

# Chapter 7

## 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
  - Third-degree (complete) AV block



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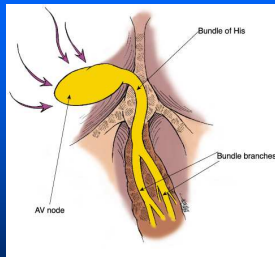
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### AV Junction

- 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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## Classification of AV Blocks

Classification by degree	
Name of block	Type of block
First-degree AV block	Incomplete
Second-degree AV block type I	Incomplete
Second-degree AV block type II	Incomplete
Third-degree AV block	Complete



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## Classification of AV Blocks

Classification by site / location	
Site	Name of block
AV node	First-degree AV block
	Second-degree AV block type I
	Third-degree AV block
Infranodal (subnodal)	
Bundle of His	Second-degree AV block type II (uncommon)
	Third-degree AV block
Bundle branches	Second-degree AV block type II (more common)
	Third-degree AV block



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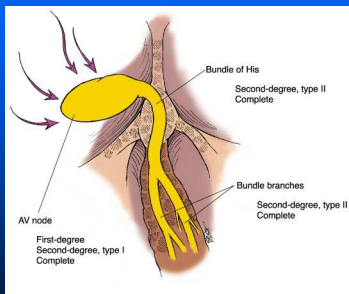
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## Location of AV Blocks



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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

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### First-Degree AV Block— How Do I Recognize It?

- 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— How Do I Recognize It?

- 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 sec in duration and constant

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## First-Degree AV Block— How Do I Recognize It?



<b>Rate</b>	Usually WNL, but depends on underlying rhythm
<b>Rhythm</b>	Regular
<b>P waves</b>	Normal in size and shape, one positive (upright) P wave before each QRS in leads II, III, and aVF



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## First-Degree AV Block— How Do I Recognize It?



<b>PR interval</b>	Prolonged (>0.20 sec) but constant
<b>QRS</b>	Usually $\leq 0.10$ sec unless an intraventricular conduction delay exists



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## First-Degree AV Block— How Do I Recognize It?

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<b>PR interval</b>	Prolonged (>0.20 sec) but constant
<b>QRS</b>	Usually $\leq 0.10$ sec unless an intraventricular conduction delay exists



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## First-Degree AV Block— How Do I Recognize It?

- First-degree AV block is not a rhythm itself
  - It is a condition describing the consistent prolonged PR interval viewed on the ECG rhythm strip
- Identify:
  - Underlying rhythm
  - Ventricular rate
  - Presence of first-degree AV block
  - Example
    - Sinus rhythm at 60 bpm with a first-degree AV block



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## First-Degree AV Block— What Causes It?

- May be a normal finding in individuals with no history of cardiac disease
- 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— What Do I Do About It?

- Usually no symptoms related to first-degree AV block
- In setting of acute MI, monitor patient 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 occur regularly across the rhythm strip
  - Not every P wave will be followed by a QRS



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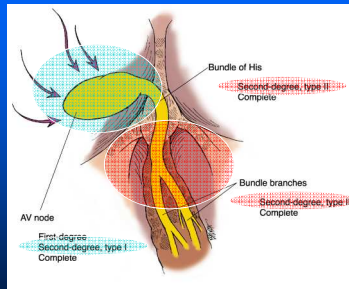
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## Second-Degree AV Block

- Above bundle of His (type I)
- At or below bundle of His (type II)



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## Second-Degree AV Block Type I



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## Second-Degree AV Block Type I—How Do I Recognize It?

- 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—How Do I Recognize It?



<b>Rate</b>	Atrial rate is faster than the ventricular rate
<b>Rhythm</b>	Atrial regular (P's plot through on time); ventricular irregular
<b>P waves</b>	Normal in size and shape; some P waves are not followed by a QRS complex (more P's than QRSs)



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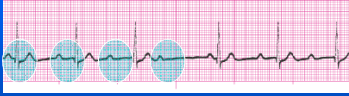
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## Second-Degree AV Block Type I—How Do I Recognize It?



<b>PR interval</b>	Lengthens with each cycle (lengthening may be very slight), until a P wave appears without a QRS; PR <i>after</i> the nonconducted beat is shorter than the interval preceding the nonconducted beat
<b>QRS</b>	Usually $\leq 0.10$ sec but is periodically dropped

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<b>QRS</b>	Usually $\leq 0.10$ sec but is periodically dropped

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## Second-Degree AV Block Type I—What Causes It?

- 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—What Do I Do About It?

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



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## Second-Degree AV Block Type I—What Do I Do About It?

- 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 rhythm occurs in conjunction with acute MI, observe for increasing AV block



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## Second-Degree AV Block Type II



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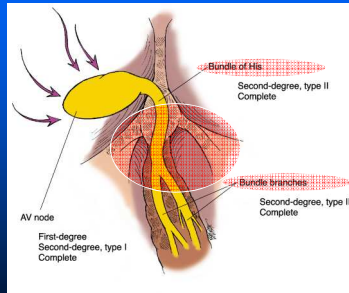
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## Second-Degree AV Block Type II

Block occurs:

- At or below bundle of His



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## Second-Degree AV Block Type II—How Do I Recognize It?

- More serious than second-degree AV block type I
- Frequently progresses to third-degree AV block



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## Second-Degree AV Block Type II—How Do I Recognize It?

- 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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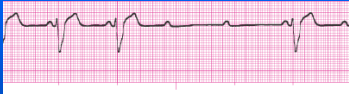
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## Second-Degree AV Block Type II—How Do I Recognize It?



<b>Rate</b>	Atrial rate is faster than the ventricular rate; ventricular rate is often slow
<b>Rhythm</b>	Atrial regular (P's plot through on time), ventricular irregular
<b>P waves</b>	Normal in size and shape; some P waves are not followed by a QRS complex (more P's than QRS's)

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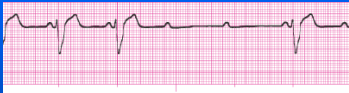
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## Second-Degree AV Block Type II—How Do I Recognize It?



<b>PR interval</b>	WNL or slightly prolonged but constant for the conducted beats; there may be some shortening of the PR interval that follows a nonconducted P wave
<b>QRS</b>	Usually $\geq 0.10$ sec, periodically absent after P waves

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## Second-Degree AV Block Type II—How Do I Recognize It?

<b>Rate</b>	Atrial rate is faster than the ventricular rate; ventricular rate is often slow
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<b>P waves</b>	Normal in size and shape; some P waves are not followed by a QRS complex (more P's than QRSs)
<b>PR interval</b>	WNL or slightly prolonged but constant for the conducted beats; there may be some shortening of the PR interval that follows a nonconducted P wave
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## Second-Degree AV Block Type II—What Causes It?

- 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—What Do I Do About It?

- Significant slowing of the ventricular rate commonly results in serious signs and symptoms
- Second-degree AV block type II is usually an indication for a permanent pacemaker



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## Second-Degree AV Block 2:1 conduction

- Also called “2:1 AV block”



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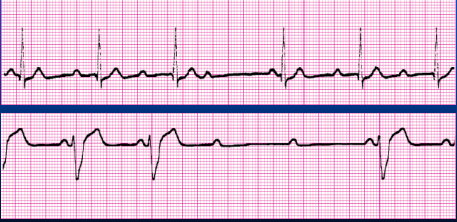
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### 2:1 AV Block— How Do I Recognize It?

- Two conducted P waves must occur consecutively and the PR intervals of the consecutive beats compared to identify either type I or type II second-degree AV block



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### 2:1 AV Block— How Do I Recognize It?

- When two P waves occur for every one QRS (2:1 conduction), the decision as to what to term the rhythm is based on the width of the QRS complex



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### 2:1 AV Block— How Do I Recognize It?

- A 2:1 AV conduction pattern associated with a narrow QRS complex ( $\leq 0.10$  sec) usually represents a form of second-degree AV block type I



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### 2:1 AV Block— How Do I Recognize It?

- A 2:1 AV conduction pattern with wide QRS complexes (>0.10 sec) is usually associated with a delay in conduction below the bundle of His—thus it is usually a type II block



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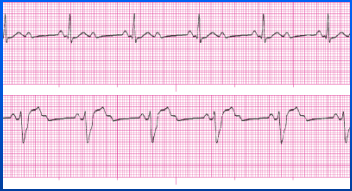
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### 2:1 AV Block— How Do I Recognize It?

- 2:1 AV block, probably type I
- 2:1 AV block, probably type II



<b>Rate</b>	Atrial rate is twice the ventricular rate
<b>Rhythm</b>	Atrial regular (P's plot through on time), ventricular regular
<b>P waves</b>	Normal in size and shape; every other P wave is followed by a QRS complex (more P's than QRSs)

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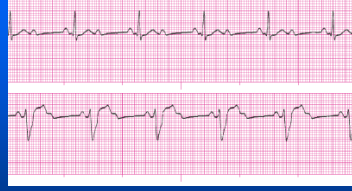
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### 2:1 AV Block— How Do I Recognize It?

- 2:1 AV block, probably type I
- 2:1 AV block, probably type II



<b>PR interval</b>	Constant
<b>QRS</b>	WNL, if the block occurs above the bundle of His (probably type I); wide if the block occurs below the bundle of His (probably type II); absent after every other P wave

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## 2:1 AV Block— How Do I Recognize It?

<b>Rate</b>	Atrial rate is twice the ventricular rate
<b>Rhythm</b>	Atrial regular (P's plot through on time), ventricular regular
<b>P waves</b>	Normal in size and shape; every other P wave is followed by a QRS complex (more P's than QRSs)
<b>PR interval</b>	Constant
<b>QRS</b>	WNL, if the block occurs above the bundle of His (probably type I); wide if the block occurs below the bundle of His (probably type II); absent after every other P wave



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## 2:1 AV Block— Causes/Treatment

- The causes and management of 2:1 AV block are those of type I or type II block previously discussed



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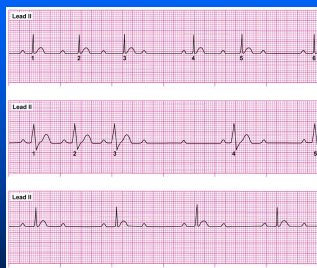
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## Types of Second-Degree AV Blocks

- A) Second-degree AV block type I
- B) Second-degree AV block type II
- C) Second-degree AV block 2:1 conduction



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# Third-Degree AV Block



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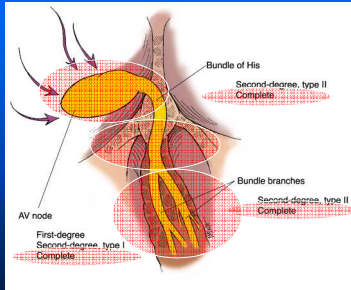
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## Third-Degree (Complete) AV Block

- Block may occur at:
  - AV node
  - Bundle of His
  - Bundle branches



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## Third-Degree AV Block— How Do I Recognize It?

- Third-degree AV block with an inferior MI
  - Probable block above the bundle of His
  - Resulting rhythm is usually stable
  - Escape pacemaker usually junctional
    - Narrow QRS complexes
    - Ventricular rate >40 bpm



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### Third-Degree AV Block— How Do I Recognize It?

- Third-degree AV block with anterior MI
  - Resulting rhythm is usually unstable
  - Escape pacemaker is usually ventricular
    - Wide QRS complexes
    - Ventricular rate <40 bpm



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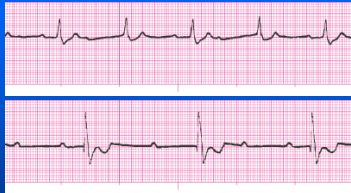
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### Third-Degree AV Block— How Do I Recognize It?



<b>Rate</b>	Atrial rate is faster than ventricular rate; ventricular rate determined by origin of escape rhythm
<b>Rhythm</b>	Atrial regular (P's plot through on time), ventricular regular; no relationship between atrial and ventricular rhythms
<b>P waves</b>	Normal in size and shape



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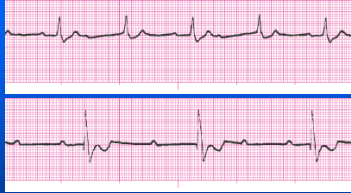
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### Third-Degree AV Block— How Do I Recognize It?



<b>PR interval</b>	None—the atria and ventricles beat independently of each other, thus there is no true PR interval
<b>QRS</b>	Narrow or wide depending on the location of the escape pacemaker and the condition of the intraventricular conduction system



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### Third-Degree AV Block— How Do I Recognize It?

<b>Rate</b>	Atrial rate faster than the ventricular rate; ventricular rate determined by origin of the escape rhythm
<b>Rhythm</b>	Atrial regular (P's plot through on time), ventricular regular; there is no relationship between the atrial and ventricular rhythms
<b>P waves</b>	Normal in size and shape
<b>PR interval</b>	None—the atria and ventricles beat independently of each other, thus there is no true PR interval
<b>QRS</b>	Narrow or wide depending on the location of the escape pacemaker and the condition of the intraventricular conduction system

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### Third-Degree AV Block— What Causes It?

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

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### Third-Degree AV Block— What Do I Do About It?

- If QRS is narrow and patient symptomatic due to slow rate:
  - Atropine and/or transcutaneous pacing
- If QRS is wide and patient symptomatic due to slow rate:
  - 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

	Second-Degree AV Block Type I	Second-Degree AV Block Type II
Ventricular Rhythm	Irregular	Irregular
PR Interval	Progressively lengthening	Constant
QRS Width	Usually narrow	Usually wide

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## Differentiation of AV Blocks

	Second-Degree AV Block 2:1 Conduction	Third-Degree (Complete) AV Block
Ventricular Rhythm	Regular	Regular
PR Interval	Constant	None—no relationship between P waves and QRS complexes
QRS Width	Narrow or wide	Narrow or wide

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## Differentiation of AV Blocks

	Second-Degree AV Block Type I	Second-Degree AV Block Type II
Ventricular Rhythm	Irregular	Irregular
PR Interval	Progressively lengthening	Constant
QRS Width	Usually narrow	Usually wide
	Second-Degree AV Block 2:1 Conduction	Third-Degree (Complete) AV Block
Ventricular Rhythm	Regular	Regular
PR Interval	Constant	None—no relationship between P waves and QRS complexes
QRS Width	May be narrow or wide	May be narrow or wide



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## Questions?



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