HARRISON'S BASED GENERAL MEDICINE

PART - 3

CONTENT

INTRODUCTION

APPROACH TO HYPERTROPHY AND BLOCKS

Atrial enlargement and LVH

00:00:13

Pointed P wave

Right Atrial Enlargement

Twelve-lead electrocardiogram showing right atrial enlargement. Tall and peaked P waves, also called "p pulmonale," are seen in leads II, III, and aVF (arrows). Note that the waves are taller in lead III than in lead I. Leads II, III, aVF, and Vare magnified to show the abnormal P wave contour. The patient has chronic obstructive pulmonary disease.

QRS complex : narrow.

PR interval : normal.

P wave : pointed, tall and peaked → characteristic in COPD.

Right atrial enlargment

Abnormal morphology P wave → atrial origin.

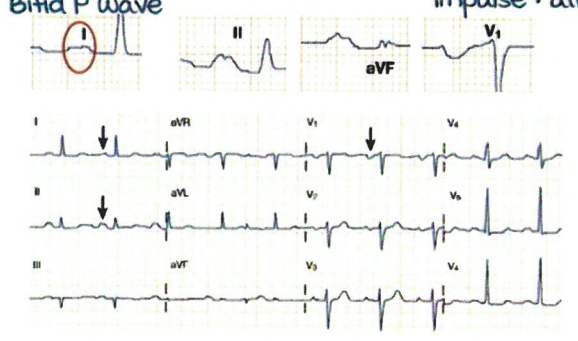
Rate > 100bpm → atrial pathology → atrial tachycardia.

Rate : normal.

Impulse : atria

Bifid P wave

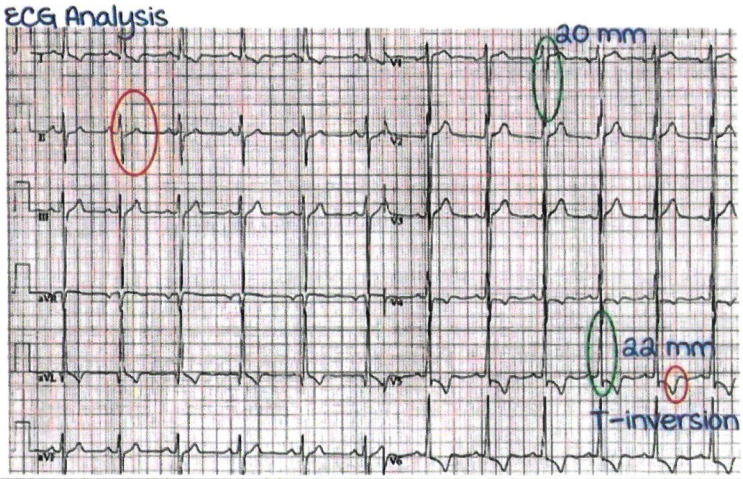
Left Atrial Enlargement



The P waves are wide in leads I, II, III, and aVF as well as several other leads. The configuration of the P wave is M-shaped (P-mitrale). The P wave is negative in V1. The negative deflection measures at least 1 x 1 (1 mm wide and 1 mm deep).

Things to look for in an ECG in a stepwise manner		
1.	QRS Complex	
2.	Origin of QRS complex	P wave
		PR interval
3.	Rhythm	
4.	Regularity	
5.	Rate	
6.	Axis	
7.	QT interval Corrected QT interval $QT_c = \frac{QT}{\sqrt{RR}}$	

ECG Analysis



1.	QRS Complex	Narrow	
2.	Origin of QRS complex	P wave	Normal
		PR interval	Normal
3.	Rhythm	Sinus rhythm	
4.	Regularity	21 small boxes b/w 2 QRS complex → Regular.	
5.	Rate		
	1500/21 = 70 bpm → Normal		
6.	Axis		
	QRS complex with max. height Lead I (17 boxes) and aVL (23 boxes). Axis lies b/w lead I and aVL → 0° to -30° → Leftward axis.		

Leftward axis

Rule out :

LVH : more muscle mass on left → vector pushed to left.

Left side leads → stronger positive deflection.

Right side leads → stronger negative deflection.

LBBB : QRS prolongation (0.12-0.165 sec).

On ECG → LVH → Sokolow Lyon index.

Sokolow Lyon index :

{(V5 or V6) r wave + (V1 or V2) s wave} > 35 mm → LVH.

22 mm + 20 mm = 42 mm > 35 mm → LVH.

OR

aVL > 11 mm → LVH.

LBBB → QRS complex → normal → Not present.

In a leftward axis ECG with LVH → 2° ST/T changes → Pressure overload LVH.

Symmetrical T inversion.

Profound ST depression.

Ischemia related ST changes

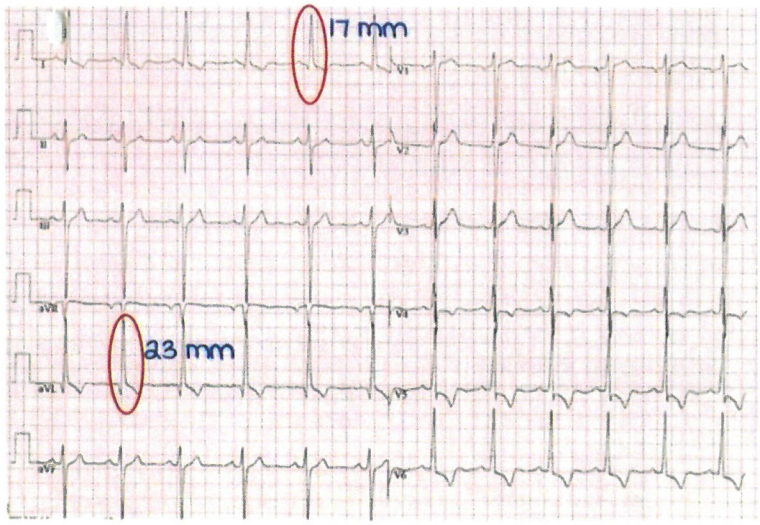
2° ST changes

LVH with strain pattern : ST depression seen only in leads showing LVH.

Inference of ECG : LVH + Strain + Leftward axis.

Causes : (elderly)

- Long standing HTN.
- Aortic stenosis.



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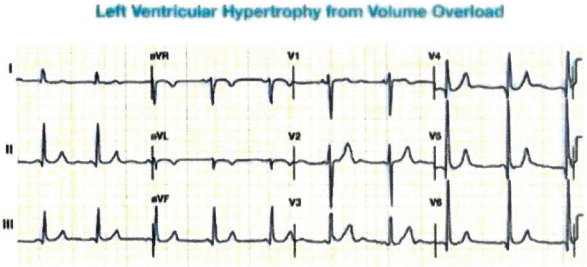
3.	Rhythm	Sinus rhythm	
4.	Regularity	Regular.	
5.	Rate		
	1500/21 = 70 bpm → Normal		
6.	Axis		
	QRS complex with max. height Lead I (17 boxes) and aVL (23 boxes). Axis lies b/w lead I and aVL → 0° to -30° → Leftward axis.		

20 mm + 20 mm = 40 mm > 35 mm → LVH.

Inference of ECG : LVH + Strain + Leftward axis.

Eccentric LVH → volume overload → Cardiomegaly. Normal axis LVH.



Twelve-lead electrocardiogram (ECG) showing tall voltage measuring >45 mm in V, and >25 mm in V, combined with prominent Q waves and tallT waves. This pattern of LVH is usually due to volume overload. This ECG is from a 55-year-old man with sickle cell anemia with gross cardiomegaly by chest x-ray.

QRS Complex, P wave, PR intereval, Rate, Rhythm, Regularity : all normal.

Axis : Lead 2 : 18mm and aVF : 15mm → b/w lead 2 and aVF → Normal axis → 60°-90°.

15 mm + 25 mm = 40 mm > 35 mm → LVH.

ECG : Eccentric LVH with normal axis.

RVH and RBBB

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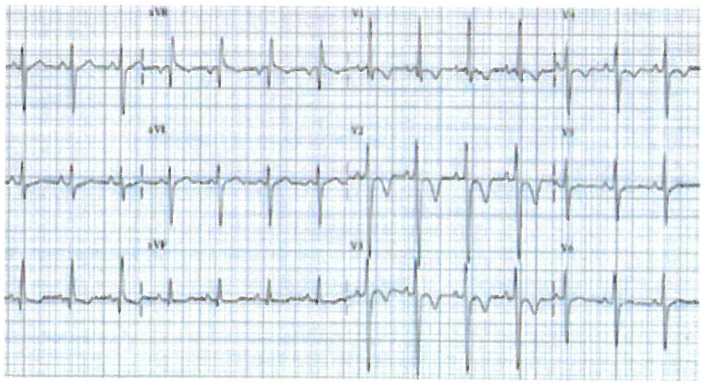


Right Ventricular Hypertrophy. There is right axis deviation, the QRS complexes are tall in V, and P waves are peaked in II and aVF. This pattern of right ventricular hypertrophy is described as type A and is frequently seen in severe right ventricular hypertrophy often associated with congenital heart disease or severe mitral stenosis.

QRS Complex, P wave, PR intereval, Rate, Rhythm, Regularity : all normal.

Axis : Lead 3 and aVF → 90°-120° → rightward axis.

If lead 3 has max. height → rightward axis.

Rightward axis :

- RVH.

  V1 : R/S ratio > 1.

  2° ST changes could be because of MS RVH strain pattern. √

- RBBB : not present.

Chronic Obstructive Pulmonary Disease

In chronic obstructive pulmonary disease, the heart is vertically oriented because of the hyperinflated lungs pushing the diaphragm downward. This causes the P, QRS, and T deflections to be oriented vertically toward 90° resulting in the so called "lead I sign, "where all the deflections in lead I become conspicuous by their diminutive appearance. This could also occur in V, because V, is also perpendicular in relation to lead aVF. In addition, the heart is rotated clockwise with peak P-pulmonale in II, II, and aVF. These changes are consistent with type CRVH

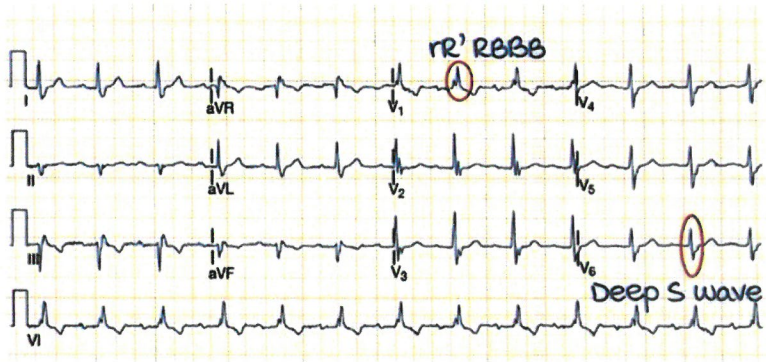
p pulmonale : seen clasiccaly in lead 2, lead 3, lead aVF.

Hyperinflated lung → pushes diaphragm down → axis shifted to 90° → prominent complexes seen in aVF and lead I → absence of complexes seen → lead I sign.

Signs of COPD :

- QRS complex : narrow.
- P wave : p pulmonale.
- Lead I : lead I sign.
- V1 to V6 : poor R wave progression.

RVH with RBBB



- Axis : b/w lead I and lead aVL → leftward axis.
- V1 : R/S ratio > 1.
- RVH + RBBB with leftward axis : biventricular hypertrophy/bifascicular block (Left fascicular block).

RBBB : unifascicular block.

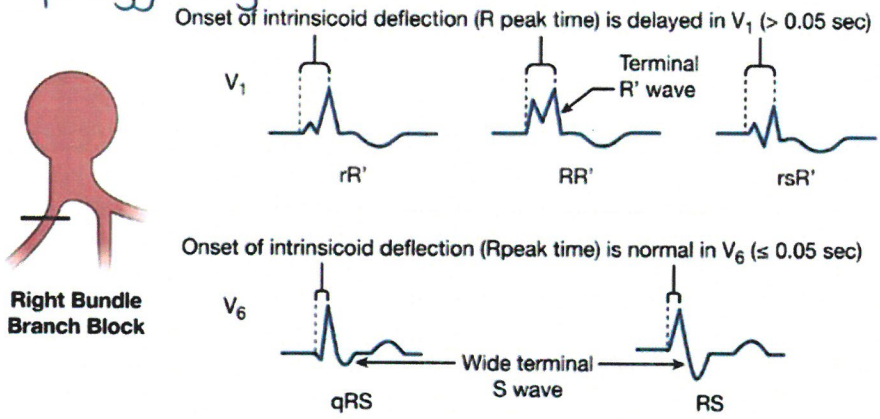
RBBB + LAFB/LPFB : bifascicular block.

LBBB : bifascicular block.

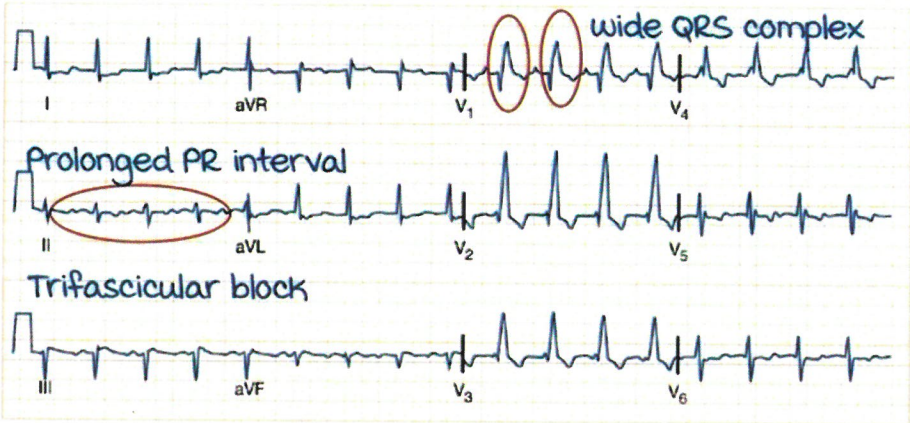
Right Bundle Branch Block

- Wide QRS complexes measuring ≥ 0.12 second.
- **V_1**
  - Large terminal R' waves with rR' or rsR' configuration.
  - Onset of intrinsicoid deflection (R peak time) > 0.05 sec.
- **V_6 and leads on left side of ventricular septum (I and aVL):**
  - Wide terminal S waves are present.
  - Septal q waves are preserved.

morphology change



Right ventricular hypertrophy with RBBB (bifascicular block)



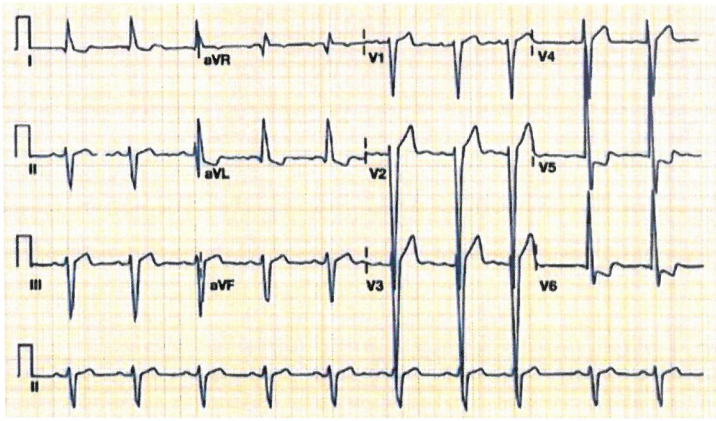
- QRS complex : wide.
- V1 : R/S ratio > 1.

Hence RVH + RBBB.

- Axis b/w aVR and aVL : Leftward axis.

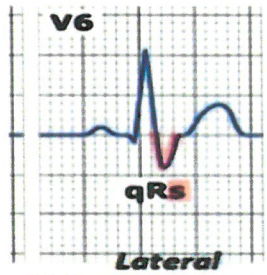
Hence : bifascicular block (PG level : Trifascicular block).

LVH with strain



- Axis : b/w lead I and aVL → leftward axis.
- LVH : 35 mm + 30 mm > 35 mm.
- 2° ST/T changes present.

ECG : LVH with strain.



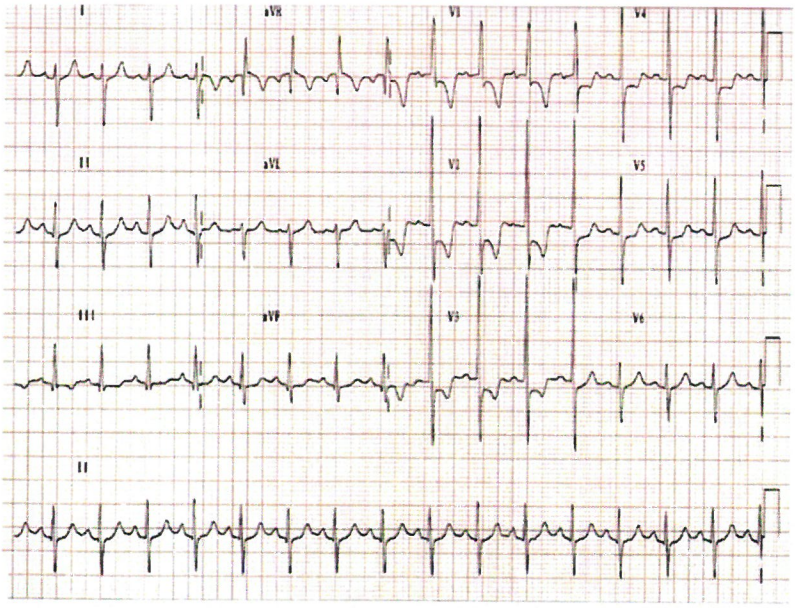
RBBB morphology

Axis : b/w lead I and aVL leftward axis.

LVH :

- Sokolow Lyon index : normal.
- aVL > 11mm LVH present.

ECG : LVH with leftward axis and minimal strain.



Looks like MI due to ST changes : Trop to rule out.

BUT, aVR and lead 3 → max. height

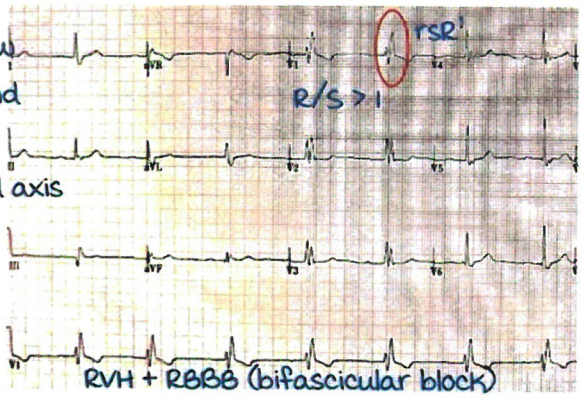
aVL and lead I very negative → axis away from them.

Hence right ward axis with RVH.

ST changes could be strain also → trop to rule out MI.

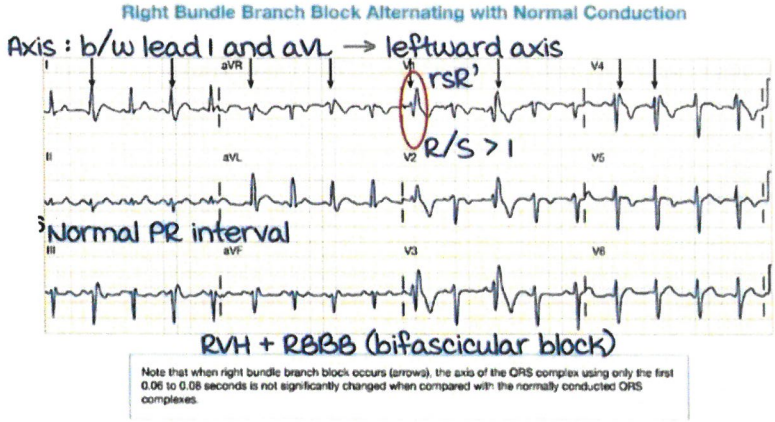
P pulmonale Type C RVH

Axis : b/w lead I and aVL → leftward axis

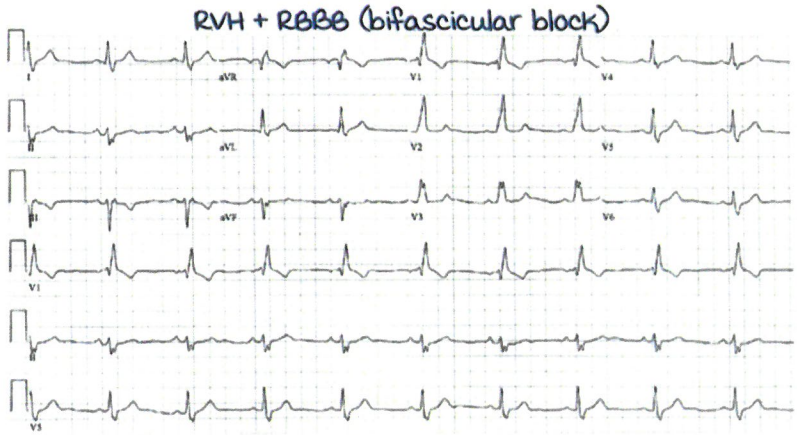


Active space

Bifascicular block + PR interval prolongation/mobitz → Trifascicular block.



RVH + RBBB (bifascicular block)



Electrocardiogram of a 59-year-old man showing a bifascicular block (consisting of a right bundle branch block and a left anterior fascicular block). Ventricular rate is 58 bpm, PR-interval 158 ms, QRS-duration 158 ms, QTc 438 ms, R-axis -45°.

LBBB and MI

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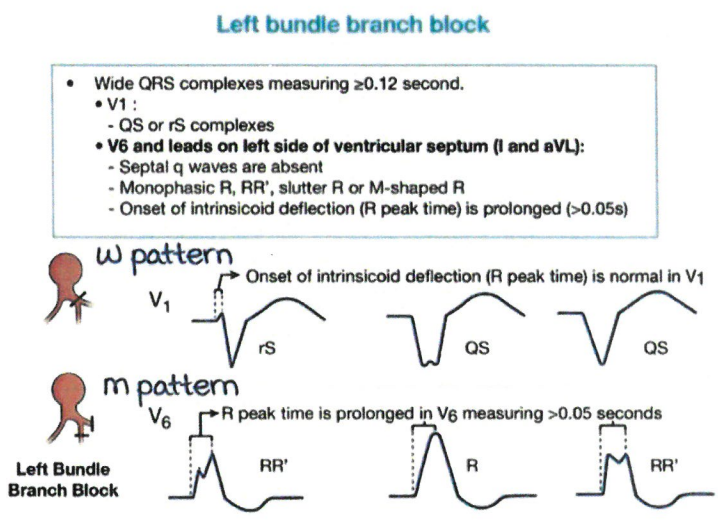
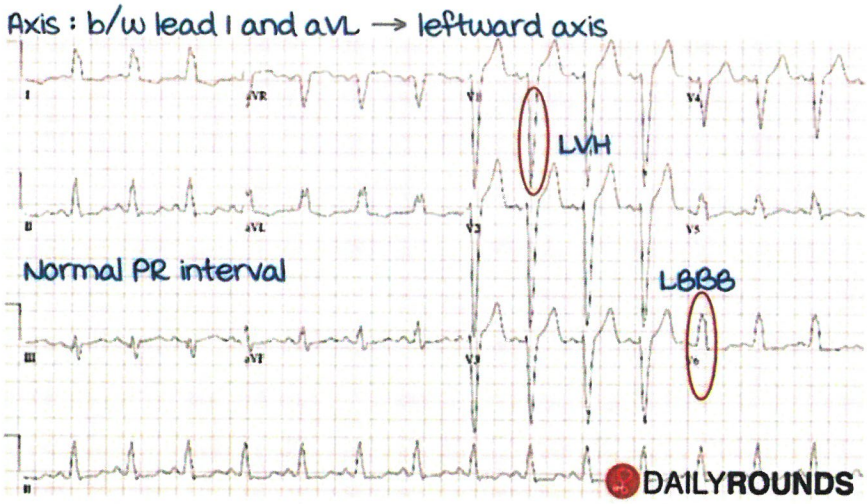
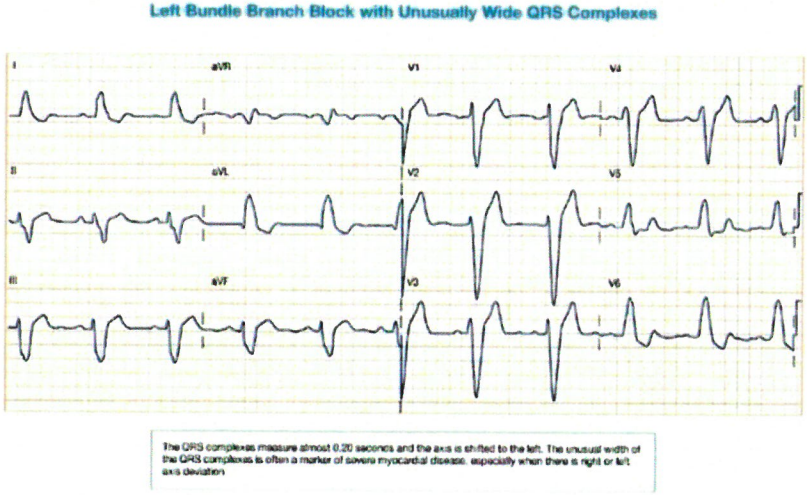
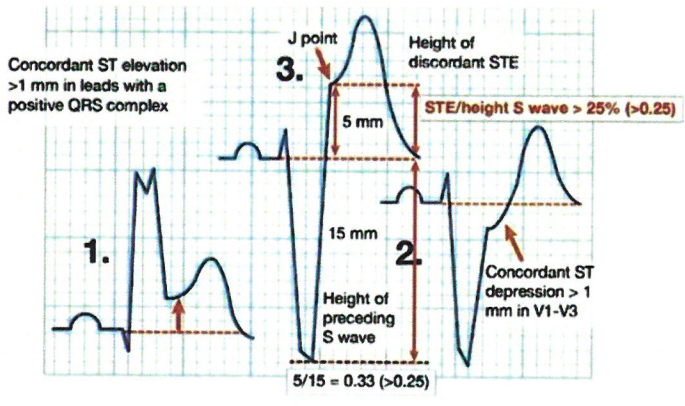


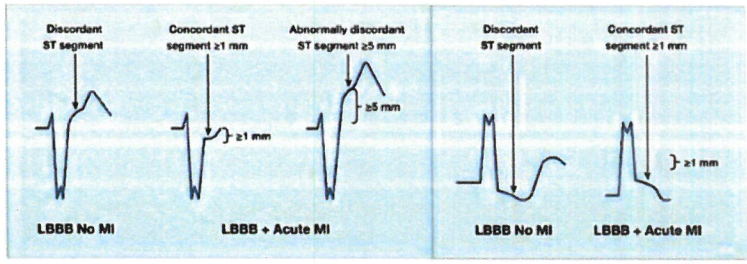


LVH with LBBB (bifascicular block) with leftward axis

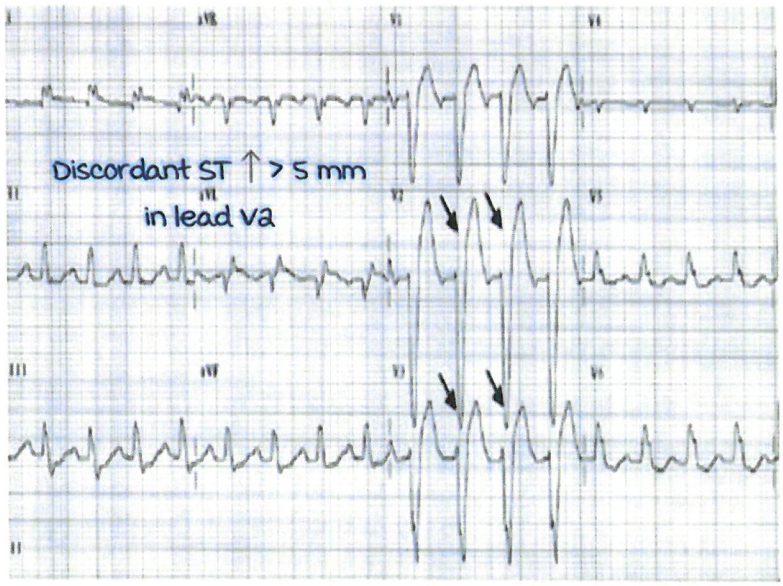




Acute myocardial infarction (MI) and left bundle branch block

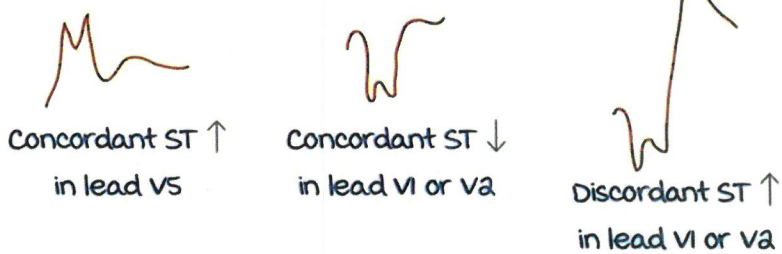


When there is complete LBBB, the presence of concordant ST segment deviation 2 mm **(A,B)** and discordant ST elevation 25 mm **(A)** are consistent with acute MI when accompanied by symptoms of acute ischemia.



Acute Myocardial Infarction (MI) and Left Bundle Branch Block (LBBB). LBBB is present with discordant ST segment elevation >5 mm in V1 and in V2 (arrows), which in the presence of symptoms chest pain indicate acute MI.

To rule out MI in LBBB : modified Sgarbossa's criteria		
1.	In leads V1 or V2	Concordant change : ST ↓ ≥ 1 mm
		Discordant change : ST ↑ ≥ 5 mm
2.	In leads V5 or V6	Concordant change : ST ↑ ≥ 1 mm

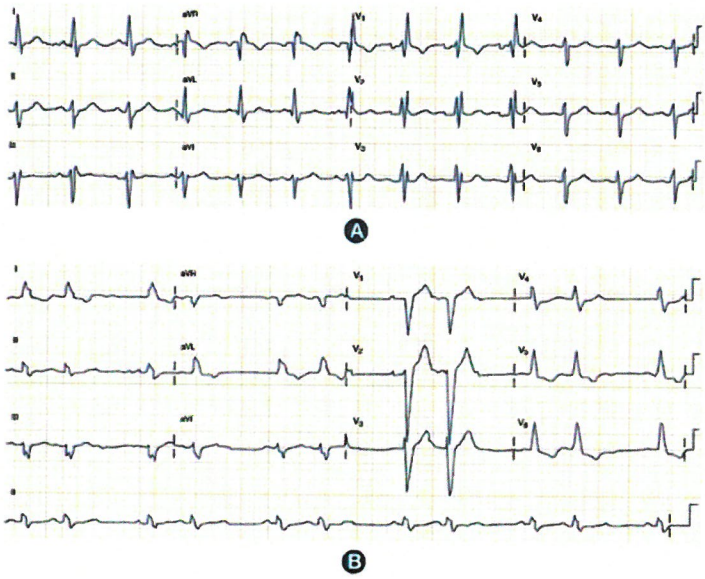


Concordant ST ↑

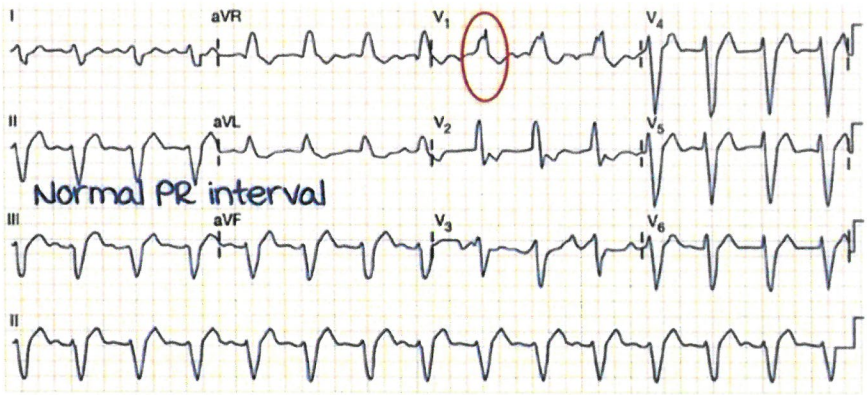
> 1 mm in lead V5

Acute myocardial infarction (MI) and Left Bundle Branch Block (LBBB). LBBB is present with wide QRS complexes measuring >0.12 seconds. Concordant ST segment elevation www.my >1 mm is present in leads with tall R waves including V5 V6 and leads I, MI, and aVF (arrows) consistent with.

Bilateral Bundle Branch Block



Electrocardiogram (ECG) **A** and ECG **B** are from the same patient taken 6 months apart. **(A)** Right bundle branch block (RBBB) with left anterior fascicular block. **(B)** Left bundle branch block (LBBB) with type II second-degree AV block. The presence of RBBB and LBBB in the same patient suggests bilateral bundle branch block. **(B)** also shows Mobitz type II second-degree AV block. Mobitz type II



RBBB with leftward axis and trifascicular block

1.	QRS Complex	Narrow	
2.	Origin of QRS complex	P wave	Normal
		PR interval	Normal
3.	Rhythm	Sinus rhythm	
4.	Regularity	Regular.	
5.	Rate		
	1500/21 = 70 bpm → Normal		
6.	Axis		0° - 90° : normal axis
7.	QT interval		
8.	V1 lead : R/S ratio		
9.	Complexes wide : rule out bundle branch morphology		
10.	M pattern in V1 and W pattern in V5 or V6 to rule out LBBB		
11.	RBBB → check axis → lefteward → bifascicular block → check PR interval → prolonged → trifascicular block.		
12.	Apply Sgarbossa's criteria in LBBB to rule out MI.		

AV blocks

Types of AV block :

- First degree.
- Second degree.
- Third degree.

First degree AV block

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Regular sinus rythm : Every P wave should be followed by a QRS complex (every atrial depolarization is to be followed by ventricular depolarization).

In first degree AV block, there is a delay in this conduction represented by prolongation of PR interval.

Usually asymptomatic.

Good prognosis.

Identifying features :

Rhythm : Regular.

Rate : Normal, atrial & ventricular rate are same.

P wave : Normal sinus.

PR : Prolonged, greater than 100 ms.

QRS : Normal (100 ms or less).

Soft S1 can be seen.