# PATIENT CARE THEORY 2

## Unit 14 Part 3: Cardiac Rhythm Interpretation- Lead II Rhythms

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2022

# Supraventricular Dysrhythmias
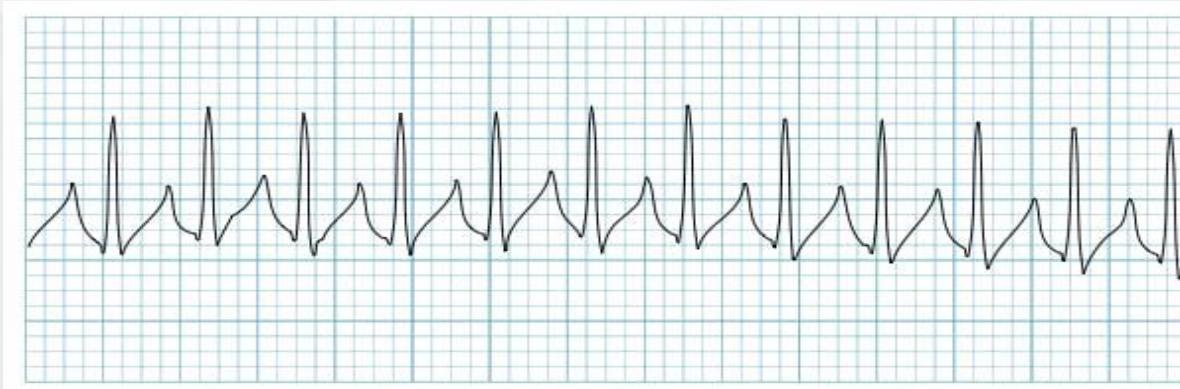
❖ Rhythms originate from above the ventricles

➢ Through the SA node

➢ Through the AV node

➢ Or through ectopy found in the atria

➢ SVT

➢ Atrial tachycardia

➢ Atrial fibrillation

➢ Atrial Flutter

➢ Junctional rhythms

➢ Exit blocks

➢ Sinus arrest/pause

➢ Premature complexes (PAC/PJC)

➢ others ( we will discuss next semester☺)

# Supraventricular Dysrhythmias

❖ **Supraventricular Tachycardia**

> SVT, also narrow ventricular tachycardia

➢ Abnormally fast HR that originates above the ventricles (≥ 150)

➢ Can refer to multiple rhythms however most often meant to refer to a *re-entrant rhythm* (i.e. WPW)

➢ PSVT (paroxysmal supra ventricular tachycardia)

➢ Regular

➢ P waves *absent (or unseen)*

➢ QRS narrow
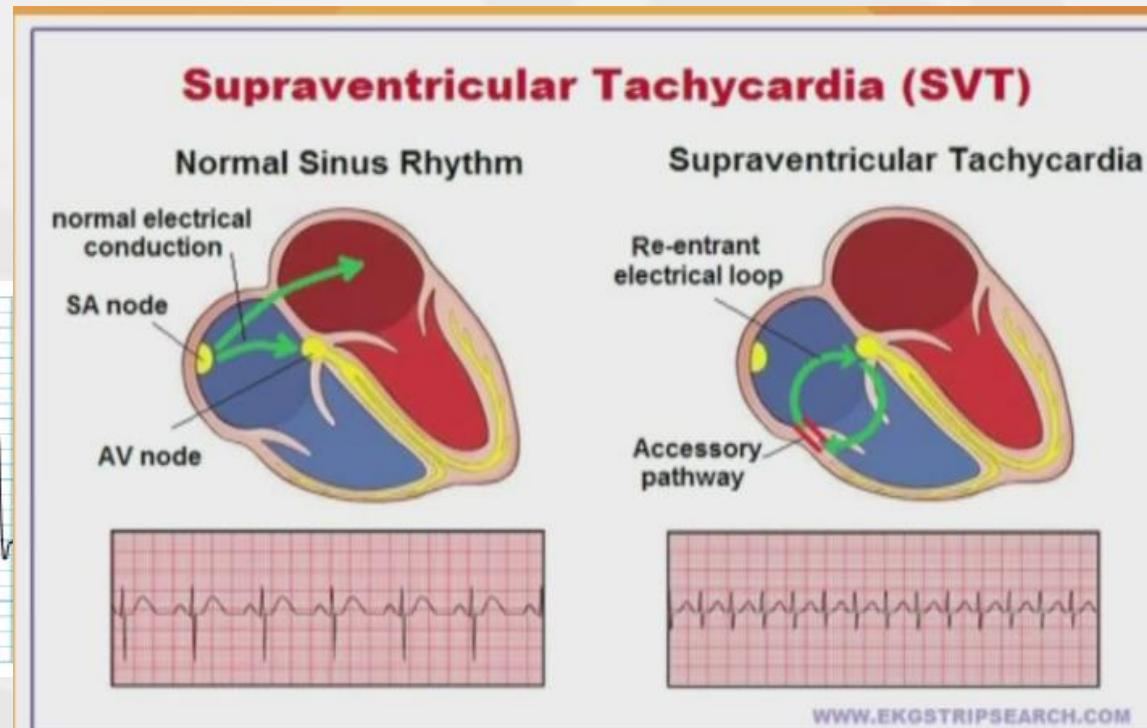
AVNRT caused by premature beat, the fast pathway of the AV node has already repolarized, and and trigger, while the slow can't

know avrt vs avnrt. the circulation part doesn't trgger contraction in AVNRT, only in AVRT

avnrt is renentrant tachycardia through av node, circling within
avrt is outside av node, travelling through the muscles

SVT Identification: >150, no P wves, regular, narrow complex
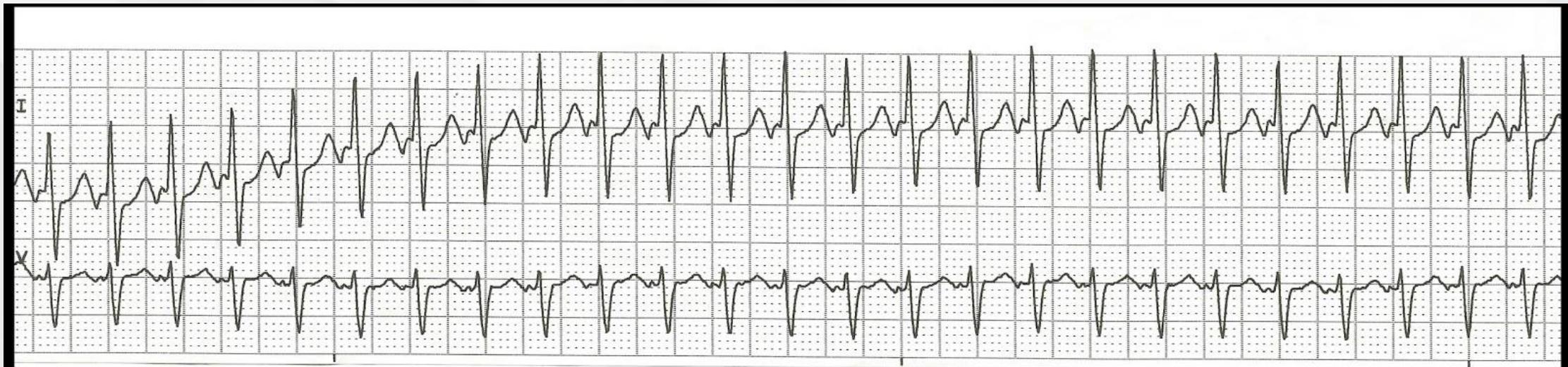


## Supraventricular Tachycardia (SVT)

### Normal Sinus Rhythm

normal electrical conduction

SA node

AV node

### Supraventricular Tachycardia

Re-entrant electrical loop

Accessory pathway

WWW.EKGSTRIPSEARCH.COM

# Supraventricular Dysrhythmia

❖ **Atrial Tachycardia**
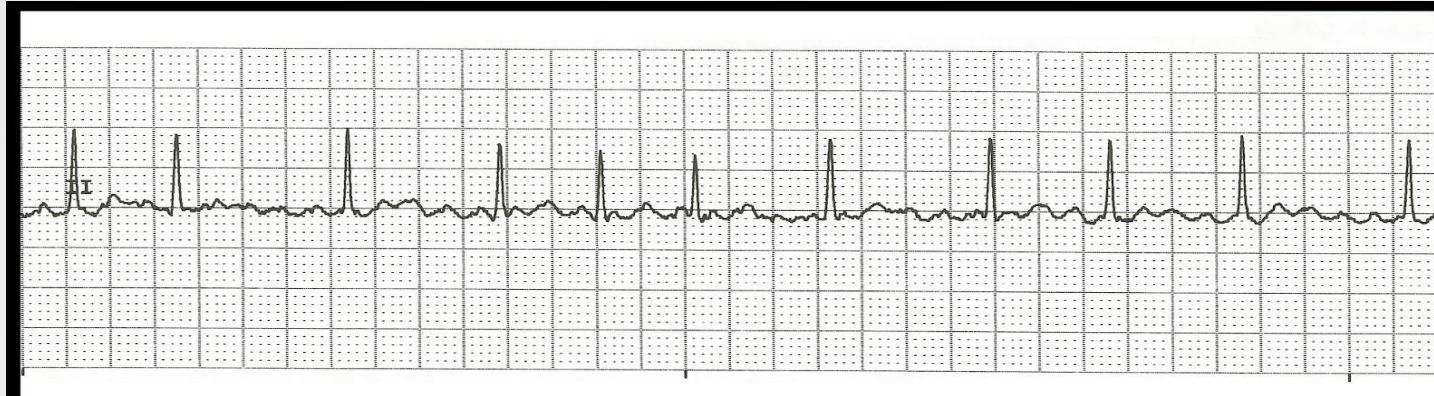
➢ One foci within the atria is firing at a rate faster than the SA node

➢ Atrial rates may be up to 250 bpm

➢ P wave is present - morphology changes from normal rhythm

➢ (SVT has no discernable P waves)

# Supraventricular Dysrhythmias

❖ **Atrial Fibrillation**

➢ *Irregularly irregular rhythm with no discernable P waves*

➢ There are multiple atrial foci with random impulse generation → only a few get through to the AV node to complete V depolarization

➢ High risk for emboli

➢ Narrow QRS
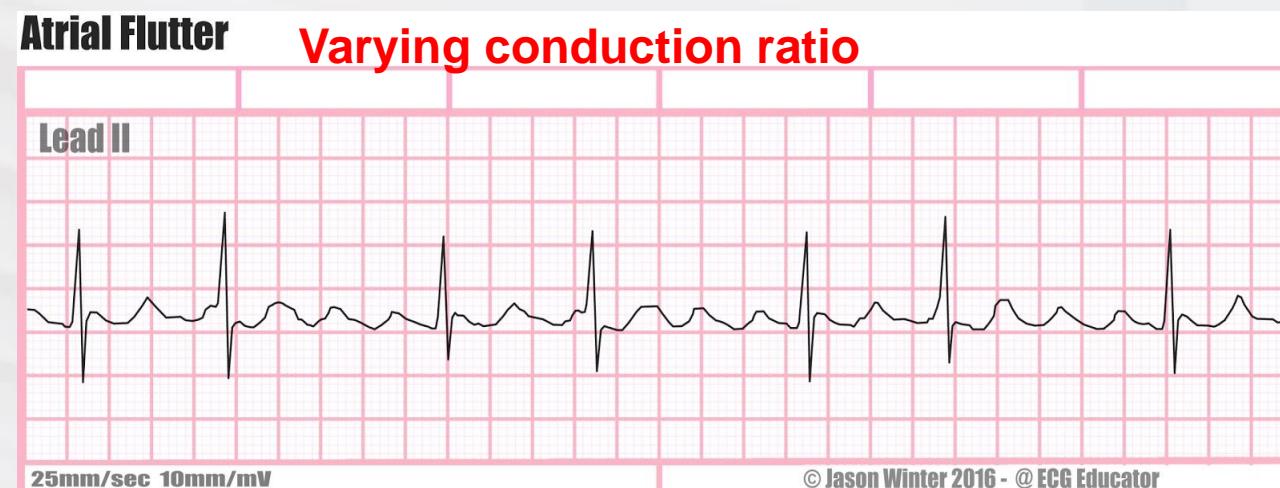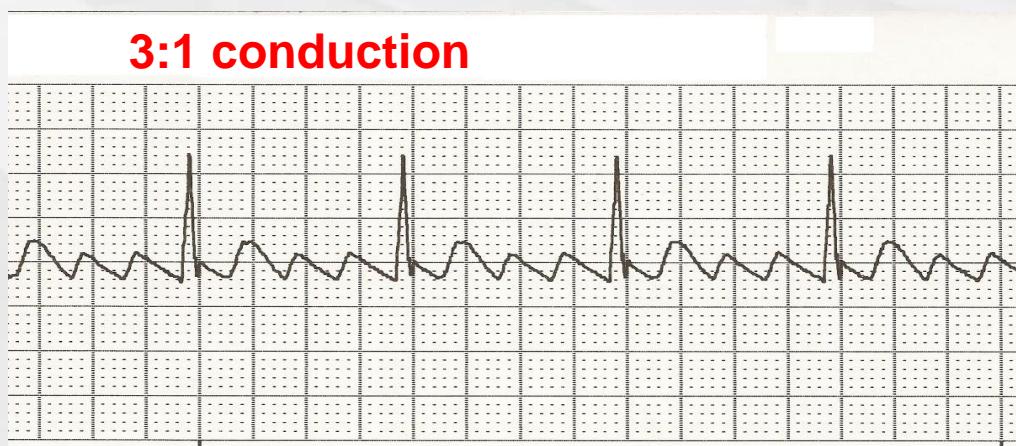


| Rate: | Variable |
|---|---|
| Rhythm: | Irregularly irregular |
| P-R Interval: | N/A |
| QRS Width: | < 0.12 second |
| P-QRS-T: | No P waves |
| Missing / Added: | No P waves |
| Identifying Features: | Irregularly irregular, no discernible P waves, +/- fibrillating baseline |

# Supraventricular Dysrhythmias

| Rate: | May vary |
|---|---|
| Rhythm: | Regular or irregular |
| P-R Interval: | ≤ 0.20 second |
| QRS Width: | < 0.12 second |
| P-QRS-T: | F waves present |
| Missing / Added: | Flutter wave between QRS complex |
| Identifying Features: | Flutter waves replace P waves |

❖ **Atrial Flutter**

➢ In contrast with A fib, there is a single ectopic foci

➢ Saw tooth P wave morphology

➢ Can be fast or slow with varied conduction (i.e. 2:1, 3:1, 4:1 etc.)

➢ Narrow QRS

**3:1 conduction**

**Atrial Flutter** **Varying conduction ratio**

Lead II

25mm/sec 10mm/mV

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# Supraventricular Dysrhythmias

❖ **Junctional Rhythms**
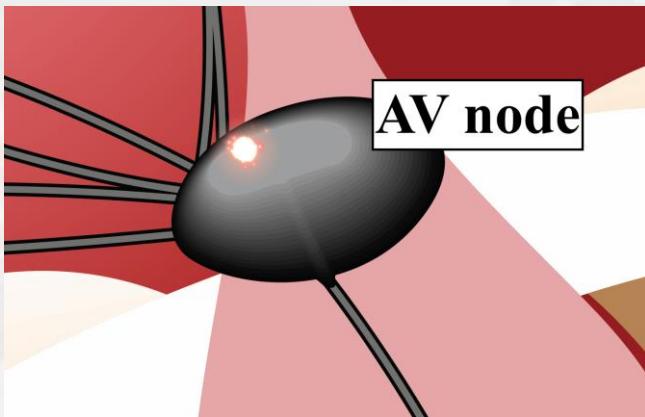
  ➢ Impulse is generated within the AV node

  ➢ P waves can be inverted, absent (buried in the QRS complex) or retrograde

  ➢ P-R interval is short (if applicable)

  ➢ Rhythm is regular

  ➢ QRS narrow

  ➢ Inherent pace of the AV node is 40-60 bpm

    ➢ Can be accelerated junctional (> 60 bpm)

| | |
|---|---|
| Rate: | 40 −60 |
| Rhythm: | Regular |
| P-R Interval: | Narrow if present |
| QRS Width: | < 0.12 second |
| P-QRS-T: | Inverted P waves, no P waves |
| Missing / Added: | retrograde P waves |
| Identifying Features: | Regular, narrow complex, 40-60, inverted P waves in front, buried, or after QRS complex |
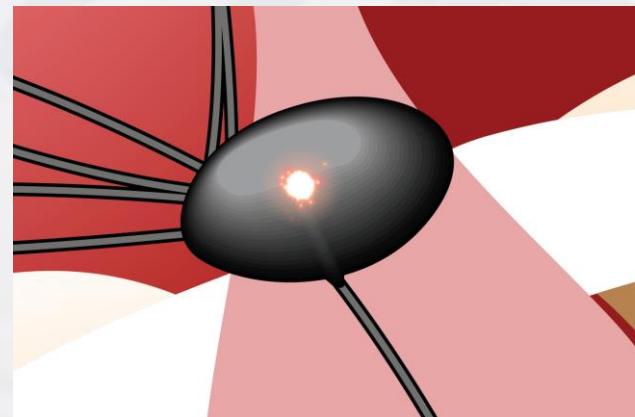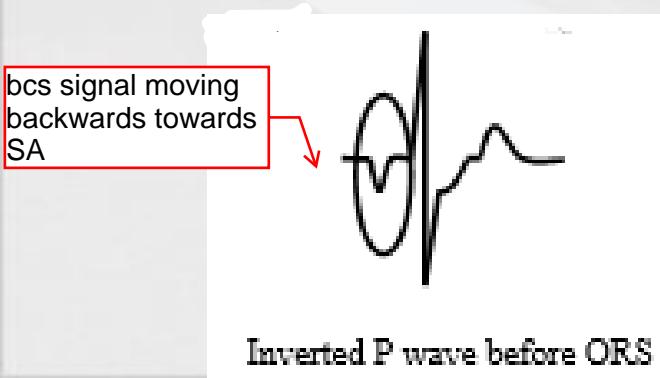
# Supraventricular Dysrhythmias
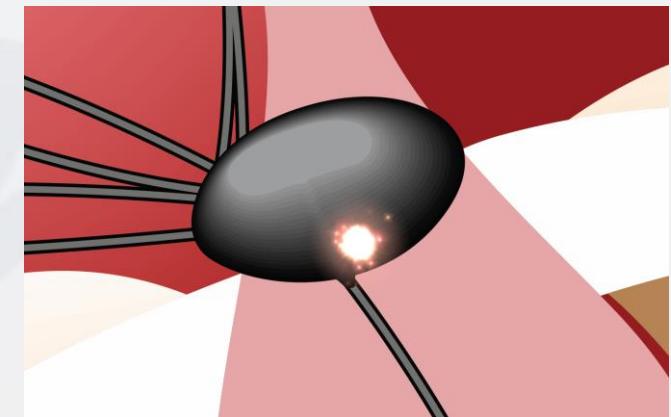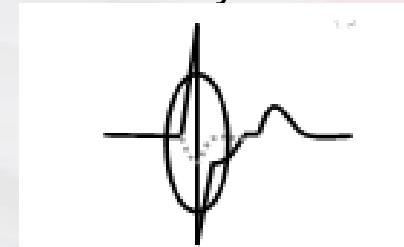
❖ Junctional Rhythms
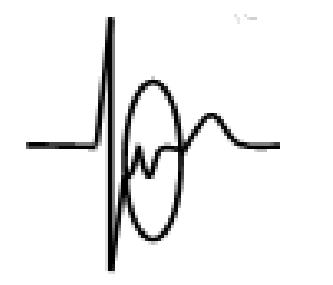


Pacemaker is near the top of the AV node
Impulse enters atria first, then ventricles second

bcs signal moving backwards towards SA

Inverted P wave before QRS

Pacemaker is near the middle of the AV node
Impulse enters the atria and the ventricles simultaneously

P wave hidden in QRS complex
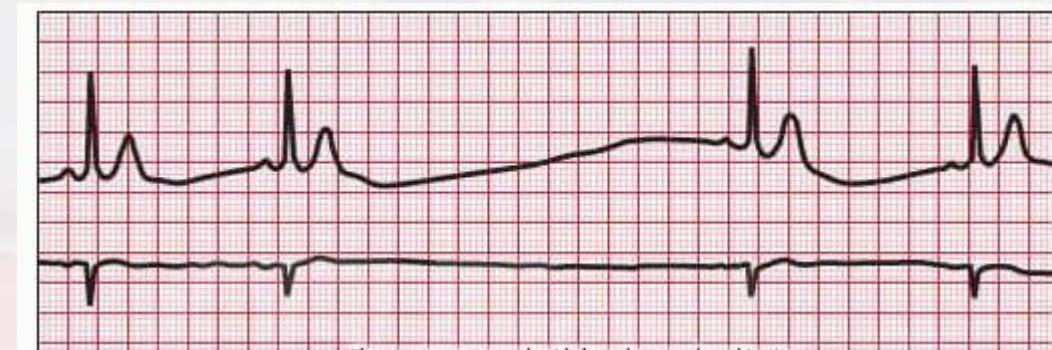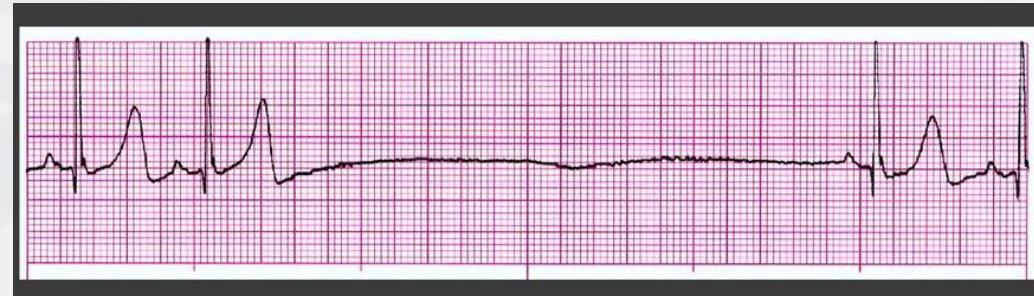
Pacemaker is near the bottom of the AV node
Impulse enters the ventricles first then the atria

P wave after QRS Complex

# Sinus Arrest/ Sinus Pause
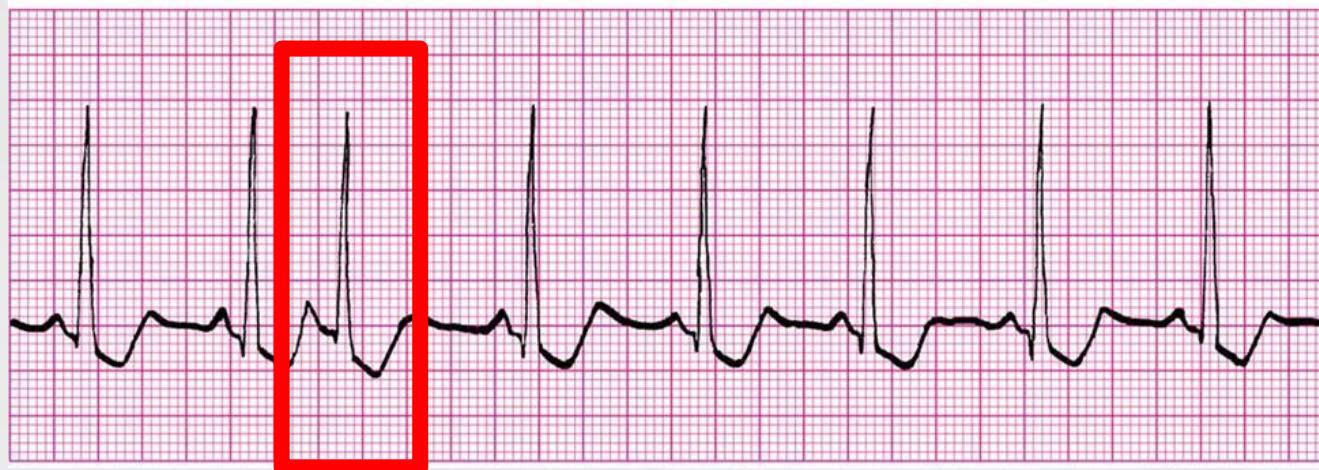
❖ Arrest = When the SA node fails to generate an impulse for ≥ 2 seconds (or more than one impulse fails to form)

❖ Pause = When the SA node fails to generate an impulse in < 2 seconds (just one impulse fails to form)

❖ Often followed by an "escape beat" (this is an alternate pacemaker site) before the SA node begins again

❖ Sometimes used interchangably
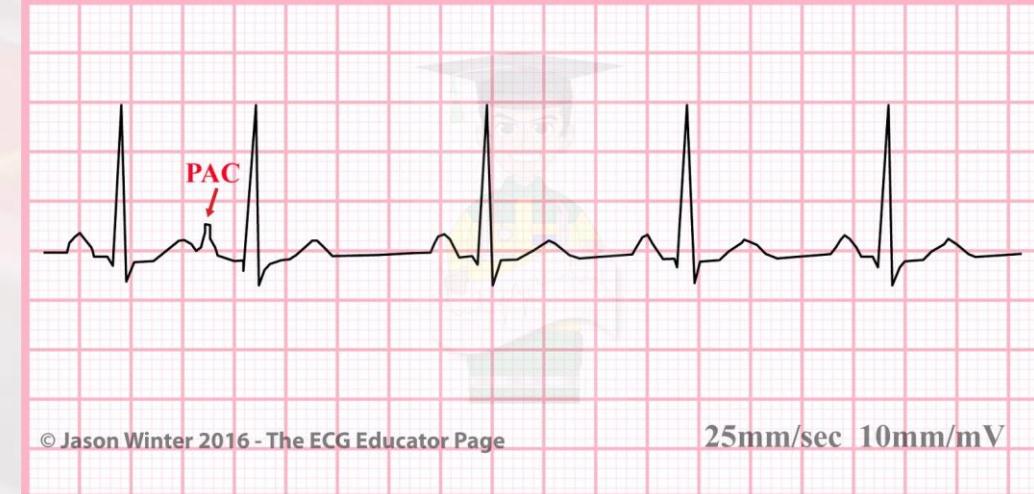
# Premature Complexes - Supraventricular

❖ **Premature Atrial Complexes (PAC's)**

➢ Occur with an underlying sinus rhythm

➢ Have a different P wave morphology (making it an ectopic beat)

  ➢ Impulse is generated from an atrial foci other than the SA node

➢ QRS morphology will be the same as the underlying rhythm

➢ Normal PR interval and Narrow QRS



Premature Atrial Contraction (PAC)

PAC

© Jason Winter 2016 - The ECG Educator Page          25mm/sec  10mm/mV
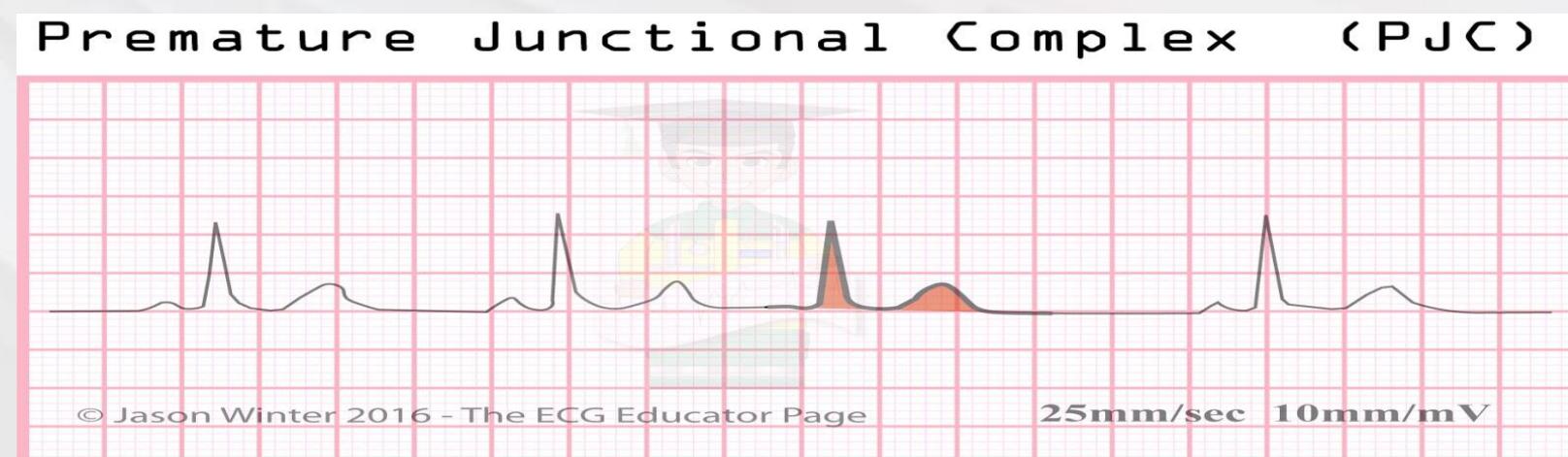
# Premature Complexes - Supraventricular

❖ **Premature Junctional Complex (PJC)**

➢ Originate from the AV junction

➢ Occur before the next expected beat followed by a *compensato*

➢ Have P waves characteristic of a junctional rhythm (absent, inverted, retrograde)

➢ QRS morphology remains consistent

➢ P-R interval normal with a narrow QRS



Premature Junctional Complex (PJC)

© Jason Winter 2016 - The ECG Educator Page    25mm/sec  10mm/mV

# Ventricular Dysrhythmias

❖ Disturbances in the normal electrical conduction of the heart that occurs in the ventricles

  ➢ PVC- uni or multi focal

  ➢ Idioventricular

  ➢ Ventricular tachycardia

    ➢ Uni/multifocal

    ➢ Torsades de pointes

  ➢ Ventricular Fibrillation

  ➢ Agonal Rhythm

  ➢ Asystole

  ➢ PEA (may or may not be ventricular)

  ➢ Pacemaker rhythms

# Ventricular Dysrhythmia - PVC

❖ Ectopic beat

❖ Usually associated with a supraventricular rhythm

❖ Occur before the next expected beat

❖ Wide (and ugly!) Can be re-entry, unifocal or multifocal

❖ Many causes - may be benign or indicate more serious disease
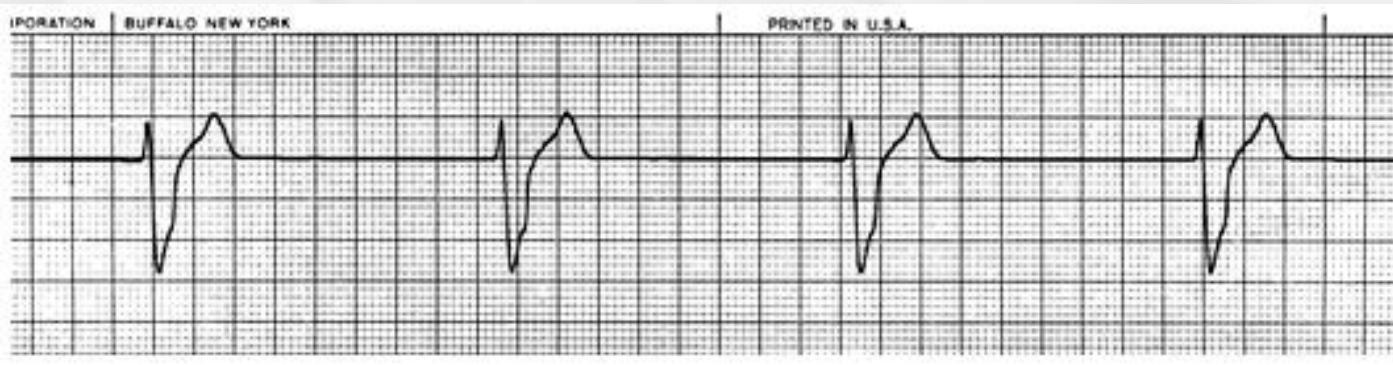


trigeminy, PVC every third beat
Bigeminy, quad, etc also exist.
Couplets and triplets are two and three in a row.
4 in a row are VTAC
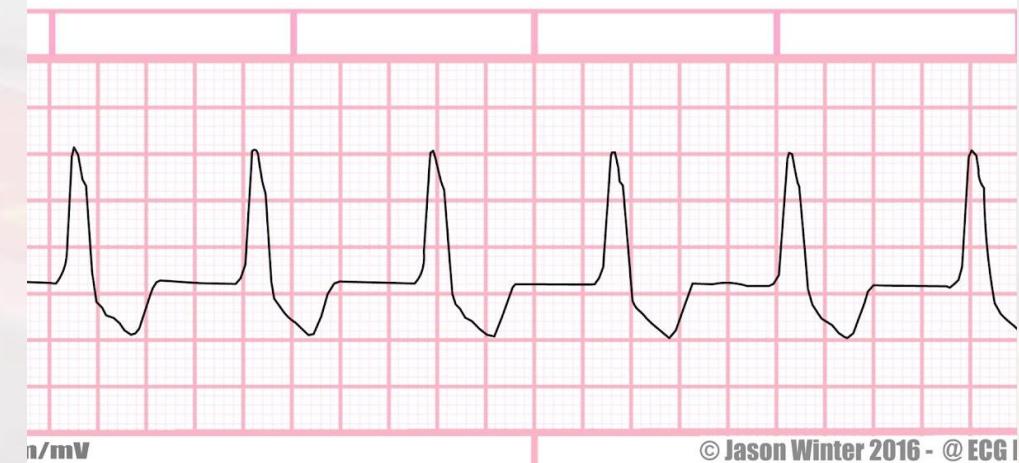
# Ventricular dysrhythmia - Idioventricular

❖ Escape rhythm that originates somewhere within the ventricle

❖ Wide complex

❖ Generally, a slow rate (20-40)

❖ Often seen in AMI, and post-arrest pt's

❖ Generally, hemodynamically unstable

| Rate : | 20 – 40 |
|---|---|
| P-R Interval : | No P waves |
| Rhythm : | Regular |
| P-QRS-T : | N/A |
| QRS Width : | ≥ 0.12 second |
| Missing / Added : | P waves |
| Identifying Features : | Wide and slow - P's absent |
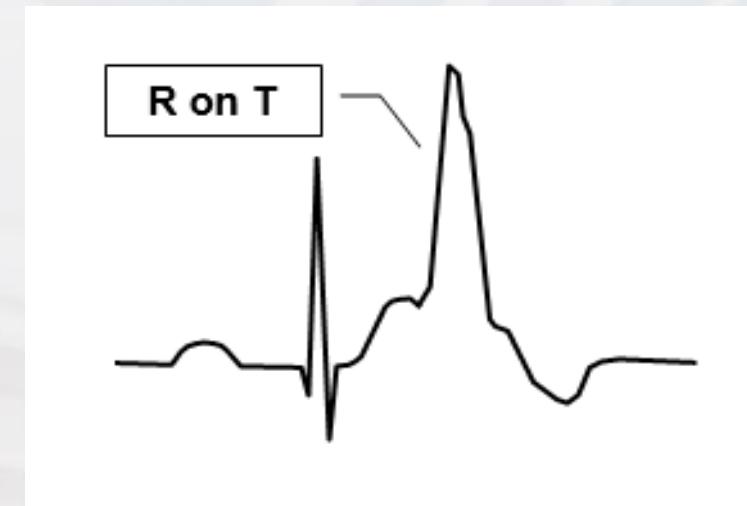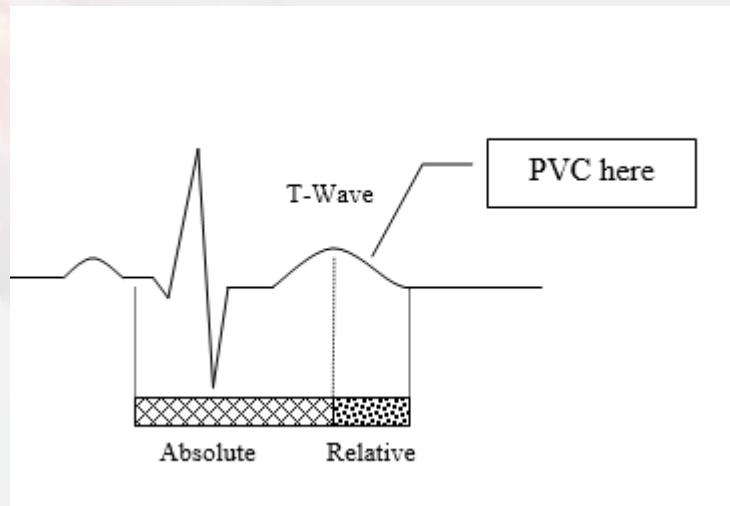
**l Idioventricular Rhythm (AIVR)**
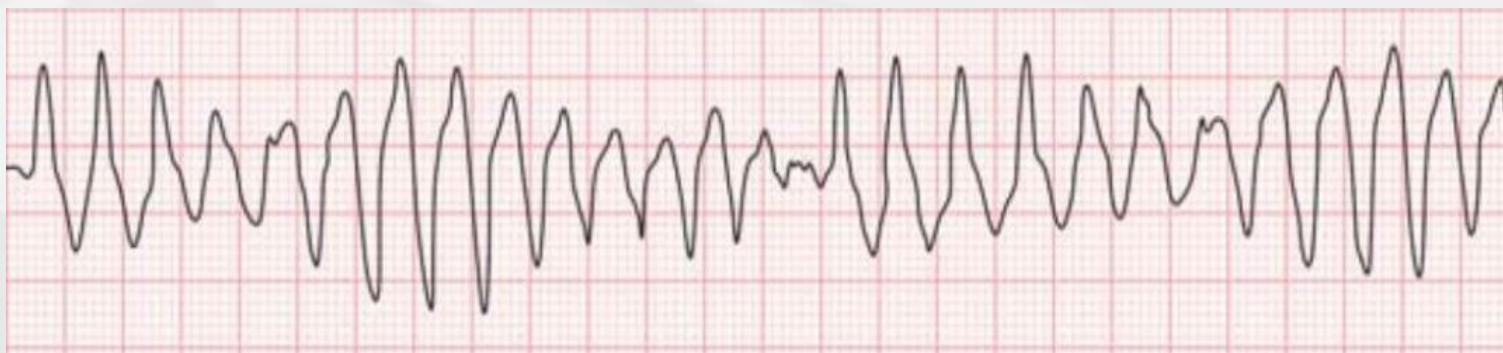
# Ventricular Dysrhythmia – PVC R on T

❖ When a PVC falls on the relative refractory period

❖ May result in ventricular arrythmias (VF, VT)

# Ventricular Dysrhythmia – Torsades de Pointes



- ❖ Polymorphic Ventricular Tachycardia
- ❖ Appears like a VT that is twisting down the paper
- ❖ Consider electrolyte imbalances (hypomagnesemia)
- ❖ Is treated like VT in the pulseless patient → defibrillate
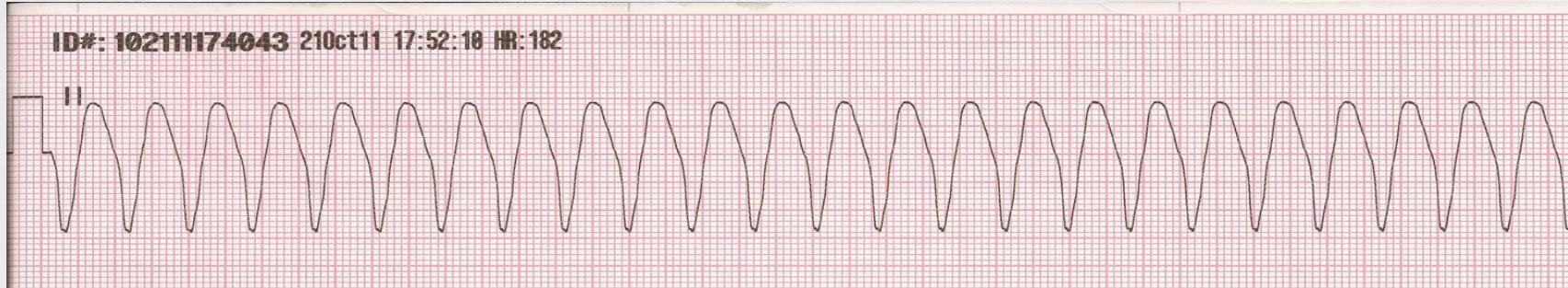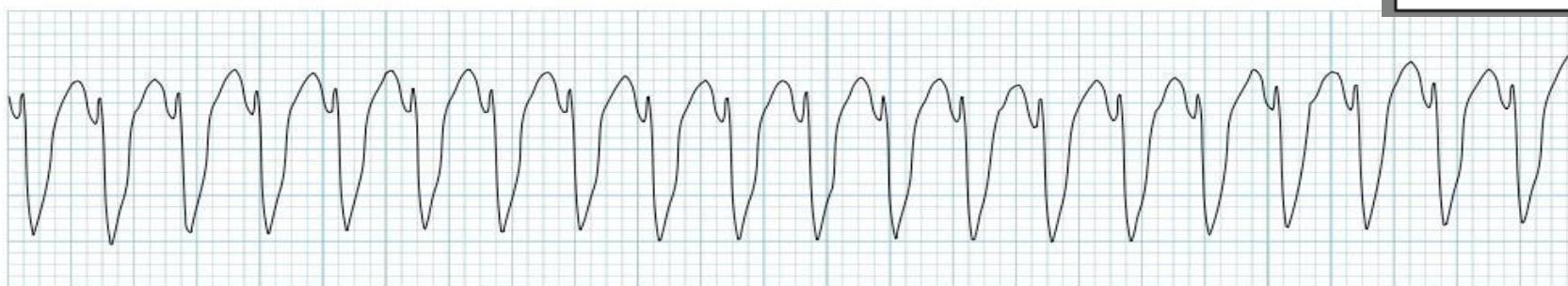


| | |
|---|---|
| Rate : | ≥100 |
| QRS Width: | ≥ 0.12 second |
| Rhythm: | Irregular |
| P-QRS-T: | No P waves |
| P-R Interval: | None |
| Missing / Added: | P waves Missing |
| Identifying Features: | Wide QRS complex rhythm that appears to twist |

# Ventricular Dysrhythmia – Ventricular tachycardia
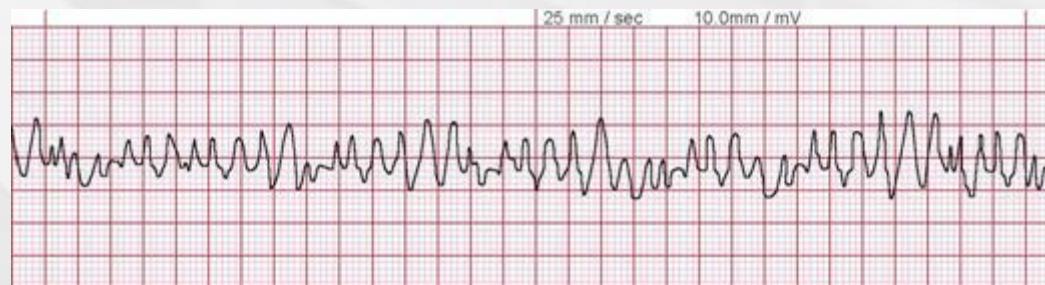
- ❖ Rapid wide complex  (>120)
- ❖ Regular
- ❖ May have a pulse or be pulseless
- ❖ Defibrillation or synchronized cardioversion

| | |
|---|---|
| Rate : | >100 (generally > 120) |
| QRS Width: | ≥ 0.12 seconds |
| Rhythm: | Regular |
| P-QRS-T: | No P waves |
| P-R Interval: | None |
| Missing / Added: | P waves missing |
| Identifying Features: | Regular wide QRS complex rhythm without P waves at rates of ≥ 100/min |



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# Ventricular Dysrhythmia – Ventricular Fibrillation
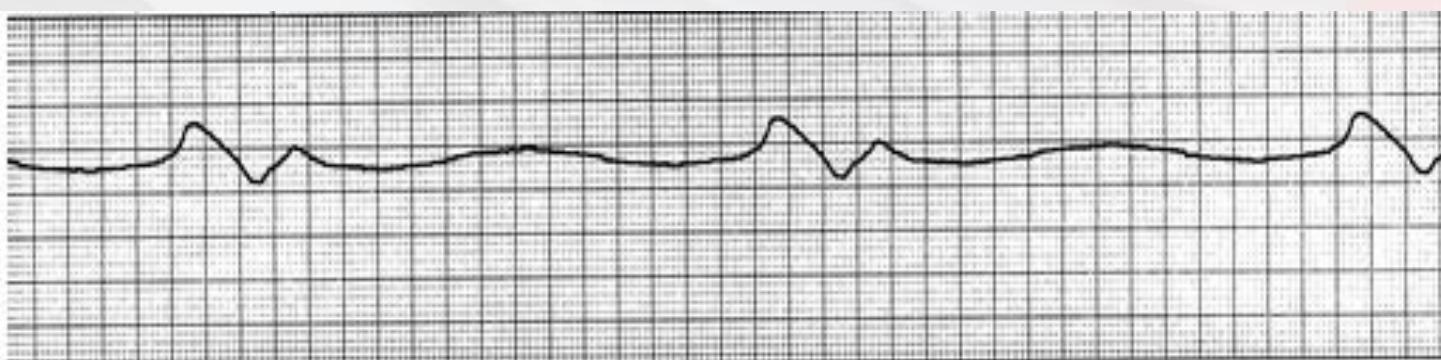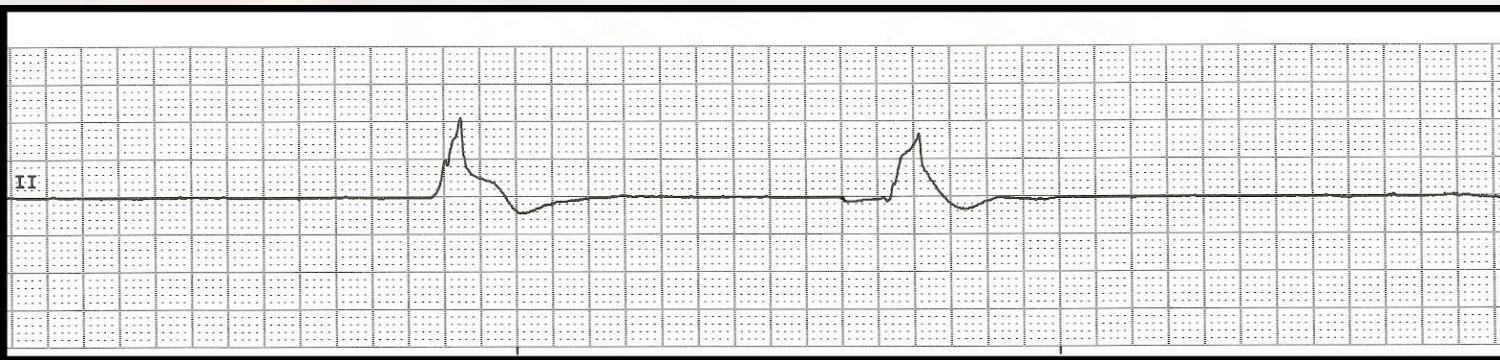
❖ Chaotic, disorganized electrical activity

❖ No discernable P, QRS, or T wave

❖ Coarse or Fine (determined by amplitude)

❖ Lethal arrythmia → required immediate intervention (defibrillation)

25 mm / sec    10.0mm / mV

| Rate : | N/A |
|---|---|
| Rhythm: | Irregular |
| P-R Interval: | None |
| QRS Width: | N/A |
| P-QRS-T: | No P waves, no QRS or T |
| Missing / Added: | No normal complexes |
| Identifying Features: | Wide, chaotic electrical activity greater than 1 large square in height |

# Ventricular Dysrhythmia – Agonal Rhythm
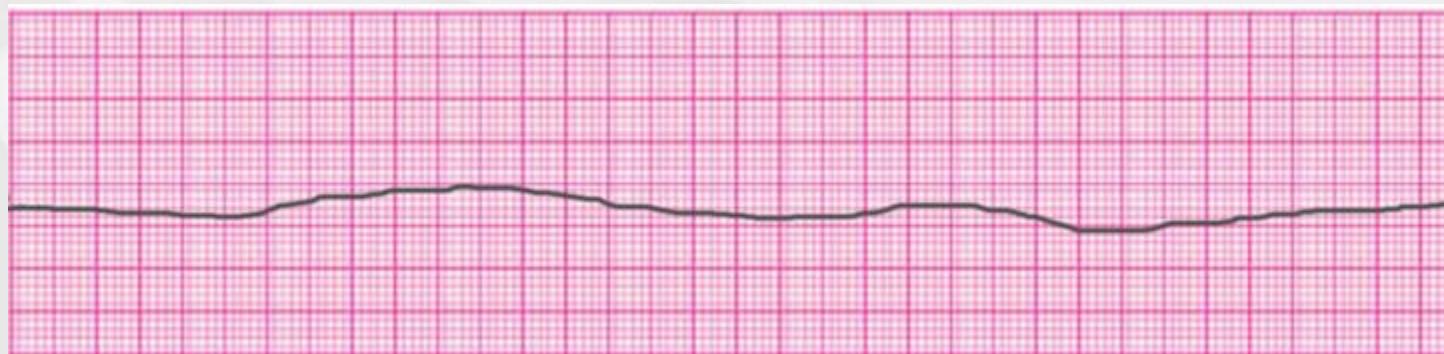
❖ Low amplitude wide complex with periods of asystole

❖ Considered a terminal rhythm →essentially asystole



| Rate: | < 20 |
|---|---|
| Rhythm: | Regular or irregular |
| P-R Interval: | N/A |
| QRS Width: | > 0.12 sec.(usually > 0.20) |
| P-QRS-T: | No P waves |
| Missing / Added: | Normal QRS |
| Identifying Features: | Slow, with long periods of flatline |

# Ventricular Dysrhythmia - Asystole
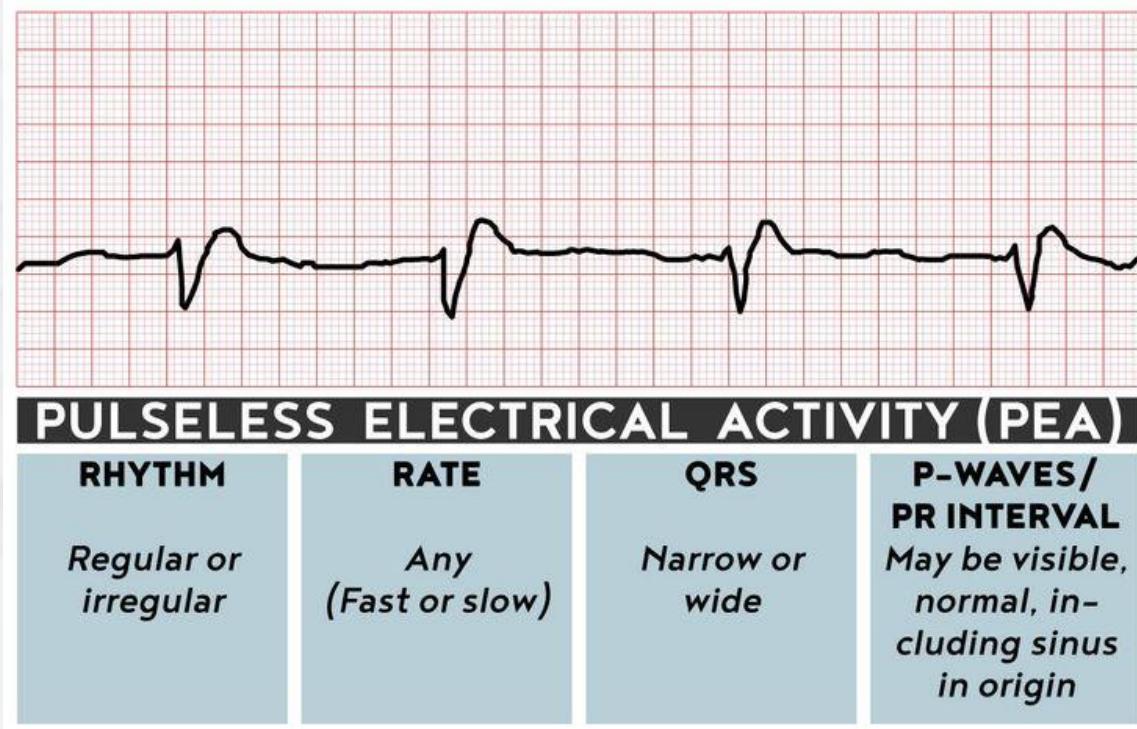
❖ Absence of electrical activity

❖ Represented by a flatline (may have a slight wave-like appearance)

❖ Patient will be VSA

| | |
|---|---|
| Rate : | 0 |
| Rhythm: | None |
| P-R Interval: | None |
| QRS Width: | 0 |
| P-QRS-T: | No P-QRS-T |
| Missing / Added: | Normal QRS |
| Identifying Features: | Flatline |

# Pulseless Electrical Activity (P.E.A.)

❖ PEA may present as any electrical rhythm that you may expect would have a corresponding pulse however, the patient is in fact VSA.



| PULSELESS ELECTRICAL ACTIVITY (PEA) | | | |
|---|---|---|---|
| **RHYTHM** | **RATE** | **QRS** | **P-WAVES/ PR INTERVAL** |
| Regular or irregular | Any (Fast or slow) | Narrow or wide | May be visible, normal, including sinus in origin |

# Causes of P.E.A.?

**H**ypovolemia
**H**ypoxia
**H**ydrogen Ion (acidosis)
**H**yper/hypokalemia
**H**ypothermia

**T**ablets (drug overdose)
**T**amponade
**T**ension pneumothorax
**T**hrombosis (coronary – i.e. massive MI)
**T**hrombosis (pulmonary embolism or PE)
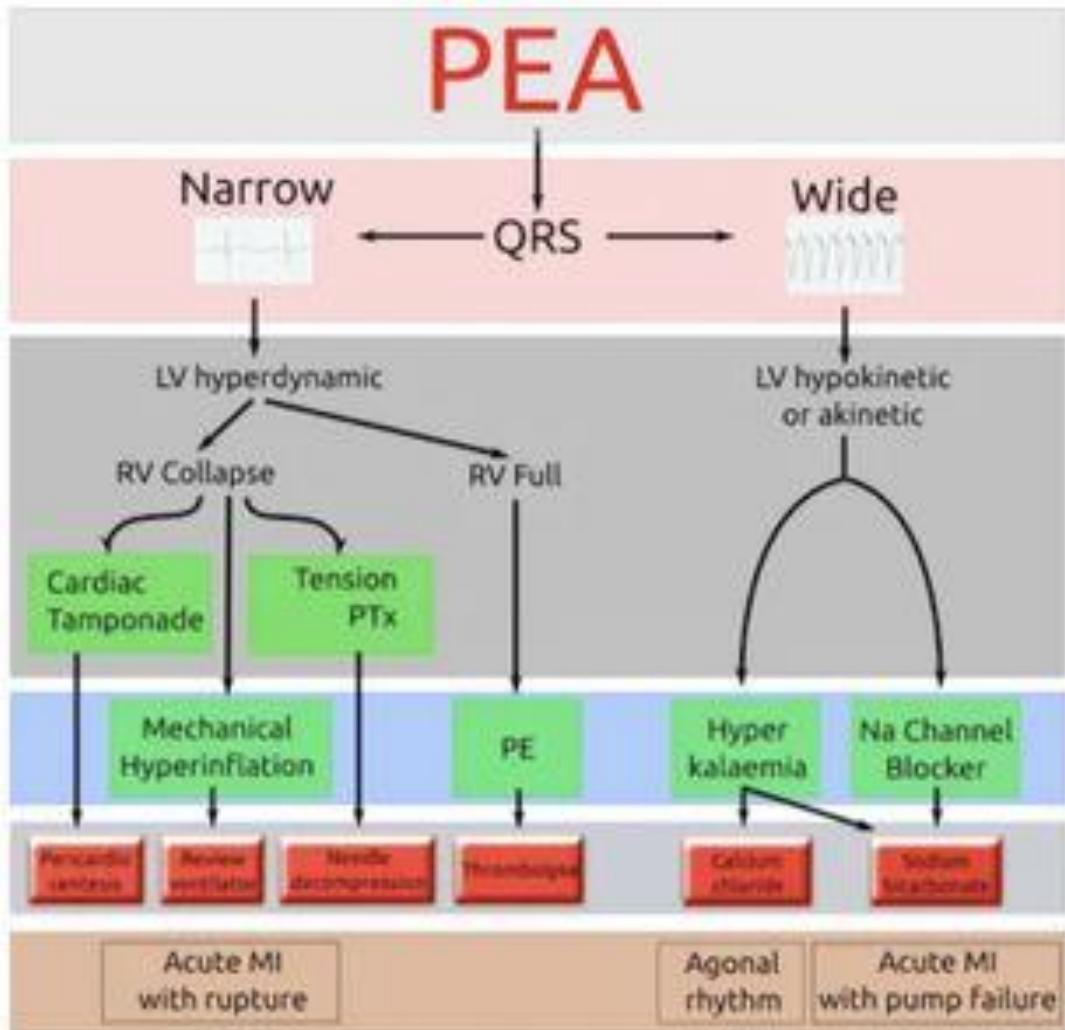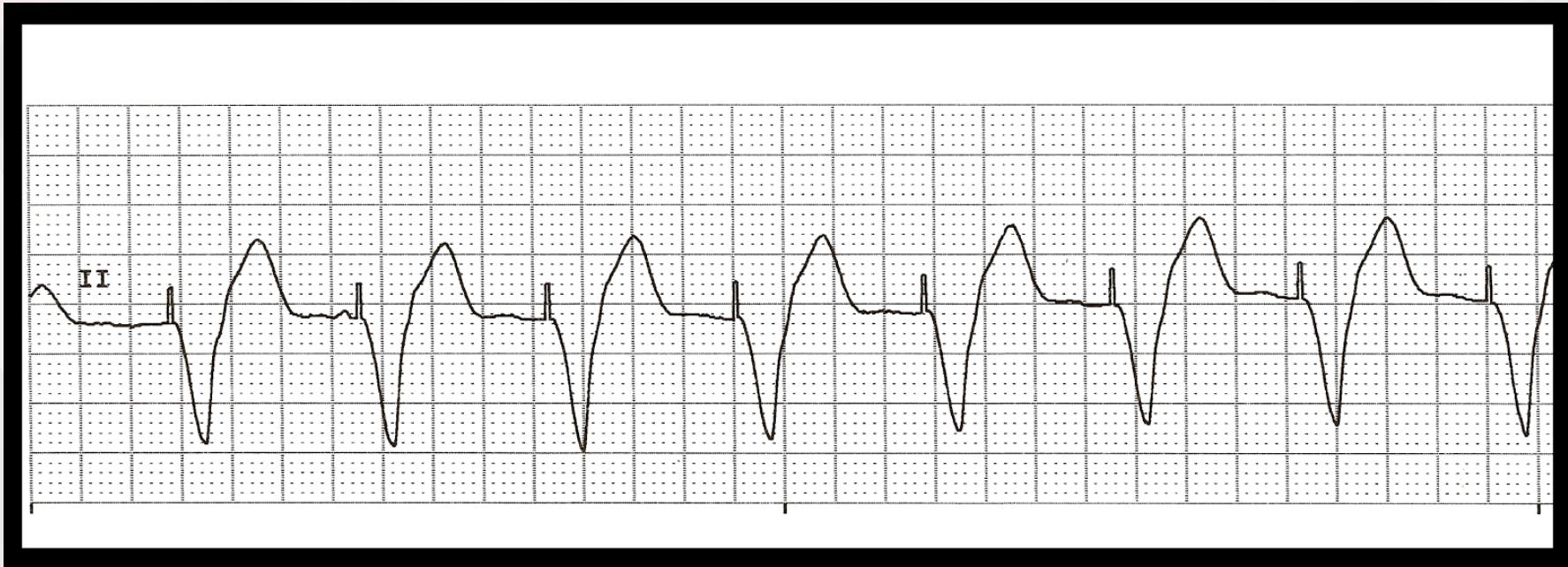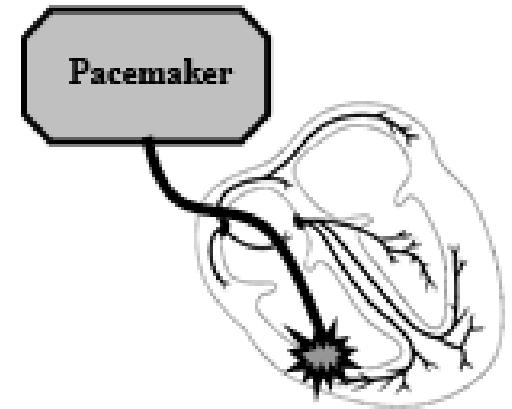
From Adelaide Emergency Physicians Education Resource

# Pacemaker rhythms

❖ Will be seen with patients who have suffered conduction system abnormalities

❖ Obvious pacemaker "spike"

➢ Ventricular

➢ Dual chamber (atria and ventricles)

➢ Fixed or demand

➢ Demand pacemakers sense the slowed natural pace and are set to initiate pacing when that number reaches a threshold (usually < 60 bpm)

# Ventricular Pacemaker
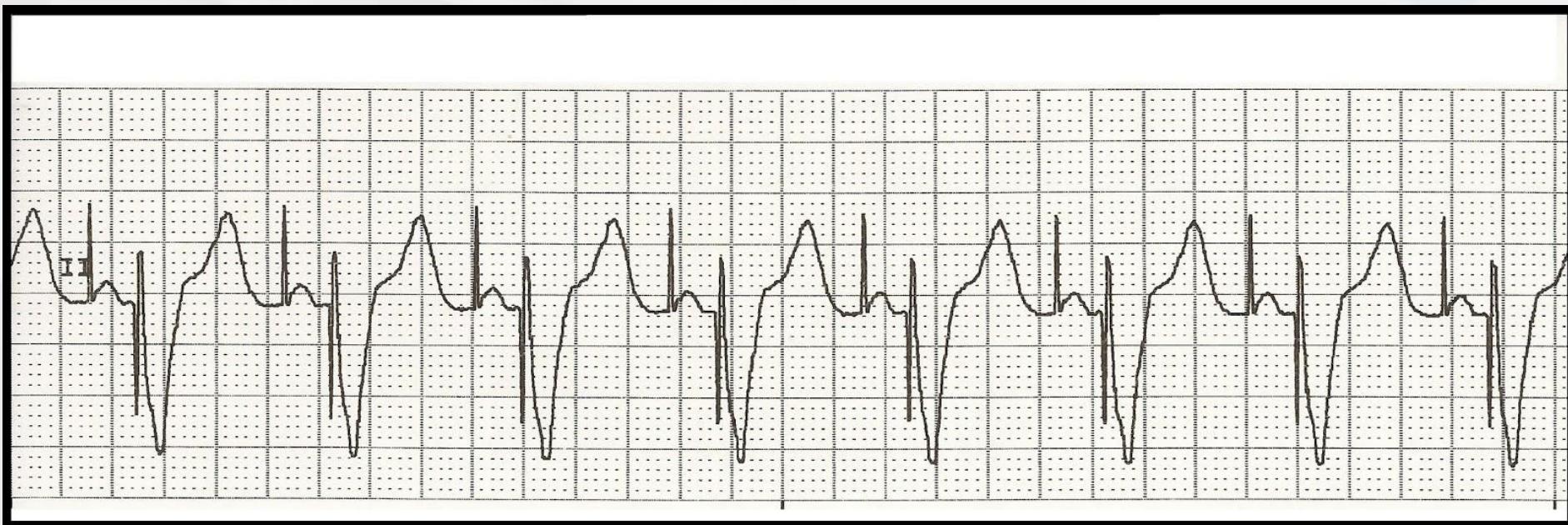
❖ Pacer spike (narrow vertical line) precedes a QRS

❖ Imbedded in the right ventricle

# Dual Chamber Pacemaker



❖ Atrio-ventricular Sequential Pacemaker

❖ 2 pacemaker spikes  - first followed by a P wave, second followed by QRS
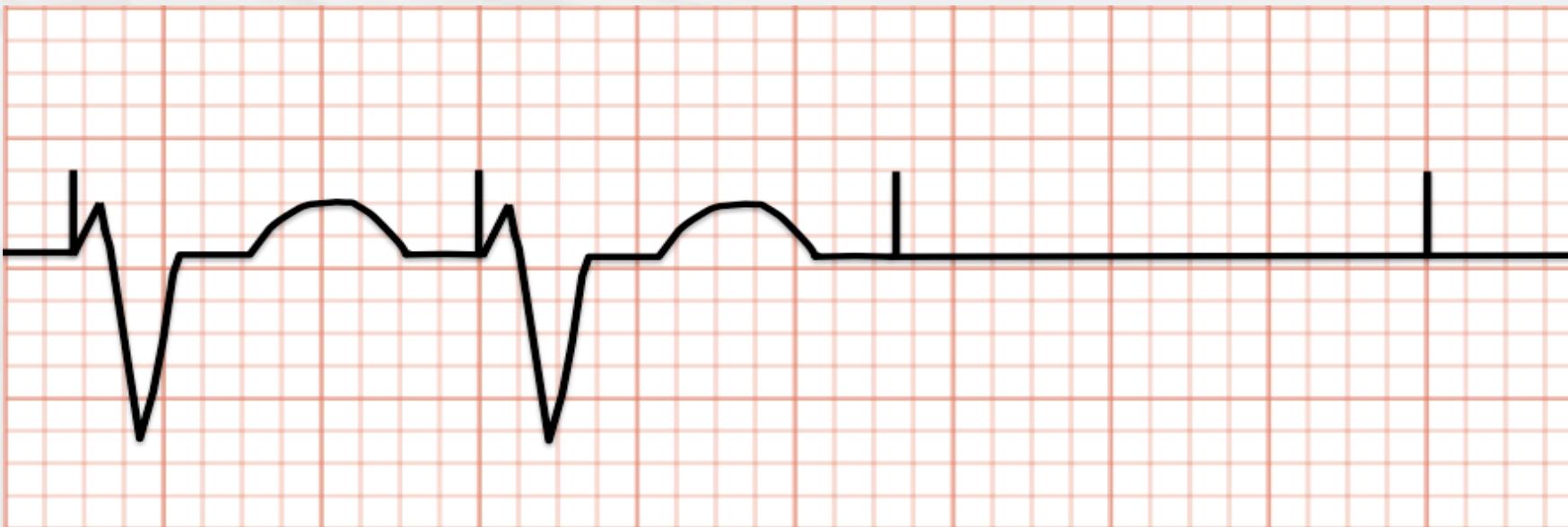
# Demand Pacer

❖ Will generate an impulse when a slowed natural rhythm is sensed

# Pacemaker Malfunction

❖ Battery failure

❖ Dislodged/fractured wire

❖ A pacer spike is seen with no corresponding QRS

❖ "loss of capture"
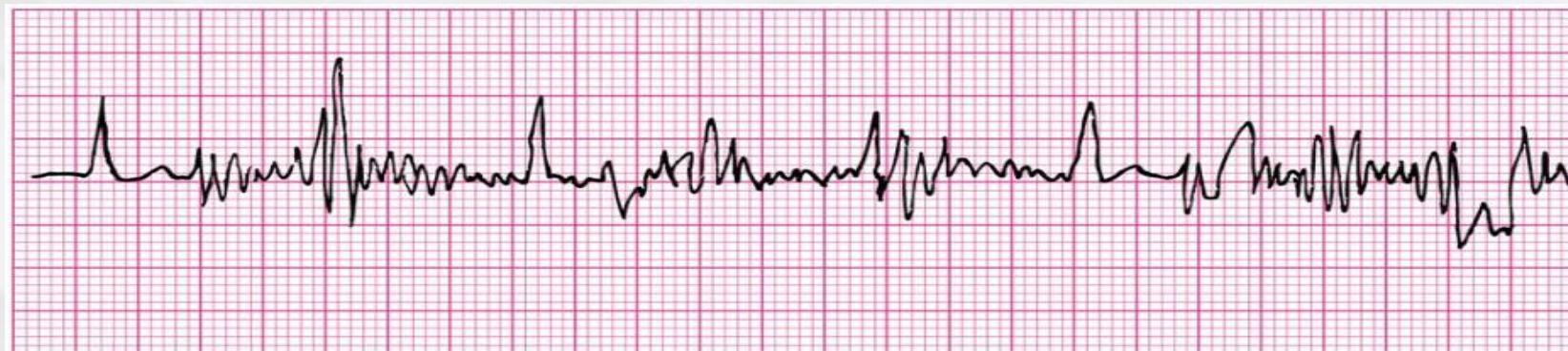
# Runaway Pacemaker

❖ Paced V-tach

❖ Cardiac output is affected

❖ Patients are given a magnet → effects of the magnet vary depending on the device
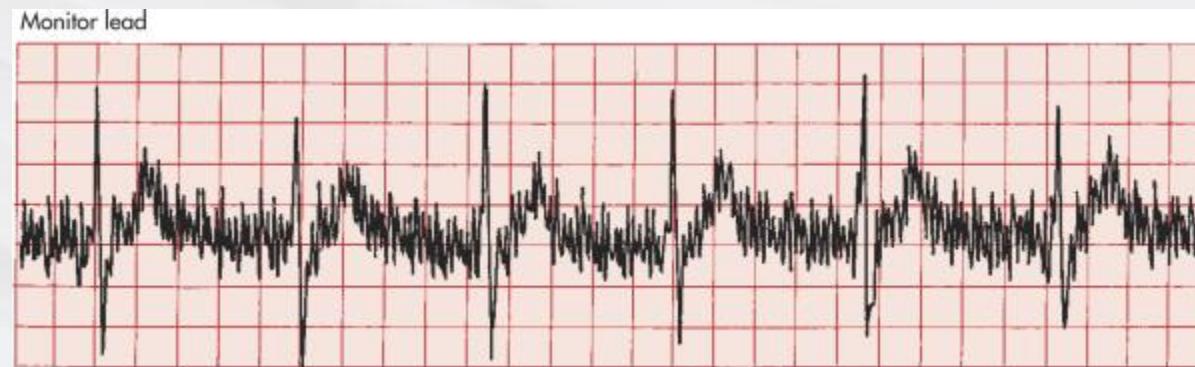
# Artifact

❖ **Somatic tremor (baseline artifact)**

➢ Distorted baseline caused by the sensing of skeletal muscle activity

➢ P waves are not identifiable but QRS is

➢ Patient Movement →anxiety, fear, shivering, Parkinson's, damaged cables, incorrect placement

# Artifact 60 cycle Interference

❖ Leakage of electrical power supply

❖ Creates a uniform thick spiky looking baseline

❖ Remove patient from source or turn off any nearby appliances, ensure patient is not touching any metal parts of the stretcher, ensure ground lead is properly placed



Monitor lead

# QUESTIONS????

# References

❖ Cardiac Muscle and Electrical Activity – Anatomy and Physiology (opentextbc.ca)

❖ Clinical electrocardiography and ECG interpretation – ECG & ECHO (ecgwaves.com)

❖ Theriault, R. (2016). Cardiac Dysrhythmia Interpretation (PowerPoint slides).

❖ McNab, K., Muir, M. (2014). PCP Autonomous IV Program Module 1; E.C.G. Rhythm Interpretation. OBHG Education Subcommittee