



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

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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 V₁) demonstrating Mobitz I (Wenckebach) second degree atrioventricular block.



Figure 4.3 ECG (lead V₁) demonstrating Mobitz II second degree atrioventricular block.



Figure 4.4 ECG (lead V₁) demonstrating third degree (complete) atrioventricular block.

BUNDLE BRANCH BLOCK

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

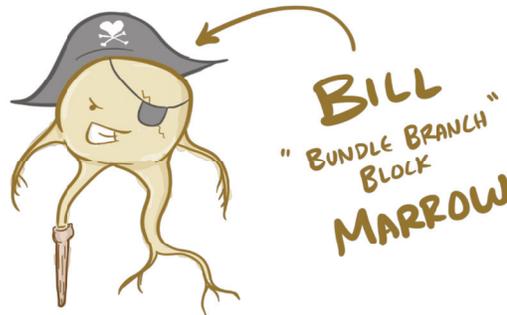
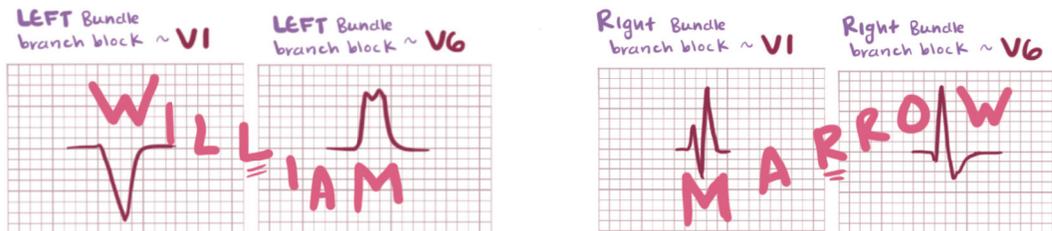


Figure 4.5 Illustration depicting mnemonic “WiLLiaM MaRRoW.”

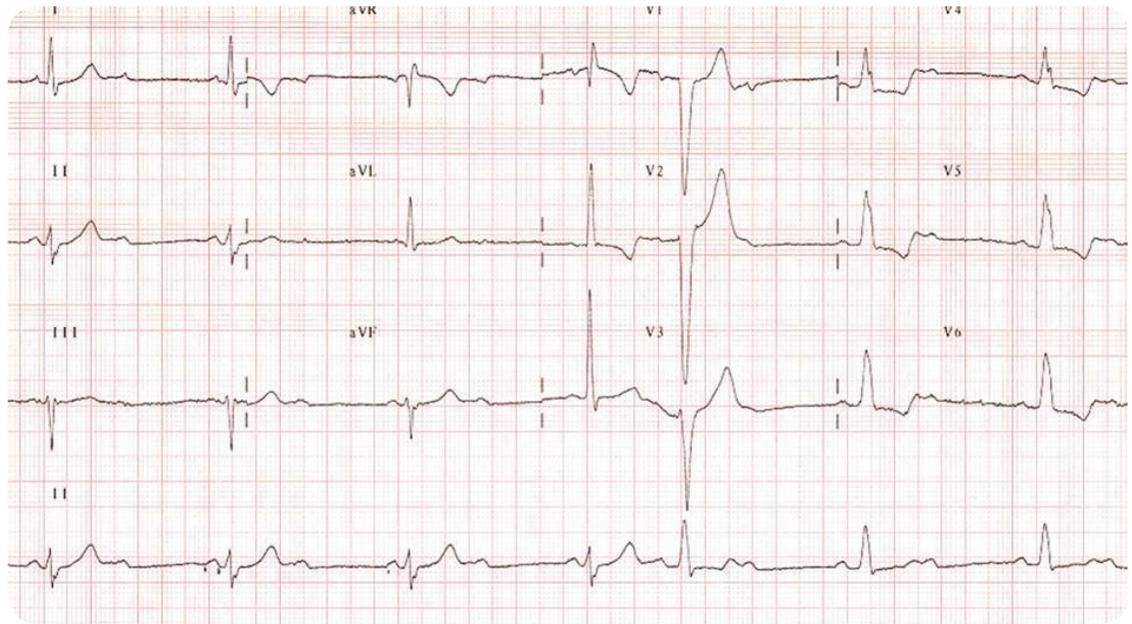


Figure 4.6 ECG demonstrating left bundle branch block.

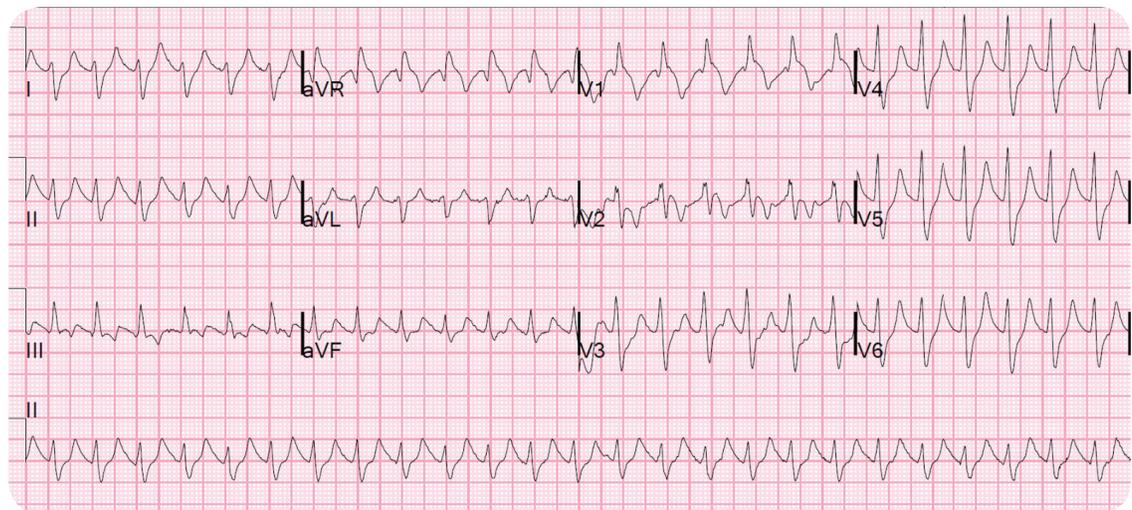


Figure 4.7 ECG demonstrating right bundle branch block.

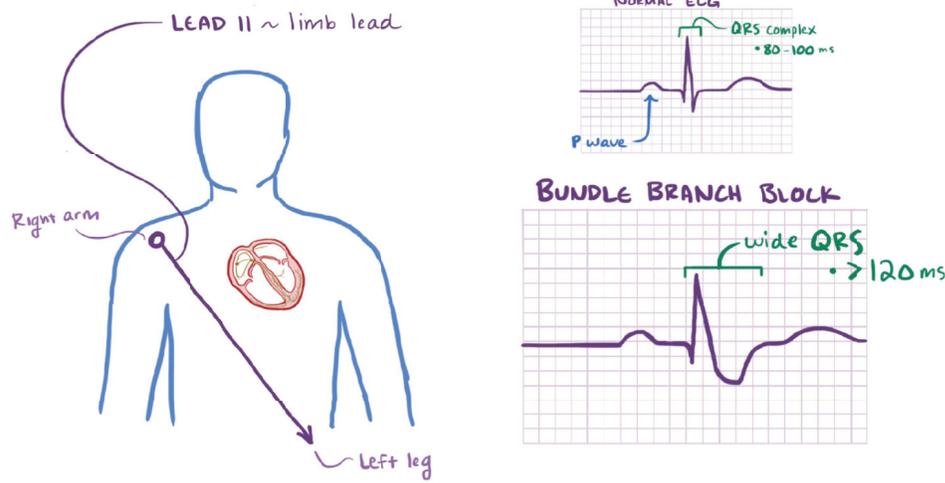


Figure 4.8 Illustration depicting wide QRS in bundle branch block.

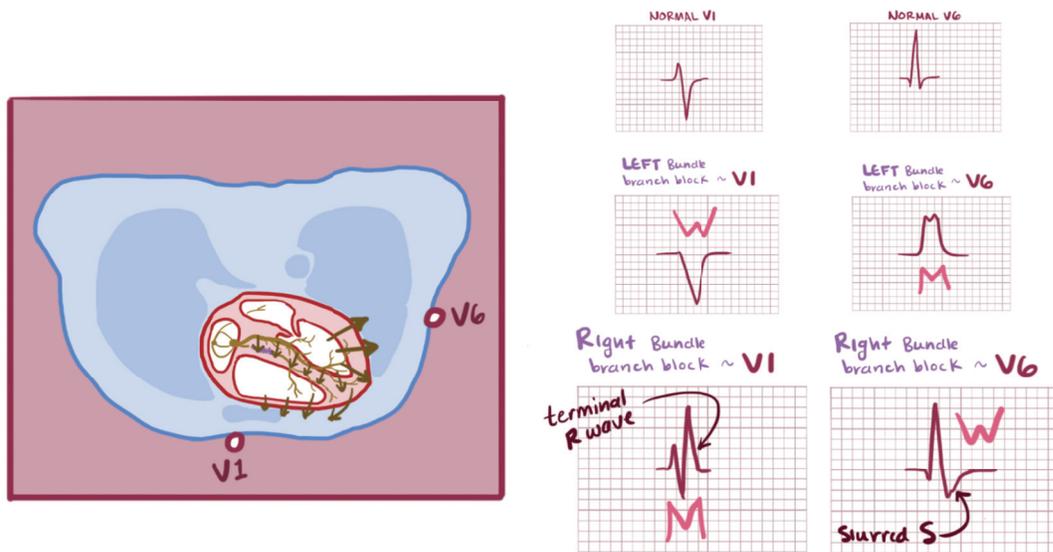


Figure 4.9 Illustration depicting M-shape and W-shape in bundle branch blocks.

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