



# Didactic Presentation

## **Intended Audience:**

Residents

Medical Students



# Diagnosis and Management of Cardiac Arrhythmias

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# Objectives

- Define arrhythmia
- Discuss common bradyarrhythmias
- Discuss common tachyarrhythmias

# Arrhythmias

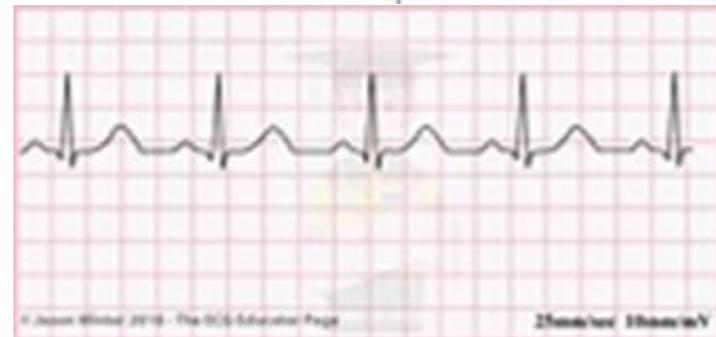
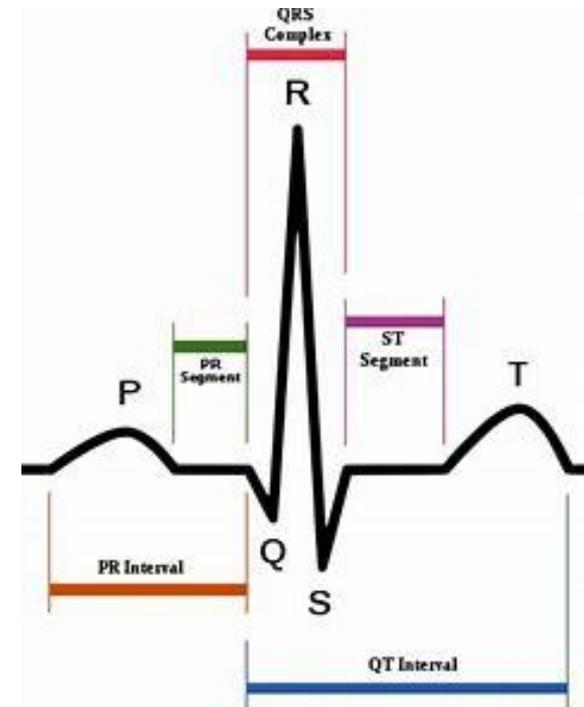
- Definition
  - A disorder of the heart rate (pulse) or heart rhythm, such as beating too fast (tachycardia), too slow (bradycardia), or irregularly
- Causes
  - Conduction system: Abnormal electrical pathways
  - Cardiac pathology: Ischemia, valve abnormalities, CHF
  - Systemic pathology: anemia, thyroid disease, pain, hypoxia, renal failure
  - Drugs/medications: cigarettes, alcohol, beta-blockers, caffeine, bronchodilators

# Arrhythmias

- Normal heart rate 60 – 100 bpm
- Normal rhythm is sinus
- Bradyarrhythmia
- Tachyarrhythmia

# Sinus Rhythm

- P wave
  - Atrial depolarization
  - Atrial contraction
- QRS complex
  - Ventricular depolarization
- T wave
  - Repolarization of ventricles
  - “Recovery”



# Bradyarrhythmia

- HR less than 60 bpm
- Causes
  - Systemic
  - Cardiac
  - Drugs
- Symptoms
  - None
  - Light-headedness
  - Syncope
  - Angina
- Diagnosis
  - Check pulse
  - Check ECG

# Bradyarrhythmias

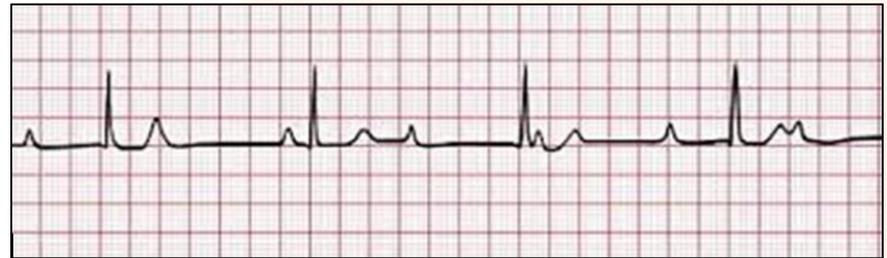
- Regular rate
  - Sinus bradycardia
  - Complete heart block
  - Second degree AV block
  - Sinus arrest with escape
- Irregular rate
  - Sick sinus syndrome
  - Second-degree AV block
  - Slow atrial fibrillation

# Bradyarrhythmias

- **Sinus Bradycardia**
  - HR < 60 bpm
  - Regular P waves
  - Consistent QRS
  - Physical fitness, medications, hypothermia

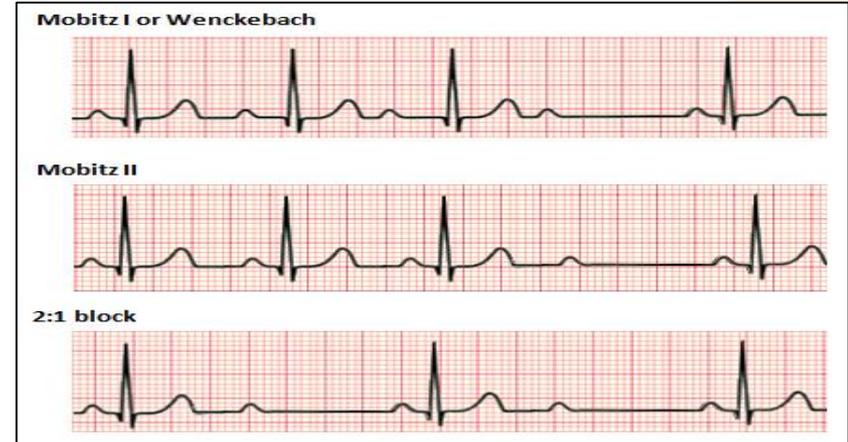


- **Complete Heart Block**
  - 3<sup>rd</sup> degree AV block
  - Impulses SA node do not propagate to ventricles
  - Accessory pacemaker generates an escape rhythm
  - Ischemia, congenital, lupus, Lyme disease, hyperkalemia



# Bradyarrhythmias

- **Second degree AV block**
  - Conduction block atria and ventricles
  - One or more (but not all) of the atrial impulses fail to conduct to the ventricles



- **Sinus arrest with escape**
  - SA node transiently fails to generate beat
  - Escape beats
    - 60 – 80 bpm atrial
    - 40 – 60 bpm junctional
    - 20 – 40 bpm ventricular
  - Ischemia, medications



# Tachyarrhythmias

- HR > 100
- Causes
  - Enhanced automaticity
  - Reentry
- Risk factors
  - HTN, thyroid disease, COPD, valve disease, medications, surgery, electrolyte issues, CAD
- Presentation
  - Palpitations
  - Dizziness or syncope
  - Diaphoresis
  - Chest pain

# Tachyarrhythmias

- Diagnosis
  - Pulse
  - BP
  - ECG

# Tachyarrhythmias

- Diagnostic evaluation
  - Supraventricular
  - Ventricular
- Regular supraventricular
  - **Sinus tachycardia**
  - **Atrial flutter**
  - Ectopic atrial tachycardia
  - AVNRT
  - AVRT
  - Junctional tachycardia
- Irregular supraventricular
  - **Atrial fibrillation**
  - **Multi-focal atrial tachycardia**
  - Atrial flutter with AV block

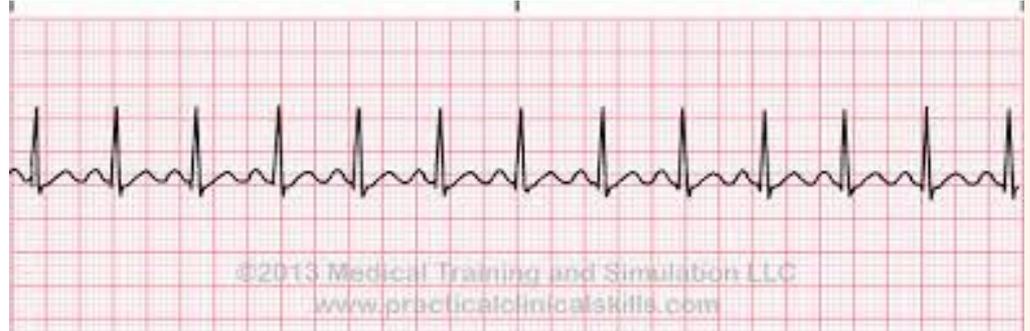
# Tachyarrhythmias

- Ventricular
  - **Ventricular tachycardia**
  - **Ventricular fibrillation**
  - **Torsade de pointes**

# Tachyarrhythmias

- **Sinus tachycardia**

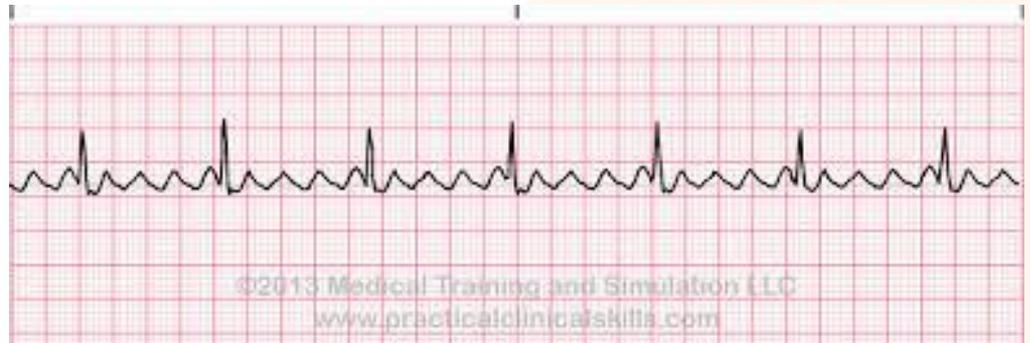
- Rate > 100 bpm
- Consistent p waves and QRS
- Causes
  - Pain
  - Anxiety
  - Dehydration
  - Anemia



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- **Atrial flutter**

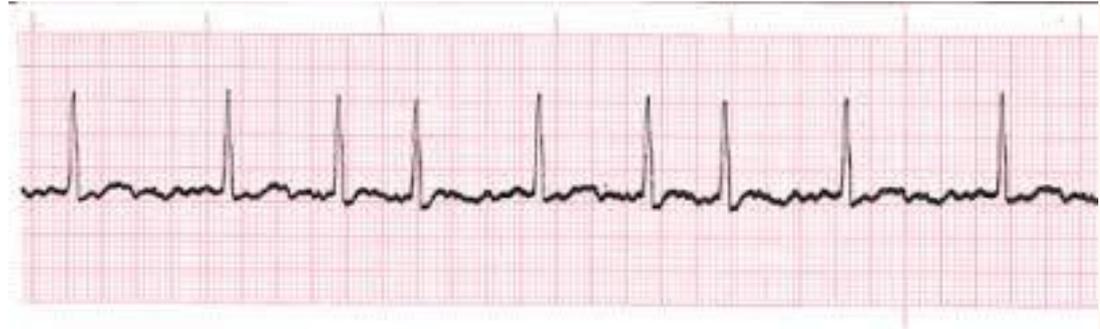
- Abnormal regular rhythm from atria
- Re-entrant rhythm
- Unstable
- Causes
  - Valvular disease
  - Electrolytes



# Tachyarrhythmias

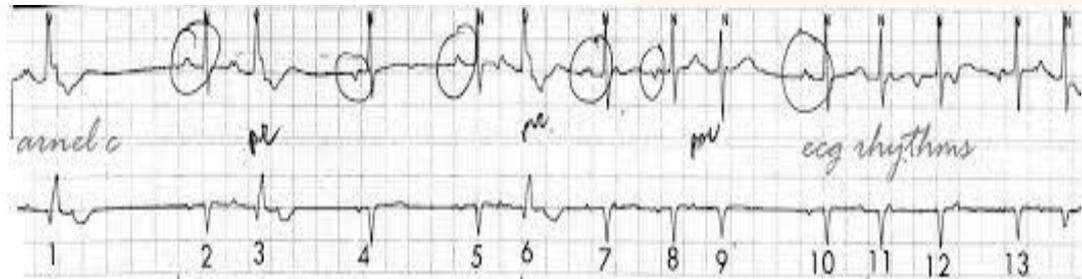
- **Atrial fibrillation**

- Rapid irregular beats
- Common
- Causes
  - HTN
  - CAD
  - Valve disease



- **Multi-focal atrial tachycardia**

- Foci of cells outside SA node create P wave
- 3 or more distinct P wave morphologies
- COPD, elderly
- Calcium channel blockers, beta-blockers, oxygen

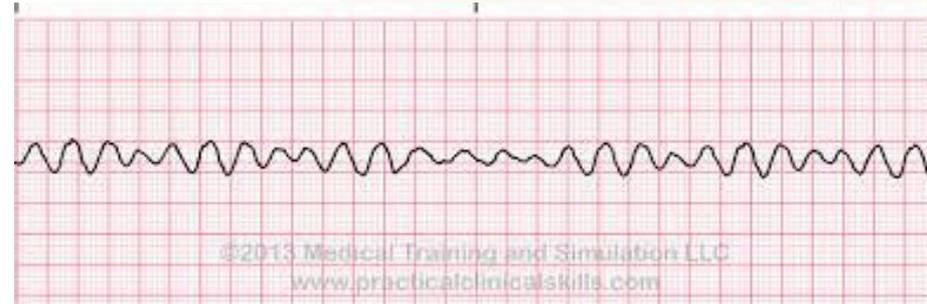
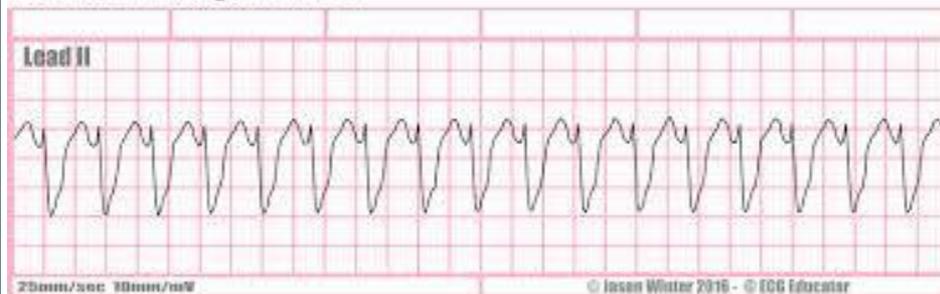


# Tachyarrhythmias

- **Ventricular tachycardia**
  - Ventricular HR > 120 bpm
  - Seen in > 5% of patients prior to cardiac arrest
  - Due to CAD, electrolytes abnormalities, AS
  - Treat cardioversion, anti-arrhythmic

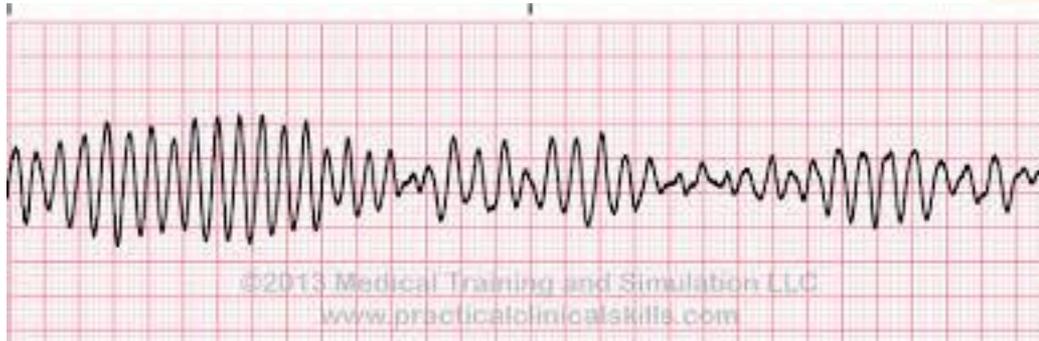
- **Ventricular fibrillation**
  - Asynchronous electrical activity originating in ventricles
  - Seen in > 10% cardiac arrest
  - Due to CAD, drowning, electrolytes abnormalities, overdose

**Ventricular Tachycardia (VT)**



# Tachyarrhythmias

- **Torsade de pointes**
  - “Twisting of the peaks”
  - Polymorphic ventricular tachycardia
  - Due to hypokalemia, hypomagnesemia, hypocalcemia and hypothermia
  - Often converts to other rhythm on own
  - Magnesium first line treatment



# Case #1

- A 26 year old female long distance runner presents to her primary care doctor for “clearance” to run in her town’s upcoming marathon. She runs at least two marathons a year and has been on a training schedule for years. On exam she is lean and muscular. She has a blood pressure of 108/50 and a heart rate of 48. There are no significant findings on exam and an ECG is performed.
- What is the likely interruption on her ECG?
- Why is her heart rate 48?
- What should be done about her heart rate?

# Case #2

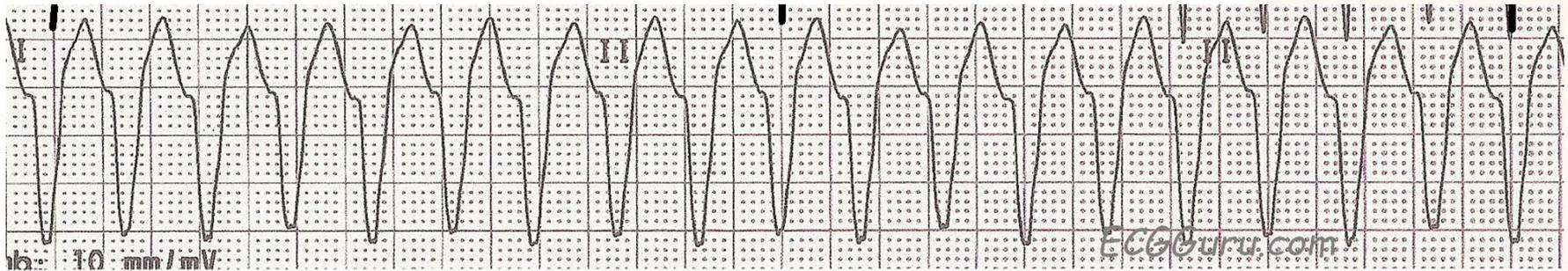
- A 74 year old male is POD #6 after CABG, MVR and AVR. His hospital course has been largely unremarkable except for symptomatic bradycardia. He is on no medications that are known to slow the heart rate and currently is requiring assistance from a temporary pacemaker placed during his surgery.
- What does his ECG likely show?
- What should be done for this patient?

# Case #3

- A 32 year old previously healthy male presents to the SICU after an orthopedic surgery due to injuries from a MVA. He was just extubated and has a saturation of 96 % on 2L NC. His heart rate is 118. He reports that he is in pain, he is making urine and his last hb was 8.7. An ECG is performed.
- What is the likely finding on ECG?
- What is the etiology of the tachycardia?
- What should be done to treat this patient?

# Case #4

- A 68 year old male with CAD and atrial fibrillation presents to the CCU with chest pain. His vitals are initially stable and then his heart rate suddenly goes up to 150 bpm and his SBP drops from 130 to 76. He has a faint pulse and is now more lethargic. His ECG is below:



- What is this heart rhythm?
- How is this treated?
- What else should be done for this patient?

# Question 1

- A 53-year-old female with hypertension that is well controlled on atenolol. She is currently recovering from a post elective knee surgery. In the post-anesthesia recovery area, she develops a heart rate of 120 bpm that is irregular. Her systolic blood pressure has remained in the 130s and she has no major symptoms.
- Which of the following is incorrect?
  - Her rhythm is likely atrial fibrillation.
  - Immediate cardioversion is needed.
  - An electrolyte abnormality may be contributing to this rhythm.
  - Tachyarrhythmias after surgery are common.

# Answer 1

- The correct answer is:
  - **Immediate cardioversion is needed.**

# Question 2

- A 79-year-old male presents to the emergency department with chest pain. His initial ECG shows ST changes consistent with ischemia. He is given aspirin, beta-blockers, statin, heparin and sublingual nitroglycerin. He becomes chest pain free and is admitted to the coronary unit. Two hours after admission his heart rate has decreased from 90 to 46 bpm.
- Which of the following is incorrect?
  - The heart rate change may be due to medication.
  - An ECG should be done.
  - The heart rate change may due to increasing ischemia.
  - The heart range change is benign. No action is necessary.

# Answer 2

- The correct answer is:
  - **The heart range change is benign. No action is necessary.**

