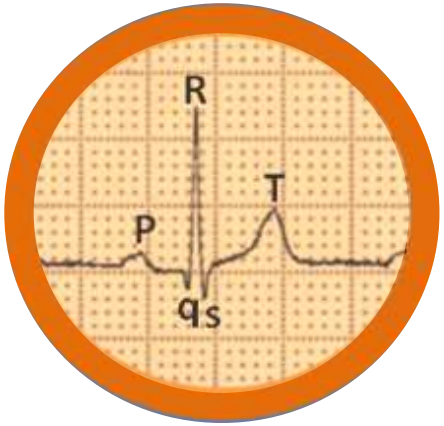

A MINI ATLAS ON BUNDLE BRANCH BLOCK

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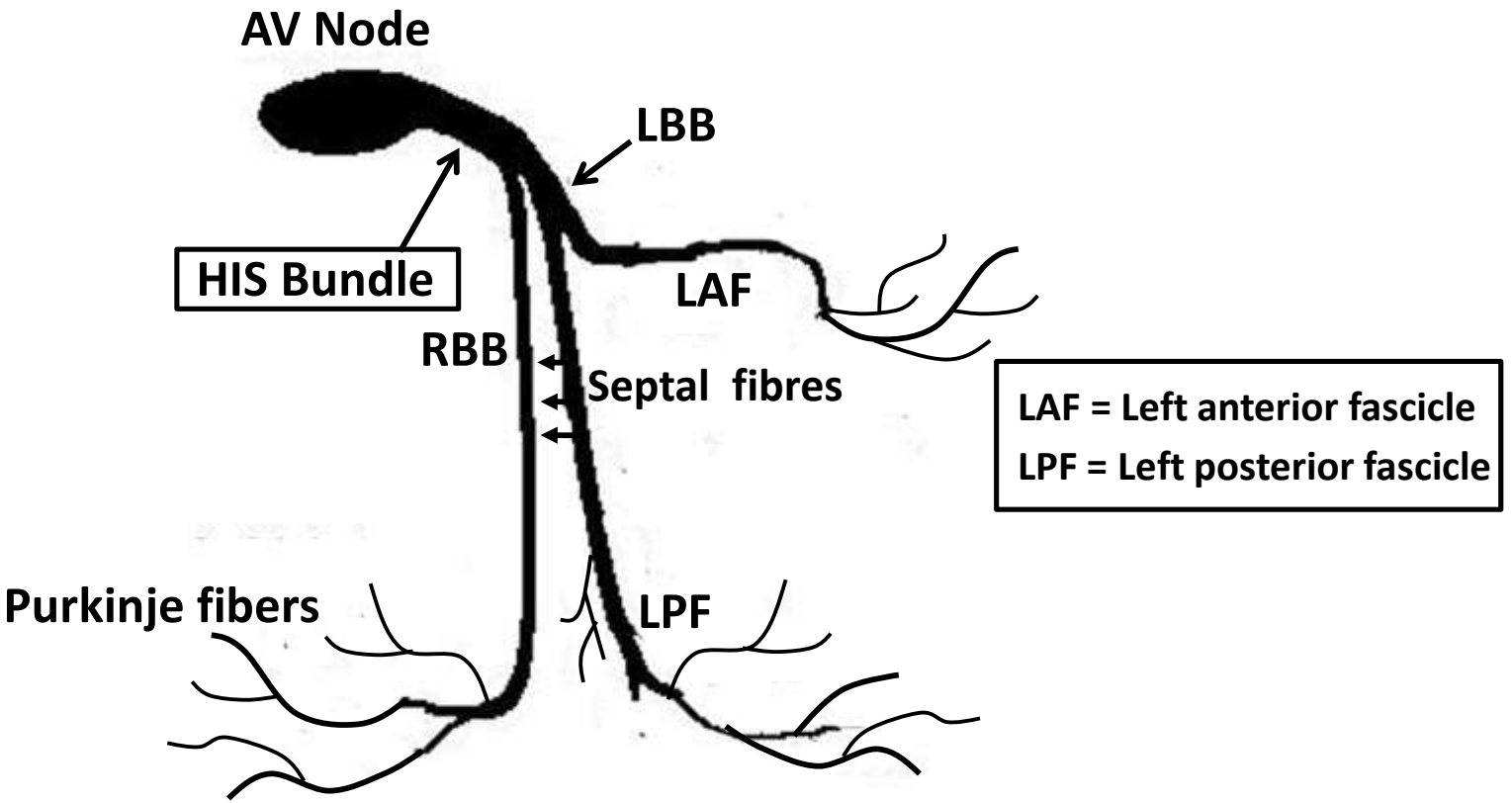
Index (contd.)

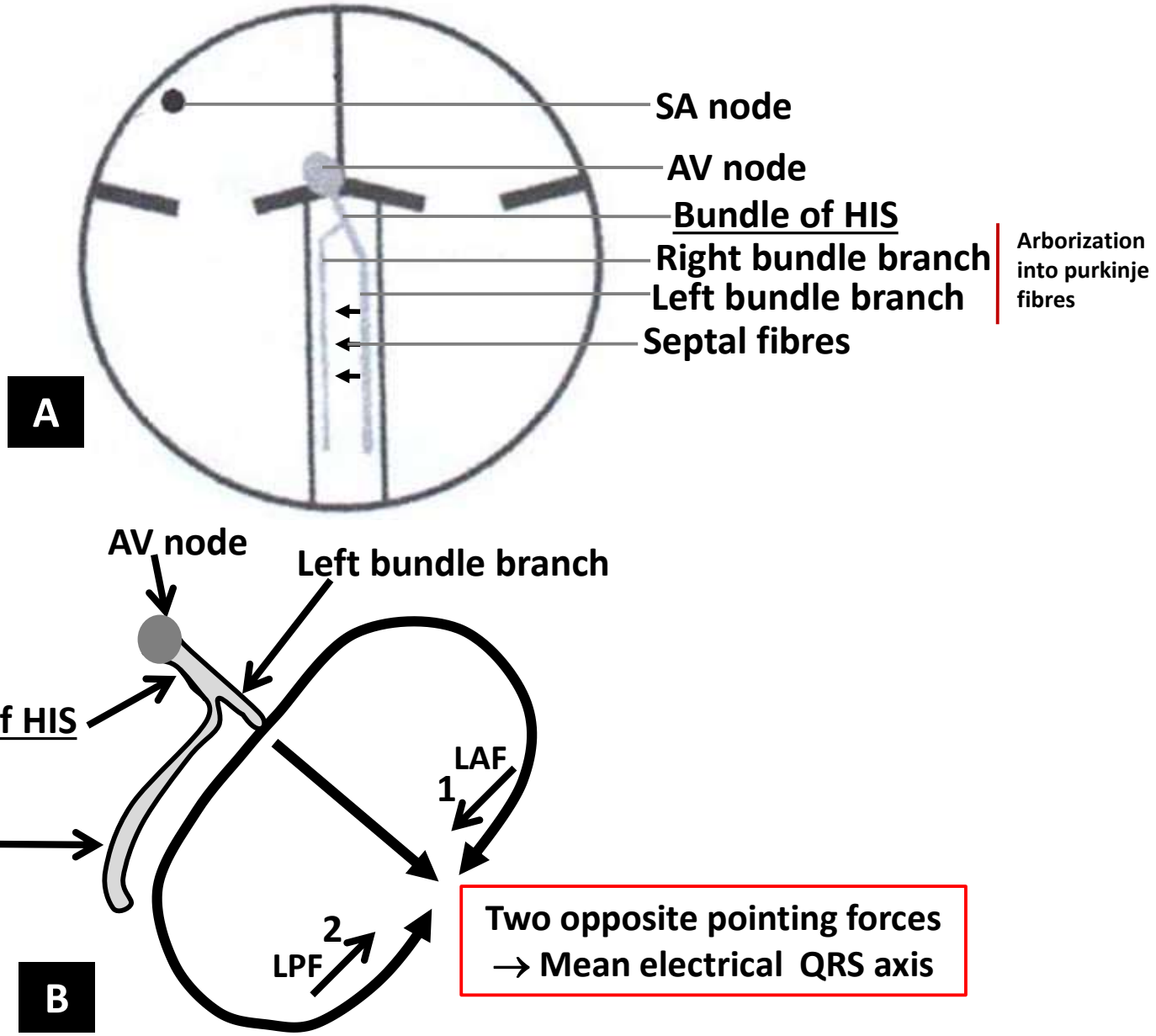
INTRODUCTION

1 Intraventricular Conduction defect

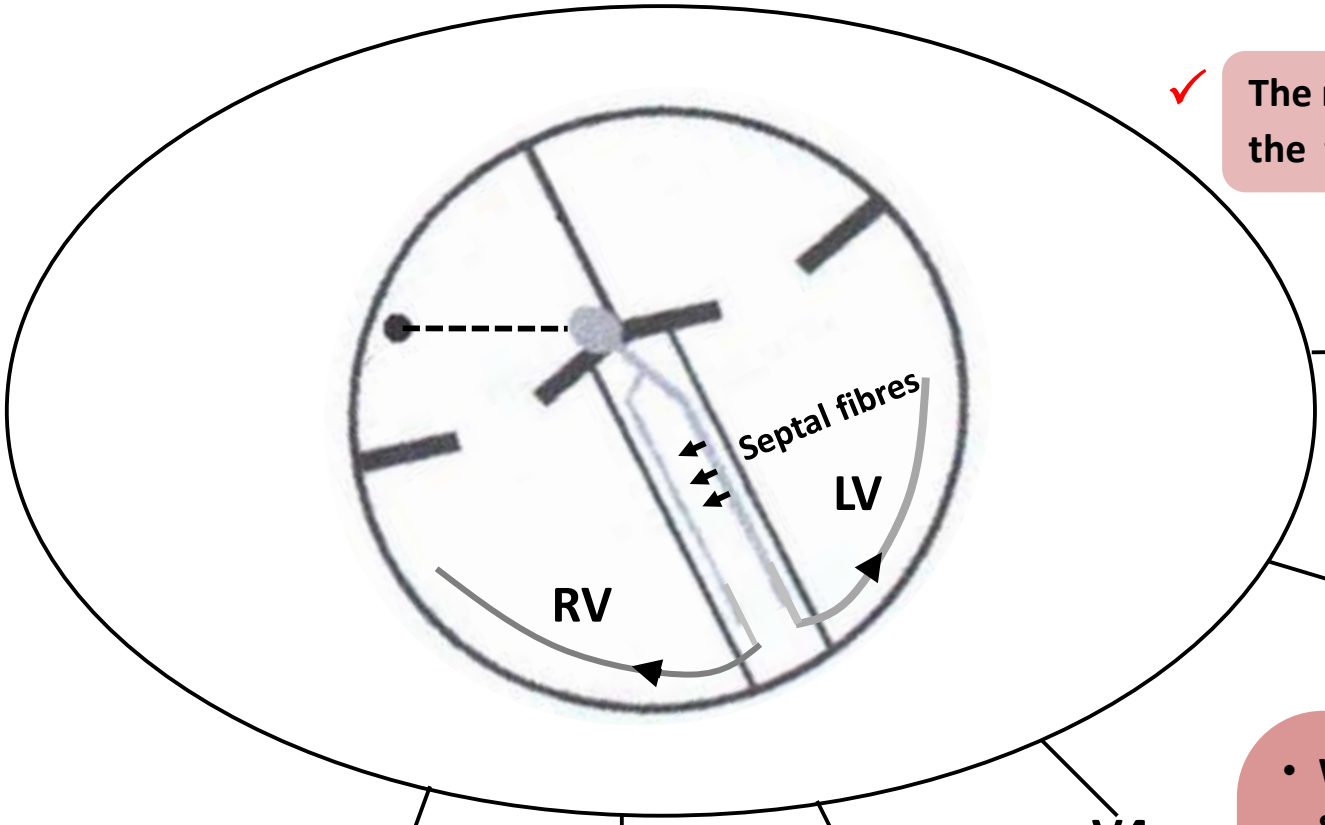
An abnormality of conduction (delay / block) through one or more divisions of the intraventricular conduction system distal to the bundle of HIS is called an Intraventricular conduction defect.



2 A sketch to illustrate intraventricular conduction



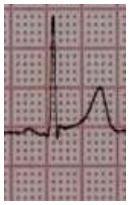
3 Electrical flow through chest leads



✓ The main flow of current towards the thicker left ventricle -

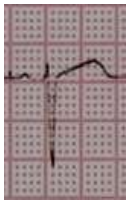
V6

V5



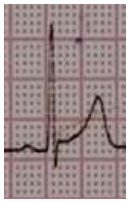
V1

V2



V3

V4

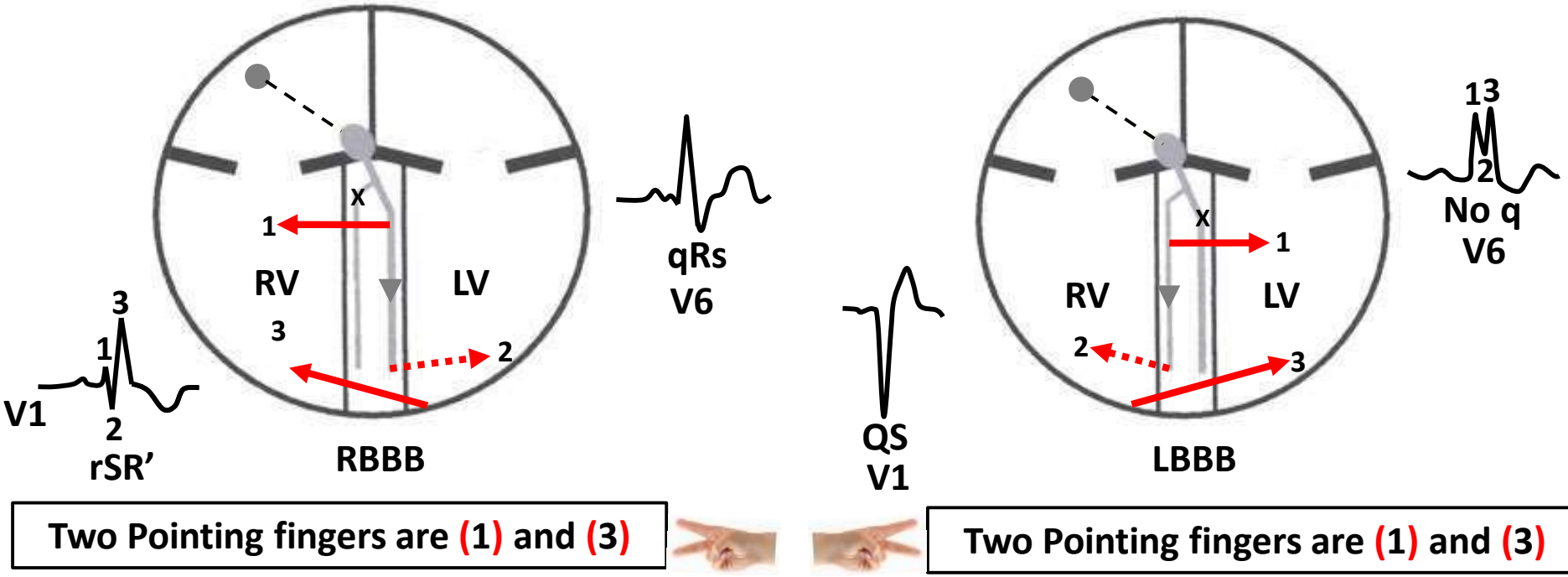


Transitional zone

- Waves morphology as per sequential activation of the Ventricles from V1 to V6.
- ✓ Positive deflection towards the flow of current , equiphasic or no deflection at transitional zone and –ve deflection when away from the flow of current.

BUNDLE BRANCH BLOCK :
TWO FINGERS POINTING APPROACH

4 Bundle branch block : two fingers pointing approach



Two Pointing fingers are (1) and (3)

Two Pointing fingers are (1) and (3)

Fundamentals :

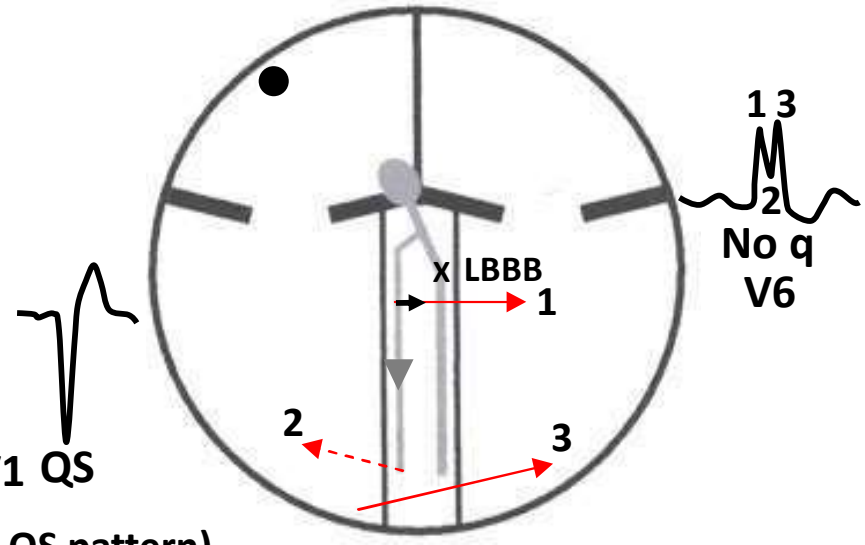
- ❑ Ventricular activation having bundle branch pathway blocked on the corresponding site : Septal depolarization from the opposite side (as shown by the flow 1) and depolarization through myocardial connecting link from the opposite ventricle (as shown by the flow 3)

✓❑ Positive deflection towards the flow of current and negative deflection when away from the flow of current.

LEFT BUNDLE BRANCH BLOCK

Electrophysiology of LBBB

- With the blockade of Left bundle branch (LBBB) , the entire sequence of depolarization is reversed – the upper part of the left interventricular septum gets depolarized in the reverse manner from right to left , and then the subsequent activation of the left ventricle via the right ventricle.



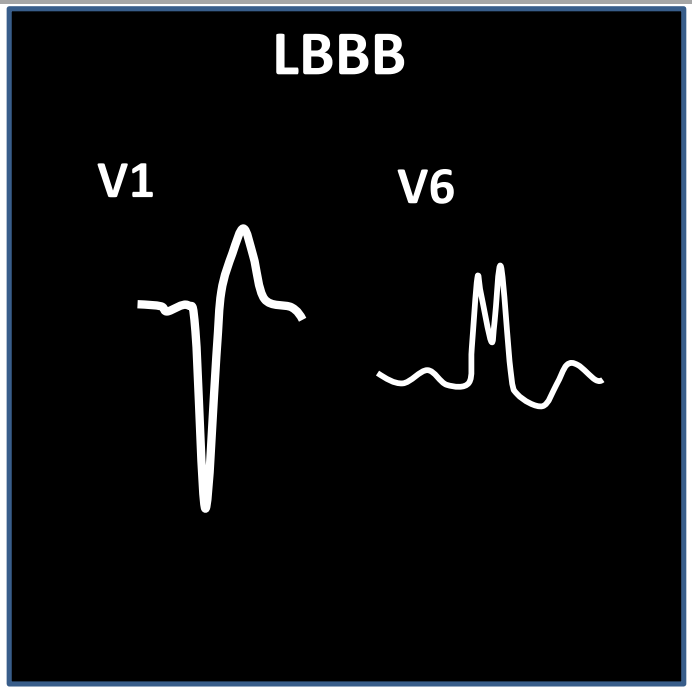
Two Pointing fingers are (1) and (3)

Sequence : Left ventricular activation through both the routes : septal depolarization from right to the left ventricle (1) and through myocardial connecting link in between Right ventricle and left ventricle (3) leading to slurred / bifid R.

The left ventricle is still electrically predominant with LBBB and therefore , produces grater voltages than the right ventricle

At a glance ECG changes in LBBB

- In LBBB , the left ventricle still electrically predominates →
  - (i) The septal depolarization from right to left produces first initial positive deflection over the lateral leads I aVL V5-6 inscribing the initial part of the tall R.
  - (ii) The subsequent activation of the LV produces the next upright part – "M-shaped" notched /slurred monophasic complex



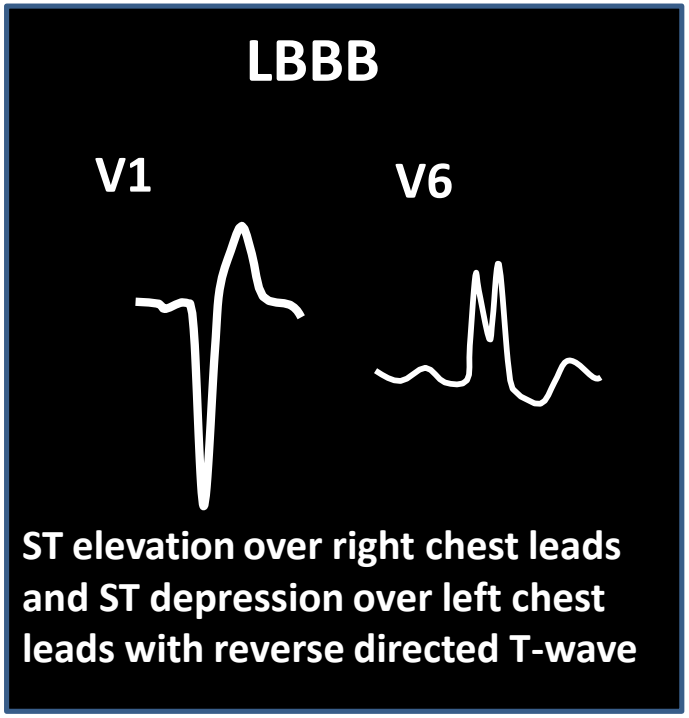
- Absence of septal depolarization from LBB side (absence of q wave in left lateral leads / r wave in right ventricular leads , mainly V1)
- Appropriate discordance of ST segment – ST elevation over right chest leads and ST depression over left-sided chest leads with reverse directed T-wave.
- Poor R wave progression (no transition zone)
- Prolonged R wave peak > 60 ms in left ventricle
  Leftward axis

Phenomenon of discordance

❑ Basis

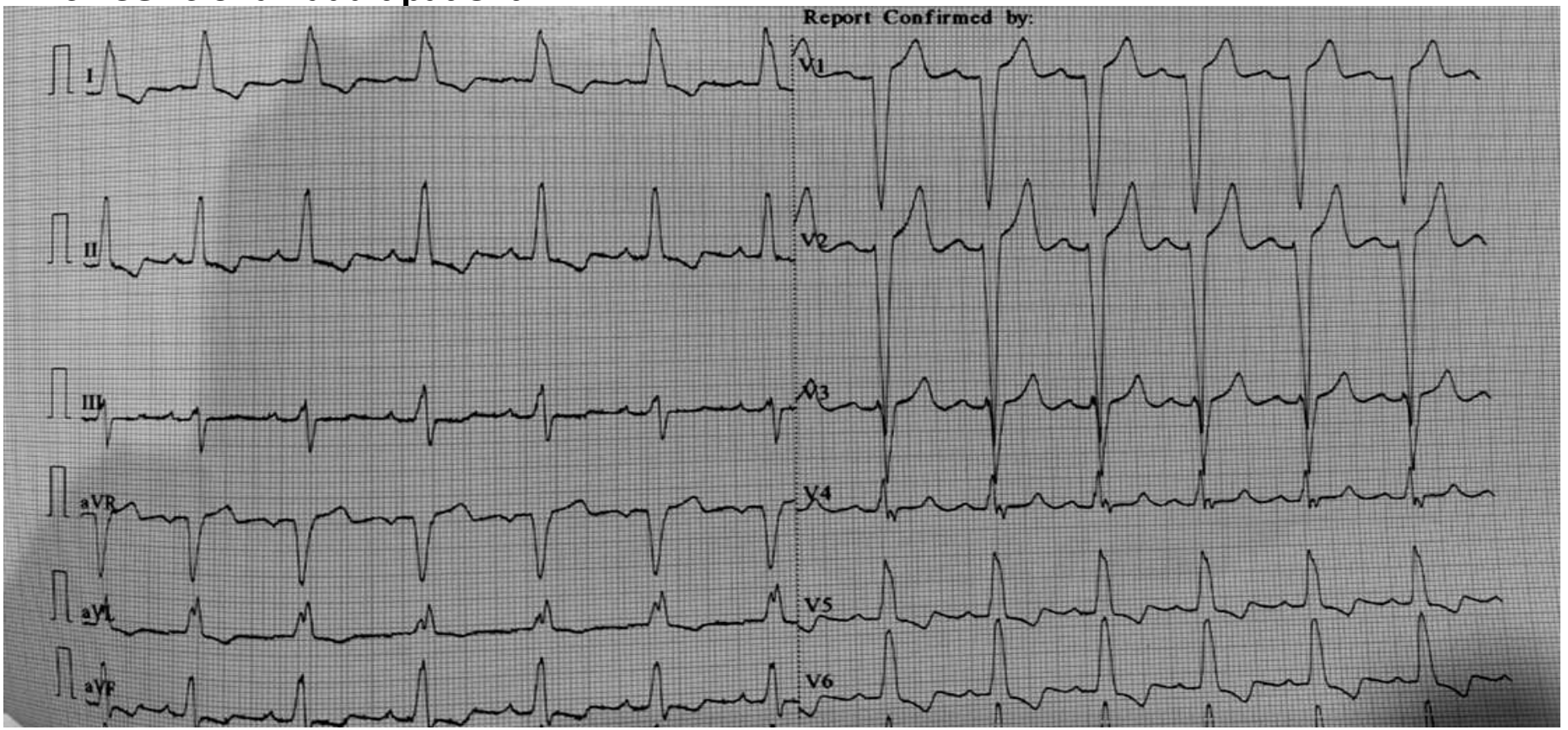
- Abnormal depolarization of LV directly through myocardial fibers →↑width ≥0.12 sec – complete LBBB (if QRS duration <0.12 sec, it is known as incomplete LBBB)
- Abnormal reversed repolarization

ST segment and T-wave are discordant to the preceding QRS complex



ECG Changes in LBBB

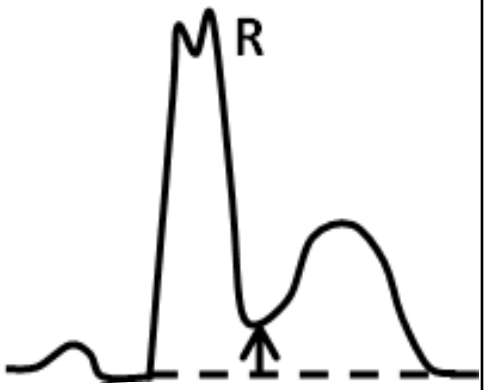
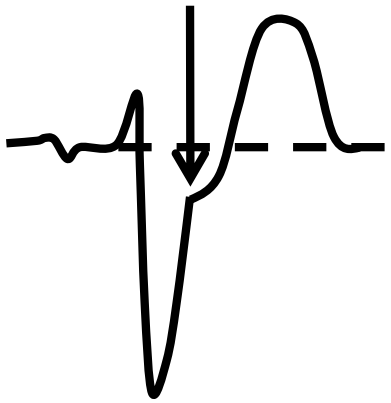
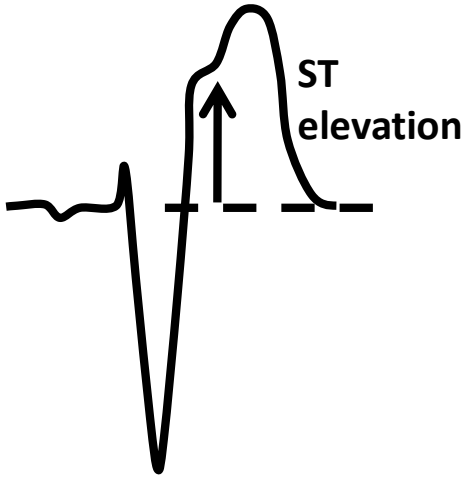
This ECG is of an adult patient



See the evidence of LBBB :

- **Slurred / notched R wave over left lateral leads I , aVL , V5-6 with the absence of setpal wave – q in left lateral leads and r in right ventricular leads , mainly V1**
- **Poor R wave progression (see in V3)**
- **QRS duration ≥ 120 ms**
- **ST and T discordance changes in association**

9 MI in the presence of LBBB (Sgarbossa criteria)

Changes during repolarization	1. Concordant ST elevation ≥1mm in leads with a positive QRS complex **Sgarbossa criteria** Score 5.	**2**. Concordant ST depression ≥1 mm in V1-V3 with negative QRS complex **Sgarbossa criteria** Score 3.	**3. Sgarbossa criteria** Excessively discordant ST elevation>5mm (Score 2) **OR Smith-Modified Sgarbossa criteria** STE ≥ 25% of the depth of the preceding S-wave.
Illustration by concerned sketches	 **Concordant ST elevation**	**Concordant ST depression** 	

- **A total score of ≥3 is reported to have a specificity of 90% to diagnose a case of MI**
- **OR the presence of Smith Modified Sgarbossa criteria itself**

LBBB with left ventricular hypertrophy

- Incident left LBBB predicts more cardiovascular events and death in hypertensive patients with LVH.
- Hypertensive patients with CLBBB are usually older and have the disease of longer duration.

It is difficult to comment LVH in the presence of left bundle branch block

- The Sokolow-Lyon criteria have a specificity of 88% for the diagnosis of 'Duo evidence of LBBB with LVH'. RaVL criteria is also having good specificity.
- ECG evidence of LAE (i.e. wide notched P-wave in lead II , deep negative component to the P-wave in lead V1)

Clinical significance of LBBB

LBBB is usually a marker of organic heart disease

- ❑ **LBBB may point towards the diagnosis of :**
  - **Advanced coronary artery disease , often correlates with impaired left ventricular dysfunction**
  - **Long-standing hypertension**
  - **Valvular heart disease (mitral and /or aortic)**
  - **Cardiomyopathy**
  - **Degenerated changes in the conducting system particularly in elderly**
  - **Injury or inflammation due to cardiac surgery or transcutaneous aortic valve replacement (TAVR)**

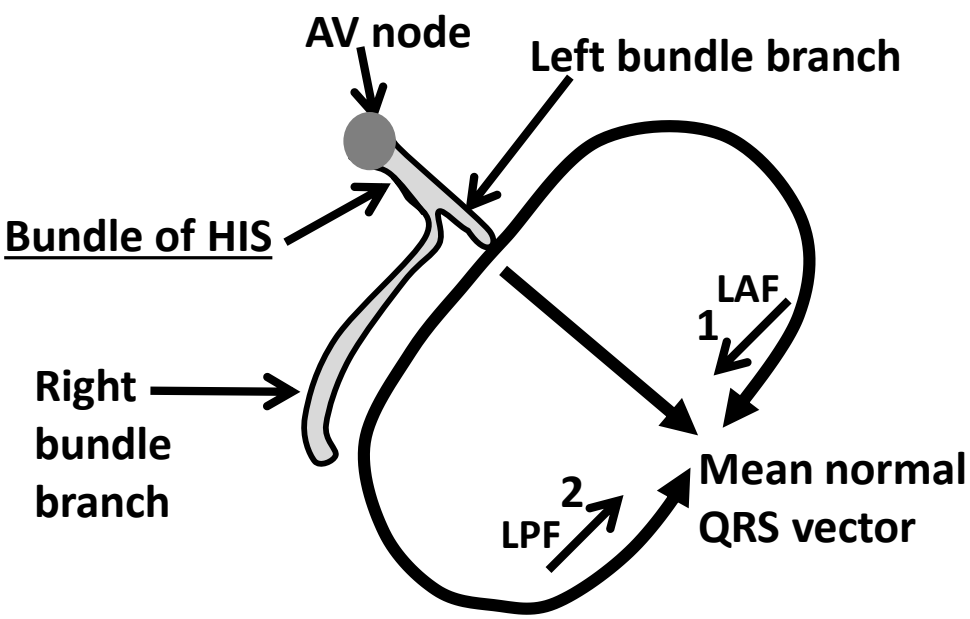
- ❑ **Septal dyssynchrony due to abnormal ventricular activation pattern**
- ❑ **Heart rate dependent LBBB (mostly acceleration dependent , much less commonly deceleration dependent)**
- ❑ **SVT with aberrancy (LBBB)**

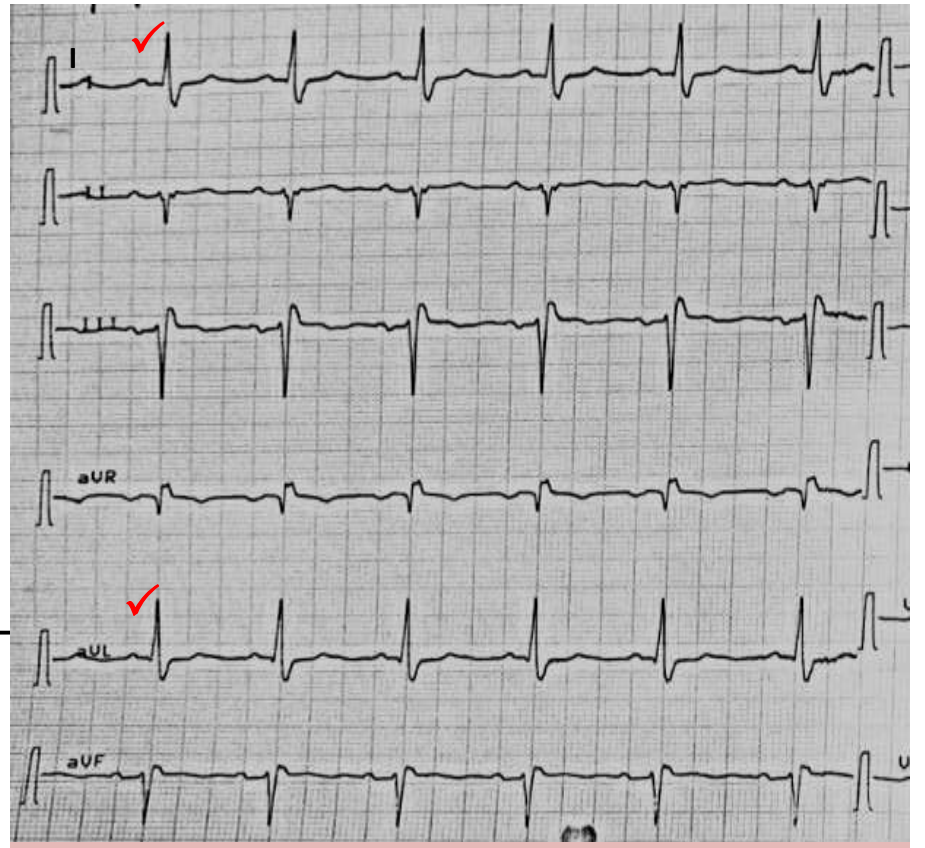
LBBB in association with

- **LBBB with AV conduction delay/block**
  First degree AV block and other grades of AV block can occurs concomitantly with LBBB , specially with hypertension and ischemic heart disease.
- **Bifasicular block : RBBB + LAFB or LPFB**
- **Trifascicular block : First degree AV block + RBBB+ LAFB**
- **Intermittent left bundle branch block**
  This pattern can uncommonly be seen with aberrantly conducted supraventricular impulses.
- **Alternating right and left bundle branch block (intermittent bilateral bundle branch block)**
  A typical complete right or left bundle branch block at one time and within a few minutes , hours or days , it would manifest with opposite type of bundle branch block. Though it is of transient nature , but is very ominous sign and predictive of CHB until it is due to some reversible factor such as drug toxicity , myocardial ischemia , etc.

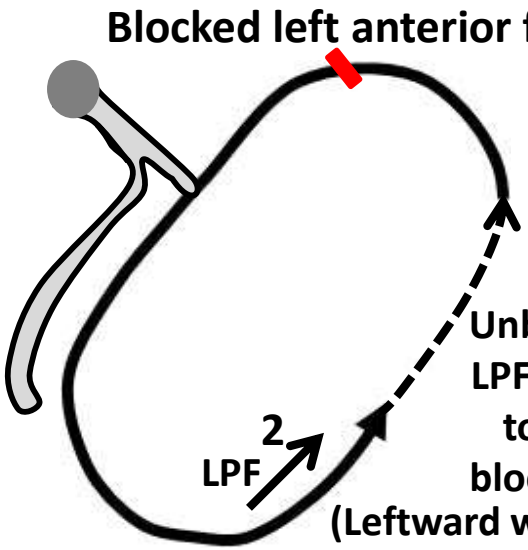
Fascicular block (Hemiblock)

Left anterior fascicular block



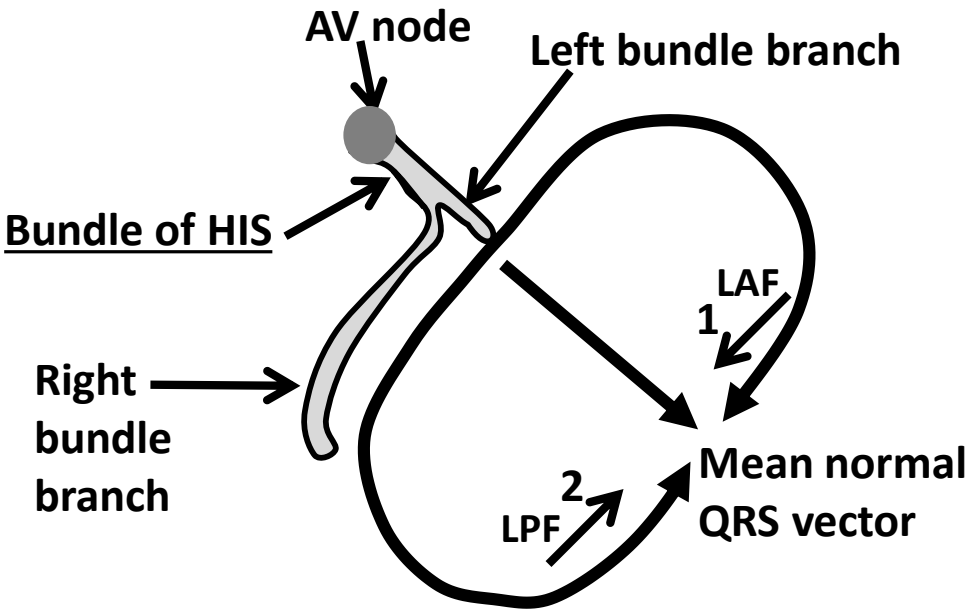


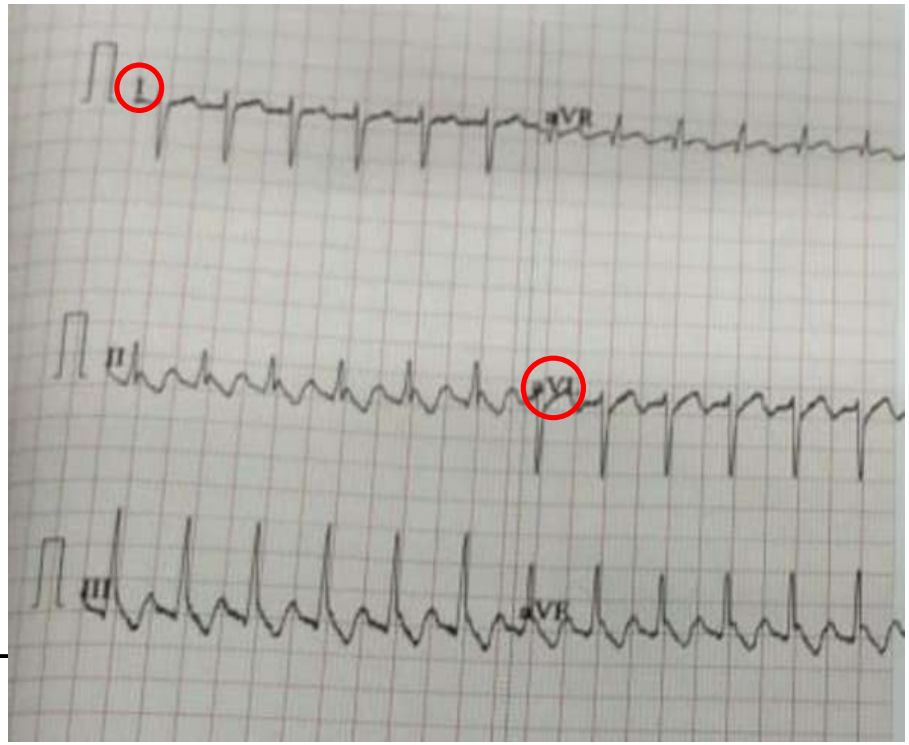
Left anterior fascicular block (LAFB) : late QRS forces point in a leftward and superior direction (negative in II, III , and aVF, and positive in I and aVL)



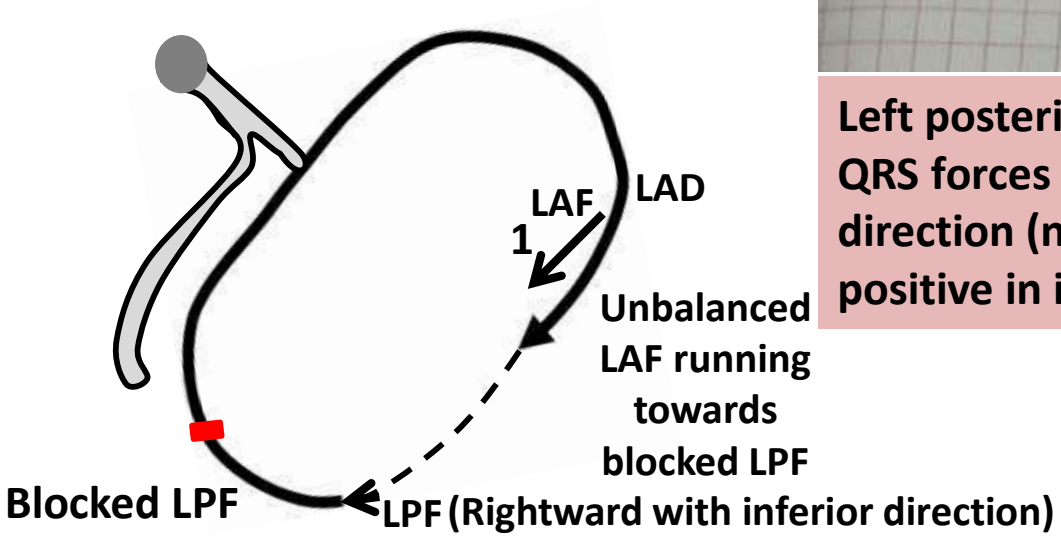
(Leftward with superior direction)

Left posterior fascicular block





Left posterior fascicular block (LPFB) : late QRS forces point in an inferior rightward direction (negative in I and aVL and positive in inferior leads)



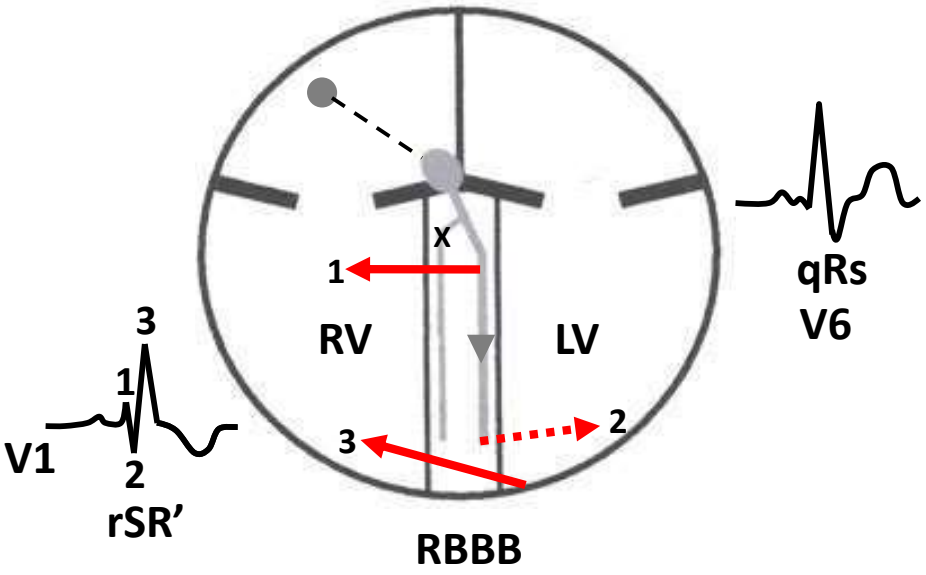
Clinical significance

Left anterior fascicular block	Left posterior fascicular block
❑ With hypertension , aortic valve disease , coronary disease and aging-related degenerative changes. ❑ Sometimes without identifiable cause	❑ Diagnosis only established by the exclusion of causes of RAD : Right-sided pathology – RVH , acute or sustained right ventricular overload due to COPD, other chronic lung disease , acute or pulmonary thromboembolism or other bronchial obstructive disease ❑ Lateral wall infarction ❑ Lead reversal in between two arms (LPFB is extremely rare)

RIGHT BUNDLE BRANCH BLOCK

Electrophysiology of RBBB

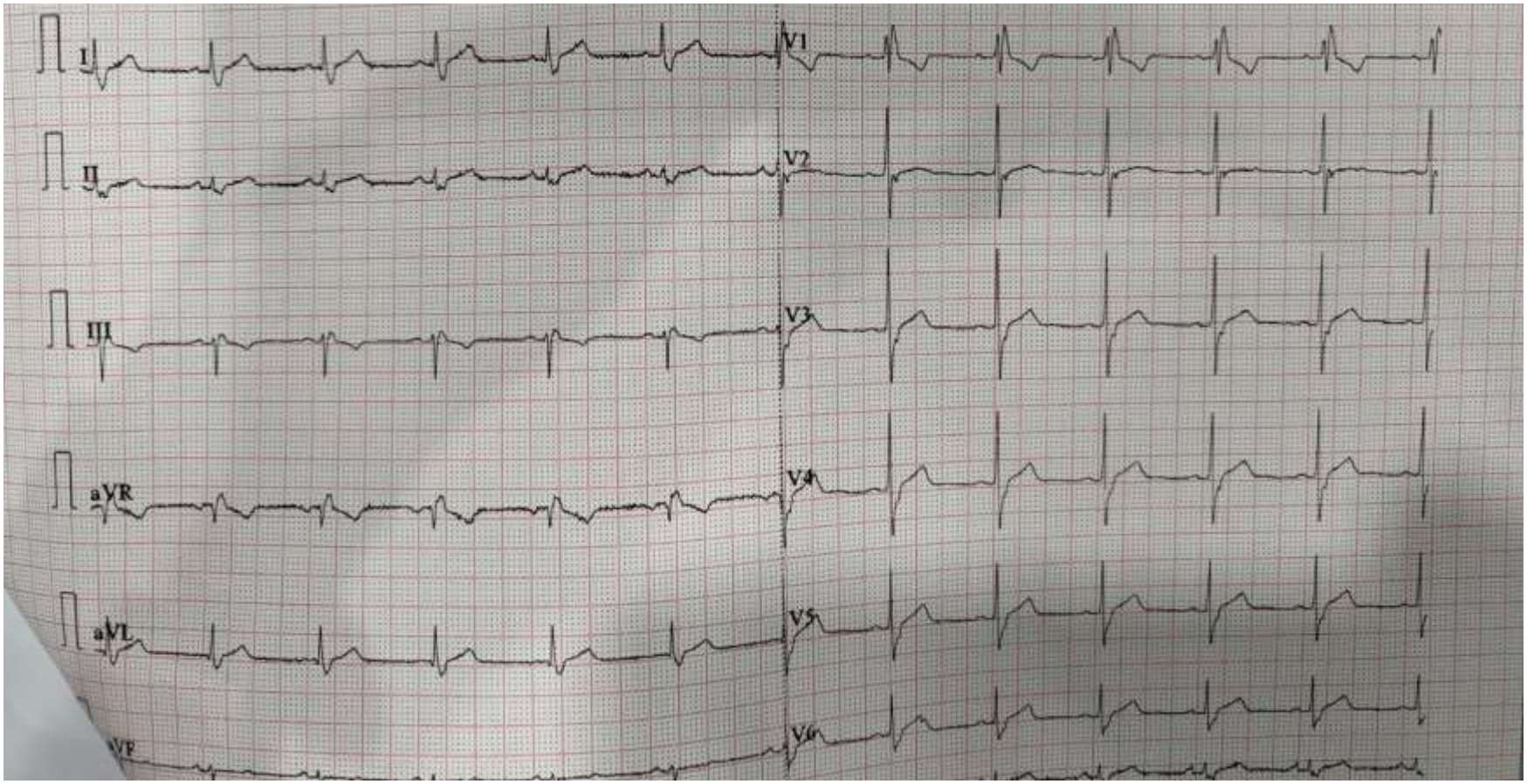
- **With the blockade of Right bundle branch (RBBB) :**
  Septal depolarization from left to right , and then the subsequent activation of the right ventricle via the left ventricle



Two Pointing fingers are (1) and (3)

ECG changes in RBBB

ECG of an adult patient



See the evidence of RBBB :

- **The classical RSR' pattern in V1 with discordant ST / T changes**
- **QRS duration > 0.12 sec (complete RBBB)**
- **Wide , Slurred S-wave in lateral leads (I-aVL-V5-6)**

Clinical significance of RBBB

- Incidental findings without underlying heart disease
- Any condition that affects the right side of the heart :
  ASD , Chronic pulmonary disease with pulmonary hypertension , Pulmonary stenosis , Acute pulmonary embolism
- Cardiomyopathy and CAD
- Chronic degenerative changes of the conduction system mainly in elderly patient
- Post cardiac surgery
- Rate related aberrancy with RBBB pattern
- Chagas disease (Trypanosoma cruzi with severe DCMP and intraventricular conduction defect)
- Pseudo RBBB with Brugada pattern

(A new RBBB is a marker of myocardial damage)

NIVCD

Non-specific or indeterminate intraventricular conduction defect (NIVCD)

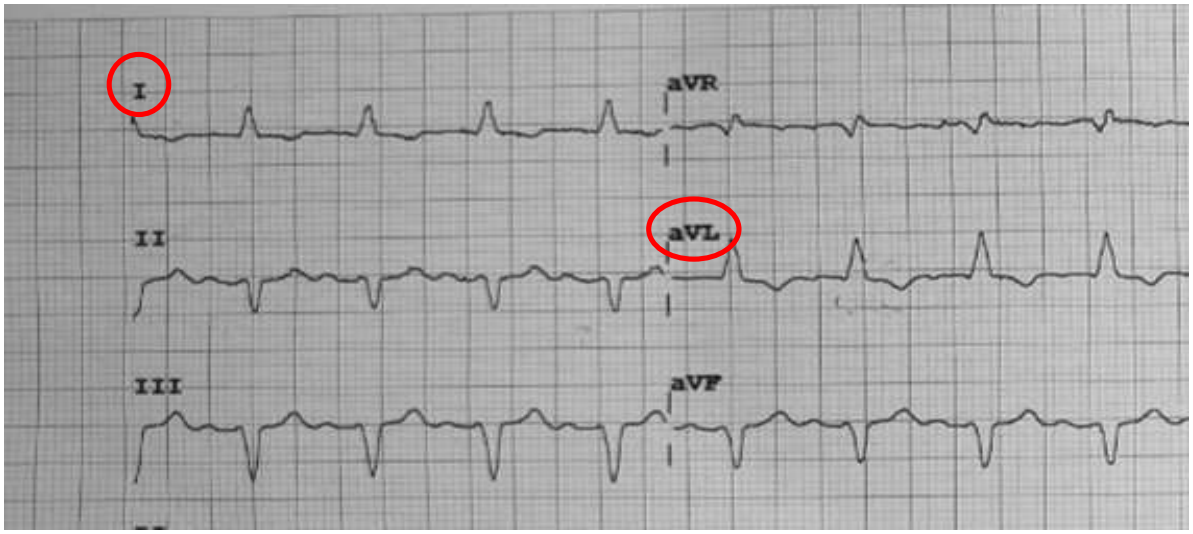
- NIVCD is defined as QRS duration > 110 ms without the morphological evidence of either right bundle branch block (RBBB) or left bundle branch block (LBBB)
- There may be several causes of non- specific intraventricular conduction defect – such as cardiomyopathies (e.g arrhythmogenic right ventricular dysplasia) , genetic disorders , ischemic heart disease with larger myocardial involvement , etc.
- NIVCD patients are having twice great risk of all-cause death and cardiovascular death , compared to patients without such disorders including RBBB and LBBB.

MASQUERADING BUNDLE BRANCH BLOCK (MBBB)

20 Masquerading bundle branch block (MBBB)

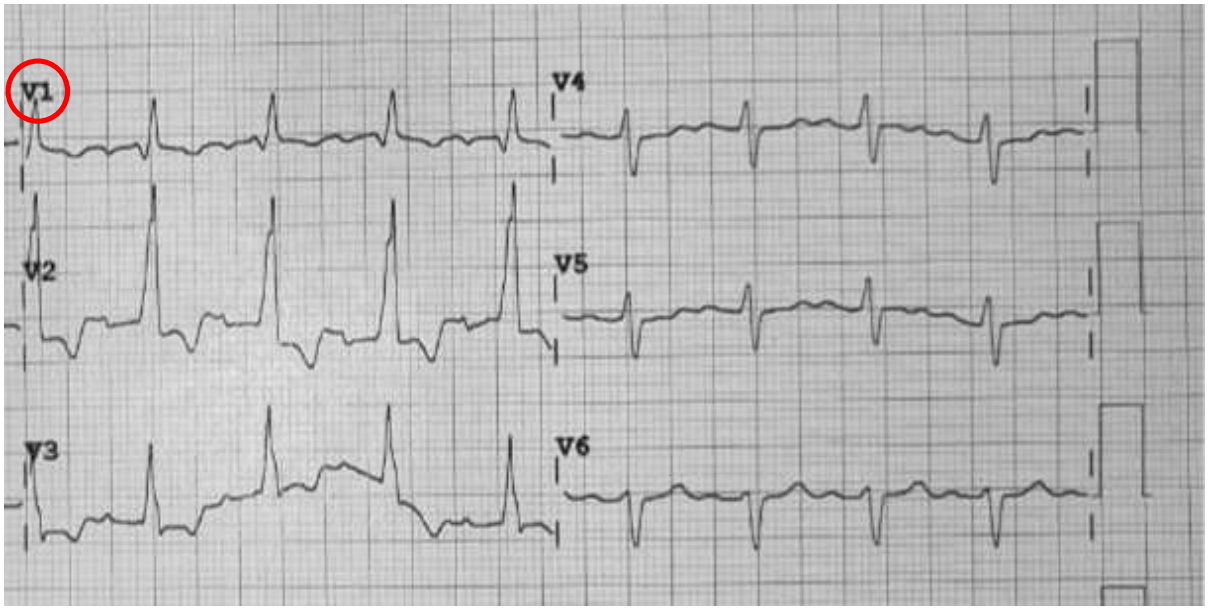
It is manifested on ECG by pattern of RBBB with marked left axis deviation and absence of a significant S wave in leads I and aVL . Its bad prognostic sign usually needs PPI

Patient presenting with fainting attack



- **The limb leads resemble LBBB with left axis deviation (QRS axis = - 60^0) with rS complexes in inferior leads II, III and aVF with negligible initial r component.**
- **Lead I and aVL is having positive broad complex with a blunted appearance and there is an absence of S wave in these leads.**

MBBB (the same case contd.)

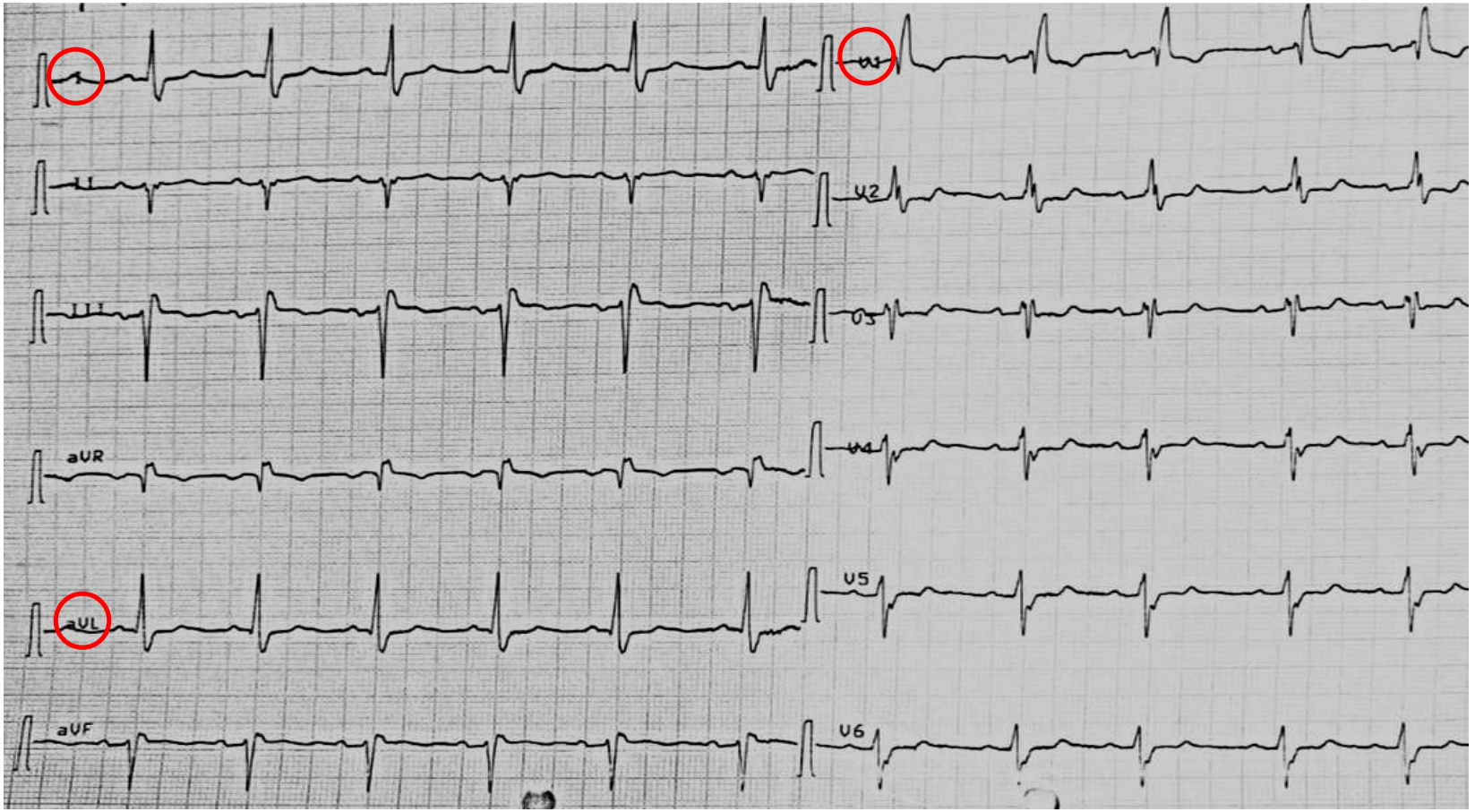


- The precordial leads shows RBBB pattern with prominent R wave in V1 to V3 and rS pattern in rest leads

MBBB is a precursor of complete heart block – a red signal warning (needs PPI)

22

Typical bifascicular block (RBBB+LAFB) just to compare it with masquerading bundle branch block (MBBB)
(Please see here the presence of S waves in lead I and aVL)




Thanks