Cardiac Arrhythmias

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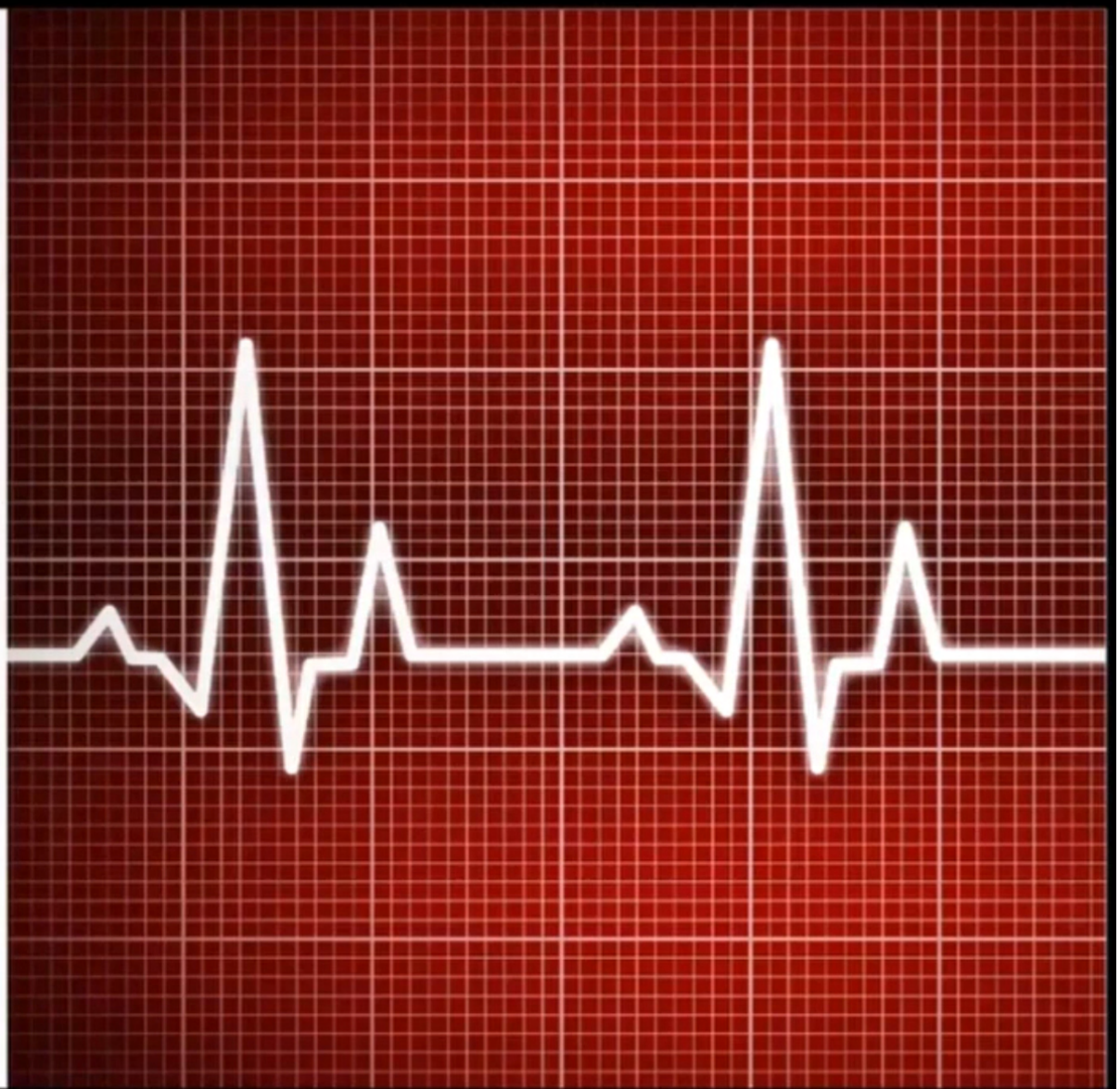
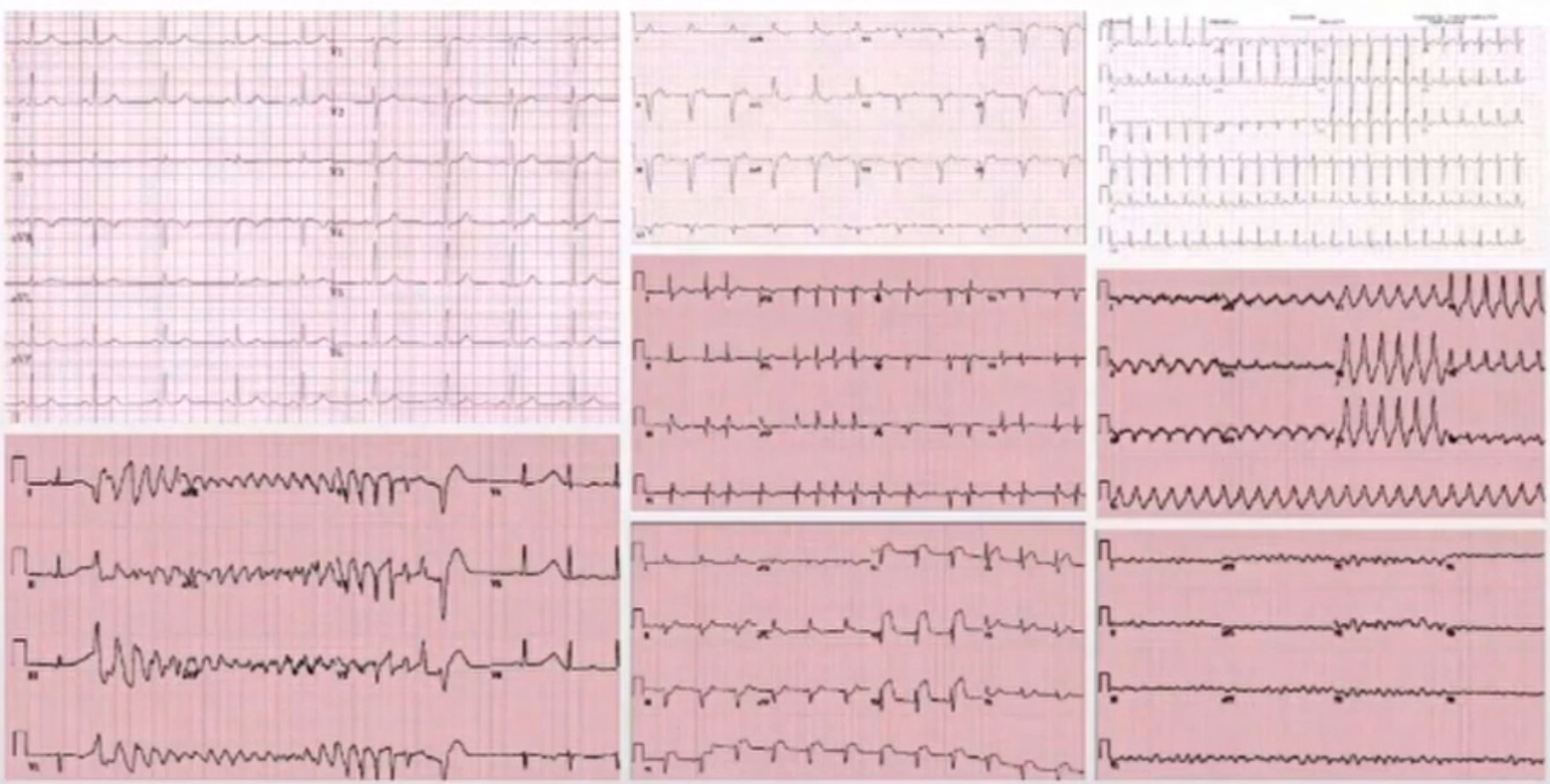
EDITED: Jana Malhas



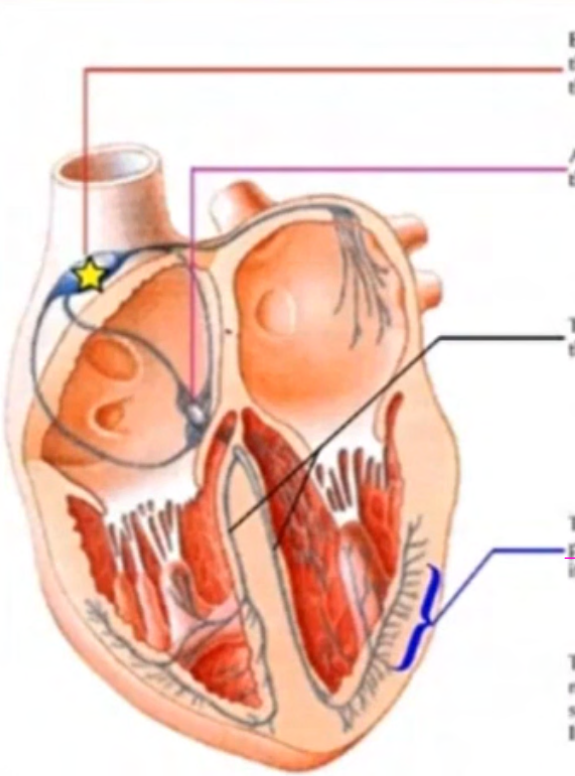
Cardiac Arrhythmias



Cardiac Arrhythmias

- ECG Basics
- Approach to Rhythm
- Brady-Arrhythmias
  - Sinus Bradycardia
- Arrhythmias
  - Premature Atrial Contraction
  - Premature Ventricular Contraction
- Tachy-Arrhythmias
  - Sinus Tachycardia
  - Atrial Fibrillation
  - Atrial Flutter
  - Multifocal Atrial Tachycardia
  - Supraventricular Tachycardias
  - Ventricular Tachyarrhythmias

ECG Basics



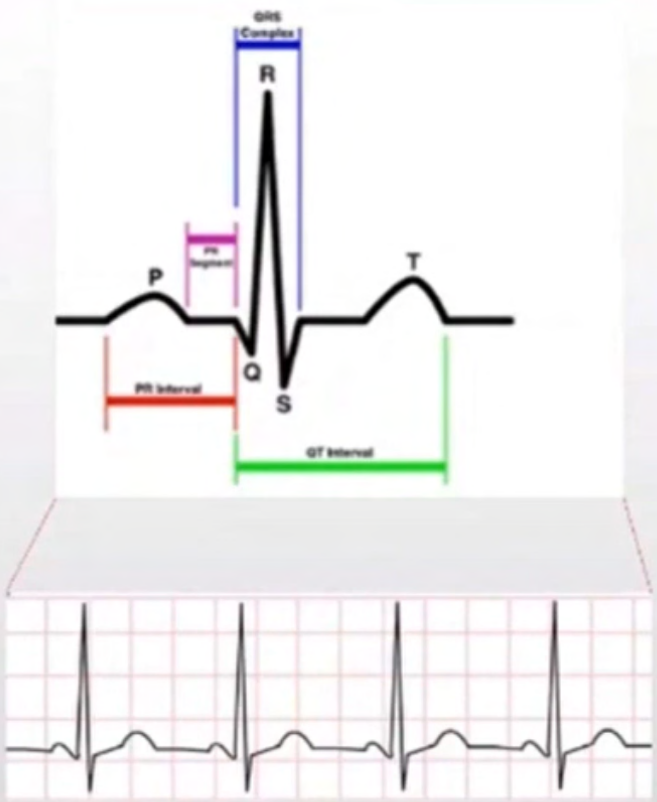
Electrical activity starts at the SA Node, this is seen as the P-wave, and the duration it makes the PR interval, this symbolizes the contraction of the atrium.

A short pause in electrical activity happens at the AV Node, this is seen as the PR segment.

The electrical single then travels down the left and right bundle branches.

Then the electrical single continues on to the purkinge fibers, this is seen as the QRS Complex, it symbolizes the contraction of the ventricles.

The heart is then at rest and repolarizes for the next contraction. This is seen as the T-wave and symbolizes the repolarization of the ventricles. Its measurements is the QT interval.

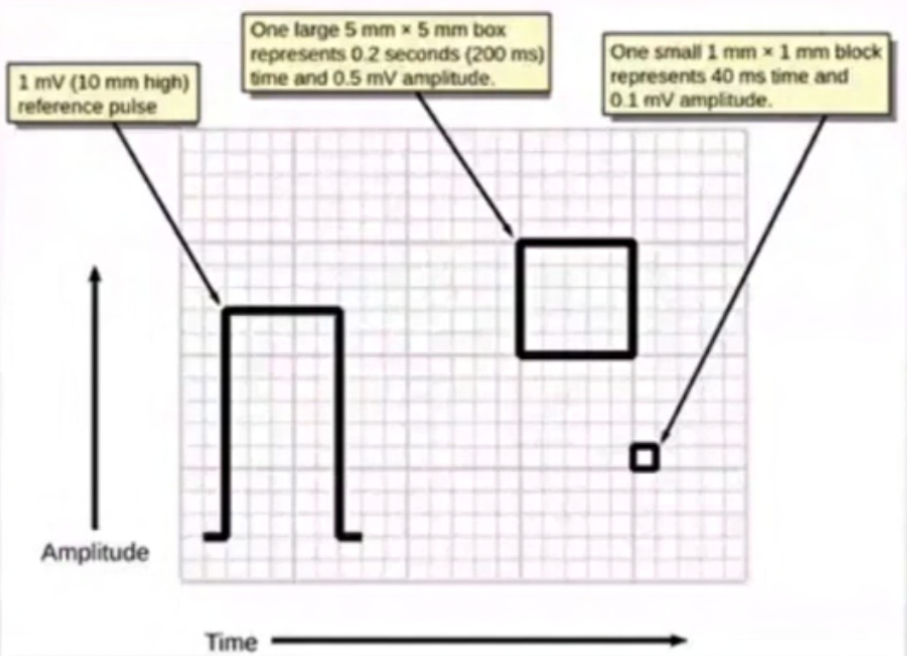


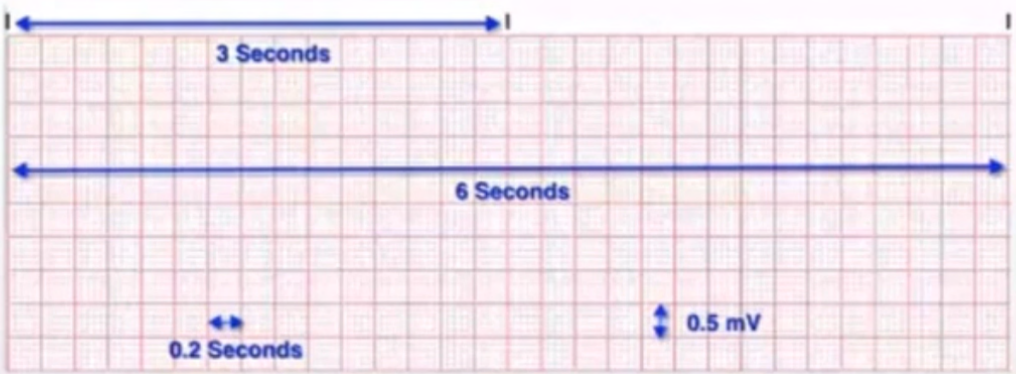
Internet Source: Amurecek.divinetart.com

ECG Basics

- **Approach to Reading ECG:**
  - Verify
  - **R**ate
  - **R**hythm
  - **A**xis
  - **A**mplitude
  - **I**ntervals
  - **I**schemia

ECG Basics





The whole ECG Strip is 10 seconds

Internet Source: practicalclinical skills.com

ECG Basics - Rate

- Heart Rate Calculation Methods:

If irregular rythm:

  - Counts QRS complexes
    - 6 second interval X 10
    - All strip (10 seconds) X 6

If regular rythm

  - Distance between QRS-QRS complex
    - Rate = 300 / Large Boxes
    - Rate = 1500 / Small Boxes

# Large Boxes	HR (BPM)
1	300
2	150
3	100
4	75
5	60
6	50

ECG Basics - Rhythm

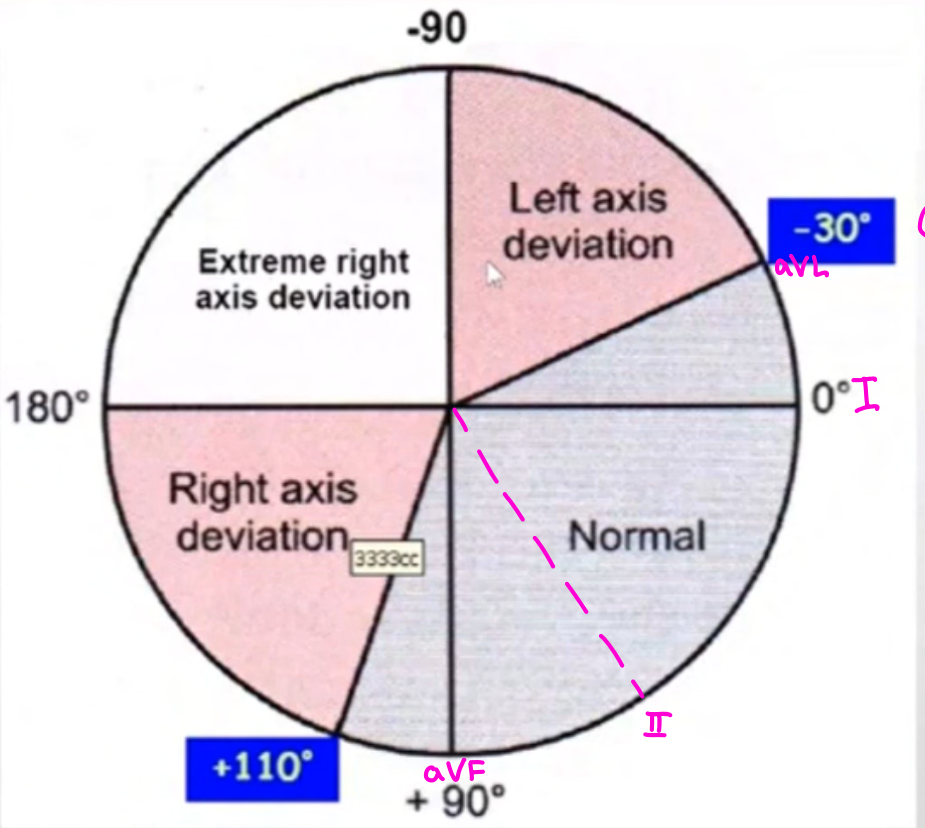
Approach to Rhythm Questions:	Clinical Significance
1. Is it Tachycardia / Normal Rate / Bradycardia?	Rate
2. QRS is it Narrow or Wide?	Narrow: Rhythm from AVN and above & conduction through normal system Wide: Rhythm below AVN OR Abnormal conduction
3a. Narrow QRS – Is it Regular or Irregular	
3b. Wide QRS – What is Morphology?	Pathophysiology of Wide QRS: Vent. Origin or Aberrant conduction?
4. Look for P-wave (Best place in Lead II and V1)	What is the atria doing?
5. Relationship between the P wave and QRS ?	What is the underlying circuit?

ECG Basics - Axis

Axis 2 ways:

Either using

1) I and aVF
2) I, II, III



(1) If lead I +ve and aVF -ve could be

1) Normal
2) Left axis deviation

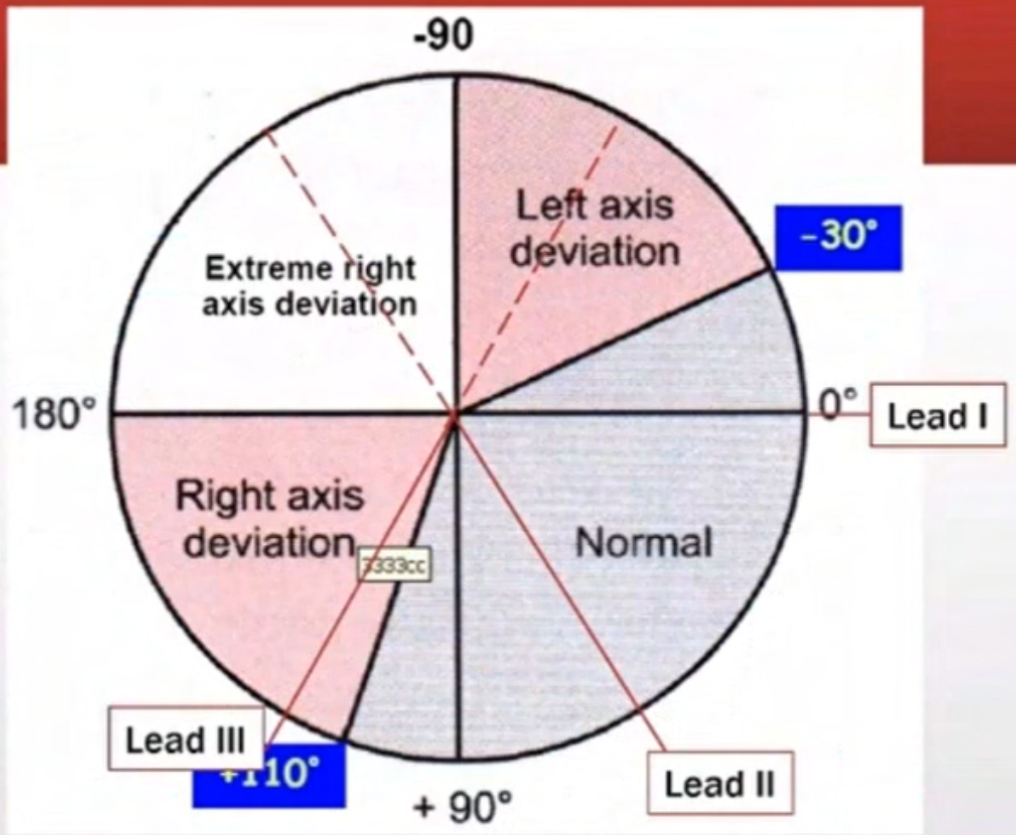
⇓

Look at lead II,
if +ve then closer to 0° → normal
if -ve then closer to -90 → LAD

ECG Basics - Axis

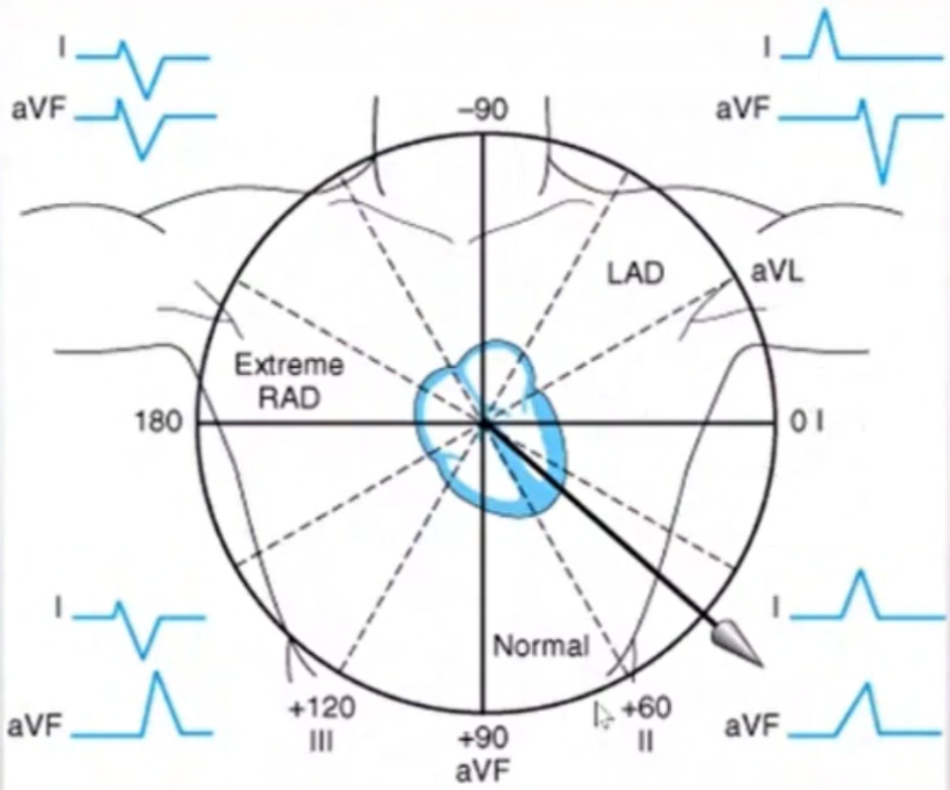
- Heart Axis Calculation Methods:
  - Lead I, II & III

Axis	Lead I	Lead II	Lead III
Normal	Positive	Positive	Positive
LAD	Positive	Negative	Negative
RAD	Negative	Positive	Positive
Extreme Axis	Negative	Negative	Negative



ECG Basics - Axis

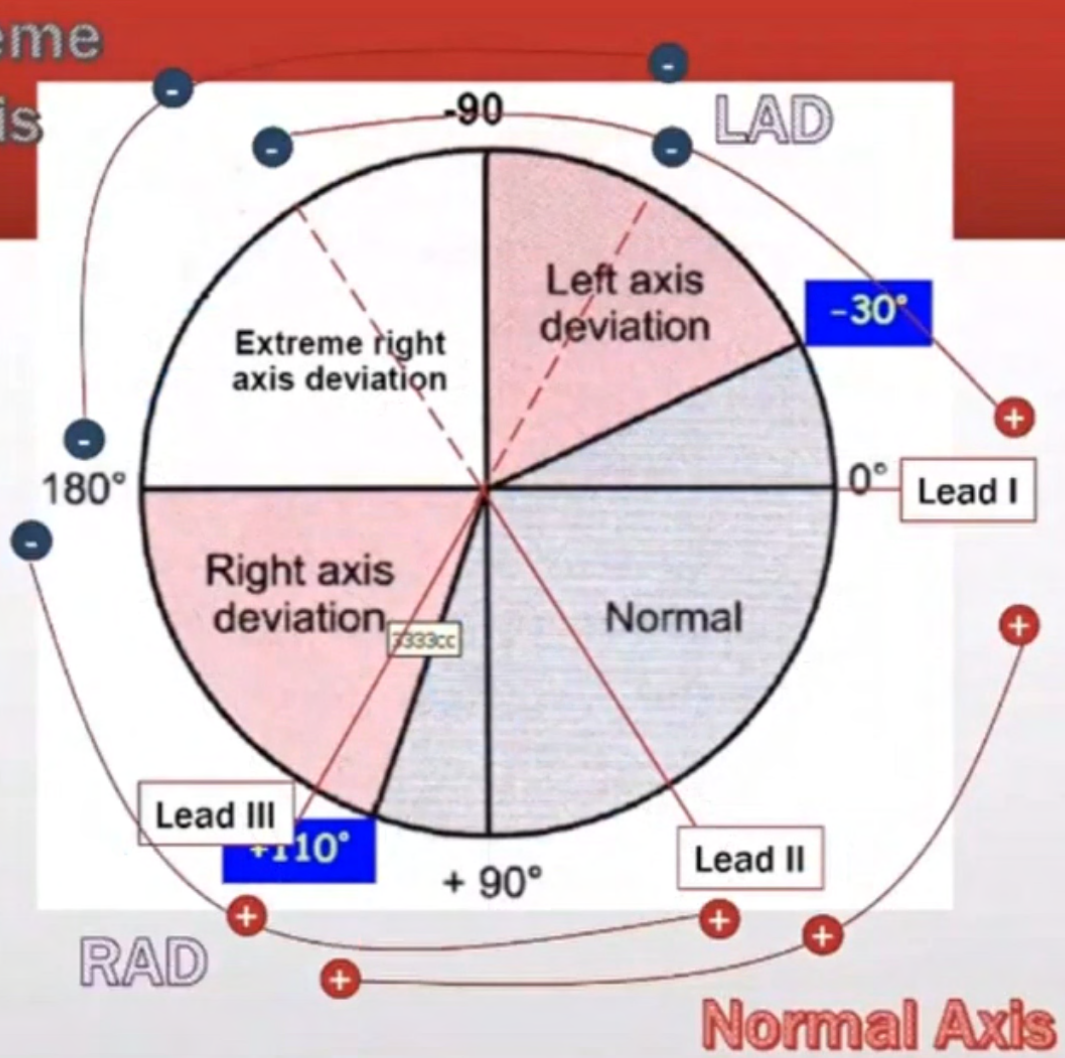
- Heart Axis Calculation Methods:
  - Lead I & Lead AVF



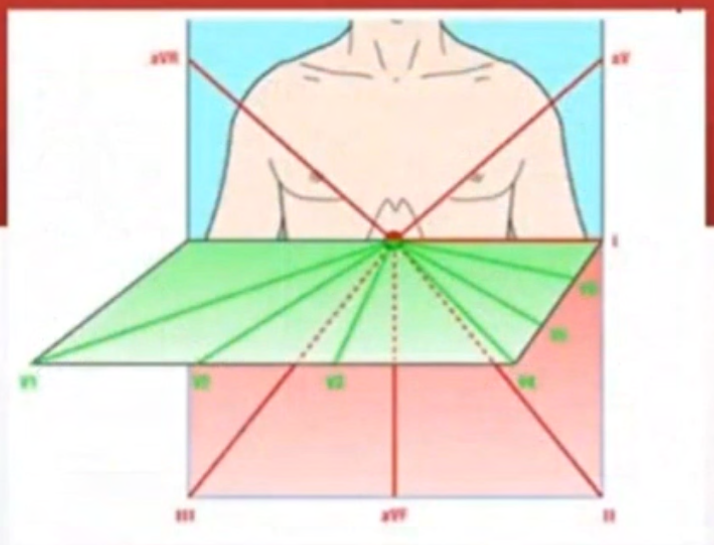
ECG Basics - Axis

- Heart Axis Calculation Methods:
  - Lead I, II & III

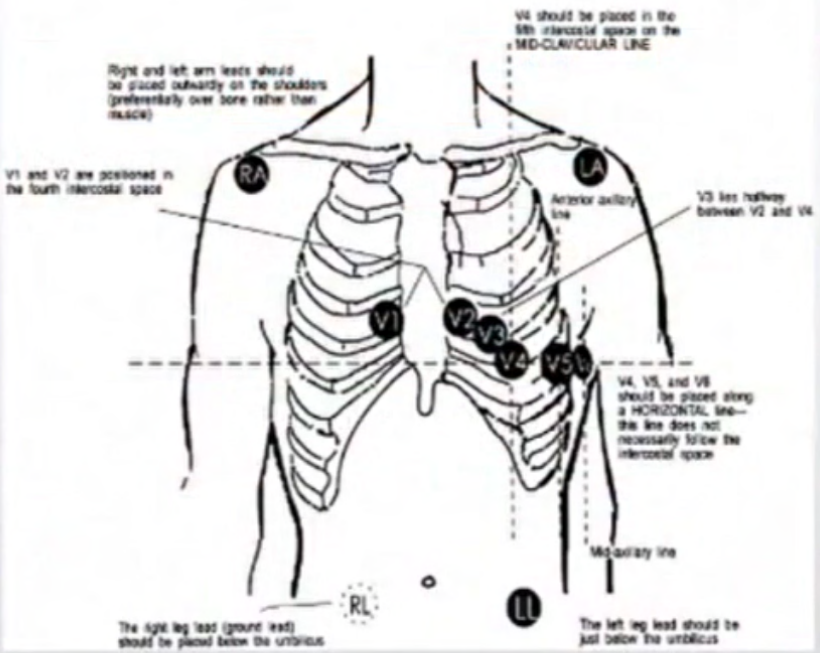
Axis	Lead I	Lead II	Lead III
Normal	Positive	Positive	Positive
LAD	Positive	Negative	Negative
RAD	Negative	Positive	Positive
Extreme Axis	Negative	Negative	Negative



ECG Basics - Axis



12-lead ECG Electrode Placement



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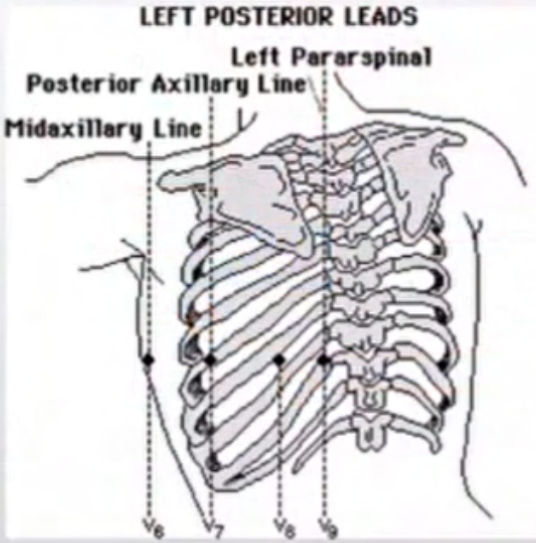
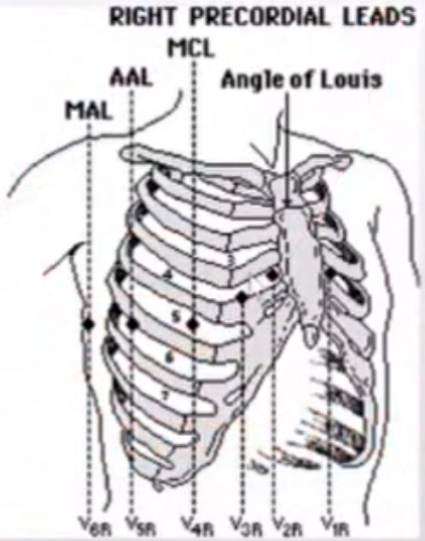




ECG Basics – Amplitude / Hypertrophy

- Low Amplitude
  - Limb leads < 0.5 mV
  - Precordial leads < 1.0 mV

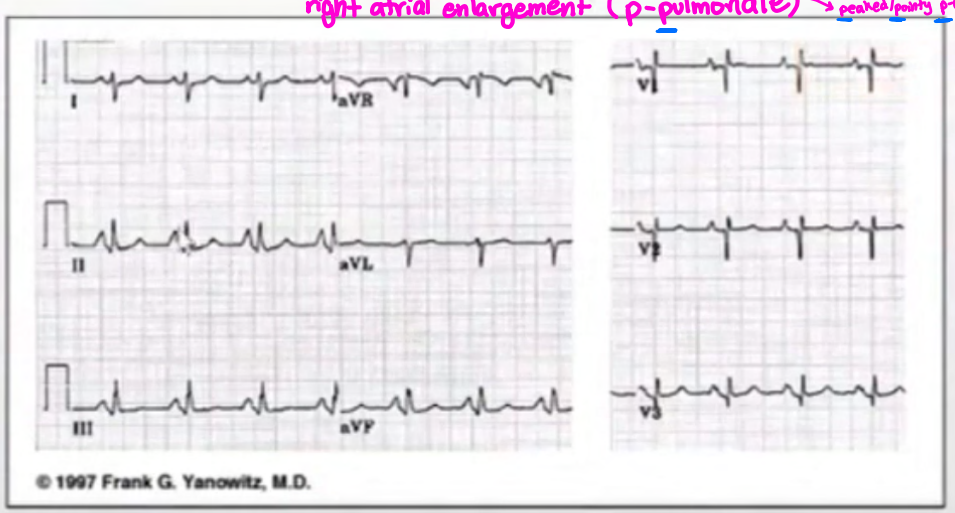
Component	Amplitude (mV)
P wave	0.2
QRS	1.0
T-wave	0.2 – 0.3

ECG Basics – Amplitude / Hypertrophy

Seen in II and V1

RAE

right atrial enlargement (p-pulmonale) → >2.5 mm amplitude + peaked/pointy p-wave

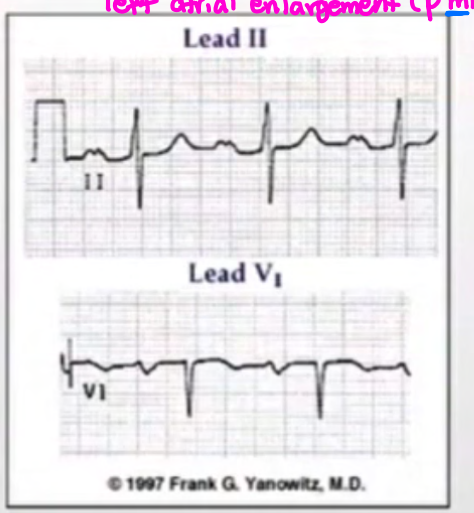


P wave amplitude > 2.5 mm in II and/or > 1.5 mm in V1

+ "peaked" p-wave

LAE

left atrial enlargement (p mitrale) → wide p-wave >0.12s; → notched/biphasic p-wave; → -ve p-wave in V1



P wave duration ≥ 0.12s in frontal plane (usually lead II)
Notched P wave in limb leads with the inter-peak duration ≥ 0.04s
Terminal P negativity in lead V1 (i.e., "P-terminal force") duration ≥ 0.04s & depth ≥ 1 mm.

ECG Basics – Amplitude / Hypertrophy

Left ventricular hypertrophy

LVH

*Increase in QRS amplitude seen in aVL + V3 (left = aVL)

DONT memorize ↓

ESTES Criteria	Points
•Voltage Criteria (any of): R or S in limb leads ≥ 20 mm •S in V1 or V2 ≥ 30 mm •R in V5 or V6 ≥ 30 mm	3 points
•ST-T Abnormalities: Without digitalis •With digitalis	3 points 1 point
Left Atrial Enlargement in V1	3 points
Left axis deviation	2 points
QRS duration 0.09 sec	1 point
Delayed intrinsicoid deflection in V5 or V6 (>0.05 sec)	1 point

("diagnostic", ≥ 5 points; "probable", 4 points)

MEMORIZE 1

CORNELL Voltage Criteria

- S in V3 + R in aVL > 24 mm (men)
- S in V3 + R in aVL > 20 mm (women)

(sensitivity = 22%, specificity = 95%)

extremely specific

Limb-lead voltage criteria:

- R in aVL ≥ 11 mm — Memorize 2
- R in aVL ≥ 13 mm + S in III ≥ 15 mm (if LAD)
- R in I + S in III > 25 mm

Chest-lead voltage criteria:

- S in V1 + R in V5 or V6 ≥ 35 mm

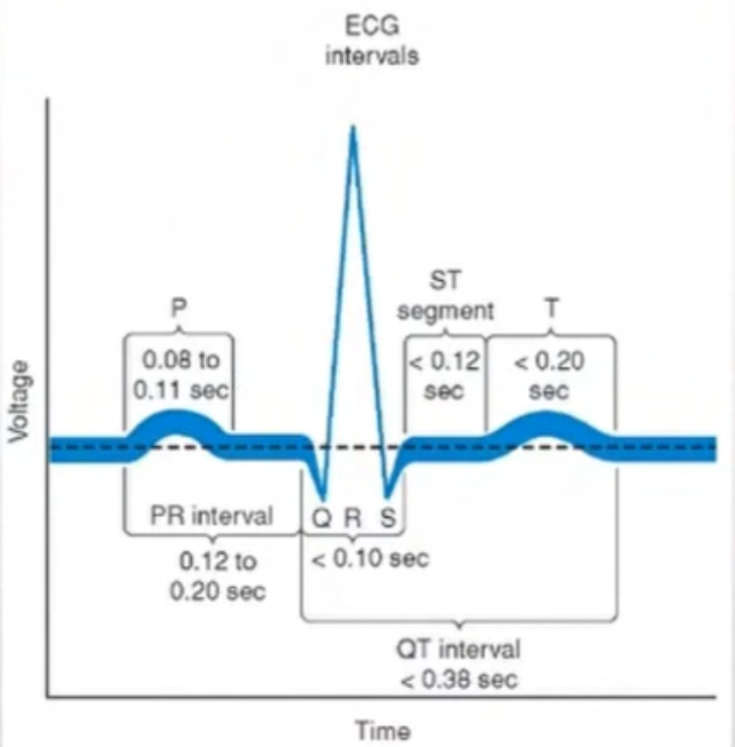
ECG Basics – Amplitude / Hypertrophy

RVH

Seen in aVR
(right = aVR)

- Any one or more of the following (if QRS duration < 0.12 sec):
  - Right axis deviation (> 90 degrees) in presence of disease capable of causing RVH
  - R in aVR ≥ 5 mm, or
  - R in aVR > Q in aVR
- Any one of the following in lead V1:
  - R/S ratio > 1 *and* negative T wave
  - qR pattern
  - R > 6 mm, *or* S < 2mm, or rSR' with R' > 10 mm
- Other chest lead criteria:
  - R in V1 + S in V5 (or V6) 10 mm
  - R/S ratio in V5 or V6 < 1
  - R in V5 or V6 < 5 mm
  - S in V5 or V6 > 7 mm

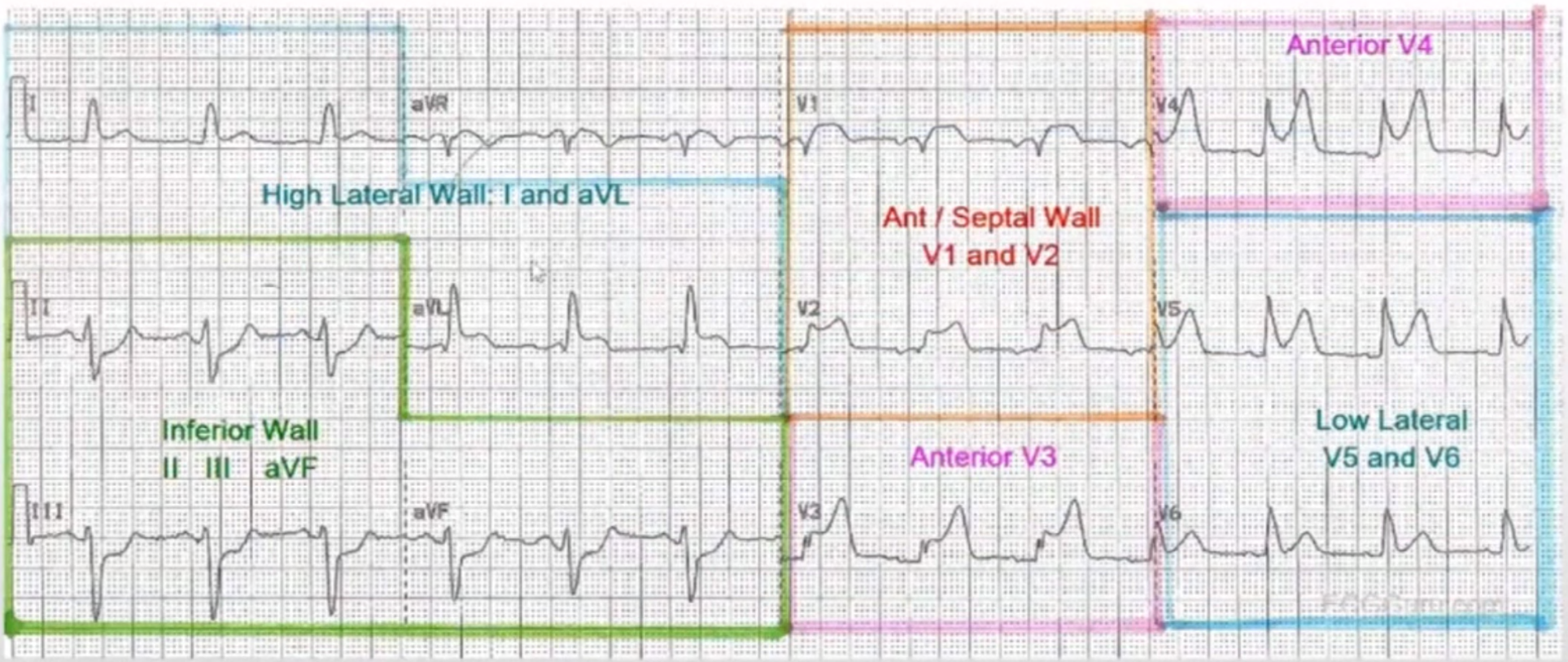
ECG Basics - Intervals



$$QTc = QT\ Interval / \sqrt{RR\ Interval}$$

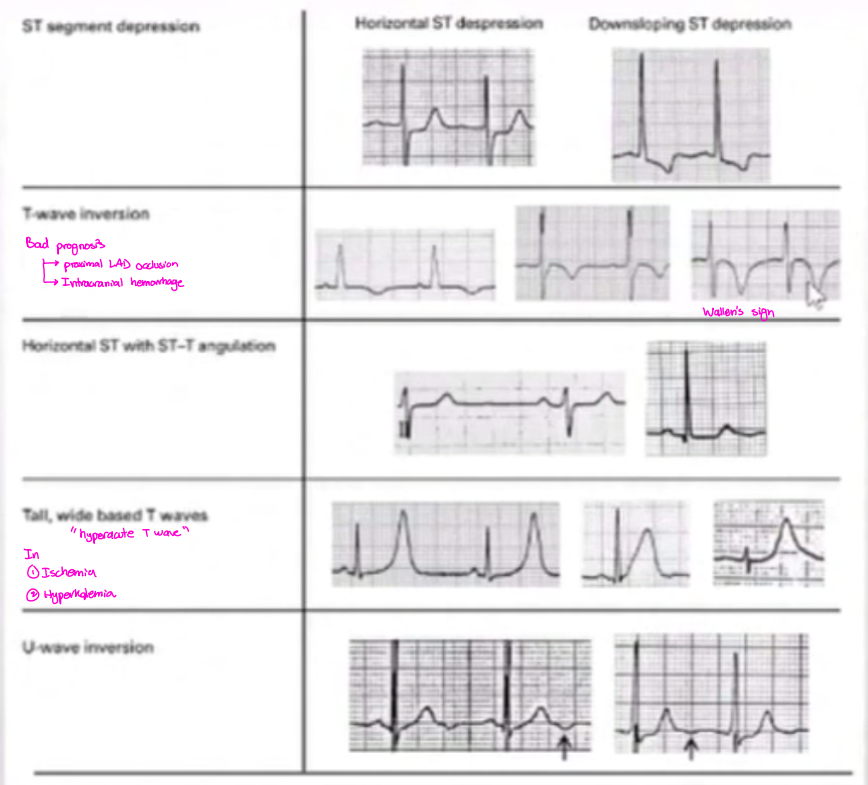
Upper Limit of Normal QTc	ms
Male	> 460 – 470
Female	> 470 – 480

ECG Basics - Ischemia



Internet Source: ECGguru.com

ECG Basics - Ischemia



Approach to ECG

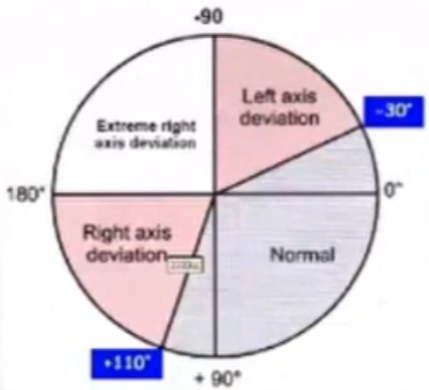
Rate

- Regular: Rate = 300 / Large Boxes
- Irregular: Rate = # R in ECG X 6

Rhythm

Approach to Rhythm Questions:
1. Is it Tachycardia / Normal Rate / Bradycardia?
2. QRS is it Narrow or Wide?
3a. Narrow QRS – Is it Regular or Irregular
3b. Wide QRS – What is Morphology?
4. Look for P-wave (Best place in Lead II and V1)
5. Relationship between the P wave and QRS ?

Axis



Amplitude

Low:
Limb <0.5 mm
Chest < 1.0 mm

LAE:
P Width >120ms

RAE:
P Ht. > 2.5 mm

LVH : Cornell's Criteria
- S in V3 + R in aVL > 24 mm (men)
- S in V3 + R in aVL > 20 mm (women)

LVH: Lead AVL > 11 mm

RVH : Lead V1
- R/S ratio > 1 *and* negative T wave
- R > 6 mm / S < 2mm
- rSR' with R' > 10 mm

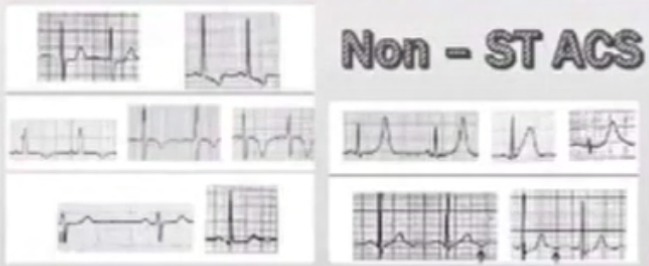
Intervals

Intervals		# Small sq.
PR	120-200 ms	3-5
QRS	< 110-120 ms	< 3
QT	< 480-500 ms	< ½ RR Interval < 12

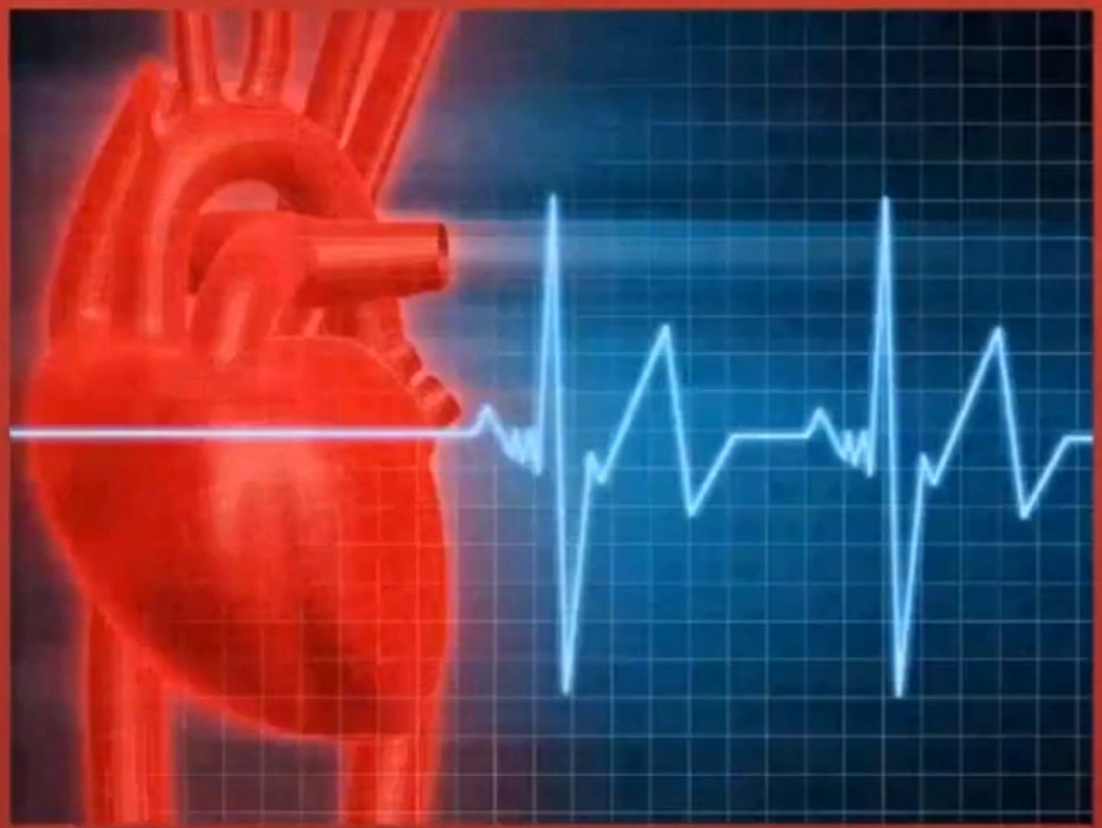
Ischemia

STEMI

Non – ST ACS



Approach to Rhythm



Approach to Rhythm – Normal Rate

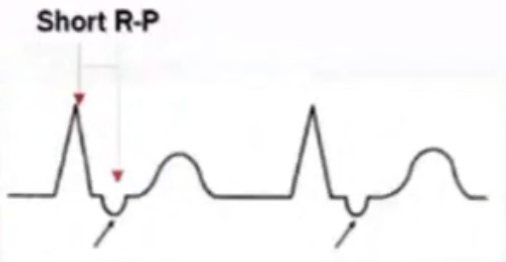
Question	Answer							
1. Rate	Normal Rate							
2. QRS	Narrow						Wide	
3. QRS	Regular				Irregular			
							Morphology	
							Ventricular	Aberrancy
4. P wave	Present			Absent	Present	Absent	Absent	Present
5. P-QRS Relation	Single	Multiple	Retrograde					
DDx	**NSR**	A.Flutter	Junctional Rhythm	Junctional Rhythm	SR with PAC	A.Fib	AIVR	Conduction Abnormality
	Atrial Rhythm	2:1 AV Block			Wandering Pacemaker			
	1st degree AV Block				A.Fl with Variable Conduction			

Approach to Rhythm - Bradycardia

Question	Answer									
1. Rate	Bradycardia									
2. QRS	Narrow								Wide	
3. QRS	Regular						Irregular			
									Morphology	
									Ventricular	Aberrancy
4. P wave	Present					Absent	Present	Absent	Absent	Present
5. P-QRS Relation	Single	Multiple	Group Beating	Retrograde	AV Dissociation					
DDx	SB	A.Flutter with SVR	2nd degree AV Block	Junctional Escape Rhythm	Complete AV Block (3rd degree)	Junctional Escape Rhythm	SB with PAC	A.Fib with SVR	Ventricular Escape Rhythm	Conduction Abnormality
	1st degree AV Block	2:1 AV Block					A.Fl with Slow & Variable Conduction			

Approach to Rhythm - Tachycardia

- **DDx of SVT**
  - *Short RP Tachycardias (RP<PR):*
    - Typical AV Nodal Re-entry Tachycardia (AVNRT)
    - Junctional Tachycardia
    - **Orthodromic Atrioventricular Tachycardia (OD – AVRT)**
    - *Atrial Tachycardia*



  - *Long RP Tachycardias (RP>PR):*
    - Sinus Tachycardia (ST)
    - Atrial Tachycardia (AT)
    - *Atypical Orthodromic Atrioventricular Tachycardia (OD – AVRT)*
    - *Atypical AV Nodal Re-entry Tachycardia (AVNRT)*
    - *Junctional Tachycardia*

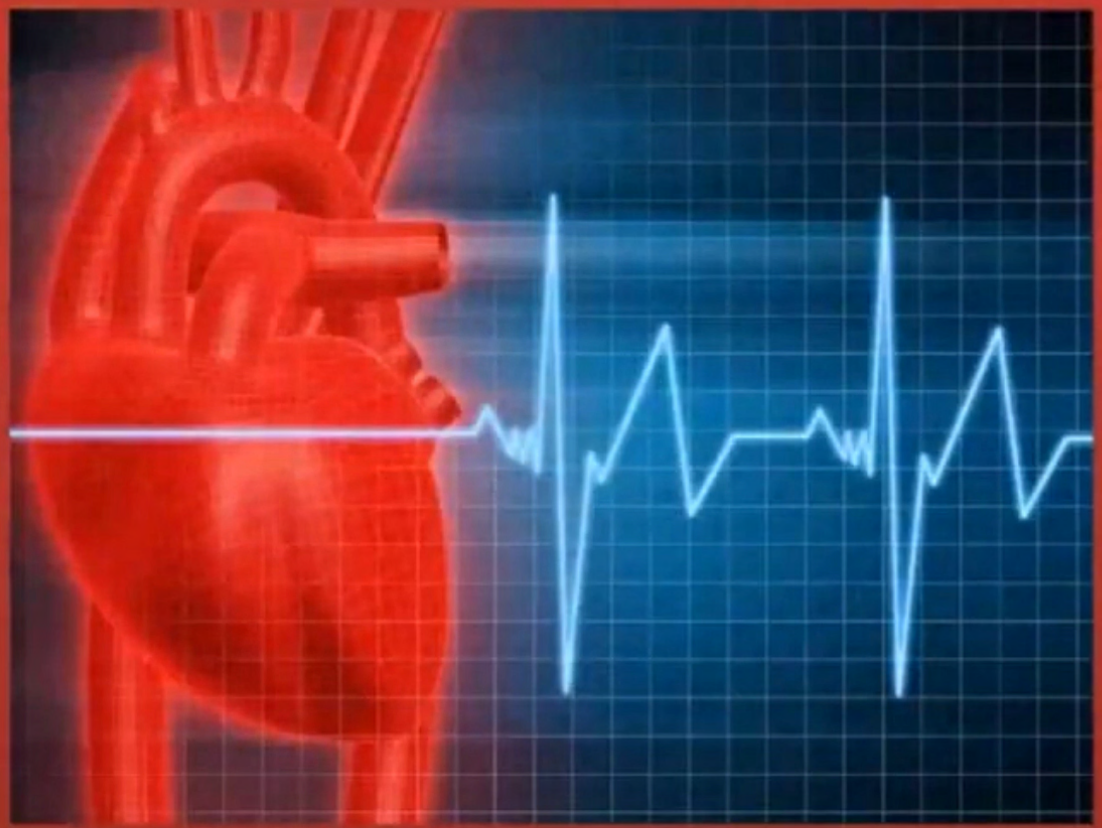
  - *Mimickers:*
    - Atrial Flutter with rapid conduction
    - A. Fibrillation with very rapid conduction

Approach to Rhythm - Tachycardia

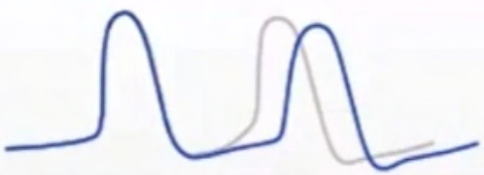
Tachyarrhythmia Framework

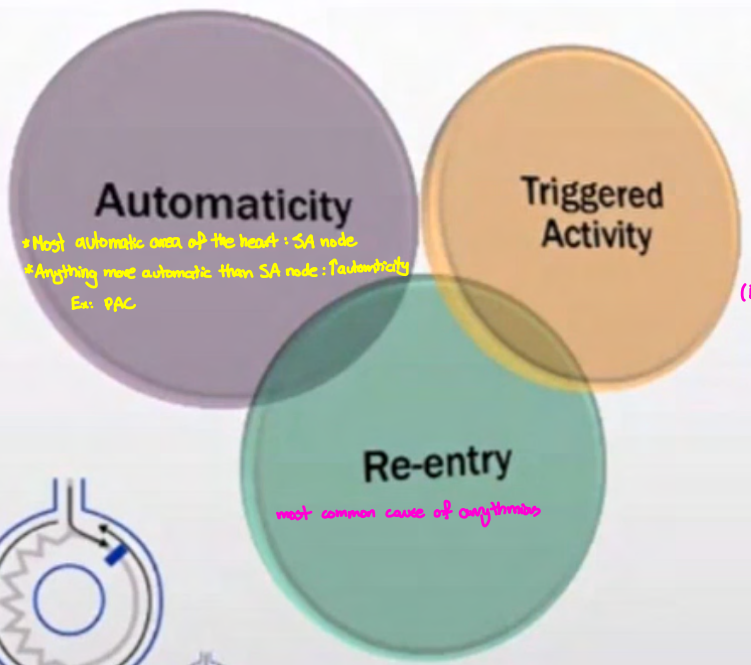
	REGULAR RHYTHM	IRREGULAR RHYTHM
NARROW QRS	• Sinus tachycardia ✓ • AVNRT ✓ • Orthodromic AVRT ✓ • Atrial Tachycardia • Atrial flutter ✓ • Junctional tachycardia	• Atrial fibrillation ✓ • Atrial flutter w/ variable AV block ✓ • Multifocal atrial tachycardia ✓
WIDE QRS	• Ventricular tachycardia ✓ • SVT with bundle branch block • Antidromic AVRT ✓ • Pre-excited SVT (WPW) ✓	• Polymorphic ventricular tachycardia • Atrial fibrillation with bundle branch block • Atrial flutter with variable AV block & bundle branch block

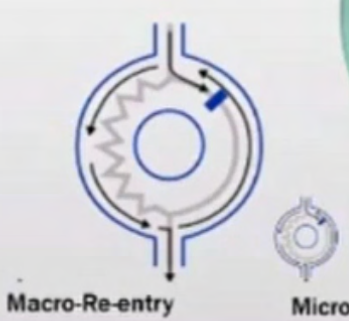
Arrhythmias

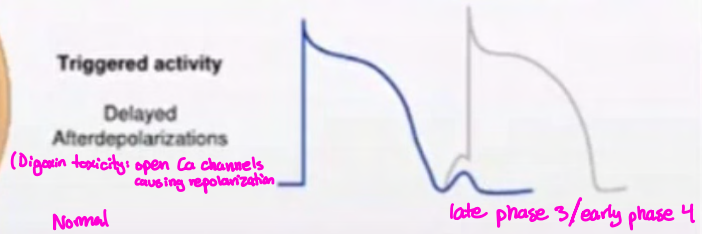


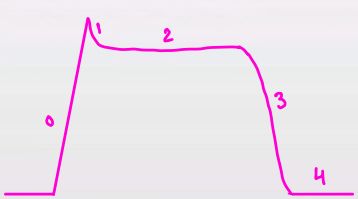
Mechanisms of Arrhythmias











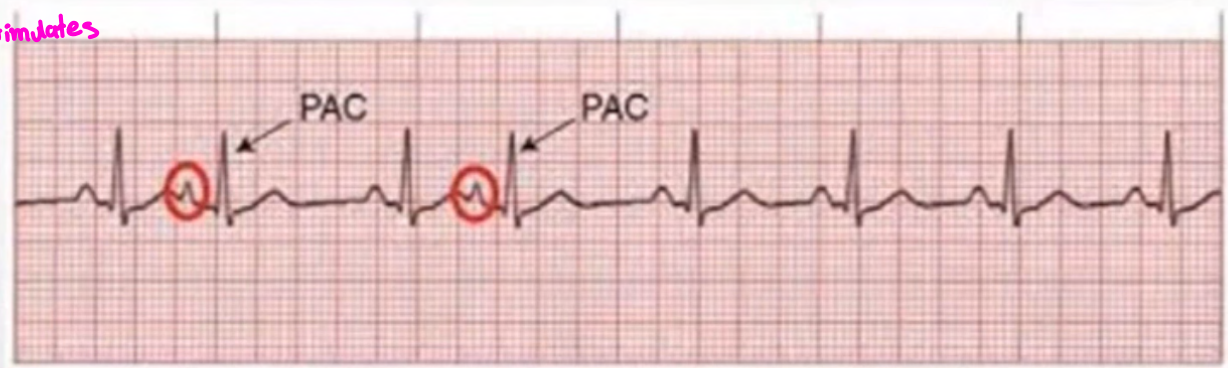
Arrhythmias

- Premature Atrial Contraction / Complex
- Premature Ventricular Contraction / Complex

*ectopic beats (no tachy or brady)

Premature Atrial Contractions / Complexes (PAC)

- Very common. May cause Palpitations
- Causes:
  - Adrenergic excess (anything that stimulates sympathetic)
  - Pharmacological
  - Electrolyte imbalances
  - Ischemia
  - Hypoxia
  - Infection.



Narrow QRS complex with preceding p-wave

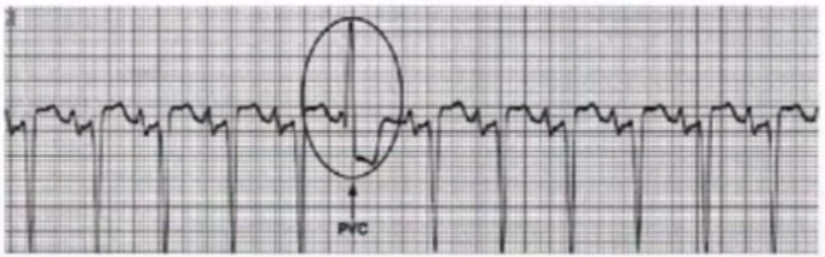
Clinical Status	Management
Asymptomatic	Observation
Symptomatic (Palpitations, Fatigue, Exercise Intolerance, Angina, Dizziness, Syncope)	Rx Cause B-Blockers

PAC and PVCs :
- same causes but structural heart disease more common in PVCs
- treatment also same

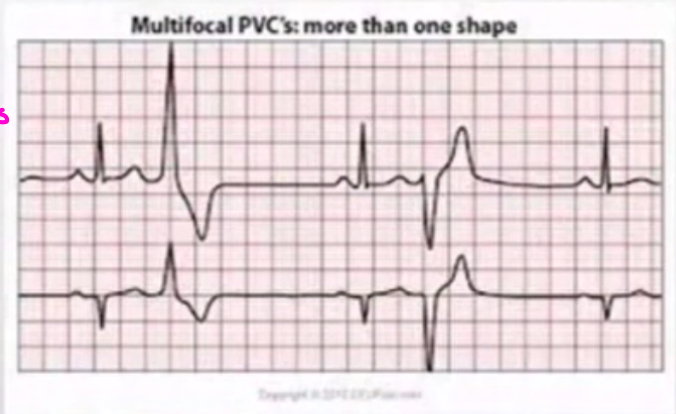
impulses do not originate from the atria but from ventricle

Premature Ventricular Contractions / Complexes (PVC)

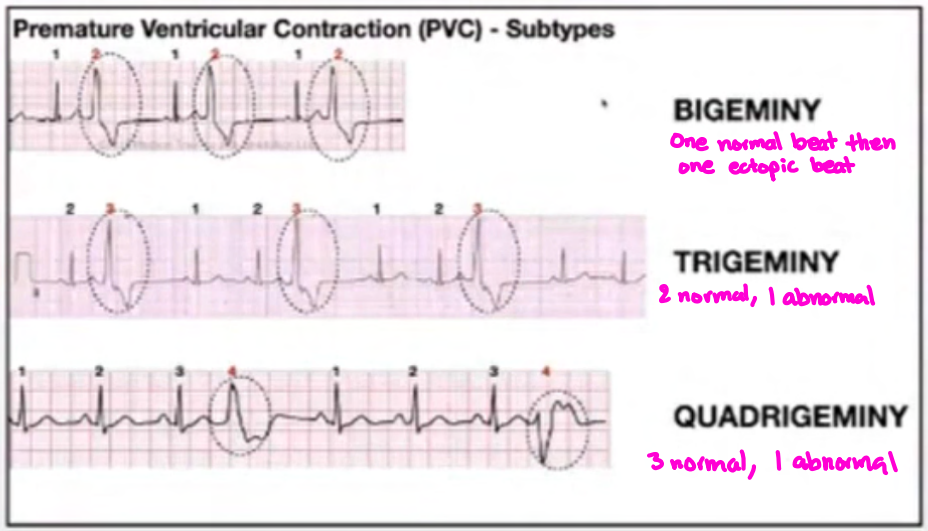
- Common. May cause Palpitations.
- Causes: similar to PACs
  - Hypoxia
  - Electrolyte abnormalities
  - Pharmacological
  - **Structural heart disease** more common in PVCs



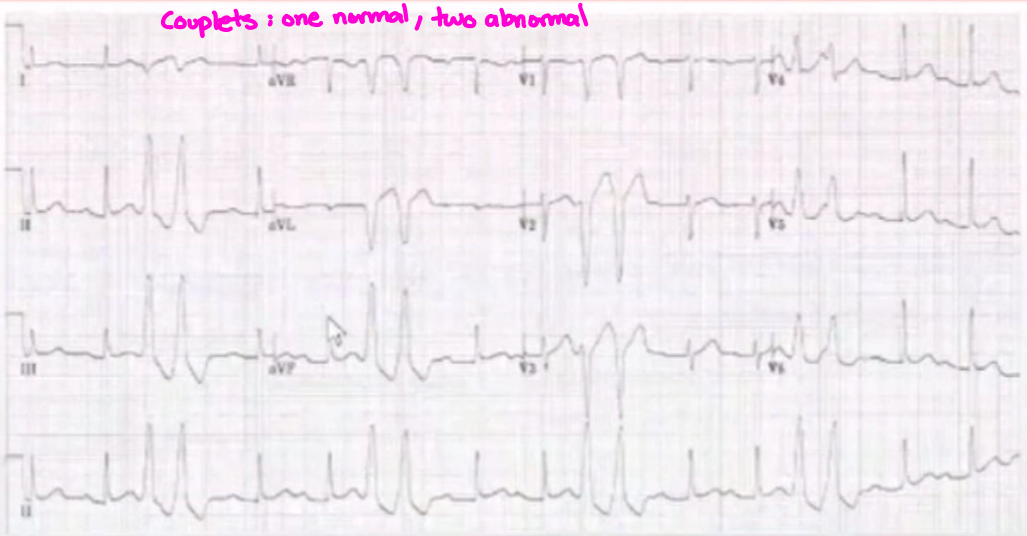
wide QRS complex with NO preceding p wave



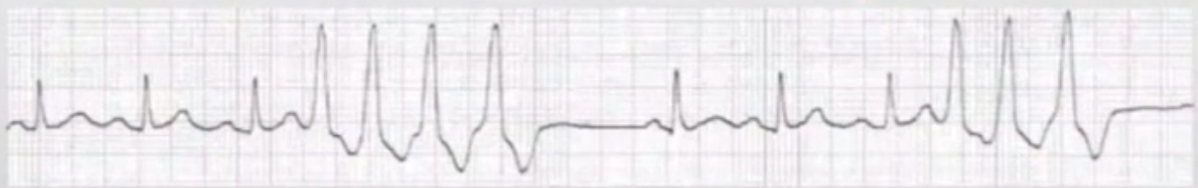
Premature Ventricular Contractions / Complexes (PVC)



Couplets : one normal, two abnormal



No 'triplets' → becomes NSVT



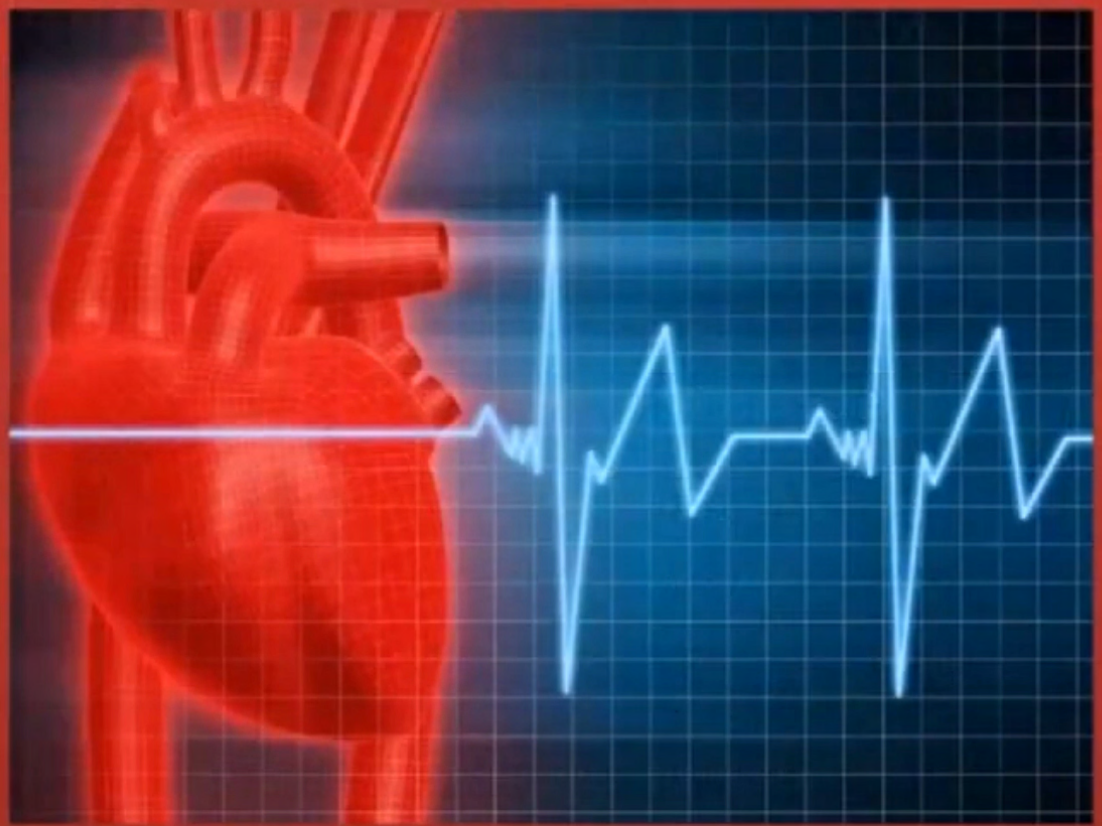
NSVT

Non-sustained VT

Premature Ventricular Contractions / Complexes (PVC)

Clinical Status	Management
Asymptomatic - Infrequent	Observation
Asymptomatic – Frequent / Repetitive	R/o Heart Disease B-Blockers EPS +/- ICD/Ablation
Symptomatic (Palpitations, Fatigue, Exercise Intolerance, Angina, Dizziness, Syncope)	Rx Cause B-Blockers

Tachyarrhythmias



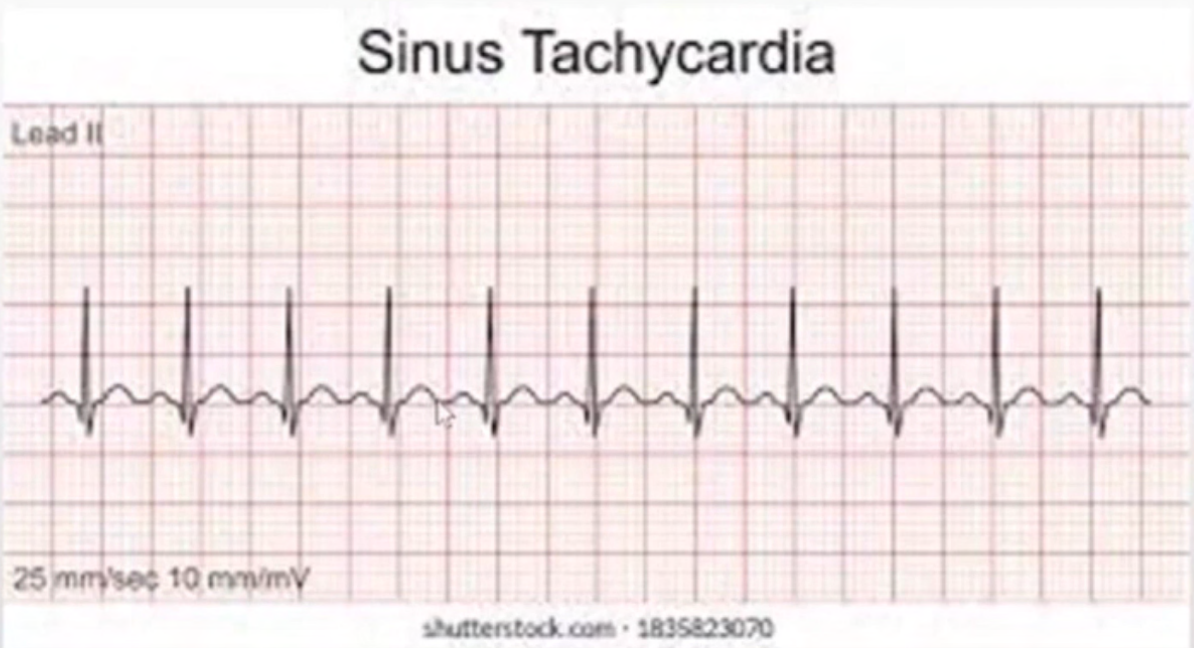
Tachyarrhythmias

- Sinus Tachycardia
  - Inappropriate Sinus Tachycardia
- Atrial Fibrillation
- Atrial Flutter
- Multifocal Atrial Tachycardia
- Supraventricular Tachycardia
- Ventricular Tachycardia
- Ventricular Fibrillation

These are also supraventricular but are categorized alone because they differ in management compared to SVT

Sinus Tachycardia

- Rate >100 bpm (< 3 big squares)



↑rate but NORMAL ECG: Regular rythm, narrow QRS, normal p-wave

Sinus Tachycardia

- Causes:

Physiological	Cardiac Conditions	Medical Condition	Pharmacological
• Exercise • Emotion • Anxiety • Pain • Fever • Pregnancy • *Volume Depletion*	• MI • Cardiomyopathy / HF • Acute Valve Disease • Pericarditis • *Postural*	• Shock • Hypoxia • Respiratory Distress • P.E. (most common arythmia in PE is ST) • Anemia • Infection • *Dehydration* • Hyperthyroidism • Pheochromocytoma • Cushing's • Hypoglycemia • Panic Attack	• Caffeine • Alcohol • Tobacco • Catecholamines • B agonist • BB Withdrawal • Vasodilators • Atropine • Theophylline • Decongestants • Cocaine • Amphetamines • Thyroid Hormones

Sinus Tachycardia

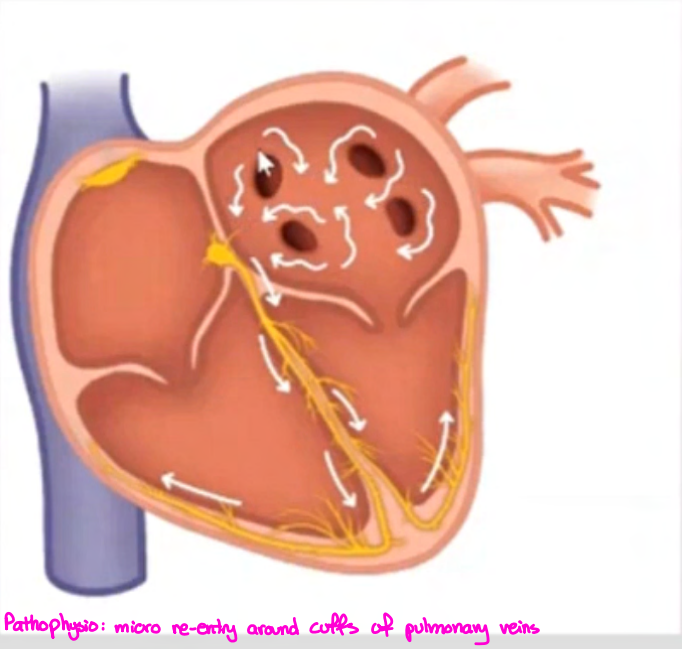
- Management:
  - Treat the underlying cause
  - Treat the underlying cause
  - Treat the underlying cause

  - Inappropriate Sinus Tachycardia (if idiopathic)
    - B-Blockers
    - Ivabradine
    - RFA

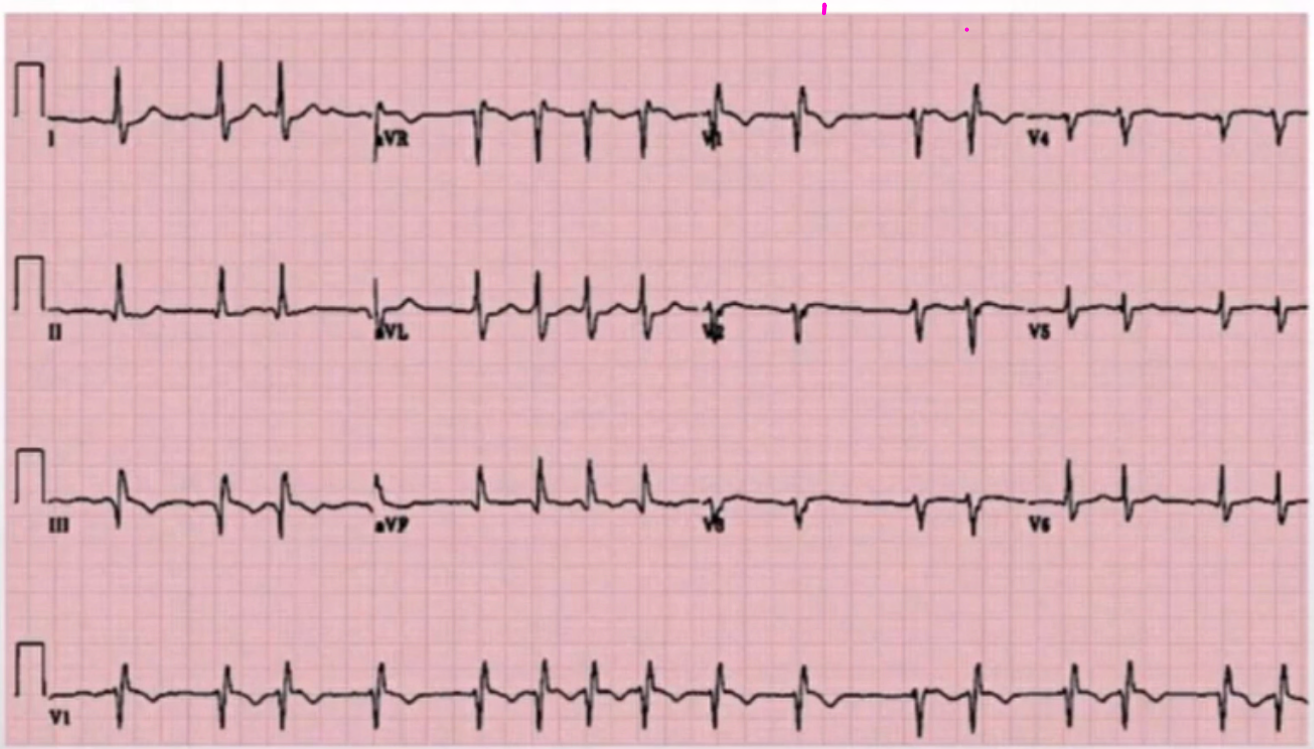
Atrial Fibrillation

No p-wave, irregular, narrow QRS

- Very common



Pathophysio: micro re-entry around cuffs of pulmonary veins



16x6

Atrial Fibrillation

- Causes: (precipitating factors)
  - Heart disease: CAD, MI, HTN, mitral valve disease
  - History of cardiac surgery (or any non-cardiac surgery)
  - Pericarditis
  - Pulmonary disease (PE, COPD, Hypoxia)
  - Thyroid disease (hyper/hypo)
  - Pheochromocytoma
  - Systemic illness (e.g. Infection,)
  - Stress (postoperative, pain, anxiety)
  - Hyperadrenergic states
  - Cocaine or methamphetamine use
  - Extremes of activity (sedentary lifestyle, excess exercise such as marathon running)
  - Excessive alcohol intake ("holiday heart syndrome")

Atrial Fibrillation - Management

- **Rate Control**
  - B-Blockers
  - CCB
  - Digoxin
    - -Not as useful
    - -Useful in pts with low BP (doesn't affect BP) unlike BB and CCB
- **Anticoagulation**
  - Warfarin
  - DOACS
    - 1) Dabigatran
    - 2) Drugs ending with "ban"

Q

If a-fib with one of these:
1) Valvular disease
2) Mechanical valve
3) Mitral regurg / stenosis
4) LVAD

DOACS ARE NOT APPROVED → USE WARFARIN

CHA2DS2-VASc Score	
CHF or LVEF ≤ 40%	1
HTN	1
Age ≥ 75	2
DM	1
CVA/TIA/TE → Stroke	2
Vascular	1
Age 65-74	1
Female Sex	1

→ To find out if we require anticoagulation (risk of thrombosis)
- → Above 1 : needs anticoagulation
- → > 0 : needs aspirin only

HAS-BLED score

(risk of bleeding for pts on anticoagulants after A fib)

Condition	Points
H - Hypertension	1
A - Abnormal renal or liver function (1 point each)	1 or 2
S - Stroke	1
B - Bleeding	1
L - Labile INRs	1
E - Elderly (> 65 years)	1
D - Drugs or alcohol (1 point each)	1 or 2

Atrial Fibrillation - Management

- **Rate Control**
  - B-Blockers
  - CCB
  - Digoxin
- **Anticoagulation**
  - Warfarin
  - DOACS

CHA2DS2-VASc Score	
CHF or LVEF ≤ 40%	1
H	1
A	2
D	1
C	2
V	1
A	1
F	1

CVA Risk	
0	0
1	1.3
2	2.2
3	3.2
4	4
5	6.7
6	9.8
7	9.6
8	6.7
9	15.2

HAS-BLED score

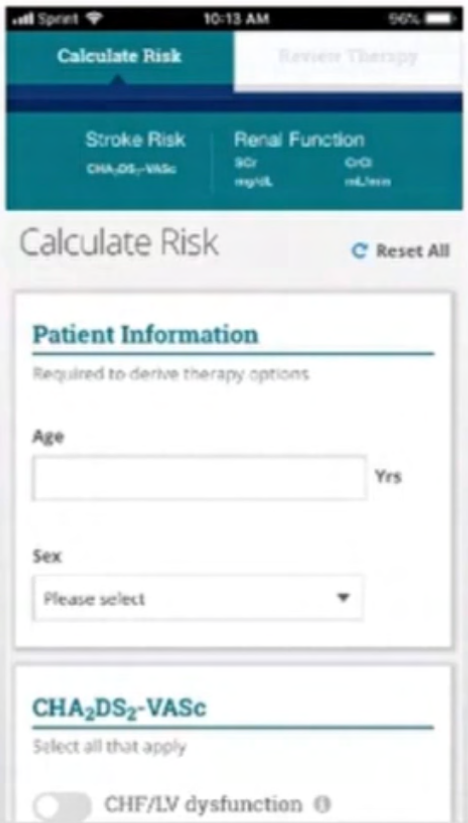
Possibility of bleeding

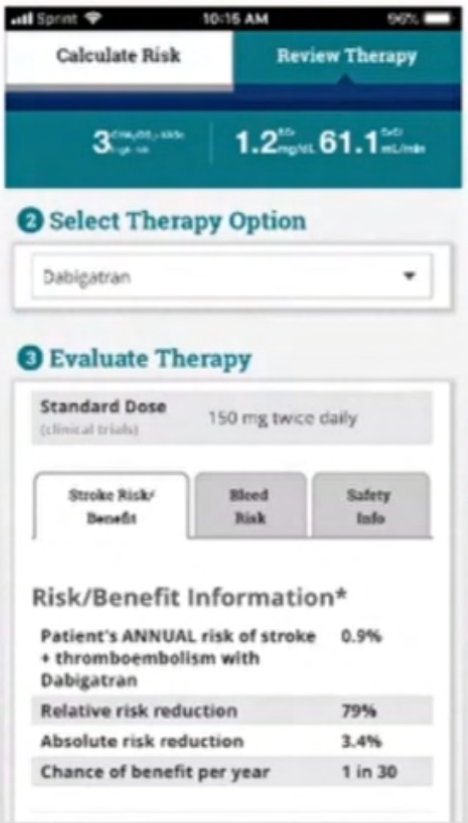
Condition	Points
H - Hypertension	1
A - Abnormal renal or liver function (1 point each)	1 or 2
S - Stroke	
B - Bleed	
L - Labile	
E - Elder	
D - Drug	2

HAS-BLED score	Bleeds per 100 patient-years
0	1.13
1	1.02
2	1.88
3	3.74
4	8.70
5	12.5

PROBLEM: Coagulation and bleeding have similar risk factor so we need to find a way to balance to avoid both

Atrial Fibrillation - Pearls





Atrial Fibrillation - Management

STEP 1

- Rate Control
  - B-Blockers
  - CCB
  - Digoxin
- Anticoagulation
  - Warfarin
  - DOACS

CHA2DS2-VASc Score	
CHF or LVEF ≤ 40%	1
HTN	1
Age ≥ 75	2
DM	1
CVA/TIA/TE	2
Vascular	1
Age 65-74	1
Female	1

STEP 2

If

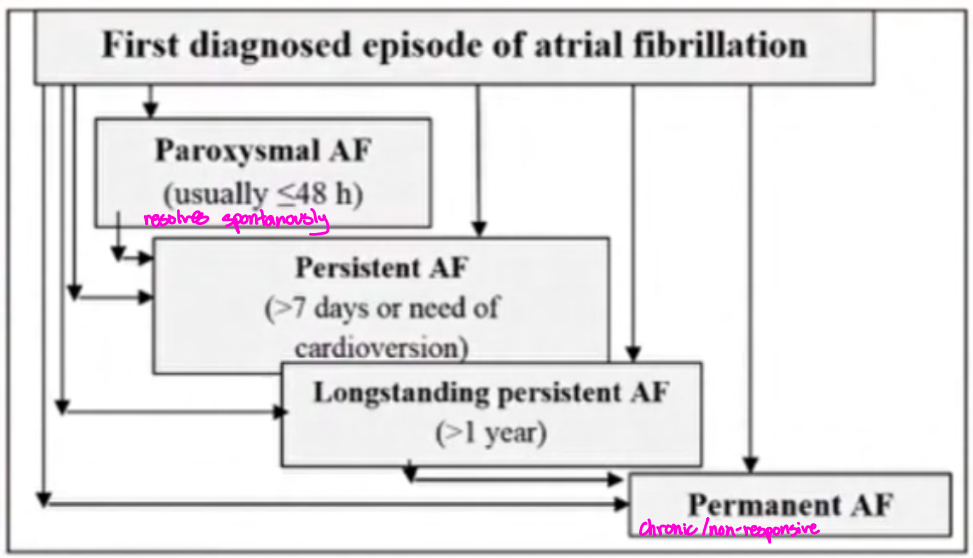
1. Unstable (↑HR, ↓BP)
2. Symptomatic
3. Rate not controlled
4. Young / New Onset

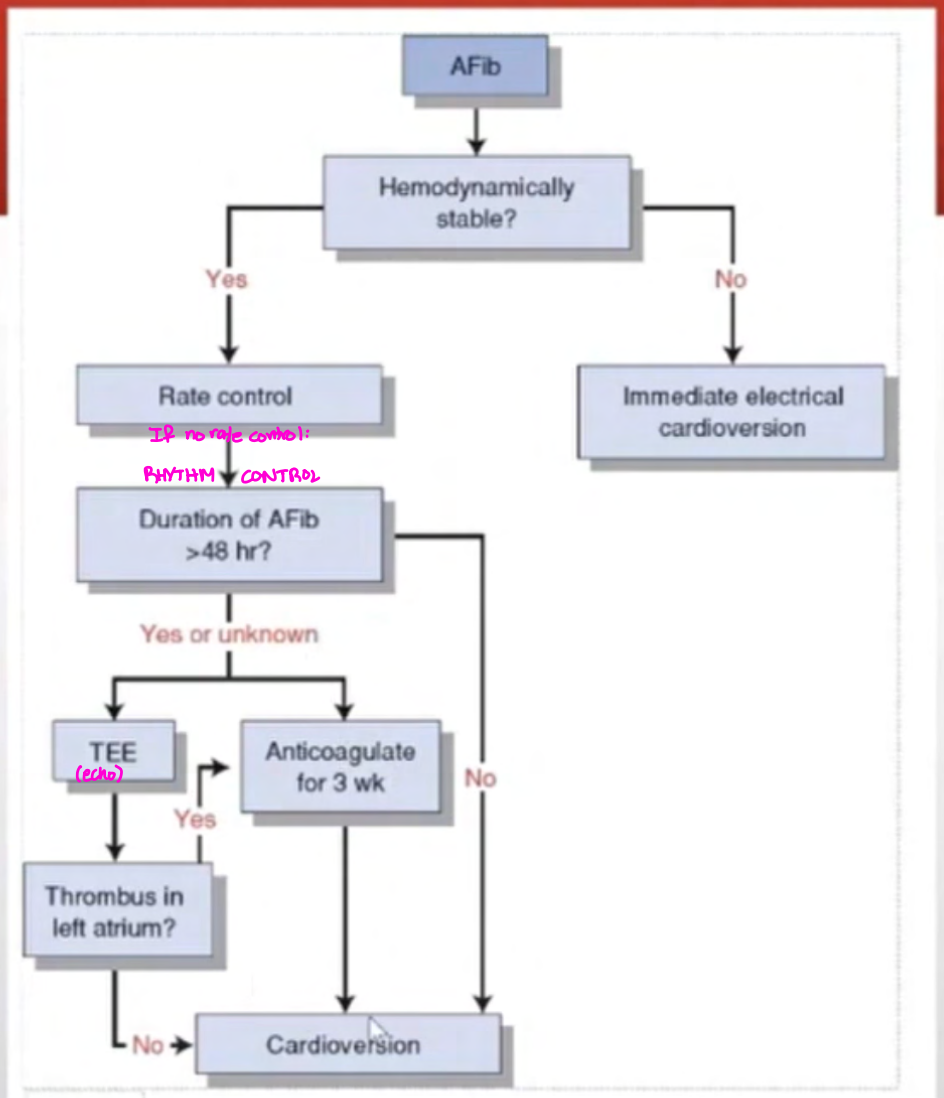
- Rhythm Control

Cardioversion through:

- Electrical
- Pharmacological
- Ablation

Atrial Fibrillation - Pearls

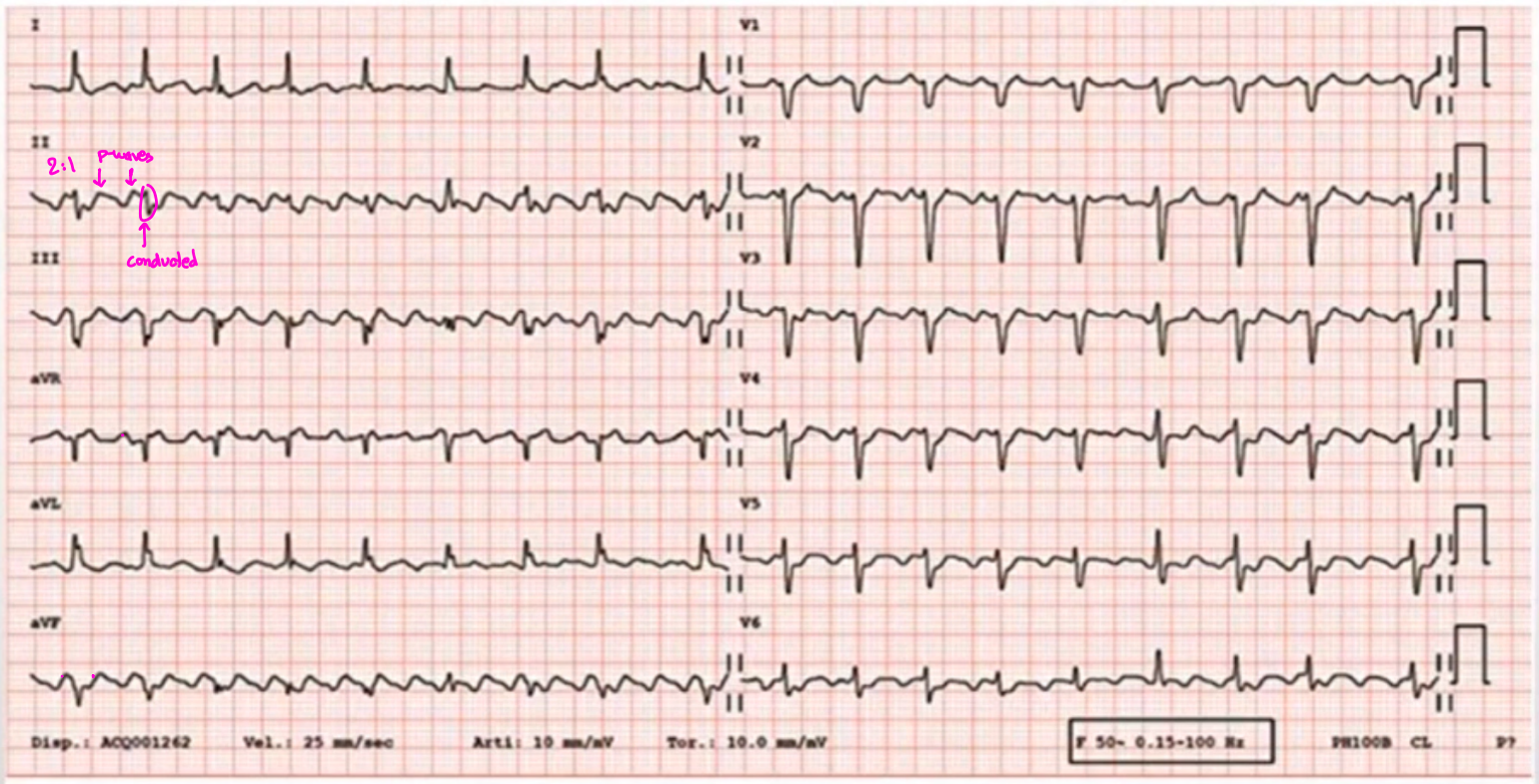




Atrial Flutter

- Common

- Saw-tooth appearance
  - → can be regular: 2:1 or 3:1 conduction
  - → can be irregular: ↑ with variable AV block



Atrial Flutter - Management

Rate Control

- B-Blockers
- CCB
- Digoxin

Anticoagulation

- Warfarin
- DOACS

CHA2DS2-VASc Score	
CHF or LVEF ≤ 40%	1
HTN	1
Age ≥ 75	2
DM	1
CVA/TIA/TE	2
Vascular	1
Age 65-74	1
Female	1

If

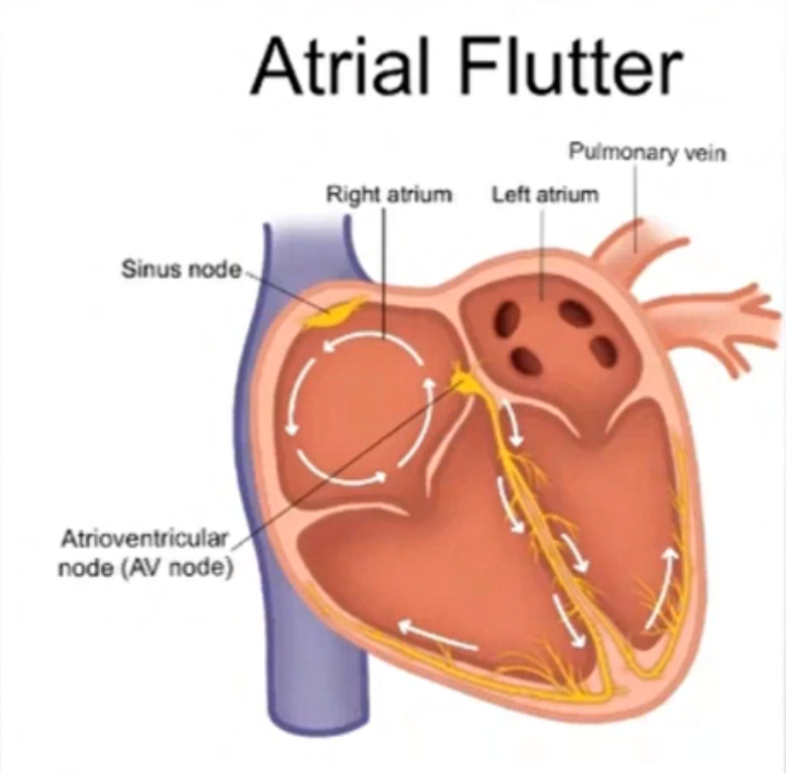
- Unstable
- Symptomatic
- Rate not controlled
- Young / New Onset

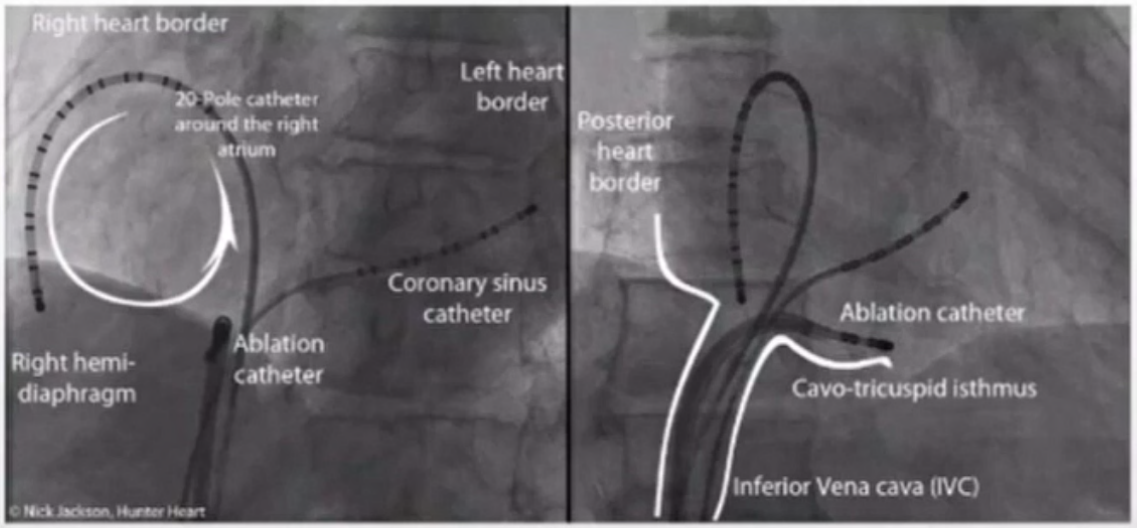
Rhythm Control

- Electrical
- Pharmacological
- Ablation

more frequent in Aflutter than AFib (easy, efficient, lower risk)

Atrial Flutter - Pearls



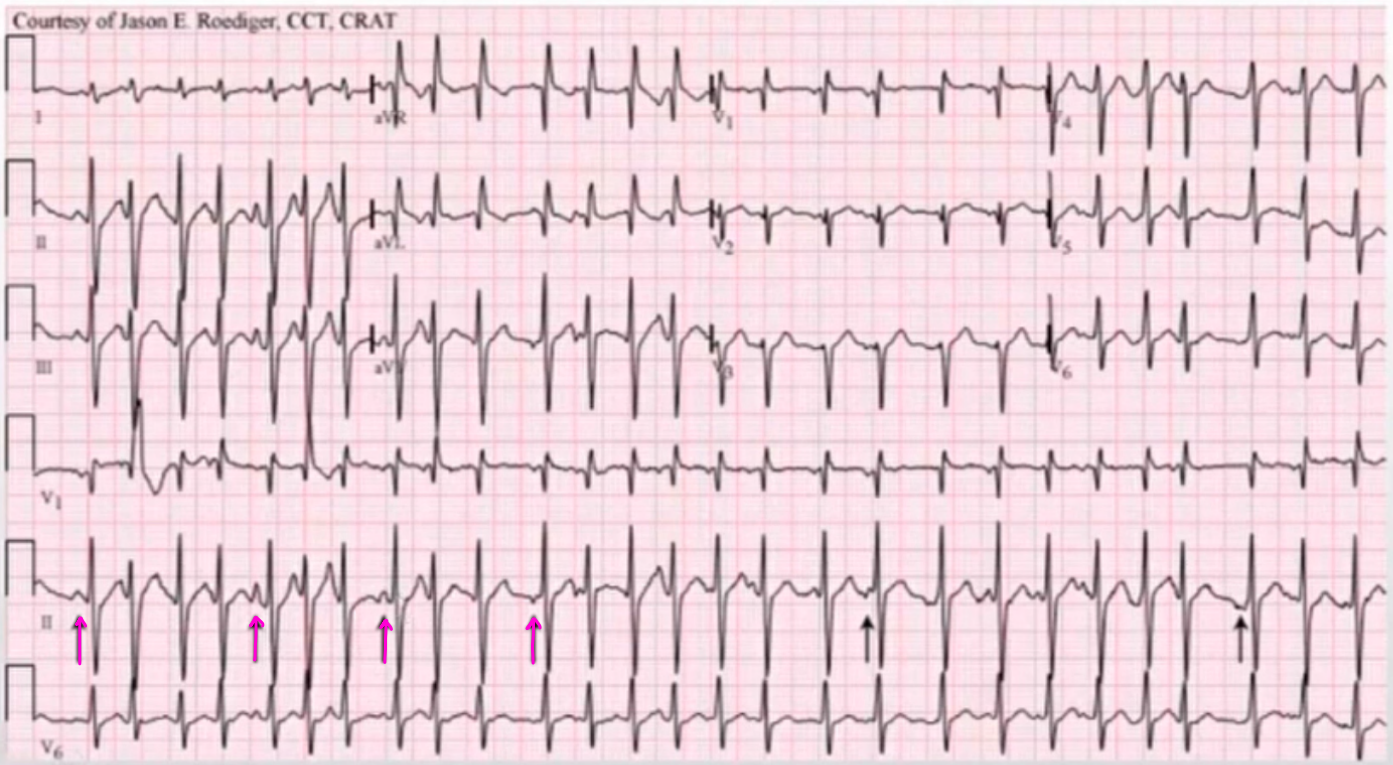


Pathophysio: Macro circuit around right atria

Multifocal Atrial Tachycardia (MAT)

Like A.fib + at least 3 p-waves with different morphologies (normal, acute, widened, notched...)
↓
look at lead II and V_1

- Common in patients with severe pulmonary disease (e.g., COPD)

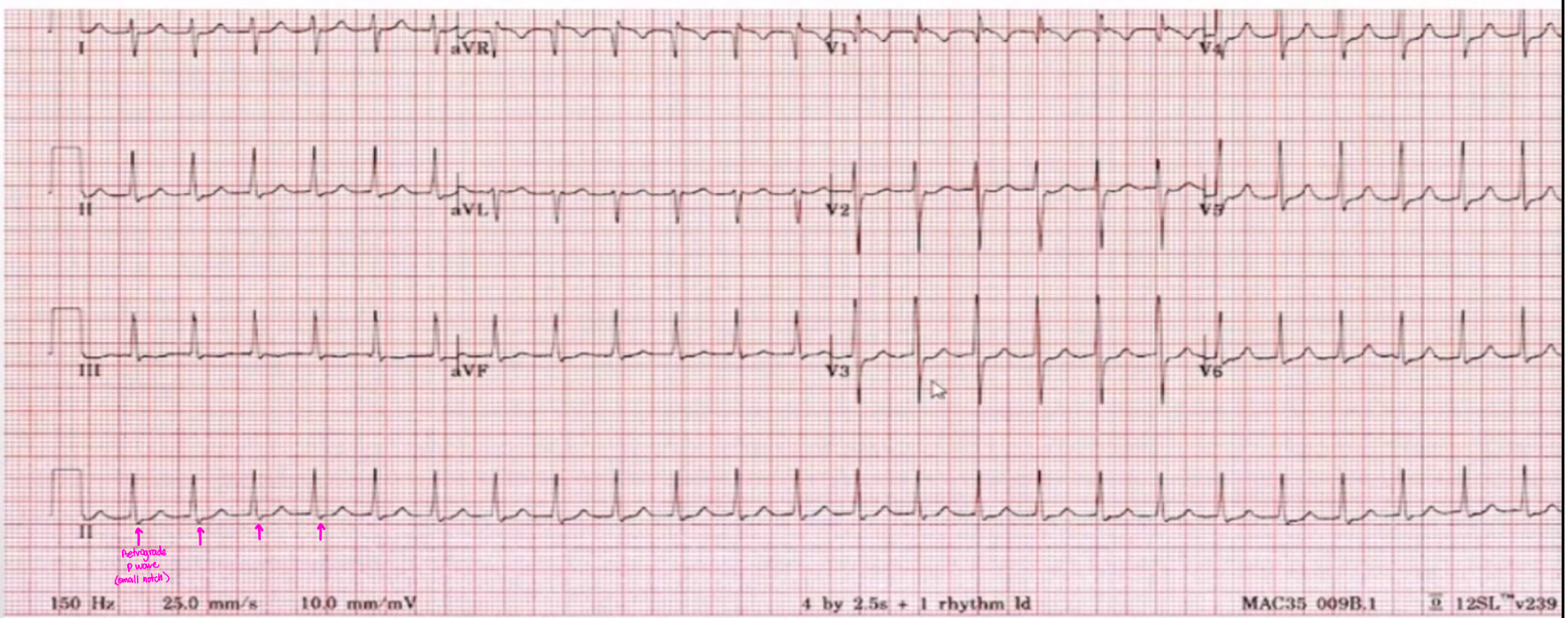


Multifocal Atrial Tachycardia (MAT)

- Treatment:
  - **Improve oxygenation and ventilation** (COPD treatment)
  - Medications: CCBs, β-blockers, digoxin, amiodarone
  - Electrical cardioversion is ineffective and should not be used

Supraventricular Tachycardia (SVT)

- Regular, narrow QRS, p-wave is unclear (retrograde pwave: atria is being depolarized in the opposite way)
- Like Afib but regular



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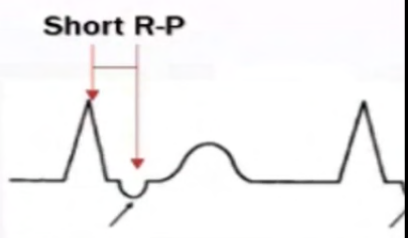
Supraventricular Tachycardia (SVT)

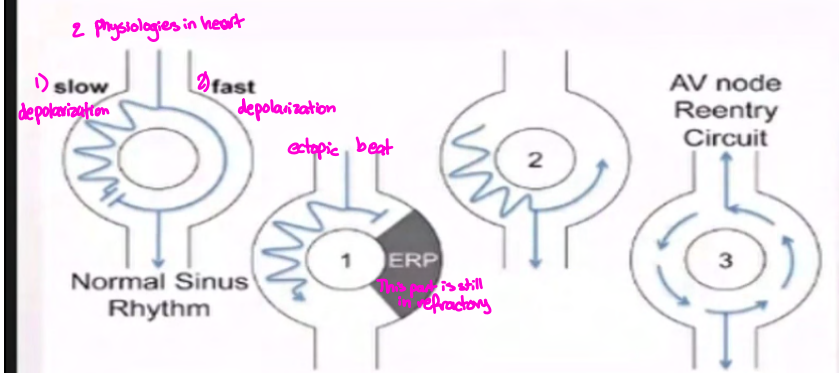
- **DDx of SVT**
  - *Short RP Tachycardias (RP<PR):* less distance between R-P than P-P
    - TYPICAL
      - Typical AV Nodal Re-entry Tachycardia (AVNRT) most common cause of SVT
      - Junctional Tachycardia
      - Orthodromic Atrioventricular Tachycardia (OD – AVRT)
      - *Atrial Tachycardia*

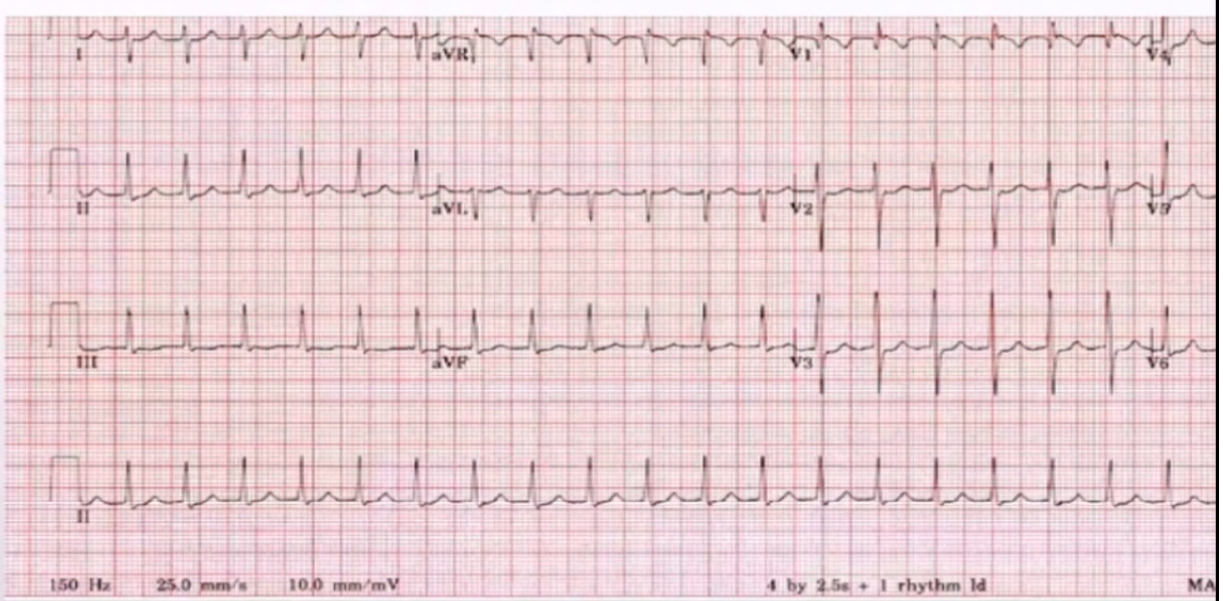


  - *Long RP Tachycardias (RP>PR):* longer distance between R-P than P-P
    - Sinus Tachycardia (ST)
    - Atrial Tachycardia (AT)
    - ATYPICAL
      - *Atypical Orthodromic Atrioventricular Tachycardia (OD – AVRT)*
      - *Atypical AV Nodal Re-entry Tachycardia (AVNRT)*
      - *Junctional Tachycardia*

  - *Mimickers:*
    - Atrial Flutter with rapid conduction
    - A. Fibrillation with very rapid conduction

SVT: AV Nodal Re-entrant Tachycardia (AVNRT)





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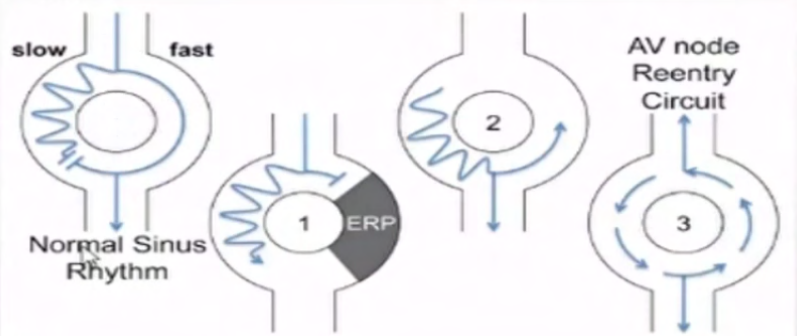
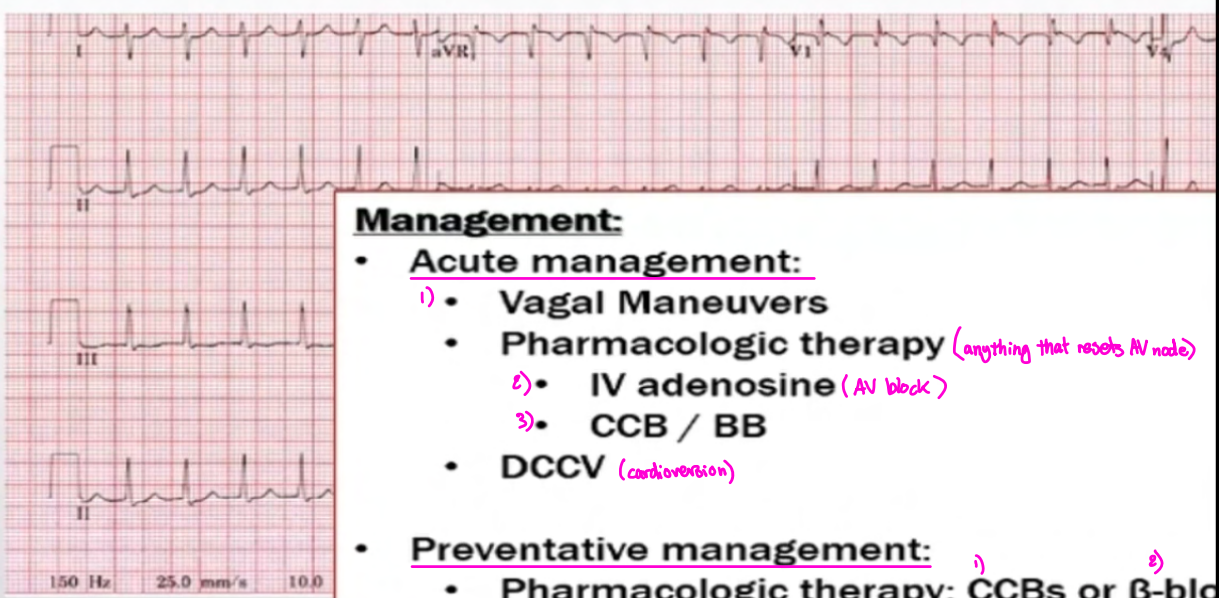
SVT: AV Nodal Re-entrant Tachycardia (AVNRT)





Management:

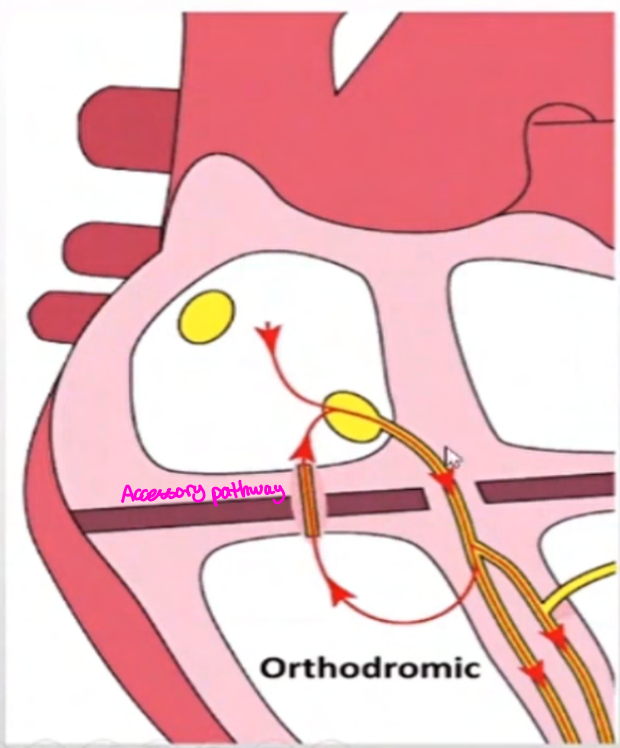
- Acute management:
  1) • Vagal Maneuvers
  - Pharmacologic therapy (anything that resets AV node)
    2) • IV adenosine (AV block)
    3) • CCB / BB
  - DCCV (cardioversion)

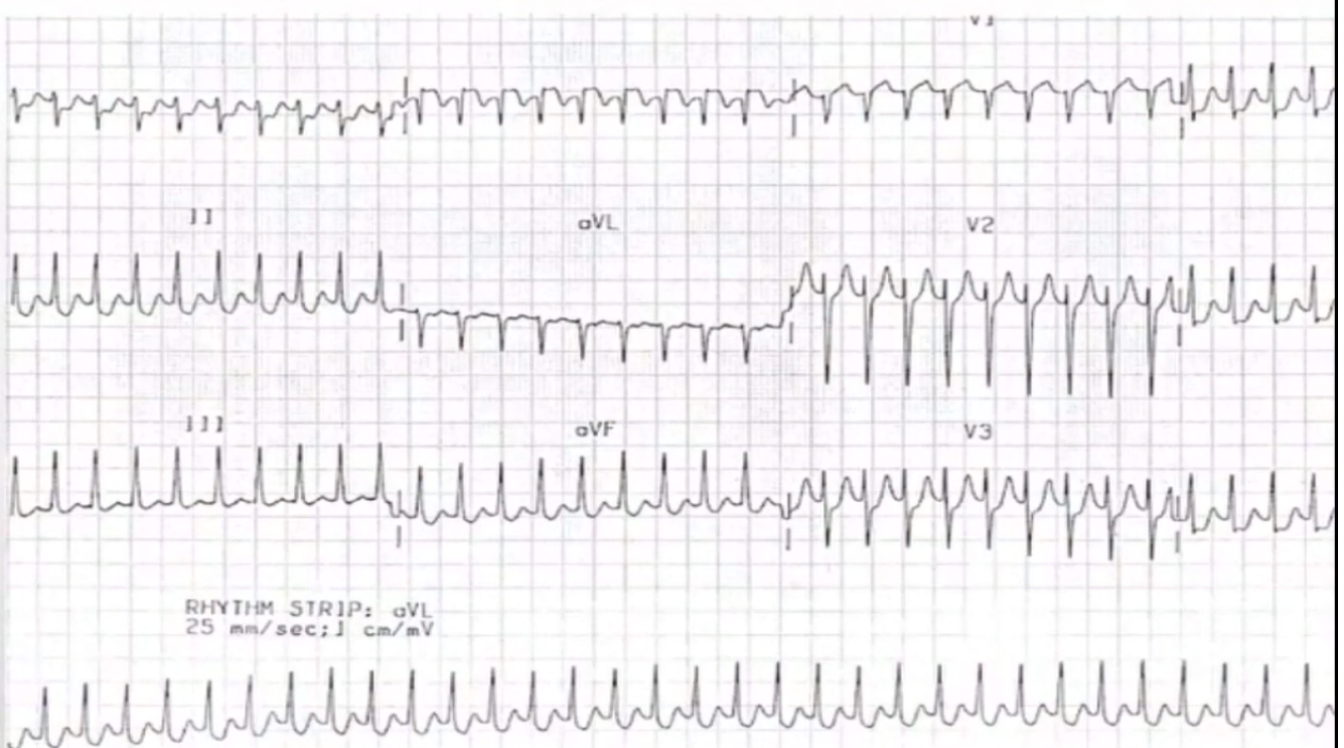
- Preventative management:
  - Pharmacologic therapy: 1) CCBs or 2) β-blo
  3) • Ablation

SVT: Orthodromic AV Re-entrant Tachycardia (AV

conduction is through normal conduction system

Regular narrow





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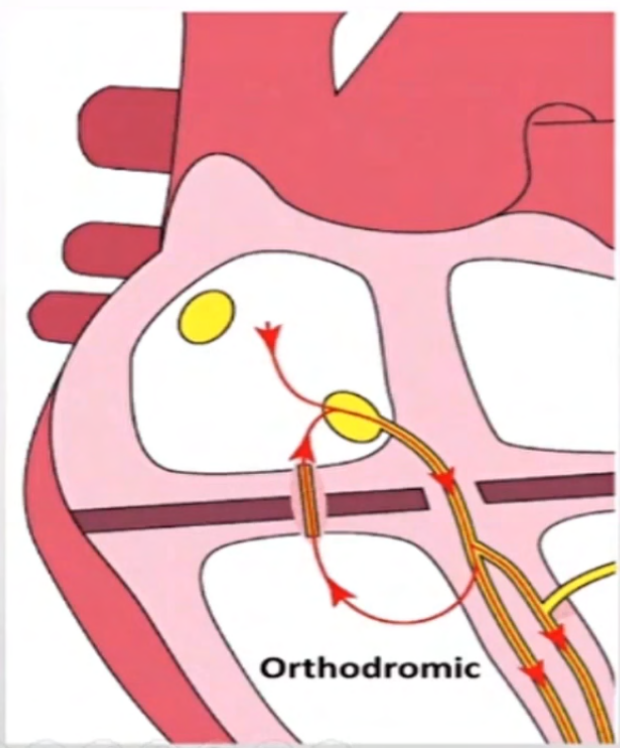
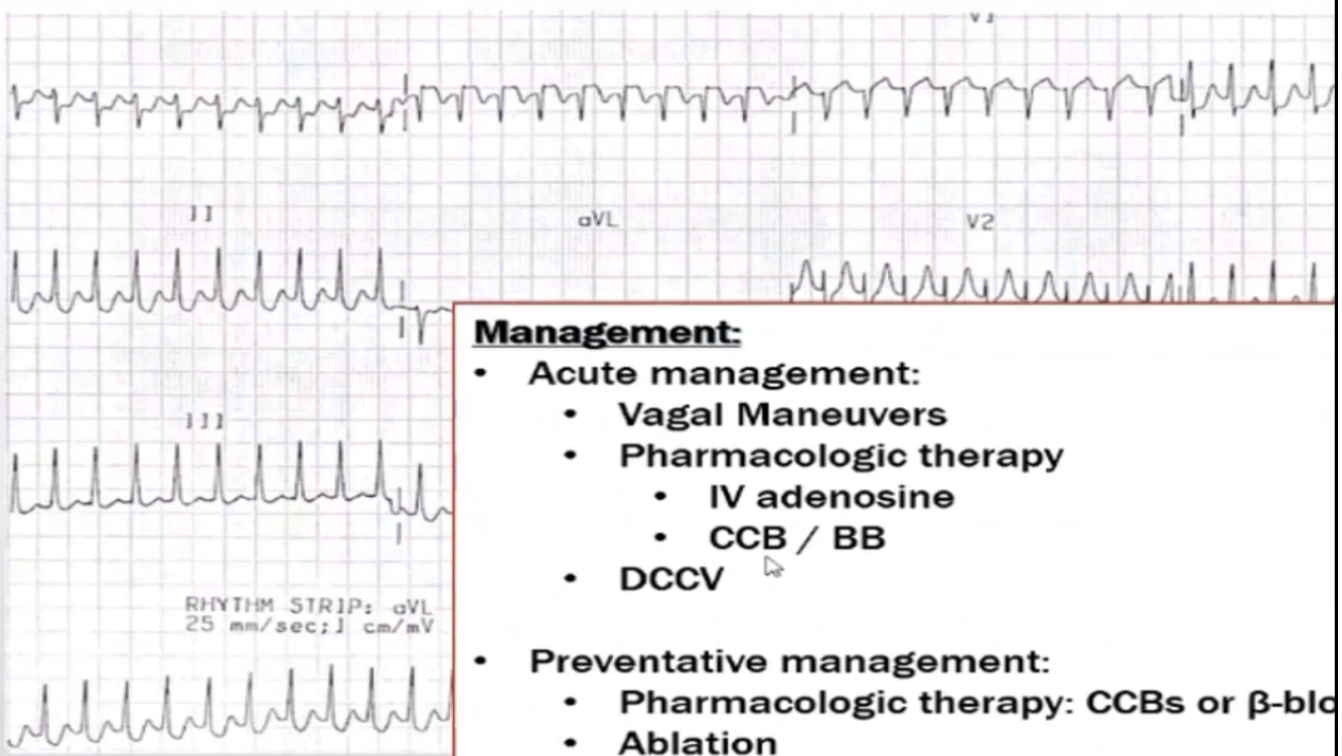
conduction is through normal conduction system
then goes back (retrograde) through an accessory pathway

SVT: Orthodromic AV Re-entrant Tachycardia (AV





Management:

- Acute management:
  - Vagal Maneuvers
  - Pharmacologic therapy
    - IV adenosine
    - CCB / BB
  - DCCV
- Preventative management:
  - Pharmacologic therapy: CCBs or β-blo
  - Ablation

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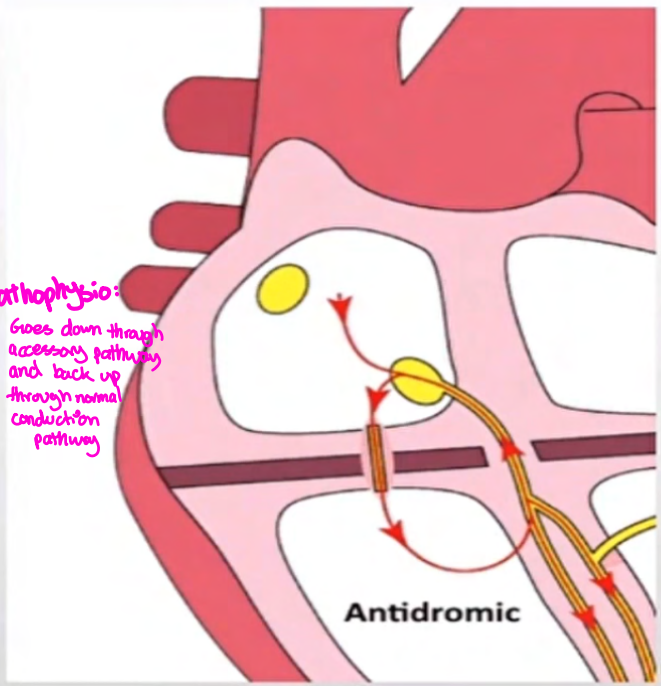
- Treatment of AVNRT and OD-AVRT → same (why? accessory pathway doesn't conduct anterograde)
- Treatment of AD-AVRT and WPW → same (why? accessory pathway conducts anterograde)

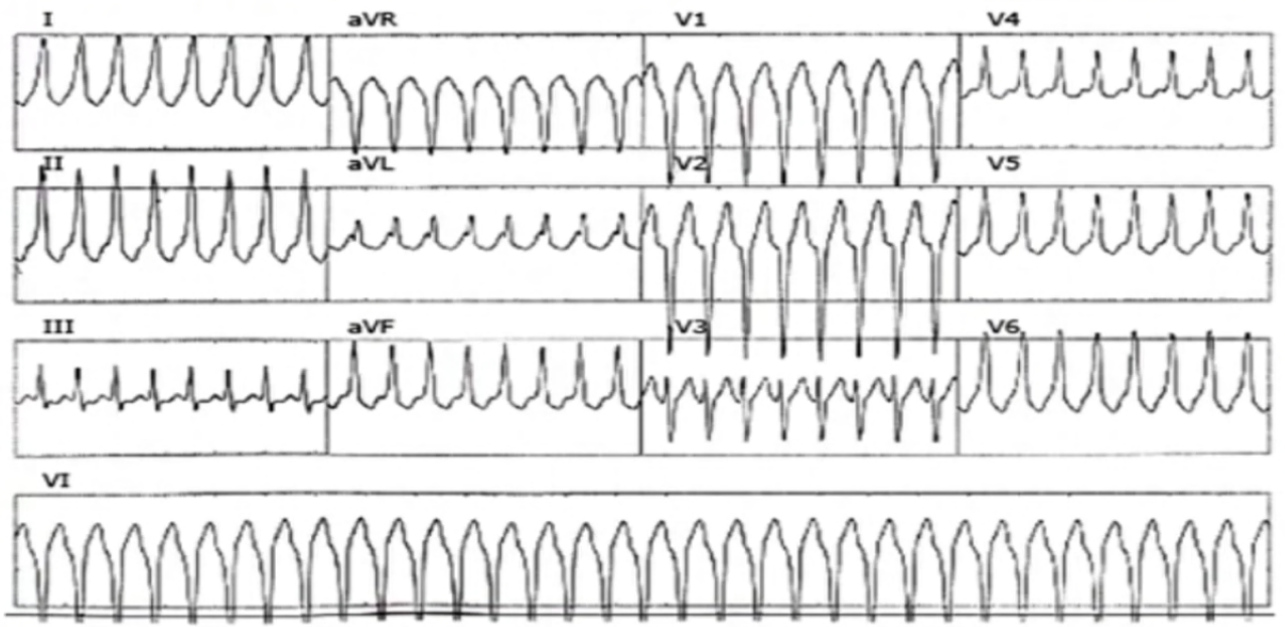
Explained more ↓

SVT: Antidromic AV Re-entrant Tachycardia (AVR

Wide complex tachy



Pathophysio:
Goes down through accessory pathway and back up through normal conduction pathway



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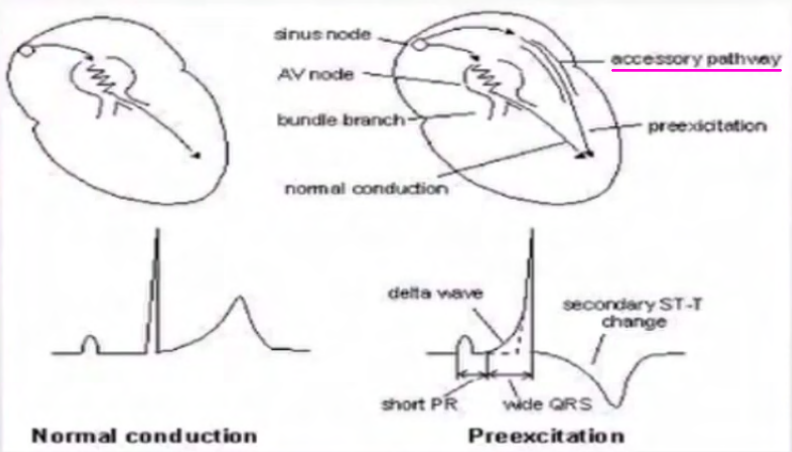
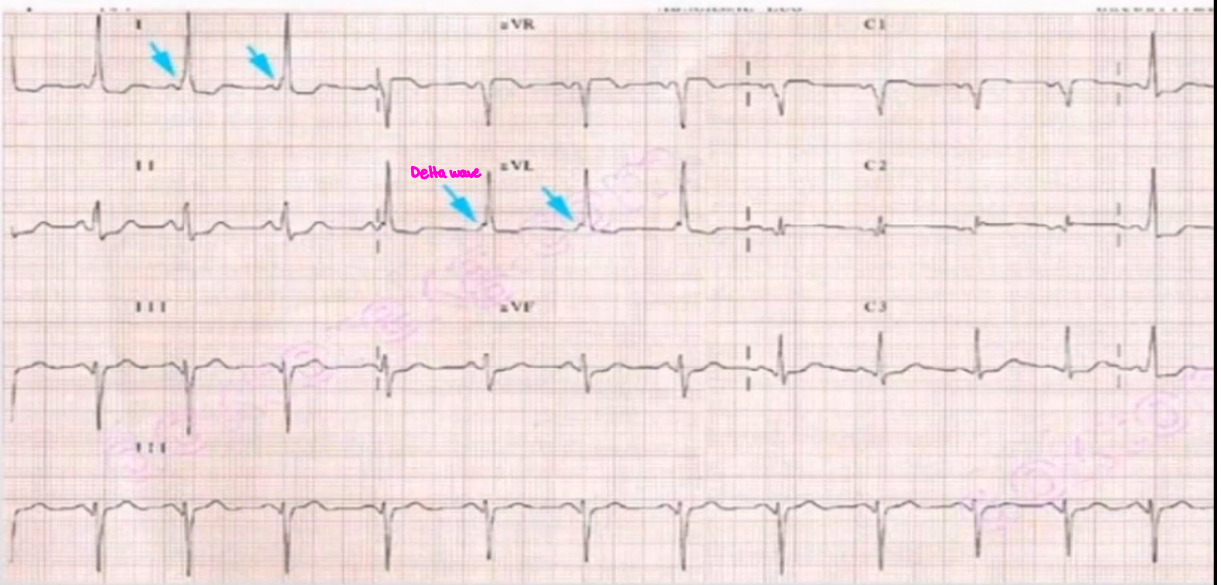
SVT: Wolf Parkinson White Syndrome (WPW)

Pre-excitation

Pathophysio:
→ Accessory conduction pathway (bundle of Kent) → by-passes AV node (responsible for slowing rate) → ventricles depolarize earlier





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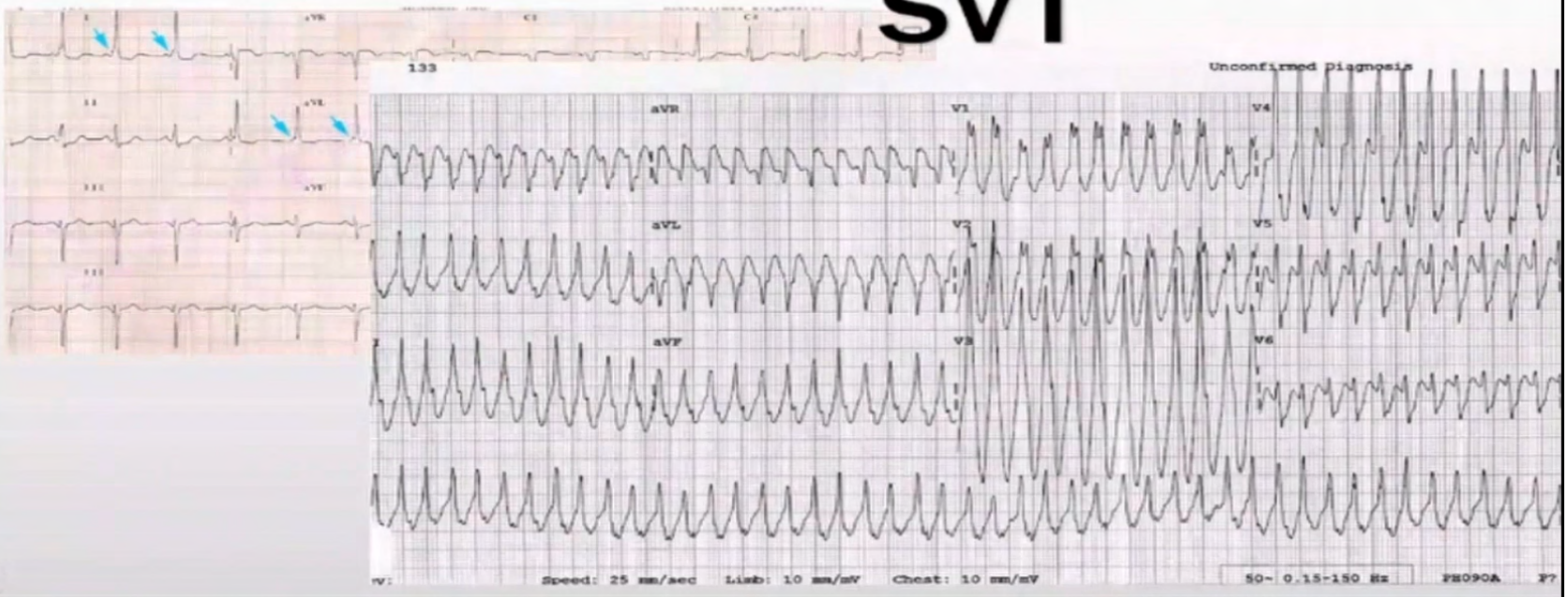
SVT: Wolf Parkinson White Syndrome (WPW)

Pre-excitation + SVT = WP



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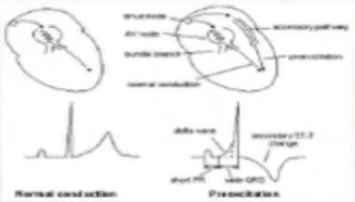
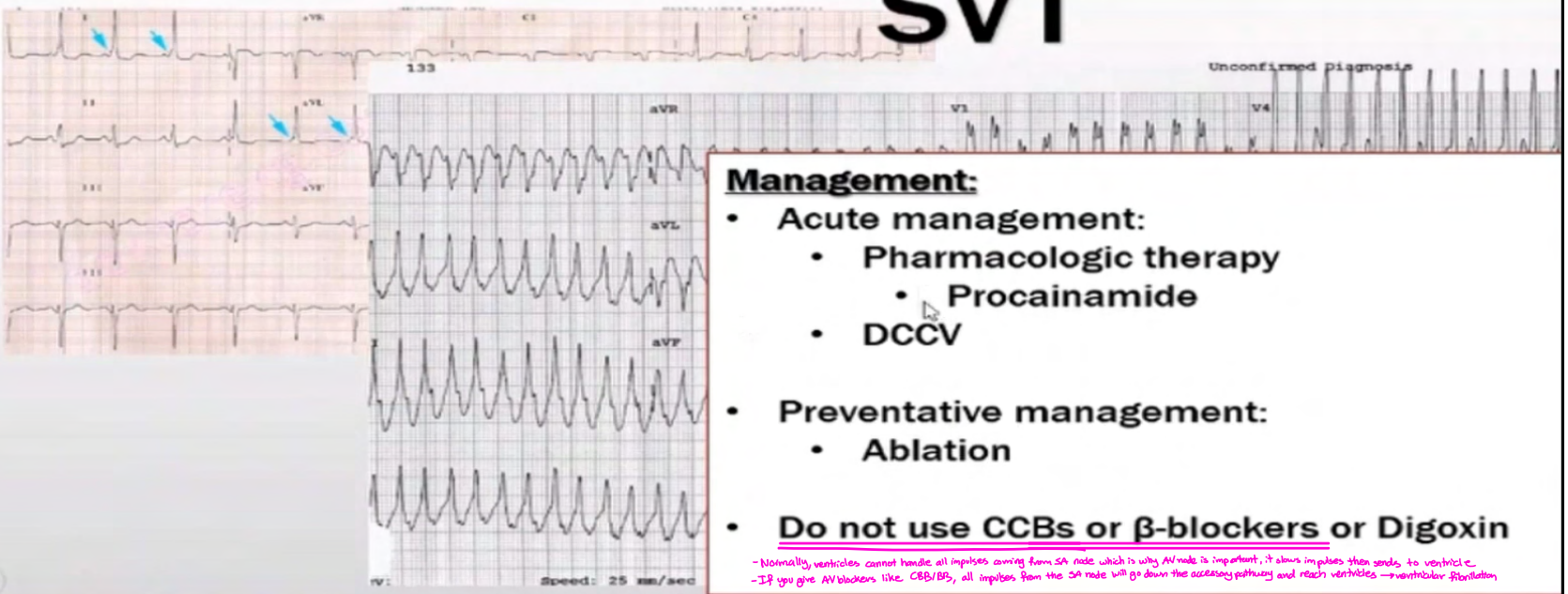
SVT: Wolf Parkinson White Syndrome (WPW)

Pre-excitation + SVT = WP





Management:

- Acute management:
  - Pharmacologic therapy
    - Procainamide
  - DCCV
- Preventative management:
  - Ablation
- Do not use CCBs or β-blockers or Digoxin

- Normally ventricles cannot handle all impulses coming from SA node which is why AV node is important, it slows impulses then sends to ventricle
- If you give AV blockers like CCB/BB, all impulses from the SA node will go down the accessory pathway and reach ventricles → ventricular fibrillation

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Ventricular Tachycardia (VT)

- Causes:
  - Ischemia
  - CAD with prior MI is the most common cause
  - Cardiomyopathies
  - Ventricular scar tissue
  - Congenital defects
  - Long QT syndrome
  - Electrolyte Abnormalities
  - Drug toxicity (antiemetics, antipsychotics, SSRIs, TCAs, macrolide and fluoroquinolone antibiotics)

Most commonly due to structural heart disease

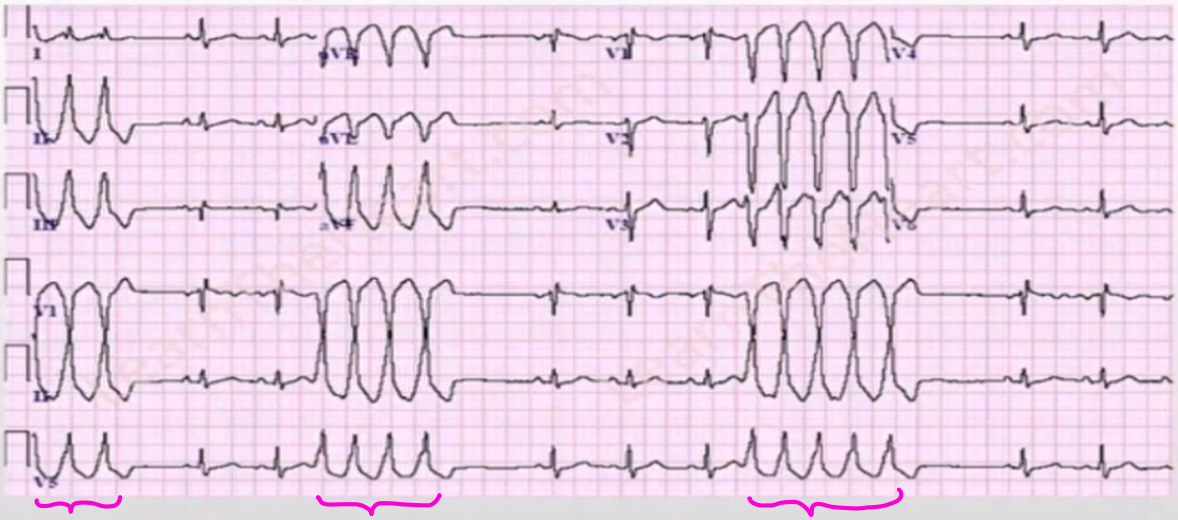
ex: azithromycin

Ventricular Tachycardia (VT)

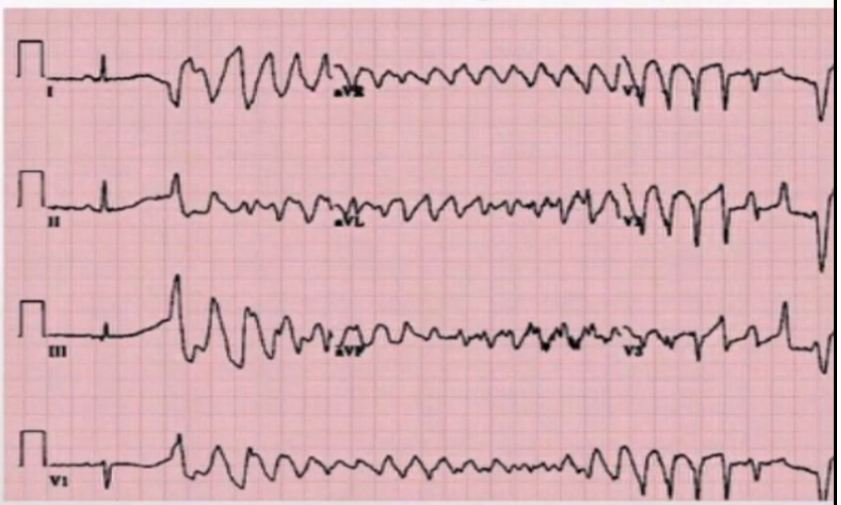
- Non-Sustained Ventricular Tachycardia (NSVT): < 30 seconds

1) Prolonged QT
2) Hypomagnesemia

Monomorphic



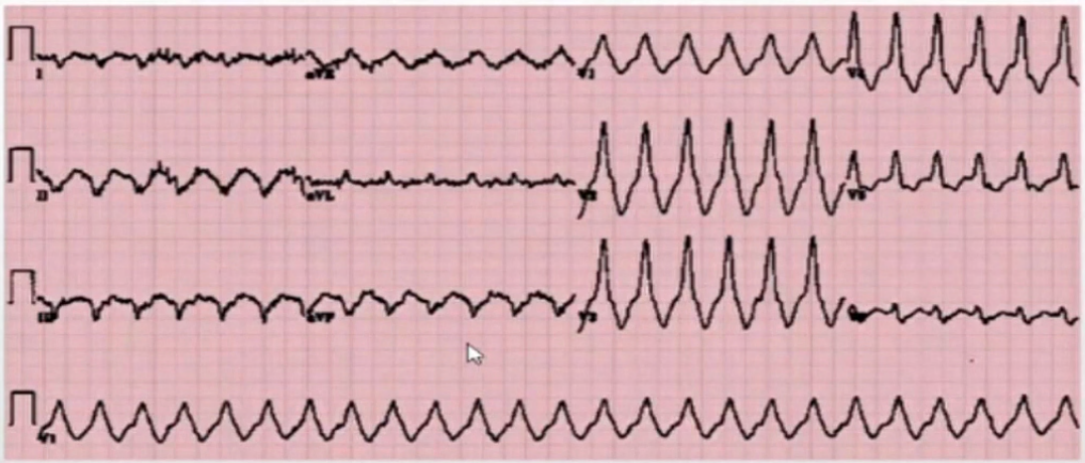
Polymorphic



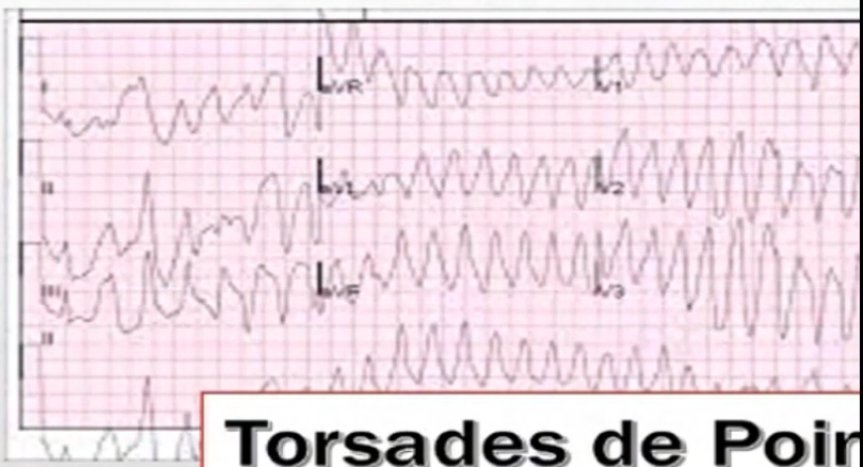
Ventricular Tachycardia (VT)

- Sustained Ventricular Tachycardia (NSVT): > 30 seconds

Monomorphic



Polymorphic



Torsades de Poin

Stable vs. Unstable?

we have time to treat with drugs

life-threatening → CARDIOVERSION

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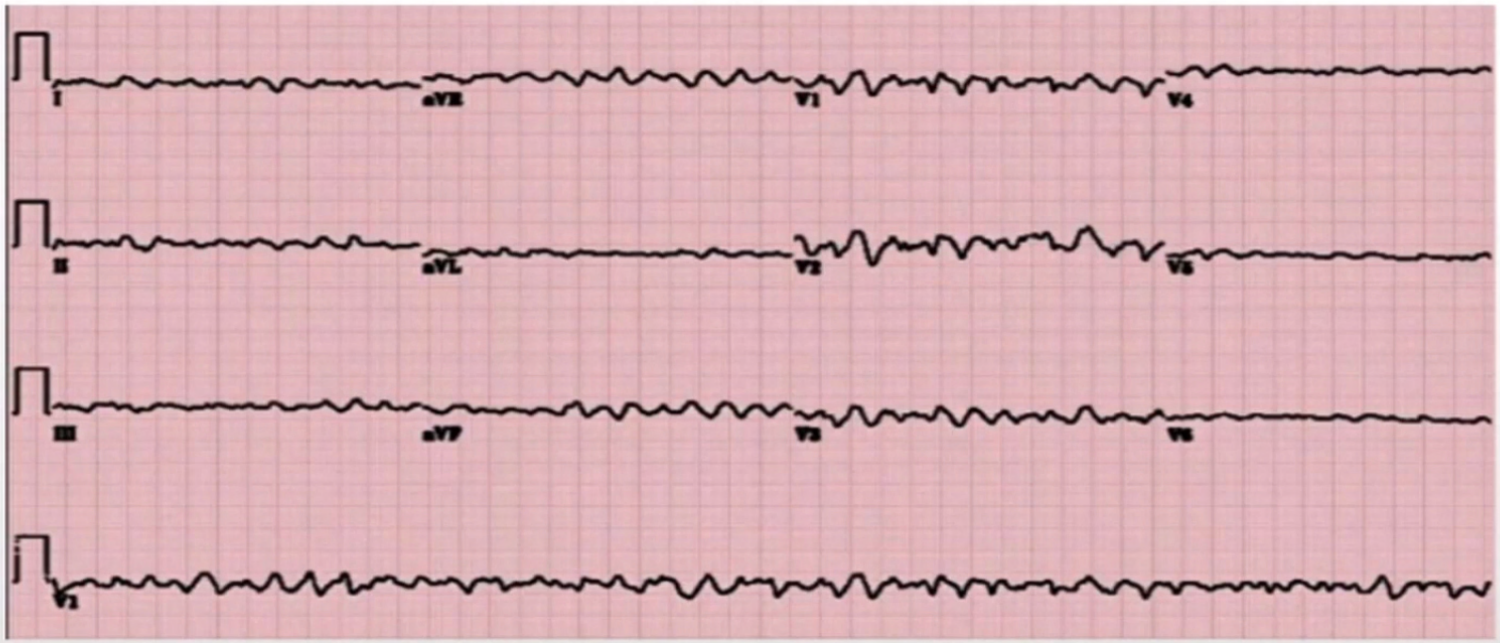
Ventricular Tachycardia (VT) - Stable

Management:

- Acute management:
  - Treat the underlying cause:
    - Ischemia
    - Correct Electrolyte Abnormalities
    - Remove Drug +/- Antidote
  - Pharmacological Therapy:
    - IV Amiodarone
  - DCCV

- Preventative management:
  - Consider ICD
  - Consider EPS

Ventricular Vibrilation (VF)

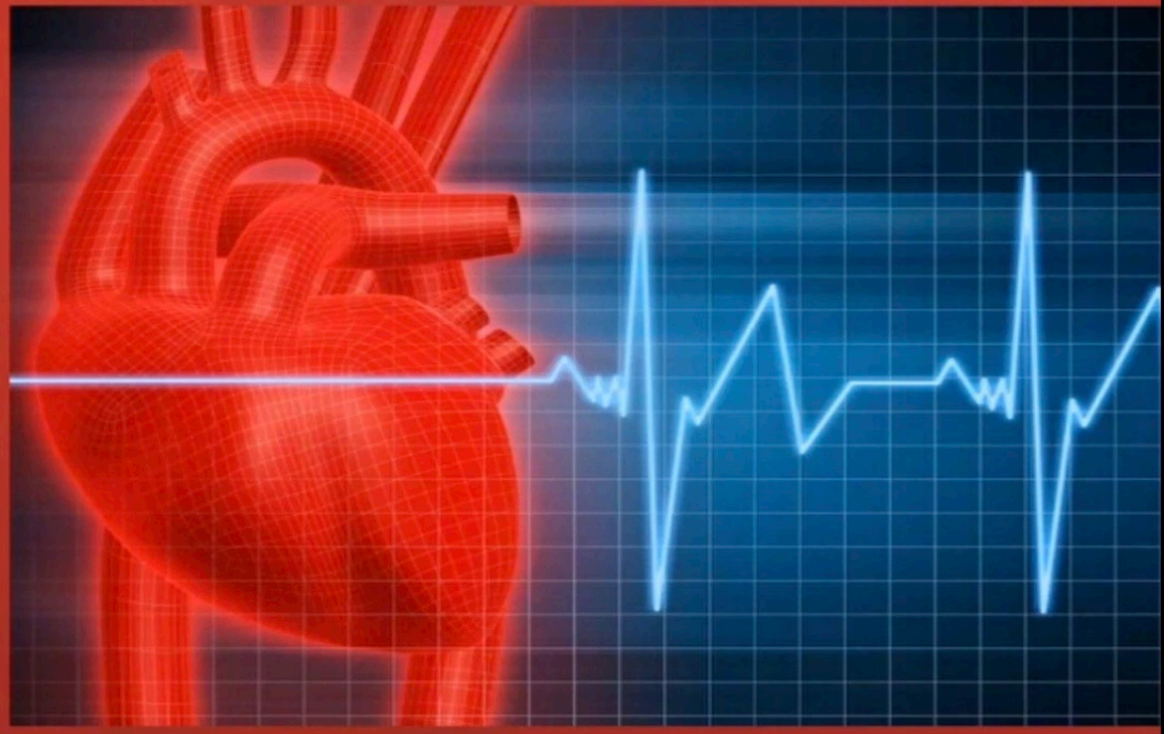


Code

Defibrill

& Unstable Sustained V

Bradyarrhythmias



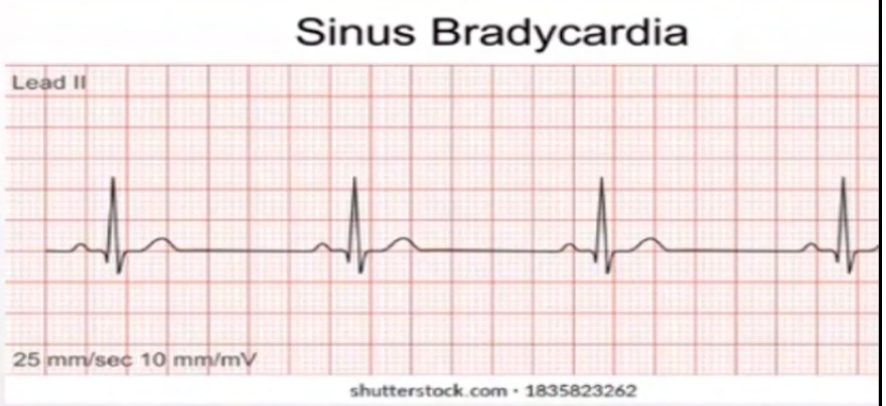
Akram Al-Saleh

Bradycardia

- Sinus Bradycardia
- Sick Sinus Syndrome (SSS)
- Atrio-Ventricular (AV) Block
  - 1st Degree
  - 2nd Degree
    - Mobitz Type I (Wenckebach)
    - Mobitz Type II
    - 2:1 Block
  - 3rd Degree (Complete)
- Pacemakers & Cardiac Devices

Sinus Bradycardia

- Rate < 60 bpm
- Causes:
  - Ischemia
  - Increased Vagal tone
  - Structural Heart Disease (Infiltrative, IE, ACHD)
    ↳ amilydosis
  - Medications (CCB, BB, digoxin)
  - Athletes



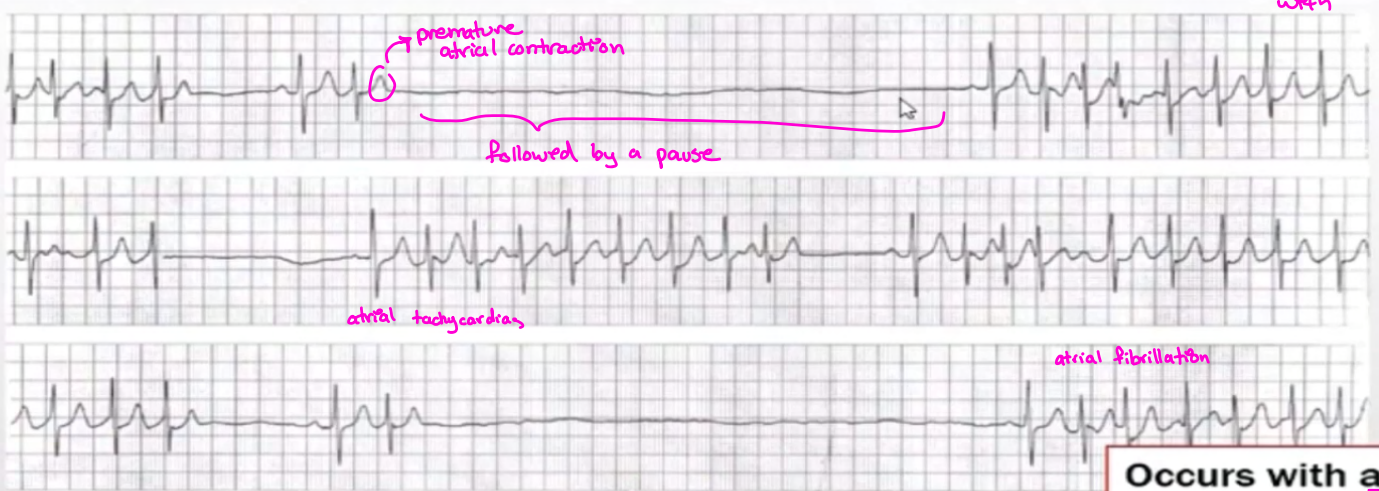
Clinical Status	Management
Asymptomatic	Observation
Symptomatic (Fatigue, Exercise Intolerance, Angina, Dizziness, Syncope) In eldery (benift from pacemaker)	① Rx Cause ② Atropine / B Agonist (Acute Adrenaline, Dopamine, isoprenaline Pacemaker (if severely slow and symptomatic)

Sick Sinus Syndrome (SSS)

- SA Dysfunction

Electrical system becomes old → SA dysfunction → AV blocks / BBB (associated with)

Tachy-brady syndromes



- Management:
  - Pacemaker placement

THEN

* If tachyarrhythmias ⇒ BB

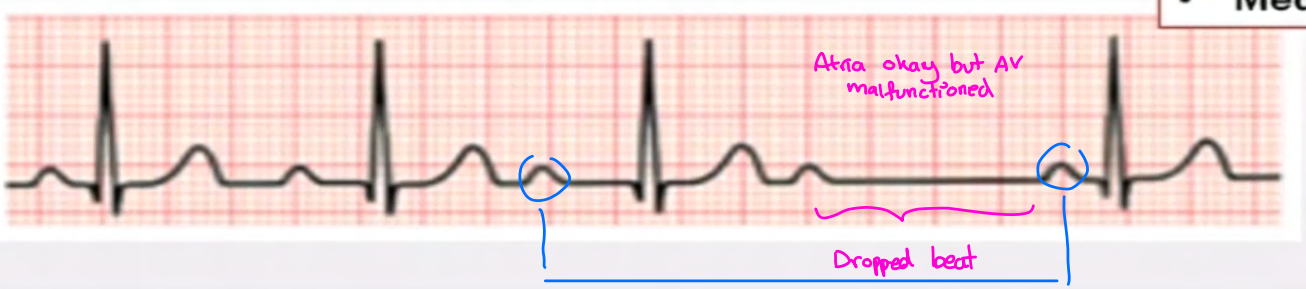
Occurs with advanced age (1)
Marked Persistent Sinus Bradycardia (2)
SA Pauses and Blocks (2)
Frequently associated with Tachy-Brady (3) Tachy-brady syndromes
Usually co-exists with AV nodal disea

Atrio-Ventricular (AV) Block

Causes:
- Ischemia
- Increased
- Structural
- Medicatio

- 2nd Degree AV Block – Mobitz Type I (Wenckebach)
  - Progressive PR Prolongation followed by a dropped QRS

1st degree
- Almost normal other than ↓
- prolonged PR >0.2 sec (but fixed)
- no dropped beats (no p without QRS)



- Management: (for 1st and 2nd degree)

Clinical Status	Management
Asymptomatic	Observation
Symptomatic (Fatigue, Exercise Intolerance, Angina, Dizziness, Syncope) • You need to connect symptom with bradycardia (to rule out other causes)	Rx Cause Atropine / B Agonist (Acu Pacemaker

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Note:

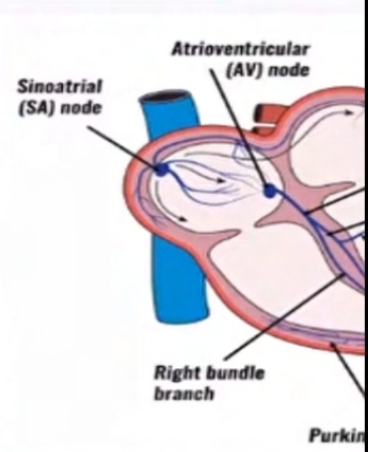
Sinus bradycardia, 1st degree AV block, 2nd degree AV block_Mobitz type 1, are all benign + above AV node, have same causes and treated the same

Difference on ECG:
- Sinus brady: completely normal, ↓ rate
- 1st degree AV block: normal except prolonged PR >0.2 sec
- 2nd degree AV block-MT1: progressive PR prolongation followed by a dropped beat

Atrio-Ventricular (AV) Block

- 2nd Degree AV Block – Mobitz Type II
  - ~~Progressive~~ PR Prolongation followed by a dropped QRS

Non-progressive (fixed)



* same as first degree but with dropped beat
* fixed PR

  - Management:
    - Pacemaker placement indicated

(whether they're symptomatic or asymptomatic)

Pathophysio: under bundle of His

Atrio-Ventricular (AV) Block

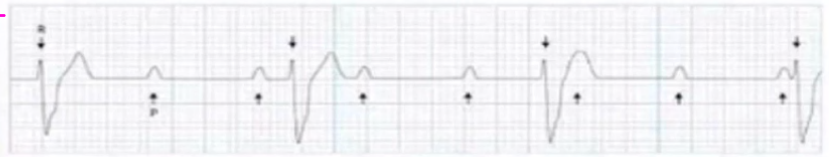
- 2nd Degree AV Block (2:1 Block)
  - Alternating conducted QRS followed by a dropped QRS

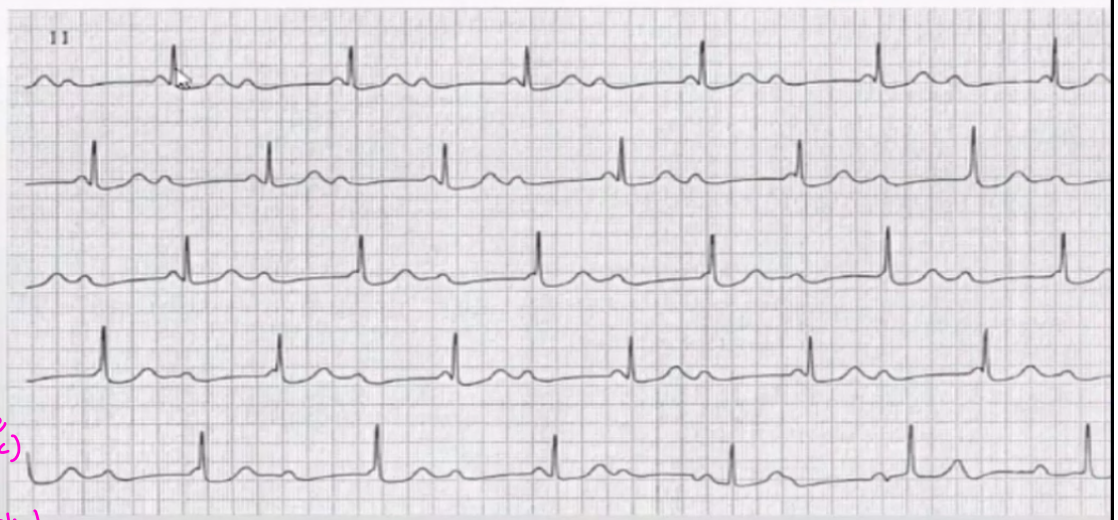
* Dx: more prolonged monitering (to differentiate with wencheback)

- Management:
  - Needs further evaluation

Atrio-Ventricular (AV) Block

- 3rd Degree AV Block (COMPLETE HEART BLOCK)
  - P > QRS
  - AV Dissociation
  - * P-R all over the place (each working alone)
    - ↳ Ps beating on their own
    - ↳ QRSs on their own
  - Management:
    - Medical Emergency
    - Emergent Pacer placement



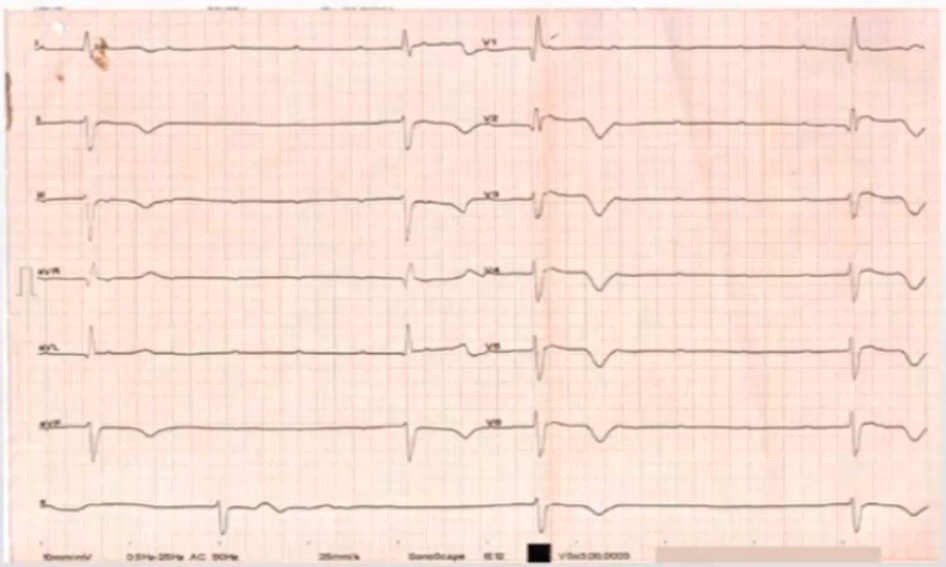


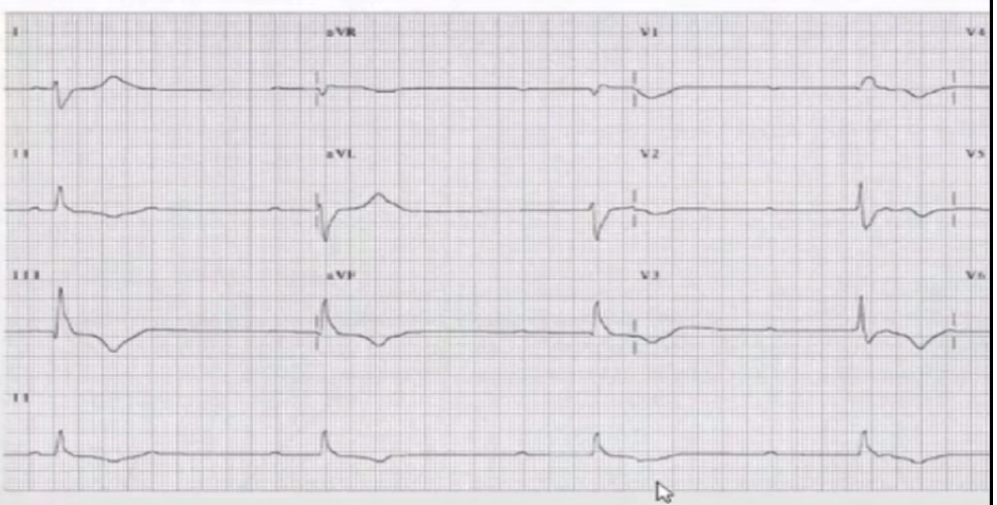
Differential causes
- complete heart block (Ps are more than QRSs)
- v. tachycardia (QRSs more the Ps)

Narrow or wide QRS?
- Depends on who picked up rythym from AV node (escape rythym)
  - ventricles (slow, more symptomatic)
  - junctional (faster, more stable, symptomatic)
- ventricles → wide
- close to AV node → narrow (ex: bundle of His)

Atrio-Ventricular (AV) Block

- 3rd Degree AV Block

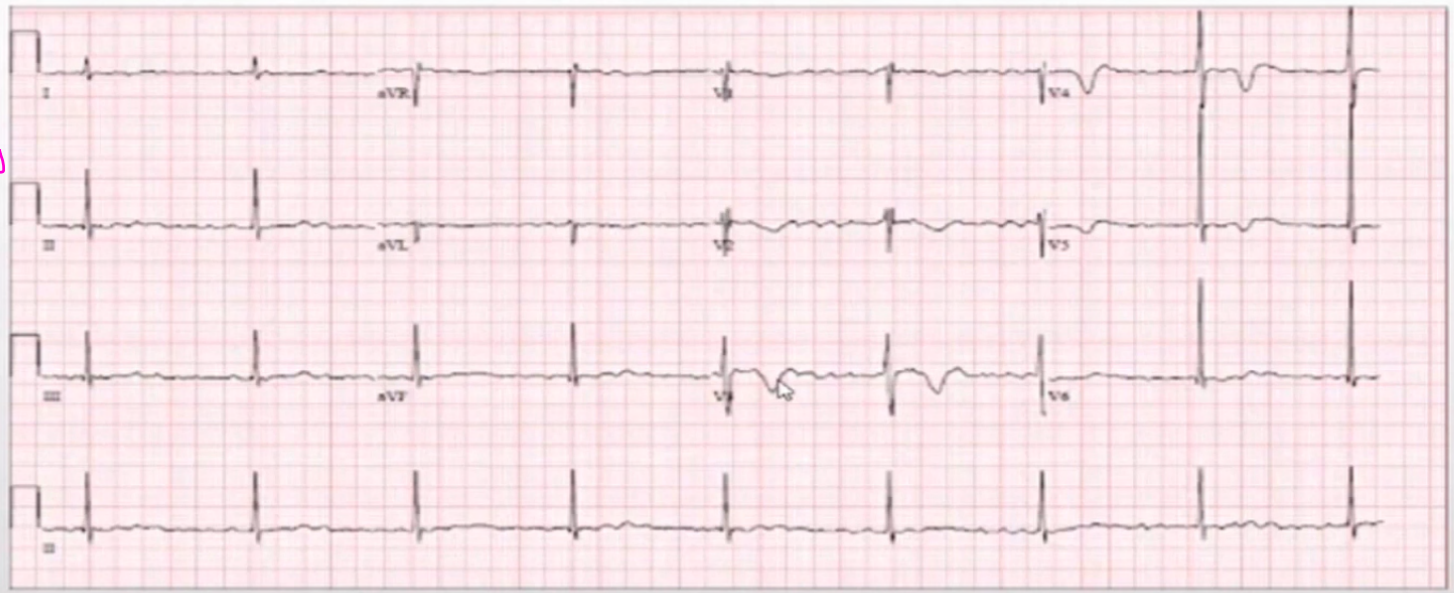




Atrio-Ventricular (AV) Block

- 3rd Degree AV Block

In this ECG patient first had baseline A fib then developed complete heart block on top ⇒ suggestive of digoxin toxicity

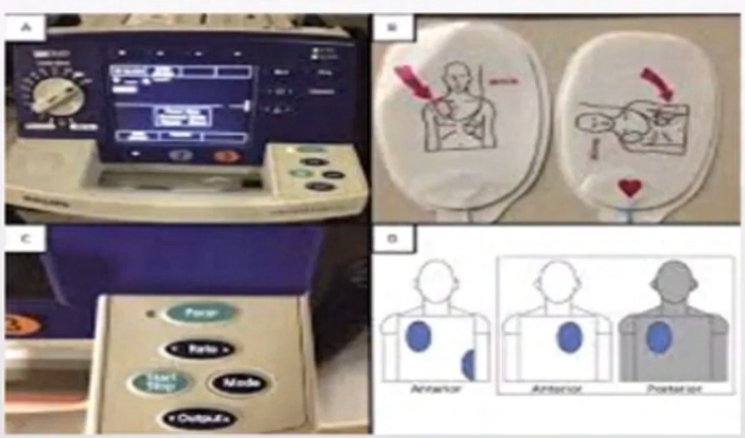


Pacemakers & Cardiac Device

Temporary

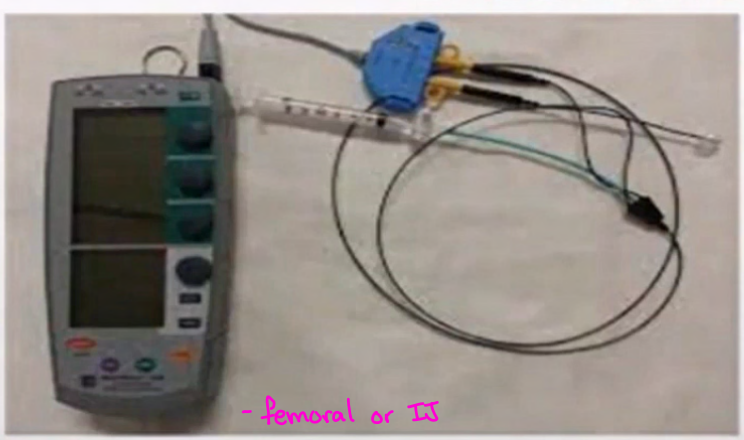
(acute emergencies where HR ↗ systolics ↘ 80s)

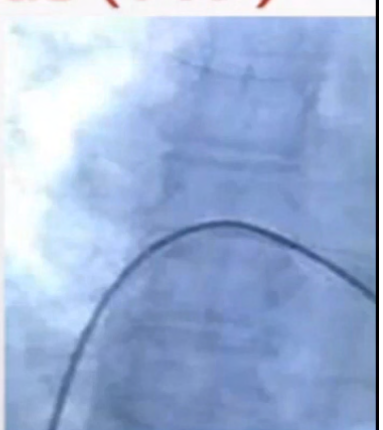
Transcutaneous



When?
- in emergency cases
- to treat temporary causes

Transvenous (TVP)

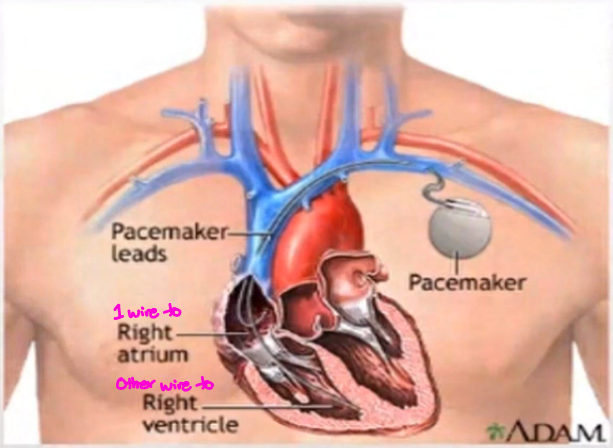


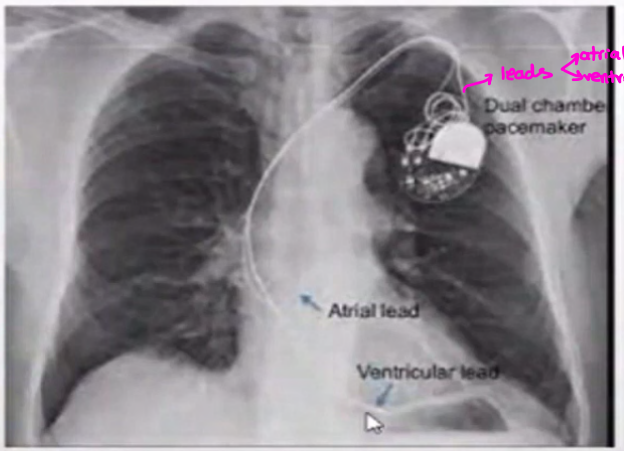


- femoral or IJ
- patient cannot move
- risk of infection
- risk of perforation of heart

Pacemakers & Cardiac Devices

Permanent Pacemaker (PPM)

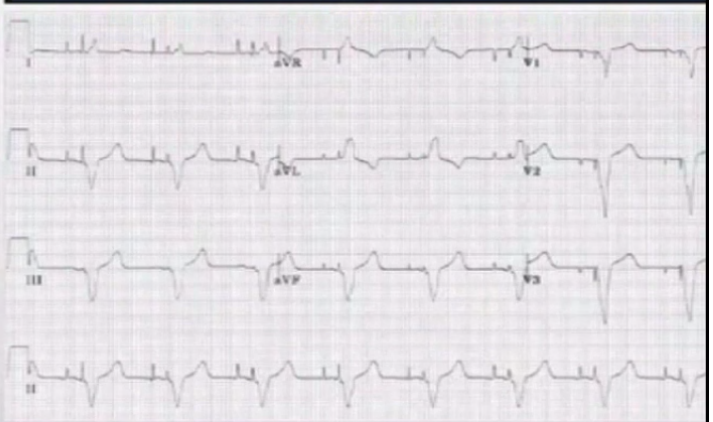




- Single lead (only in ventricle) vs. dual lead (atria and ventricle)

Functions (do not memorize but know that letters before PM have to do with function)

Letter I	Letter 2	Letter 3	Letter
Chamber Paced	Chamber Sensed	Sensing Response	Programm
A = Atrium	A = Atrium	T = Triggered	P = Sim
V = Ventricle	V = Ventricle	I = Inhibited	M = Multiprogra
D = Dual	D = Dual	D = Dual (Inhibits Both the Atrium & Ventricle)	R = Rate Ad
O = None	O = None	O = None	O = No



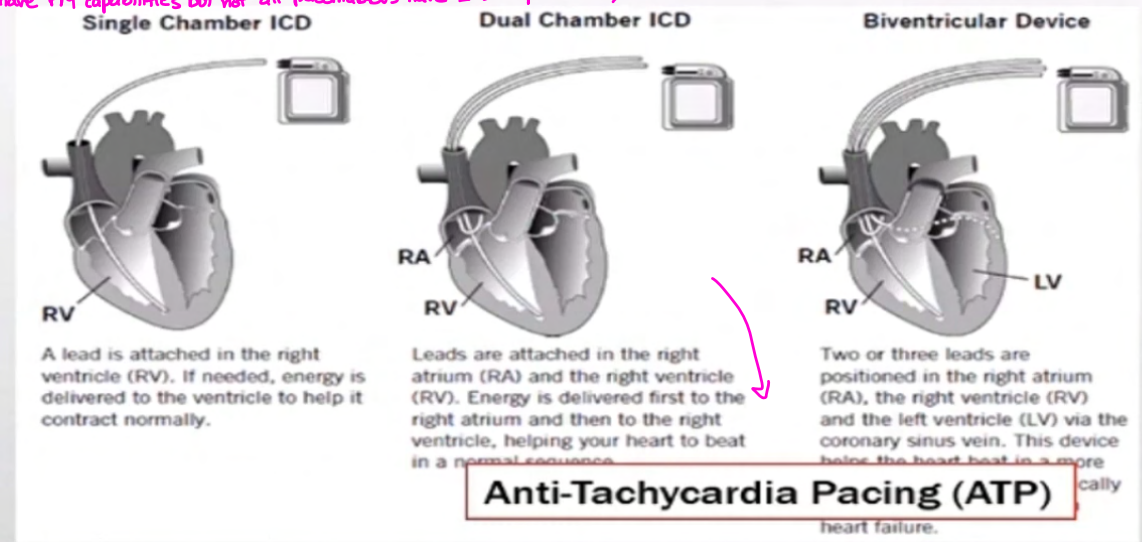
*Paced rythym is WIDE (since we are not using our own ventricles which is fast/narrow)

Pacemakers & Cardiac Devices

Implantable Cardiac Defibrillator (ICD)

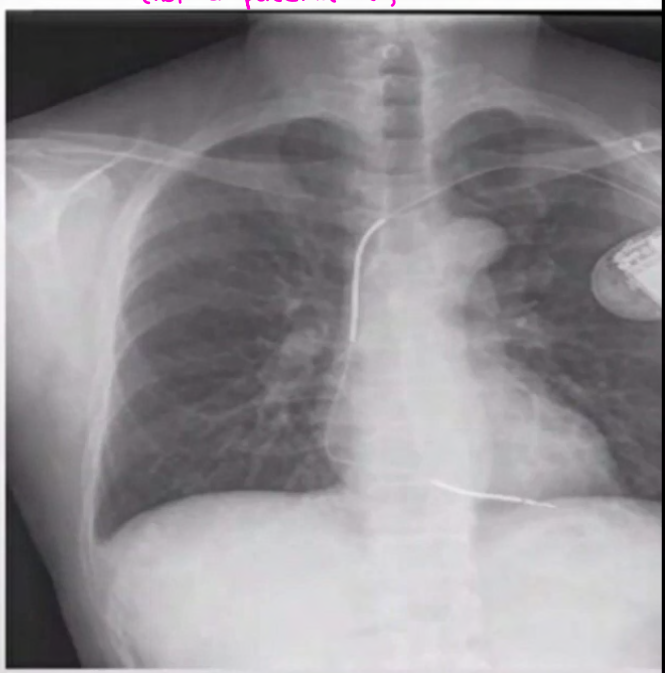
* Like a policeman
  ↳ if ventricular tachy → gives shock that is life-threatening

* They have pacemaker capabilities
(All ICDs have PM capabilities but not all pacemakers have ICD capabilities)



Anti-Tachycardia Pacing (ATP)

(not a pacemaker)



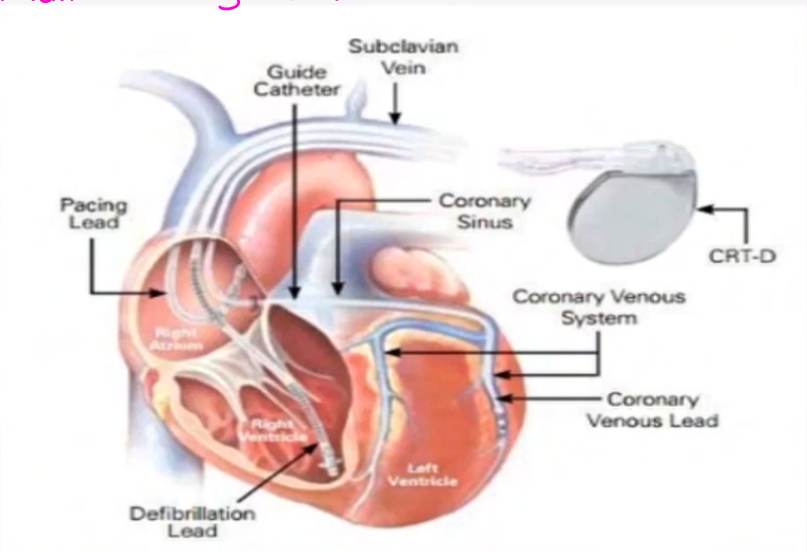
Pacemakers & Cardiac Devices

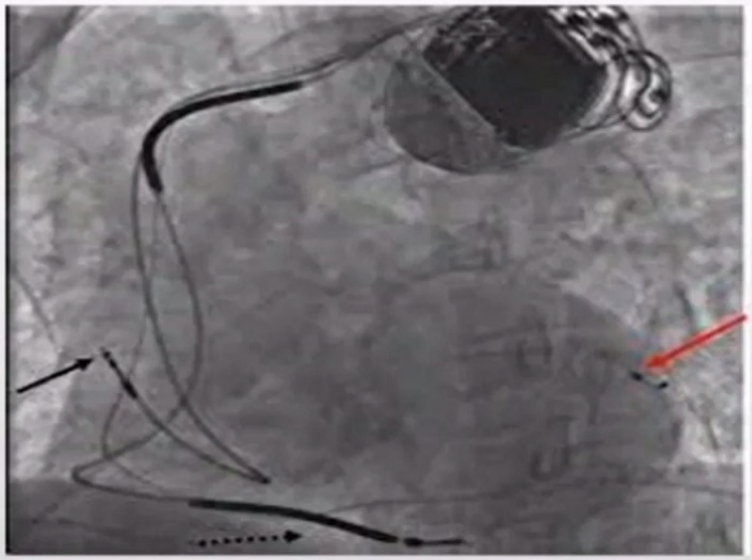
Cardiac Resynchronization Therapy (CRT)

3 leads:
1 in atria, 1 in ventricle

synchronized between atria vs. ventricle + ventricle vs. ventricle ⇒ when? HEART FAILURE

1 in vein → coronary sinus → ventricular vein





AKA
Bi Ventricul
(BiV P

Type
CRT - P
CRT only

Pacemakers & Cardiac Devices

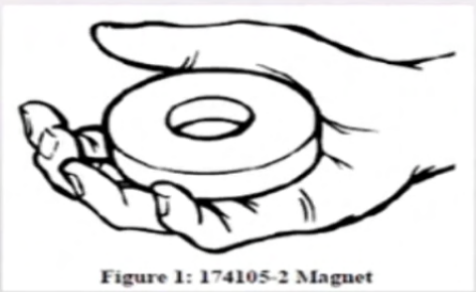


Figure 1: 174105-2 Magnet

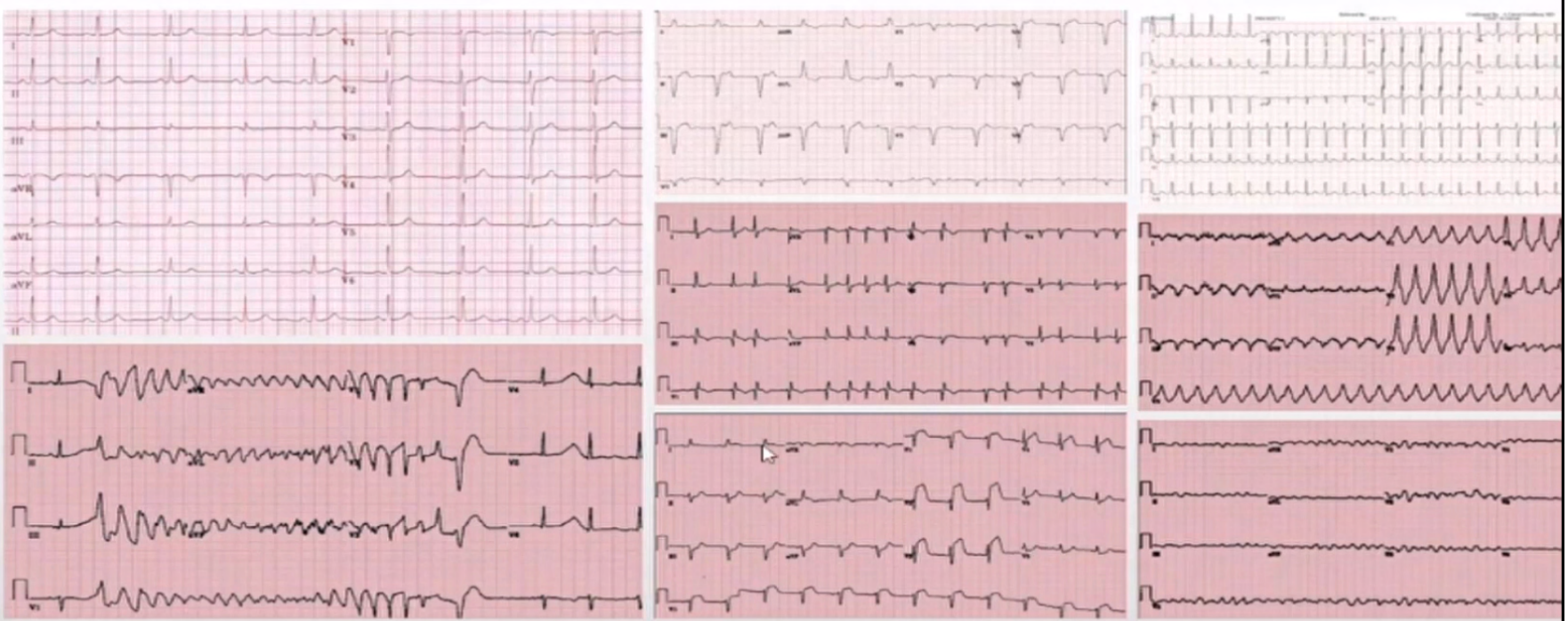
Magnet Mode

IMP for practical life - cautery

	Magnet Mode ON
Pacemaker	Asynchronous Pacing
ICD	Defibrillator OFF

USES
1) If patient going to surgery (cautery) and has pacemaker
2) In defibrillation if pt has an ICD

Cardiac Arrhythmias



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