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Chapter 7
Atrioventricular (AV) Blocks

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Objectives

- Describe the ECG characteristics, possible causes, signs and symptoms, and emergency management for the following dysrhythmias:
  - First-degree AV block
  - Second-degree AV block type I
  - Second-degree AV block type II
  - Second-degree AV block, 2:1 conduction
  - Complete AV block

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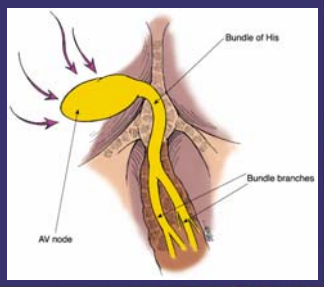
The AV Junction

- The AV junction provides the electrical links between the atrium and ventricle
- If a delay or interruption in impulse conduction occurs within the AV node, bundle of His, or His-Purkinje system, the resulting dysrhythmia is called an "atrioventricular (AV) block"



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Classification of AV Blocks

- AV blocks have been traditionally classified in two ways — according to the degree of the block and/or according to the site of the block

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Classification of AV Blocks

- The PR interval is the key to differentiating the type of AV block
- The key to differentiating the level (location) of the block is the width of the QRS complex
  - And, in second- and third-degree (complete) AV blocks, the rate of the escape rhythm

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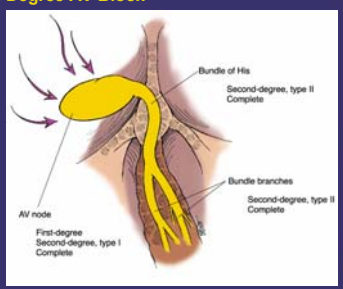
Location of First-Degree AV Block

- In first-degree AV block, impulses from the SA node to the ventricles are delayed (not blocked)
- Usually occurs at the AV node



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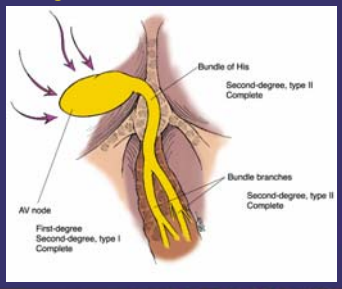
Location of Second-Degree AV Blocks

- With second-degree AV blocks, there is an intermittent disturbance in the conduction of impulses between the atria and ventricles



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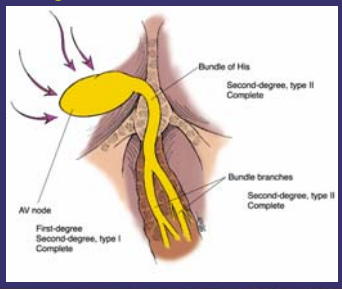
Location of Second-Degree AV Blocks

- Second-degree AV block type I
  - The site of the block is typically at the AV node
- Second-degree AV block type II
  - The site of the block is the bundle of His or, more commonly, the bundle branches



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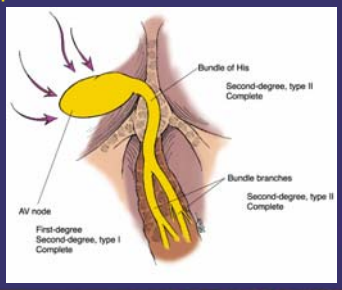
Location of Complete AV Block

- In complete (third-degree) AV block, the AV junction does not conduct any impulses between the atria and ventricles
- The site of block may be the AV node or, more commonly, the bundle of His or bundle branches



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AV Blocks – Clinical Significance

- Clinical significance of an AV block depends on:
  - Degree (severity) of the block
  - Rate of escape pacemaker (junctional vs. ventricular)
  - Patient's response to that ventricular rate

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First-Degree AV Block

- In first-degree AV block, all components of the cardiac cycle, except the PR interval, are usually within normal limits

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First-Degree AV Block

- Despite its name, the sinus impulse is not blocked
  - All sinus beats are conducted
- Impulses are delayed for the same period before they are conducted to the ventricles
  - Results in PR intervals that are more than 0.20 second in duration and constant

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First-Degree AV Block

- First-degree AV block is not a dysrhythmia itself, but a condition describing the consistent prolonged PR interval viewed on the ECG rhythm strip
- Identify:
  - Underlying rhythm
  - Ventricular rate
  - Presence of a first-degree AV block
  - Example: Sinus bradycardia at 40 beats/min with a first-degree AV block

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First-Degree AV Block – ECG Characteristics

Rate	Usually within normal range but depends on underlying rhythm
Rhythm	Regular
P Waves	Normal in size and shape; one positive (upright) P wave before each QRS in leads II, III, and aVF
PR Interval	Prolonged (greater than 0.20 second) but constant
QRS Duration	Usually 0.10 second or less unless an intraventricular conduction delay exists

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First-Degree AV Block

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First-Degree AV Block – Causes

- May be a normal finding in individuals with no history of cardiac disease, especially in athletes
- May also occur because of:
  - Ischemia or injury to the AV node or junction
  - Medication therapy
  - Rheumatic heart disease
  - Hyperkalemia
  - Acute myocardial infarction (often inferior wall MI)
  - Increased vagal tone

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First-Degree AV Block – Clinical Significance

- The patient usually demonstrates no symptoms related to the first-degree AV block

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First Degree AV Block - Intervention

- In the setting of an acute MI, the patient should be monitored closely for increasing signs of block

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Second-Degree AV Block

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Second-Degree AV Block

- When some, but not all, atrial impulses are blocked from reaching the ventricles, second-degree AV block results
- Because the SA node generates impulses in a normal manner, P waves will occur regularly across the rhythm strip
  - But not every P wave will be followed by a QRS complex

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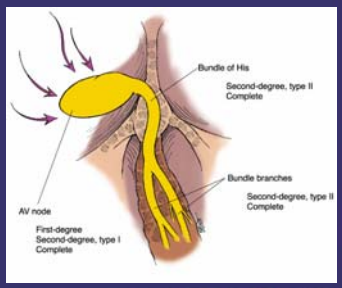
Second-Degree AV Block

- Second-degree AV block is classified as type I or type II depending on the location of the block
  - Above the bundle of His (type I)
  - Below the bundle of His (type II)



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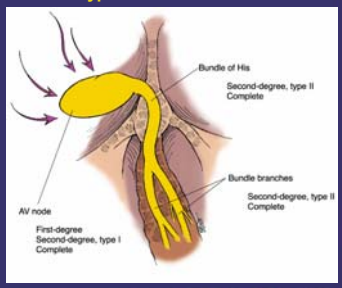
Second-Degree AV Block Type I

- The conduction delay in second-degree AV block, type I is usually at the level of the AV node



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Second-Degree AV Block Type I

- Impulses generated by the SA node take longer and longer to conduct through the AV node until, finally, a sinus impulse is blocked
  - Appears on the ECG as a P wave with no QRS after it
  - Cycle then begins again
  - Repetition of pattern is called “grouped beating”

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Second-Degree AV Block Type I – ECG Characteristics

Rate	Atrial rate is greater than the ventricular rate
Rhythm	Atrial regular (P’s plot through); ventricular irregular
P Waves	Normal in size and shape. Some P waves are not followed by a QRS complex (more P’s than QRS`s).
PR Interval	Lengthens with each cycle (although lengthening may be very slight), until a P wave appears without a QRS complex. The PR interval *after* the nonconducted beat is shorter than the interval preceding the nonconducted beat.
QRS Duration	Usually 0.10 second or less but periodically dropped

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Second-Degree AV Block Type I

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Second-Degree AV Block Type I – Causes

- Increased parasympathetic tone
- Ischemic heart disease
- Effects of drugs
  - Digitalis
  - Beta-blockers
  - Verapamil
- Inferior wall MI
  - Result of increased parasympathetic stimulation rather than injury to conduction system

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Second-Degree AV Block Type I – Clinical Significance

- The patient is usually asymptomatic
- If the patient is symptomatic and the dysrhythmia is the result of medications, these substances should be withheld

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Second-Degree AV Block Type I – Intervention

- If the heart rate is slow and serious signs and symptoms occur because of the slow rate, consider atropine and/or temporary pacing
- When this dysrhythmia occurs in conjunction with acute MI, observe for increasing AV block

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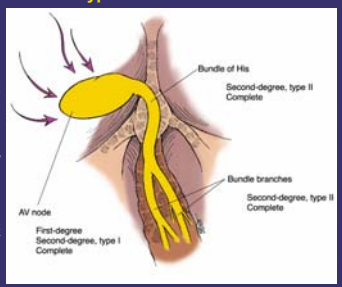
Second-Degree AV Block Type II

- Conduction delay occurs below the level of the AV node, either at the bundle of His or, more commonly, at the level of the bundle branches
  - More serious than second-degree AV block type I
  - Frequently progresses to complete AV block



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Second-Degree AV Block Type II

- Because the SA node is generating impulses in a normal manner:
  - P waves occur at regular intervals
- Impulses generated by the SA node are conducted to ventricles at the same rate until an impulse is suddenly blocked
  - Appears on ECG as a P wave with no QRS after it

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Second-Degree AV Block Type II – ECG Characteristics

Rate	Atrial rate is greater than the ventricular rate; ventricular rate often slow
Rhythm	Atrial regular (P's plot through); ventricular irregular
P Waves	Normal in size and shape. Some P waves are not followed by a QRS complex (more P's than QRS's).
PR Interval	Within normal limits or slightly prolonged but constant for the conducted beats. There may be some shortening of the PR interval that follows a nonconducted P wave.
QRS Duration	Usually 0.10 second or greater, periodically absent after P waves

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Second-Degree AV Block Type II

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Second-Degree AV Block Type II – Causes

- Left coronary artery disease
- Anterior wall MI
- Acute myocarditis
- Other types of organic heart disease

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Second-Degree AV Block Type II – Clinical Significance

- Significant slowing of the ventricular rate commonly results in serious signs and symptoms
- May progress to complete AV block or asystole with no warning

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Second-Degree AV Block Type II – Intervention

- If the patient is symptomatic, transcutaneous pacing should be instituted until transvenous pacemaker insertion can be accomplished
- Second-degree AV block type II is usually an indication for a permanent pacemaker

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Complete AV Block

Third-degree AV block

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Complete AV Block

- First- and second-degree AV blocks are types of "incomplete" blocks because the AV junction conducts at least some impulses to the ventricles
- In complete AV block, the atria and ventricles beat independently of each other
  - Impulses generated by the SA node are blocked before reaching the ventricles

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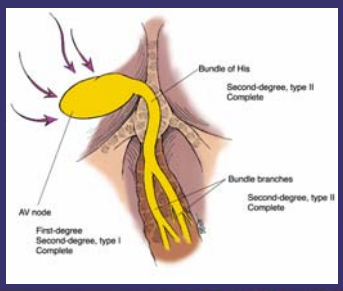
Complete AV Block

- The block may occur at the:
  - AV node
  - Bundle of His
  - Bundle branches



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Complete AV Block

- A secondary pacemaker (either junctional or ventricular) stimulates the ventricles
  - The QRS may be narrow or wide depending on the location of the escape pacemaker and the condition of the intraventricular conduction system

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Complete AV Block – Inferior MI

- Complete AV block associated with an inferior MI is thought to be due to a block above the bundle of His
  - Resulting rhythm is usually stable
  - Escape pacemaker usually junctional
    - Narrow QRS complexes
    - Ventricular rate greater than 40 beats/min

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Complete AV Block – Narrow QRS

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Complete AV Block – Wide QRS

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Complete AV Block – ECG Characteristics

Rate	Atrial rate is greater than ventricular rate. Ventricular rate is determined by origin of escape rhythm.
Rhythm	Atrial regular (P's plot through); ventricular regular. There is no relationship between atrial and ventricular rhythms.
P Waves	Normal in size and shape
PR Interval	None; the atria and ventricles beat independently of each other, thus there is no true PR interval.
QRS Duration	Narrow or wide depending on location of escape pacemaker and condition of intraventricular conduction system. Narrow = junctional pacemaker; wide = ventricular pacemaker.

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Complete AV Block – Causes

- When associated with an inferior MI, often resolves on its own within 1 week
- Complete AV block associated with an anterior MI may develop suddenly and without warning
  - Usually 12 to 24 hours after onset of acute ischemia

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Complete AV Block – Clinical Significance

- Signs and symptoms depend on:
  - The origin of the escape pacemaker
  - The patient's response to a slower ventricular rate

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Complete AV Block – Intervention

- If the QRS is narrow and the patient is symptomatic:
  - Atropine and/or transcutaneous pacing
- If the QRS is wide and the patient is symptomatic:
  - Transcutaneous pacing should be instituted while preparations are made for transvenous pacemaker

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Differentiation of AV Blocks

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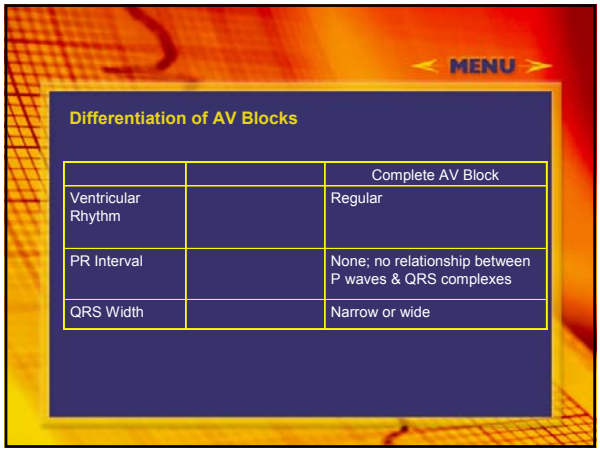
Differentiation of AV Blocks

	2nd Degree Type I	2nd Degree Type II
Ventricular Rhythm	Irregular	Irregular
PR Interval	Lengthening	Constant
QRS Width	Usually narrow	Usually wide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Differentiation of AV Blocks
Complete AV Block
Ventricular Rhythm
Regular
PR Interval
None; no relationship between P waves & QRS complexes
QRS Width
Narrow or wide