

Chapter 25 Nursing Care of Patient with Cardiac Arrhythmias

Audra Xenakis, BSN, RN

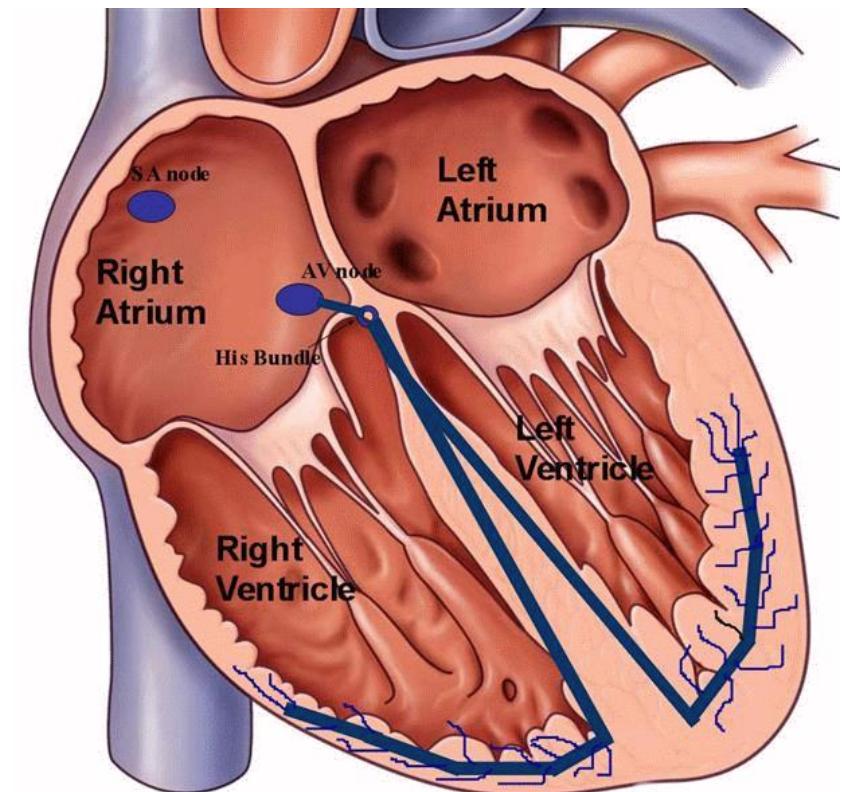
Health & Illness III

Objectives

- Describe how electrical activity flows through the heart
- List the six step used for arrhythmia interpretation
- Explain current medical treatment for cardiac arrhythmia
- Discuss cardiac pacemakers and implantable cardioverter defibrillators and the use
- Plan nursing care for patients with an arrhythmia and implanted device

Cardiac Conduction System

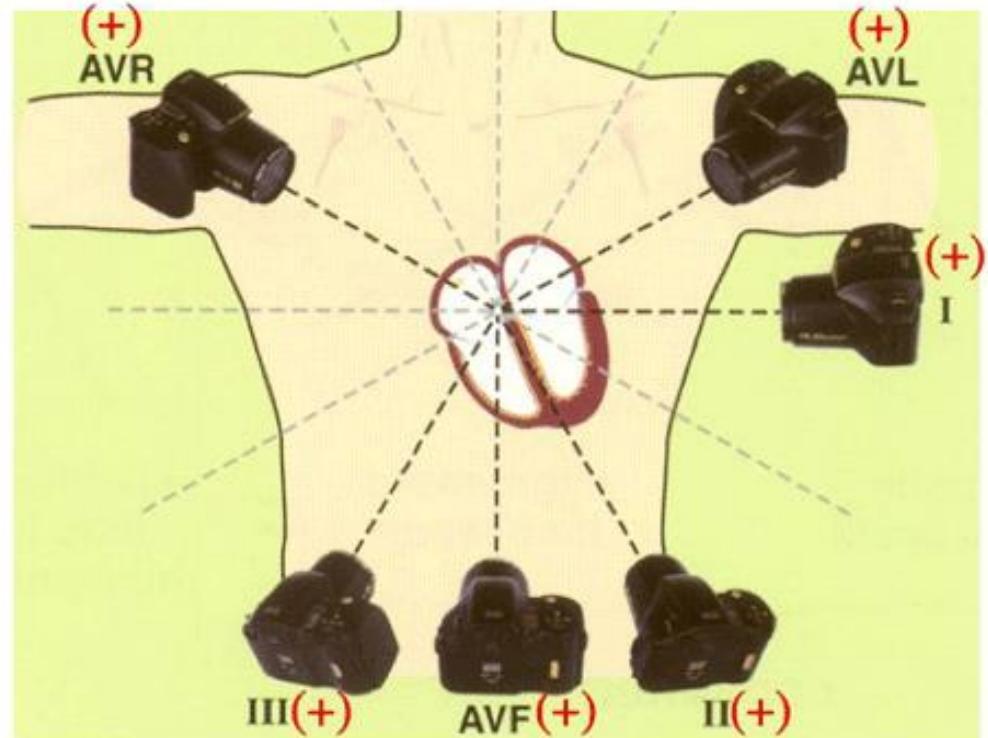
- Electrocardiogram (ECG) tracing
- SA node to AV node-contract atriums
 - Atrial systole (atrium contracting)
- Bundle of His to Purkinje Fibers-contracts ventricles
 - Ventricular systole (ventricle contracting)
 - Depolarization-Electrical activity that causes heart to contract
 - Atrial depolarization
 - Ventricle depolarization
 - Repolarization-heart resting state
 - Atrial repolarization
 - Ventricle repolarization



Electrocardiogram

- Shows electrical activity of heart
- Electrodes are placed on skin
- Allow various views of heart's electrical activity
- **Each view** referred as "lead"
- 12-lead ECG shows 12 different views of the heart
 - There are 10 leads, but gives a total of 12 views

“Limb Lead Views”

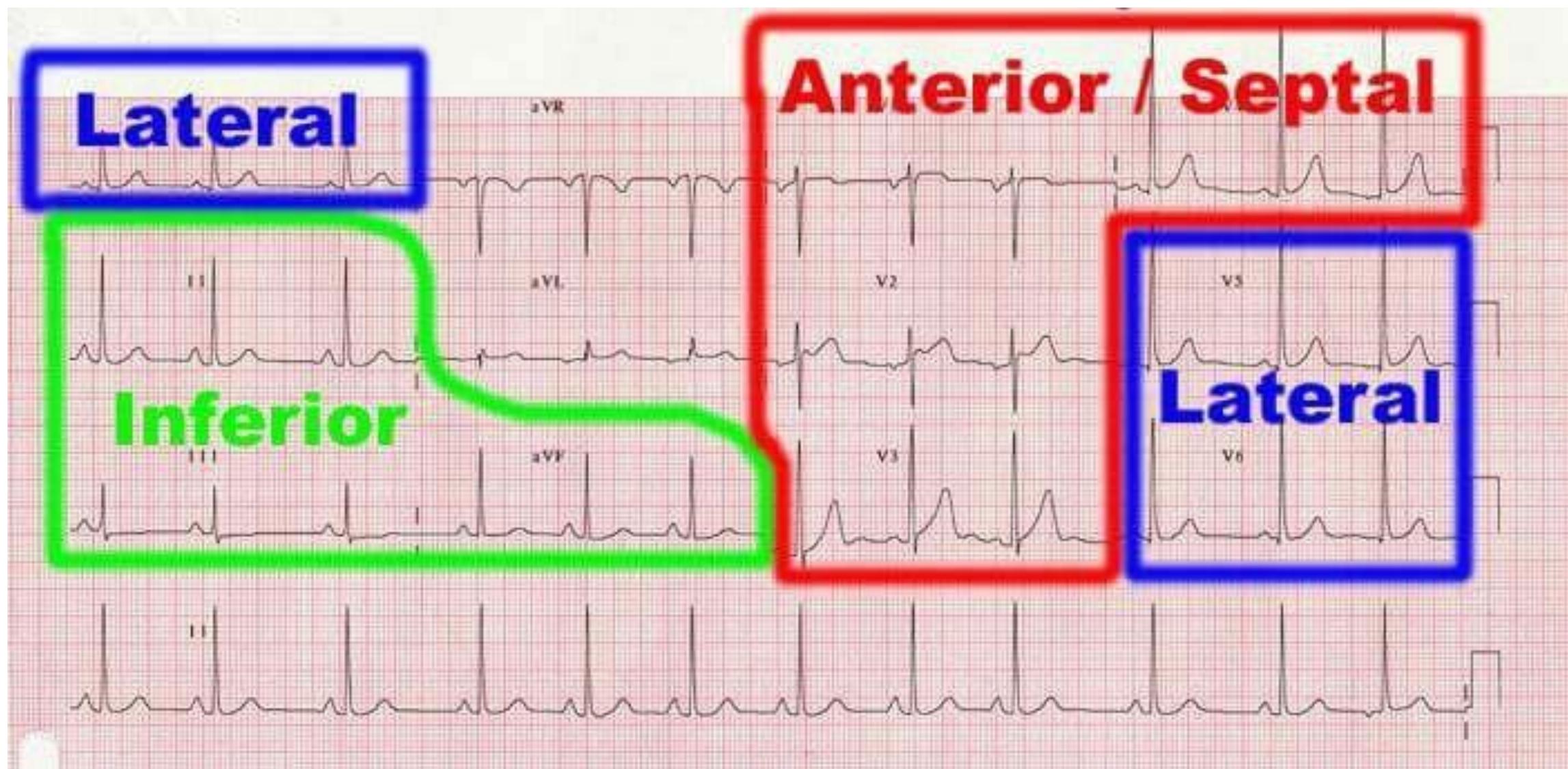


Lateral

Anterior / Septal

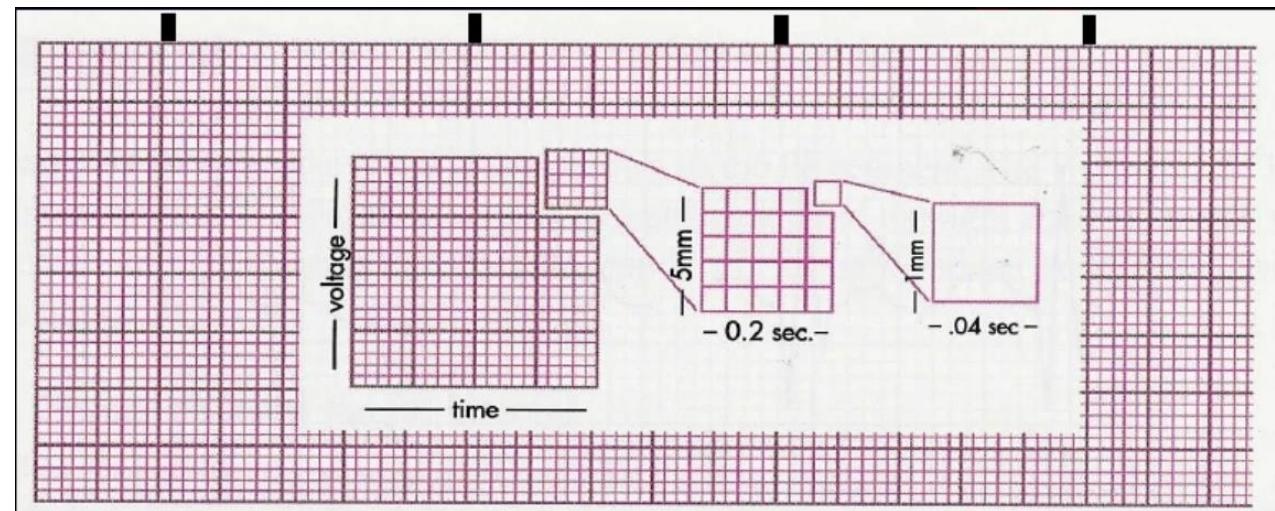
Inferior

Lateral



ECG Graph Paper

- One (1) Large block-has 5 small squares
 - One (1) large block-Represents 0.20 seconds
- Each Small squares-Represents 0.04 seconds
- Half of a Small square-Represents 0.02 seconds



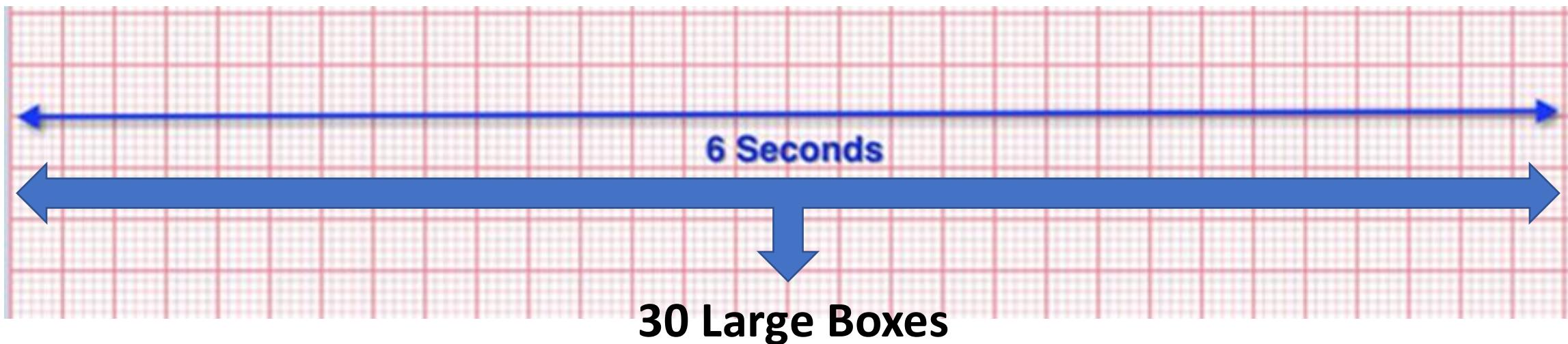
6 second ECG Paper measures time and voltage of the heart's electrical activity...

Time is measured by:

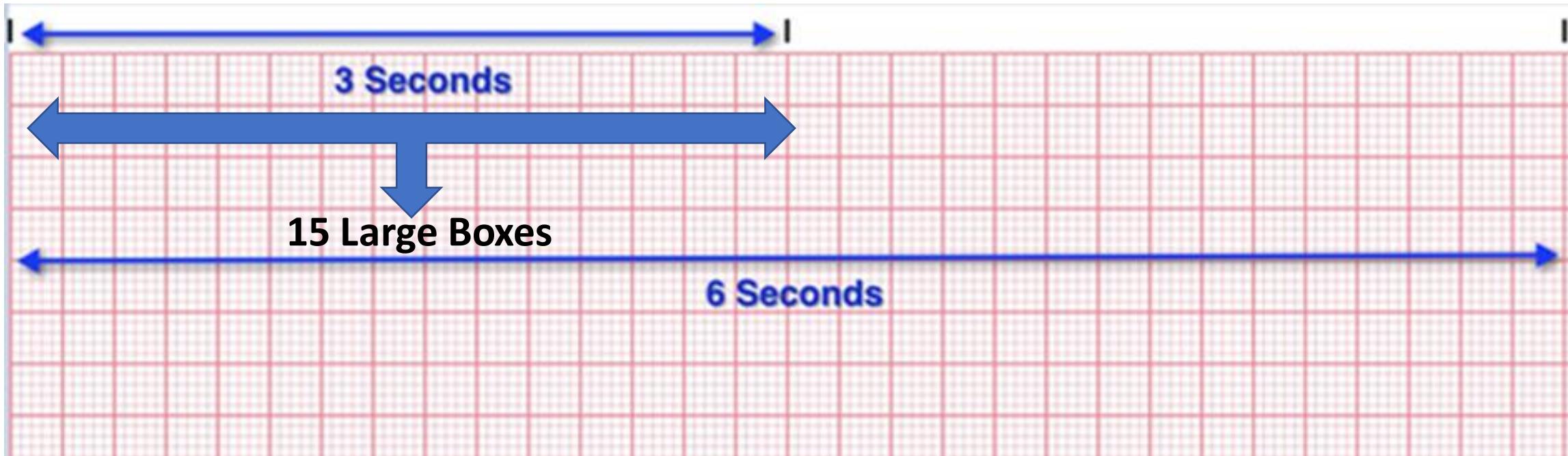
Large Boxes

Small boxes

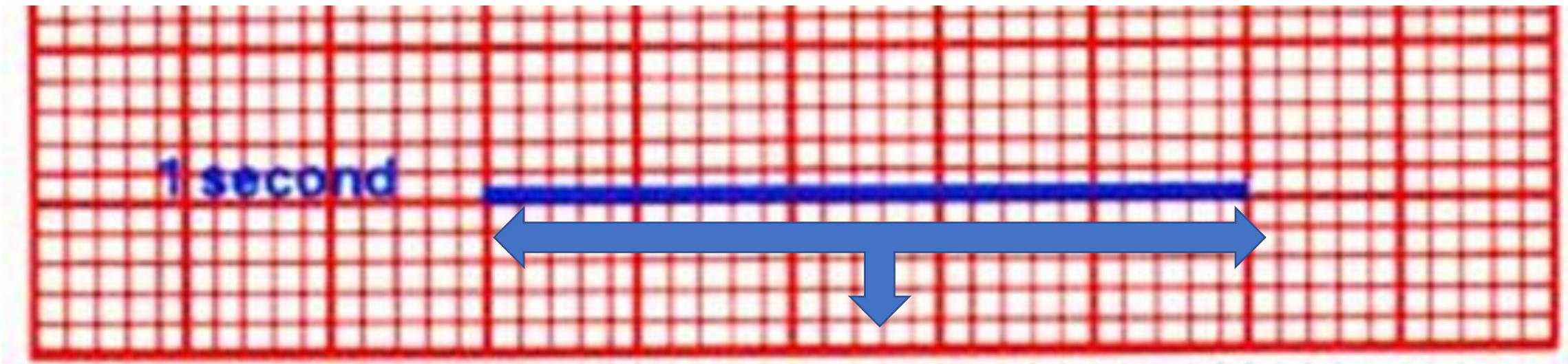
30 Large Boxes = 6 seconds



15 Large boxes = 3 seconds

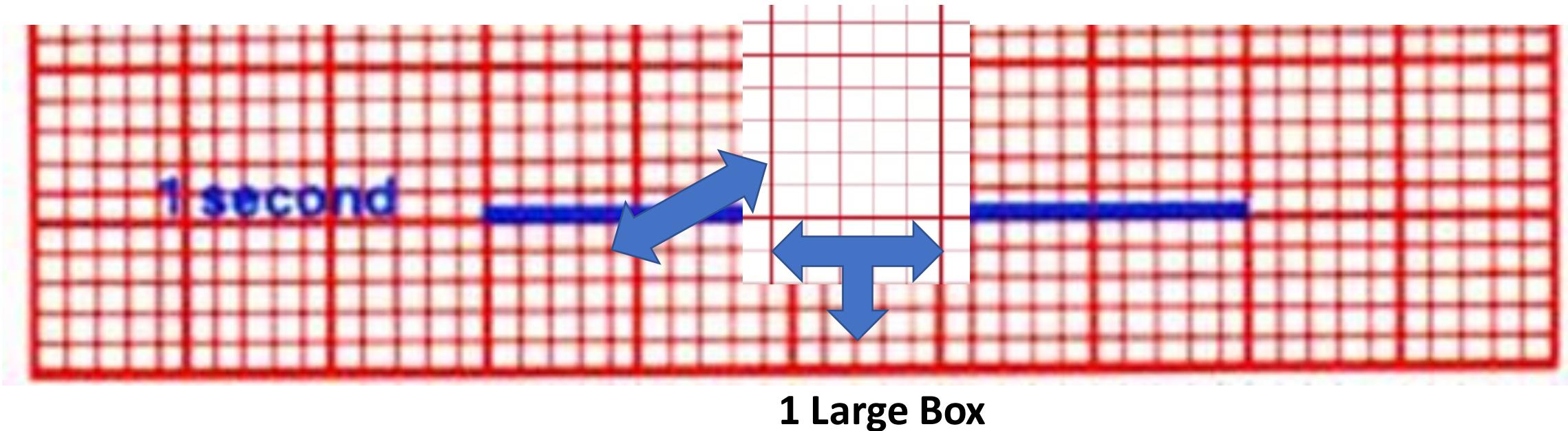


5 Large Boxes = 1 second

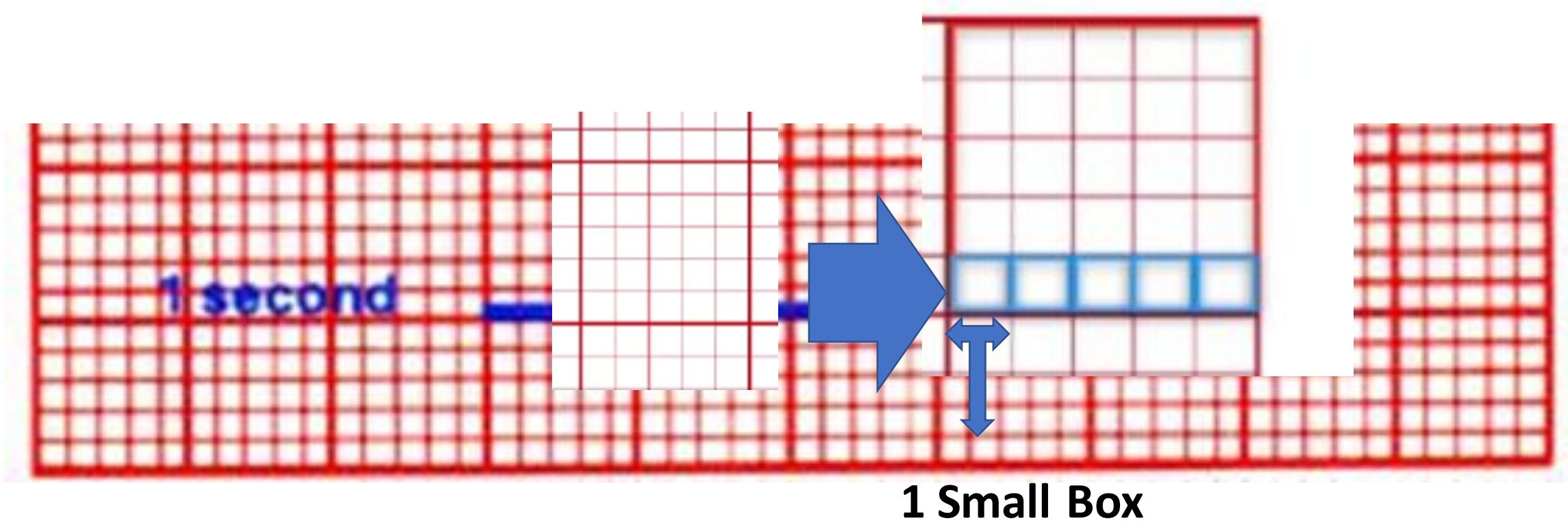


5 Large Boxes

**1 Large Box = 0.20 seconds
($0.20 \times 5 = 1.0$ second)**



1 Small Box = 0.04 seconds
($0.04 \times 5 = 0.20$ seconds)



.04 seconds —

Small Box = 0.04 Seconds

.08 seconds —

2 Small boxes X 0.04 seconds = 0.08 seconds

.12 seconds —

3 Small boxes X 0.04 seconds = 0.12 seconds

.16 seconds —

4 Small boxes X 0.04 seconds = 0.16 seconds

.20 seconds —

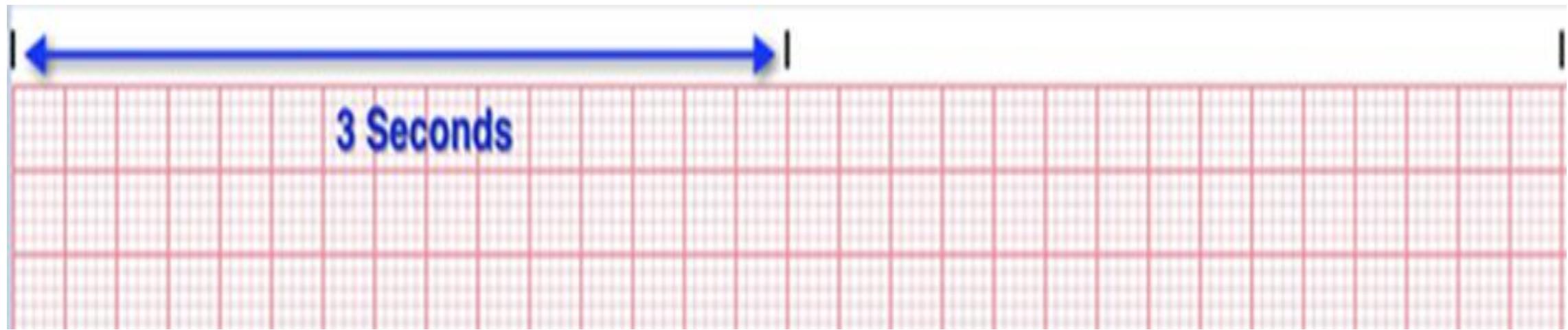
5 Small boxes X 0.04 seconds = 0.20 seconds

Which is 1 Large Box

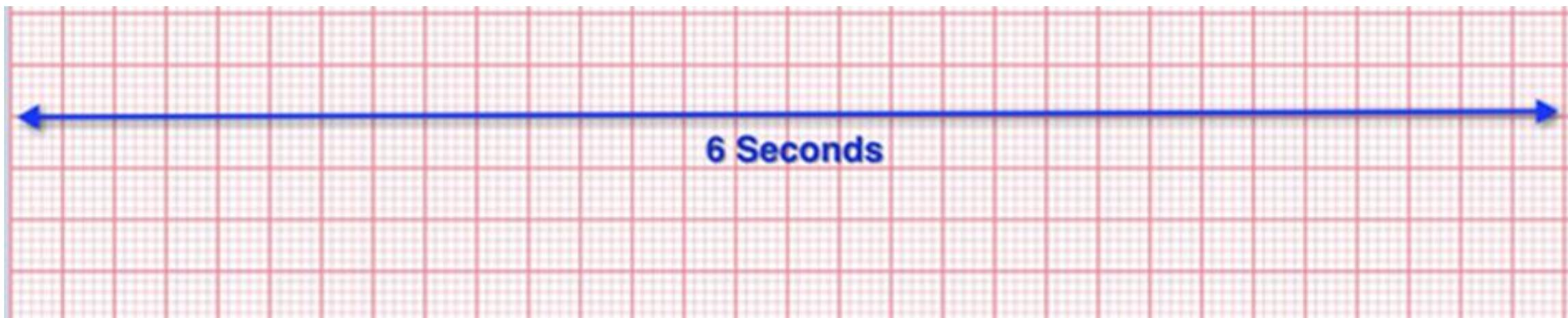
1 second —

5 Large Boxes = 1 second

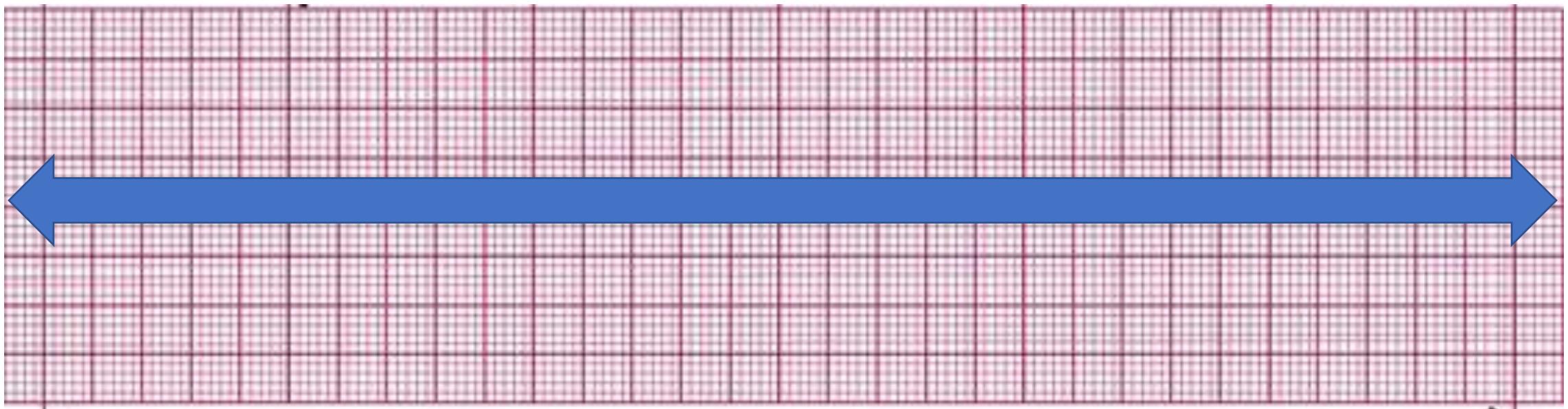
15 Large boxes = 3 seconds



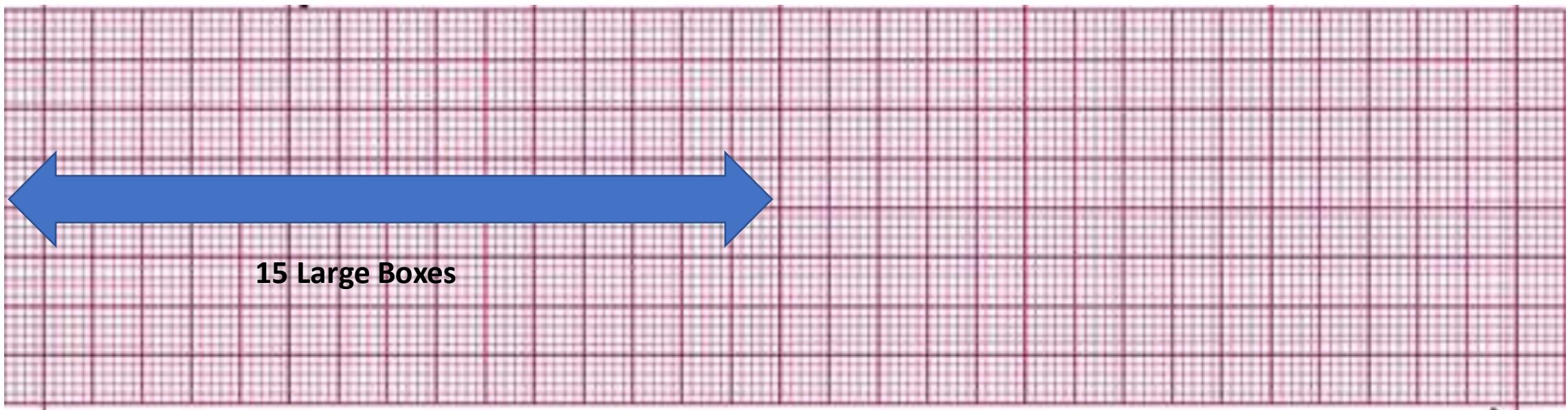
30 Large Boxes = 6 seconds



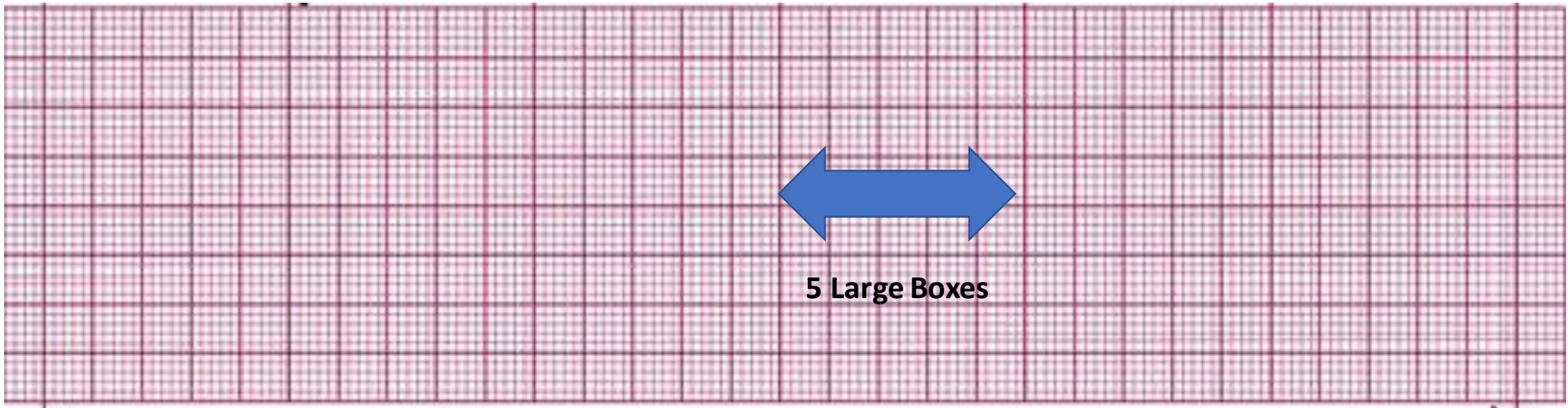
Mark 6 Seconds on this Strip
30 Large Boxes



Mark 3 Seconds on this Strip

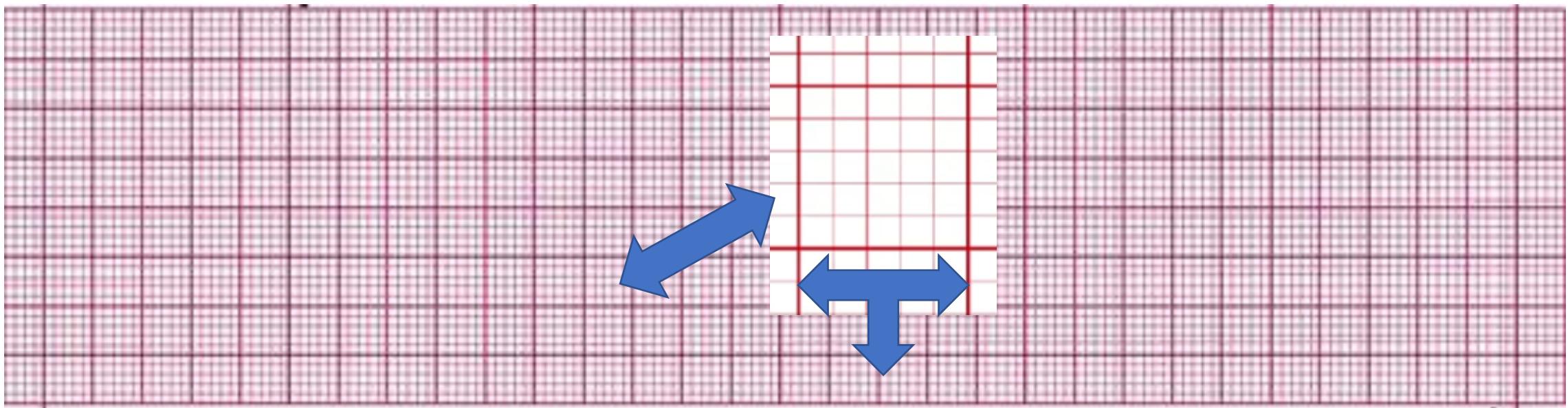


Mark 1 Second on this Strip



Mark 1 Large Box

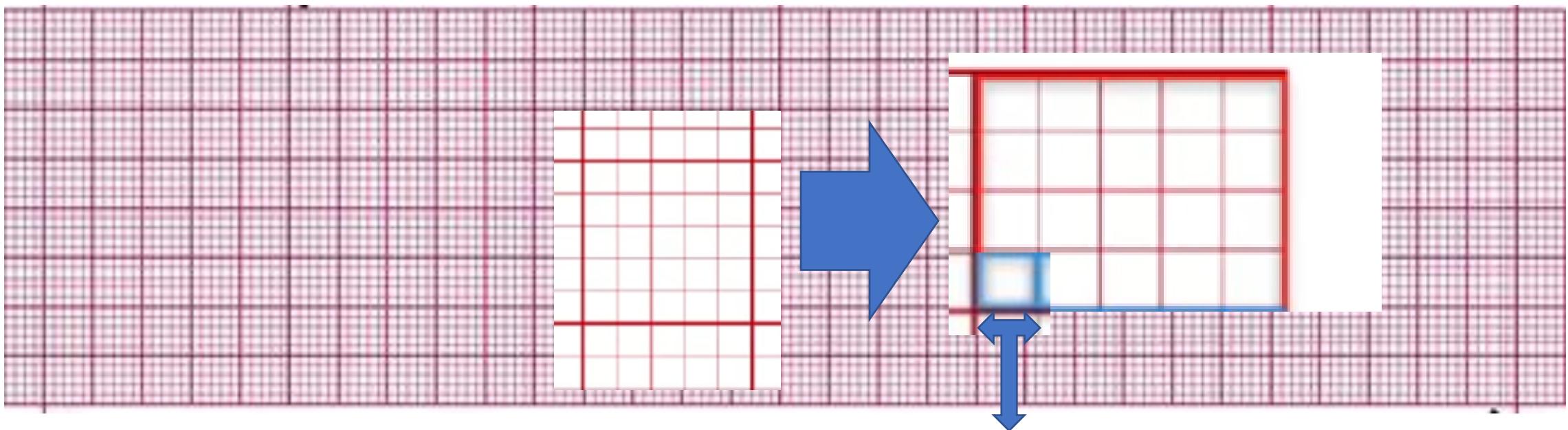
How many Seconds does this represent?



1 Large Box = 0.20 Seconds

Mark 1 Small Box

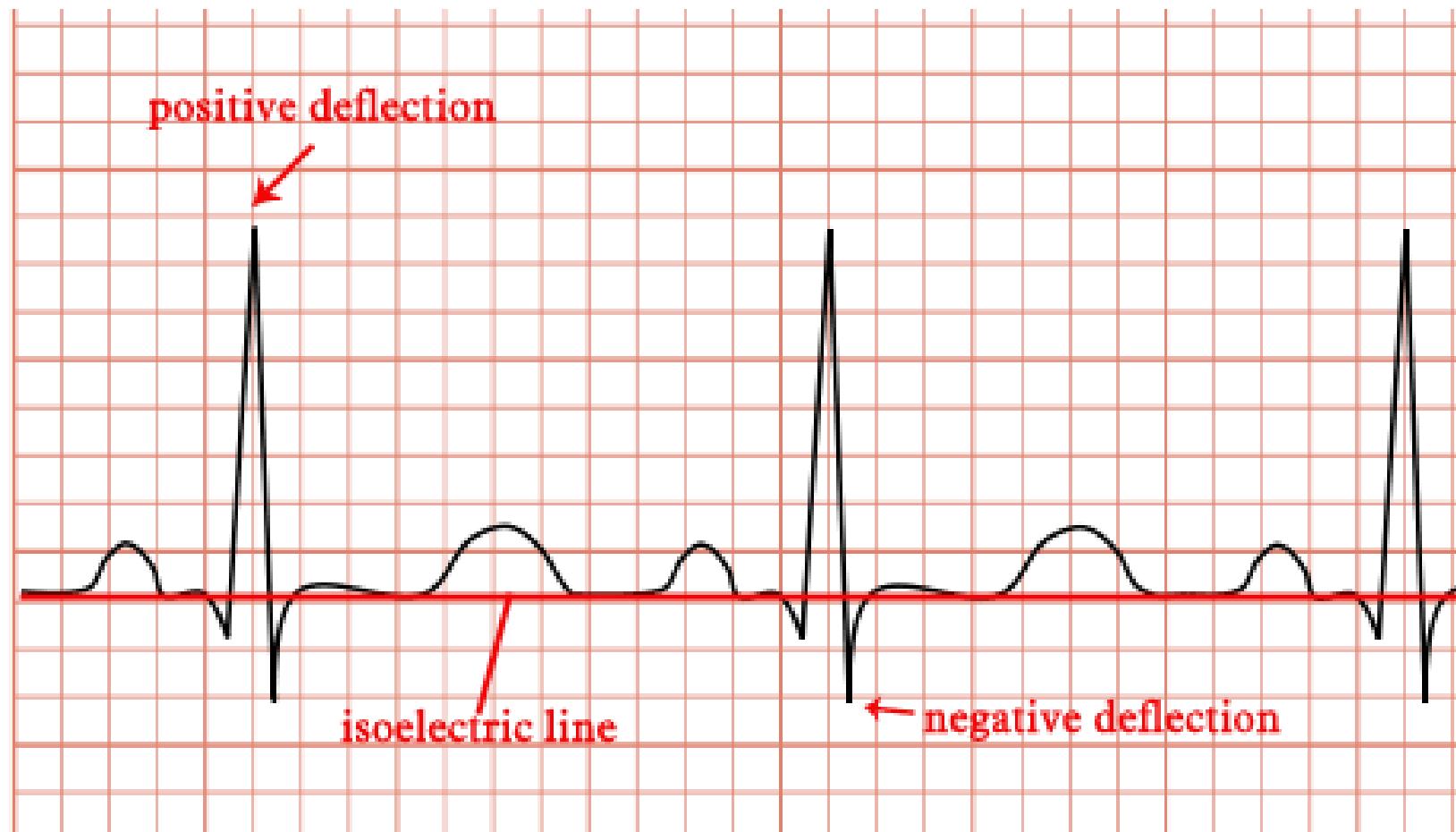
How many Seconds does this represent?



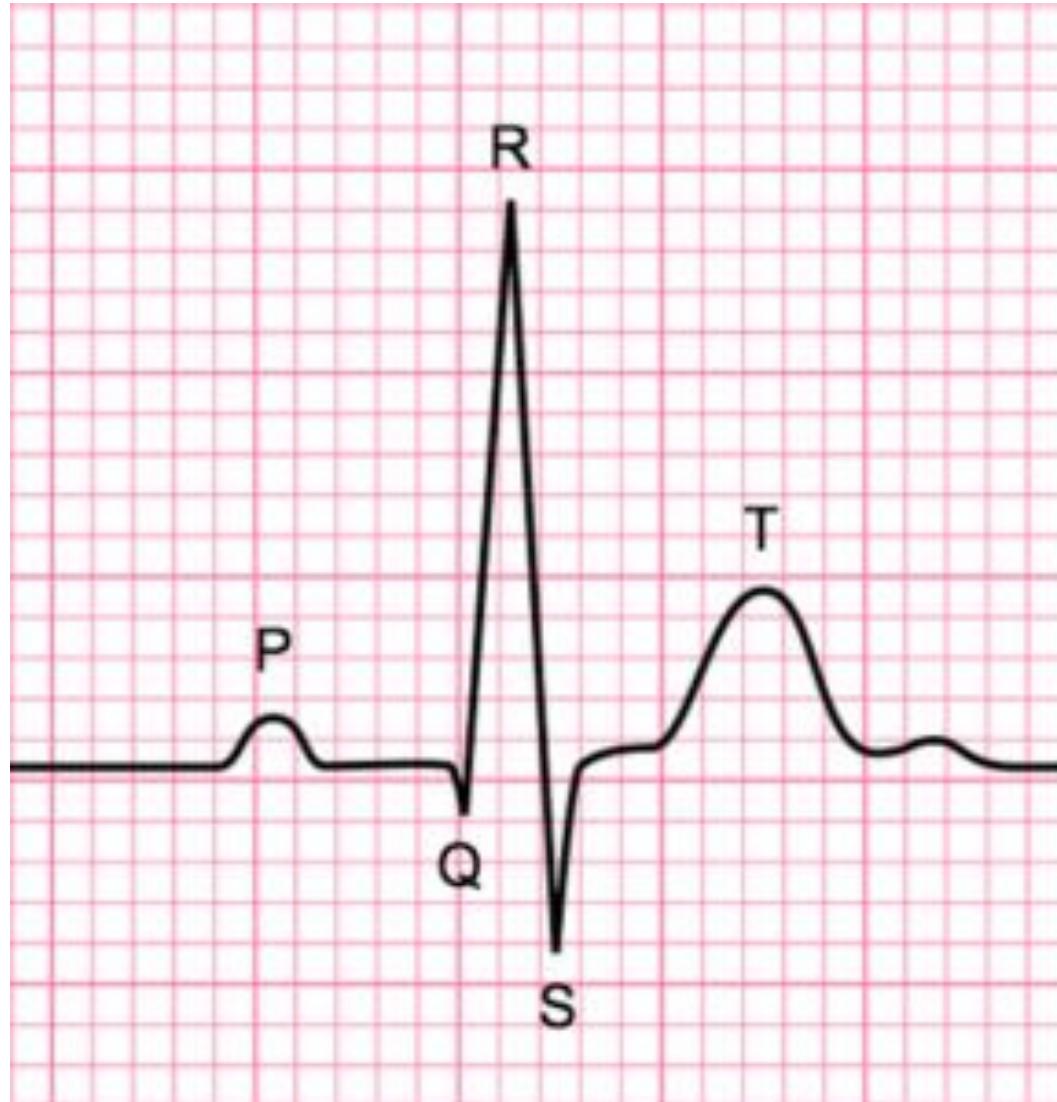
1 Small Box = 0.04 seconds
($0.04 \times 5 = 0.20$ seconds)



Isoelectric Line-Baseline

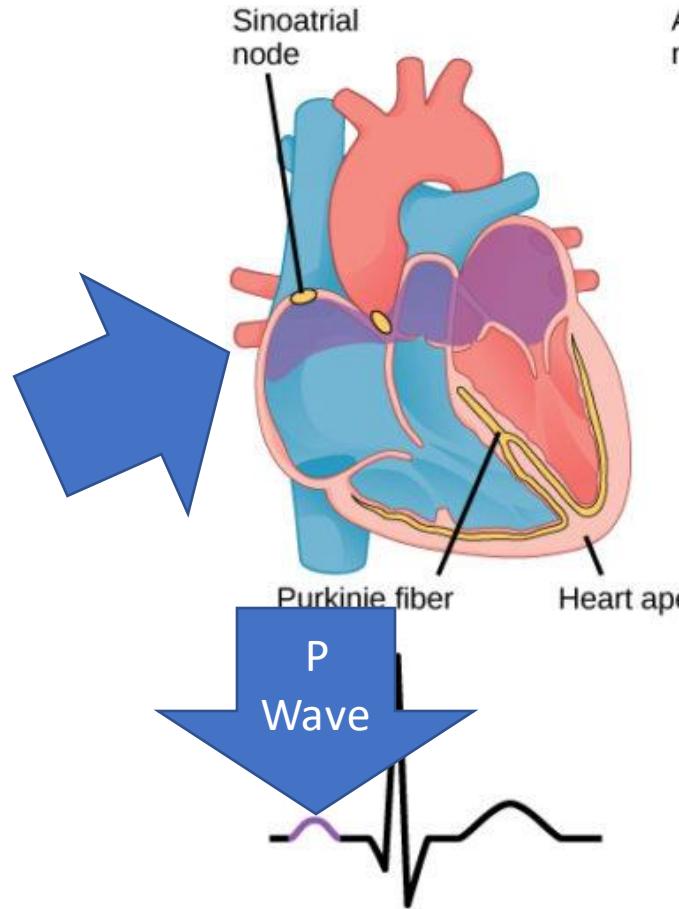


Components of the Cardiac Cycle



P Wave

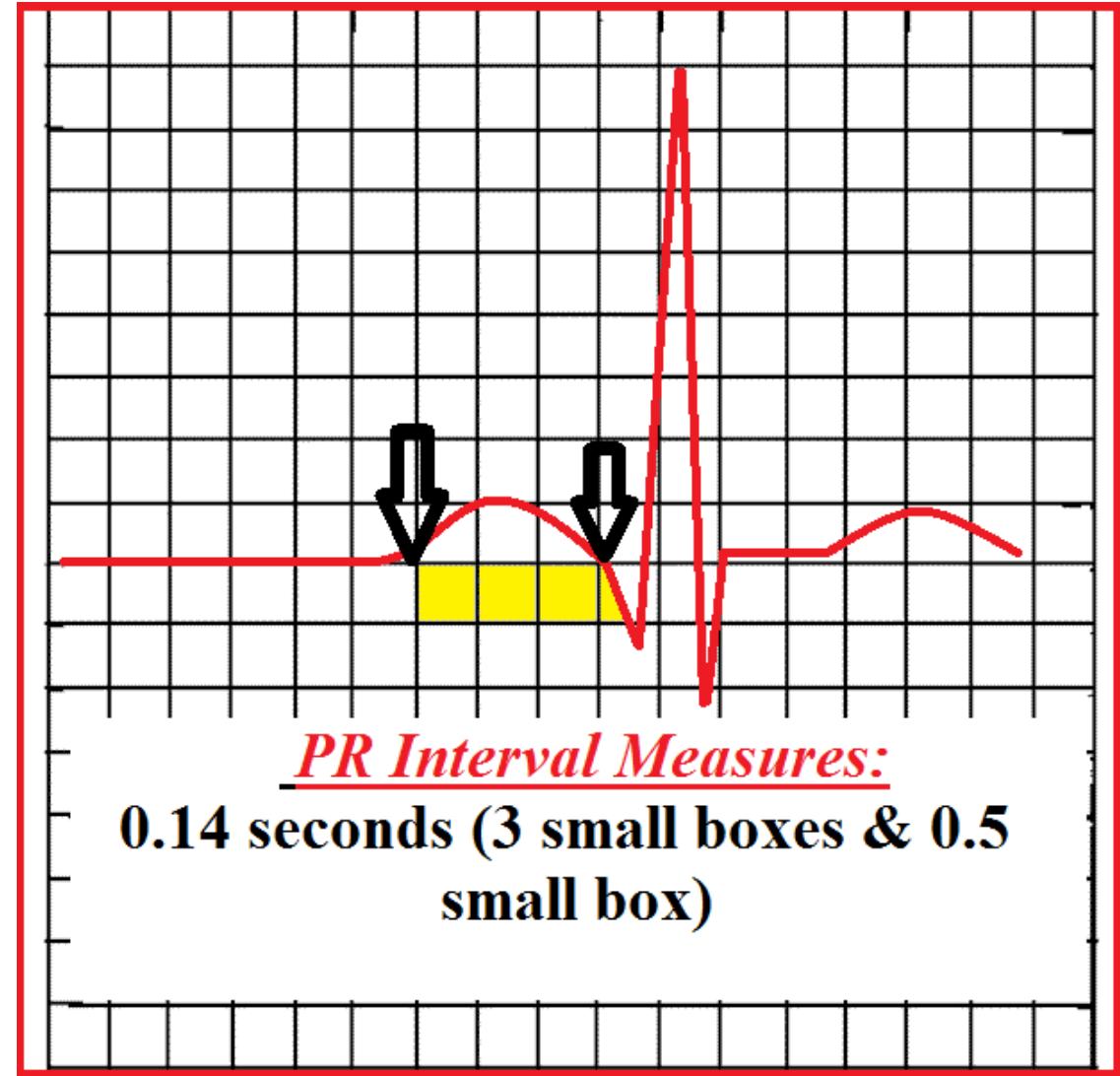
- Represents Atrial Depolarization (Atriums contracting)
- Begins when SA node fires electrical impulse
- Spreads through atrium and contracts atrium
- Appears rounded, small hill on ECG paper
- Disorders will alter shape and size



(a) An electrical impulse travels from the sinoatrial node to the walls of the atria, causing them to contract.

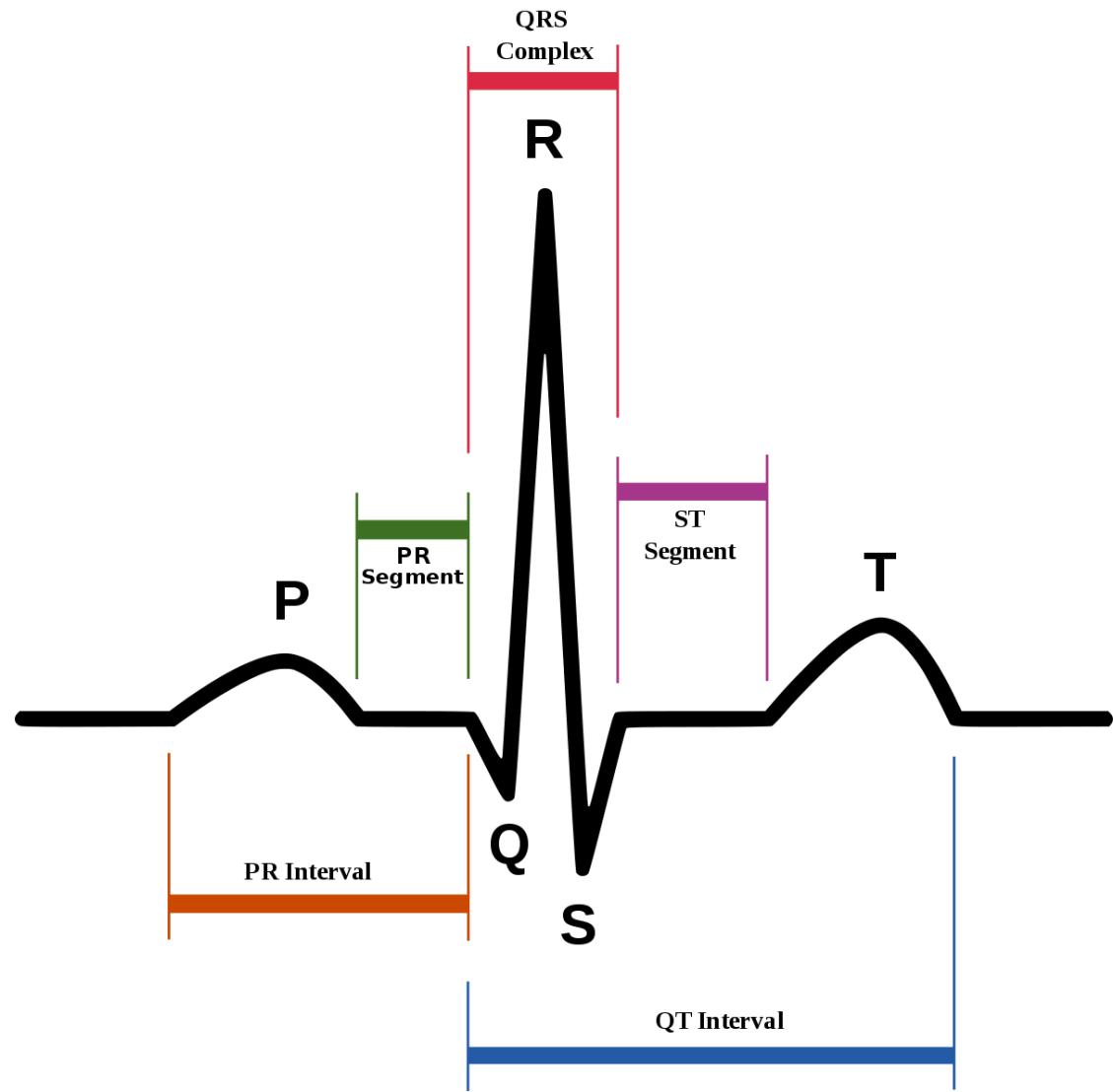
PR Interval

- Time it take from SA to AV nodes
- Normal: 0.12 to 0.20 seconds



QRS Complex

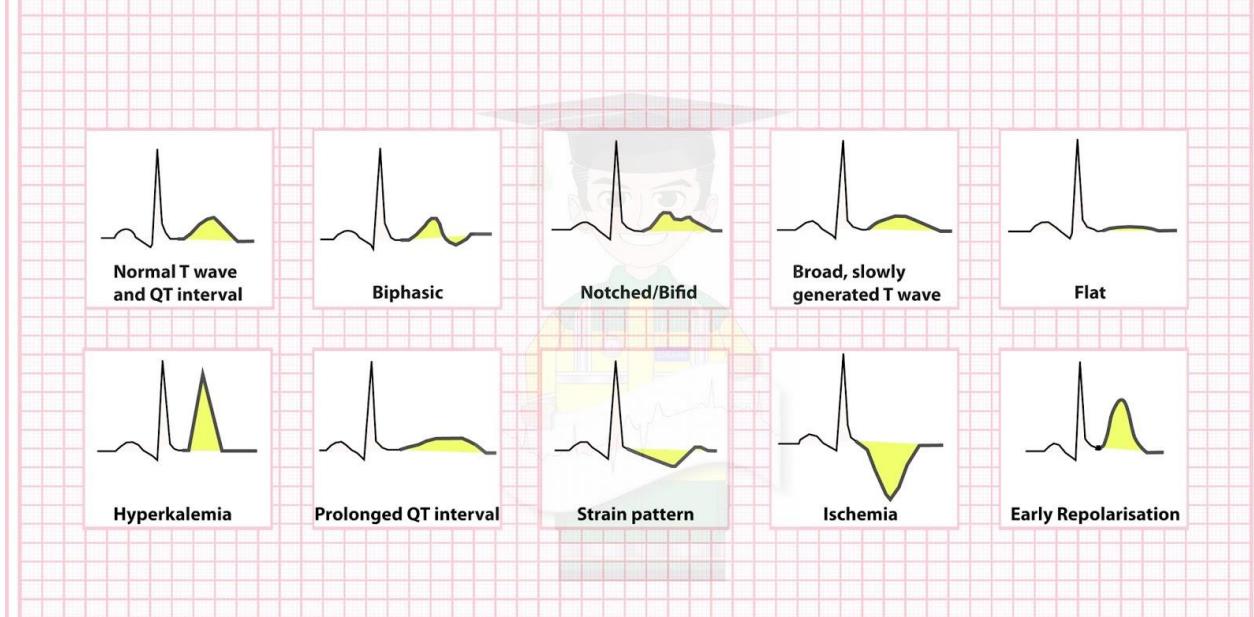
- Ventricle Depolarization (Ventricle contracting)
- Time takes AV node to Purkinje Fibers
- Normal: 0.06 to 0.10 seconds
- Complex is Larger than P Wave
 - Ventricles are larger-muscle mass



T Wave

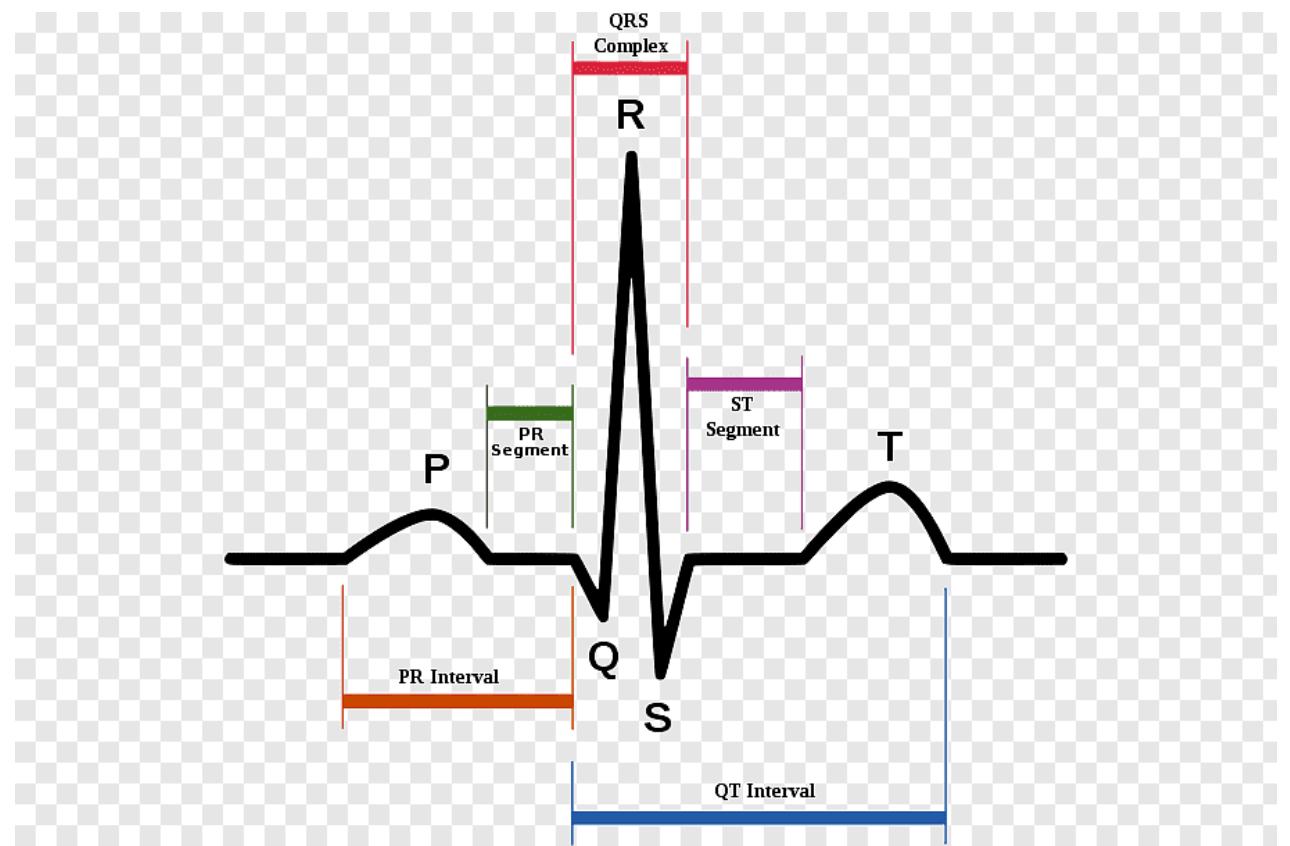
- Ventricular Repolarization- Resting state of ventricles
- Rounded wave
- Usually "positive" (above isoelectric line)
- Inverted (below isoelectric line)-can indicate cardiac ischemia

Types of T wave Morphologies



QT Interval

- Time from start of Q wave to end of T wave
- Represents time for ventricles depolarization and repolarization
 - (Ventricle's contract and rest)
- Normal 0.34-0.43 seconds
- Varies based on gender, heart rate, age
- Prolonged or shortened-can lead to ventricular arrhythmias
- Abnormal intervals
 - Genetic, heart conditions, electrolyte imbalances, medication



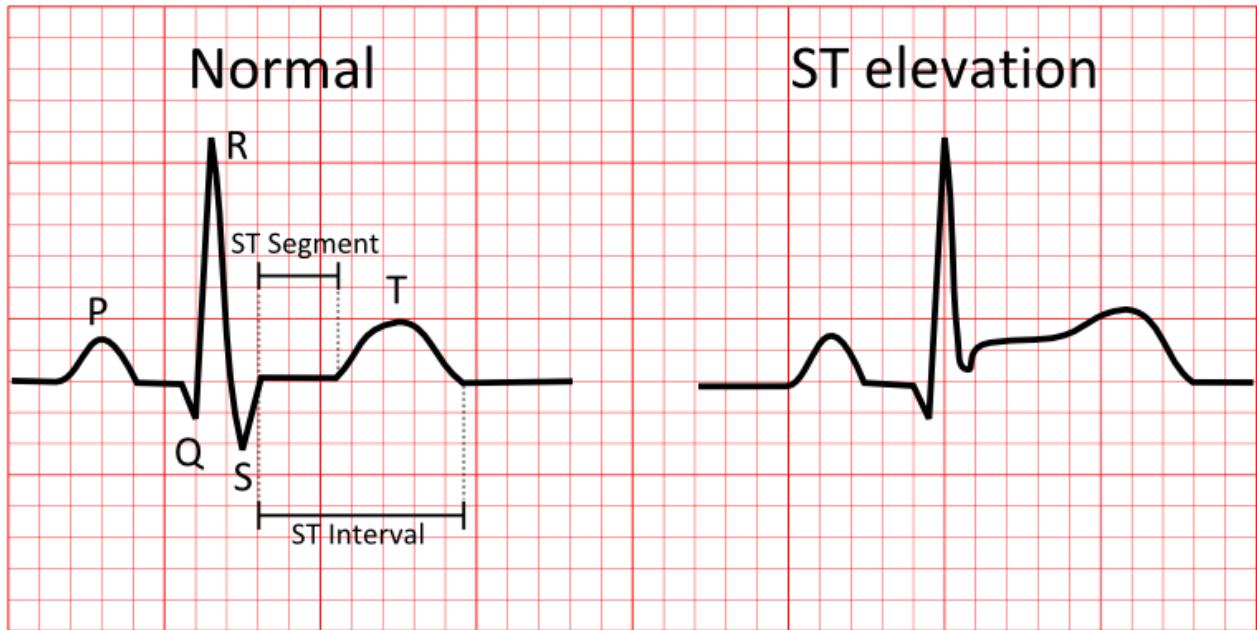
U Wave

- Usually not seen
- When is seen-generally hypokalemia (low potassium)

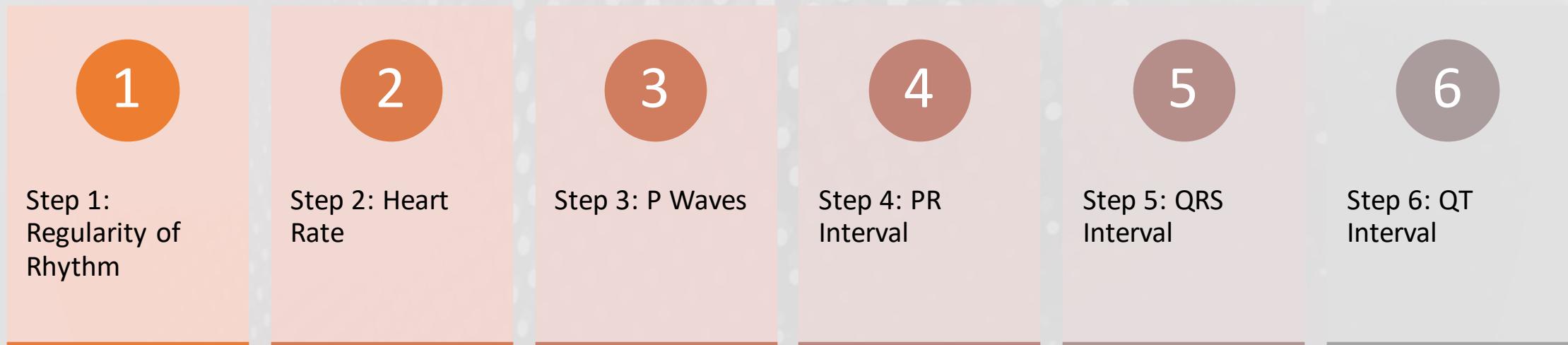


ST Segment

- Time from completion of depolarization (contraction) to repolarization (recovery)
- ST segments reviewed with chest pain
- Transmural Ischemia(MI with full thickness of myocardium)-ST segment can be inverted or depressed

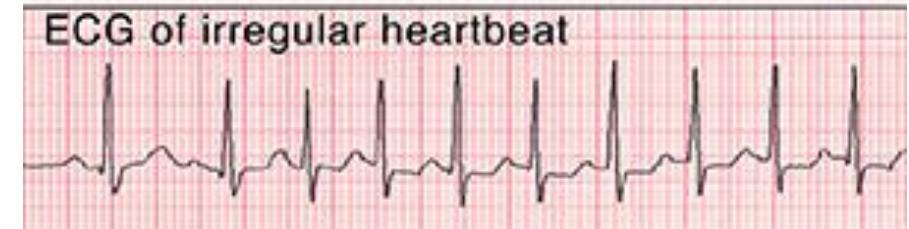


Six Step Process for Arrhythmia Interpretation



Six Step Process for Arrhythmia Interpretation

- Step 1: Regularity of Rhythm
- Look at "R" to "R" spacing-should be no greater than 2 small squares
- Calipers



1500 Method

- Most precise way to determine rate
- Can only be used if rhythm is regular
- Count number of small squares between two QRS complexes (R wave to R wave)
- Divide the number of small squares into 1500



Six second method

- On six second strip, count the number of R waves and multiply that number by 10
- For example, if the number of R waves on a three second strip is 8, the rate is $8 \times 10 = 80$

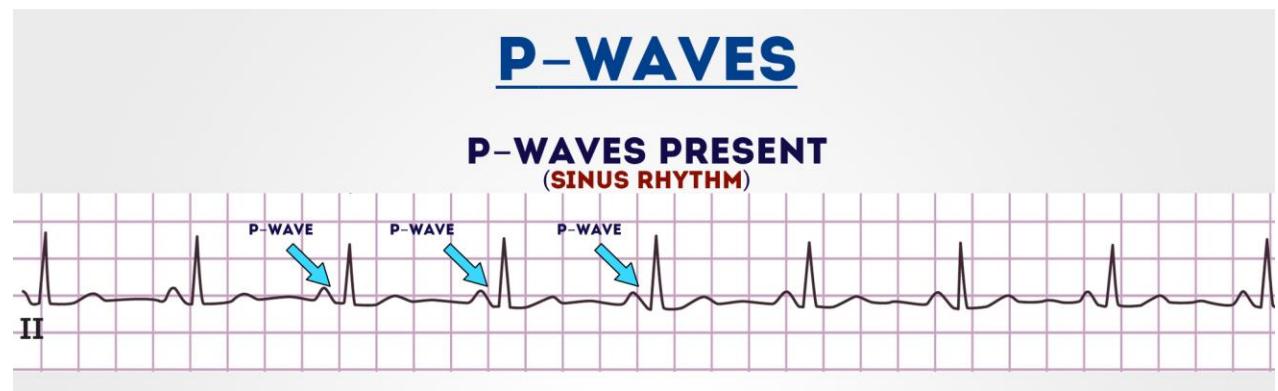


7

Step 2: Heart Rate

Step 3: P waves

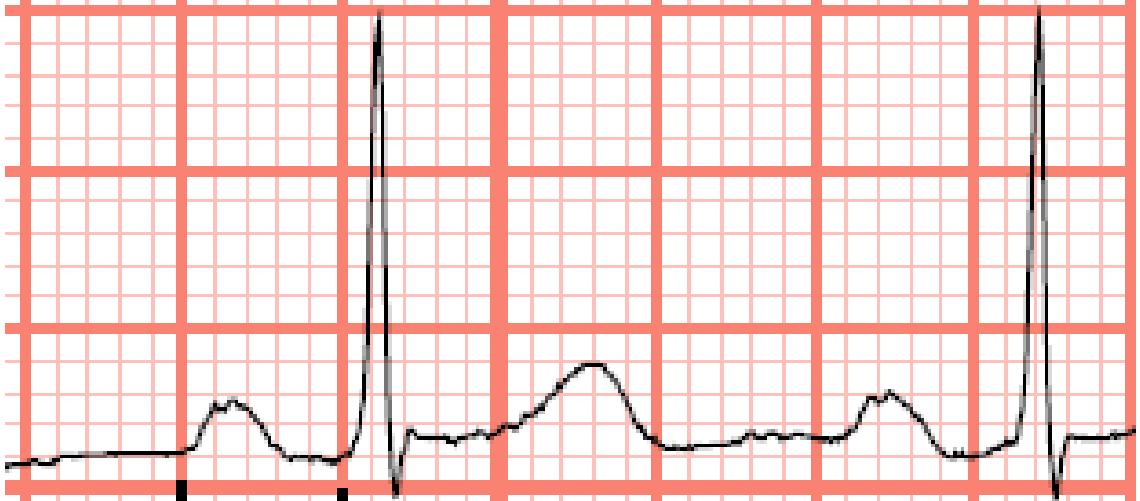
- Are there P waves before each QRS?
- Are P waves regular?
- Do P waves all look alike?
- If so... P waves are normal



Step 4: PR Interval

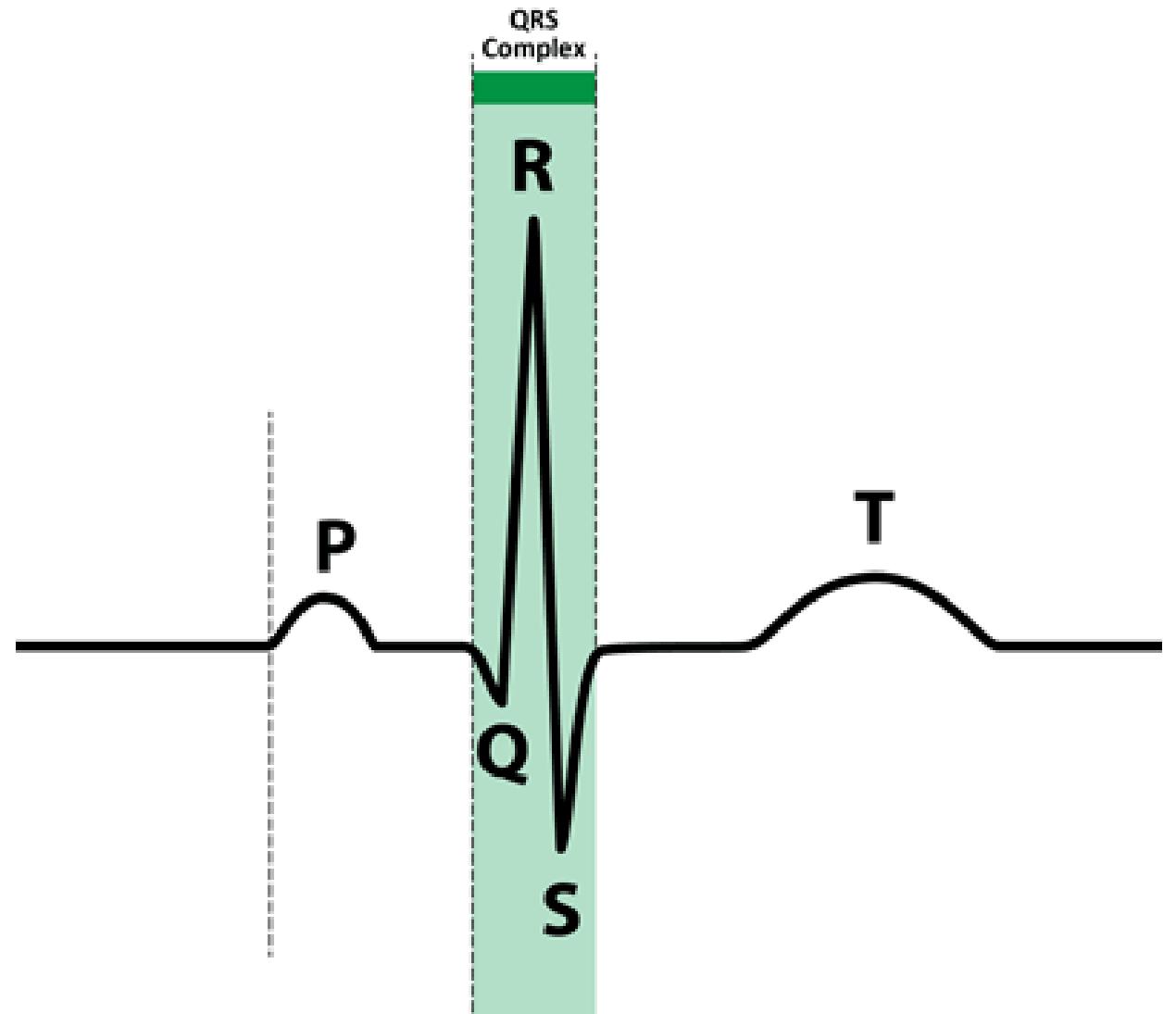
- Distance between start of P wave to start of "R"
- Normal: 0.12-0.20 seconds

Measure the PR Interval



Step 5: QRS Interval

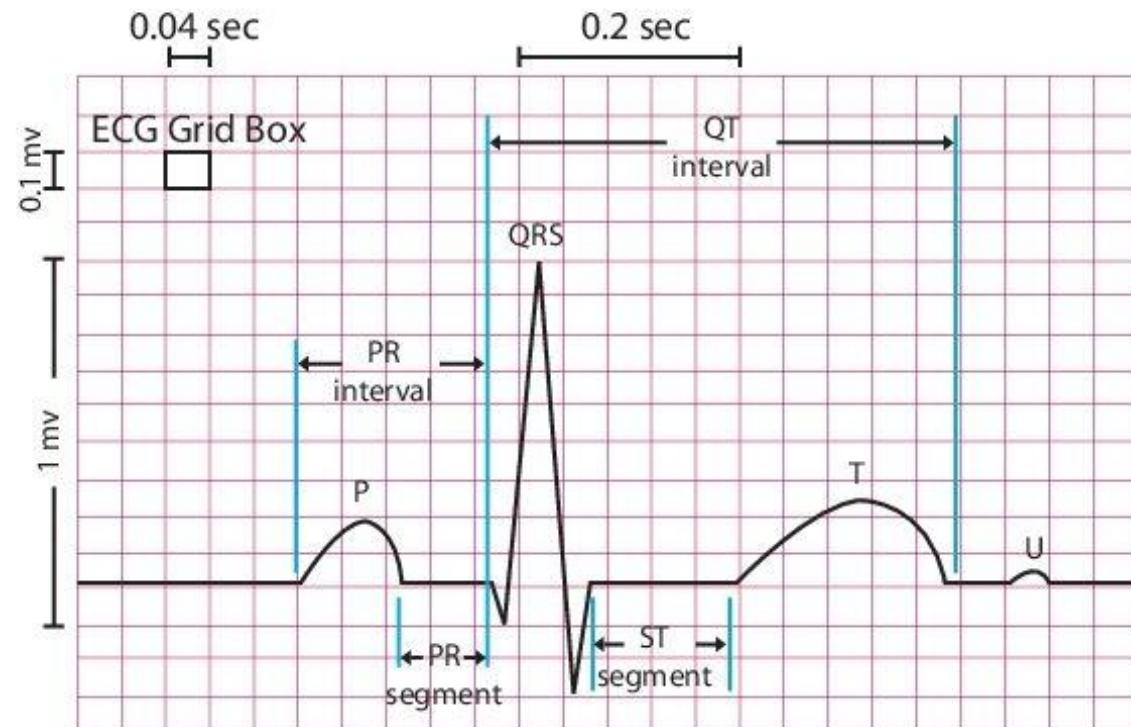
- Time from "Q" to "S"
- Normal: 0.06 to 0.10 seconds

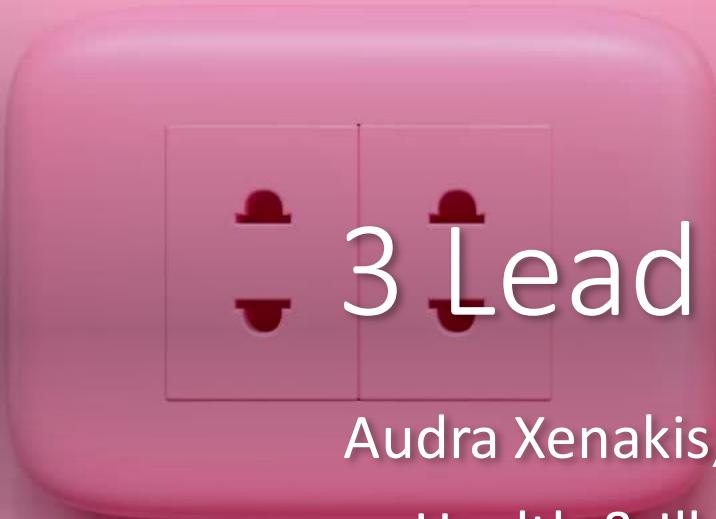


Step 6: QT Interval

- Time from start of "Q" to Start of "T"
- Measured to determine if prolonged or shortened
- Represents time of depolarization (ventricle contraction) to repolarization (ventricle rest)

ECG Recording of a Healthy Heartbeat

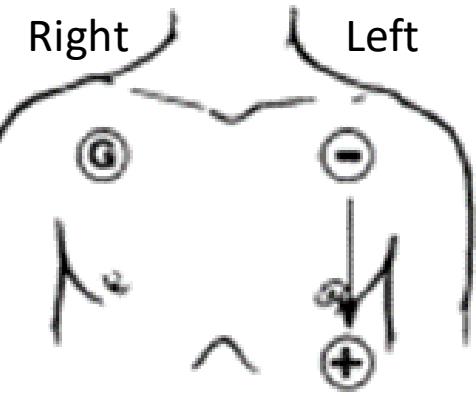
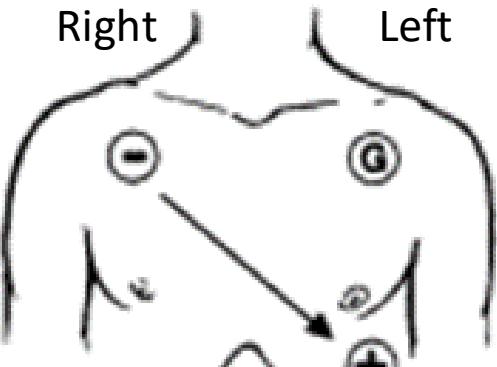
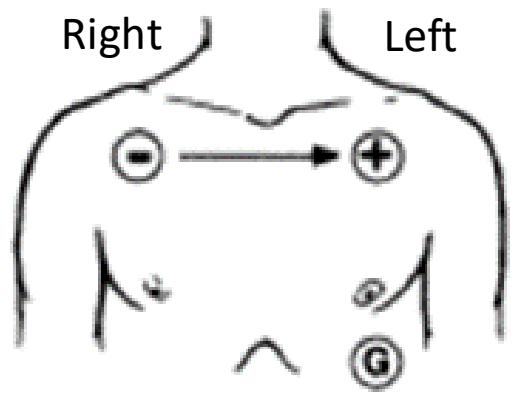




3 Lead ECG

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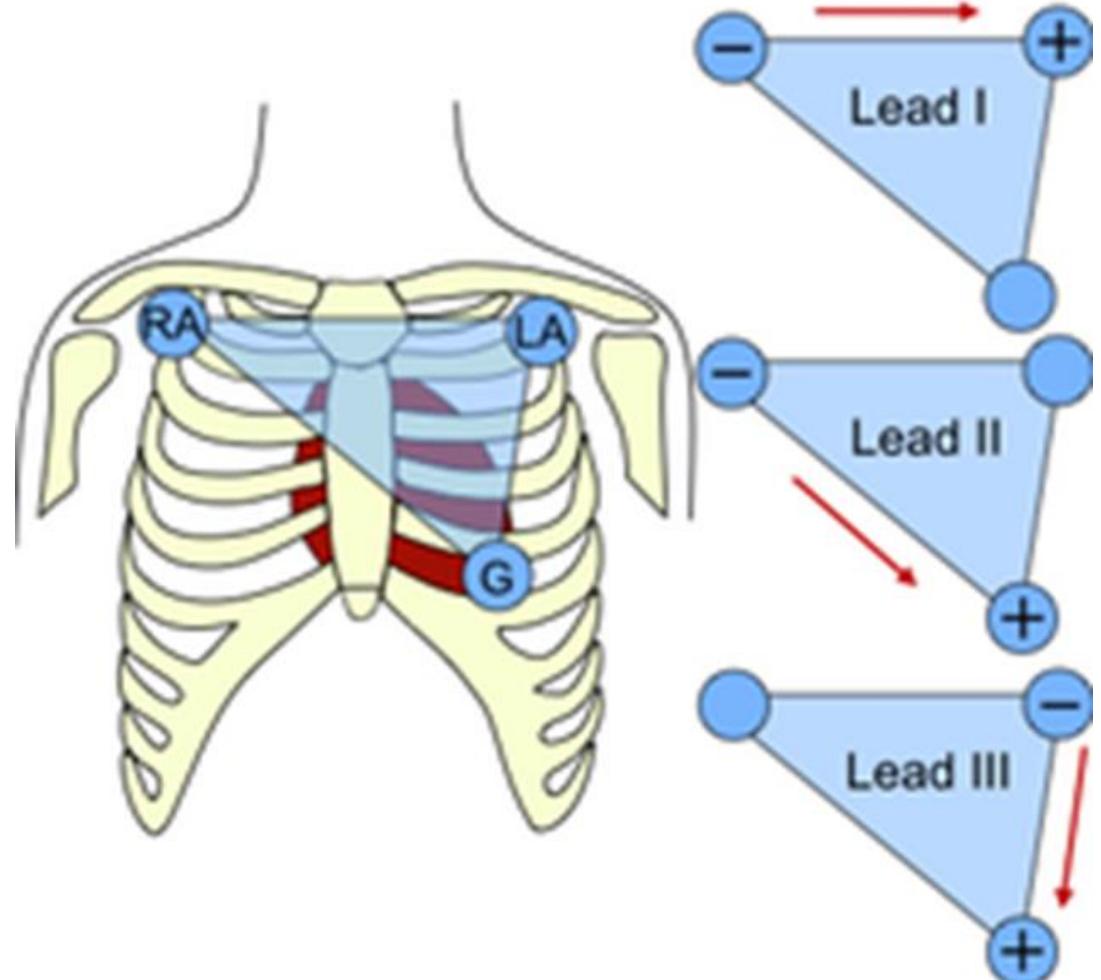
Health & Illness III

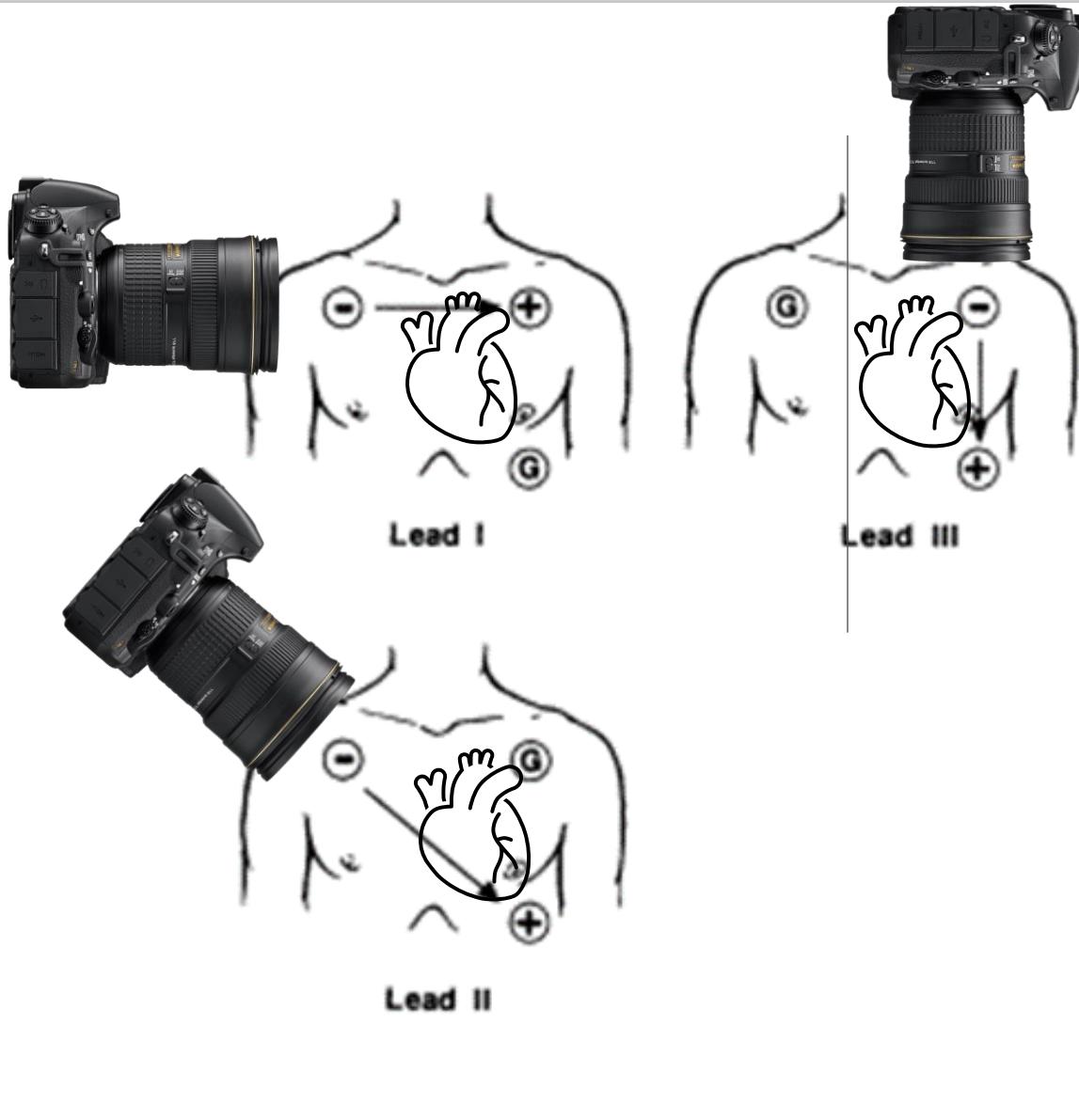


Leads read from negative to positive.

Lead II is used most.

Placement of Leads I, II, III (in a 3-lead system)

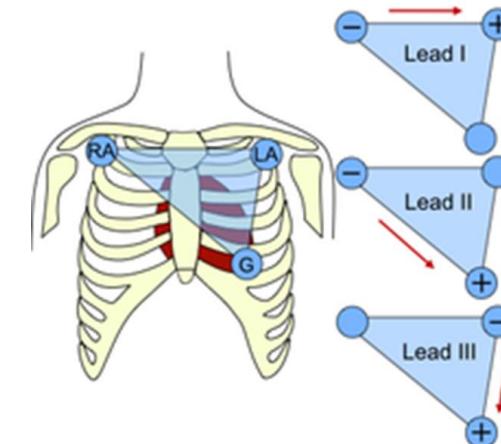


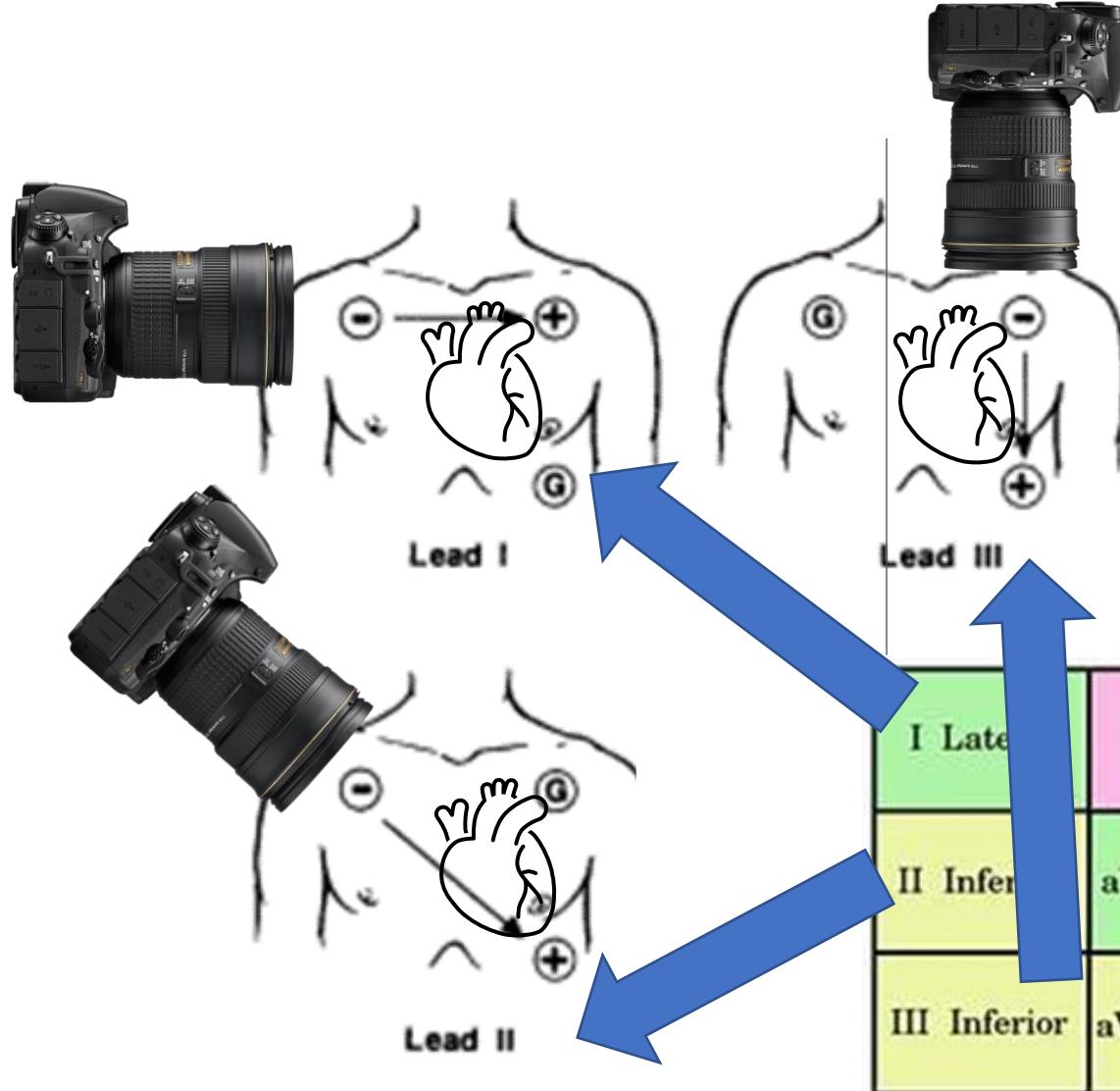


As cardiac electric activity is occurring, the ECG is viewing and recording it.

The different Lead placements, provide different "camera views" of what the lead is viewing.

**Placement of Leads I, II, III
(in a 3-lead system)**

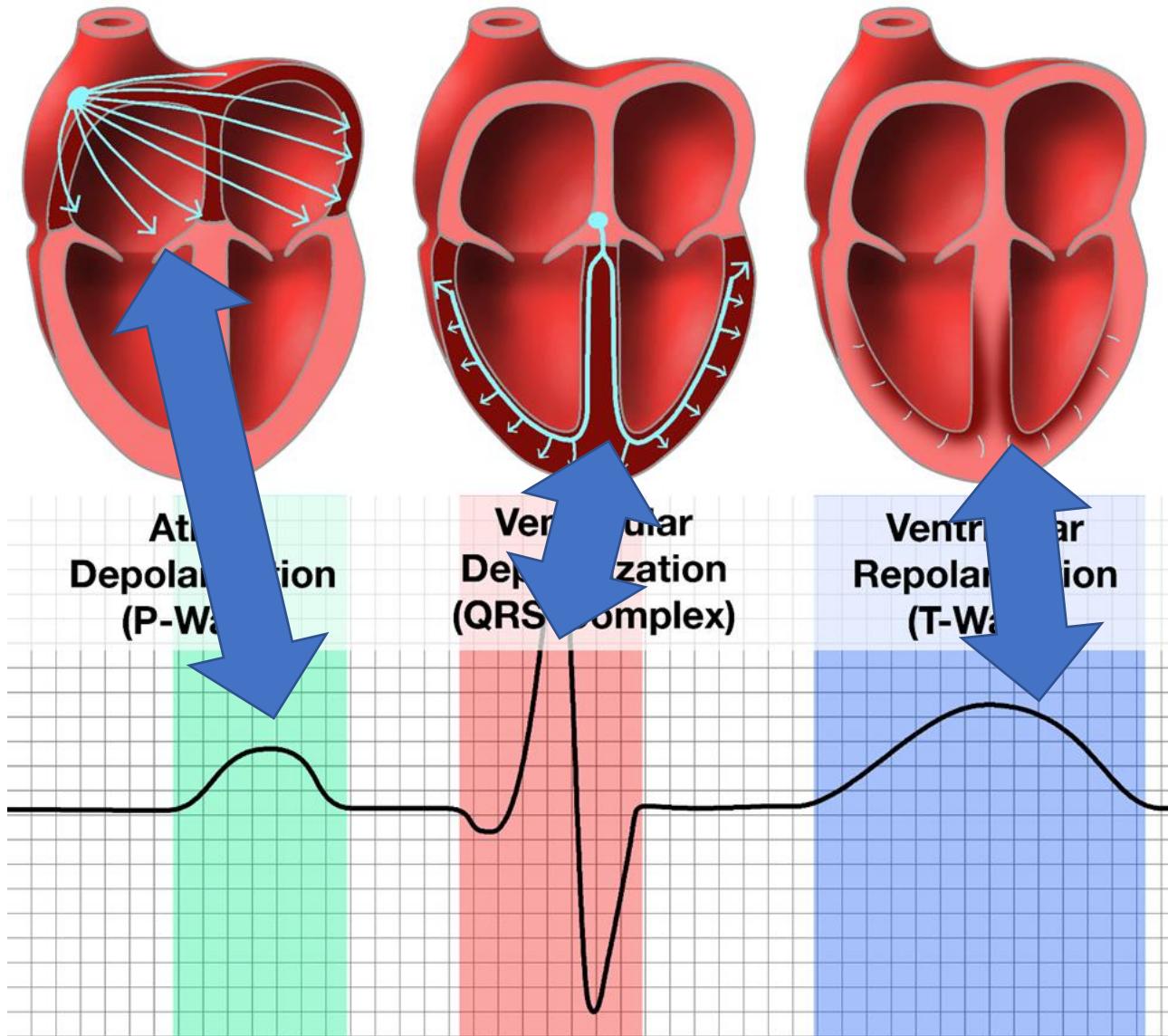


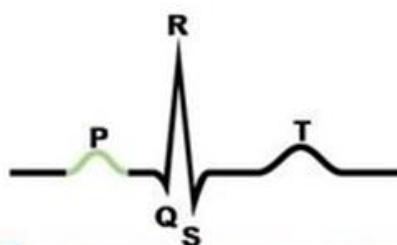


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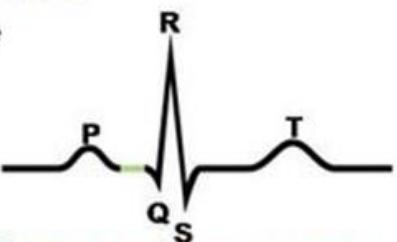
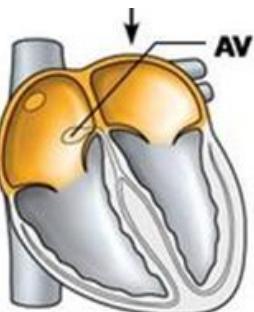
The different Lead placements, provide different "camera views" of what the lead is viewing.

I Lateral	aVR	V1 Septal	V4 Anterior
II Inferior	aVL Lateral	V2 Septal	V5 Lateral
III Inferior	aVF Inferior	V3 Anterior	V6 Lateral

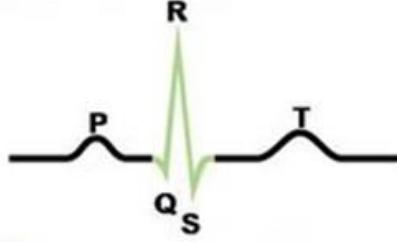
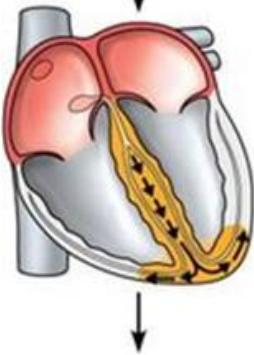




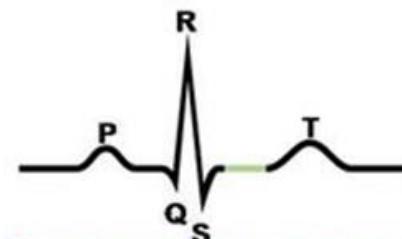
① Atrial depolarization, initiated by the SA node, causes the P wave.



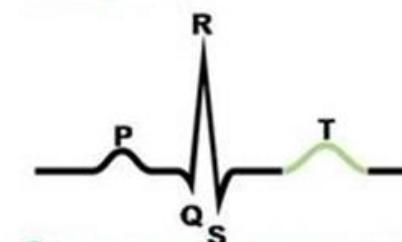
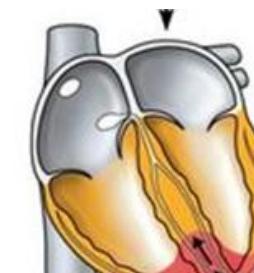
② With atrial depolarization complete, the impulse is delayed at the AV node.



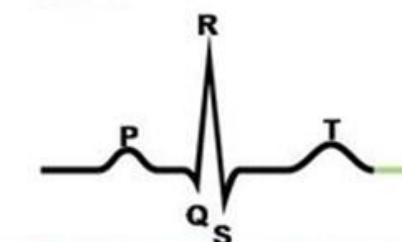
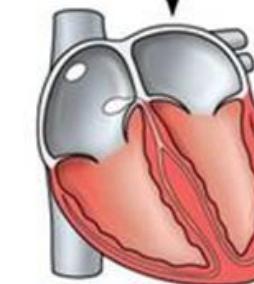
③ Ventricular depolarization begins at apex, causing the QRS complex. Atrial repolarization occurs.



④ Ventricular depolarization is complete.

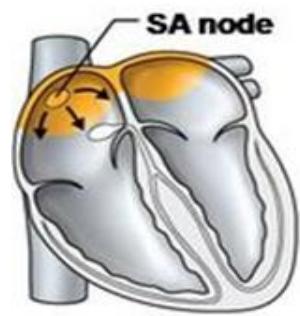


⑤ Ventricular repolarization begins at apex, causing the T wave.

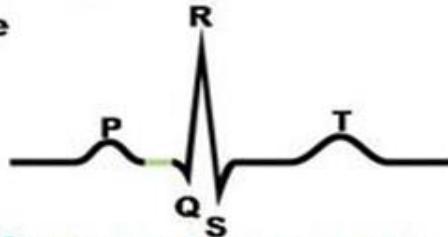
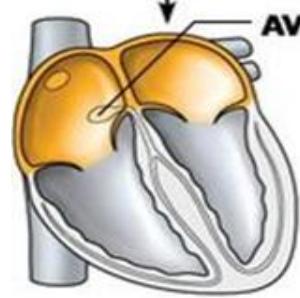


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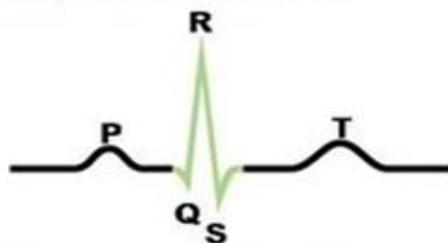
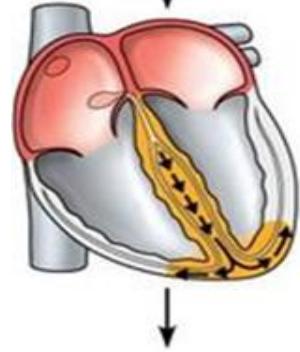
Figure 18.17



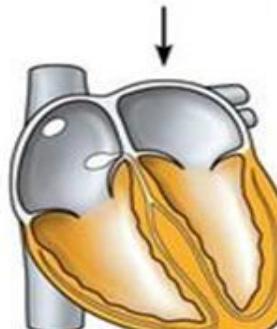
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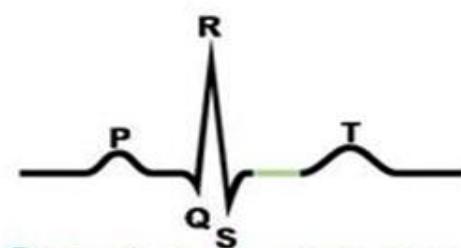
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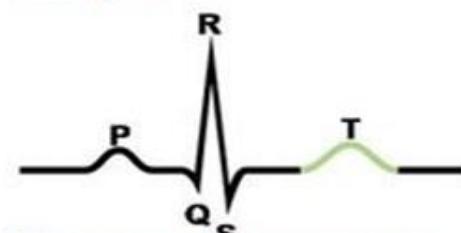
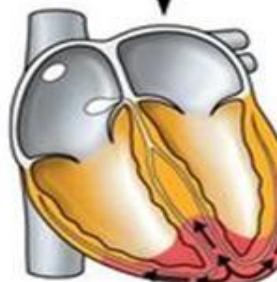
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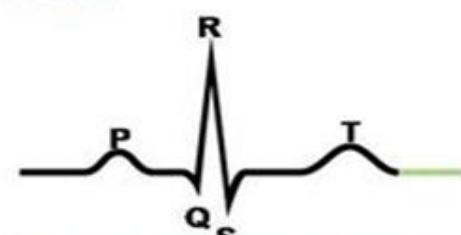
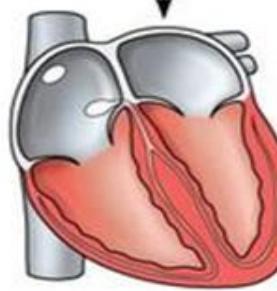
Depolarization Repolarization



④ Ventricular depolarization is complete.

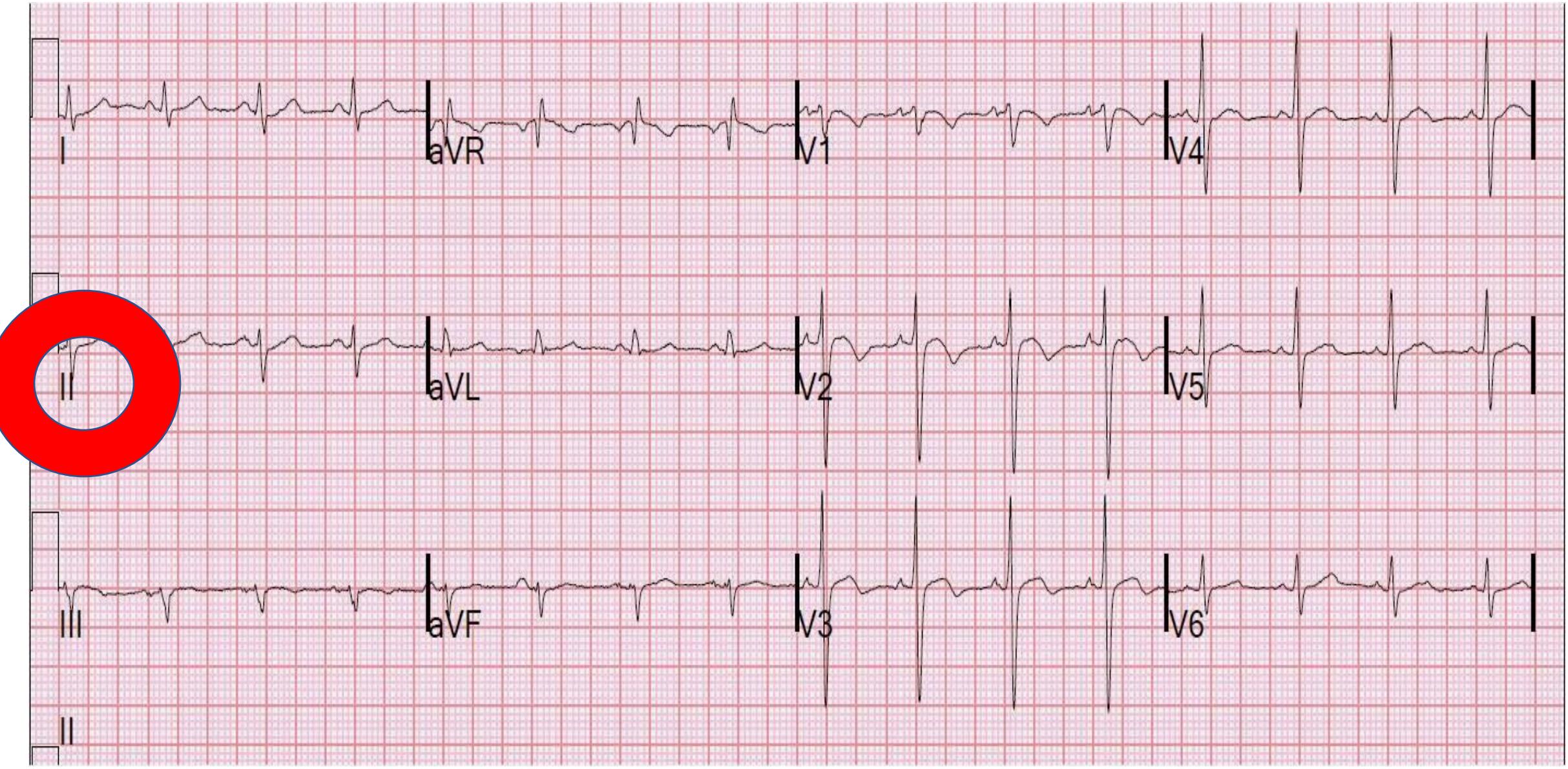


⑤ Ventricular repolarization begins at apex, causing the T wave.

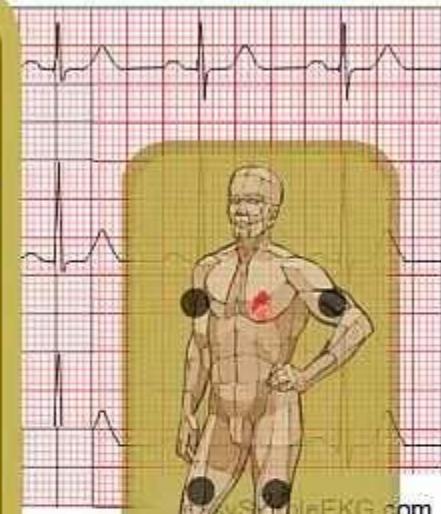
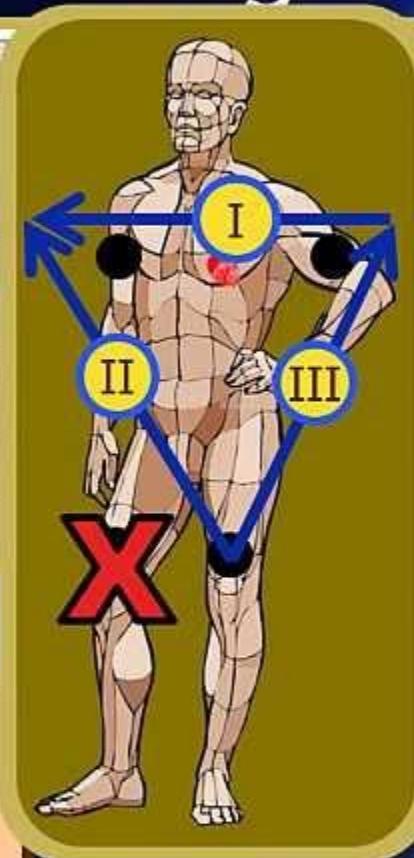
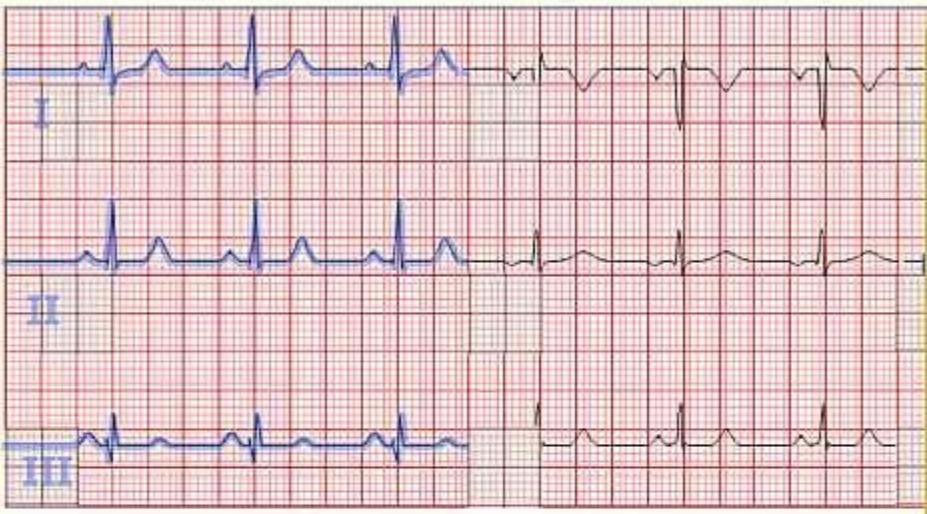


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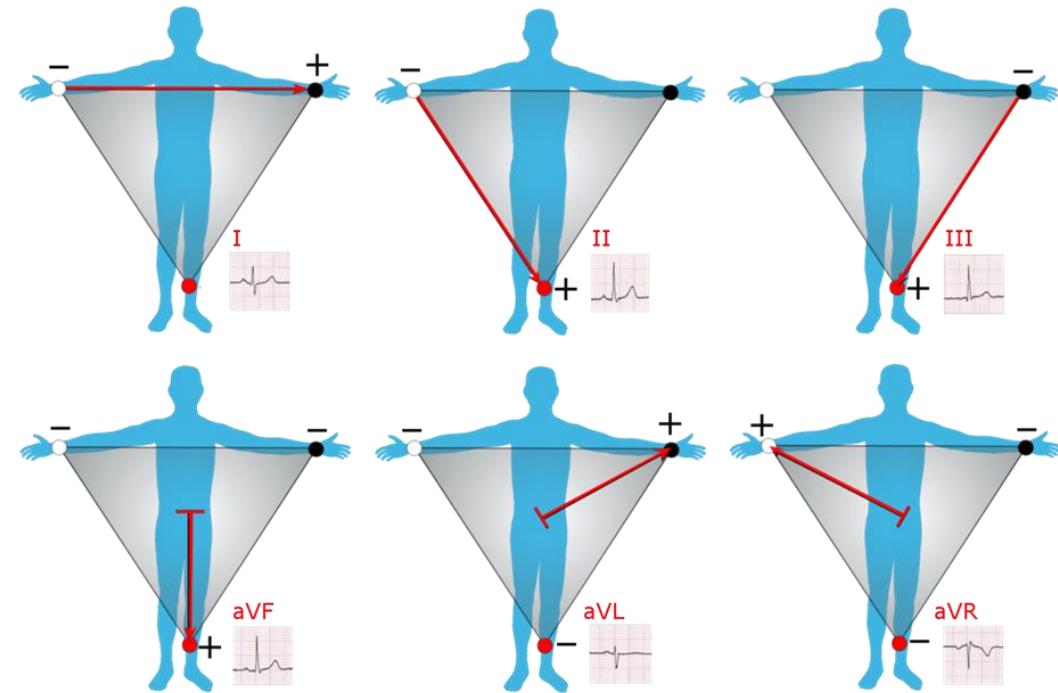
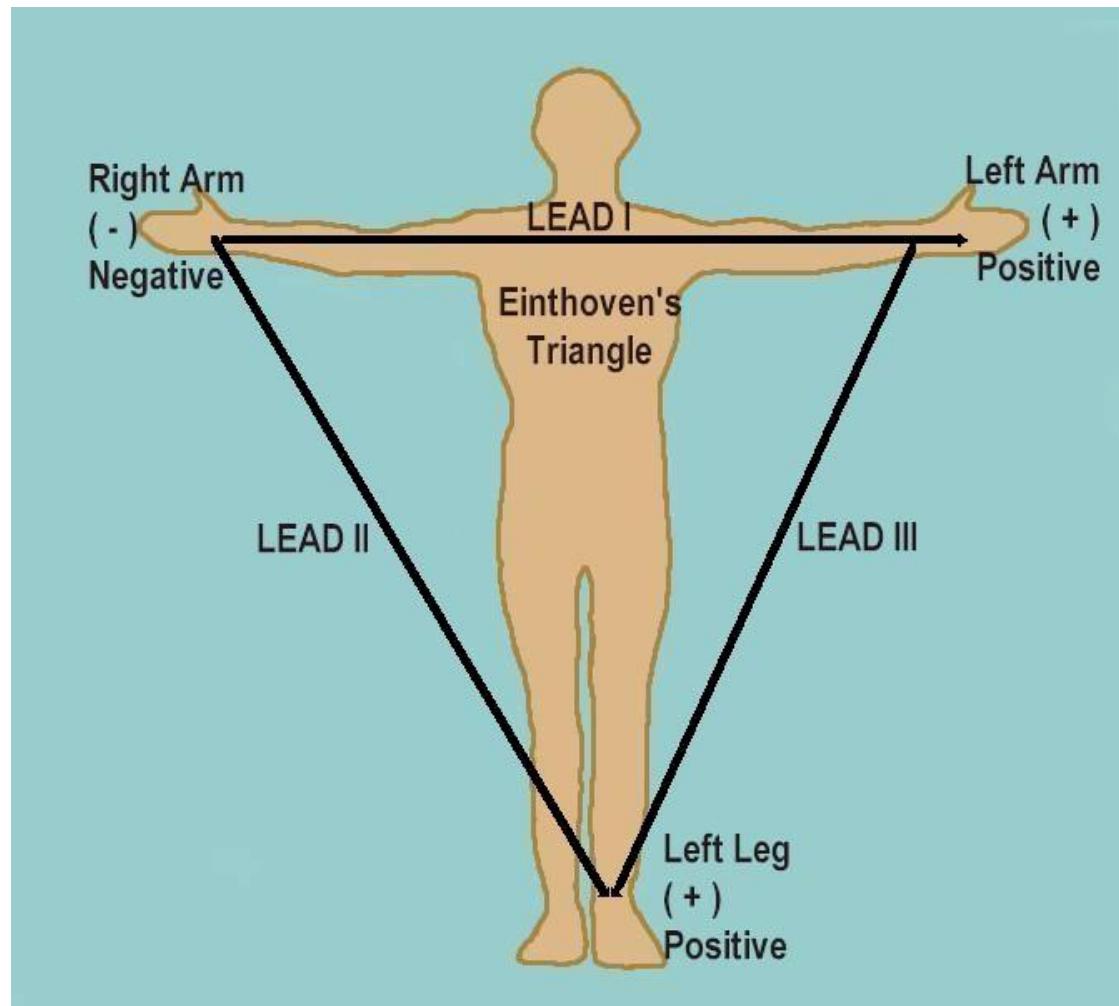
Figure 18.17



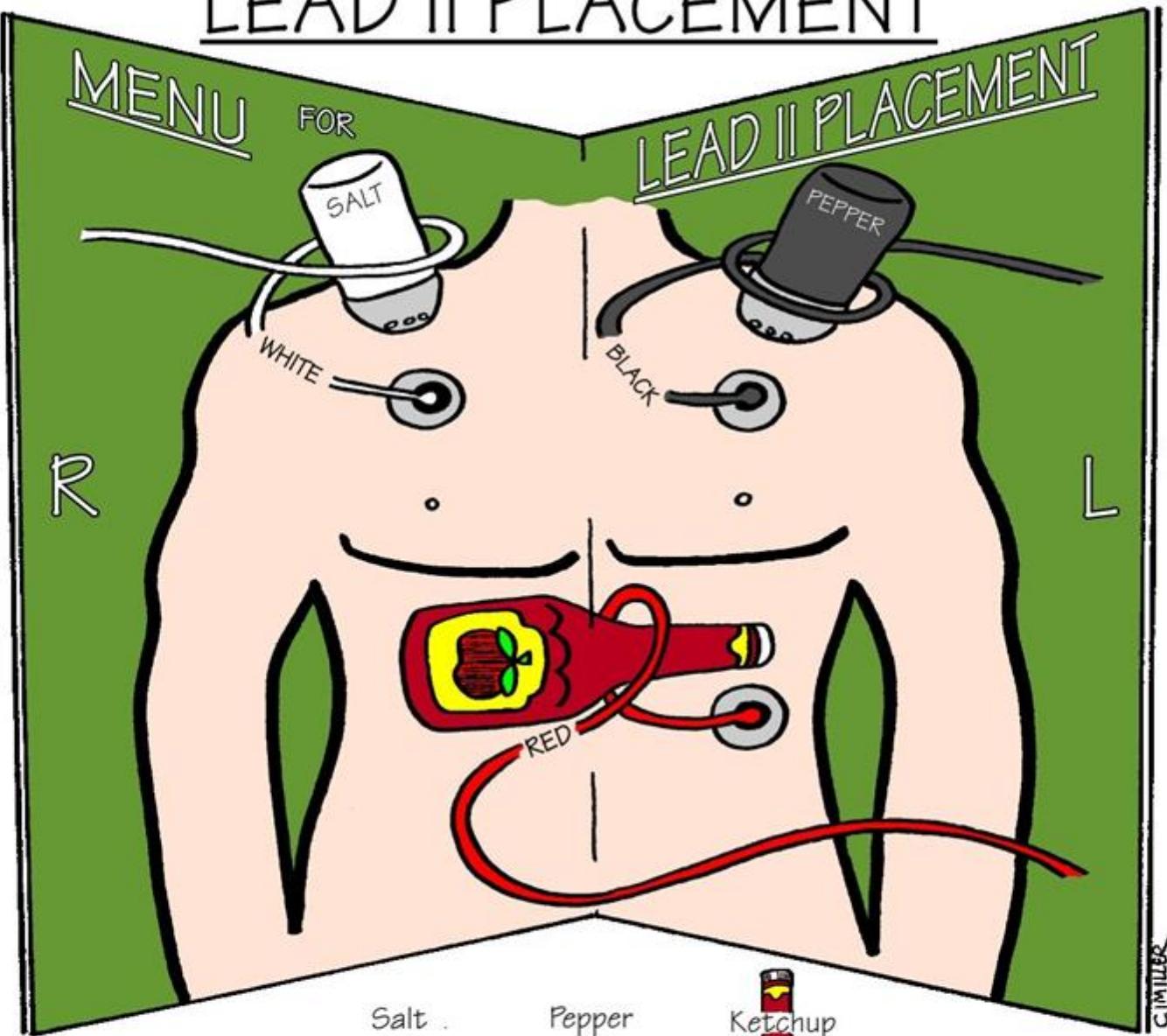
The Normal 12-lead EKG- Einthoven's Triangle



Willem Einthoven won a Nobel Prize in 1924 for inventing the EKG machine.



LEAD II PLACEMENT



Salt



White

Pepper



Black

Ketchup

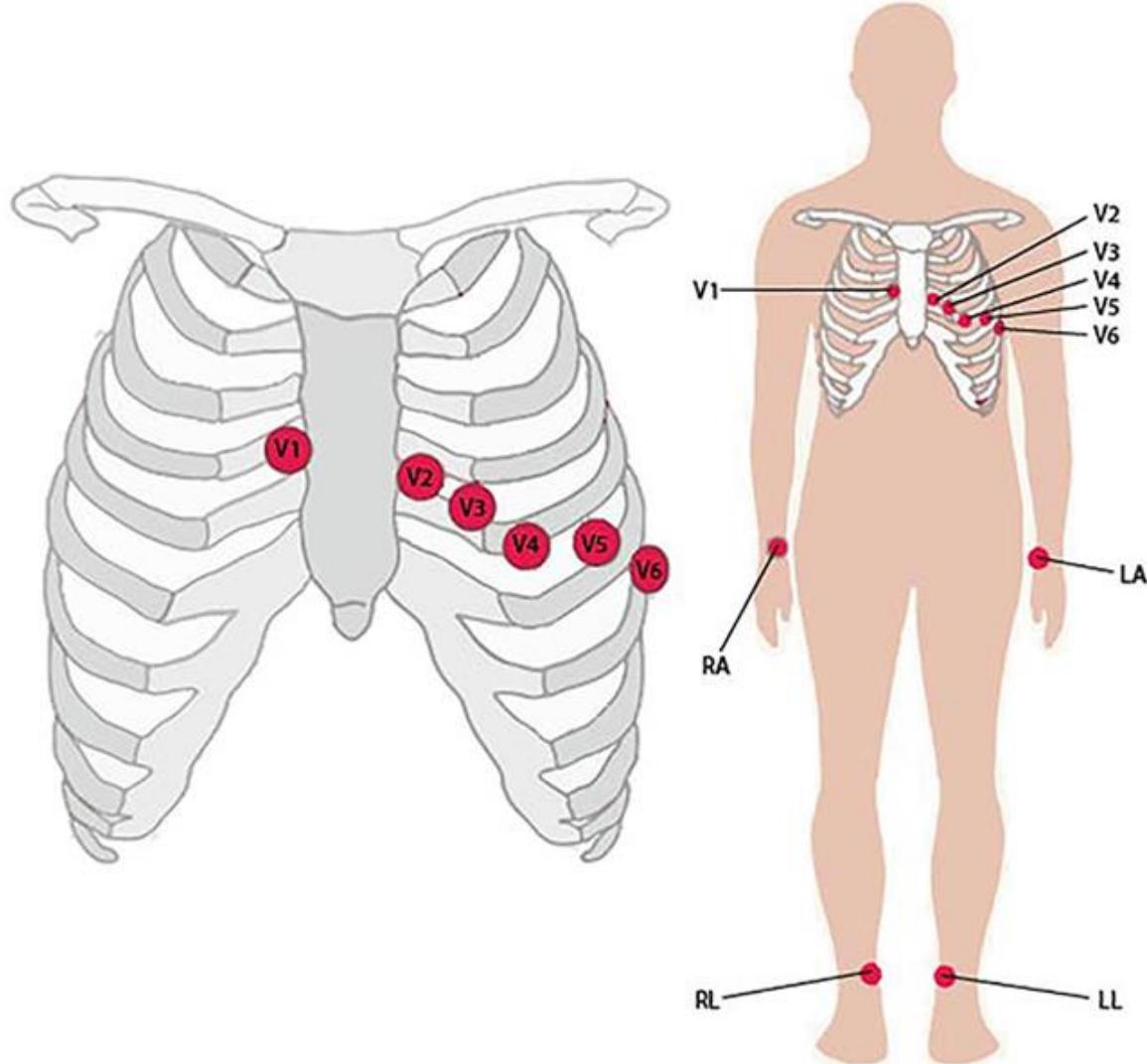


Red



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12-Lead EKG Electrode Placement



A wide-angle photograph capturing a massive crowd of spectators at a baseball stadium. The fans are densely packed in the stands, all with their right hands raised high in the air, creating a continuous wave of arms across the entire scene. Many individuals are wearing New York Yankees apparel, including blue shirts with the team's logo and caps. The atmosphere is one of collective excitement and enthusiasm. In the foreground, a white semi-transparent bar spans the width of the image, containing the text.

Catch the Wave

Catch the Wave!

- SA Nodes



- AV Nodes



- Bundle of His



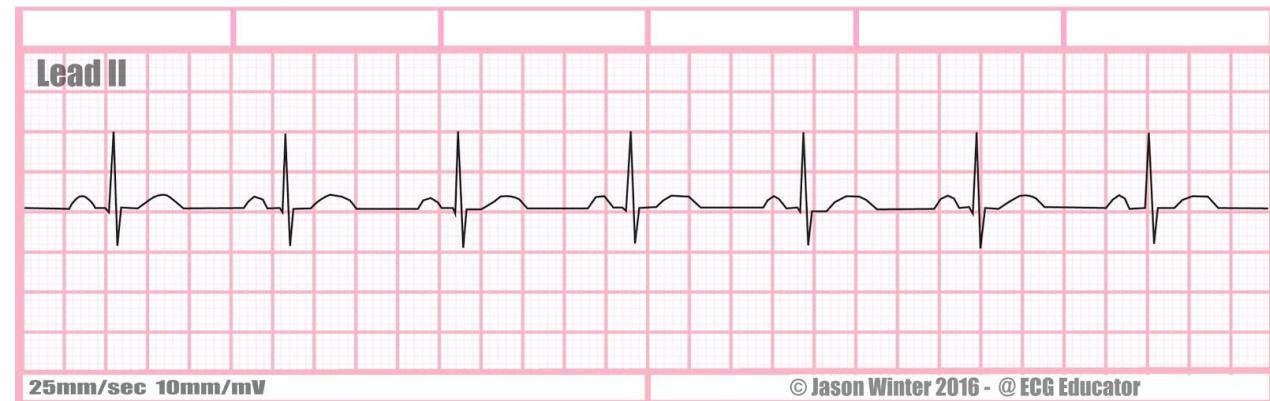
- Purkinje Fibers



Normal Sinus Rhythm

- Originates in SA node
- Rhythm: regular
- Heart rate: 60-100 bpm
- P waves: rounded, upright, precede each QRS, alike
- PR Interval: 0.12 to 0.20 seconds
- QRS Interval: less or equal to 0.10 seconds

Normal Sinus Rhythm (NSR)

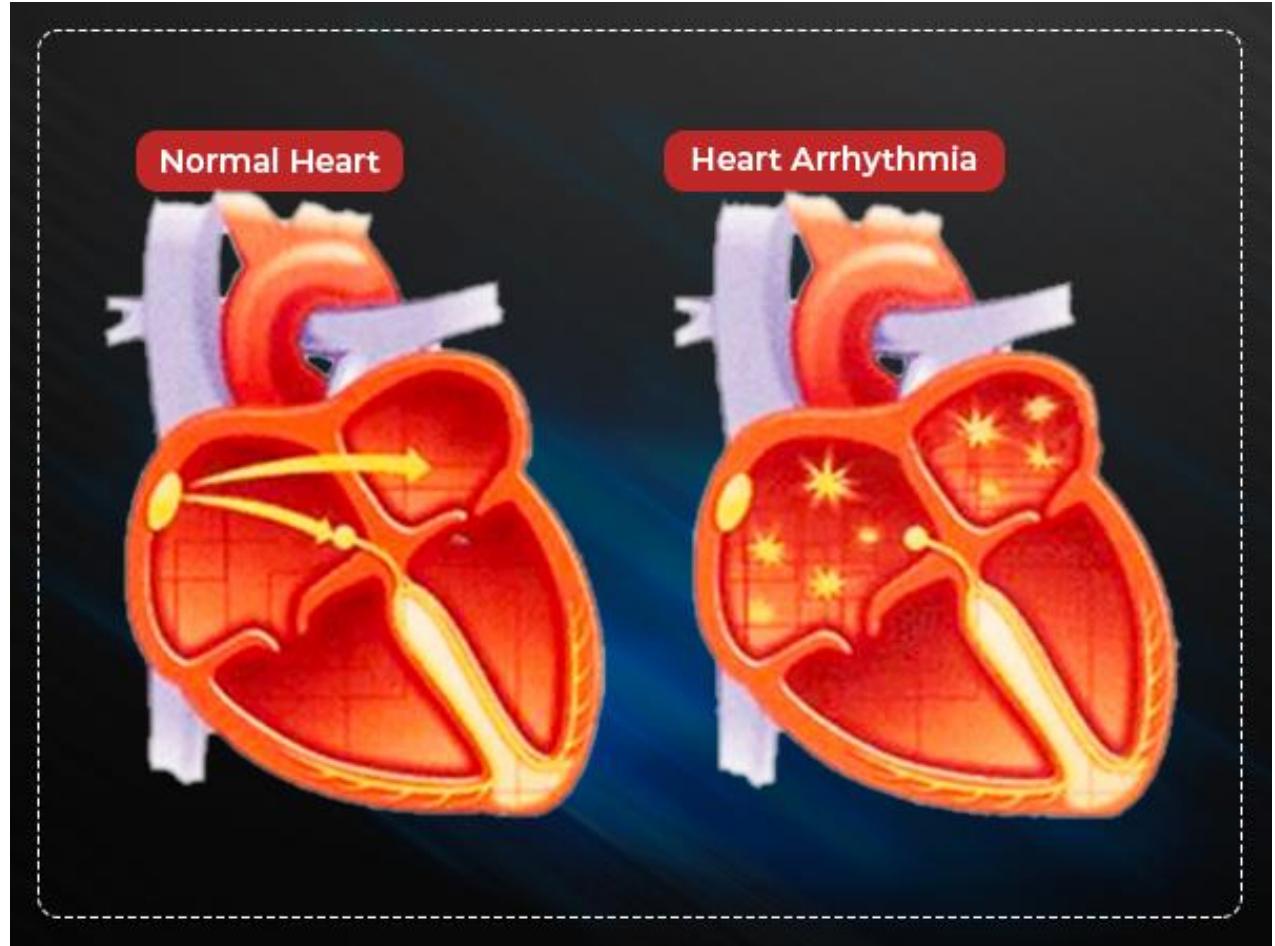




Catch the Wave-Normal Sinus Rhythm

Arrhythmias

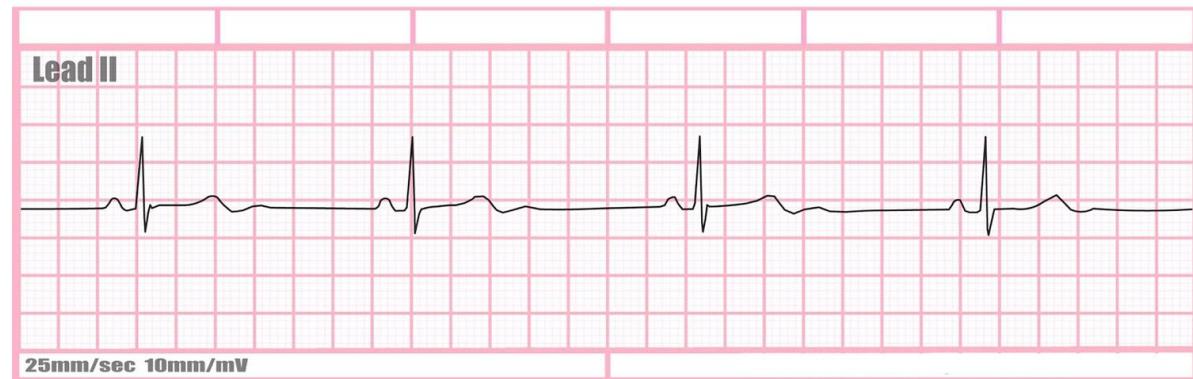
- Abnormal rhythm of heart
- Causes: Abnormal starting (formation/conduction) of electrical impulse
- Can Cause:
 - Increase or decrease in heartrate
 - Early or late heartbeats
 - Atrial or ventricle fibrillation
 - Impulse being blocked



Sinus Bradycardia

- Heart rate slower than 60 bpm
- Originates from SA node
- Can be symptomatic or asymptomatic
- Causes:
 - Digoxin
 - Myocardial infarction
 - Electrolyte imbalance
 - Well-conditioned athletes-heart works efficiently
- Rhythm: regular
- Heart rate: less than 60 bpm
- P Waves: rounded, upright precedes each QRS, alike
- PR Interval: 0.12 to 0.20 seconds
- QRS Interval: less than or equal to 0.10 seconds
- S/S: decreased blood pressure, respiratory distress, diminished pulses, fatigue, syncope
- Treatment: Intravenous atropine, dopamine, epinephrine

Sinus Bradycardia

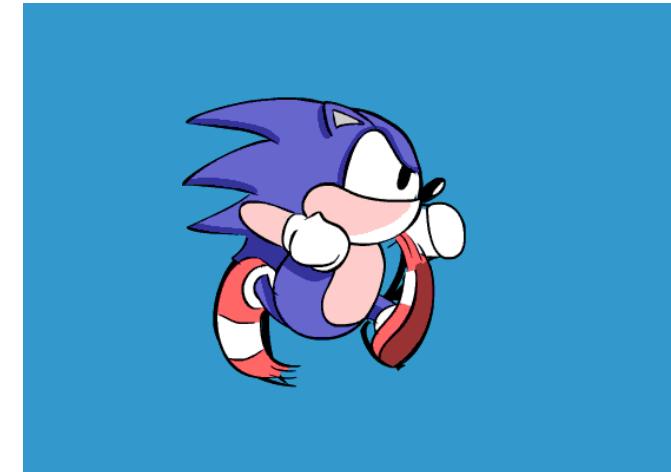


A wide-angle photograph of a stadium crowd, predominantly composed of New York Yankees fans. They are all raising their right hands high into the air, creating a collective "wave" effect. Many fans are wearing Yankees merchandise, including caps and shirts. The scene is filled with excitement and energy.

Catch the Wave-Bradycardia

Sinus Tachycardia

- Heart rate greater than 100 bpm
- Originates from SA Node
- Causes: physical activity, hemorrhage, shock, medications, dehydration, fever, MI, electrolyte imbalance, fear
- Rhythm: regular
- Heartrate: 101 to 180 bpm
- P Waves: rounded, upright, precede each QRS, alike
- PR Interval: 0.12 to 0.20 seconds
- QRS Interval: less than or equal to 0.10 seconds
- S/S: angina, dyspnea, syncope, tachypnea
- Treatment: Treat cause; medications-adenosine, beta blockers, calcium blockers (slows heartrate)



A wide-angle photograph of a stadium crowd, predominantly composed of New York Yankees fans. Many individuals are wearing Yankees apparel, including caps and shirts with the team's logo. The crowd is captured in a moment of collective excitement, with numerous hands raised high above their heads. The scene is set against the dark, illuminated background of the stadium stands.

Catch the Wave-Tachycardia

Premature Atrial Contractions (PACs)

- Premature- "Early"
- Atria fires impulse BEFORE SA node
- Causes: hypoxia, smoking, stress, myocardial ischemia, enlarged atria in valve disorders, Digoxin, electrolyte imbalance, heart failure
- Rhythm: PAC interrupts underlying rhythm
- Heartrate: depends on underlying rhythm
- P waves: early beat abnormal shaped
- PR interval: With PAC-shortened or prolonged
- QRS Interval: less than or equal to 0.10 seconds
- S/S: None to palpitations
- Treatment: Not usually serious; Frequent PACs-atrial irritability...can worsen...beta blockers to slow heartrate

Premature Atrial Contraction (PAC)

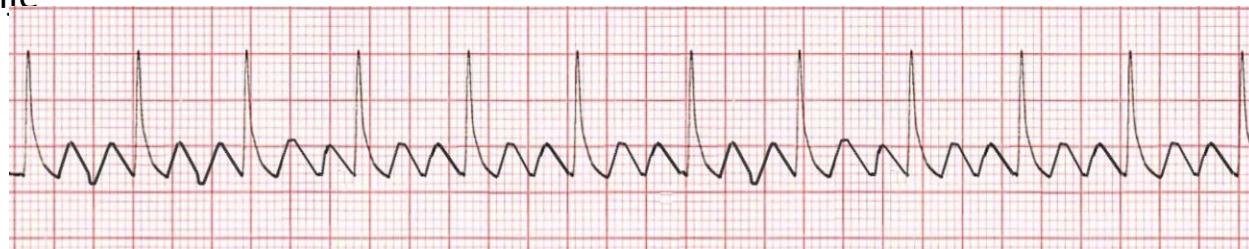




Catch the Wave-Premature Atrial Contraction (PAC)

Atrial Flutter

- Atria contracts (Flutters) rate 250-350 bpm
- Also known as "F" waves, appears like sawtooth pattern
- Some impulses are captured by AV node to Bundle of His...Purkinje Fibers
- Result is normal QRS (normal ventricle contractions)
- 2-4 Flutter waves between QRS
- Causes: rheumatic fever, ischemia, congestive heart failure, hypertension, pericarditis, pulmonary embolism, post-CABG, medications
- Rhythm: Regular
- Heartrate: varies for ventricle bpm; 250-350 for atrial bpm
- P Waves: Flutter
- PR Interval: none measurable
- QRS Interval: less than or equal to 0.10 second
- S/S: Depends on ventricle rate; if rapid-palpitations, angina or dyspnea
- Treatment: Unstable-cardioversion (electrical shock); calcium channel blockers, ablation in atria



A wide-angle photograph capturing a large, enthusiastic crowd of spectators at a baseball game. The fans are seated in tiered stadium seating, filling the frame from left to right. Many individuals have their right hands raised high in the air, palms facing forward, creating a sense of collective energy and excitement. The crowd is diverse in age and attire, with many wearing New York Yankees merchandise, such as caps and t-shirts with the team's logo. The background shows the dark interior of the stadium and the bright field beyond the fence.

Catch the Wave-Atrial Flutter

- Atria is fibrillating (quivering)
- Not effective in pumping blood out of atriums
 - Risk for blood clots
 - Stroke
 - Medications to decrease risk
- Atrial rate 350-600 bpm
- Only few impulses get to AV node-irregular rhythm
- Causes: age, cardiac surgery, heart failure, hypertension, heart valve replacement, MI, hyperthyroidism, emphysema, sleep apnea, medications
- Rhythm: irregular
- Heart rate: Atrial-350-600 bpm; ventricles under 100 bpm (controlled) over 100 bpm (uncontrolled)
- P waves: not identifiable
- PR Interval: none
- QRS Interval: less than or equal to 0.10 seconds
- S/S: irregular rhythm-feel it; palpitations, short of breath, dizzy, chest discomfort
- Treatment: Prevent thromboembolism; unstable-synchronized cardioversion; stable-medications to control ventricular rate; anticoagulants
- Catheter Ablation

Atrial Fibrillation



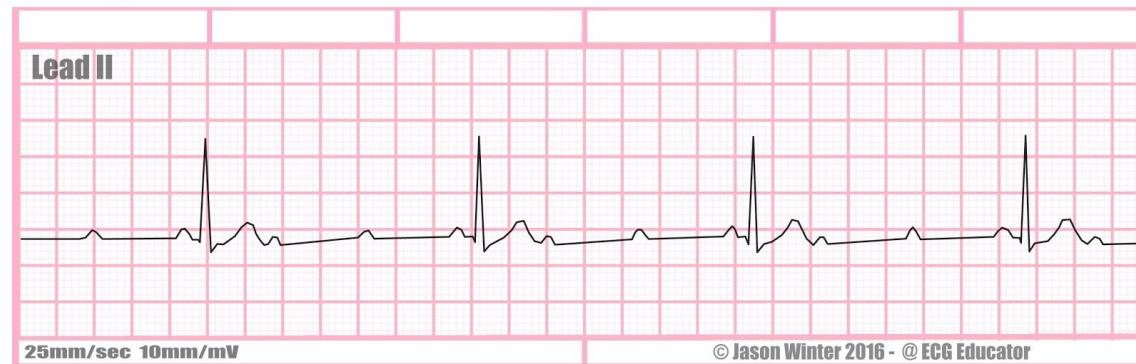


Catch the Wave-Atrial Fibrillation

Third-Degree Atrioventricular Block

- SA Nodes are blocked to ventricles-but still are produced
- AV Node or Bundle of His or Purkinje Fibers must create impulse-or heart stops
- Also known as "Complete Heart Block"
- Atriums and ventricles are working independent of each other
- QRS will be either narrow (AV node) wide (Bundle of His or Purkinje Fibers)-depends on which is sending impulse to ventricles
- Rhythm: P to P regular; R to R regular; but not working together
- Heartrate: atrial 60-100 bpm; ventricular rates slower-40-60 bpm (remember if ventricles must start impulse...it is slower)
- P waves: rounded, upright, alike
- PR interval: No actual interval; not working correctly
- QRS Interval: less than or equal to 0.10 (AV node) greater than 0.10 (Ventricular)
- Causes: MI, hyperkalemia, infection, medication, digoxin
- Treatment: Medical emergency! Oxygen, transcutaneous pacing immediately, atropine, permanent pacemaker

3rd Degree AV Block



© Jason Winter 2016 - @ECG Educator





Catch the Wave-Third Degree Heart Block

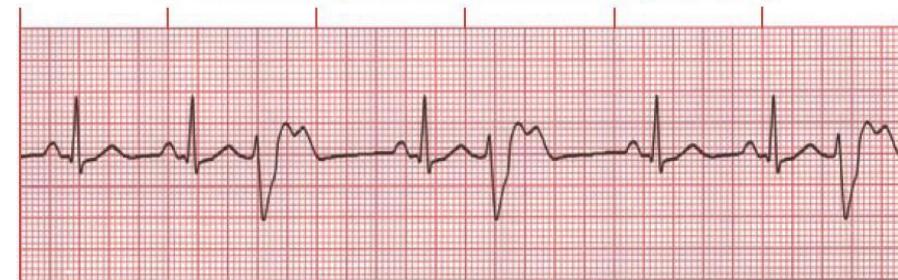
Premature Ventricular Contractions (PVCs)

- Originates in ventricles
- Irritable ventricles fires prematurely before the SA Node
- Creating a wide (greater than 0.10 seconds) "bizarre" QRS
- Shapes: Unifocal (all look same), Multifocal (all look different), Repetitive cycles (Bigeminy, Trigeminy, Quadrigeminy)
- Causes: caffeine, alcohol, anxiety, hypokalemia ,cardiomyopathy, ischemia, MI
- Rhythm: PVC interrupts rhythm
- Heartrate: depends on underlying rate
- P waves: absent before PVC
- PR Interval: none for PVC
- QRS Interval: if PVC is greater than 0.10 seconds T wave is opposite direction of QRS (QRS upright; T downward or QRS downward; T upright)
- S/S: Described as skipped beat, palpitation, with frequent-dizziness, decreased cardiac output
- Treatment: Occasional PVC-no treatment; more than 6 per minute, falling on the T wave (R-on-T wave phenomenon)-life threatening; antidysrhythmic drugs

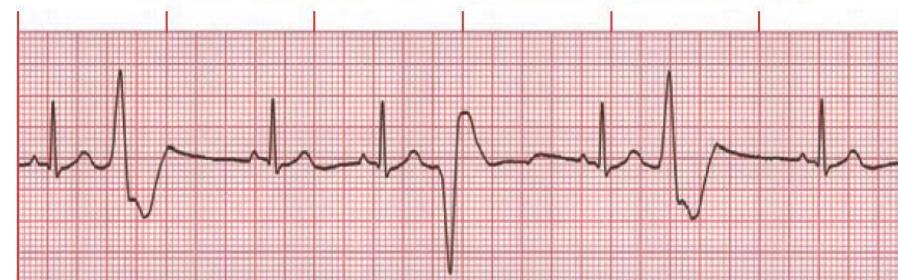
NSR with isolated PVC



Premature Ventricular Contraction: Uniform (same form)



Premature Ventricular Contraction: Multiform (different forms)

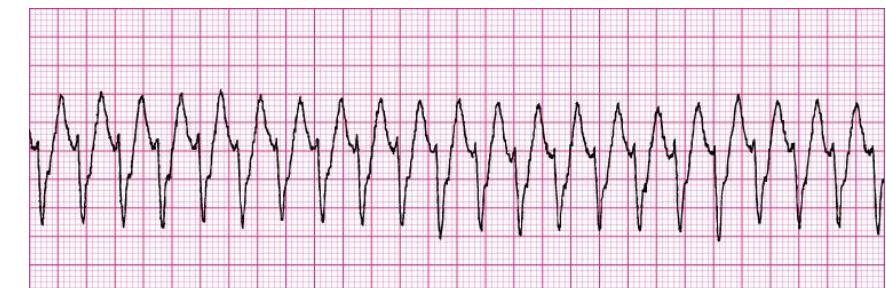
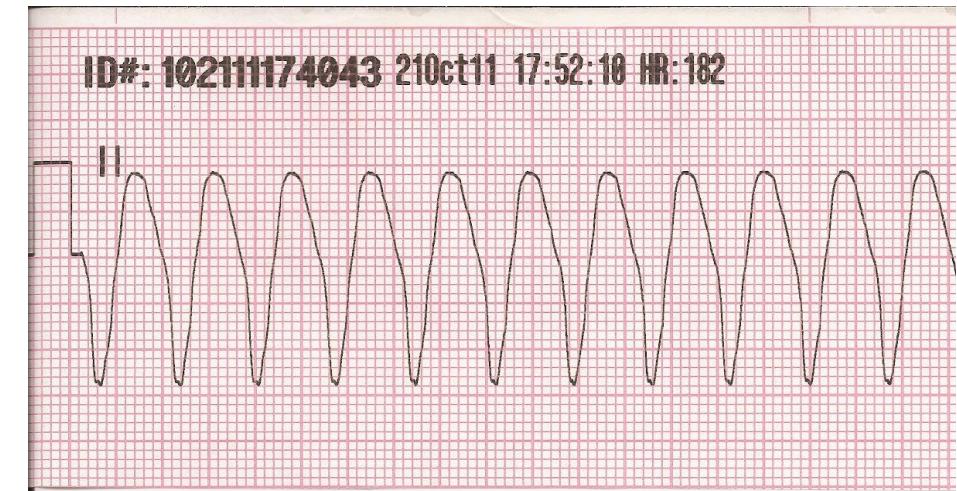




Catch the Wave-Premature Ventricular Beat

Ventricular Tachycardia

- 3 or more PVCs
- Continuous firing of ectopic ventricular impulse
- The ventricles instead of SA node become pacemaker
- Produces wide (greater than 0.10 seconds) bizarre QRS
- Causes: myocardial irritability, MI, cardiomyopathy, respiratory acidosis, hypokalemia, digoxin, cardiac cath, pacing wires
- Rhythm: regular
- Heartrate: 150-250 ventricular bpm; slow VTach-below 150 bpm
- P waves: absent
- PR Interval: none
- QRS Interval: greater than 0.10 seconds
- S/S: dyspnea, awareness of increased heartrate, palpitations, dizziness, angina, sustained VTach-compromises cardiac output and can become pulseless VTach
- Treatment: stable-antidysrhythmic medications; pulseless and not breathing-CPR and defibrillation

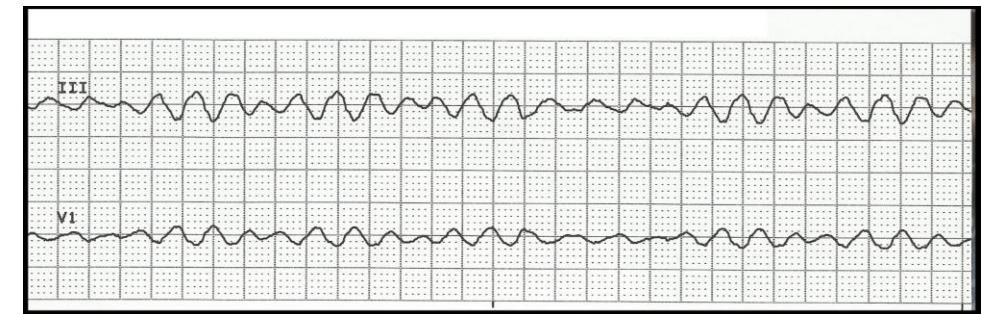




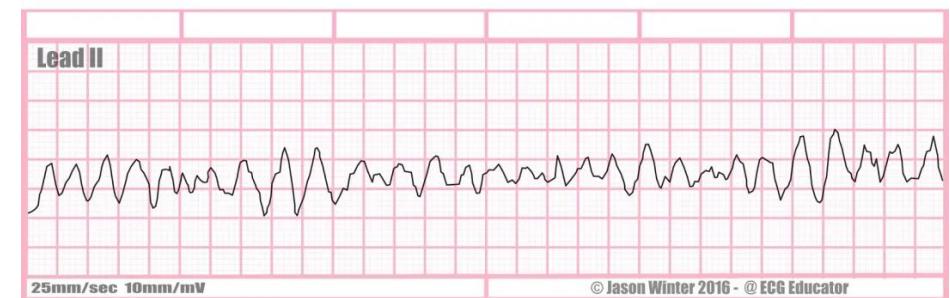
Catch the Wave-Ventricular Tachycardia

Ventricular Fibrillation

- Many ectopic ventricular impulses fire at same time
- Ventricles are chaotic, ventricles quiver
- Loss of cardiac output
- If not corrected immediately-death will occur
- Causes: hyperkalemia, hypomagnesemia, electrocution, coronary artery disease, MI
- Rhythm: chaotic, irregular
- Heartrate: not measurable
- P Waves: none
- PR Interval: None
- QRS Interval: none
- S/S: Loss of consciousness, no heart sounds, pulses, blood pressure readings, respiratory arrest, cyanosis, pupil dilation
- Treatment: immediate defibrillation and CPR, Endotracheal intubation with oxygen



Ventricular Fibrillation (VF)

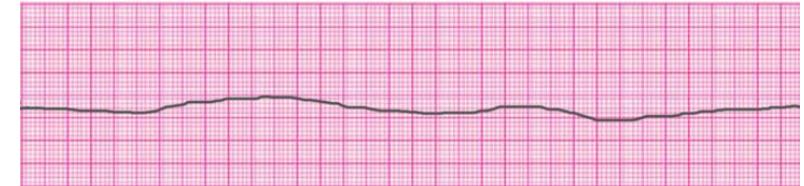




Catch the Wave-Ventricular Fibrillation

Asystole

- Absence of electrical activity of heart
- Causes: hyperkalemia, VF, MI
- Rhythm: None
- Heart rate: None
- P wave: None
- PR Interval: None
- QRS Interval: None
- S/S: unconscious and unresponsive; no heart sounds, pulses, blood pressure
- Treatment: CPR, endotracheal intubation for oxygen, epinephrine

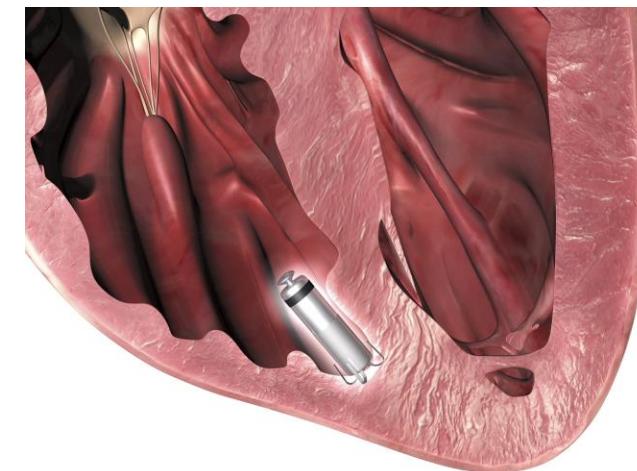
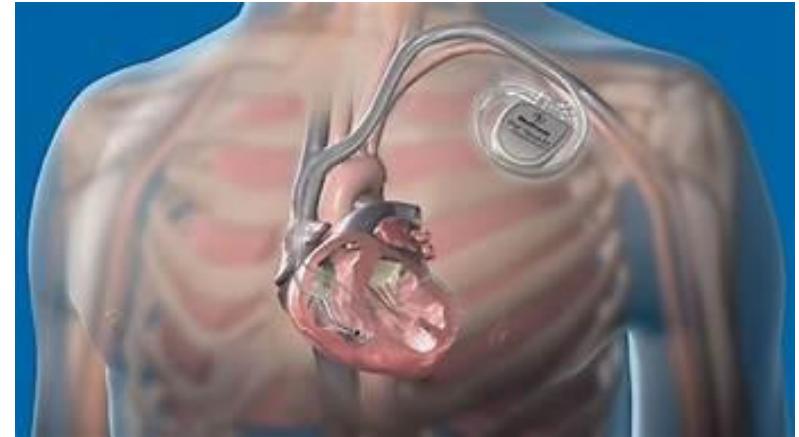


A wide-angle photograph capturing a massive crowd of spectators at a baseball stadium. Every person in the frame has their right hand raised high above their head, palm facing forward, creating a dense sea of arms. The crowd is a mix of men and women of various ages, all appearing to be in high spirits and cheering. Many are wearing baseball caps and jerseys, with the New York Yankees' signature blue and white colors being the most prominent. The background shows the dark, tiered seating of the stadium, with some bright lights visible through the windows.

Catch the Wave-Astyole

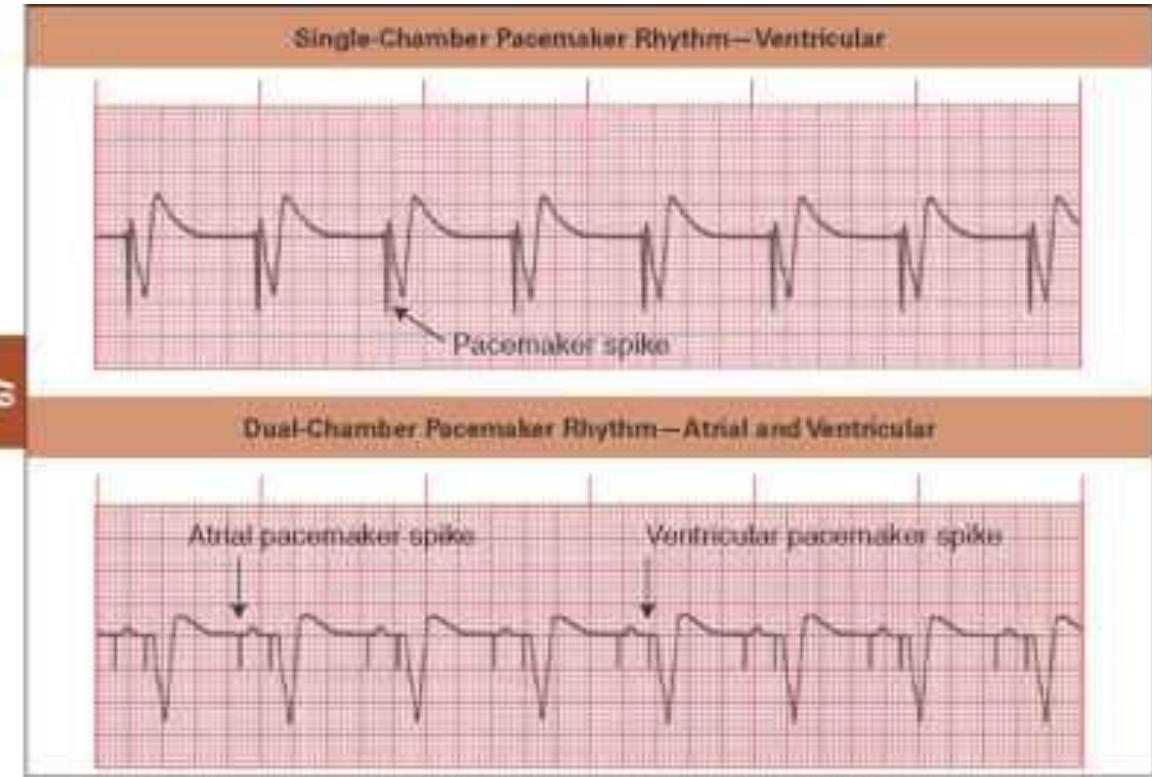
Cardiac Pacemakers

- Used to generate electrical impulse when heart's conduction system has a problem in performing it
- Can be temporary or permanent
- Temporary: bradycardia or tachycardia, after MI (allows heart time to heal)
- Permanent: inserted subcutaneously, attached to leads inserted into heart; lead delivers impulse directly to heart wall
- Can be single to right or left atrium
- Can be dual chamber-one lead to right atrium and other to right ventricle
- Leadless pacemakers-implanted in right ventricle without leads; size of vitamin capsule



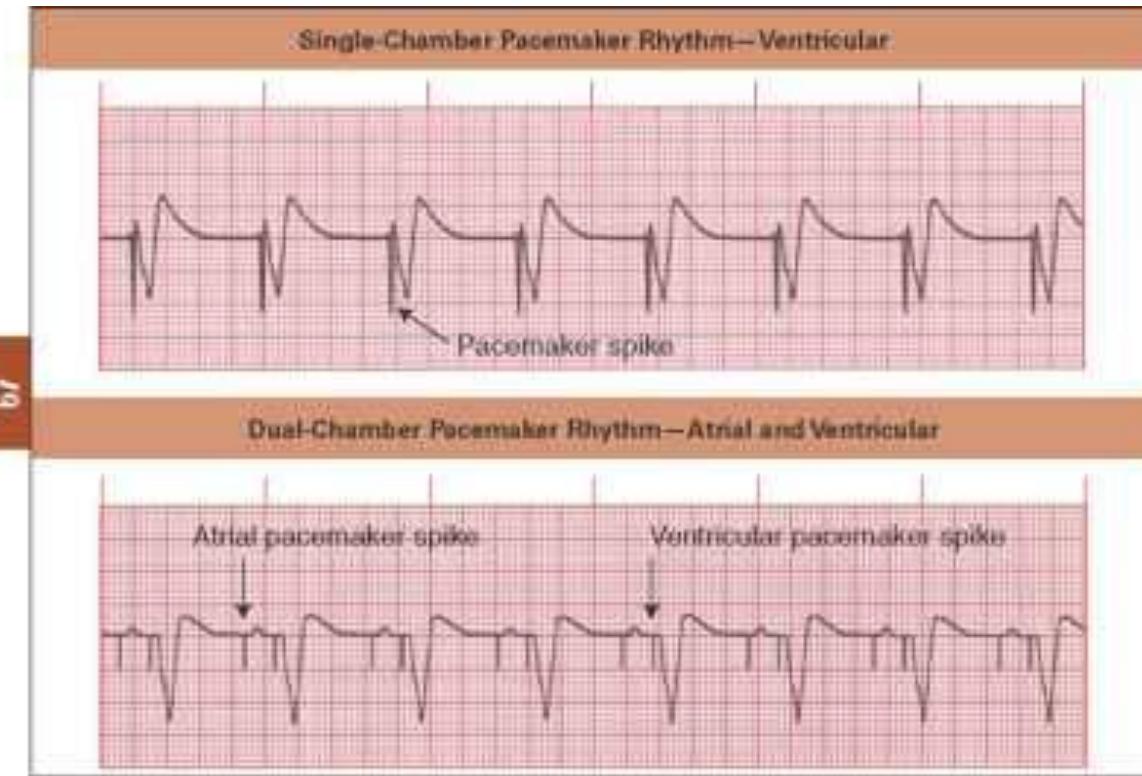
Cardiac Pacemakers

- Small spike is seen on ECG at the start of the pace beat
- Can precede P wave or QRS complex
- Problems with pacemakers:
- Failure to sense a patient's own beat
- Failure to pace because of malfunction
- Failure to capture-not causing heart to depolarize (contracting)

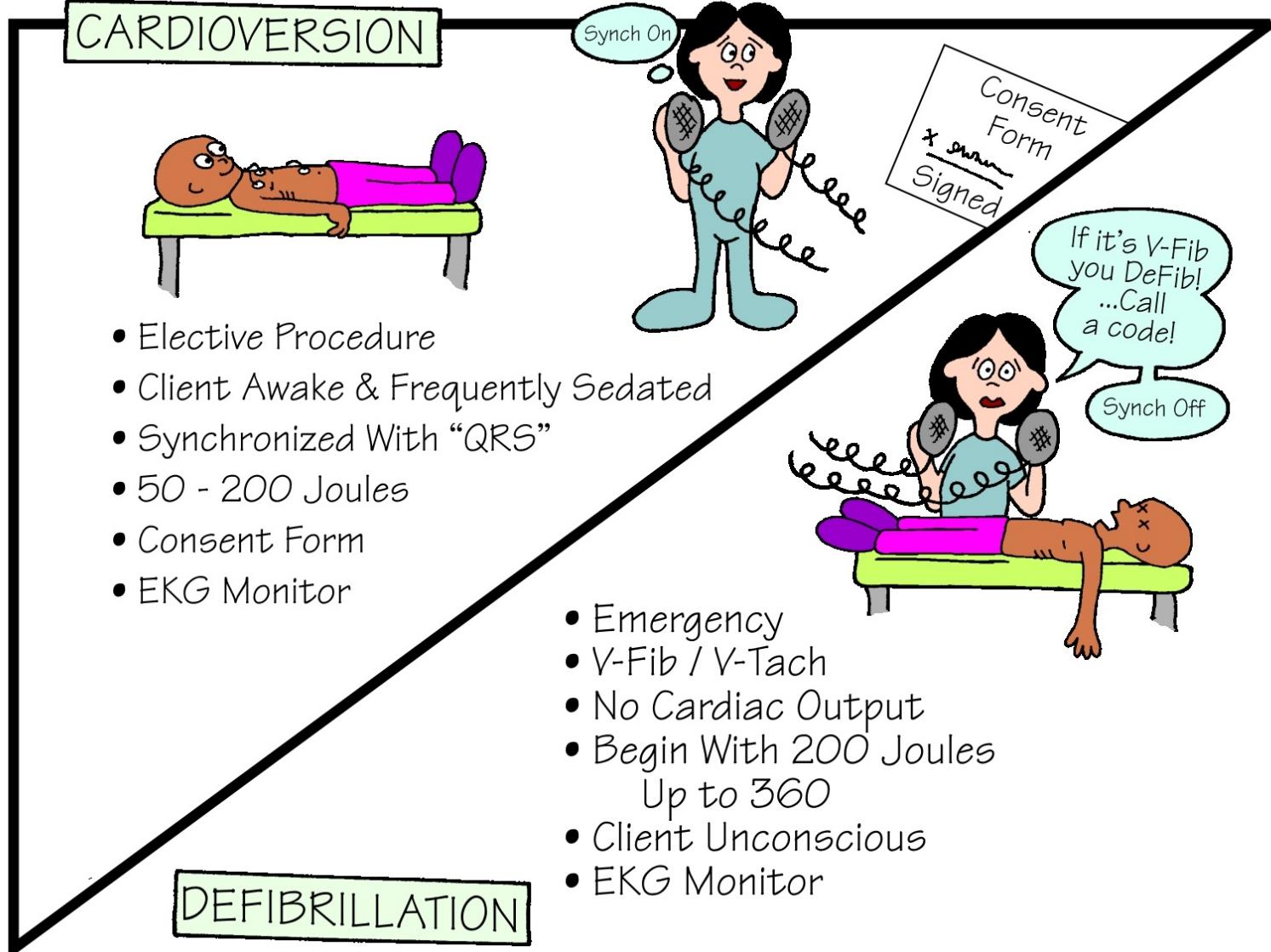


Cardiac Pacemakers

- Nursing Care:
- Rhythm, apical pulse, and incision are monitored
- Chest pain or change in V/S are immediately reported
- Discharge teaching:
- Care for incision
- Ordered activity restrictions (limit raising arm on pacemaker side, driving, returning to work)
- Caution with security metal detectors, antitheft systems, MP3 headphones, MRI, Welders above 130 amps, radio towers, touching running car engines
- Carry pacemaker identification card
- Report chest pain, dizziness, fainting, irregular beats, palpitations, muscle twitching
- Keep follow up appointments



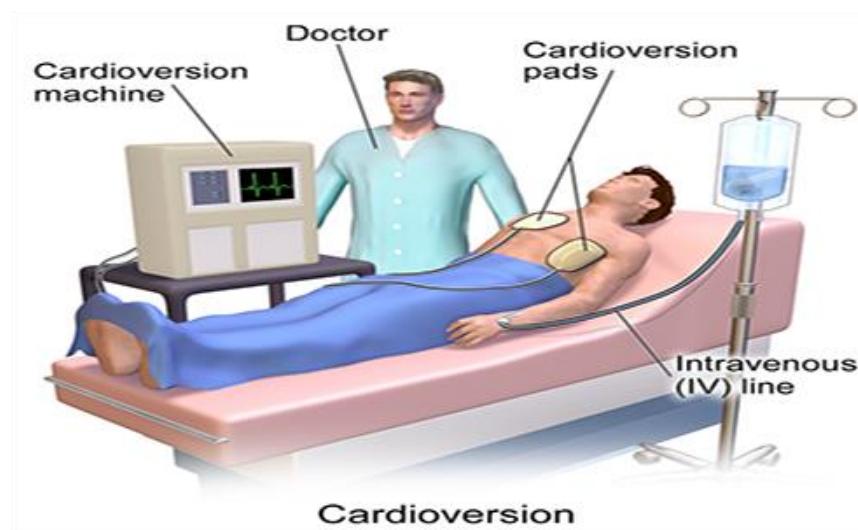
Defibrillation versus Cardioversion



Defibrillation versus Cardioversion

Defibrillation

- Used for pulseless VTach or Vfib
- Delivers electrical shock to reset heart's rhythm



Cardioversion

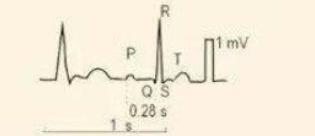
- Defibrillator set in synchronized mode
- **Picks up R wave** and shock is given
- Used for Vtach with pulse, arrhythmias not responsive to medications
- Patient given sedative during procedure

The Heart Block Poem

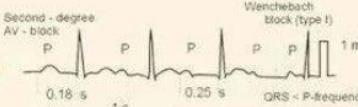
The Heart Block Poem

by the Princeton Surgical Group & [nurseslabs](#)

If the **R** is far from **P**,
then you have a **FIRST DEGREE**.



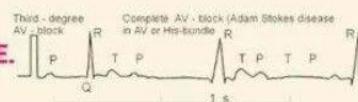
Longer, longer, longer, drop!
Then you have a **WENKEBACH**.



If some **Ps** don't get through,
then you have **MOBITZ II**.



If **Ps** and **Qs** don't agree,
then you have a **THIRD DEGREE**.



Normal sinus rhythm



ECG Description

PR > 0.20 sec
All P waves conduct

1st degree heart block Type I



Progressive prolongation of PR interval
until QRS dropped

2nd degree heart block Type II



Constant PR interval

3rd degree heart block



Complete disruption of AV conduction



REBEL
REVIEWS

Who am I?



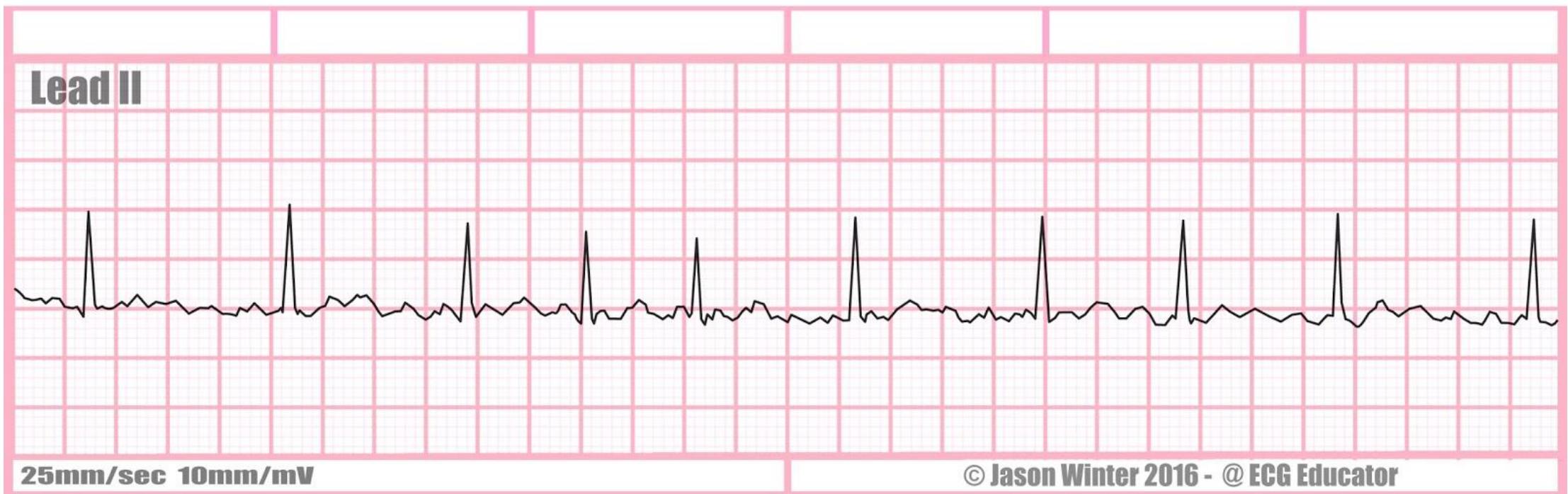
Who am I?



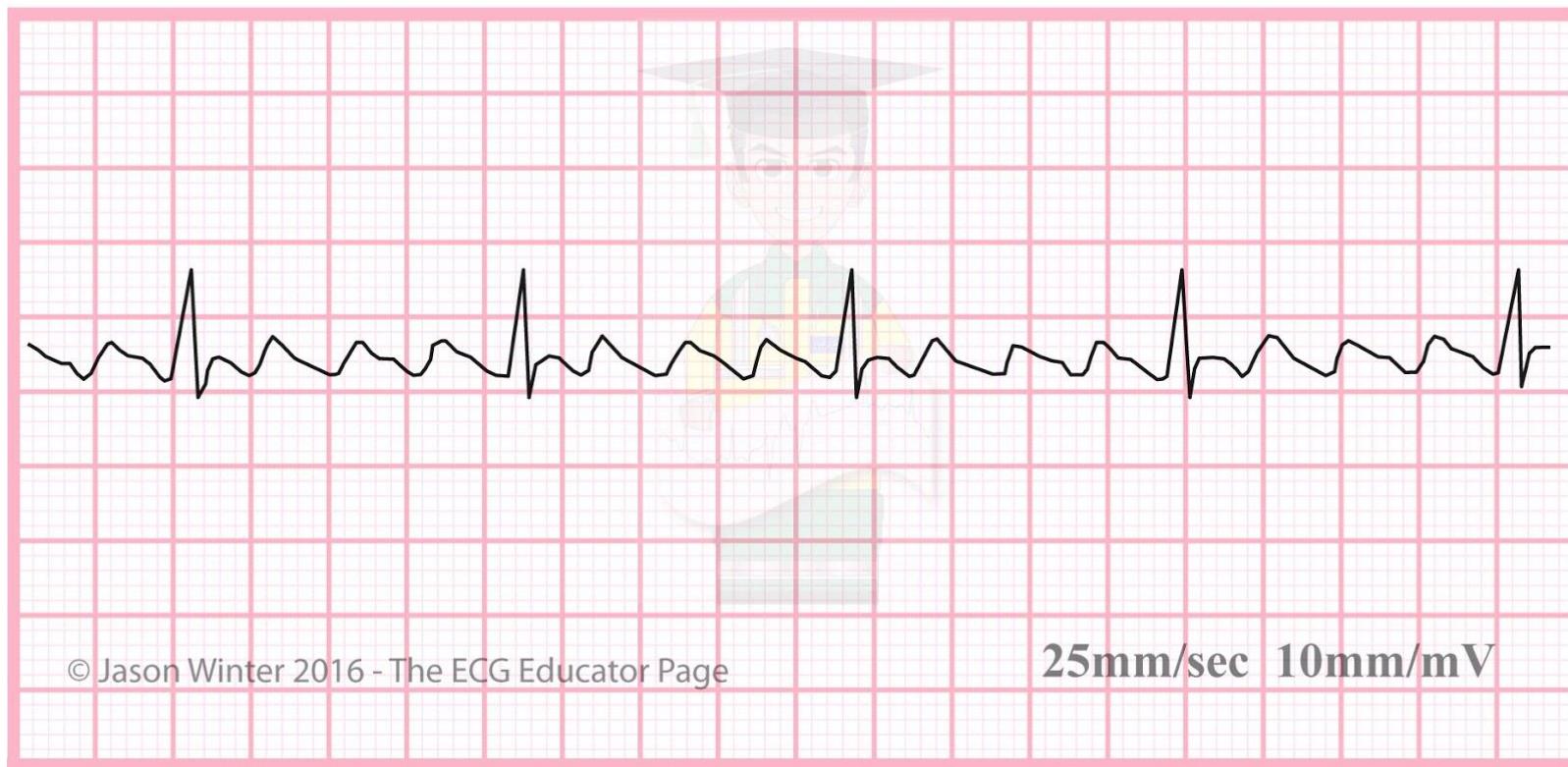
Who am I?



Who am I? 



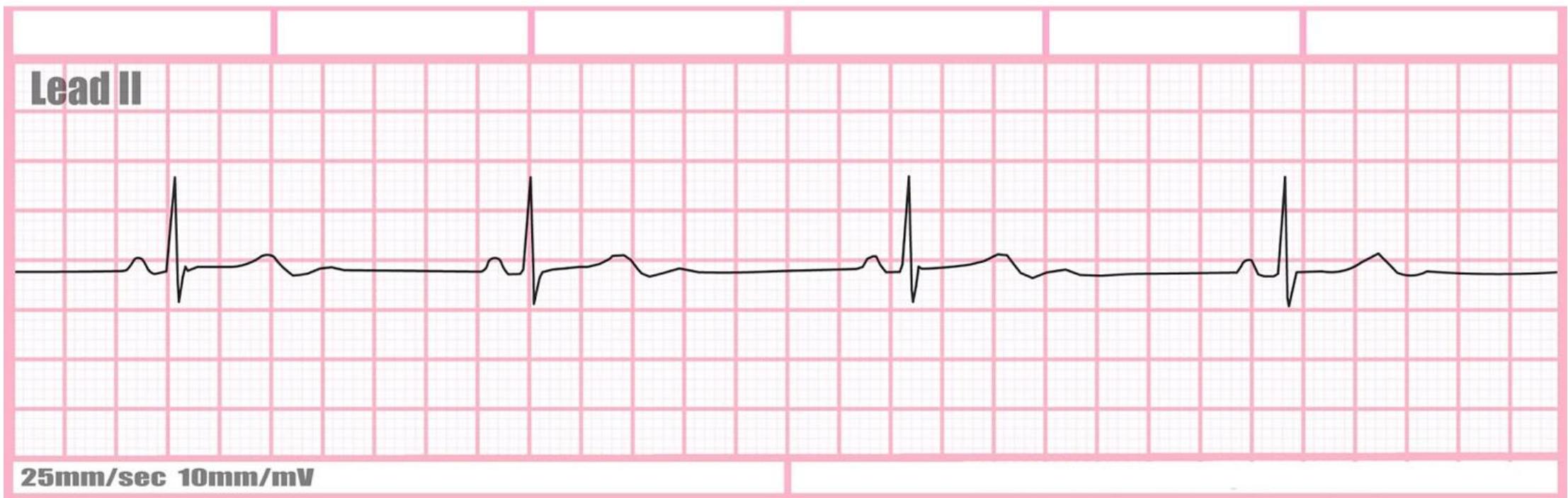
Who am I?



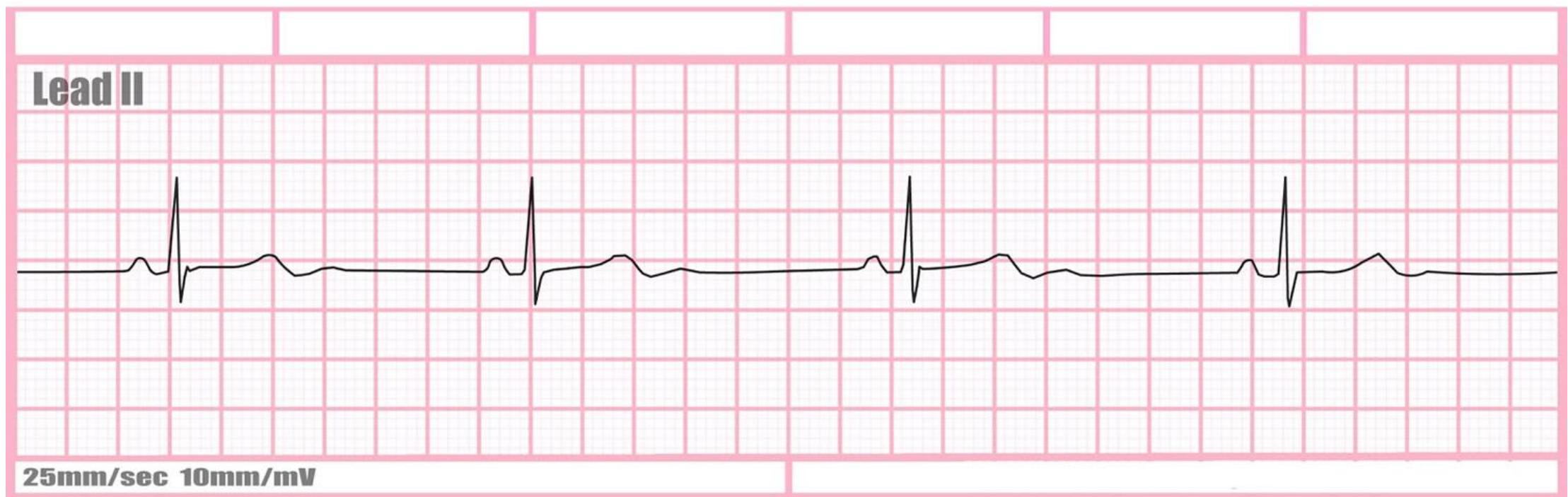
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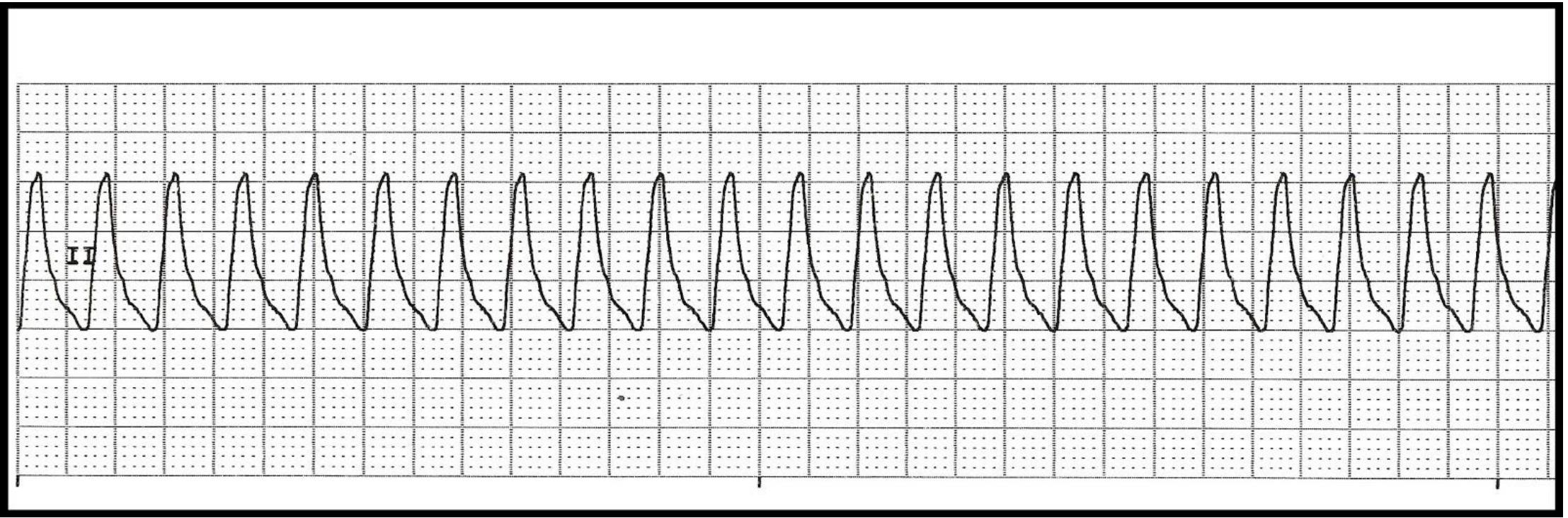
Who am I?



Who am I?

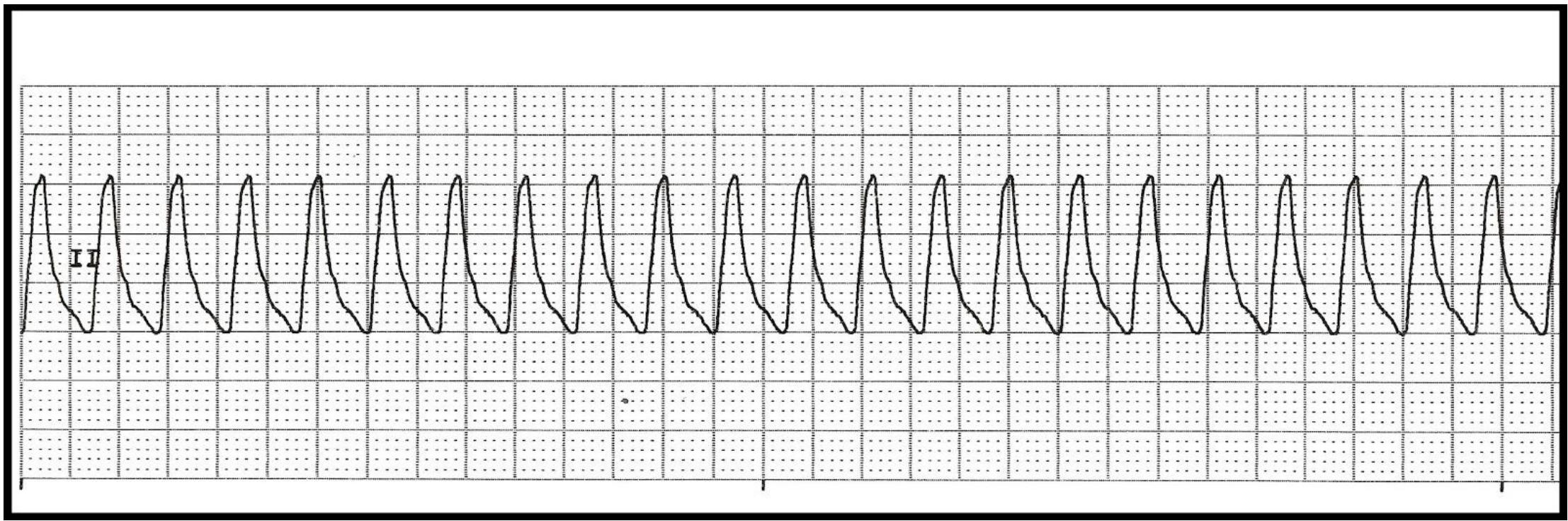


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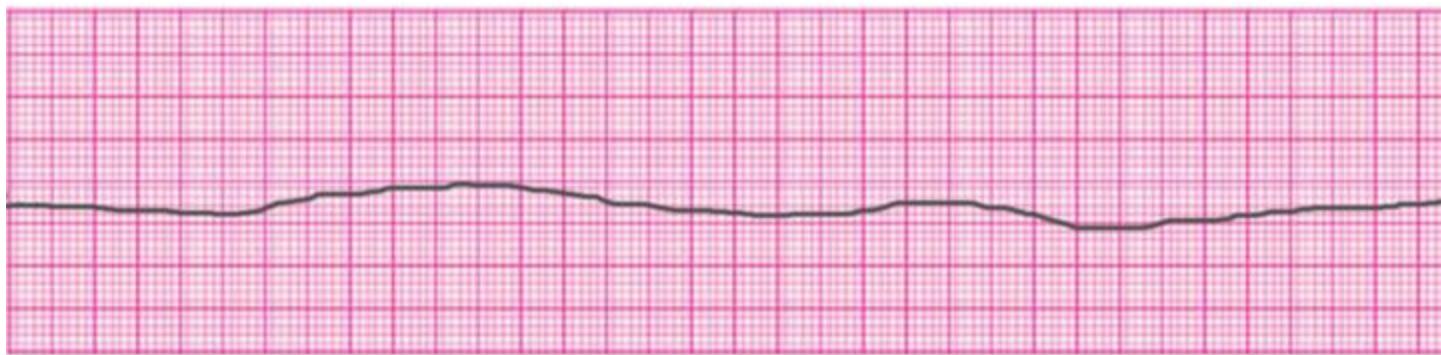


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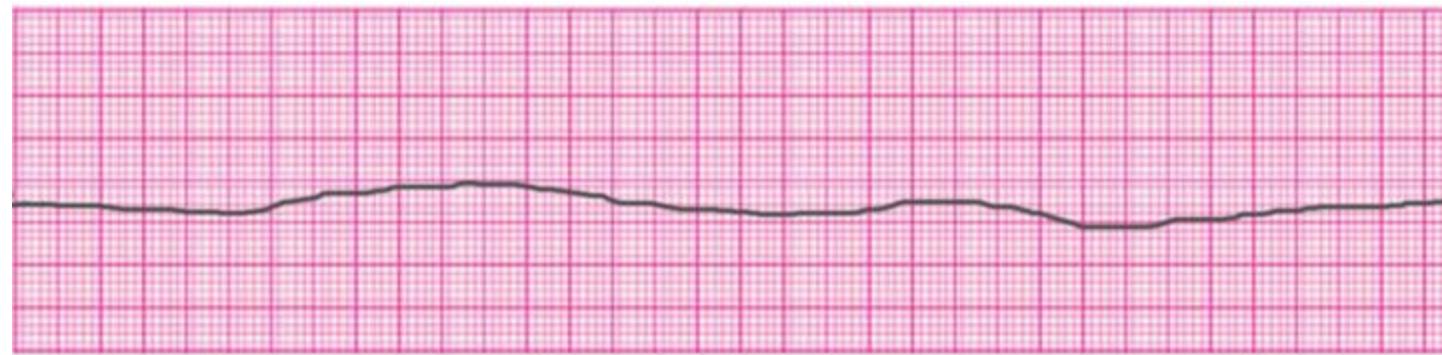
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Who am I?



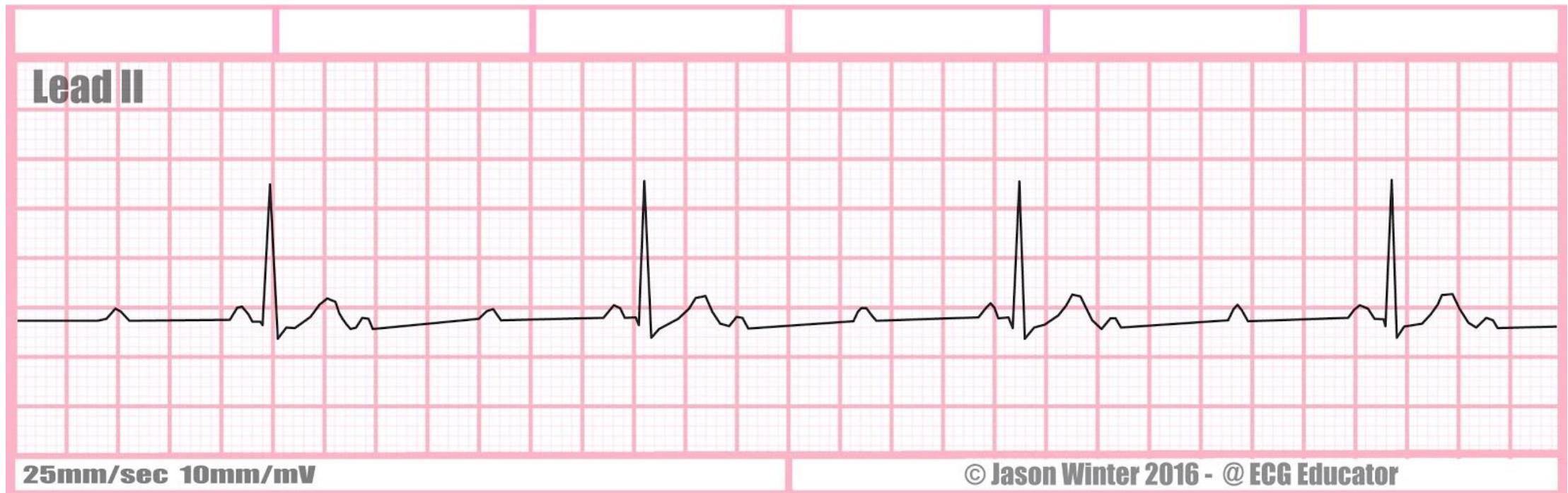
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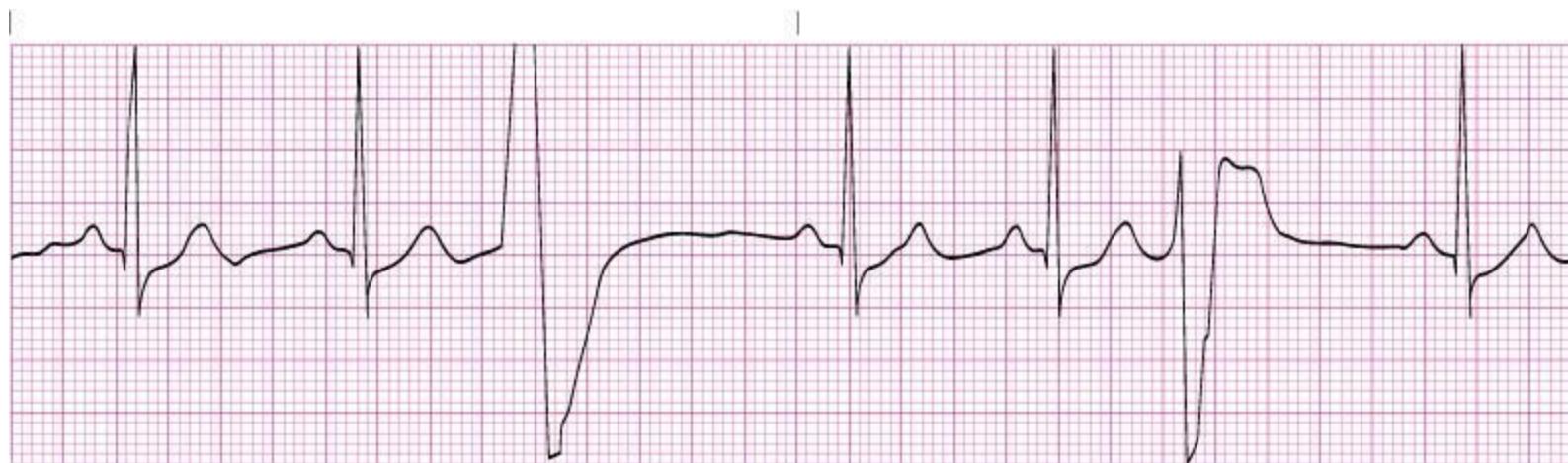
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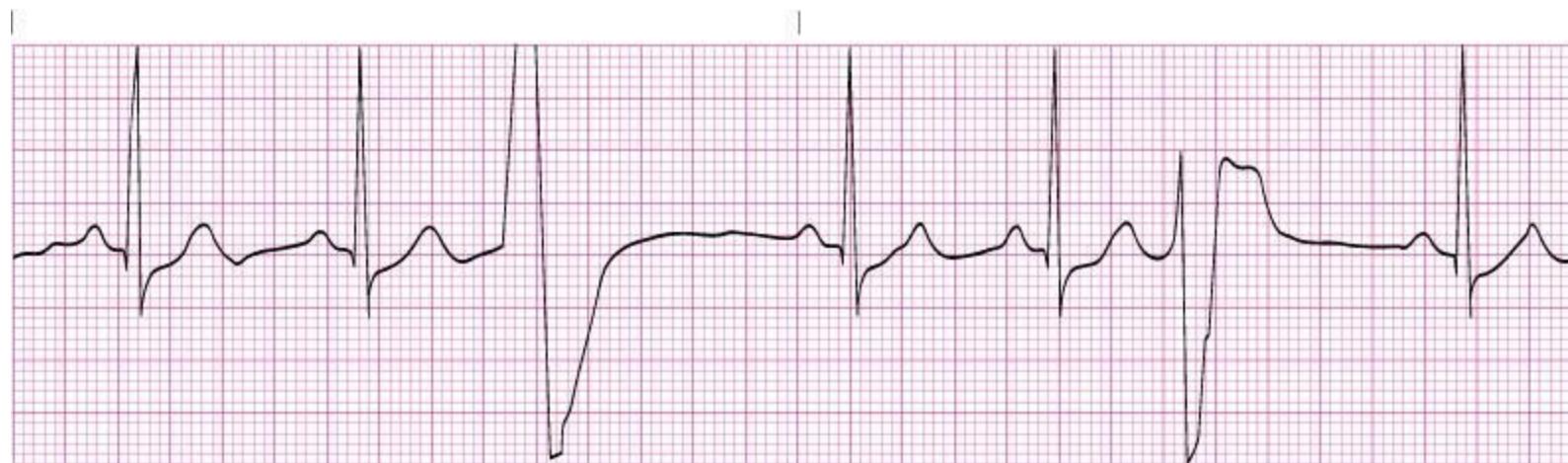
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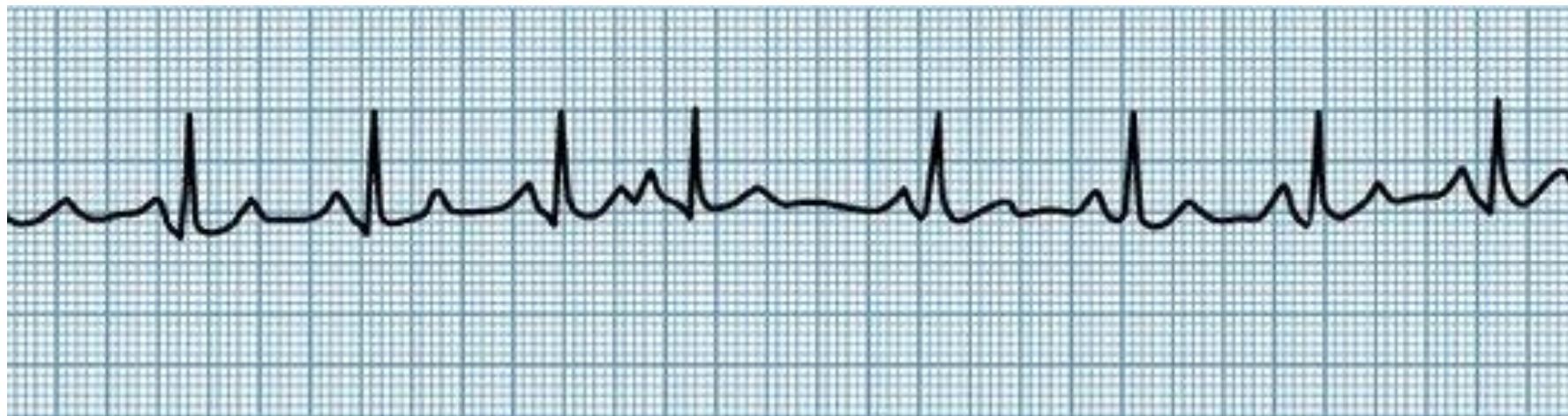
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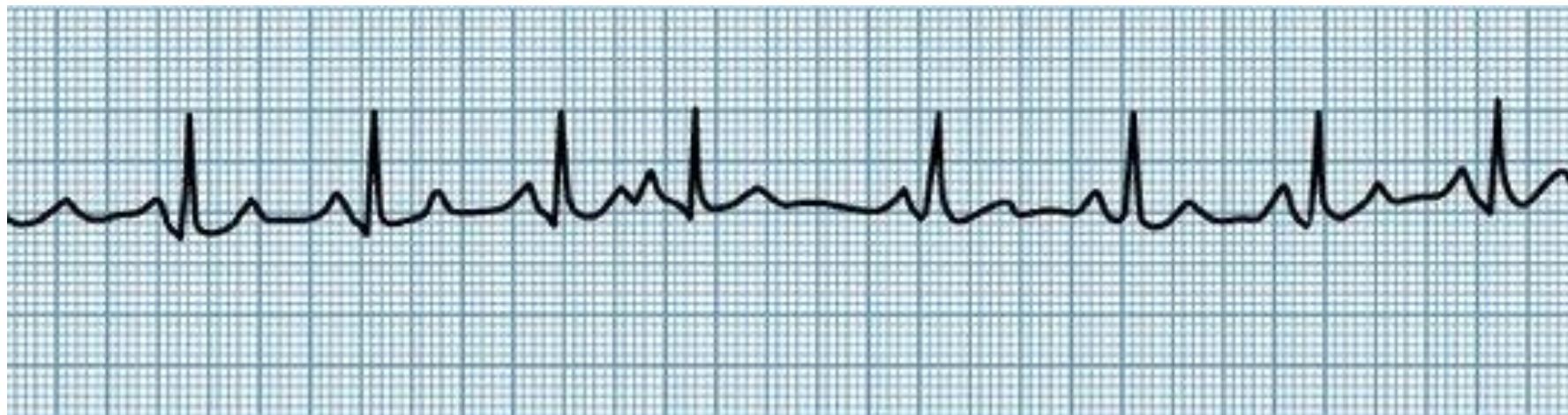
Who am I?



Who am I?



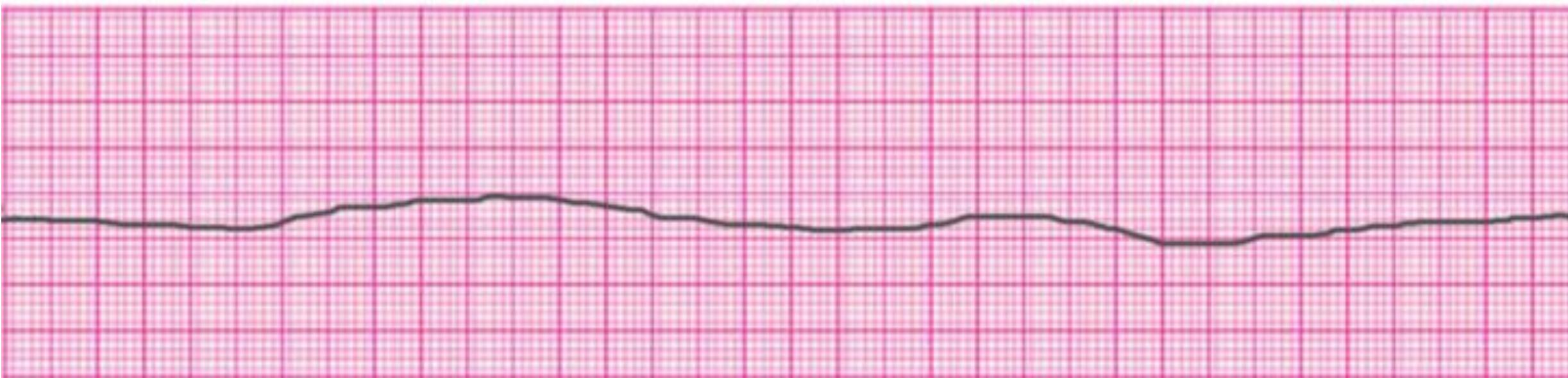
Who am I?



What is normal

- Rhythm: regular
- Heartrate: 60-100 bpm
- P Waves: rounded, upright, alike
- PR Interval: 0.12 to 0.20 seconds
- QRS Interval: 0.06 to 0.10 seconds

What to do?



What is the difference between defibrillation and cardioversion?

- Defibrillation:

- [REDACTED]

- Cardioversion:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

What to do?

