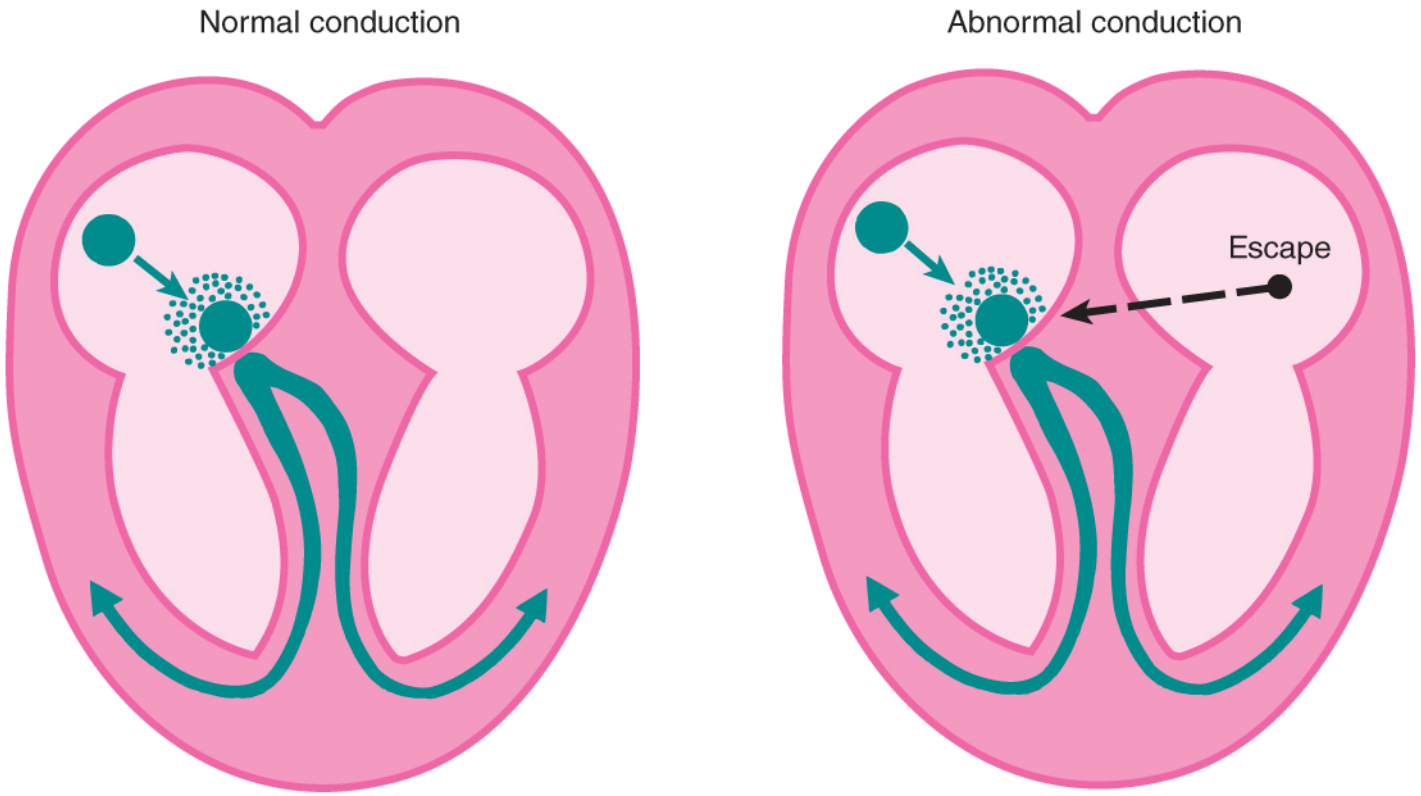
“Funny Looking Beats”

Escape Beats

- When sinus arrest or HR = bradycardic, impulse may “escape” from site other than atria and cause depolarization of myocardium
- Way that heart attempts to maintain normal rate/rhythm
- Can be either single complex or progress to an escape rhythm
  - Examples of escape rhythms: Junctional tachycardia and idioventricular dysrhythmias

Escape Beats



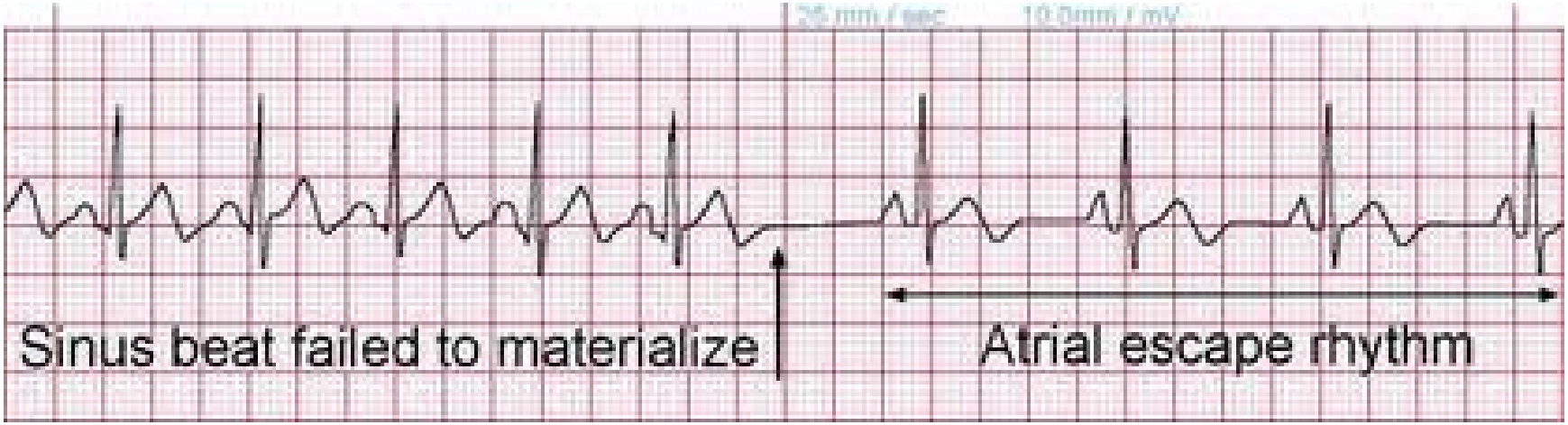
- Left heart shows normal electrical conduction pathway. Right heart shows conduction pathway of an atrial escape beat.

Escape Beats

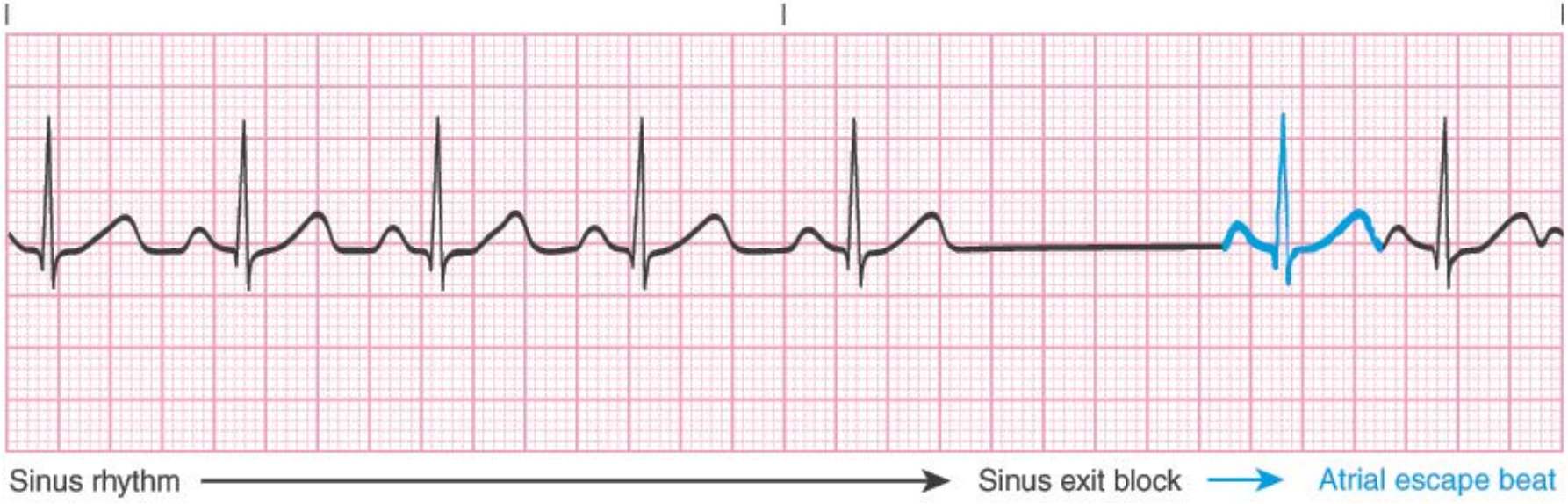
- May originate from:
  - Atria
  - AV junction
  - Ventricles
- Rate of rhythm containing escape beat will vary depending on underlying rhythm and number of escape beats
- Atrial escape beats
  - Originate from anywhere in atria except SA node
  - End a sinus arrest or sinus exit block
  - Upright P wave
  - PR interval = 0.12-0.2 second
  - QRS = < 0.12 second

Escape Beats

- Atrial escape beats



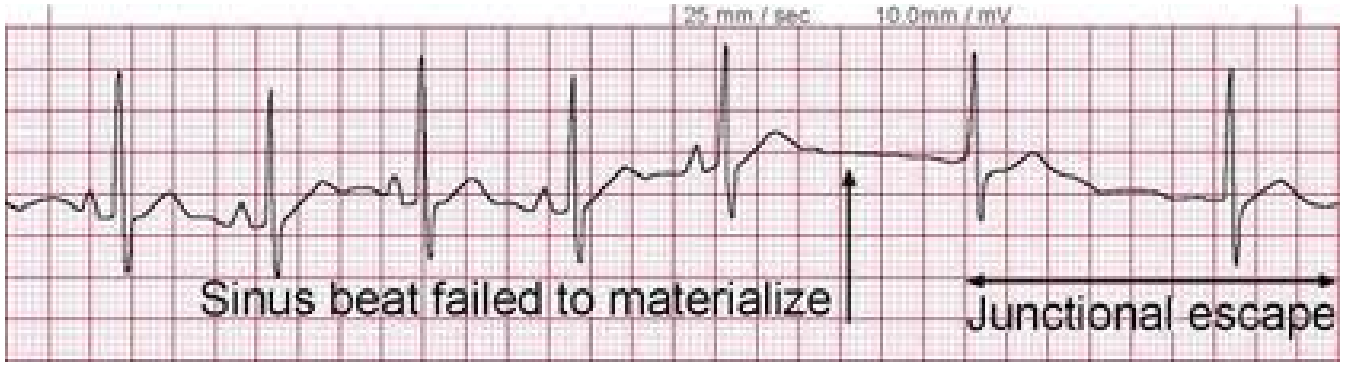
Atrial Escape Beats



- Escape beats and escape rhythm. Sinus rhythm with sinus arrest ended by an atrial escape beat; heart rate, 70 beats/min.

Escape Beats

- Junctional escape beats:
  - If SA node and atria fail to generate impulse or impulse not conducted, AV junction initiates impulse that “escapes” to increase HR
  - P wave inverted, hidden, or retrograde
  - QRS < 0.12 second

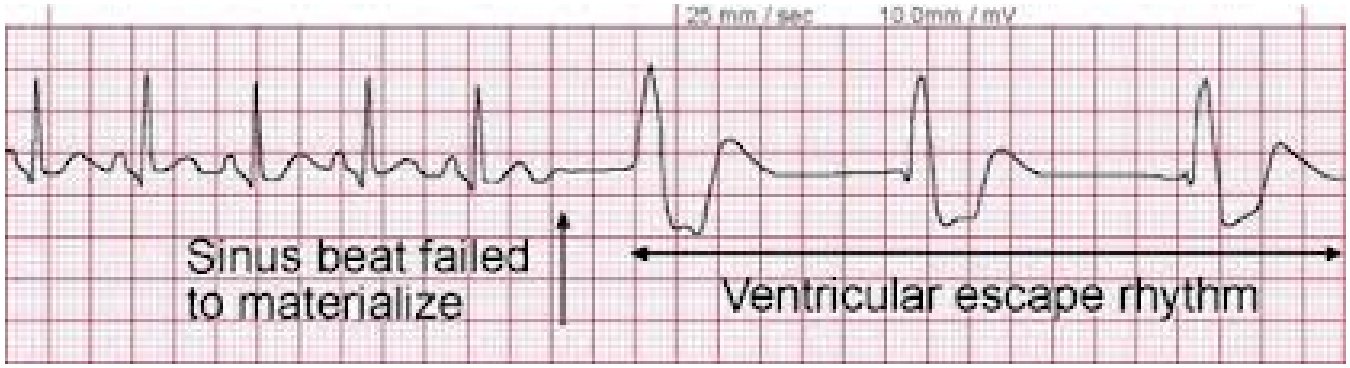


Junctional Escape Beats

- Sinus bradycardia with premature junctional complex (PJC) escape beat beginning a junctional escape rhythm; heart rate, 50 beats/min.

Escape Beats

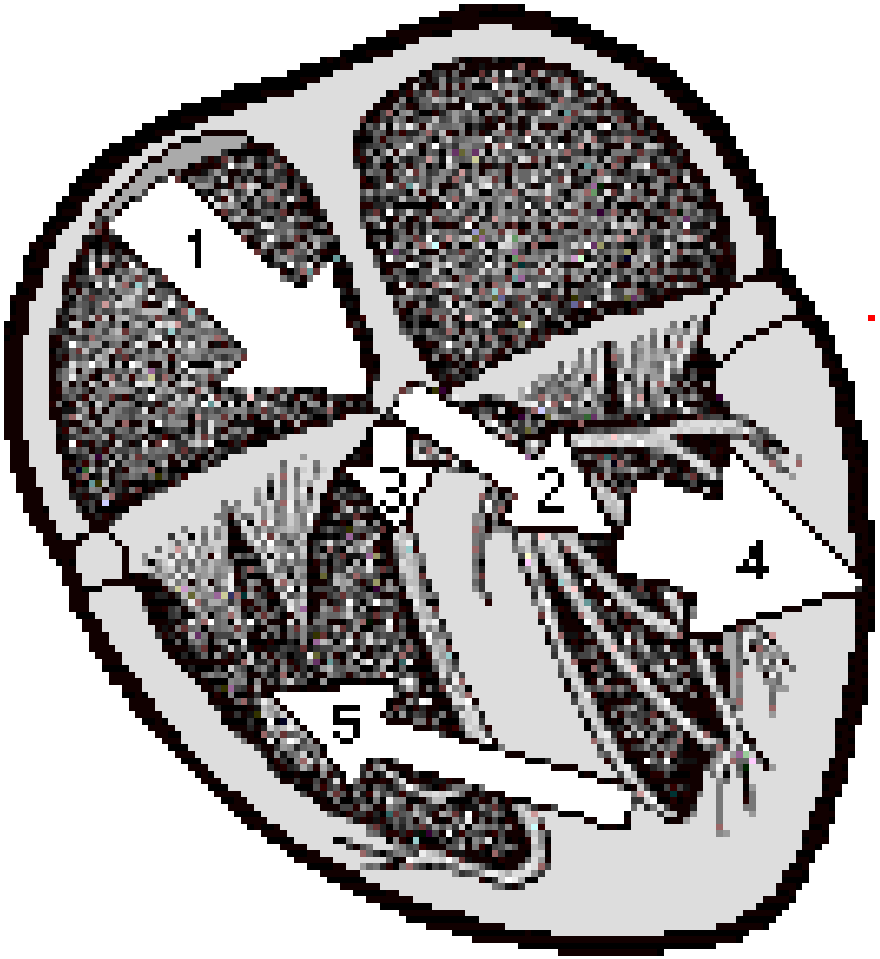
- Ventricular escape beats:
  - If SA node, atria, and AV junction fail to generate impulse or HR < junctional inherent rate of 40 bpm, ventricles initiate impulse
  - QRS > 0.12 second
  - P wave usually not seen

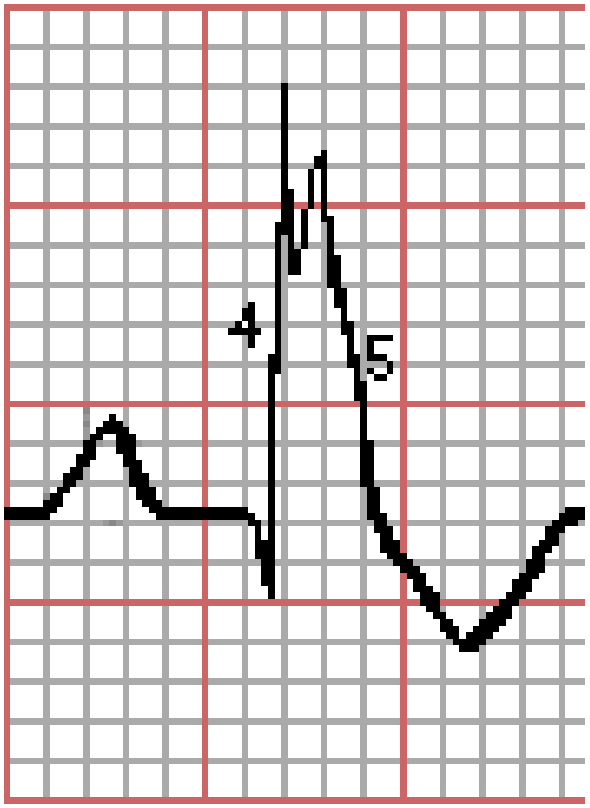


Aberrantly Conducted Complexes

- Formed when impulse generated above bundle of His and travels through bundle branches in abnormal manner
  - Causes one ventricle to depolarize at slower rate than other
  - QRS resembles bundle branch block
- Appear different than complexes of underlying rhythm
  - Does not follow same electrical conduction pathway as underlying rhythm
    - Example: Complex may have negative QRS when underlying rhythm has positive QRS or QRS of complex may be wider, narrower, or shorter

Aberrantly Conducted Complexes

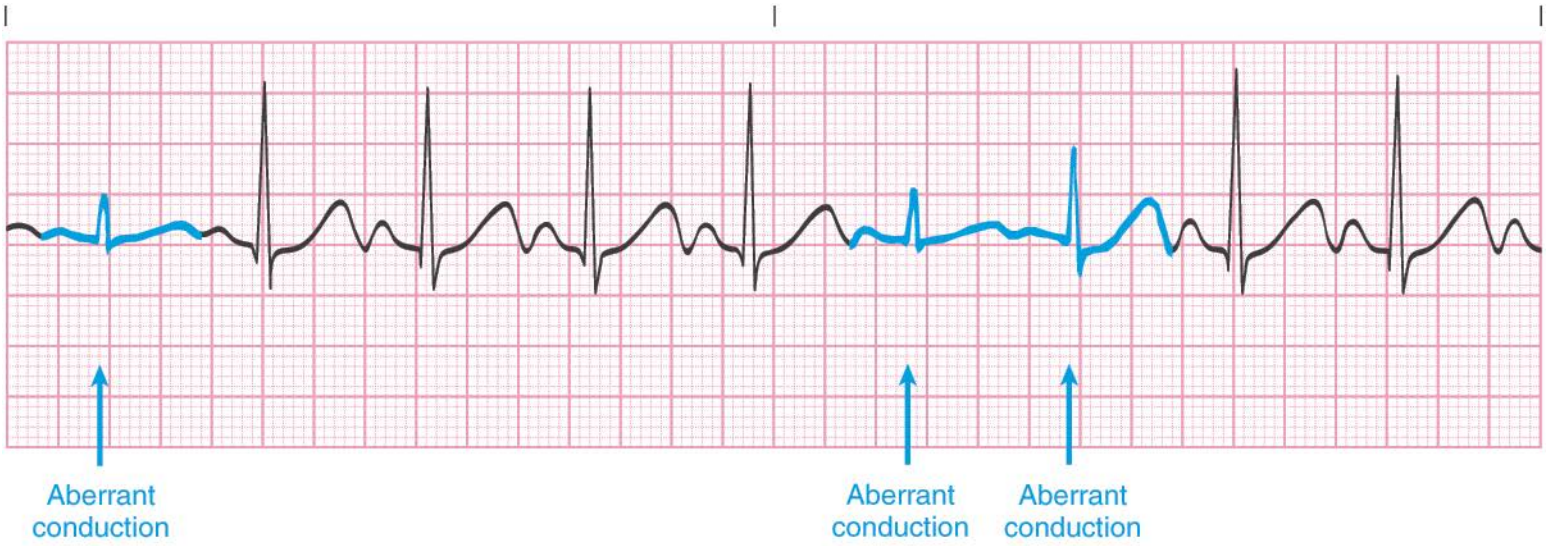




Aberrantly Conducted Complexes

- Can originate from anywhere in atria, AV junction, or ventricles
- Origin determines size and shape
- Difficult to distinguish from a bundle branch block
- Most have wide QRS but usually appears as complex rather than rhythm

Funny-Looking Beats



- Aberrantly conducted complexes. Sinus rhythm with three aberrantly conducted complexes; heart rate, 90 beats/min (notice peaked P waves and prolonged QT intervals).

Pulseless Electrical Activity

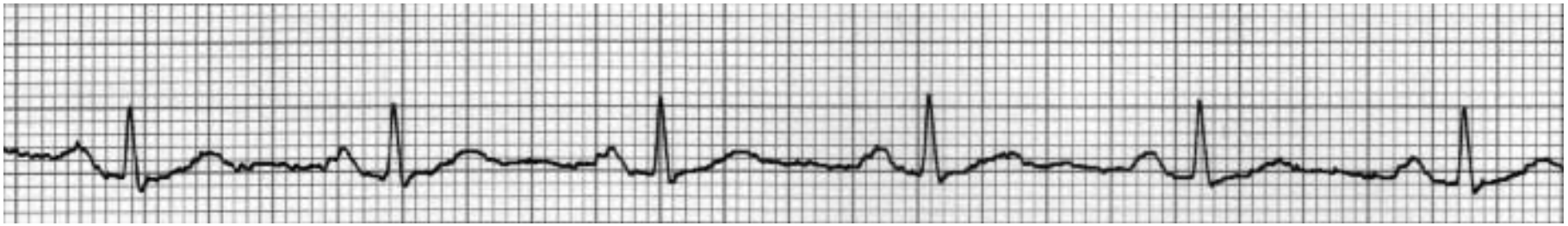
- Current term to describe any dysrhythmia that shows impulse conduction without contraction of myocardium
- Electrical depolarization of cardiac cells occurs, but patient does not have pulse or blood pressure
- Almost any cardiac rhythm can appear on strip but rhythm usually appears bradycardic and may have wide or narrow QRS

Pulseless Electrical Activity

- Lethal dysrhythmia because patient does not have pulse and CO ceased
- Treatment must be started immediately
- Some types:
  - Idioventricular dysrhythmias
  - Ventricular escape rhythms
  - Bradyasystolic dysrhythmias
- All show complexes on monitor but blood not being circulated

Pulseless Electrical Activity

- Causes:
  - Hypovolemia
  - Hypoxia
  - Cardiac tamponade
  - Tension pneumothorax
- May also occur when cardiac muscle too damaged to contract



Funny-Looking Beats

- Pulseless electrical activity. Rhythm strip shows sinus bradycardia (heart rate, 40 beats/min), but the patient does not have a pulse (notice depressed ST segments).

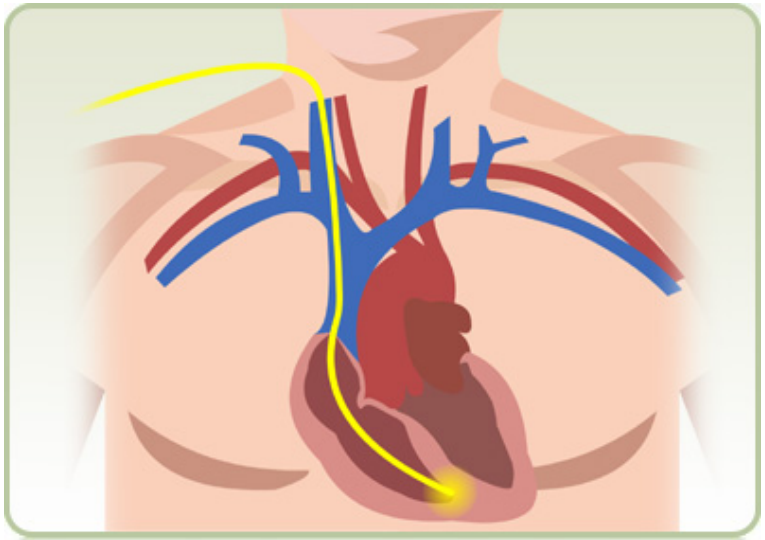
Pacemakers

- Small, battery-operated devices that initiate impulses in myocardium
- Two main parts:
  - Generator
    - Small box that initiates and controls rate and strength of impulse
  - Lead wires
    - Has electrode at tip that senses heart's electrical activity, transmits info to generator, and delivers an electrical stimulus from generator to myocardium
- Pacemakers can be temporary or permanent

Pacemakers

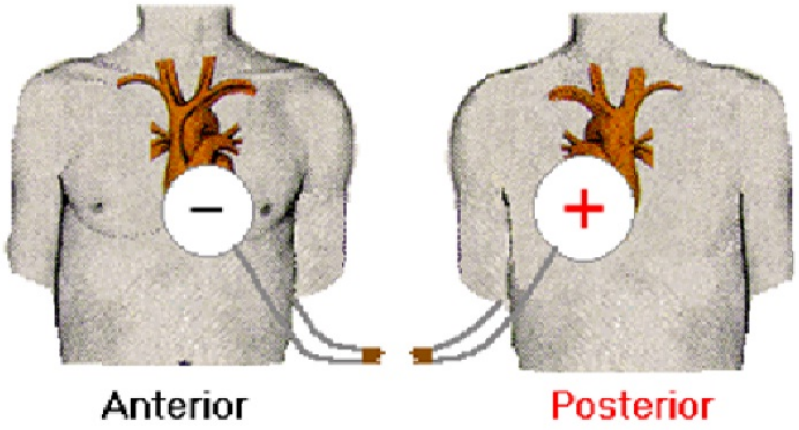
Temporary Pacemakers

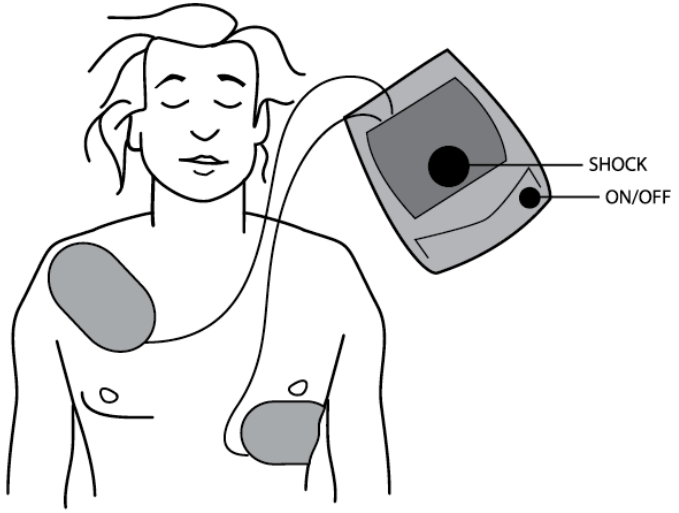
- Used to maintain HR in emergency or until permanent pacemaker can be surgically implanted
- Two types:
  - Transvenous – through a vein
    - Lead wire inserted through skin and threaded through large vein into right atrium



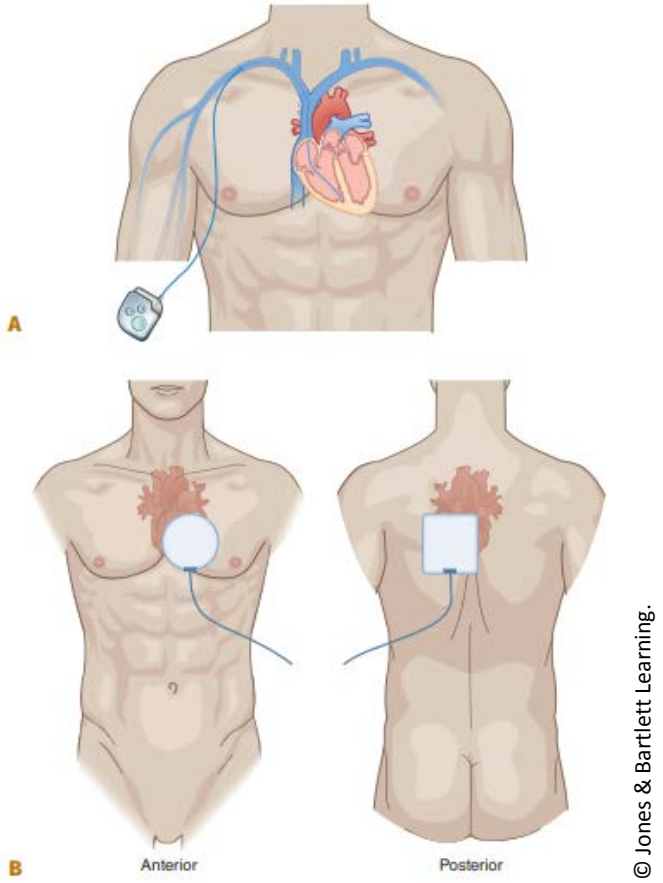
Temporary Pacemakers

– Transcutaneous – through the skin
  - Delivers impulse through skin and body to heart
  - Have 2 lead wires connected to large adhesive pads
  - One pad on chest, other pad on back or both pads on chest





Pacemaker Rhythms



- **A.** Temporary transvenous pacemaker placement. **B.** Temporary transcutaneous pacemaker placement.

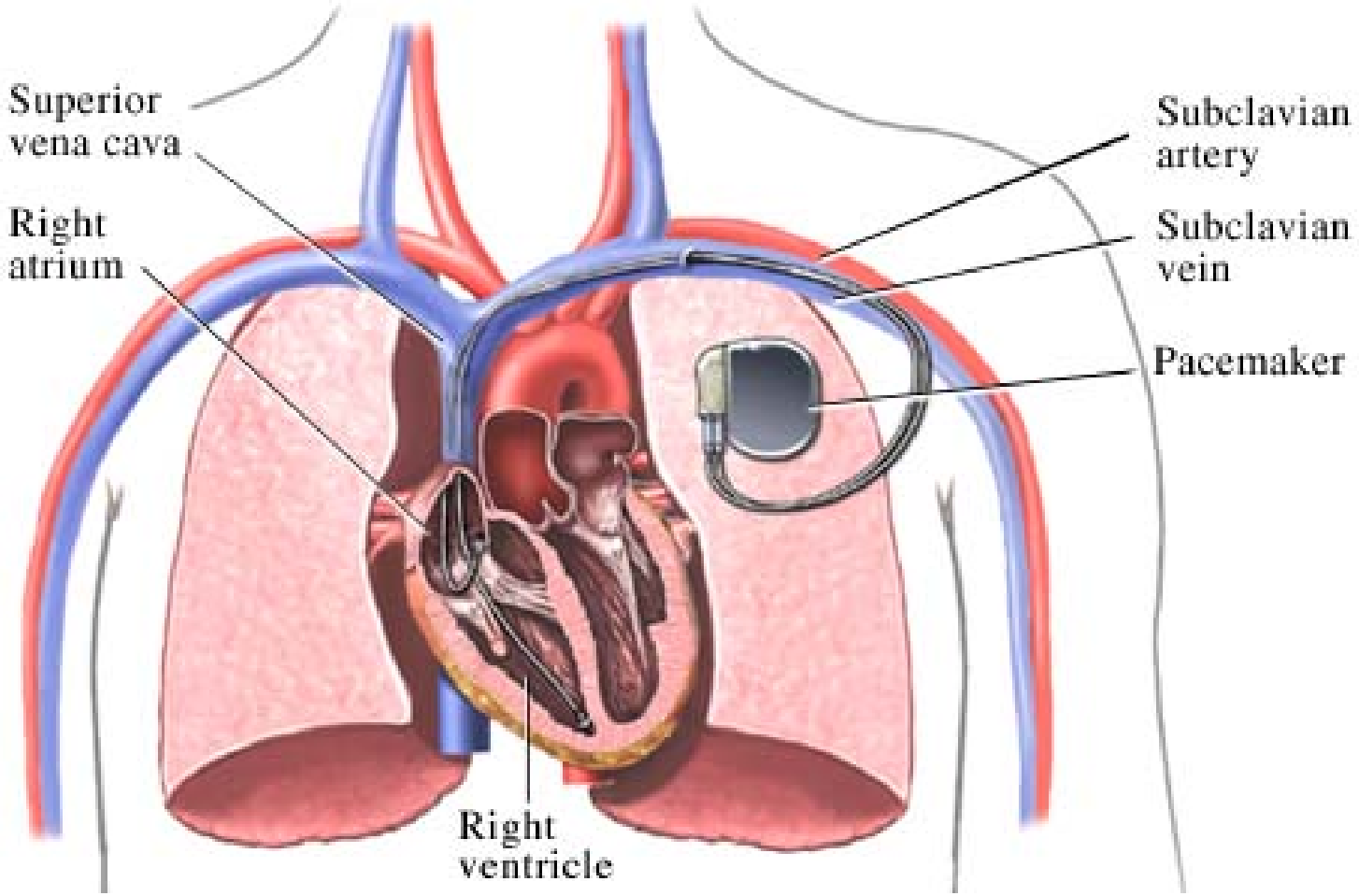
Temporary Pacemakers

- Generator settings:
  - Fixed: Set to generate impulses at constant rate, usually 70-80 ipm
  - Demand: Set to generate impulses and maintain adequate CO, only when pacemaker senses patient's HR < predetermined rate, usually < 65 ipm
    - Transcutaneous pacemakers can't be set to demand

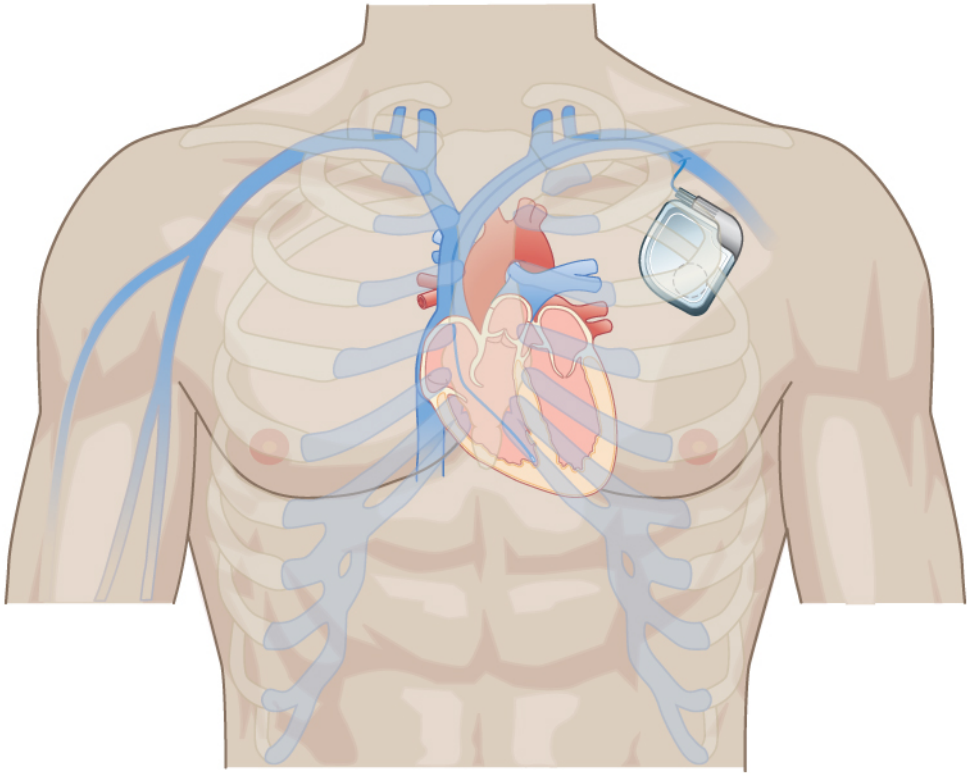
Permanent Pacemakers

- Necessary when patient's heart unable to maintain normal HR or normal CO, even with aid of medications
- Generator surgically implanted under skin, usually upper left chest, upper right chest, or upper abdominal area
- Lead wire inserted into heart through large vein

Permanent Pacemakers



Permanent Pacemakers



- Permanent pacemaker placement.

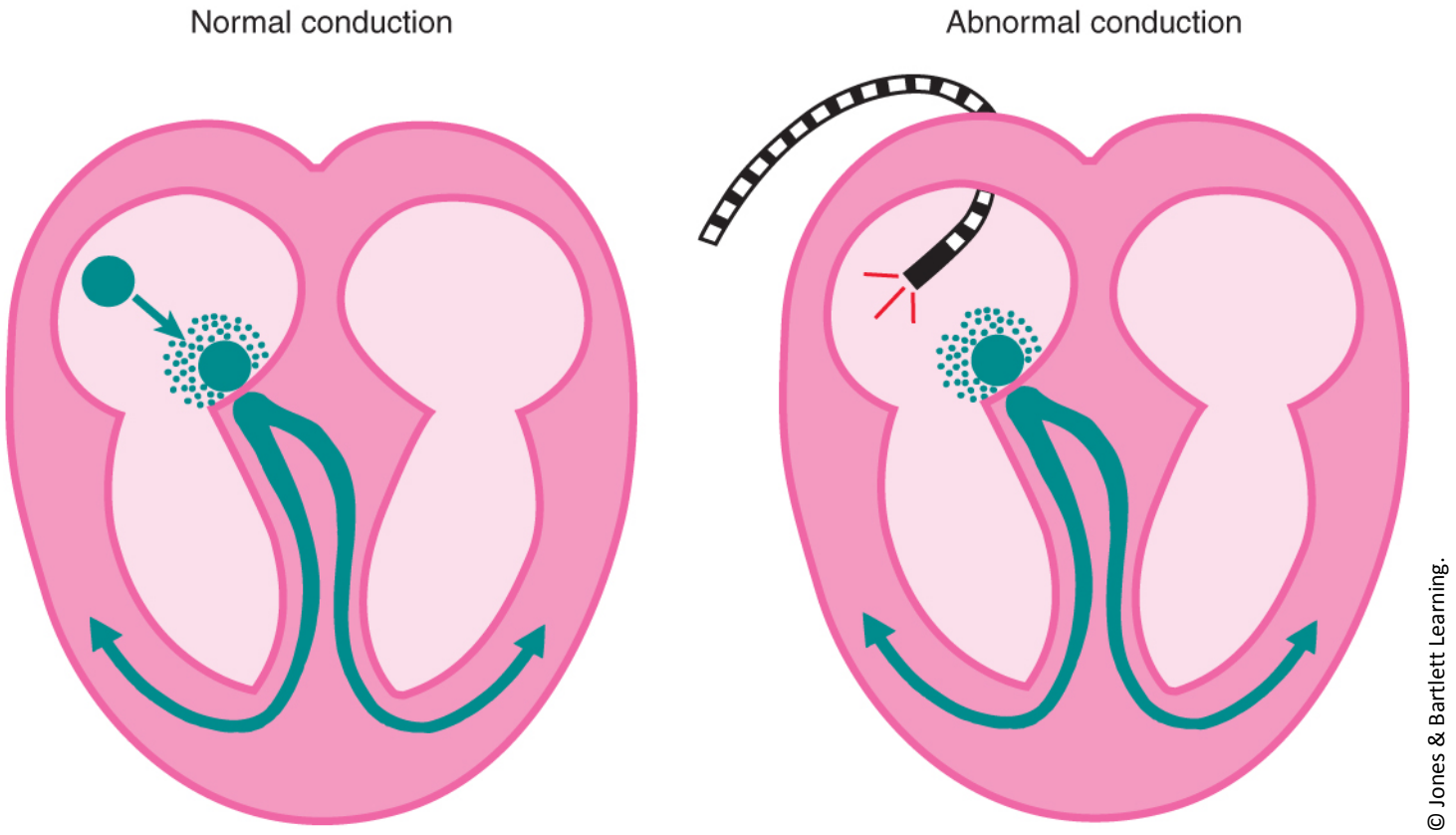
Permanent Pacemakers

- Four types:
  - Atrial pacemakers
  - Ventricular pacemakers
  - Sequential pacemakers
  - Biventricular pacemakers
- Atrial and ventricular pacemakers also known as single chamber pacemakers

Atrial Pacemakers

- Single or one chambered
- Lead wire and electrode inserted into right atrium
- Impulse generated stimulates atria, then follows normal conduction pathway
- Discharge of electrical energy from pacemaker represented on strip by vertical line (pacer spike or spike)
  - Spike followed by P wave and QRS, although P wave may not be seen
- Can only be used if AV junction and ventricular conduction pathways are functioning
- Rarely used today because less efficient

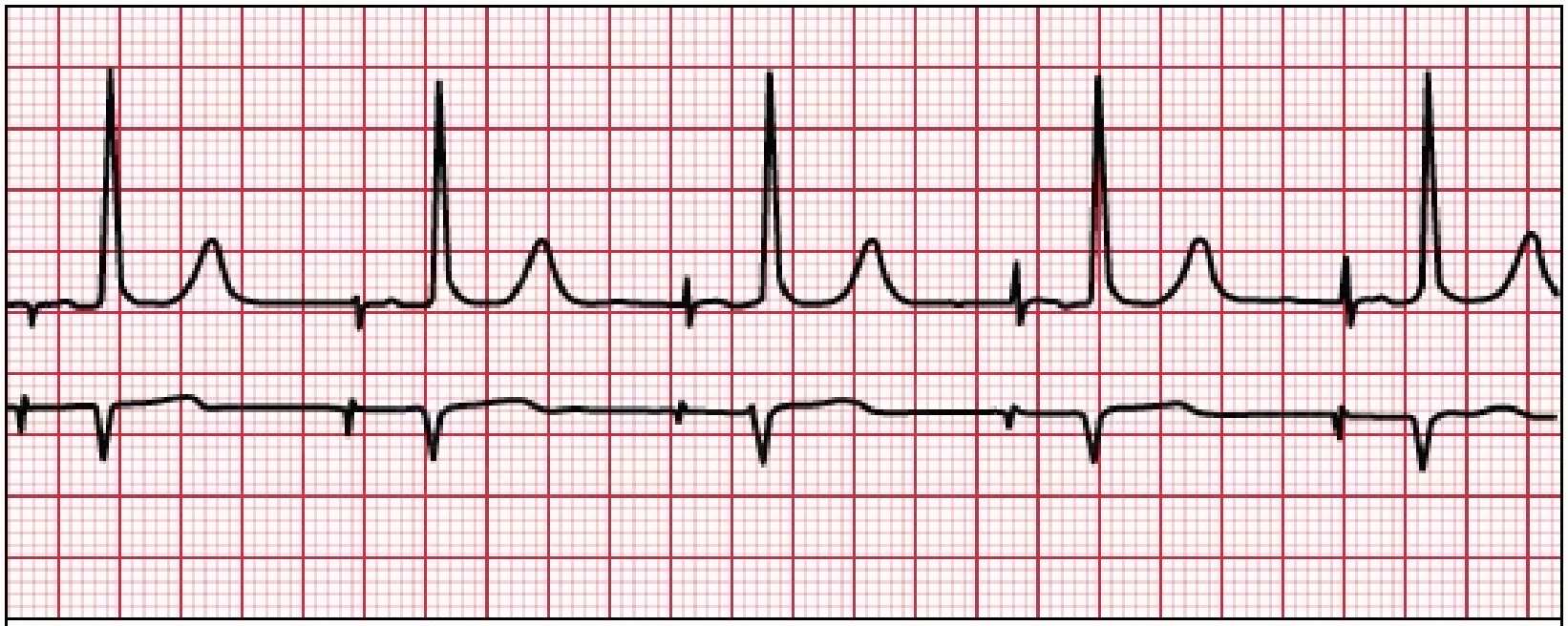
Atrial Pacemakers



- Left heart shows normal electrical conduction pathway. Right heart shows conduction pathway of atrial pacemaker.

Atrial Pacemakers

Atrial Pacemaker (single chamber)



One spike producing an abnormal P wave (atrial capture) followed by a normal QRS

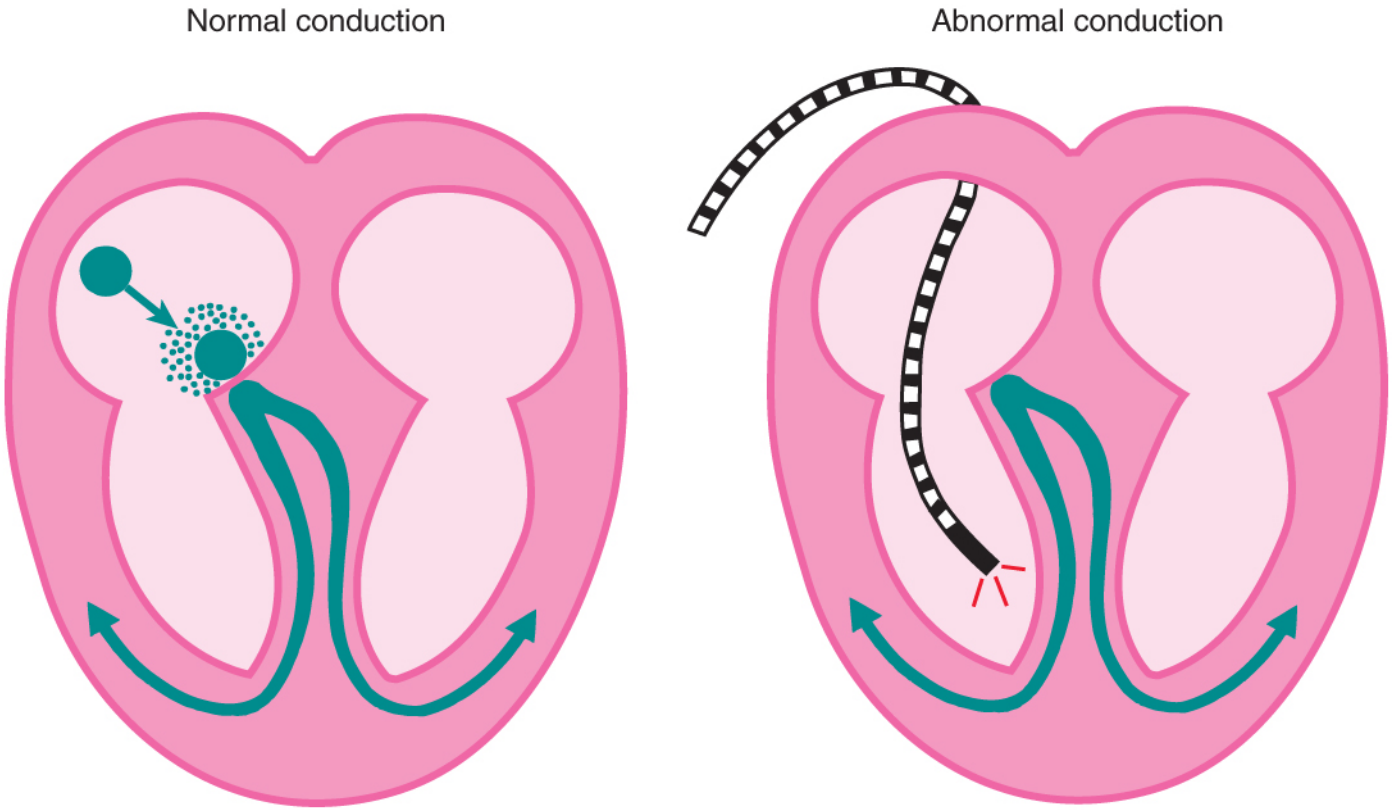
Atrial Pacemakers

- Atrial pacemaker rhythm showing pacer spikes; heart rate, 70 beats/min; pacer rate, 70 per minute (notice depressed ST segments).

Ventricular Pacemakers

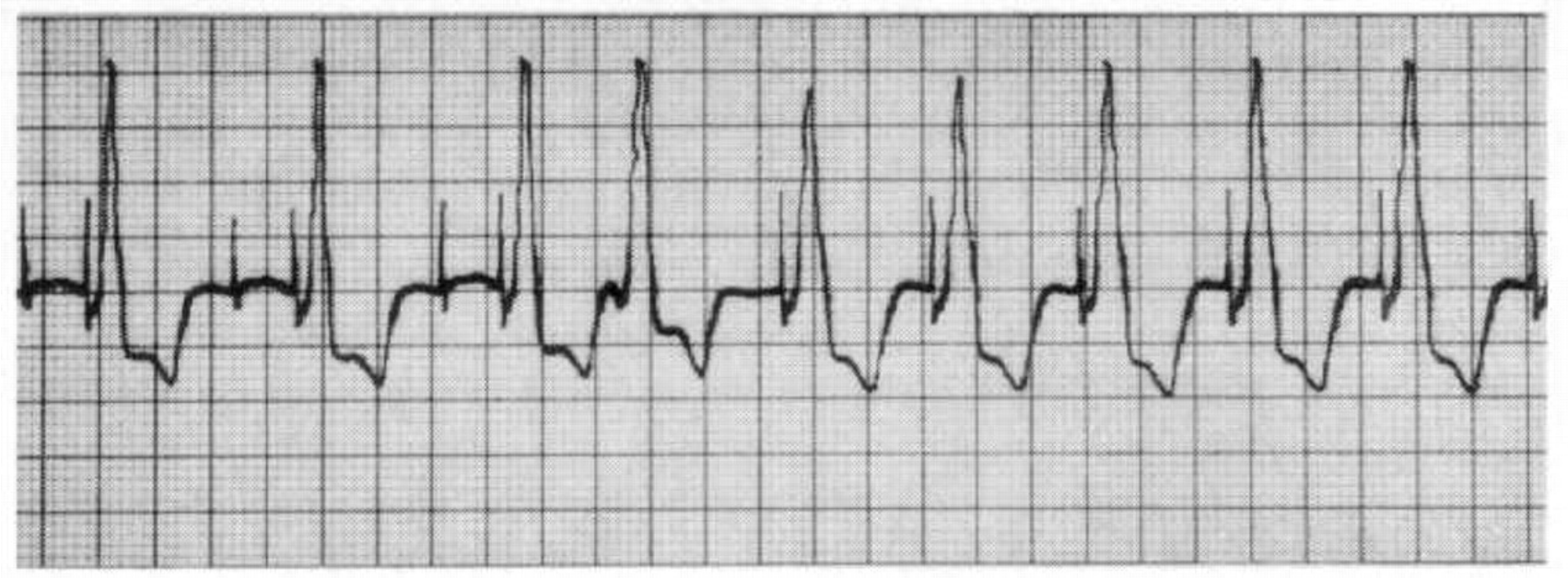
- Single or one chambered
- Lead wire and electrode may be placed either in right ventricle or in left ventricle
- Pacemaker impulse causes depolarization of ventricular muscle
- Atria may not depolarize if extensively damaged
- Pacer spike, followed by QRS will appear
- QRS usually > 0.12 second

Ventricular Pacemakers

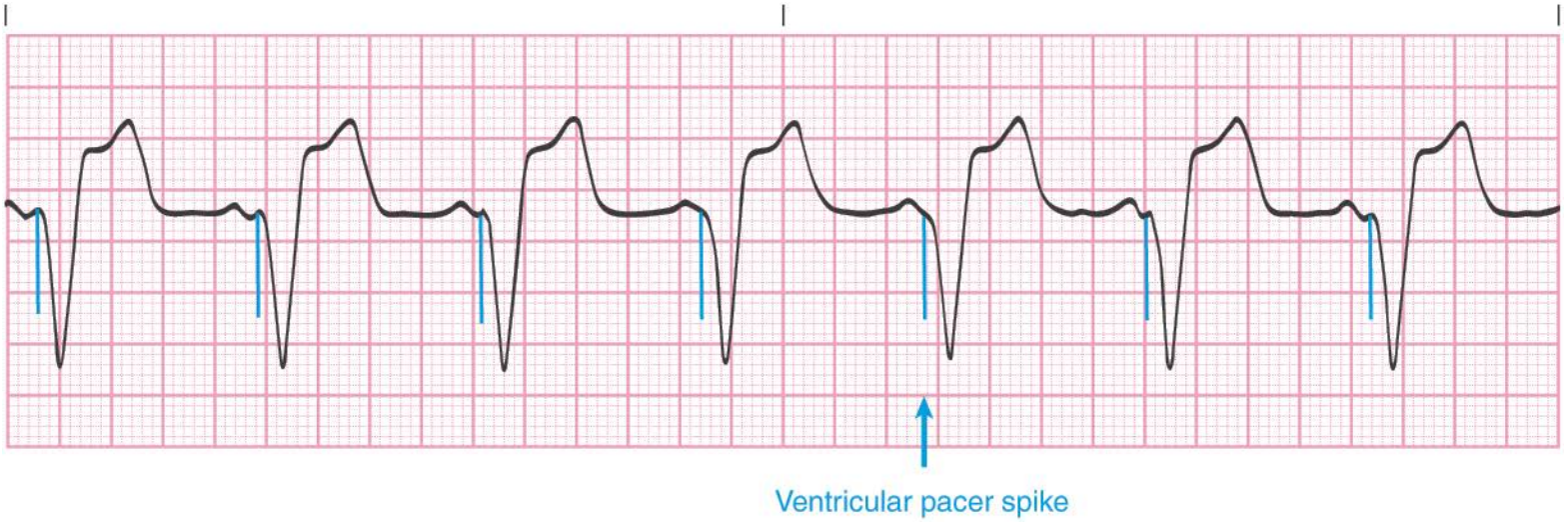


- Left heart shows normal electrical conduction pathway. Right heart shows conduction pathway of ventricular pacemaker.

Ventricular Pacemakers



Ventricular Pacemakers

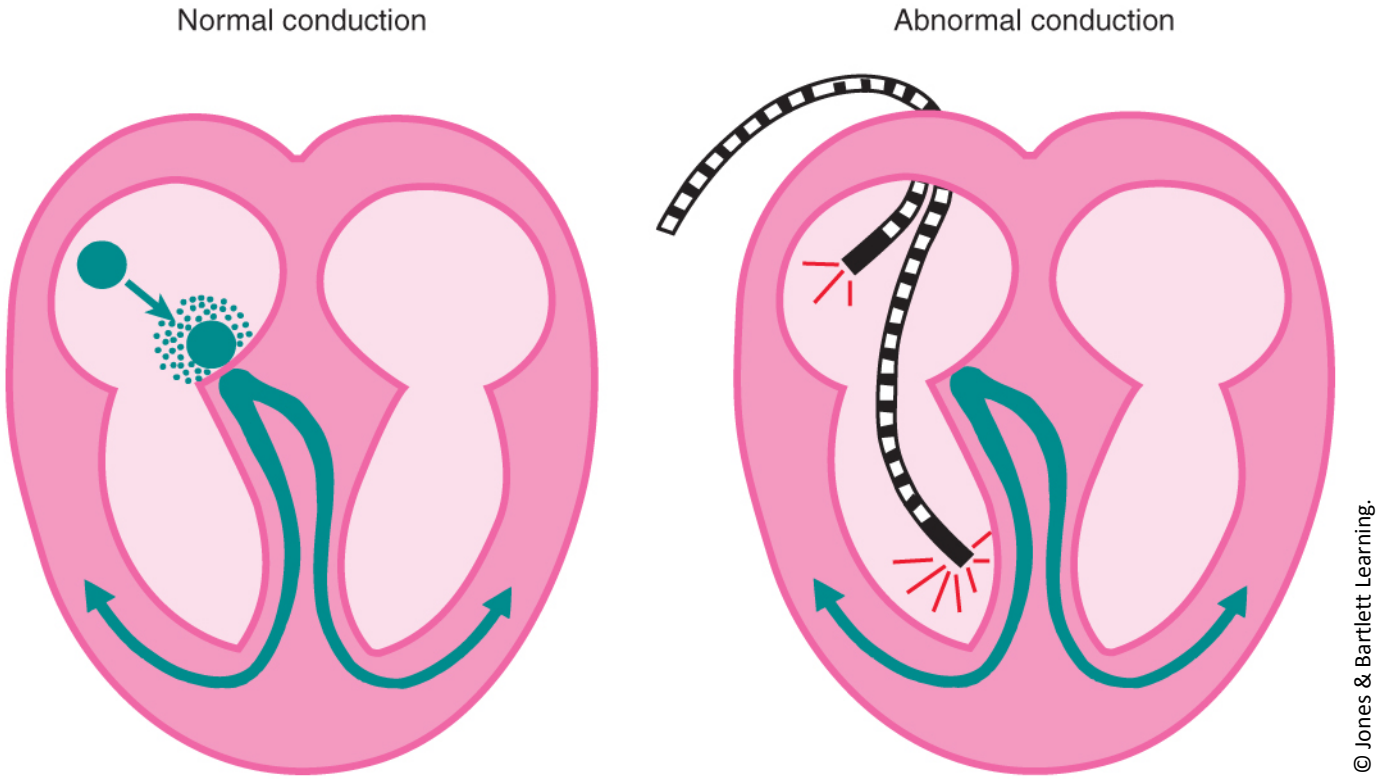


- Ventricular pacemaker rhythm with pacer spikes; heart rate, 70 beats/min; pacer rate, 70 per minute (notice elevated ST segments).

AV Sequential Pacemakers

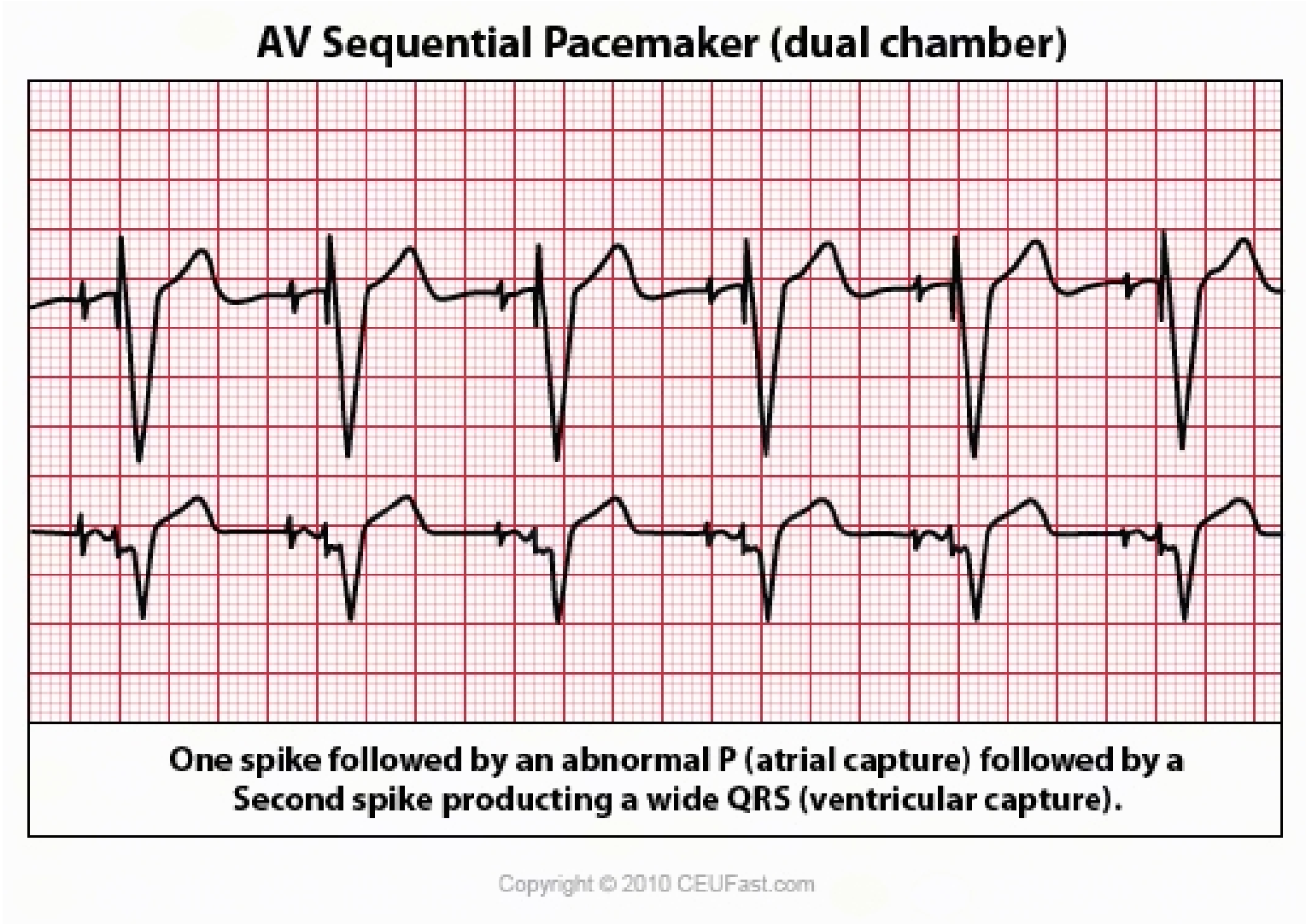
- Two or dual chambered
- Most commonly used type of pacemaker
- Stimulates depolarization of both atria and ventricles
- One type has 2 lead wires:
  - One in right atrium
  - One in right ventricle
- Use of two electrodes allows atria and ventricle to depolarize in normal sequential manner

AV Sequential Pacemakers



- Left heart shows normal electrical conduction pathway. Right heart shows conduction pathway of sequential pacemaker.

AV Sequential Pacemakers



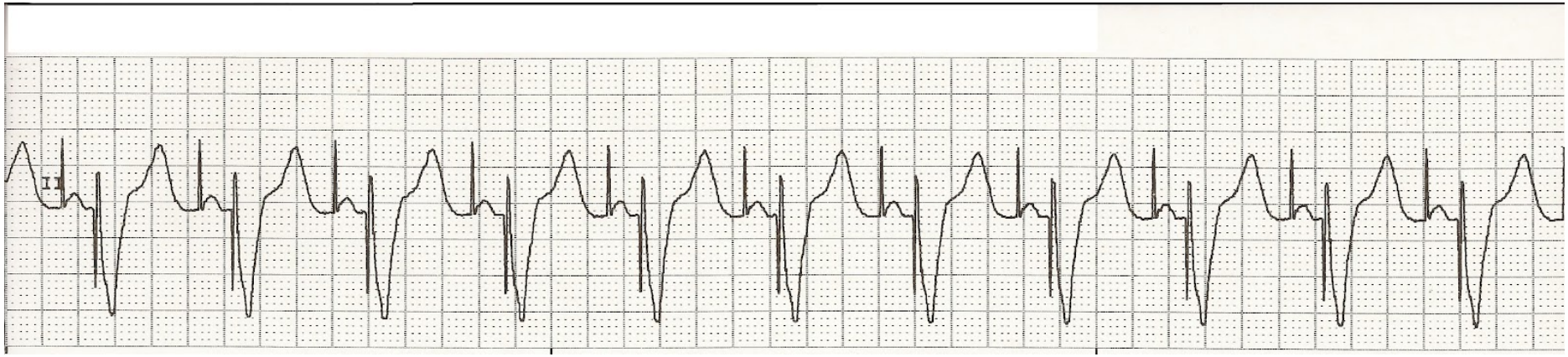
Biventricular Pacemakers

- Cardiac resynchronization therapy
- Used to greatly improve CO by causing both ventricles to contract at same time
- Usually have three lead wires
  - One in right atrium
  - One in right ventricle
  - Third in left ventricle
- Controls depolarization using overdrive pacing
  - Uses stronger impulse than heart's own impulse

Biventricular Pacemakers

- Also a sequential pacemaker
  - Known as a triple-chamber pacemaker or three-chambered pacemaker
- May show 2 pacer spikes before each QRS
  - May occur so close together that they appear as one long spike
  - First spike = atrial lead firing
  - Second spike = ventricular lead(s) firing
- P wave may not be seen
- QRS > 0.12 second

Biventricular Pacemakers

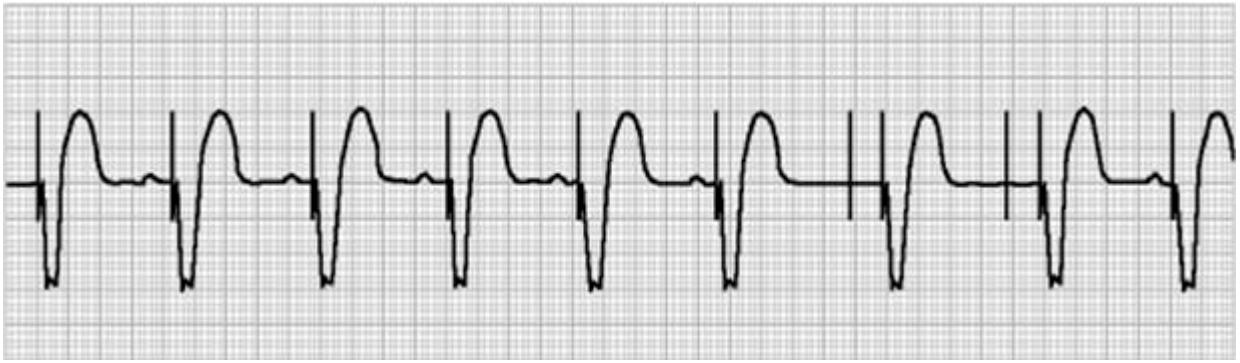


Capture and Pacing

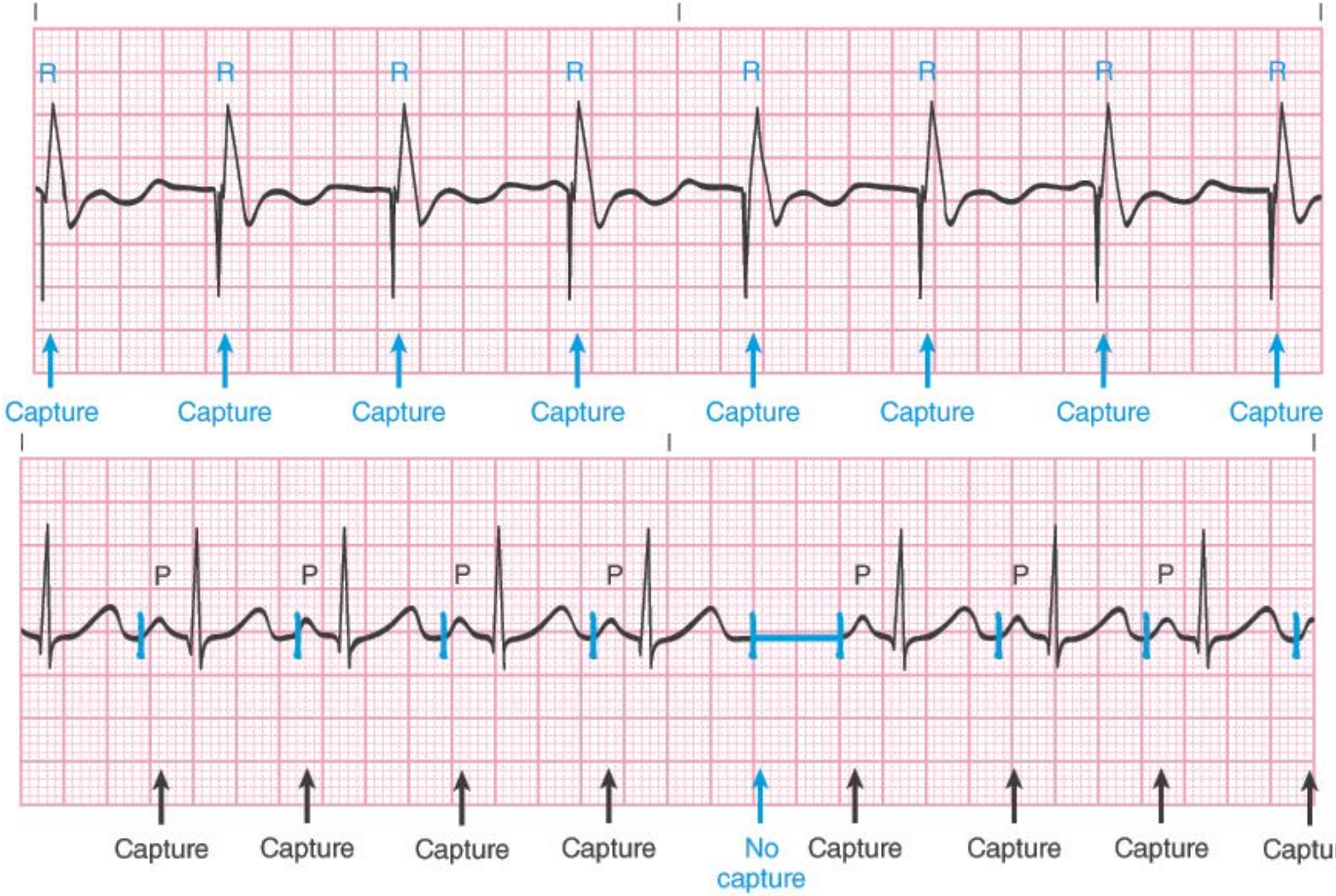
- Capture = Cardiac cell's ability to depolarize in response to impulse generated by artificial pacemaker
  - Depolarization indicated by P wave or QRS after every pacer spike
  - Presence of QRS does not always indicate contraction of myocardium, only contraction of impulse through cardiac muscle

Capture and Pacing

- Pulse = mechanical capture (ability of cardiac muscle to contract in response to depolarization
- % of capture determined by # of pacer spikes that are followed by complex in relationship to total # of pacer spikes on entire strip



Capture



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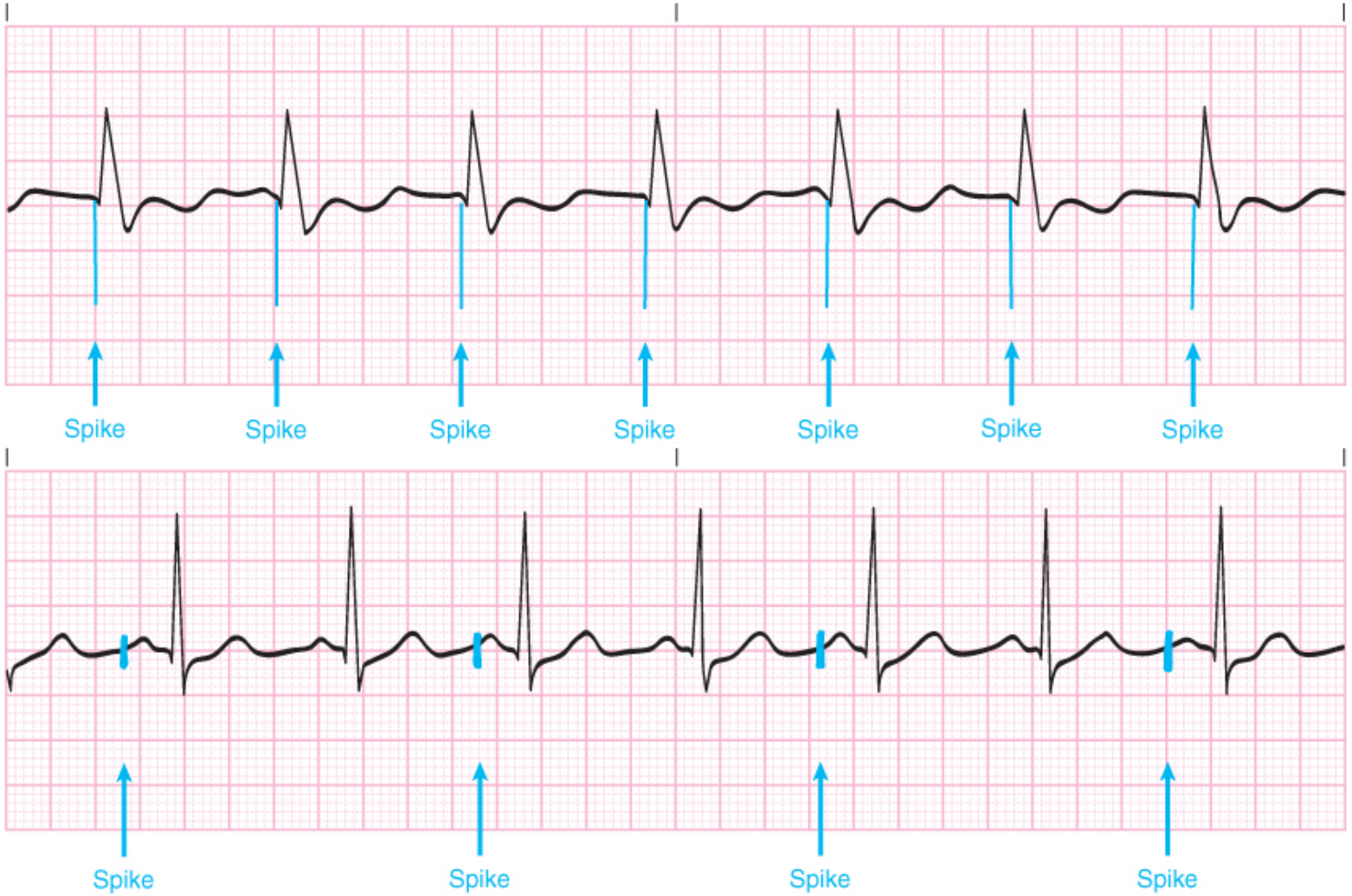
- Pacemaker capture. **A.** Ventricular pacemaker with 100% capture (notice depressed ST segment and diphasic T waves); heart rate, 80 beats/min; pacer rate, 80 per minute. **B.** Loss of capture; atrial pacemaker with 90% capture; heart rate, 80 beats/min; pacer rate, 90 per minute.

Capture and Pacing

- Loss of capture = When QRS doesn't follow pacer spike
  - May indicate voltage needs to be increased or myocardium so damaged that unable to respond
- Pacing = % of complexes generated by artificial pacemaker
  - QRS without pacer spike generated by heart
- % of pacing depends on pacemaking ability of heart and type of pacemaker
- % of capture should always be 100% regardless of % of pacing

Pacing



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- Pacemaker pacing. A. Ventricular pacemaker with 100% pacing; heart rate, 70 beats/min; pacer rate 70 per minute (notice depressed ST segment and diphasic T waves). B. Atrial pacemaker with 50% pacing; heart rate, 70 beats/min; pacer rate, 40 per minute.

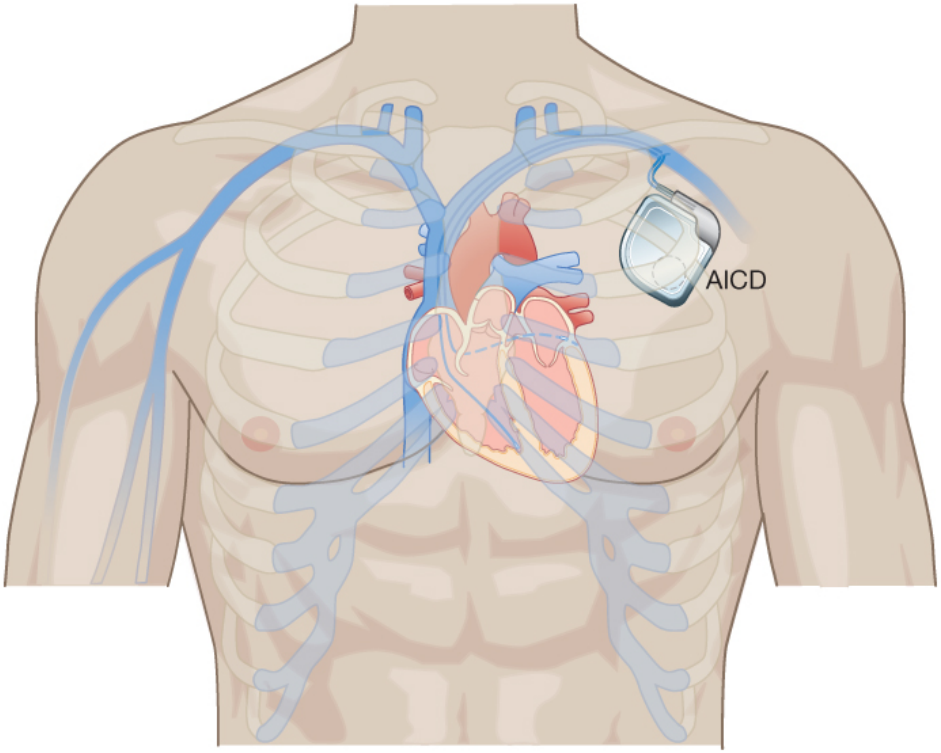
Implantable Cardioverter Defibrillator

- Technique that delivers electrical current to heart to correct V Fib and pulseless V Tach
- Automatic implantable cardioverter defibrillator (ICD or AICD) surgically implanted under skin
- For potentially lethal dysrhythmias
- Designed to recognize ventricular dysrhythmias such as V Fib and V Tach and programmed to defibrillate heart

Implantable Cardioverter Defibrillator

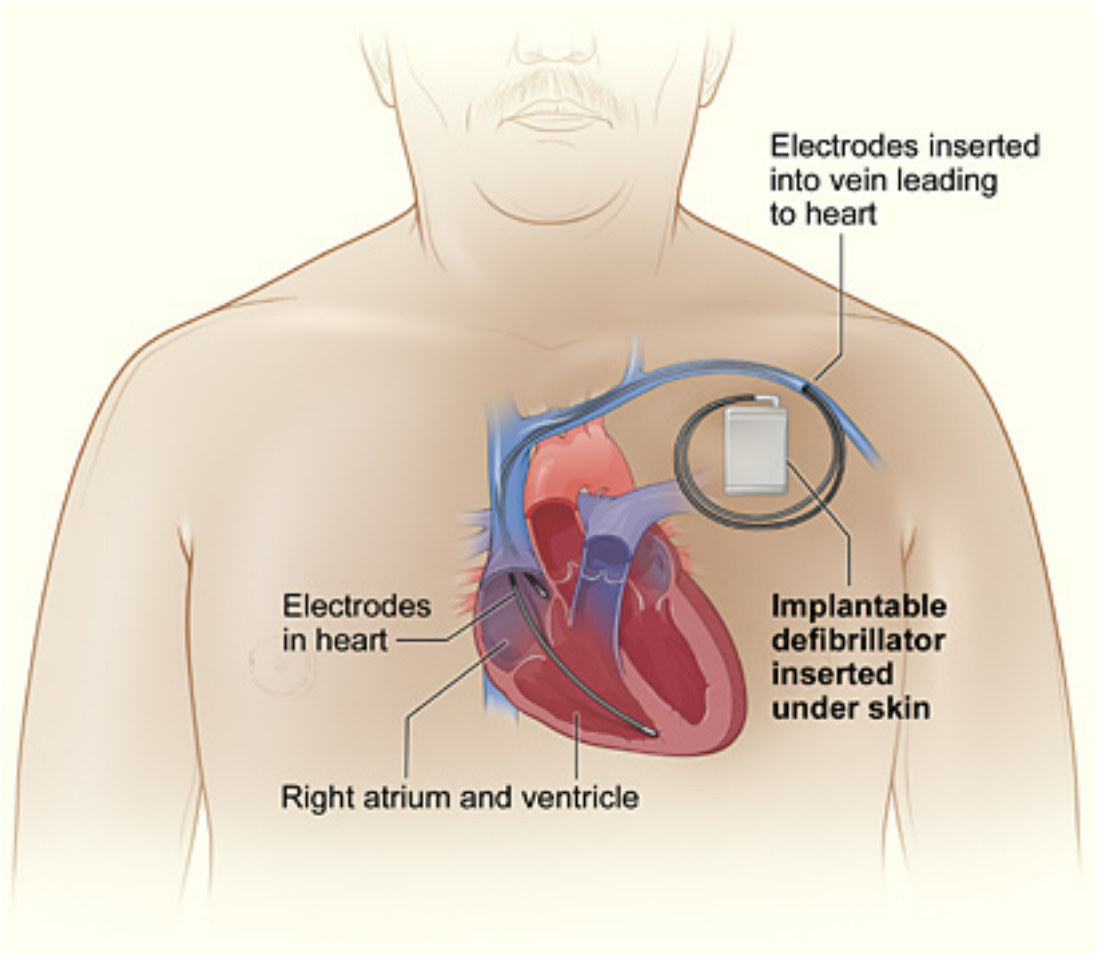
- Designed to terminate V Fib and V Tach and restore sinus rhythm
- Lead wires and sensing units inserted into atria and either one or both ventricles
- Can be programmed to initiate low-voltage impulses when HR becomes rapid (> 150 ipm)
- If impulse not strong enough, may be programmed to increase voltage and initiate 1-2 more impulses
  - Patient may complain of feeling “kicked” in chest

Implantable Cardioverter Defibrillator



- Automatic implantable cardioverter defibrillator (AICD) unit. Electrodes are inserted into the atrium and the ventricle.

Implantable Cardioverter Defibrillator



Implantable Cardioverter Defibrillator

- If HR remains rapid, will deliver shock
- Will defibrillate until heart returns to normal rate or AICD turned off
- Firing of ICD appears similar to pacing spike, but may have greater amplitude

Automated External Defibrillator

- Also known as AED
- Device that can increase survival rate after cardiac arrest
- Provides treatment before medical rescuers arrive
- Senses and evaluates heart rhythm and rate
- Either delivers shock or instructs rescuer what to do

Automated External Defibrillator

- Make sure patient on dry surface not touching metal
- Remove medication patches if applicable
  - Be careful not to touch medicated side of patch with bare fingers
- Don’t place pads over pacemaker/ICD
- 2 electrode pads:
  - One below right collarbone
  - Second slightly beneath left armpit
- Turn on machine and ask everyone to stand back
  - Device will analyze patient’s cardiac rhythm and provide defibrillation if needed
  - Don’t touch patient while analyzing or defibrillating

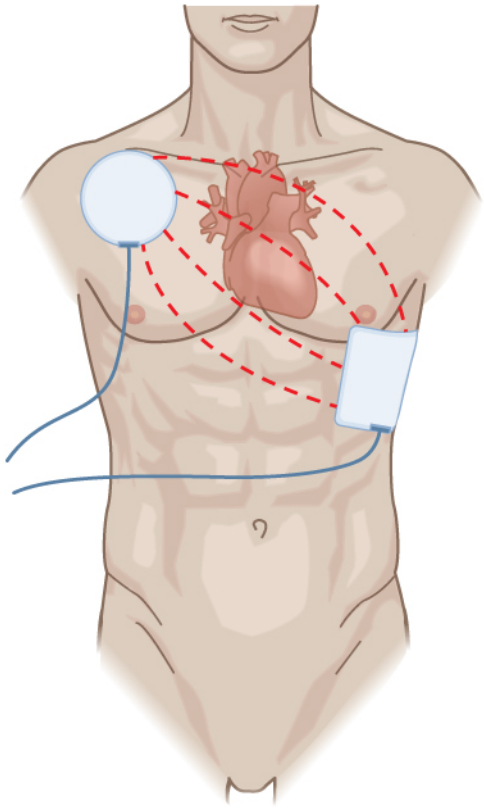
Automated External Defibrillator

- Machine will analyze cardiac rhythm again after defibrillation and instruct rescuer when to begin CPR, if needed
- Tell emergency personnel how long AED has been in use, if defibrillation was given and how many times, and what length of time CPR has been performed
- AED repeatedly has been shown to be one of the most important tools for resuscitating patients with lethal ventricular dysrhythmias

Automated External Defibrillator

Automated External Defibrillator

- Automated external defibrillator (AED) unit.



- AED electrode placement.