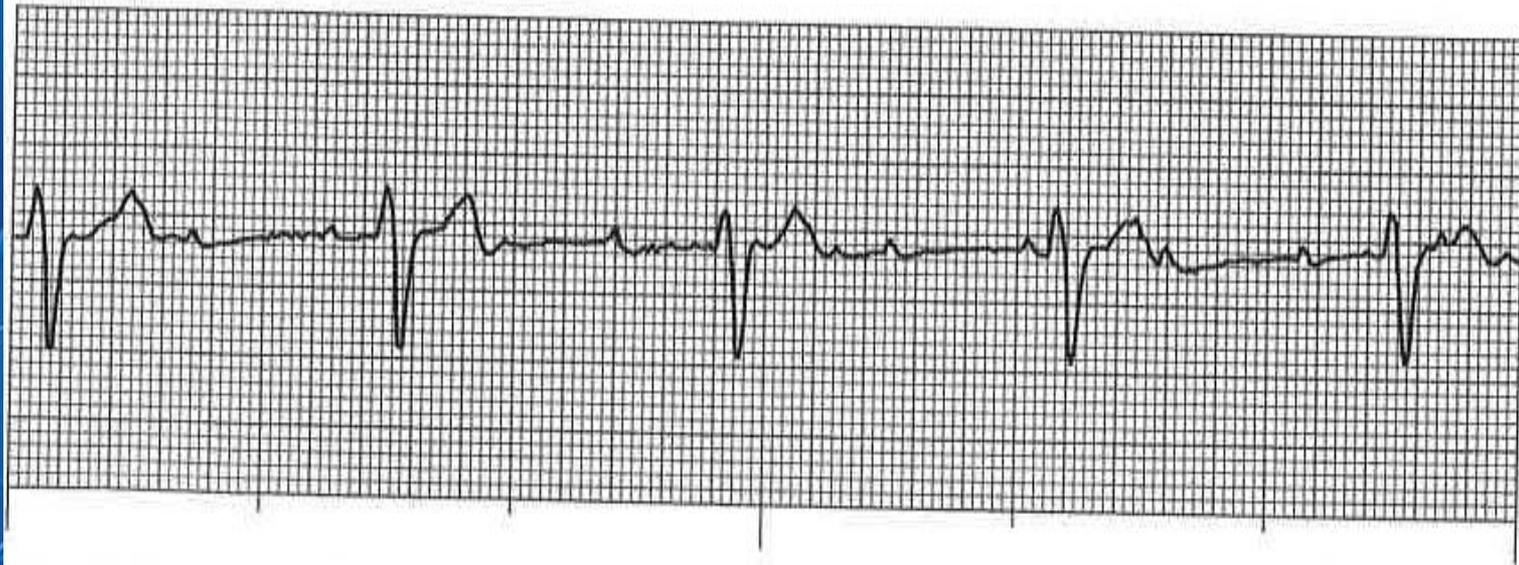
P Wave	PR Interval (in seconds)	QRS (in seconds)	Characteristics
Normal but not related to QRS	None	N/A	No relationship between P&RS





\_\_\_\_\_

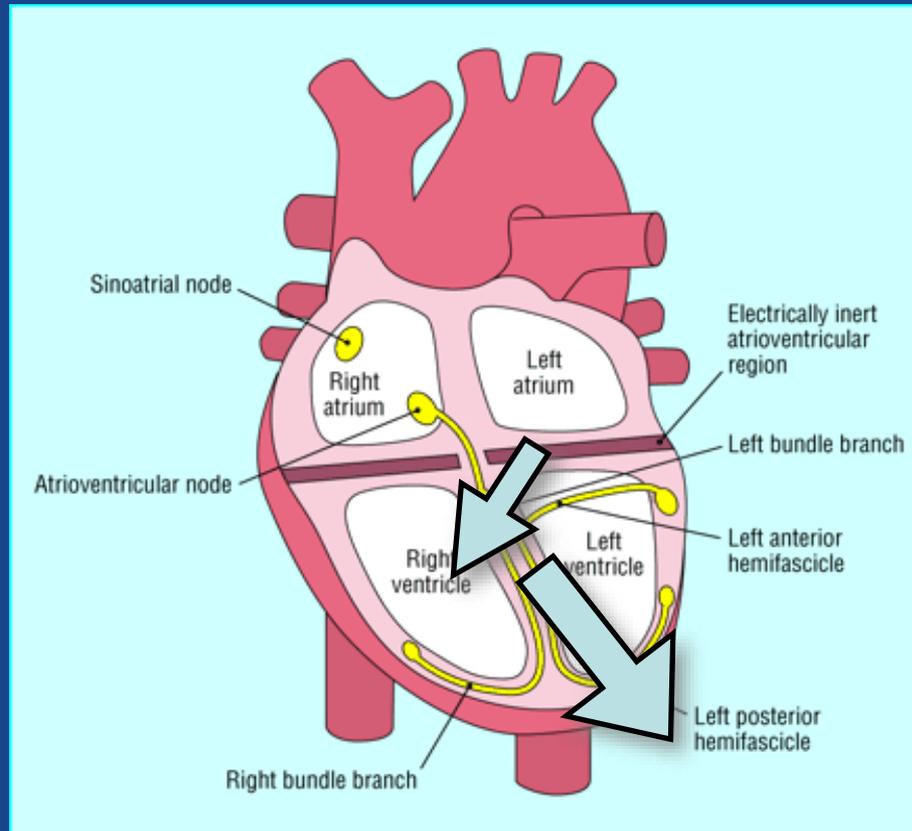
\_\_\_\_\_



\_\_\_\_\_

\_\_\_\_\_

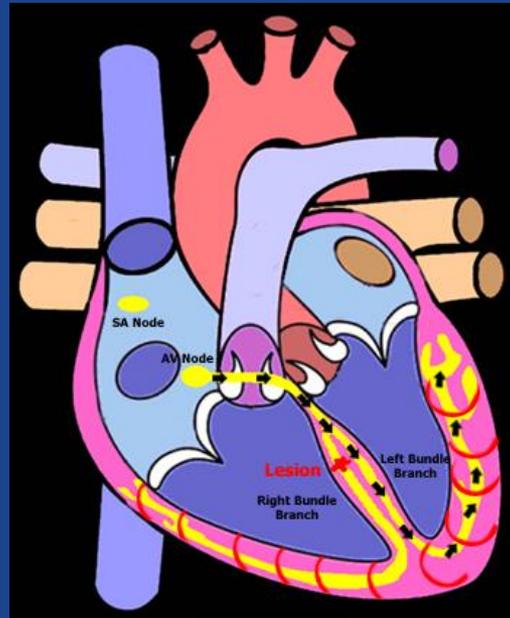
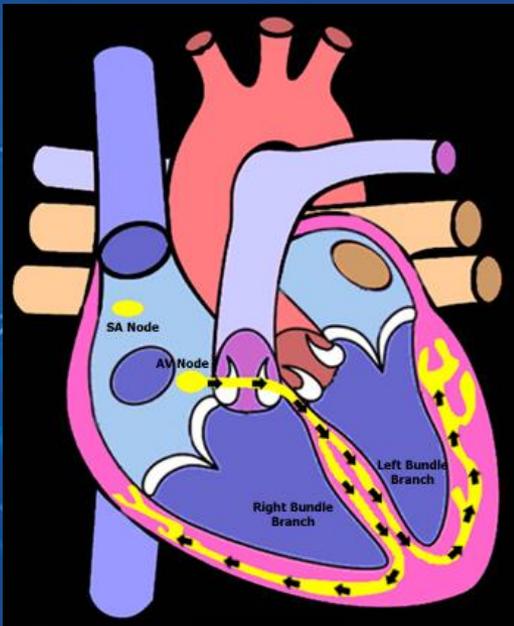
# Bundle Branches



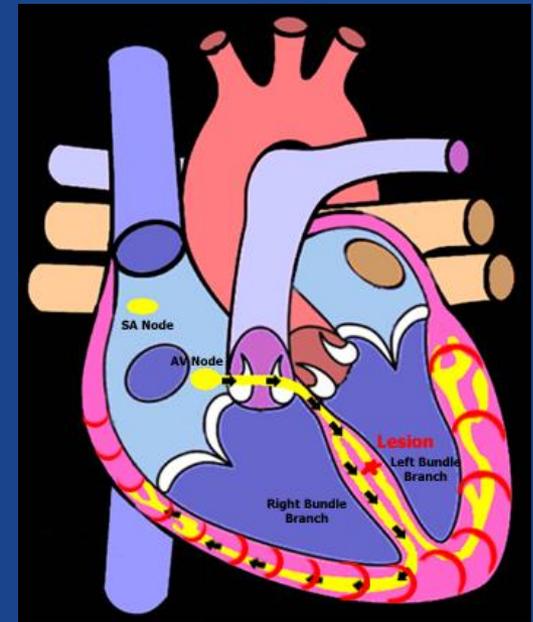
Normal conduction speed through the bundles is about 0.1 seconds

# Bundle Branch Block

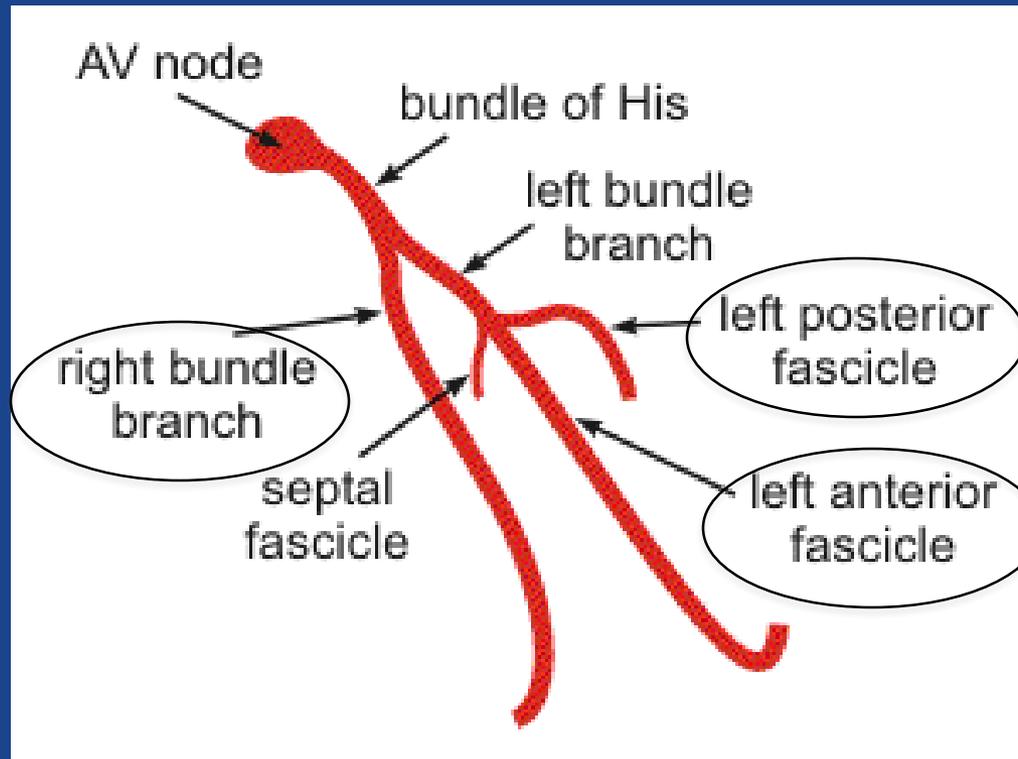
Consider a blocked or slowed branch or bundle



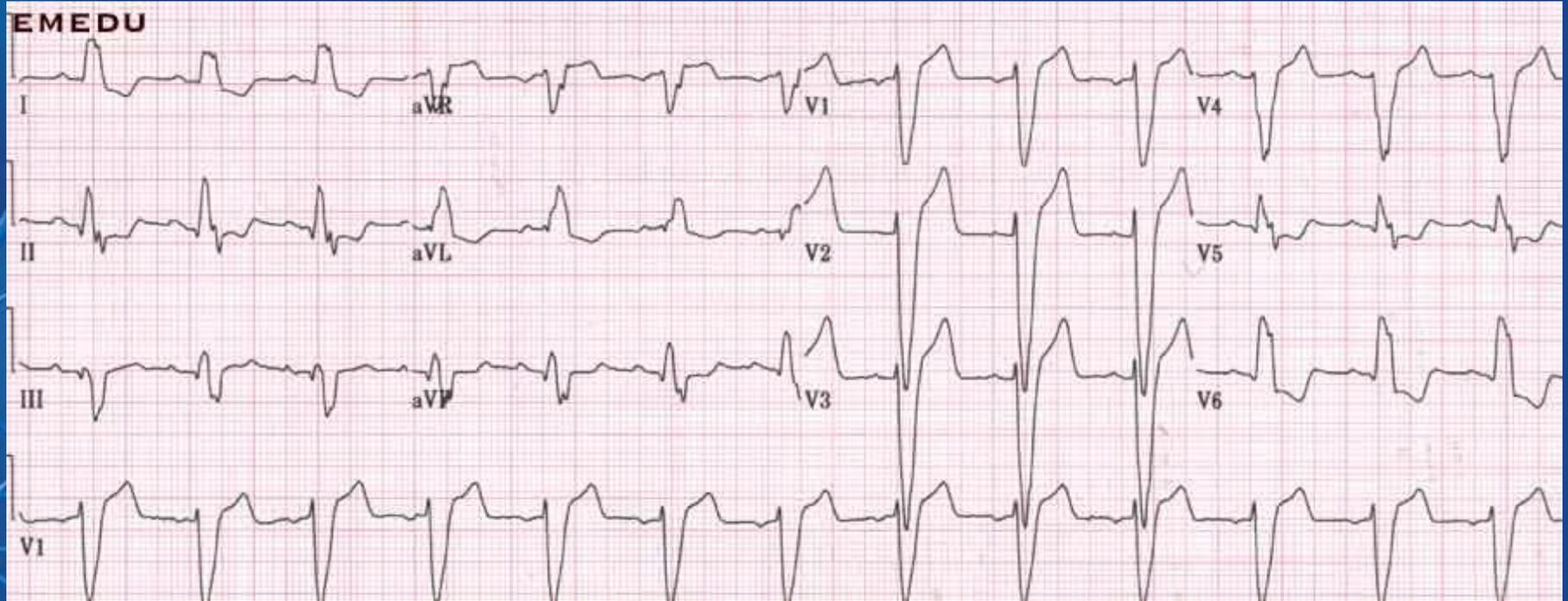
*Right*



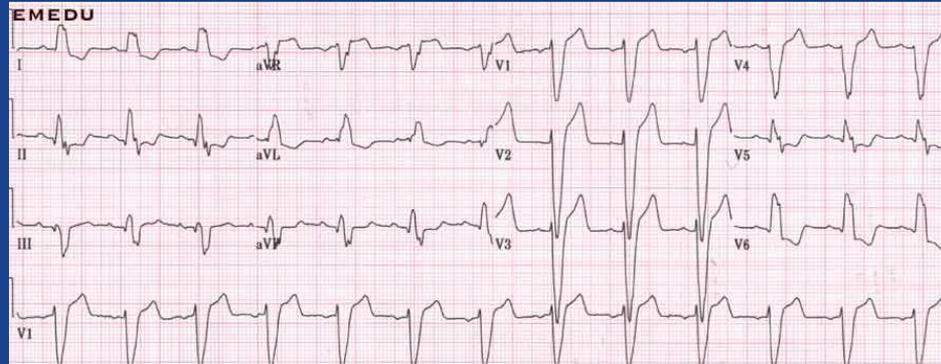
*Left*



# LBBB



# Left Bundle Branch Block



**Left ventricle gets a delayed impulse**

**QRS is widened (at least 3 boxes)**

**V<sub>5</sub> and V<sub>6</sub> have RR' (rabbit ears)**

**Be careful not to miss any hiding q waves!**

**Pacemaker if syncope occurs**

# Left Bundle Branch Block

**Increases the likelihood of:**

- 1-underlying structural heart disease**
- 2- left ventricular systolic dysfunction.**

# Left Bundle Branch Block

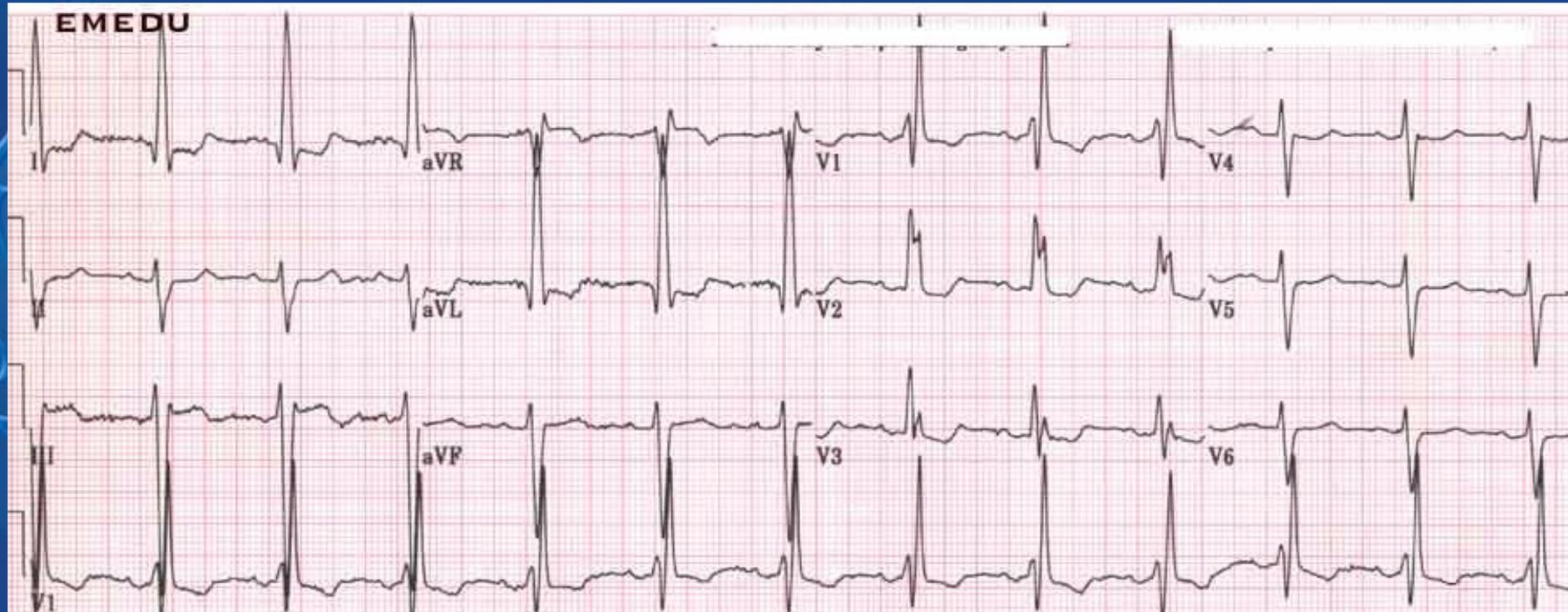
## Causes

- long standing hypertension
- valvular lesion
- cardiomyopathy
- coronary artery disease

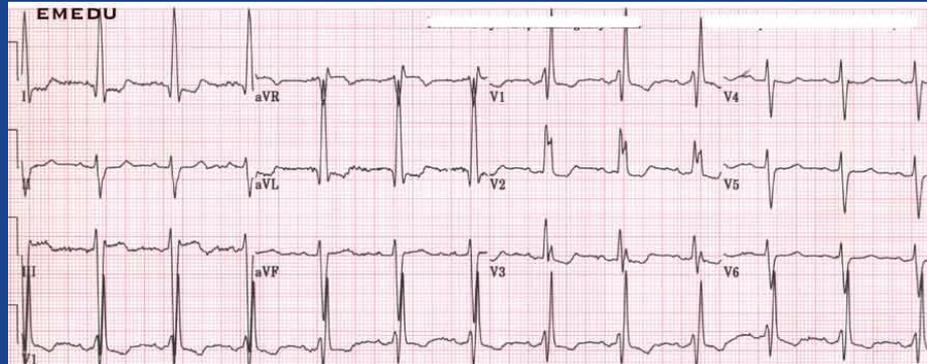
## Precursor

1. Advanced CAD
2. Valvular heart disease
3. Hypertensive heart disease
4. Cardiomyopathy

# RBBB



# Right Bundle Branch Block



Right ventricle gets a delayed impulse

**QRS is widened (at least 3 boxes)**

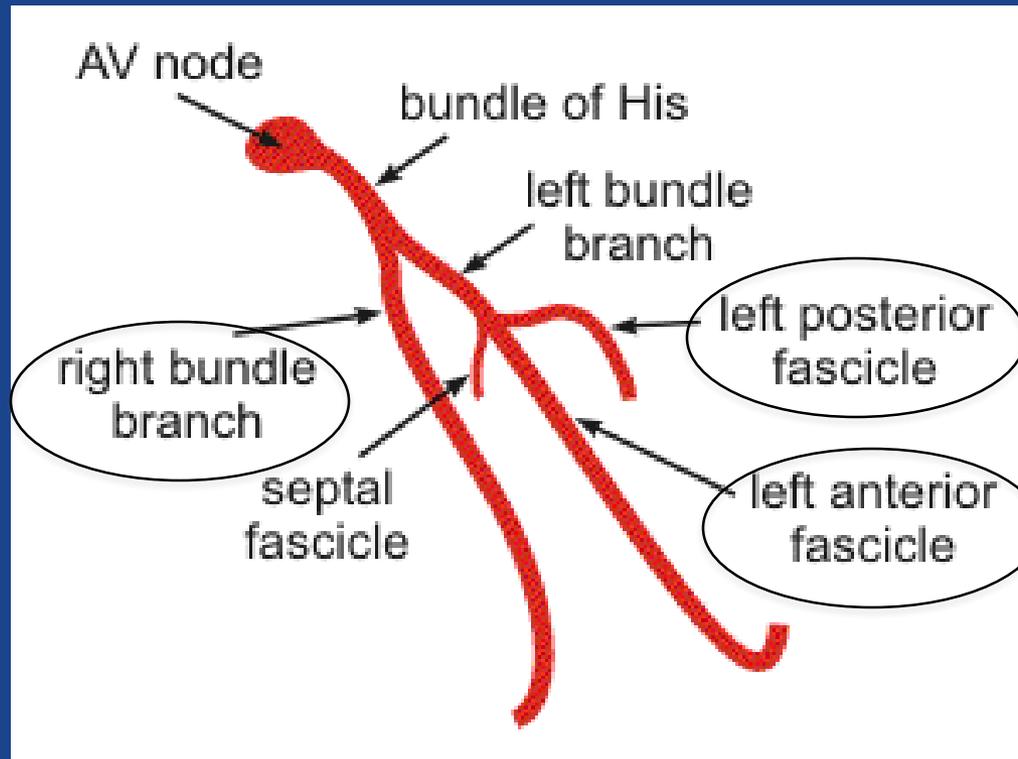
**V<sub>1</sub> and V<sub>2</sub> have rSR'**

# Right Bundle Branch Block

- **Healthy heart**
- **Organic heart disease**
  - atrial septal defect
  - pulmonary disease
  - valvular lesions
- **degenerative changes in conduction system**
- **chronic coronary artery disease**
- **pulmonary embolism**
- **after bypass graft surgery**

**Permanent or transient**

**RBBB by itself requires no treatment**



# Fascicular Blocks

Fascicular blocks only slightly prolongs the QRS.

Fascicular blocks cause axis deviation as do infarcts and hypertrophy.

Left or right axis deviation without signs of infarct or hypertrophy are fascicular blocks.

# Left Anterior Fascicular Block

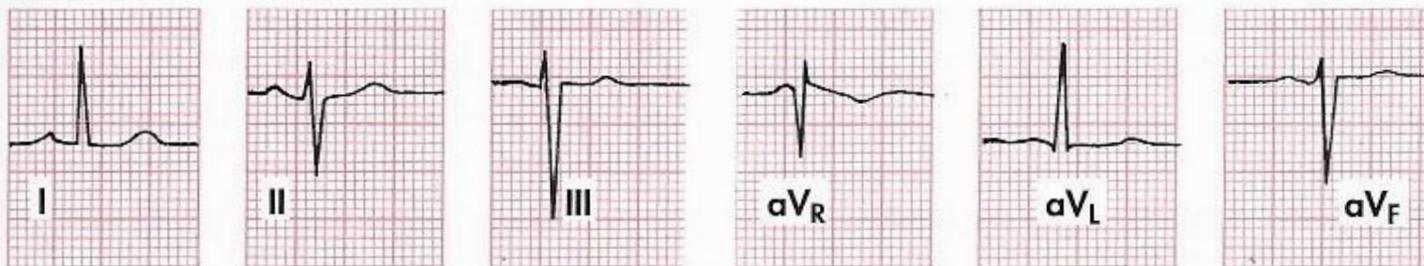
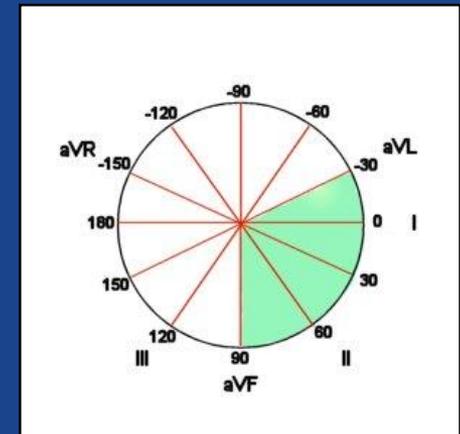
**Limb leads:**

**QRS less width less than 0.12 sec.**

**QRS axis = Left axis deviation ( $-45^\circ$  or more)**

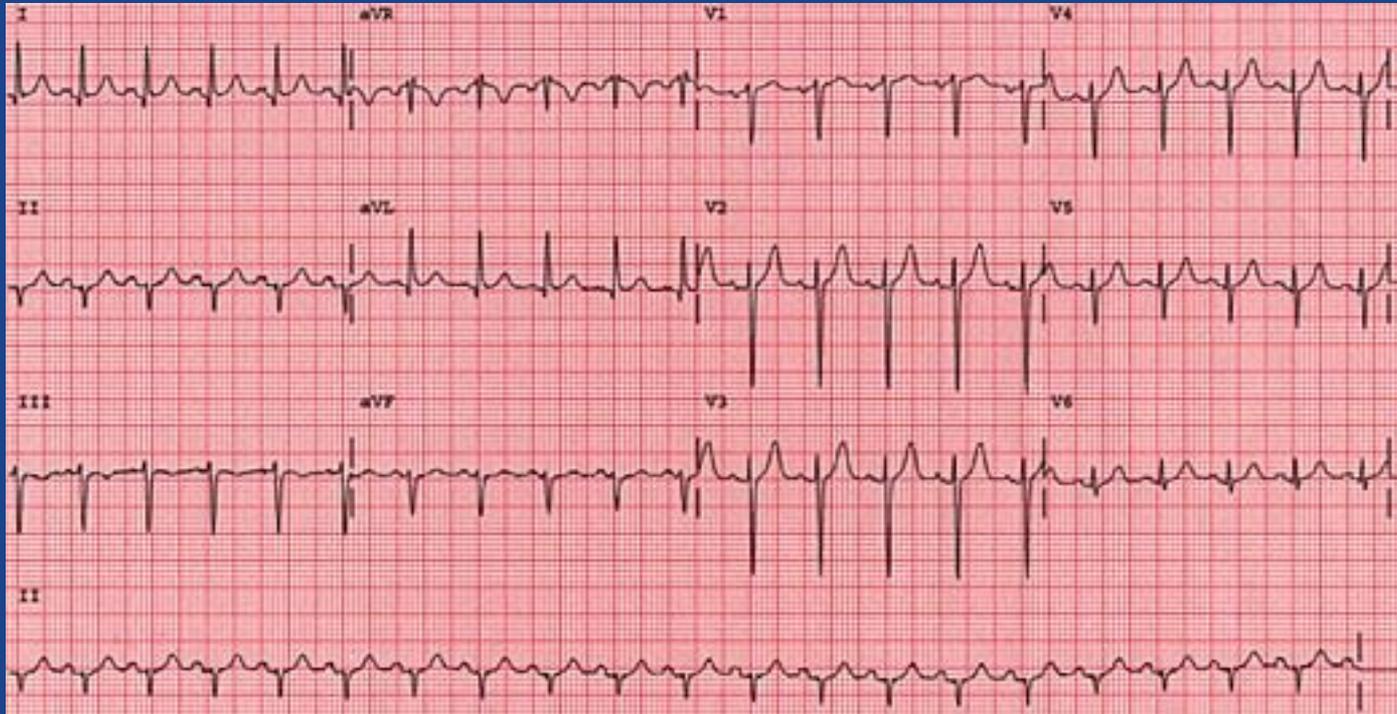
**if S wave in  $aV_F$  is greater than R wave in lead I**

**small Q wave in lead I,  $aV_L$ , or  $V_6$**



**FIGURE 7-10** Left anterior fascicular block (hemiblock). Notice the marked left axis deviation without significant widening of the QRS duration. Compare this with Figure 9-8B, which shows left posterior fascicular (hemiblock).

# Anterior Fascicular Block

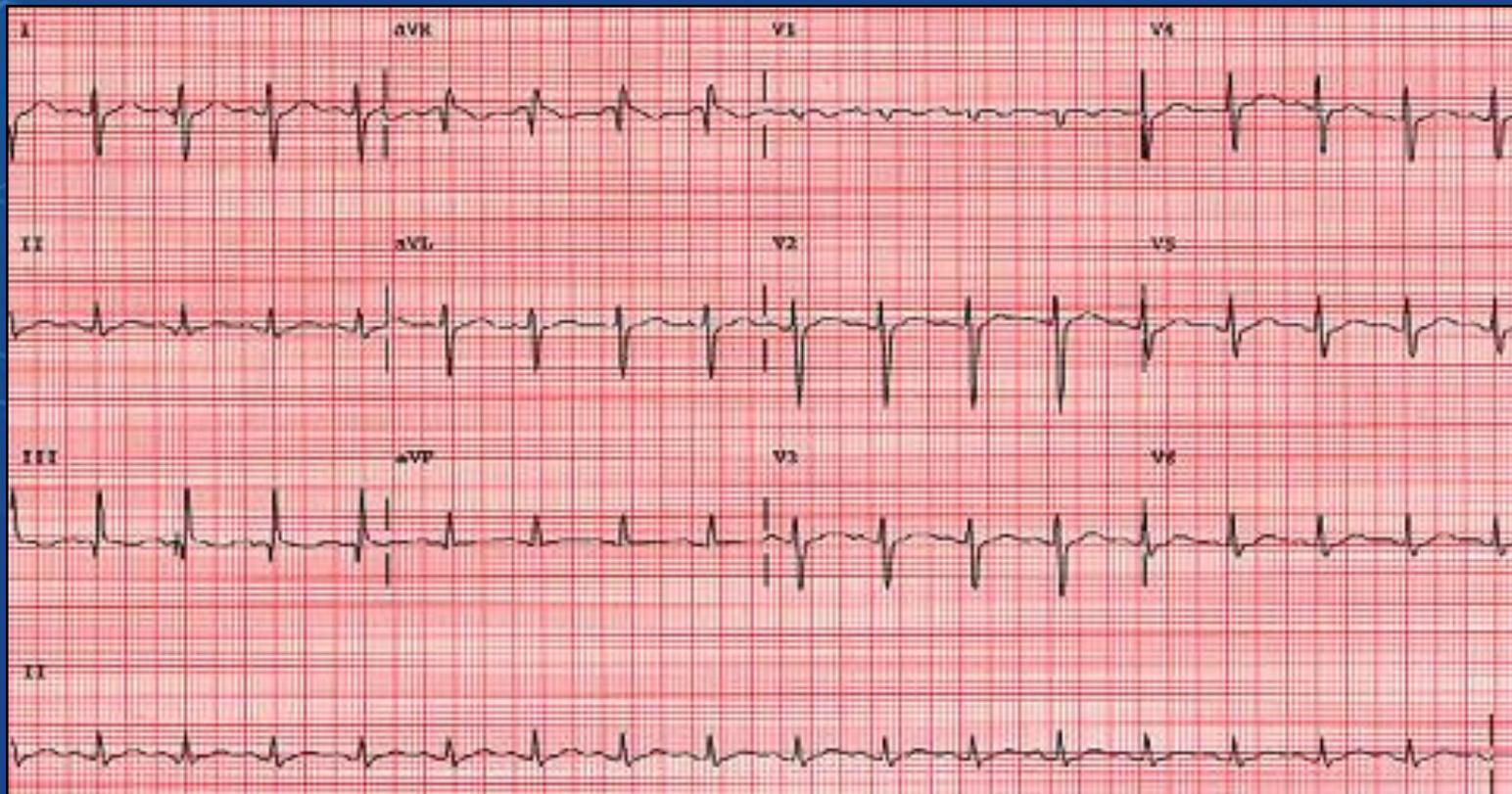


# Left Posterior Fascicular Block

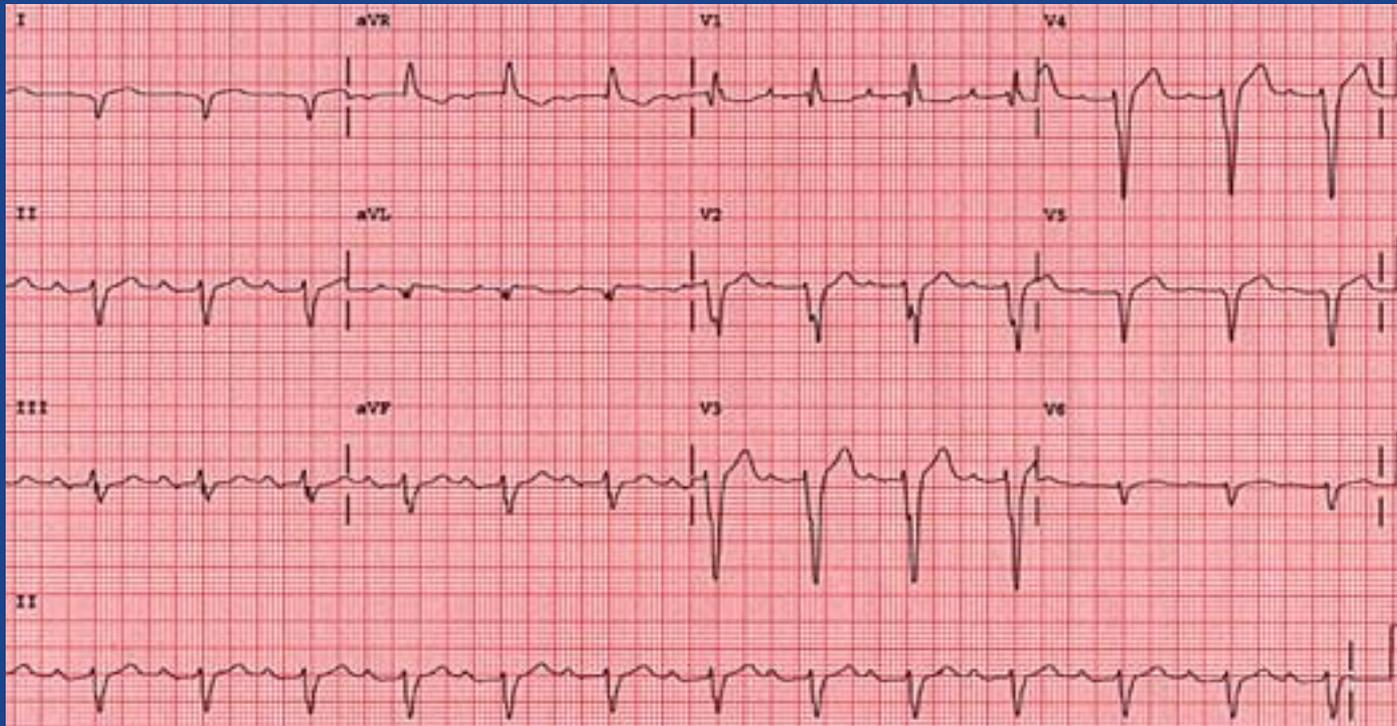
Right axis deviation (QRS axis  $+120^\circ$  or more)

S wave in lead I and a Q wave in lead III (S1Q3)

Rare



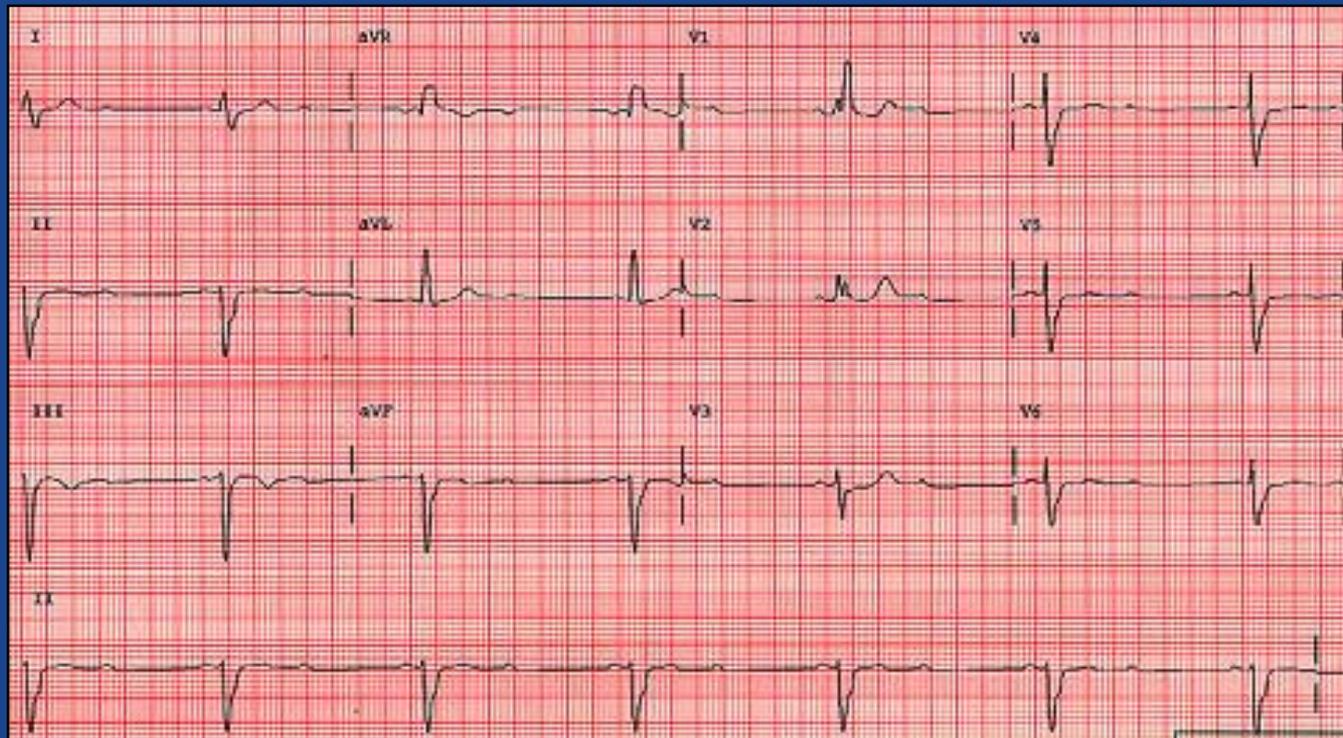
# Posterior Fascicular Block



# Bifascicular Block

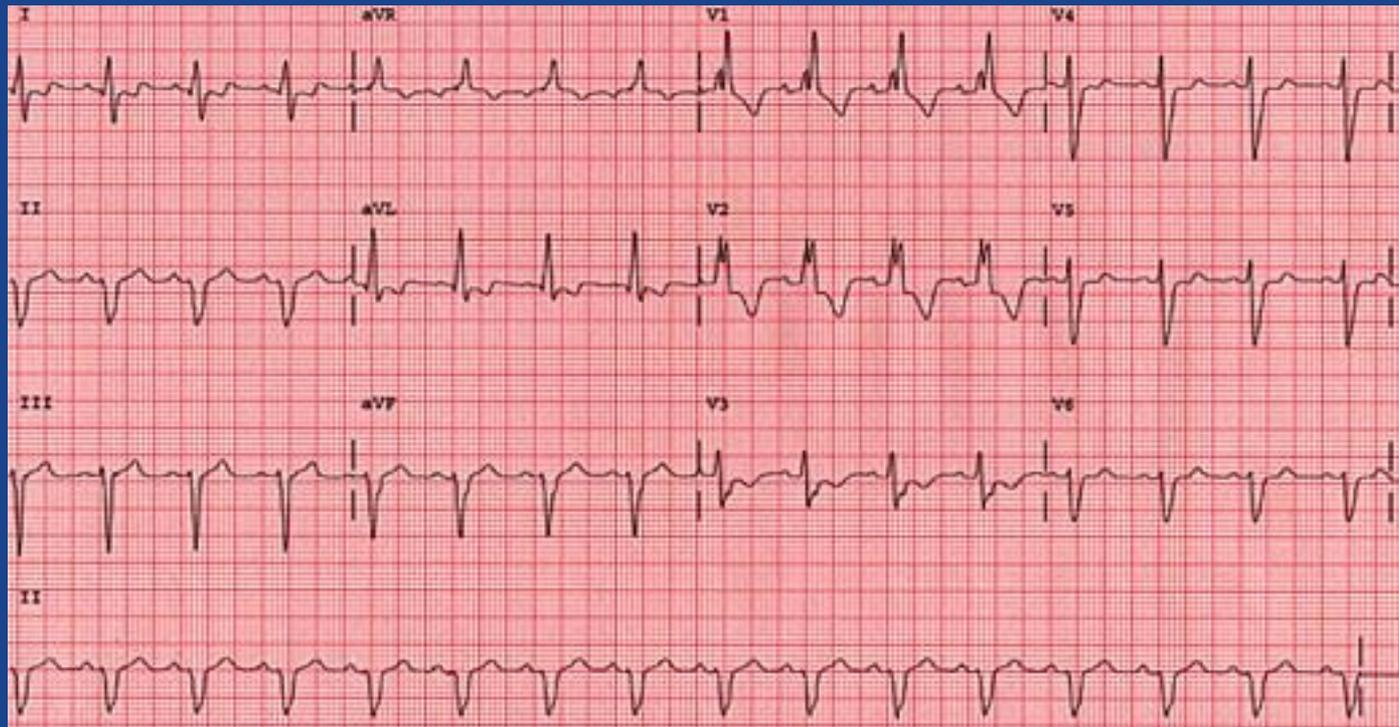
Two of the three fascicles are blocked.

Most common is RBBB with left anterior fascicular block.

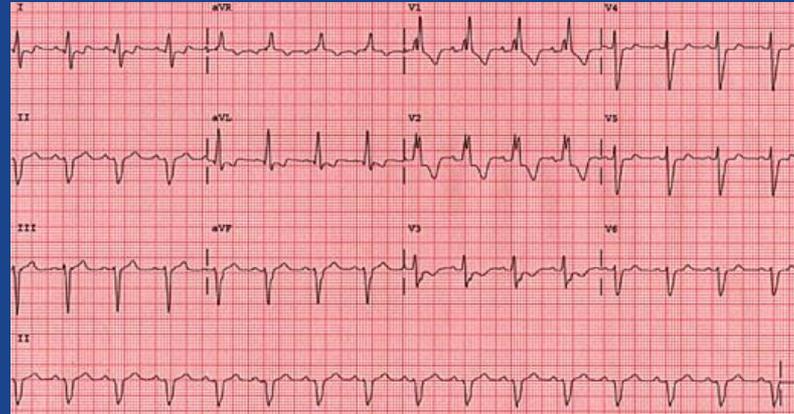


# Bifascicular Block

*(RBBB &  
LAFB)*



# Bifascicular Block



**RBBB plus LAFB OR RBBB plus LPFB**

**QRS is widened (at least 3 boxes)**

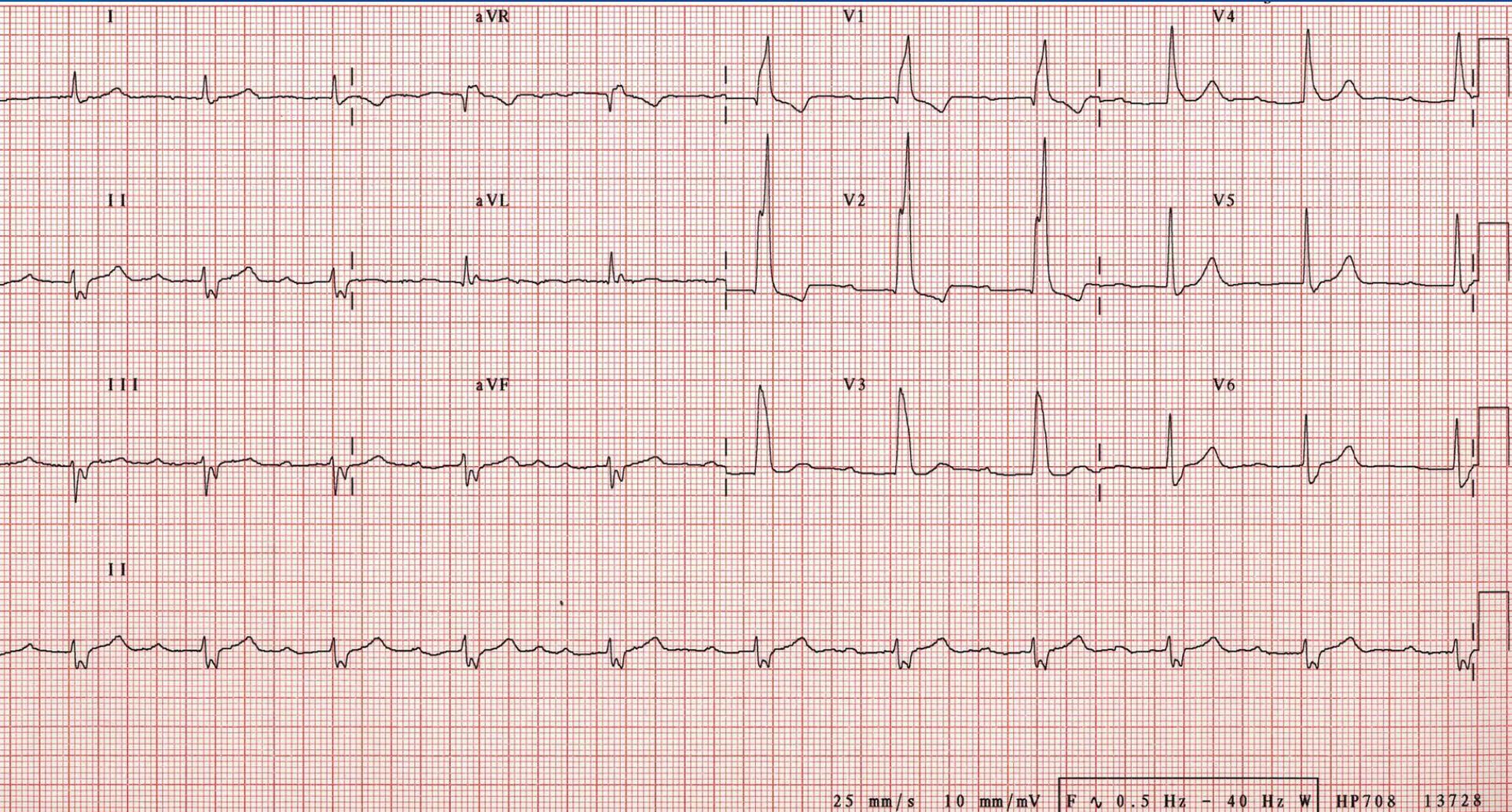
**V<sub>5</sub> and V<sub>6</sub> have RR' (rabbit ears)**

**V<sub>1</sub> and V<sub>2</sub> have rSR'**

**Pacemaker if syncope occurs**

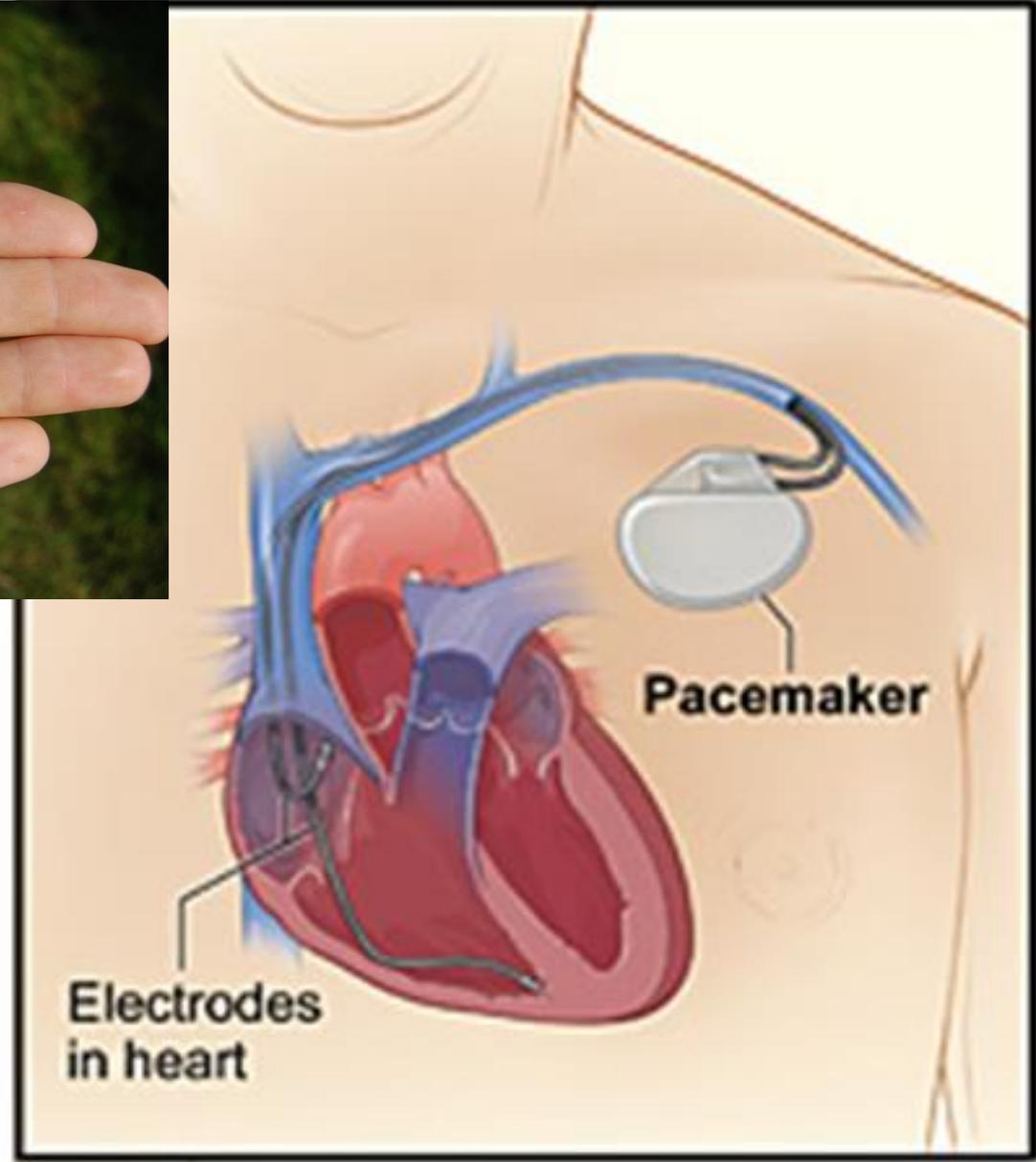
# Trifascicular Block

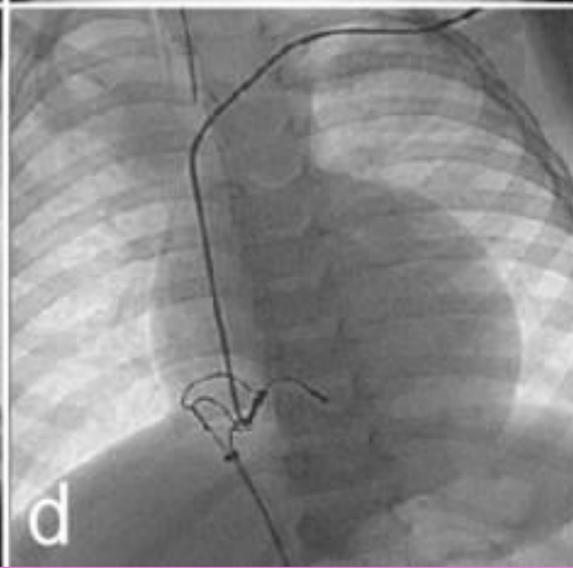
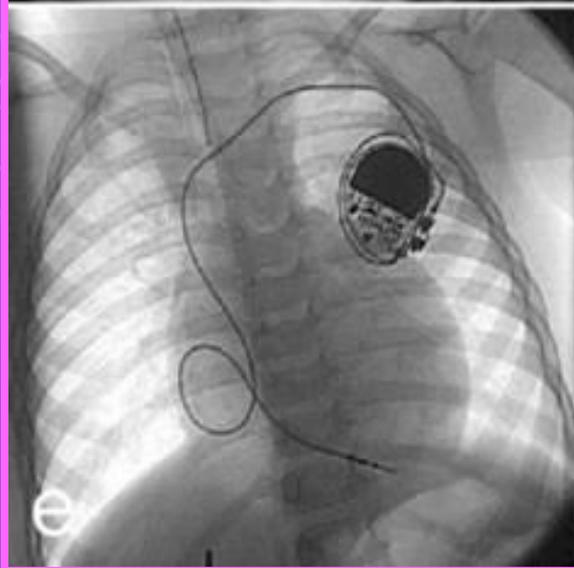
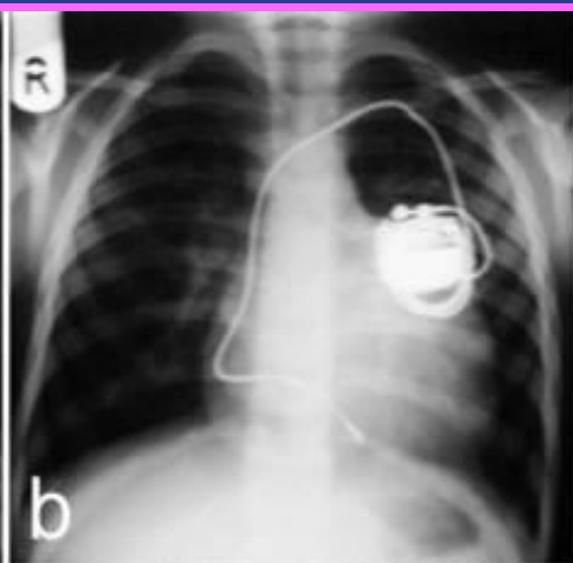
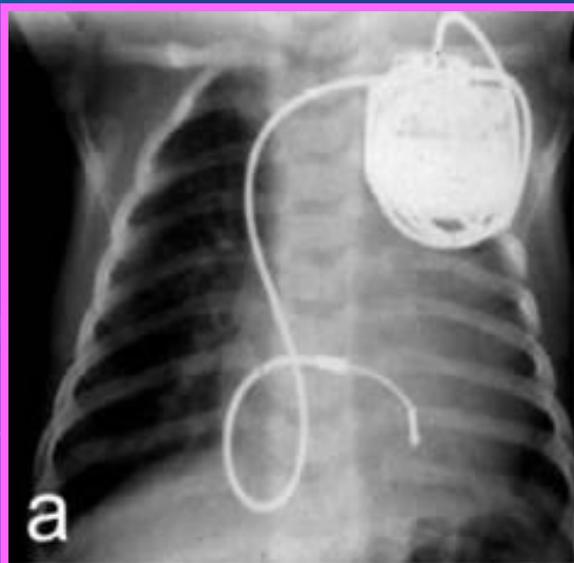
(RBBB + LAFB + 1° AV block)



B  
M  
E  
3  
1  
2  
-  
B  
M  
I  
I  
I  
-  
L  
1  
-  
A  
L  
I  
I  
S  
I  
N  
2  
0  
1  
5

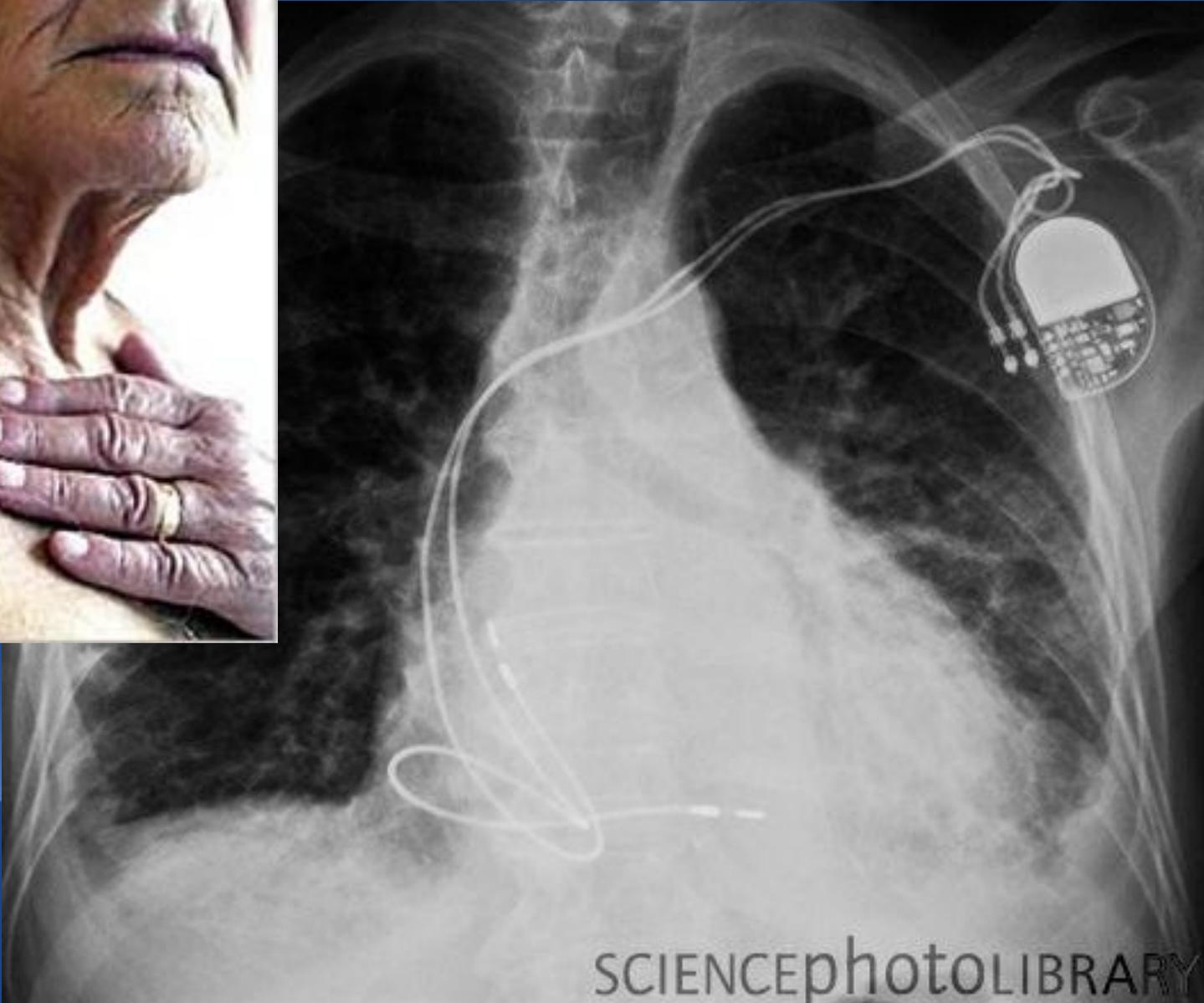
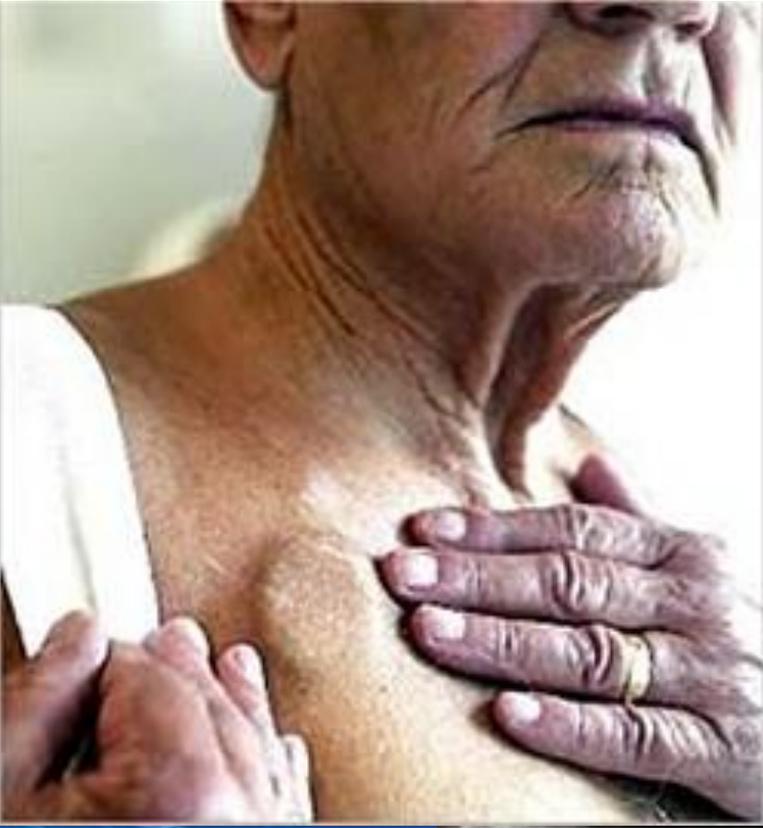
# Cardiac Pacemakers





# Cardiac Pacemakers

B  
M  
E  
3  
1  
2  
-  
B  
M  
I  
I  
I  
-  
L  
1  
-  
A  
L  
i  
I  
S  
I  
N  
2  
0  
1  
5



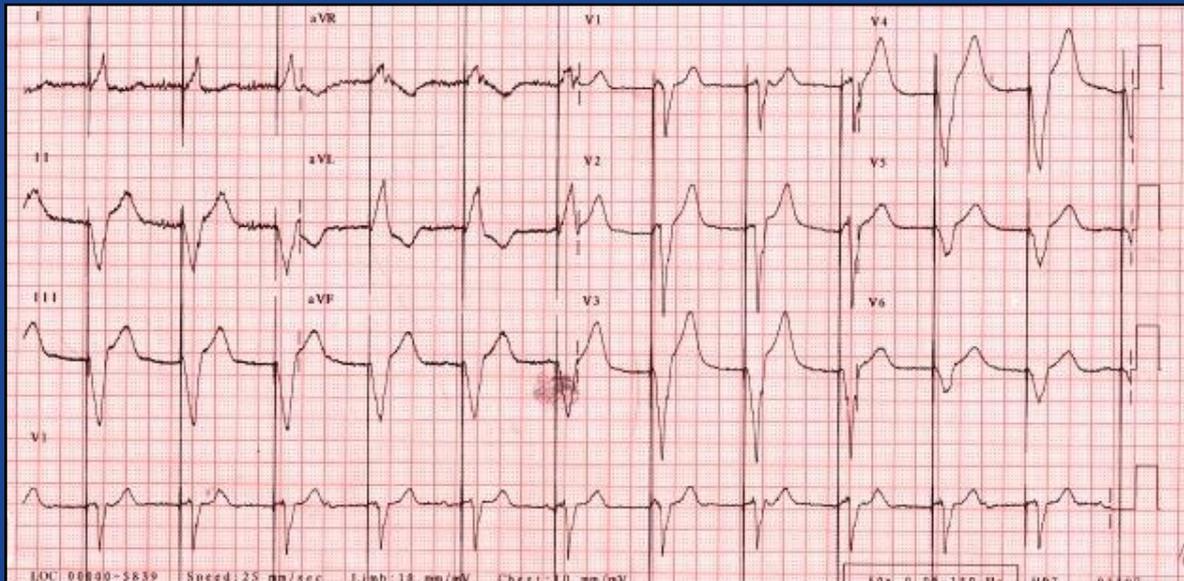
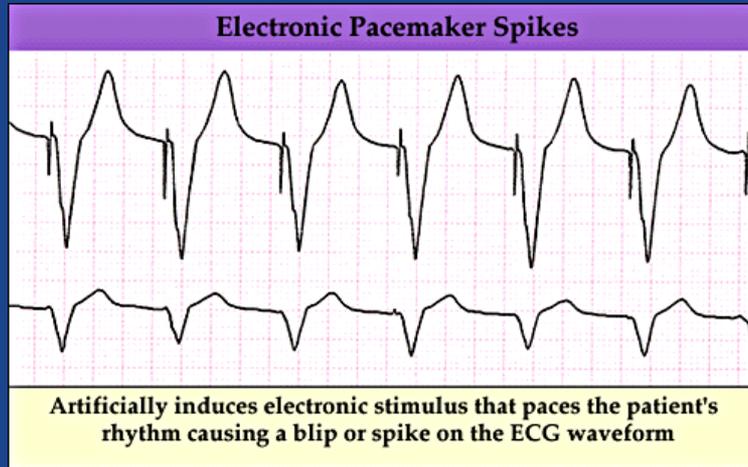
# Pacing types

**Permanent**  
**Temporary**  
**biventricular**

# Who gets a pacemaker?

- ♥ Syncope, presyncope or exercise intolerance that can be attributed to bradycardia
- ♥ Symptomatic 2<sup>nd</sup> or 3<sup>rd</sup> degree AV block
- ♥ Congenital 3<sup>rd</sup> degree AV block with wide QRS
- ♥ Advanced AV block after cardiac surgery
- ♥ Recurrent type 2 2<sup>nd</sup> degree AV block after MI
- ♥ 3<sup>rd</sup> degree AV block with wide QRS or BBB.

# Pacemaker Patterns



**Thank you**

