



# NOTES

## BRADYCARDIA & HEART BLOCK

### GENERALLY, WHAT ARE THEY?

#### **PATHOLOGY & CAUSES**

- Delay or complete blockage in the electrical conduction system of the heart → abnormal heart rhythm; primarily, bradycardia

#### **CAUSES**

- Can be caused by defect in
  - Atrioventricular node
  - Bundle branches
  - Sinoatrial node
- Idiopathic or secondary to
  - Myocardial ischemia
  - Fibrosis
  - Infections
  - Congenital heart disease
  - Cardiomyopathies
  - Iatrogenic (e.g. medication, post-surgery)

#### **COMPLICATIONS**

- May progress to fatal arrhythmias, heart failure, and/or sudden cardiac death

#### **SIGNS & SYMPTOMS**

- If symptomatic, may present as lightheadedness, headache, syncope, palpitations, Stokes–Adams attacks, fatigue, dyspnoea etc.

#### **DIAGNOSIS**

- ECG-based; see individual disorders

#### **TREATMENT**

- May not require treatment

#### **MEDICATIONS**

- E.g. atropine

#### **OTHER INTERVENTIONS**

- Transcutaneous pacing
- Pacemaker implantation

# ATRIOVENTRICULAR BLOCK

osms.it/atrioventricular-block

## PATHOLOGY & CAUSES

- Blockage/delay in electrical signal stimulating contraction between atria, ventricles

## TYPES

- First degree atrioventricular (AV) block
- Second degree atrioventricular block
  - Type I/Mobitz I/Wenckebach
  - Type II/Mobitz II
- Third degree atrioventricular block/complete heart block

## CAUSES

### Congenital heart disease

### Heart damage

- Infiltrative/dilated cardiomyopathies, muscular dystrophy, lyme disease, myocardial ischemia, myocarditis, endocarditis with abscess, hyperkalemia, high vagal tone

### Iatrogenic causes

- Medication (beta blockers, calcium channel blockers, cardiac glycosides), post-cardiac surgery, post-catheter ablation, post-transcatheter aortic valve implantation

### Lev's disease/Lenegre-Lev syndrome

- Idiopathic fibrosis and calcification of heart's electrical conduction system, most common in elderly

## COMPLICATIONS

- Heart failure secondary to bradycardia; third degree AV block risk for sudden cardiac death

## SIGNS & SYMPTOMS

- Presence/severity depends on ventricular rate
  - Lightheadedness, syncope, fatigue, dyspnea

## DIAGNOSIS

## OTHER DIAGNOSTICS

### ECG

- First-degree AV block
  - Signal delayed; continues to ventricles
  - PR interval > 200ms due to delayed ventricular contraction
- Second degree AV block
  - **Type I/Mobitz I/Wenckebach:** PR interval lengthens with each beat until blocked completely (e.g. progressive PR intervals : 200ms → 260ms → 300ms → dropped beat; no QRS). Ventricular escape beat: if ventricle does not receive signal from atrioventricular node after short time, latent pacemaker cells within bundle of His/ventricle kick in, begin pacing heart at slower than normal rate (~20–50bpm)
  - **Type II/Mobitz II:** prolonged PR interval (> 200ms). Block commonly in bundle of His → QRS usually wide (> 110ms), intermittent dropped beats (no QRS). Happens randomly; no progressive lengthening of PR interval; every second P wave blocked, may progress to third degree AV block
- Third degree AV block/complete heart block
  - Signal completely blocked every time
  - Eg. ventricles contract at lower rate than atria (ventricular pacemaker cells establish rate)
  - No association between P waves, QRS complexes

## TREATMENT

- Depends on type/severity
  - *For all:* identify electrolyte imbalances/ medication-induced causes
- No treatment:
  - First degree AV block, asymptomatic
  - type I second degree

## MEDICATIONS

- Atropine: second degree, third degree

## OTHER INTERVENTIONS

### Permanent pacemaker

- Asymptomatic: type II second degree, third degree
- Symptomatic: type I & II second degree, third degree

### Transcutaneous pacing

- Symptomatic: type I & II second degree, third degree



## MNEMONIC

### AV blocks

If the R is far from P, then you have a **First Degree**.

Longer, longer, longer, drop! Then you have a **Wenckebach**.

If some P's don't get through, then you have **Mobitz II**.

If P's and Q's don't agree, then you have a **Third Degree**.



**Figure 4.1** ECG (lead II) demonstrating first degree atrioventricular block.



**Figure 4.2** ECG (lead V<sub>1</sub>) demonstrating Mobitz I (Wenckebach) second degree atrioventricular block.



**Figure 4.3** ECG (lead V<sub>1</sub>) demonstrating Mobitz II second degree atrioventricular block.



**Figure 4.4** ECG (lead V<sub>1</sub>) demonstrating third degree (complete) atrioventricular block.

## BUNDLE BRANCH BLOCK

[osms.it/bundle-branch-block](https://osms.it/bundle-branch-block)

### PATHOLOGY & CAUSES

- Electrical signal for contraction of left/right ventricle completely blocked or delayed

### TYPES

- Either right or left bundle branch blocks can be complete or incomplete
  - **Complete:** total blockage of signal transmission
  - **Incomplete:** slowed signal transmission

#### Right bundle branch block (RBBB)

- Signal blocked in right bundle branch
  - **Left ventricle contracts first** → signal carried to right side via Purkinje fibers → right ventricle contracts

#### Left bundle branch block (LBBB)

- Signal blocked in left bundle branch
  - **Right ventricle contracts** → left ventricle contracts

#### Bilateral bundle branch block

- Caused by disease involving **both right/left bundle branches**; on ECG, indistinguishable

from complete heart block and may lead to ventricular asystole

#### Intermittent bundle branch block

- Occasional block, **unrelated to heart rate**

#### Rate-related bundle branch block

- Block occurs when heart rate is relatively fast, **temporarily resolves** once heart rate slows down

### CAUSES

- Fibrosis/scarring, formed acutely/chronically

#### Acute

- Ischemia, myocardial infarction, myocarditis
- Sudden increase in right ventricular pressure → pulmonary embolism
- Iatrogenic: right heart catheterization/ethanol ablation of basal ventricular septum

#### Chronic

- Gradual remodelling of heart muscle
  - Hypertension, coronary artery disease, cardiomyopathies
  - Pulmonary hypertension
  - Congenital heart disease

**RISK FACTORS**

- Increasing age, associated with underlying or advancing heart disease

**SIGNS & SYMPTOMS**

**RBBB**

- Asymptomatic; wide splitting on auscultation

**LBBB**

- Asymptomatic; reversed splitting on auscultation

**DIAGNOSIS**

**OTHER DIAGNOSTICS**

**ECG**

- LBBB and RBBB
  - Lead II (limb lead) shows long QRS complex > 120ms (normal: 80–120ms)
  - Longer QRS complex because depolarization starts on time but ends later due to depolarization delay in one ventricle

- LBBB only
  - Negative  $V_1$ , positive  $V_6$  (away from  $V_1$  towards  $V_6$ )
  - $V_1$ : QS, or “little r”-rS complex. W shape
  - $V_6$ : large, notched R wave. M shape
- RBBB only
  - Positive  $V_1$ , negative  $V_6$
  - $V_1$ : large terminal R wave. M shape
  - $V_6$ : slurred S wave, W shape

**TREATMENT**

- No treatment



**MNEMONIC: WiLLiaM MaRRoW**

**ECG of Left BBB**

W-shape in V1 Left BBB  
Left BBB has V6 M-shape

**ECG of Right BBB**

M-shape in V1 Right BBB  
Right BBB has V6 W-shape

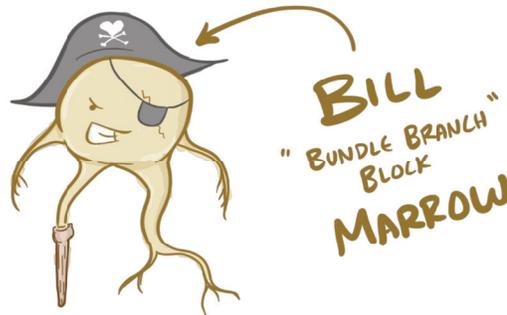
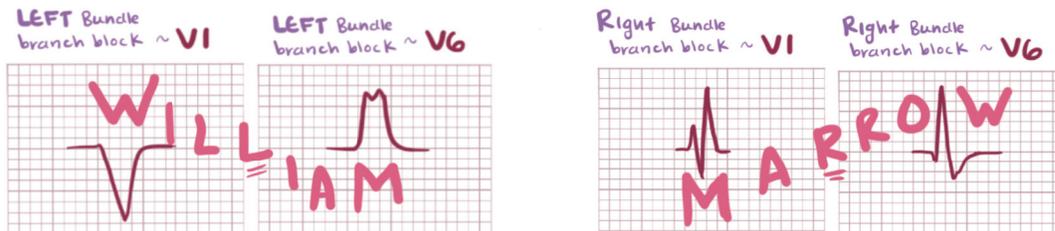
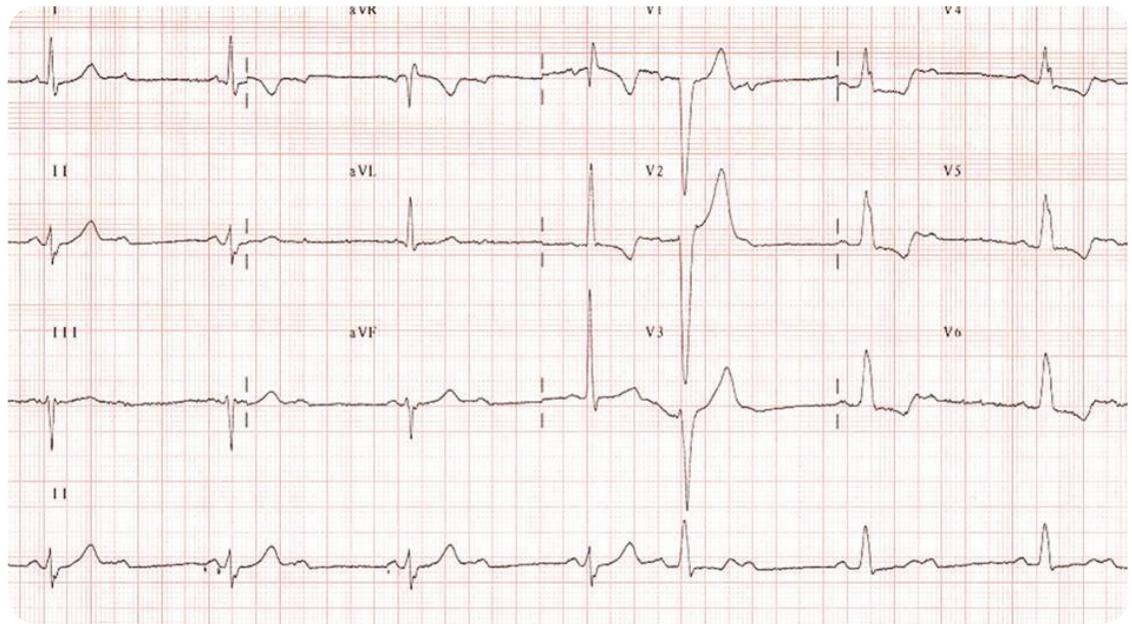
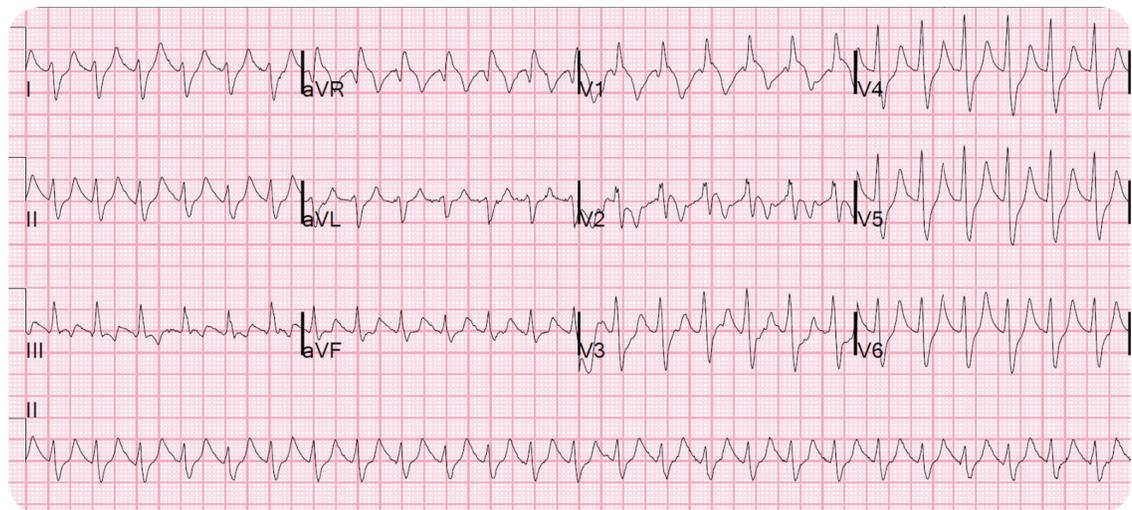


Figure 4.5 Illustration depicting mnemonic “WiLLiaM MaRRoW.”



**Figure 4.6** ECG demonstrating left bundle branch block.



**Figure 4.7** ECG demonstrating right bundle branch block.

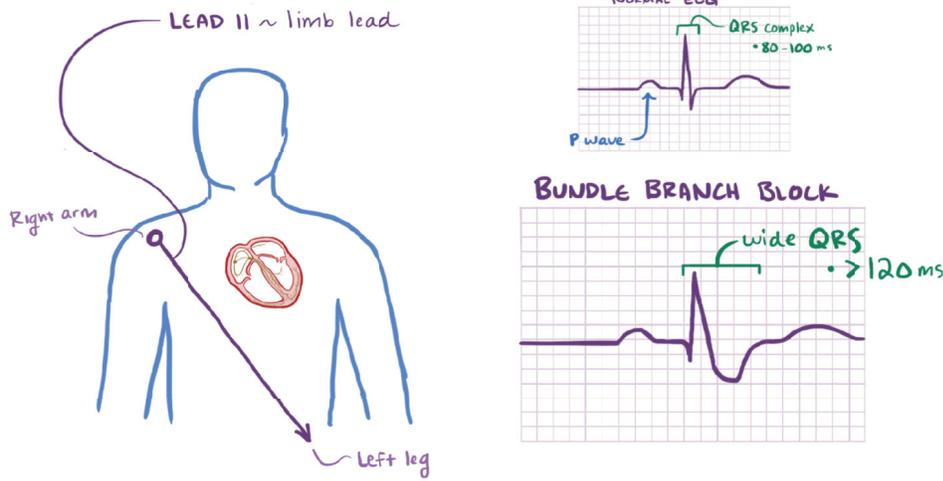


Figure 4.8 Illustration depicting wide QRS in bundle branch block.

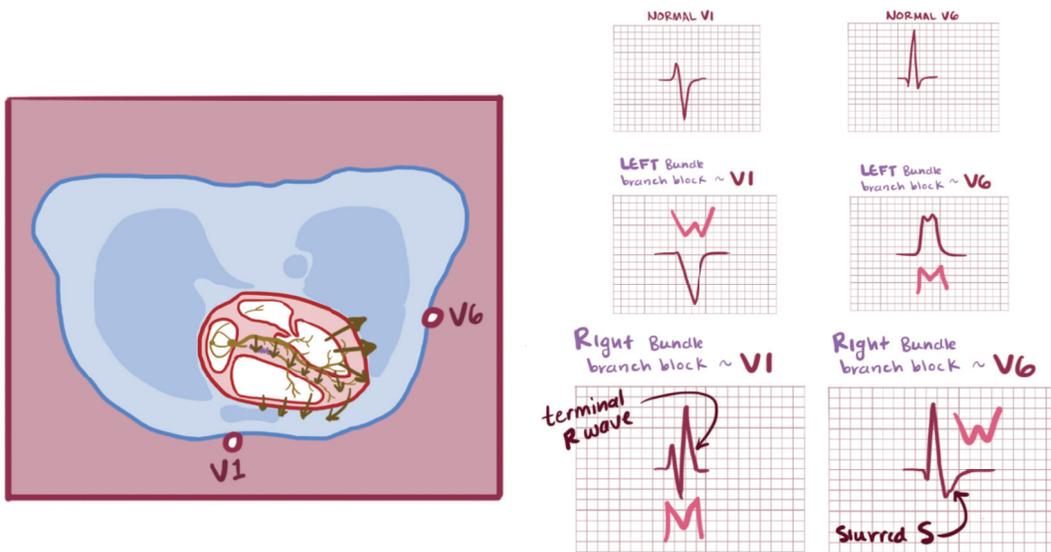


Figure 4.9 Illustration depicting M-shape and W-shape in bundle branch blocks.

# SICK SINUS SYNDROME

osms.it/sick-sinus-syndrome

## PATHOLOGY & CAUSES

- Malfunction in sinoatrial node (SA node) characterized by persistent spontaneous sinus bradycardia, alternating sinus bradycardia and tachyarrhythmia (sometimes called tachycardia-bradycardia syndrome)

## CAUSES

- Disorders causing scarring/degeneration/damage to SA node
  - Sarcoidosis, amyloidosis, hemochromatosis, Chagas disease, cardiomyopathies
- Can be caused/worsened by certain medications
  - Digoxin, calcium channel blockers, beta blockers, anti-arrhythmics
- Congenital
  - Mutations of SCN5A gene encoding alpha subunit of sodium ion channel

## RISK FACTORS

- Elderly
- Coronary artery disease
- High blood pressure
- Aortic, mitral valve diseases

## COMPLICATIONS

- Sinus arrest, sinus node exit block, sinus bradycardia
  - May be associated with tachycardia (characterized by long pause after tachycardia), e.g. atrial tachycardia, atrial fibrillation
  - Associated with azygos continuation of interrupted inferior vena cava

## SIGNS & SYMPTOMS

- Stokes–Adams attacks (fainting due to asystole/ventricular fibrillation), syncope, palpitations, chest pain, dyspnea, fatigue, headache, nausea
- Variable ECG findings

## DIAGNOSIS

### DIAGNOSTIC IMAGING

#### ECG

### OTHER DIAGNOSTICS

- Tilt table testing
- Holter monitor

## TREATMENT

### OTHER INTERVENTIONS

#### Pacemaker implantation

- For hemodynamically stable individuals, tachycardia can be treated with medication; can be combined with pacemaker in some cases
- For hemodynamically unstable individuals, definitive therapy requires pacemaker implantation; medication plays limited role