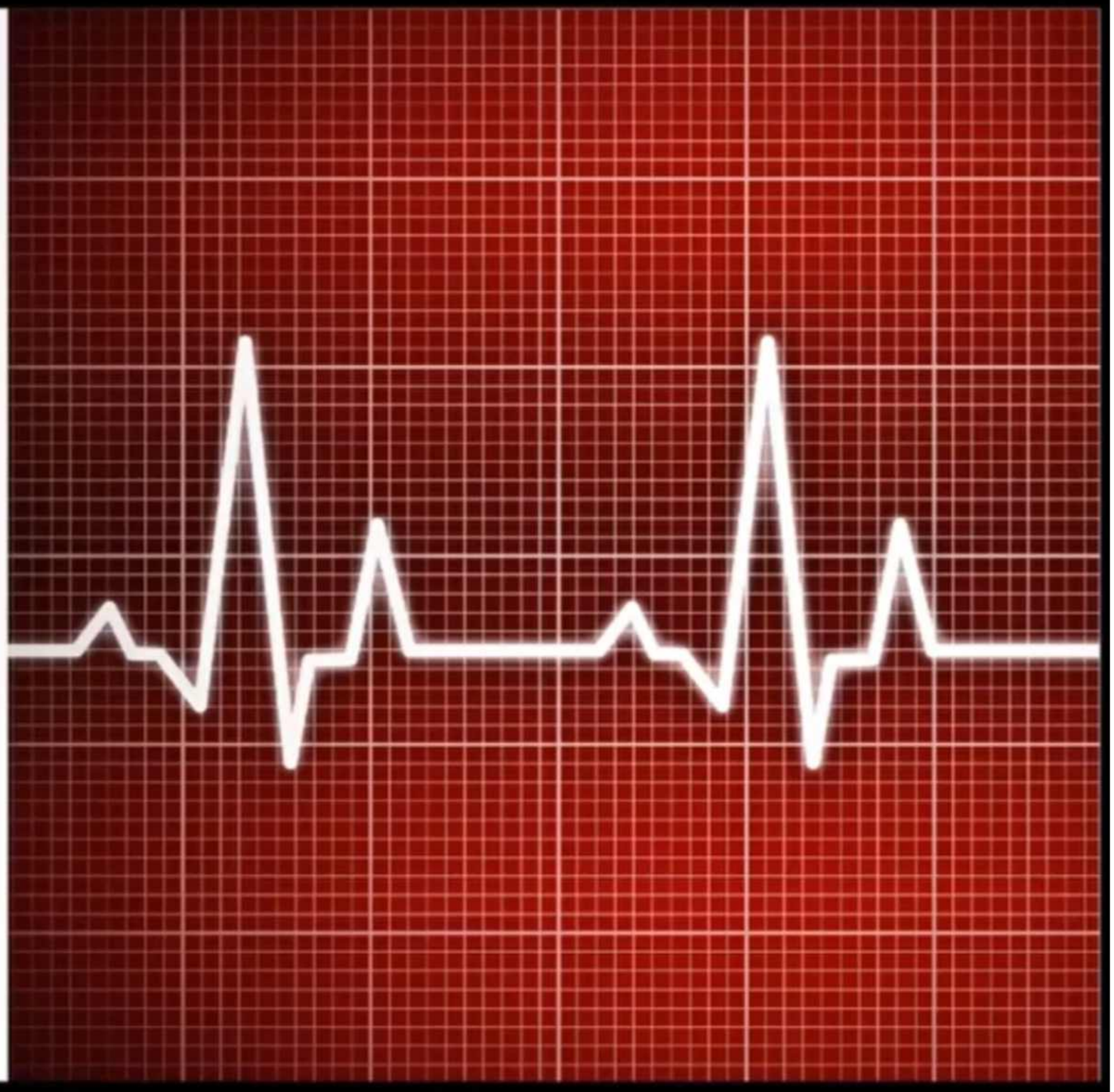

Cardiac Arrhythmias

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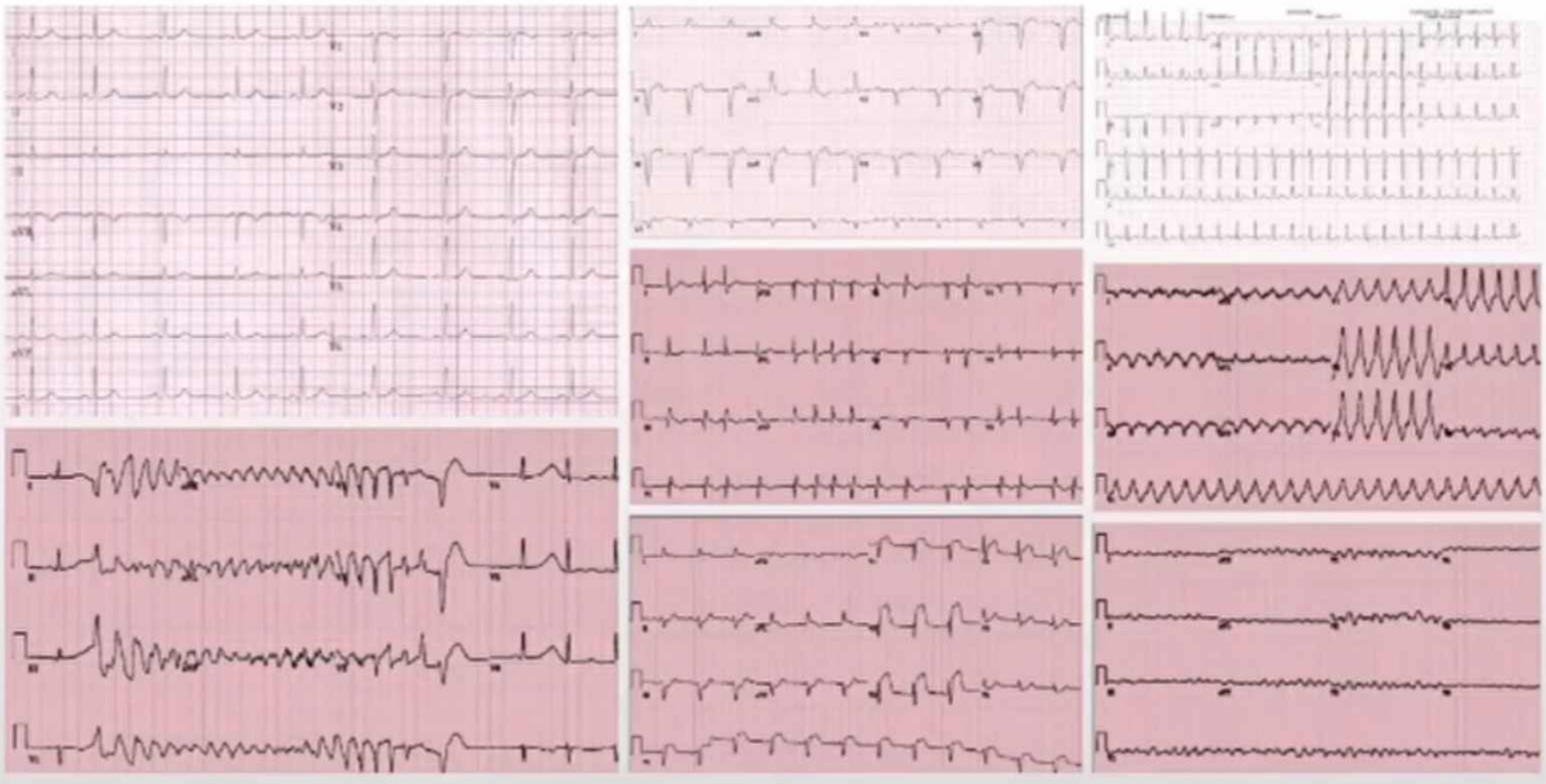
ASSOCIATE PROFESSOR OF INTERNAL MEDICINE

Edited by: Ruaa Hdeib

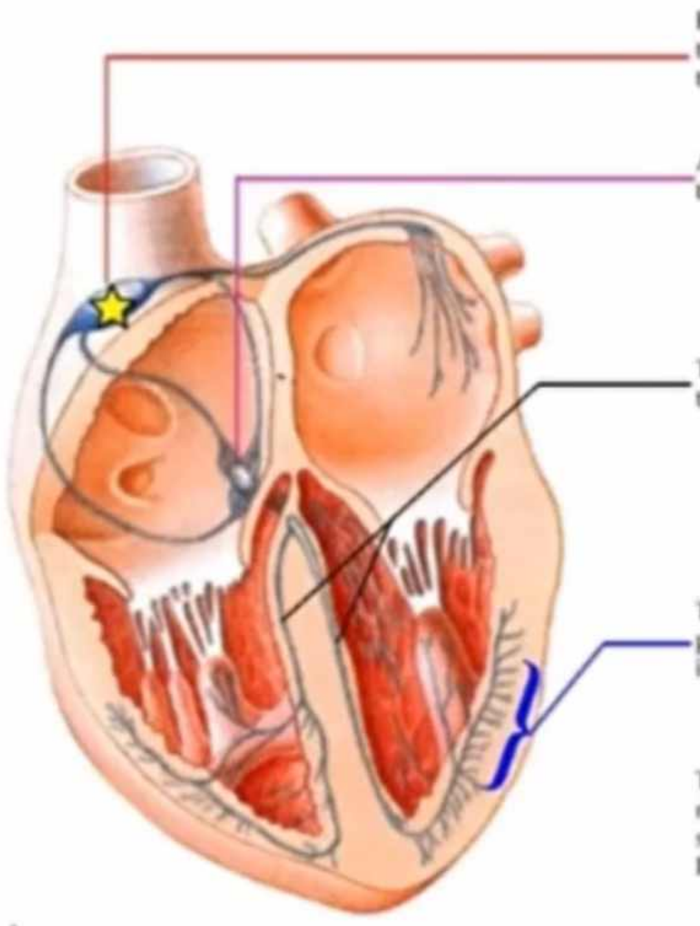
Cardiac Arrhythmias



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



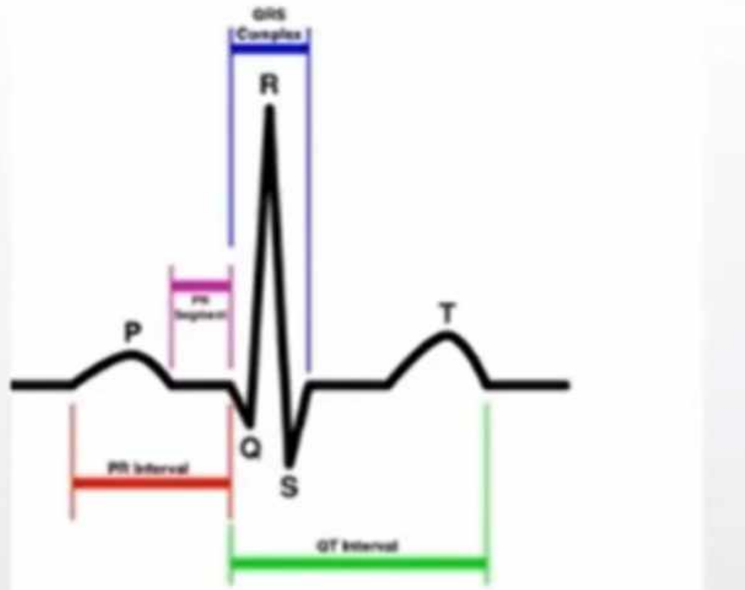
Electrical activity starts at the SA Node, this is seen as the P-wave, and the duration it makes the PR interval, this symbolizes the contraction of the atrium.

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

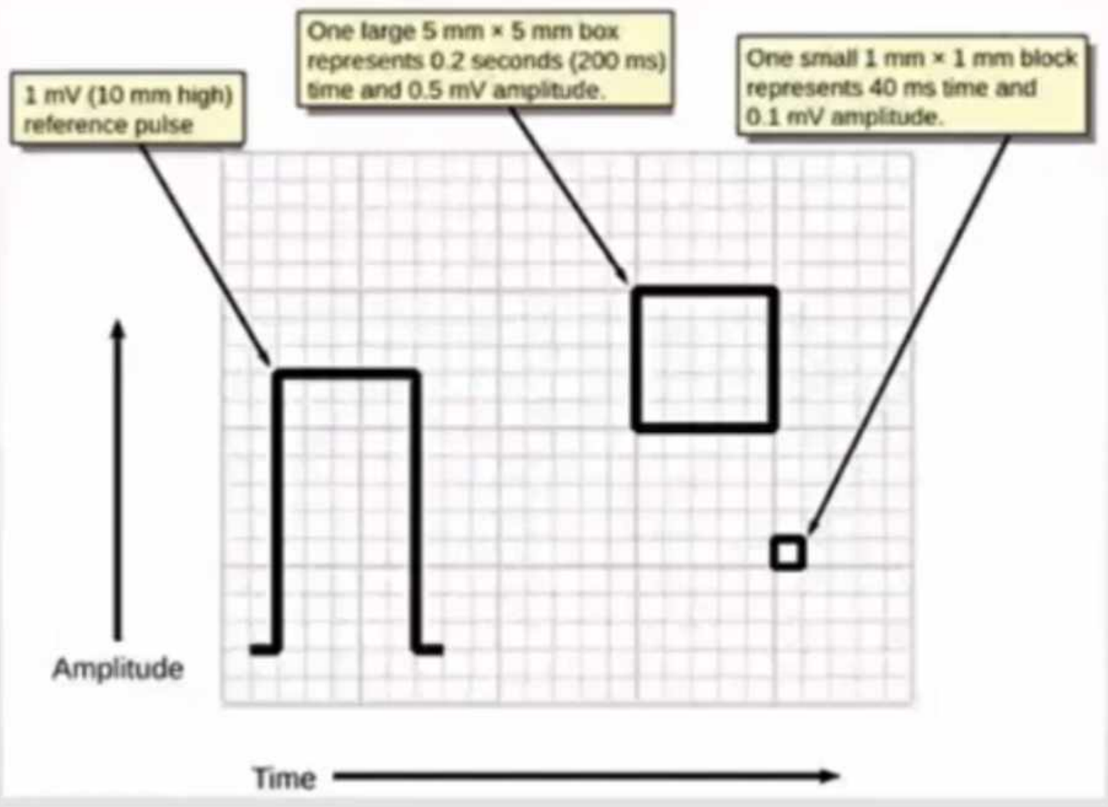
- **Approach to Reading ECG:**
  - Verify

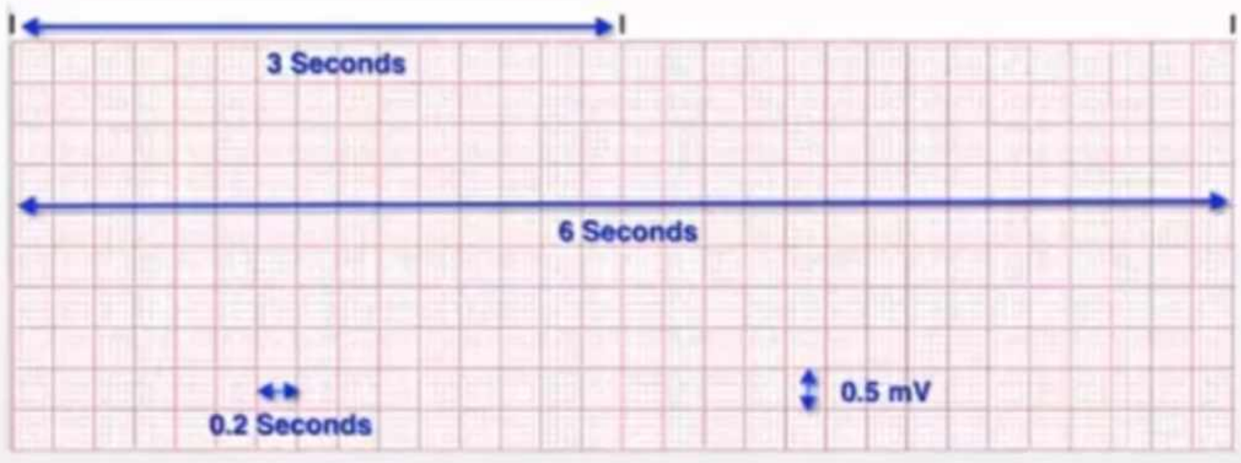
  - **R**ate
  - **R**hythm

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

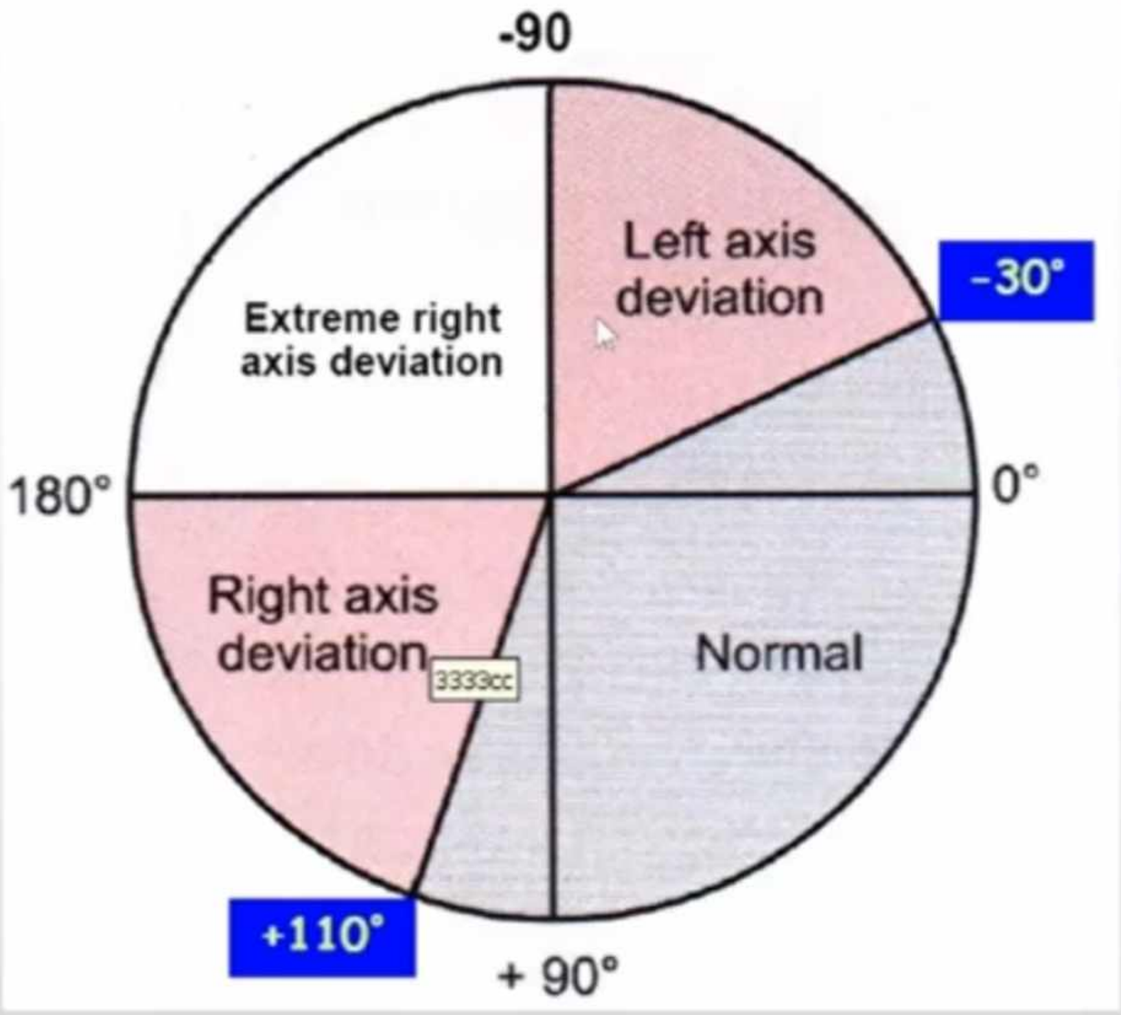
- Distance between QRS-QRS complex
  - Rate = 300 / Large Boxes
  - Rate = 1500 / Small Boxes

# 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?

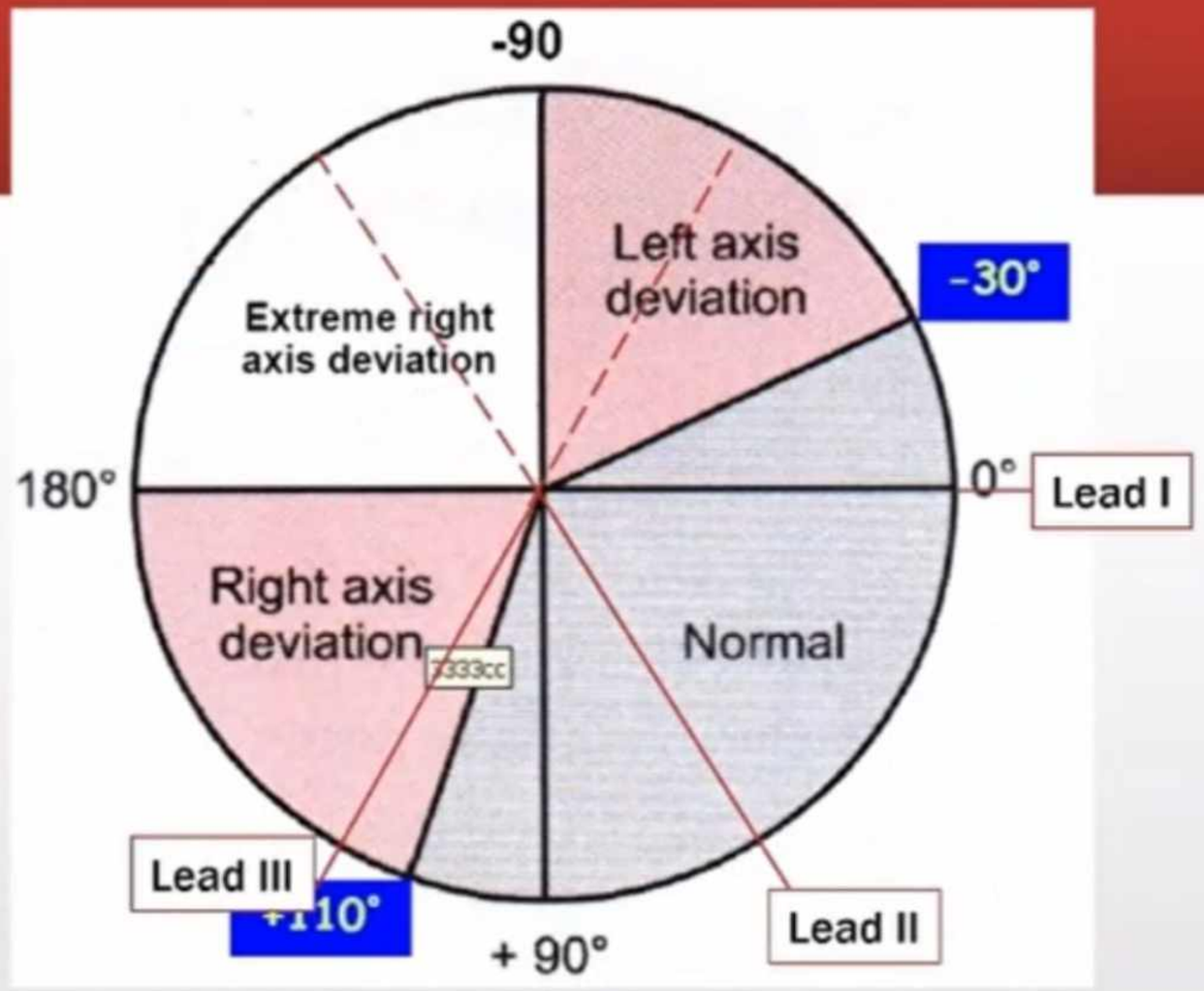
ECG Basics - Axis



ECG Basics - Axis

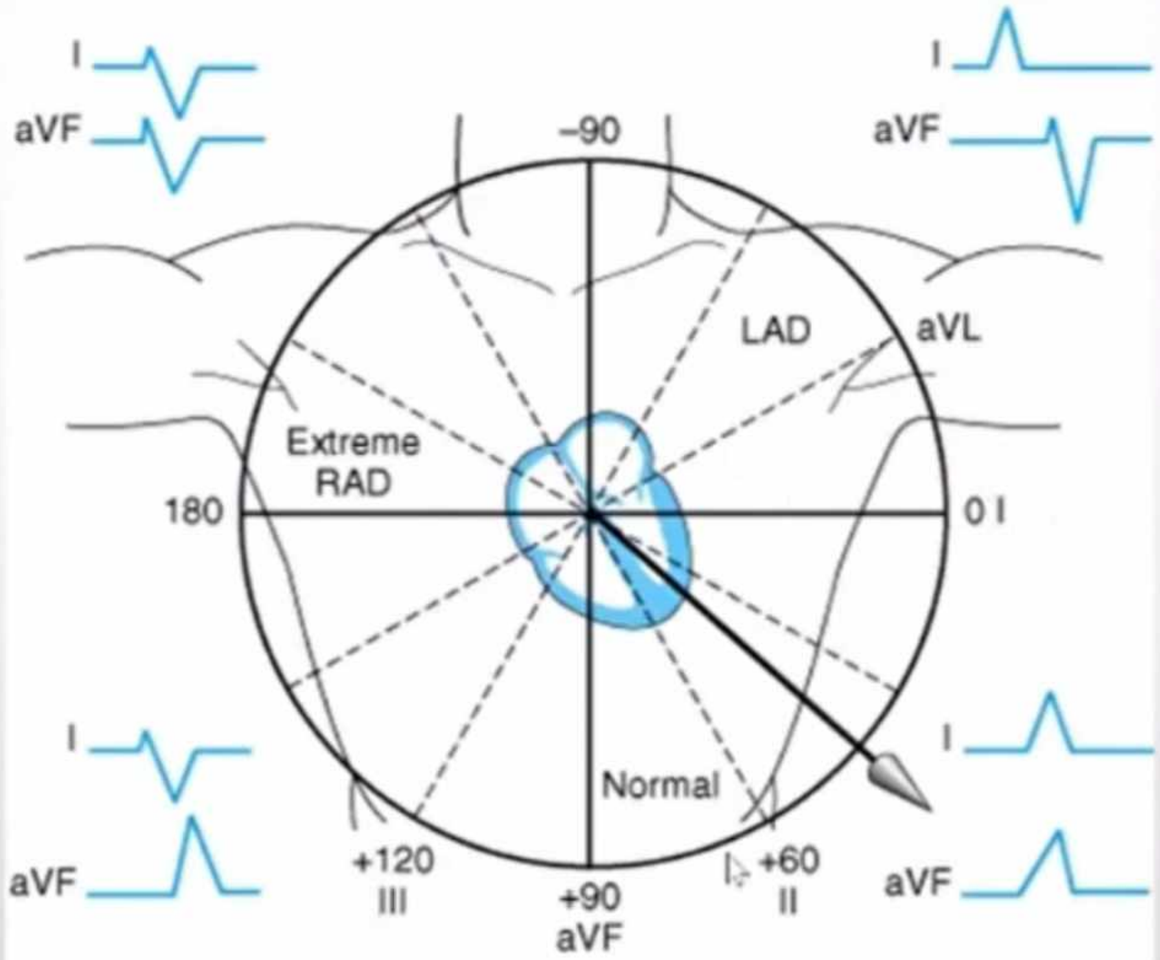
- Heart Axis Calculation Methods:
  - Lead I, II & III

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

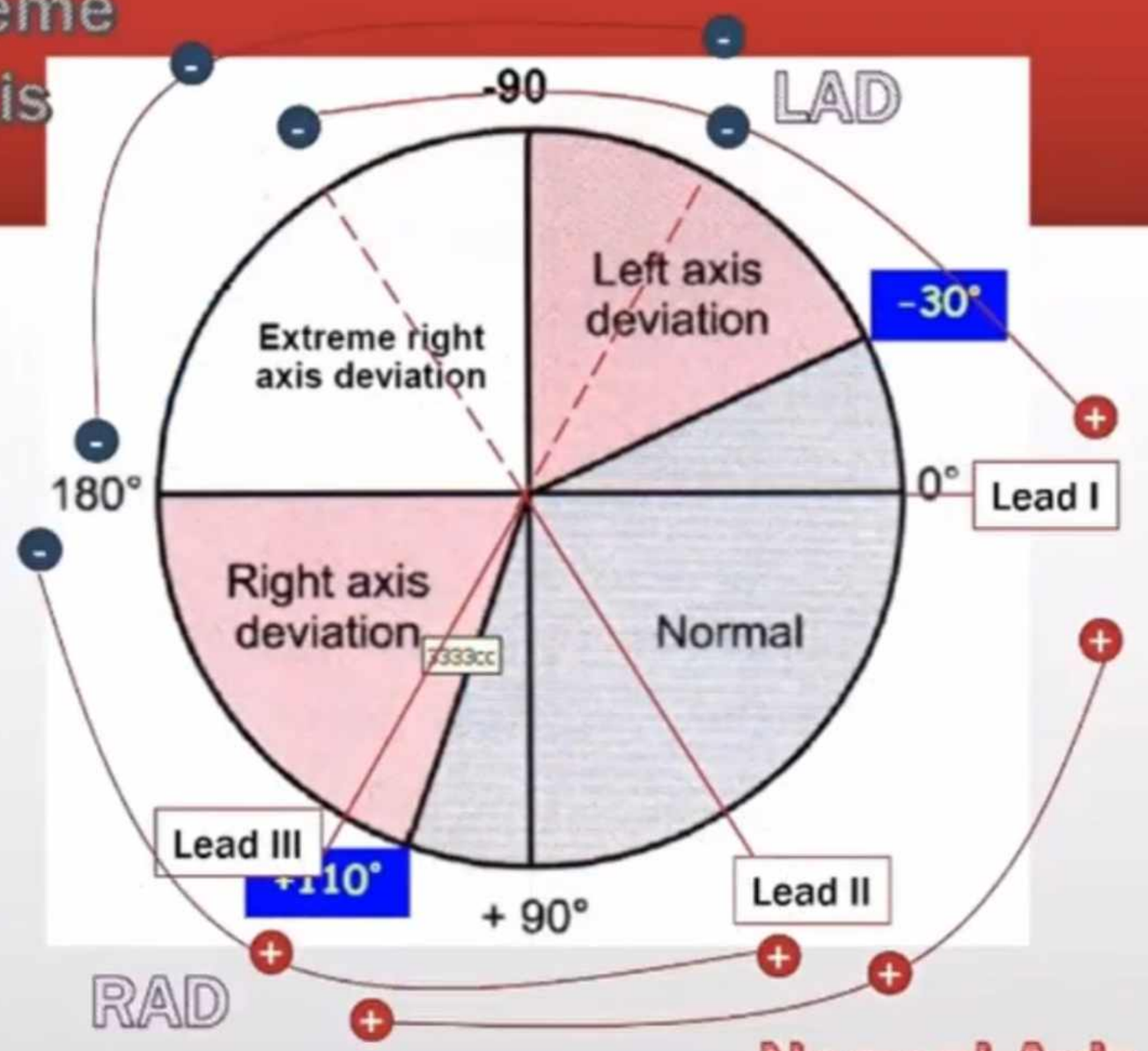
- Heart Axis Calculation Methods:
  - Lead I & Lead AVF



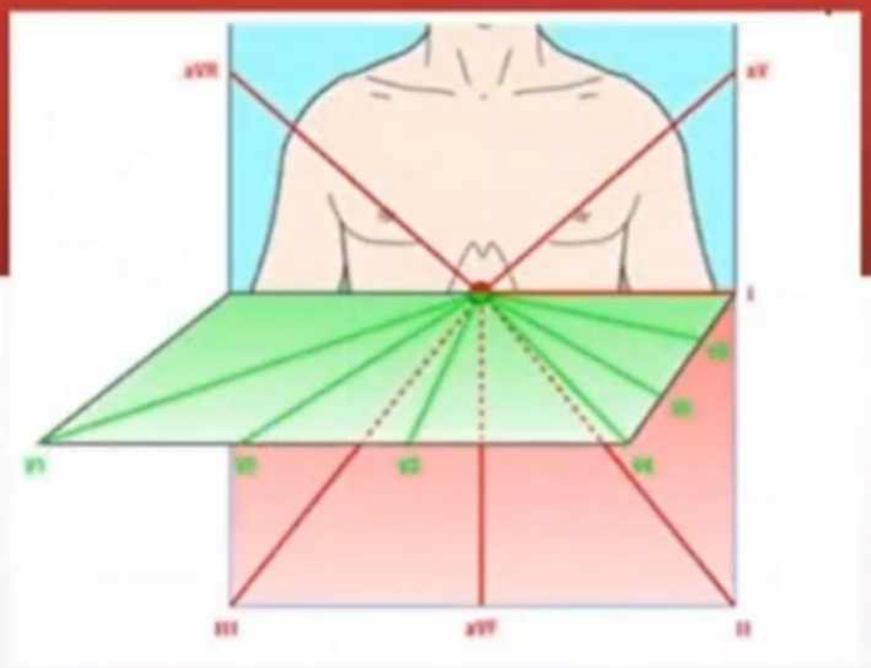
ECG Basics - Axis

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

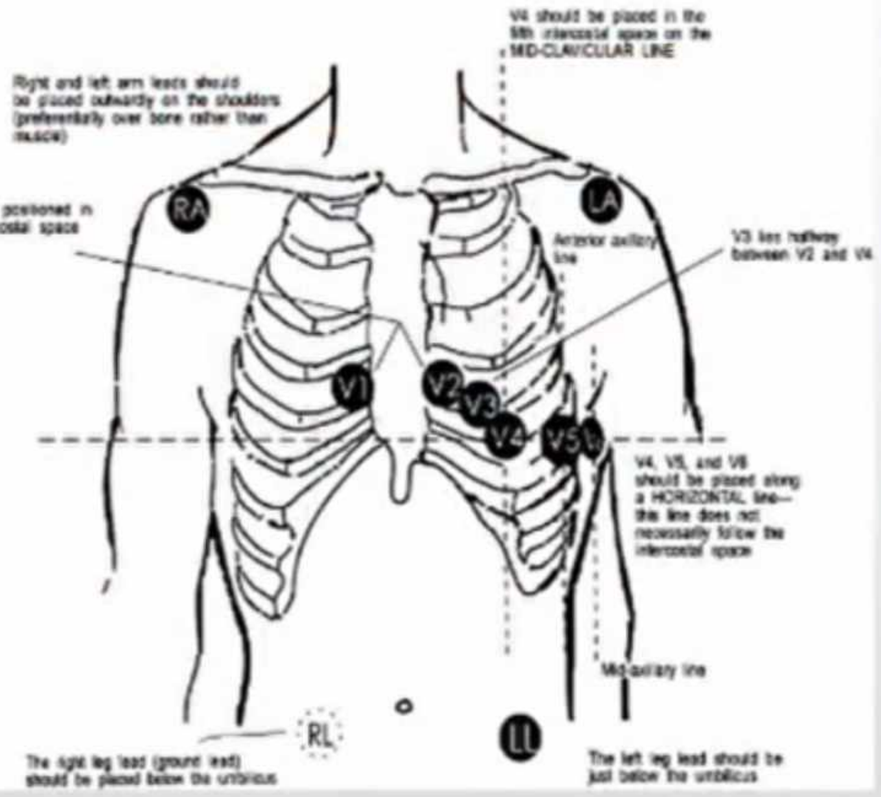
Axis	Lead I	Lead II	Lead III
Normal	Positive	Positive	Positive
LAD	Positive	Negative	Negative
RAD	Negative	Positive	Positive
Extreme Axis	Negative	Negative	Negative



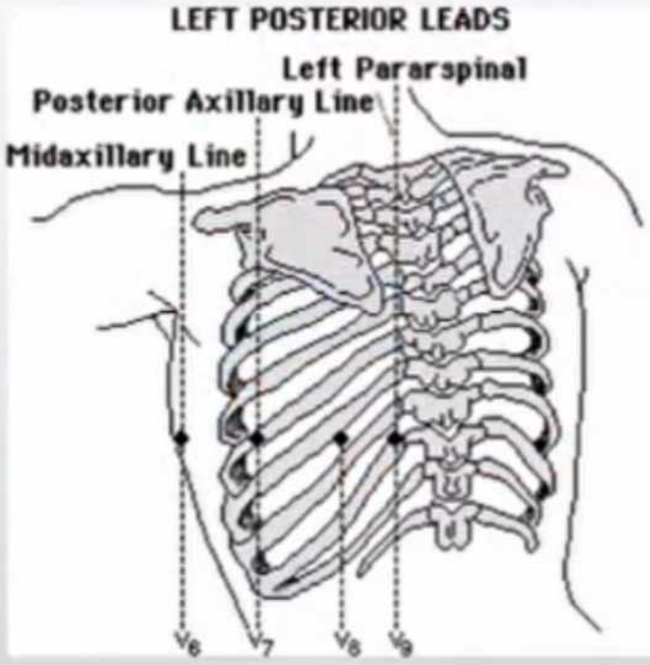
ECG Basics - Axis

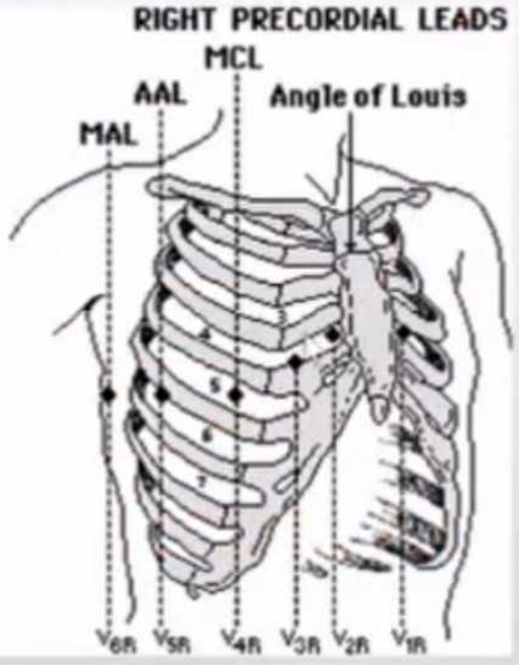


12-lead ECG Electrode Placement



Internet Source: circ.ahajournal.org





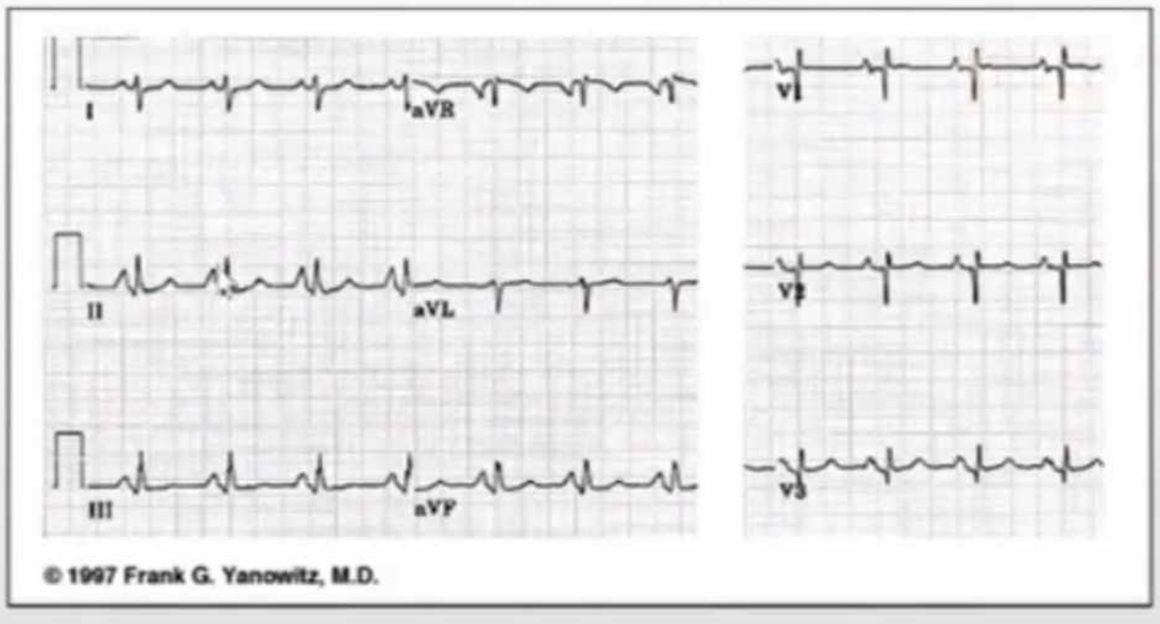
ECG Basics – Amplitude / Hypertrophy

- 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

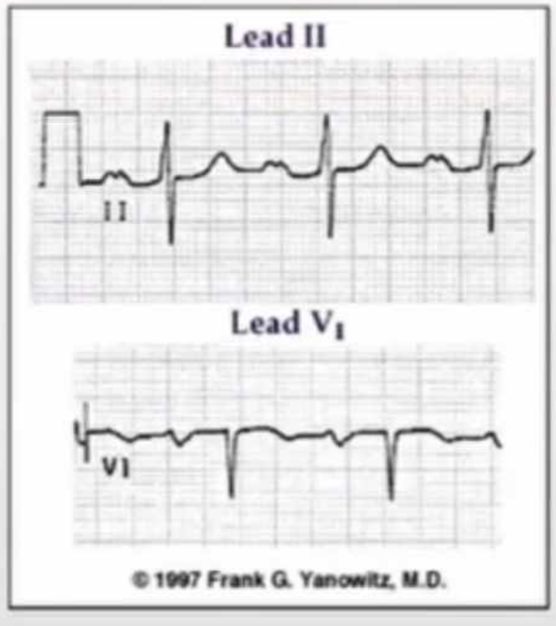
ECG Basics – Amplitude / Hypertrophy

RAE



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

LAE



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

LVH

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)

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%)

Limb-lead voltage criteria:

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

Chest-lead voltage criteria:

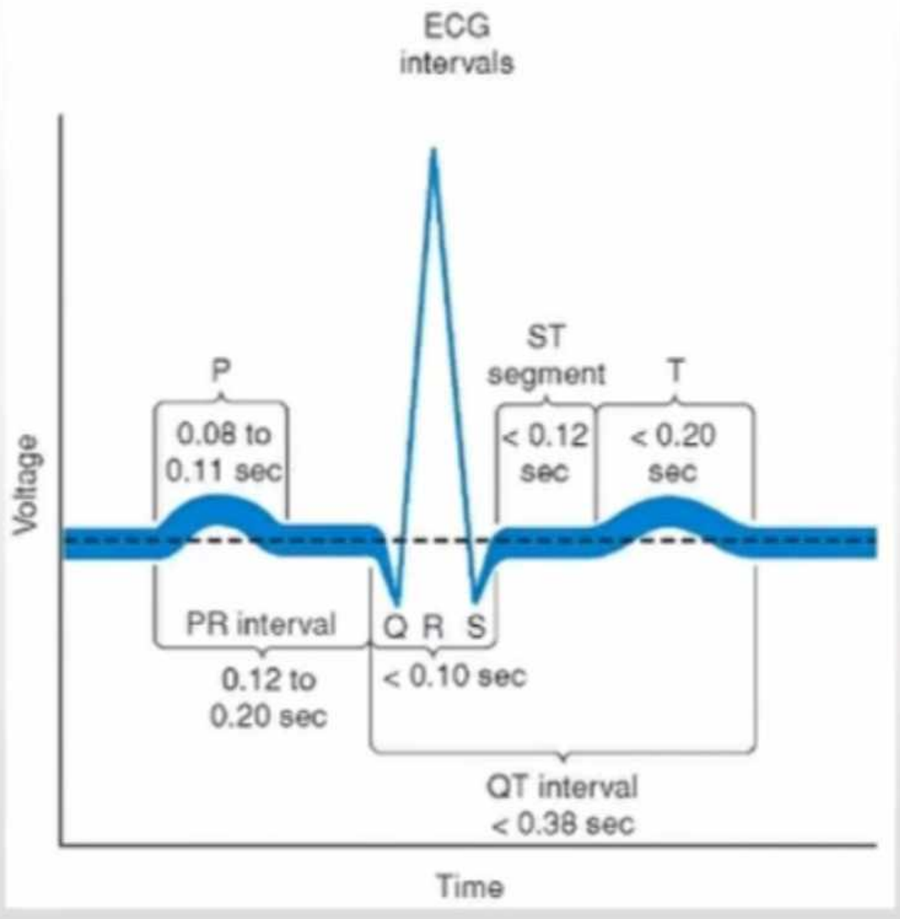
- S in V1 + R in V5 or V6 ≥ 35 mm

ECG Basics – Amplitude / Hypertrophy

RVH

- 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

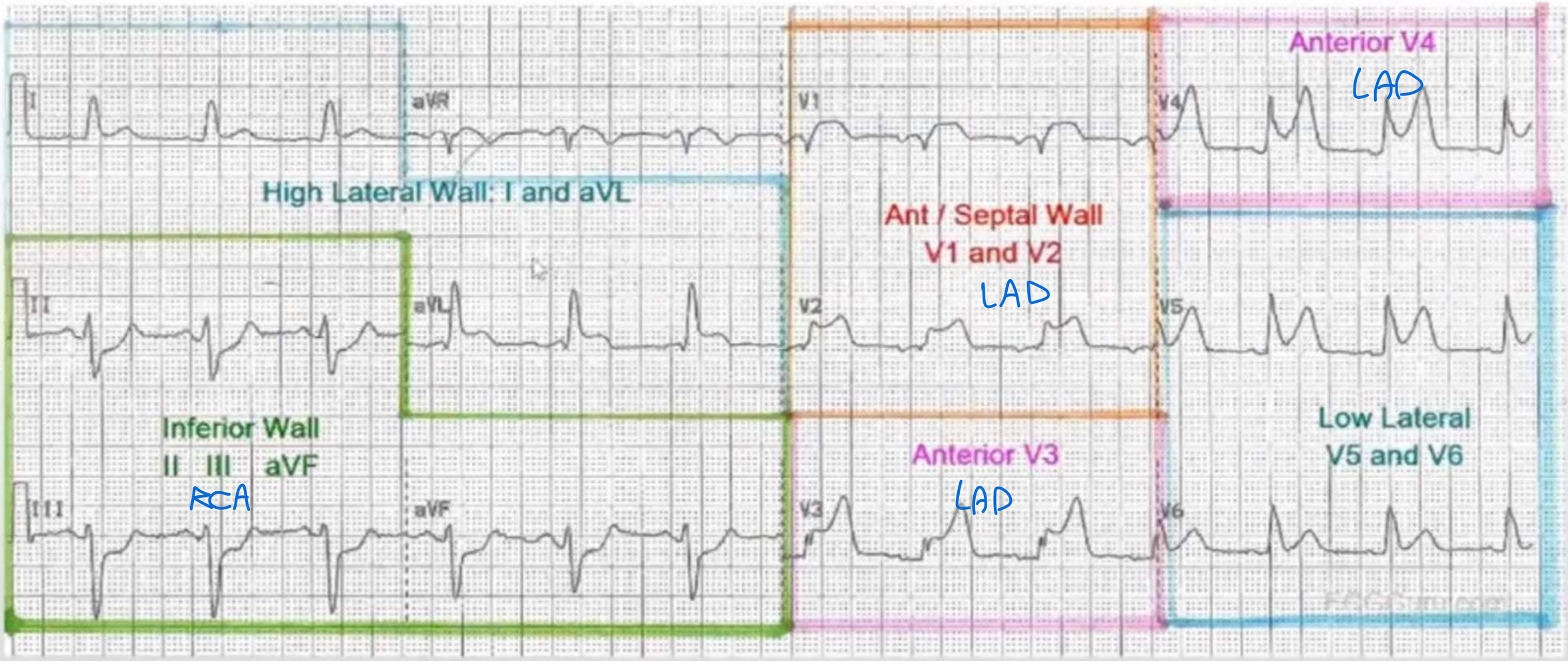


$$QTc = QT\ Interval\ /\ \sqrt{RR\ Interval}$$

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

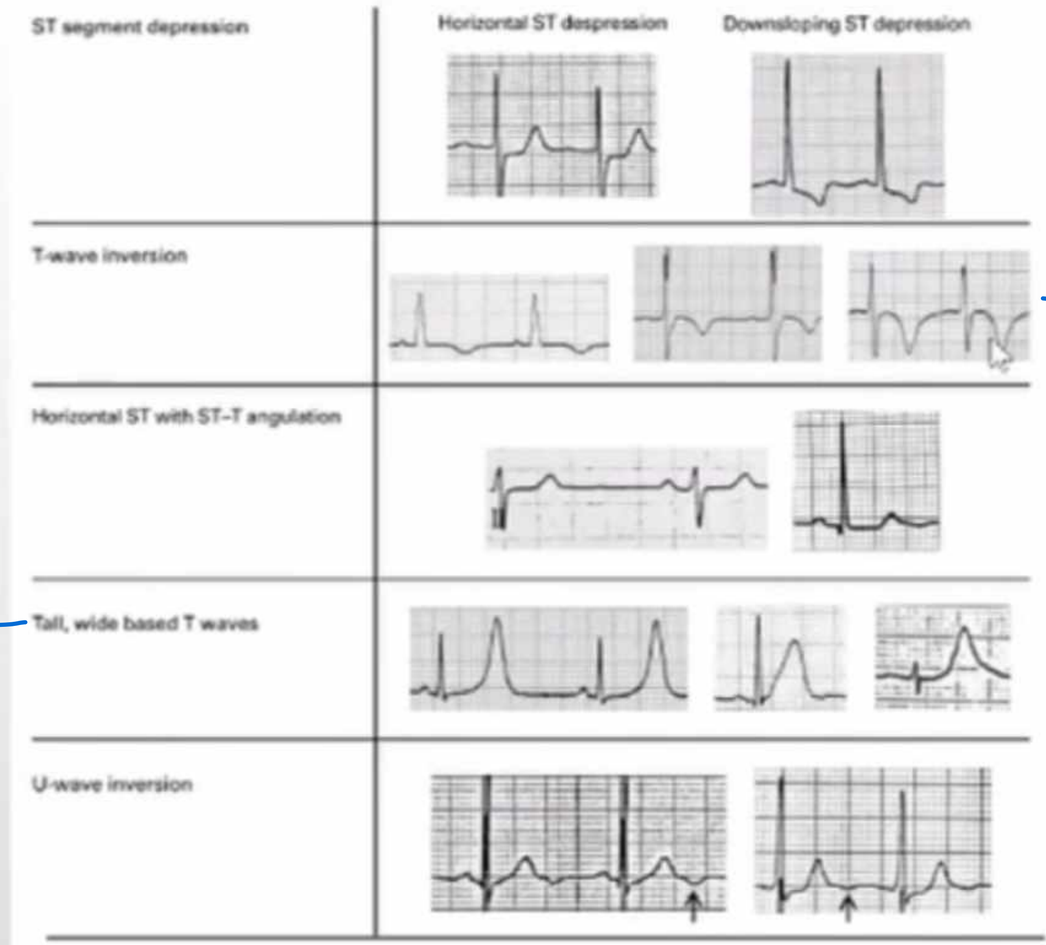
> 500 → QT prolongation

ECG Basics - Ischemia



Internet Source: ECGguru.com

ECG Basics - Ischemia



→ Wellen's sign:
↳ LAD proximal occlusion
↳ Intracranial hemorrhage

← *hyperacute T-wave:
↳ ischemia
↳ hyperkalemia

Approach to ECG

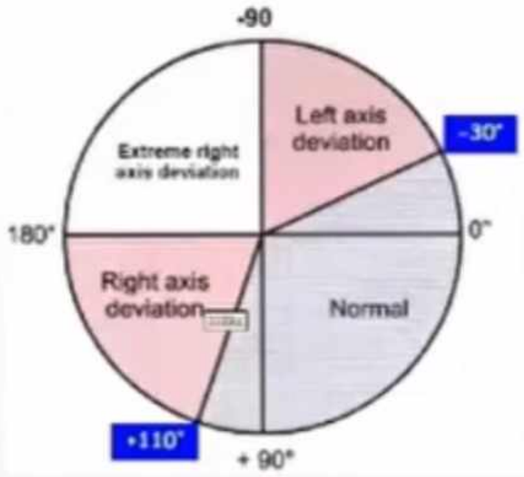
▪ Rate

- 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)

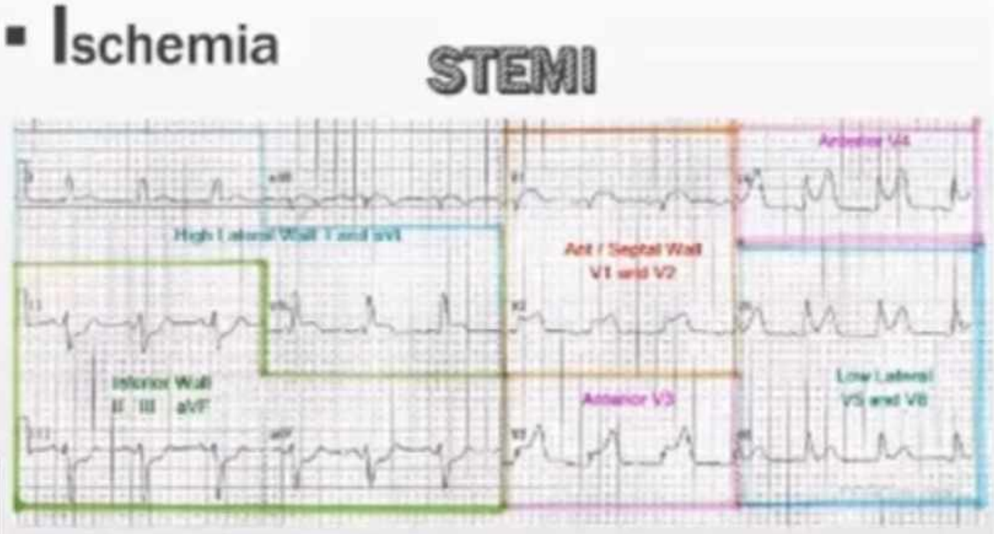
LVH: Lead AVL > 11 mm

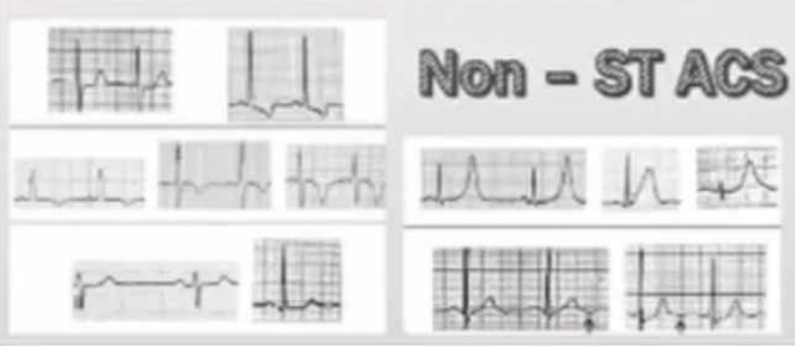
RVH : Lead V1
- R/S ratio > 1 *and* negative T wave
- R > 6 mm / S < 2mm
- rSR' with R' > 10 mm

▪ Intervals

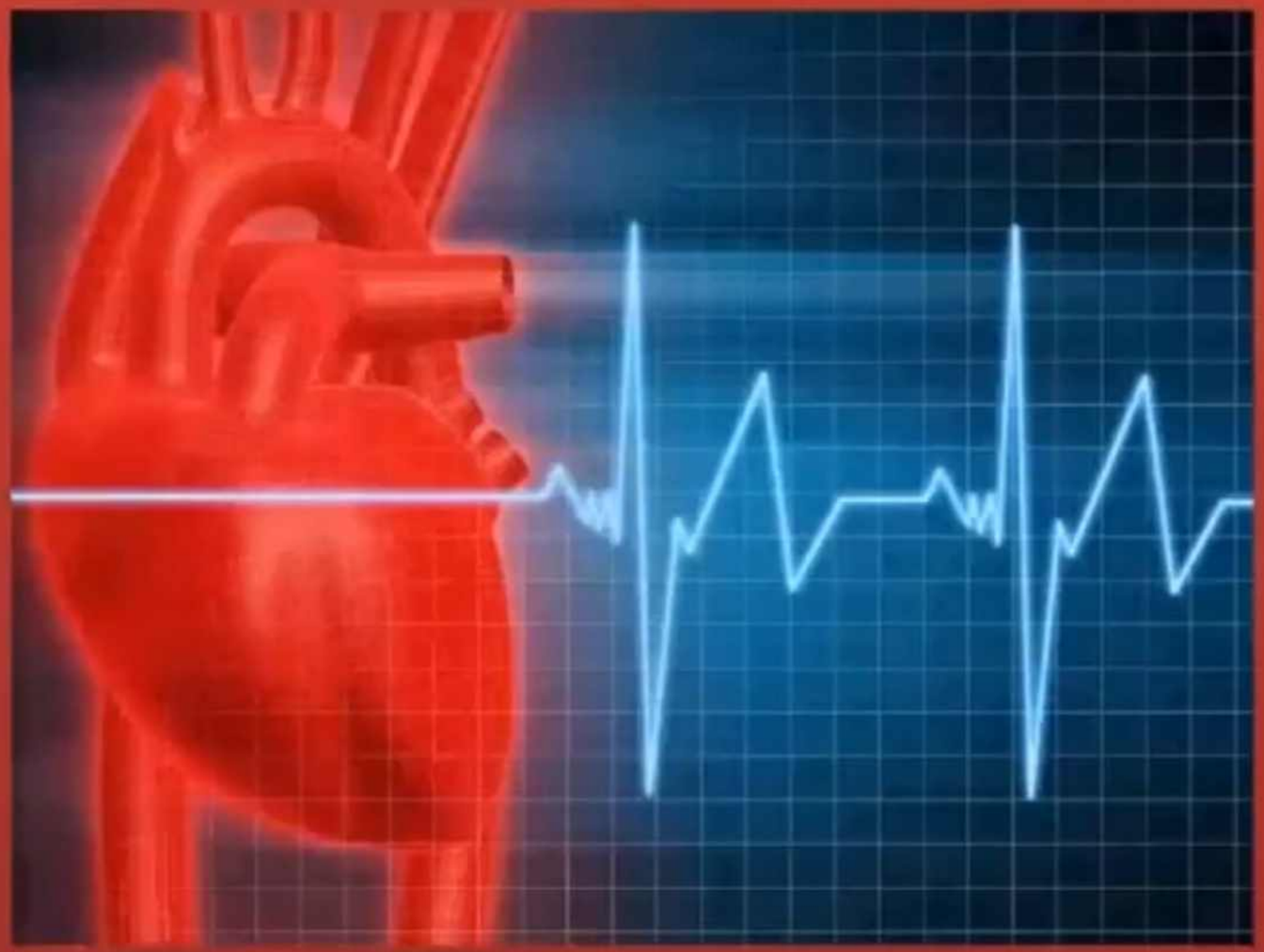
Intervals		# Small sq.
PR	120-200 ms	3-5
QRS	< 110-120 ms	< 3
QT	< 480-500 ms	< ½ RR Interval < 12

▪ Ischemia





Approach to Rhythm



Approach to Rhythm – Normal Rate

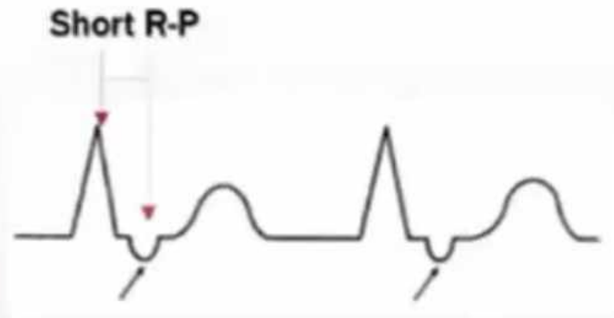
Question	Answer							
1. Rate	Normal Rate							
2. QRS	Narrow						Wide	
3. QRS	Regular				Irregular			
							Morphology	
							Ventricular	Aberrancy
4. P wave	Present			Absent	Present	Absent	Absent	Present
5. P-QRS Relation	Single	Multiple	Retrograde					
DDx	**NSR**	A.Flutter	Junctional Rhythm	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***

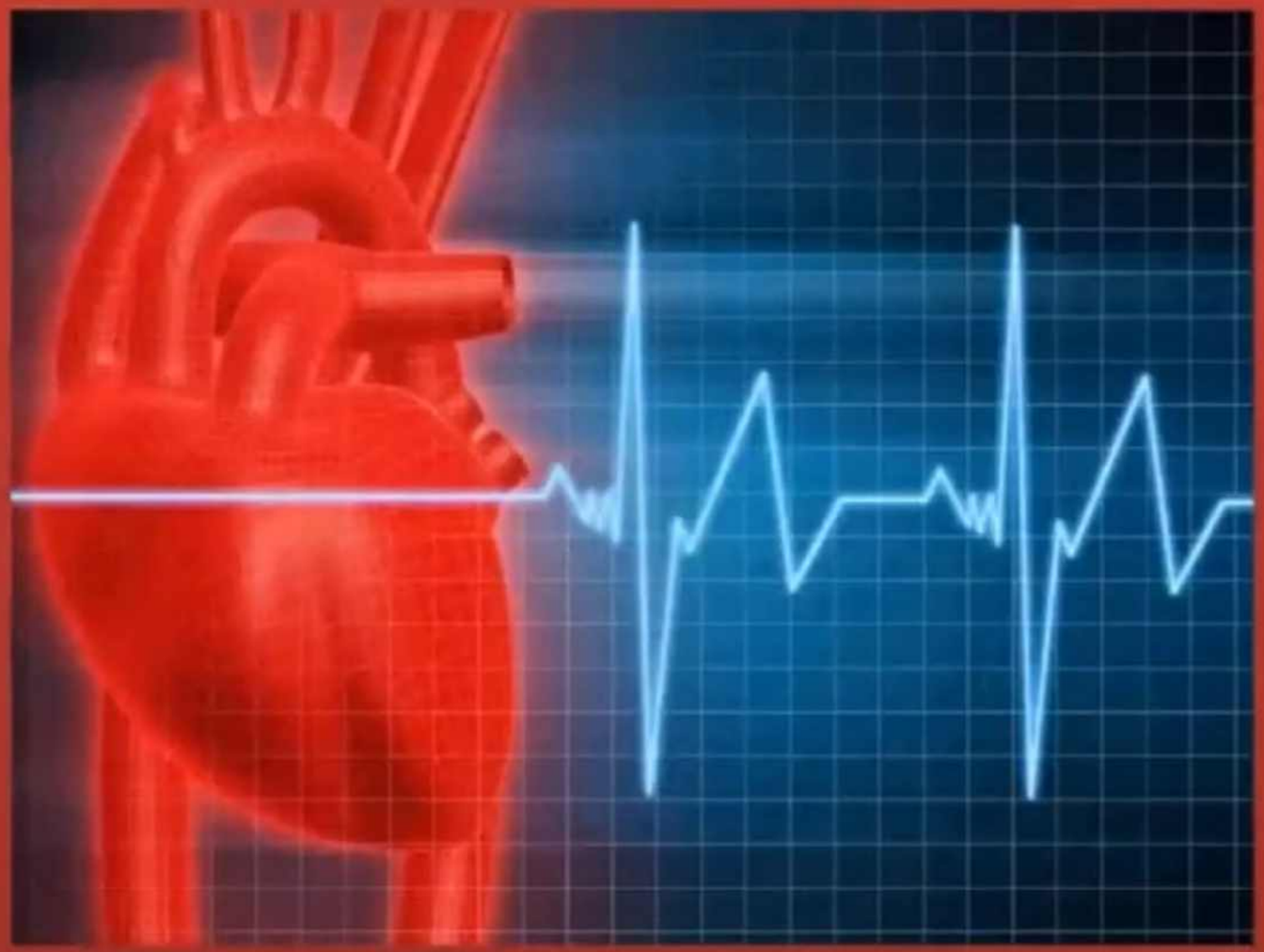
  - ***Mimickers:***
    - **Atrial Flutter with rapid conduction**
    - **A. Fibrillation with very rapid conduction**

Approach to Rhythm - Tachycardia

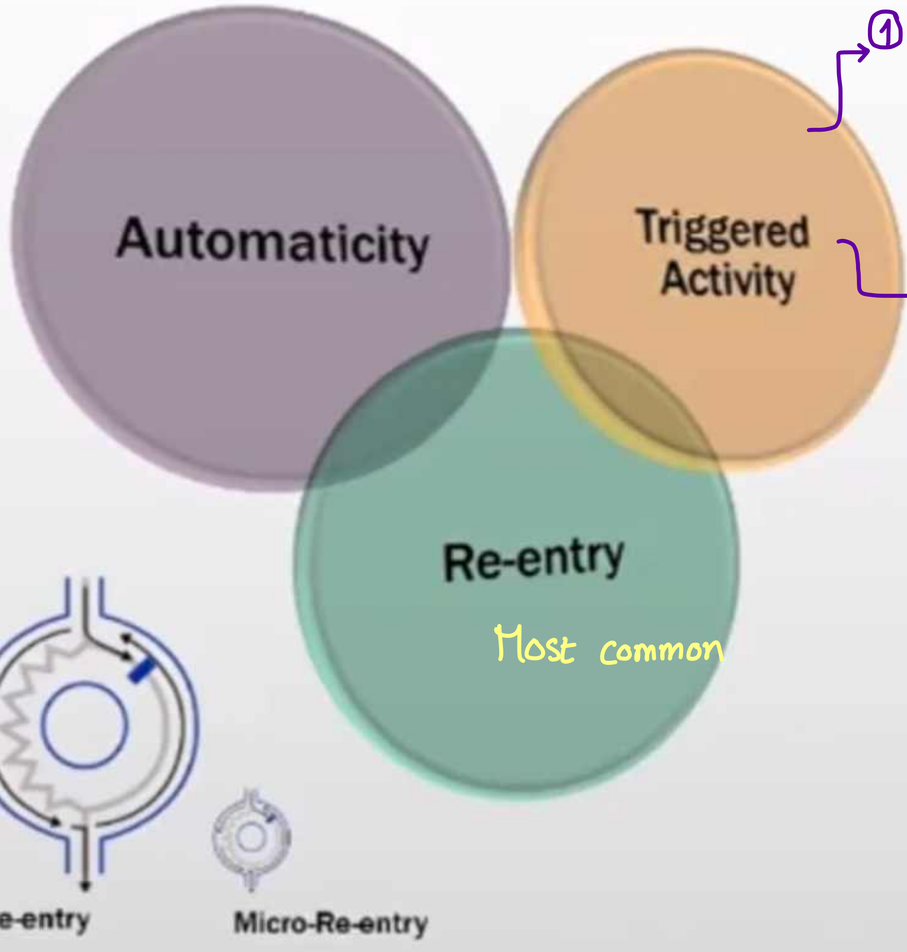
Tachyarrhythmia Framework

	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	• Polymorphic ventricular tachycardia • Atrial fibrillation with bundle branch block • Atrial flutter with variable AV block & bundle branch block

Arrhythmias



Mechanisms of Arrhythmias



Triggered activity

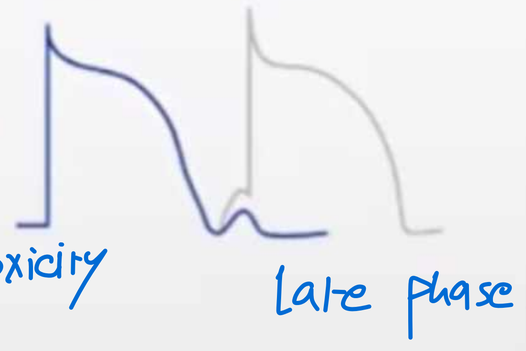
① Early Afterdepolarizations

Torsade de pointes

Triggered activity

② Delayed Afterdepolarizations

Digoxin toxicity



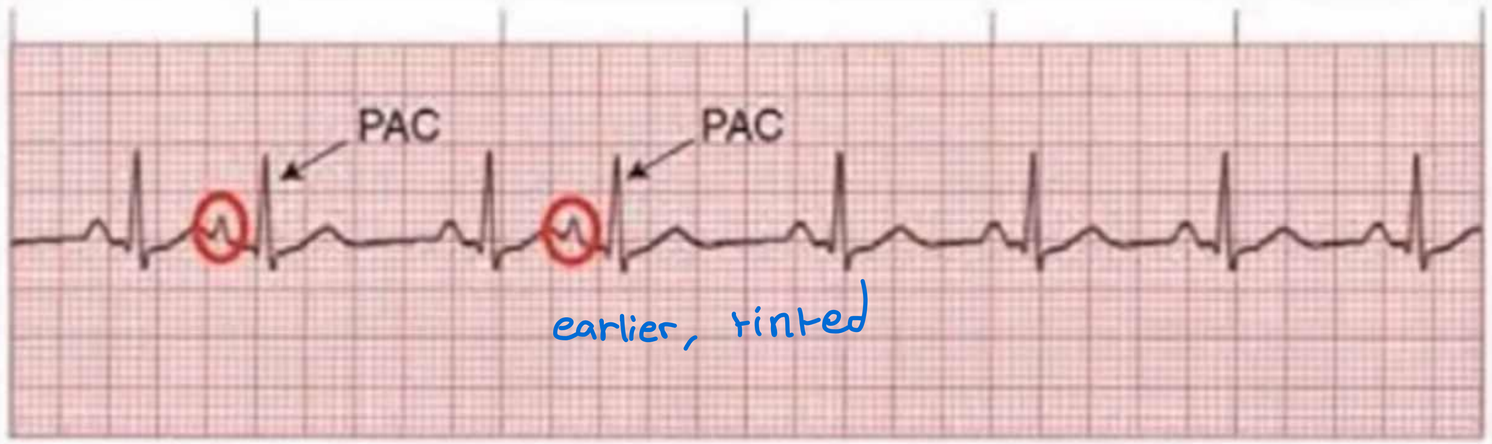
Arrhythmias

NO tachy , No brady

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

Premature Atrial Contractions / Complexes (PAC)

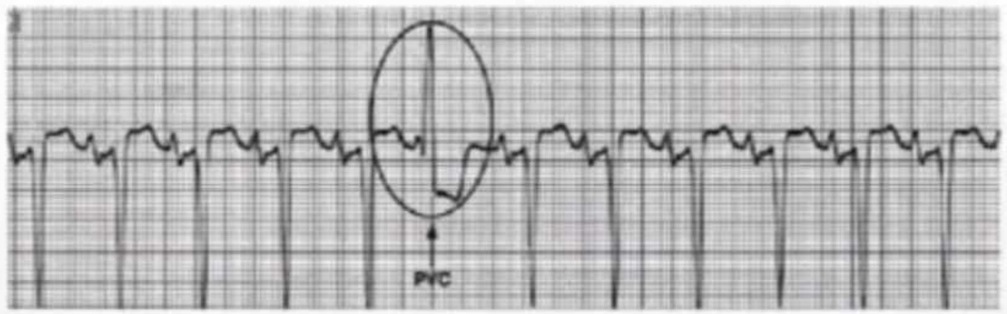
- Very common. May cause Palpitations
- Causes:
  - Adrenergic excess
  - Pharmacological
  - Electrolyte imbalances
  - Ischemia
  - Hypoxia
  - Infection.



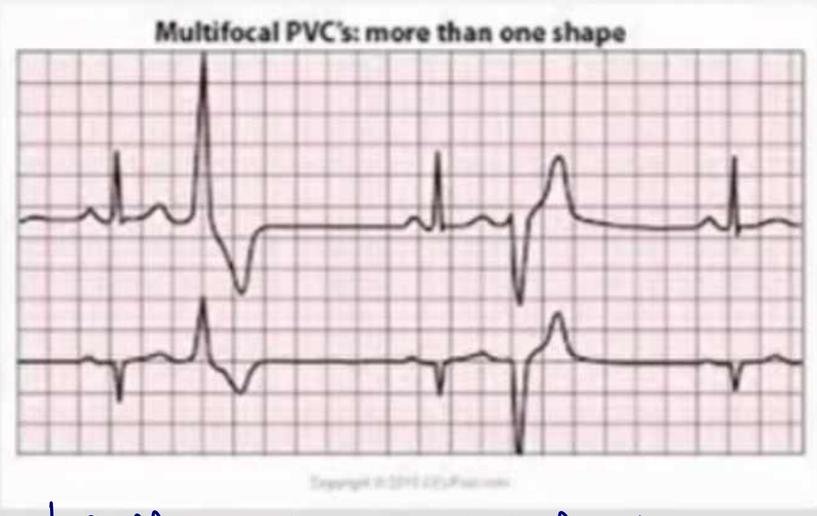
Clinical Status	Management
Asymptomatic	Observation
Symptomatic (Palpitations, Fatigue, Exercise Intolerance, Angina, Dizziness, Syncope)	Rx Cause B-Blockers

Premature Ventricular Contractions / Complexes (PVC)

- Common. May cause Palpitations.
- Causes:
  - Hypoxia
  - Electrolyte abnormalities
  - Pharmacological
  - Structural heart disease

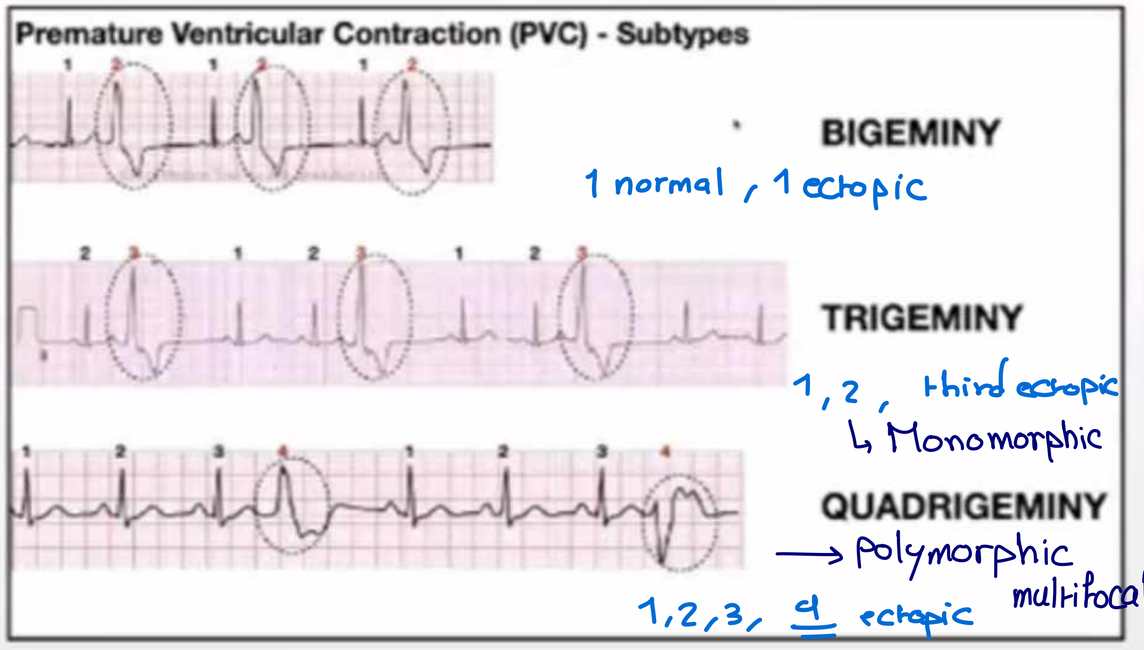


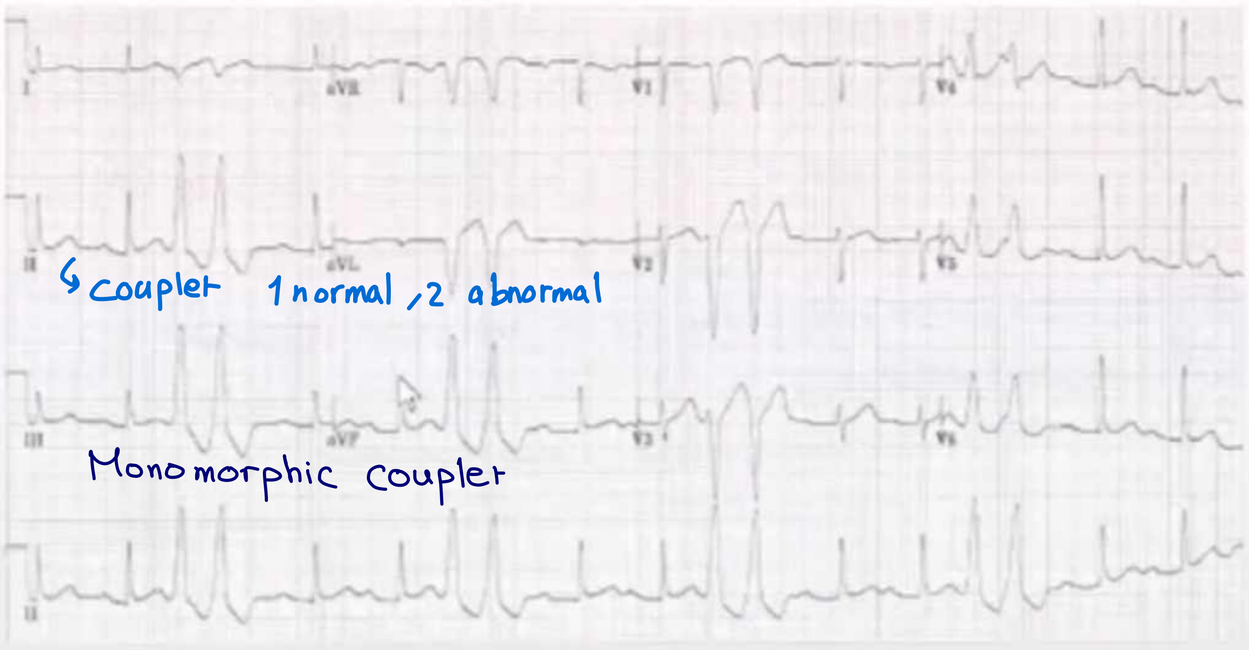
↳ same shape: Monomorphic



↳ Different shapes: Multifocal
Polymorphic

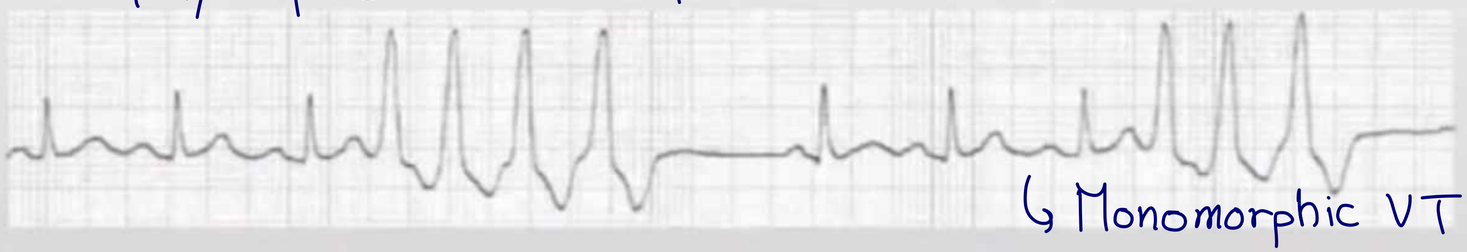
Premature Ventricular Contractions / Complexes (PVC)





Monomorphic VT : إذا زاد عددهم

Polymorphic



if 3 abnormal وإذا بعضهم

NSVT

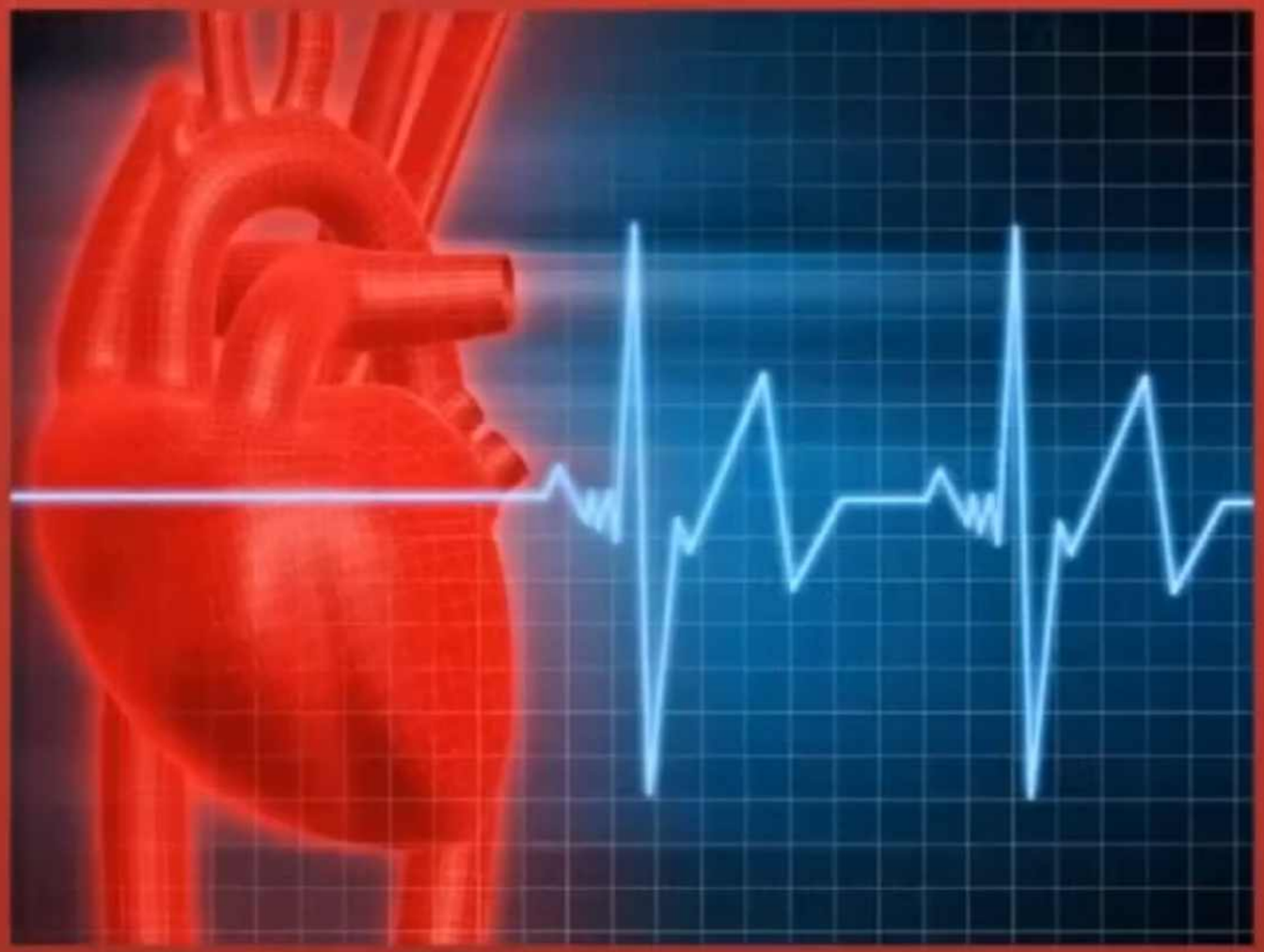
non – sustained

↳ means < 30 sec

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

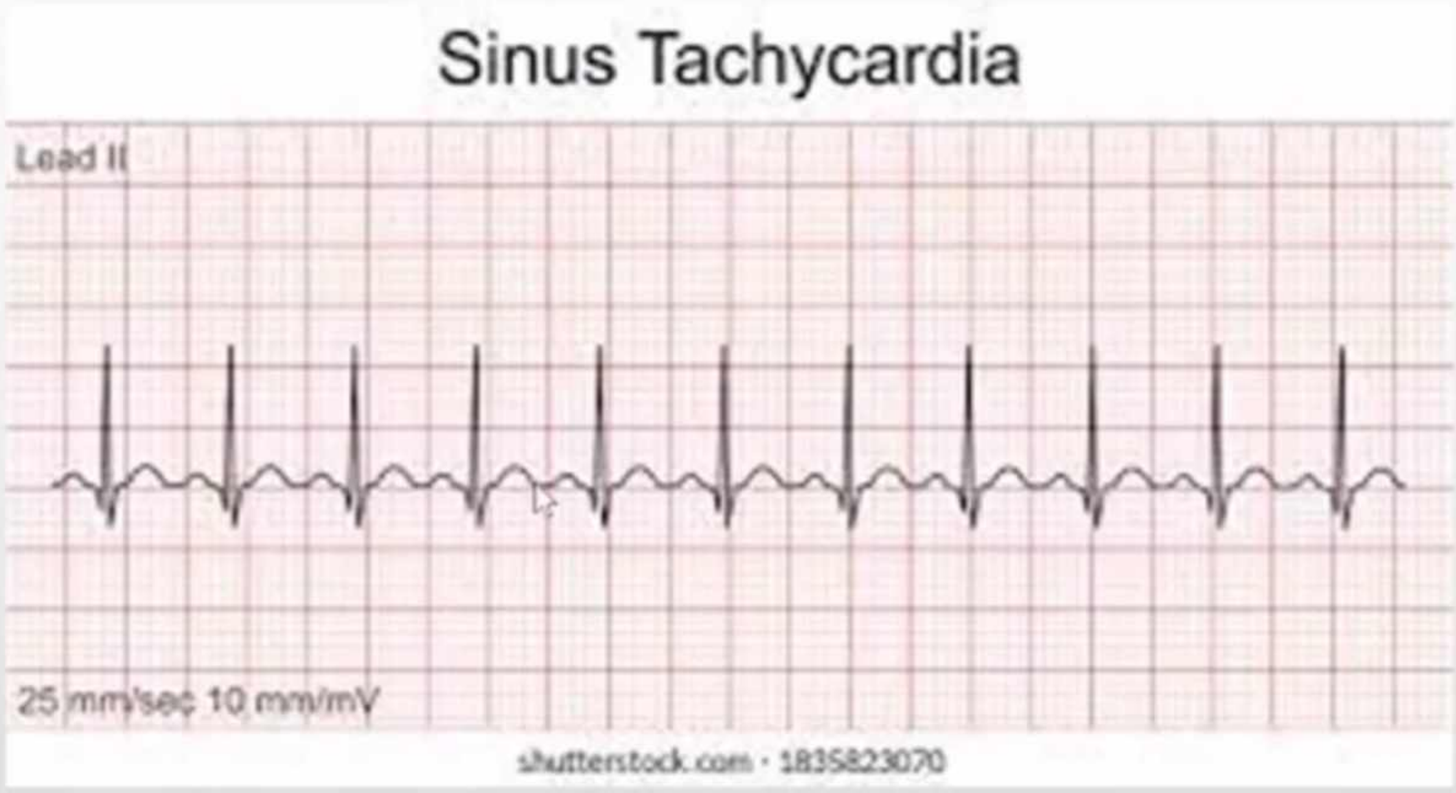


Tachyarrhythmias

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

Sinus Tachycardia

- Rate >100 bpm



Regular

Sinus Tachycardia

- Causes:

Physiological	Cardiac Conditions	Medical Condition	Pharmacological
• Exercise	• MI	• Shock	• Caffeine
• Emotion	• Cardiomyopathy / HF	• Hypoxia	• Alcohol
• Anxiety	• Acute Valve Disease	• Respiratory Distress	• Tobacco
• Pain	• Pericarditis	• P.E. → most commonly with sinus tachy	• Catecholamines
• Fever	• *Postural*	• Anemia	• B agonist
• Pregnancy		• Infection	• BB Withdrawal
• *Volume Depletion*		• *Dehydration*	• Vasodilators
		• Hyperthyroidism	• Atropine
		• Pheochromocytoma	• Theophylline
		• Cushing's	• Decongestants
		• Hypoglycemia	• Cocaine
		• Panic Attack	• Amphetamines → weight loss drugs
			• Thyroid Hormones

Sinus Tachycardia

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

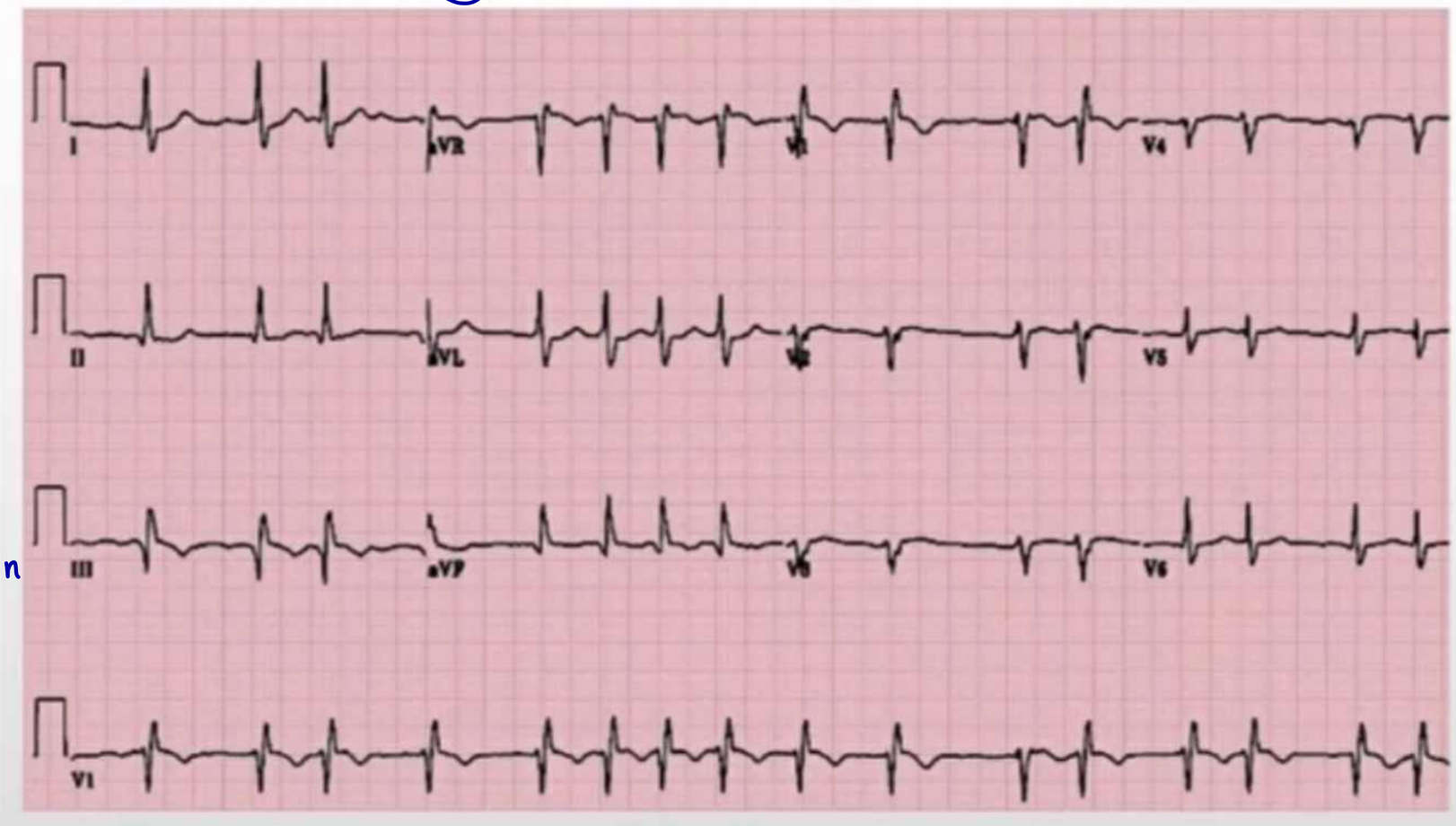
- Inappropriate Sinus Tachycardia Na cause
  - B-Blockers
  - Ivabradine → ↓HR (works on the funny current) → HF drug
  - RFA

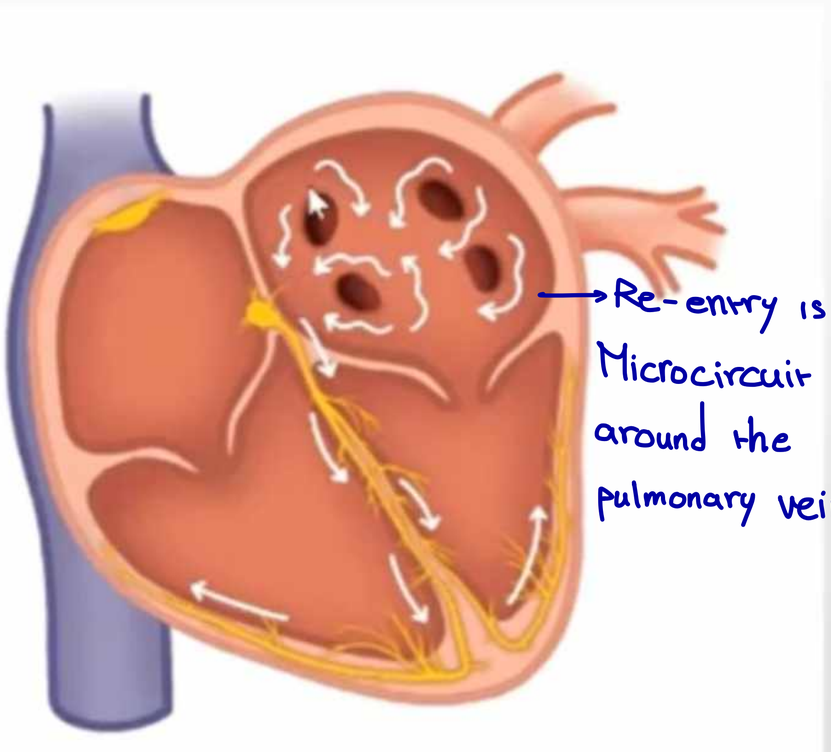
Ablation → End game

Atrial Fibrillation

- Very common

no p wave, irregular, narrow QRS





→ Re-entry is Microcircuit around the pulmonary vein

Atrial Fibrillation

with ageing

- Causes:
  - Heart disease: CAD, MI, HTN, mitral valve disease
  - History of cardiac surgery
  - Pericarditis
  - Pulmonary disease (PE, COPD, Hypoxia)
  - Thyroid disease hypo, hyper
  - 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

- ① Rate Control
  - B-Blockers
  - CCB
  - Digoxin
- Anticoagulation
  - Warfarin
  - DOACS

Lower blood pressure

*Dabigatran – direct thrombin inhibitor

* rivaroxiban – direct factor X inhibitor
  bixiban

useful in who has low blood pressure
بنزل الضغط

To know if they need anticoagulant or no:

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

↳ >1 → needs coagulation
0 → needs aspirin only [called loan AFib]
1 → grades on → if the 1 is bcs she is a female, aspirin may be enough
if other cause, may consider anti-coag

To know the possibility of bleeding:

HAS-BLED score

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

** Alert in AKI pts

Valvular A-Fib:

A-Fib with mechanical valve ↳ INR = 2.5 - 3.5 , A Fib with severe mitral stenosis ↳ INR = 2-3 , A Fib with LVAD] you have to use warfarin, DOACs are not approved for this

Atrial Fibrillation - Management

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

CHA2DS2-VASc Score	
CHF or LVEF ≤ 40%	1
HTN	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

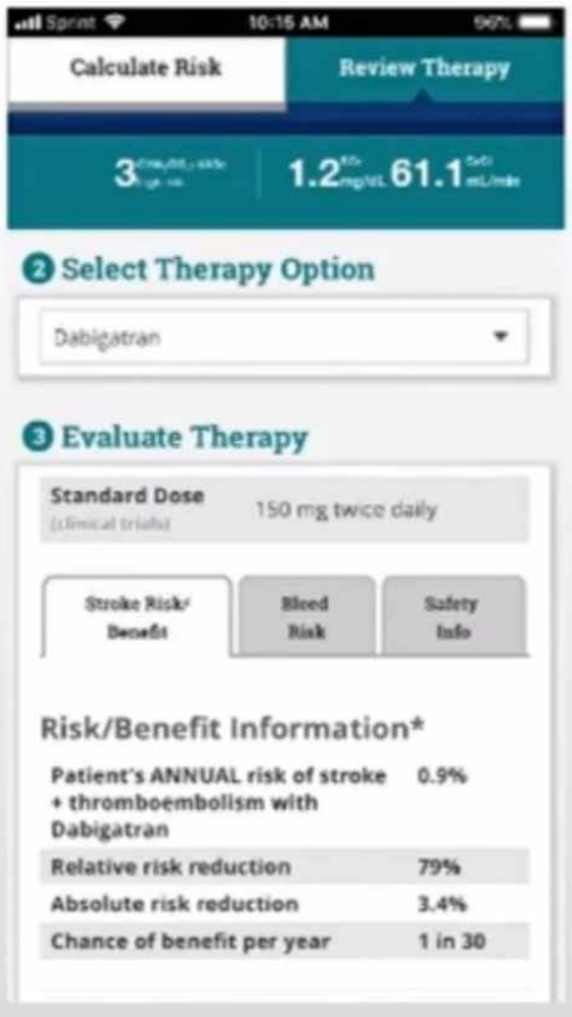
HAS-BLED score

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	

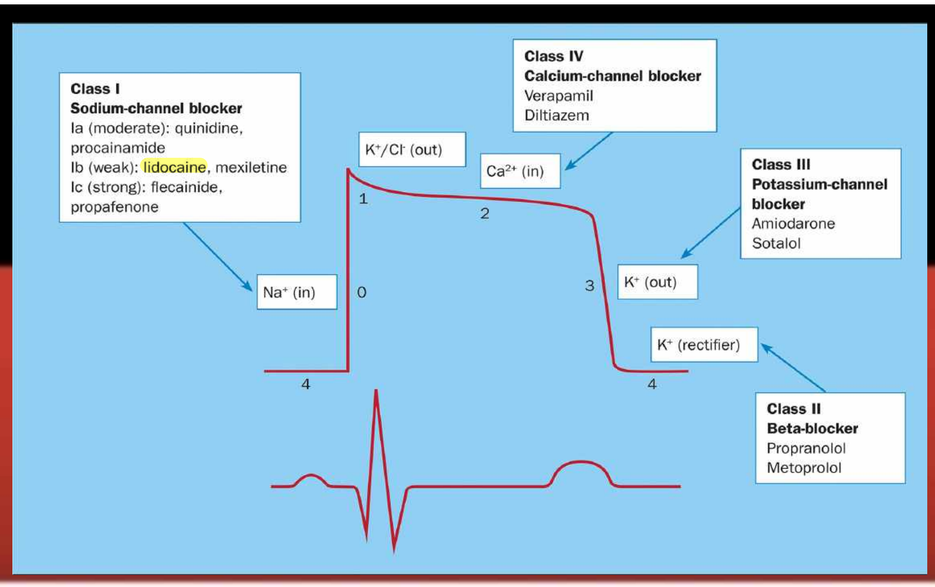
HAS-BLED score	Bleeds per 100 patient-years
0	1.13
1	1.02
2	1.88
3	3.74
4	8.70
5	12.5

Atrial Fibrillation - Pearls

Discuss with the pt. and his family



Atrial Fibrillation - 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 ↑HR ↓BP
- Symptomatic despite rate control
- Rate not controlled
- Young / New Onset

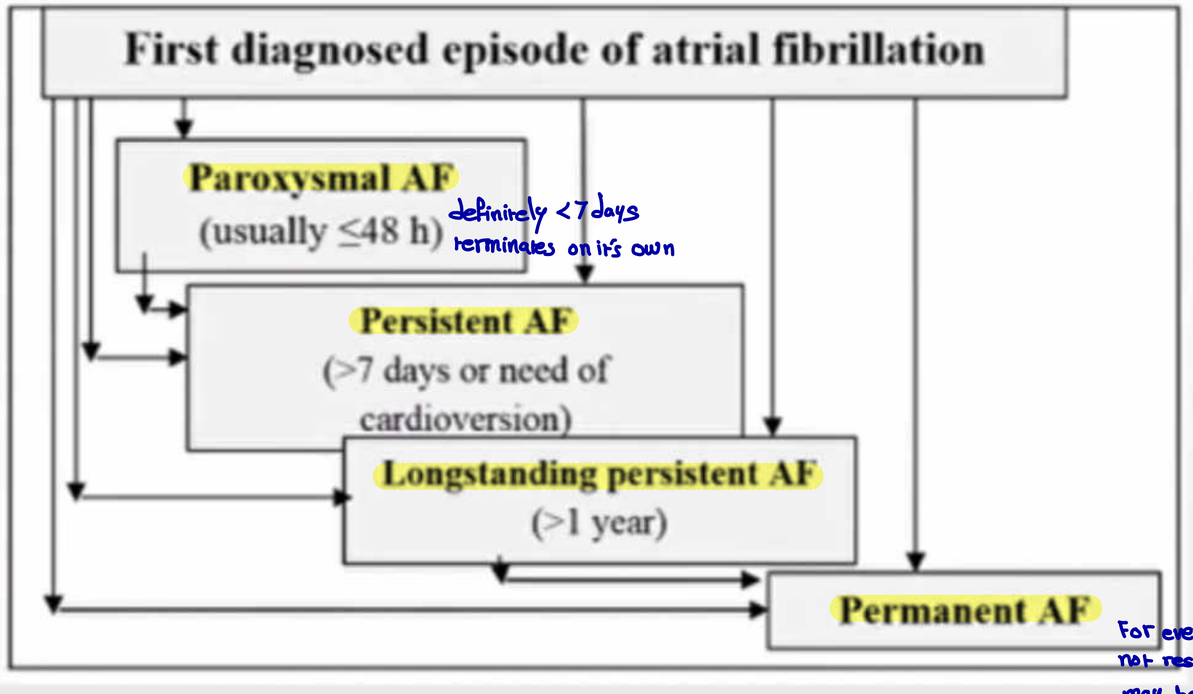
Drug	Therapeutic Uses	Comments
amiodarone	severe supraventricular and ventricular arrhythmias	very long half-life (25-60 days); Class I, II, III & IV (multichannel) actions and therefore decreases phase 4 slope and conduction velocity; potentially serious side effects (e.g., pulmonary fibrosis; hypothyroidism)
ibutilide	supraventricular arrhythmias; atrial flutter and fibrillation conversion	slow inward Na^+ activator, which delays repolarization; inhibits Na^+-channel inactivation, which increases ERP; IV only

effective refractory period
↳ the time when a new AP can't be initiated

Rhythm Control

- Electrical cardioversion
- Pharmacological cardioversion
  - Amiodarone
  - ibutilide - class III anti-arrhythmic
- Ablation
  - burning the spots around the pulmonary vein

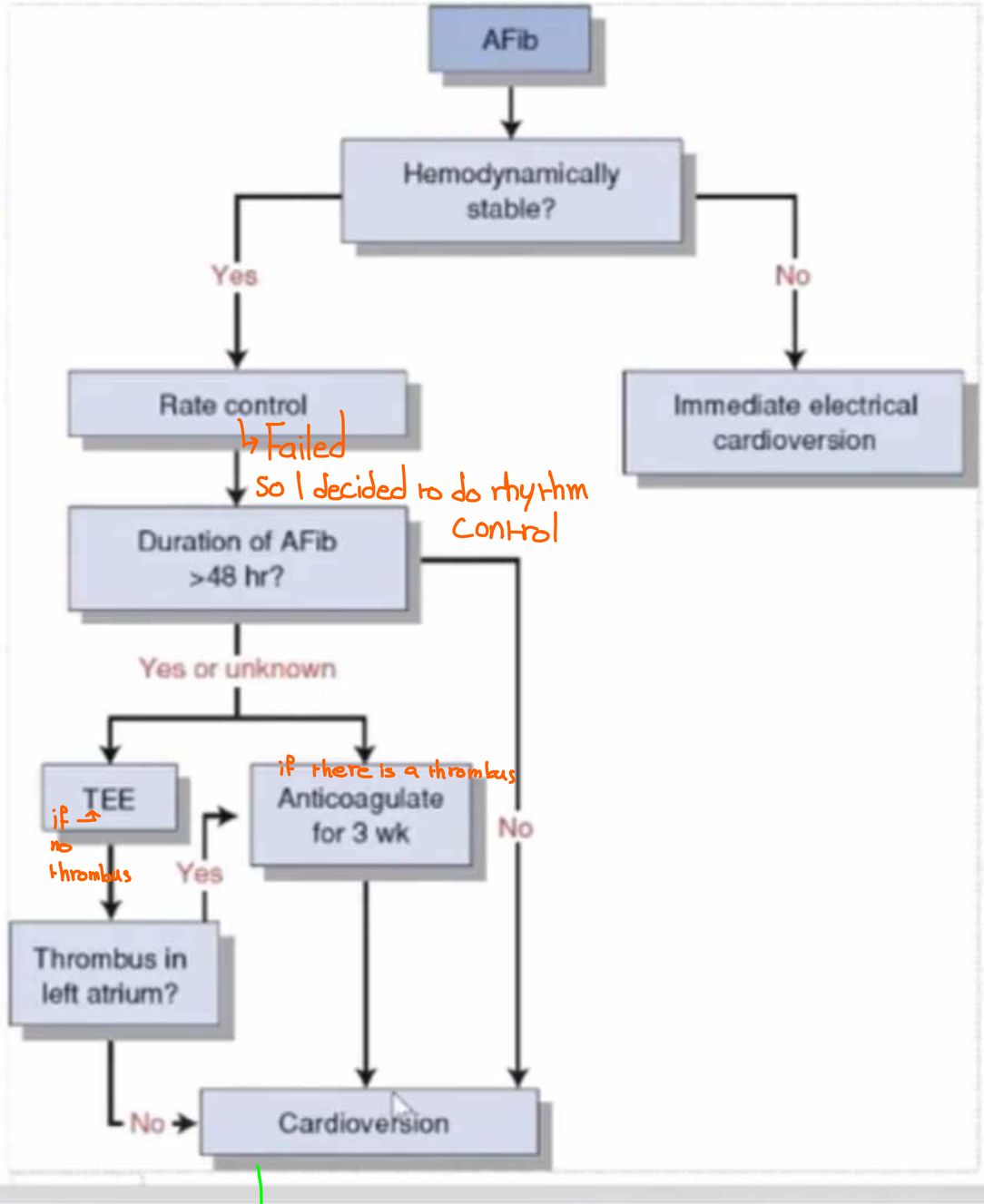
Atrial Fibrillation - Pearls



definitely <7 days terminates on it's own

For even not responsive may benifit from ablation

* Same control



↳ Failed
so I decided to do rhythm control

if there is a thrombus

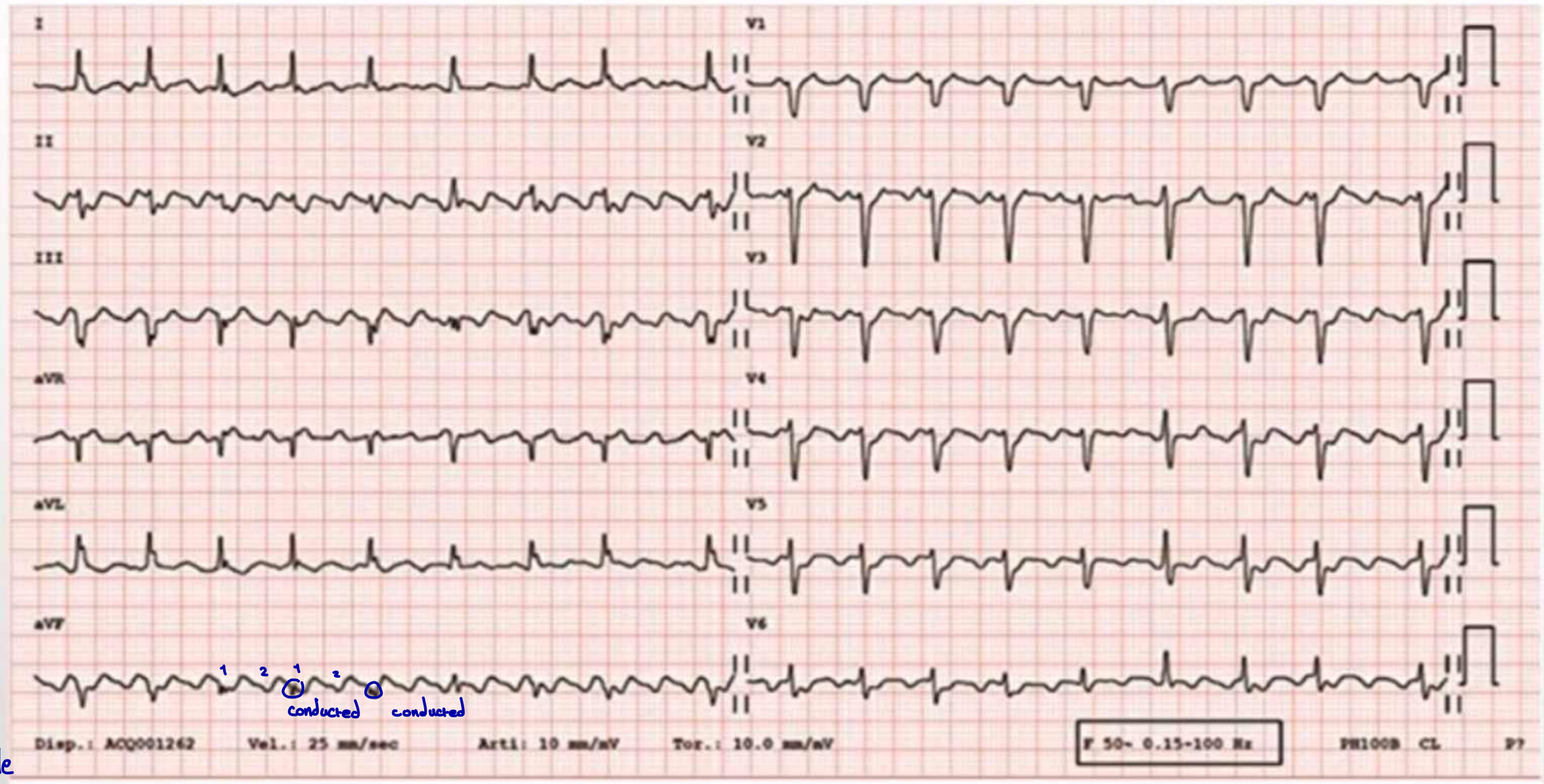
if ↳ no thrombus

↳ very low probability that there is a thrombus

Atrial Flutter

* Flutter wave is more organized than AFib → saw tooth appearance. ① no normal baseline (go against sinus tachy at 150) ② not irregular like AFib

- Common



2:1 conduction →

could be 3:1, 4:1 or variable

↳ irregular !!

Atrial Flutter - Management

Managed exactly as AFib

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

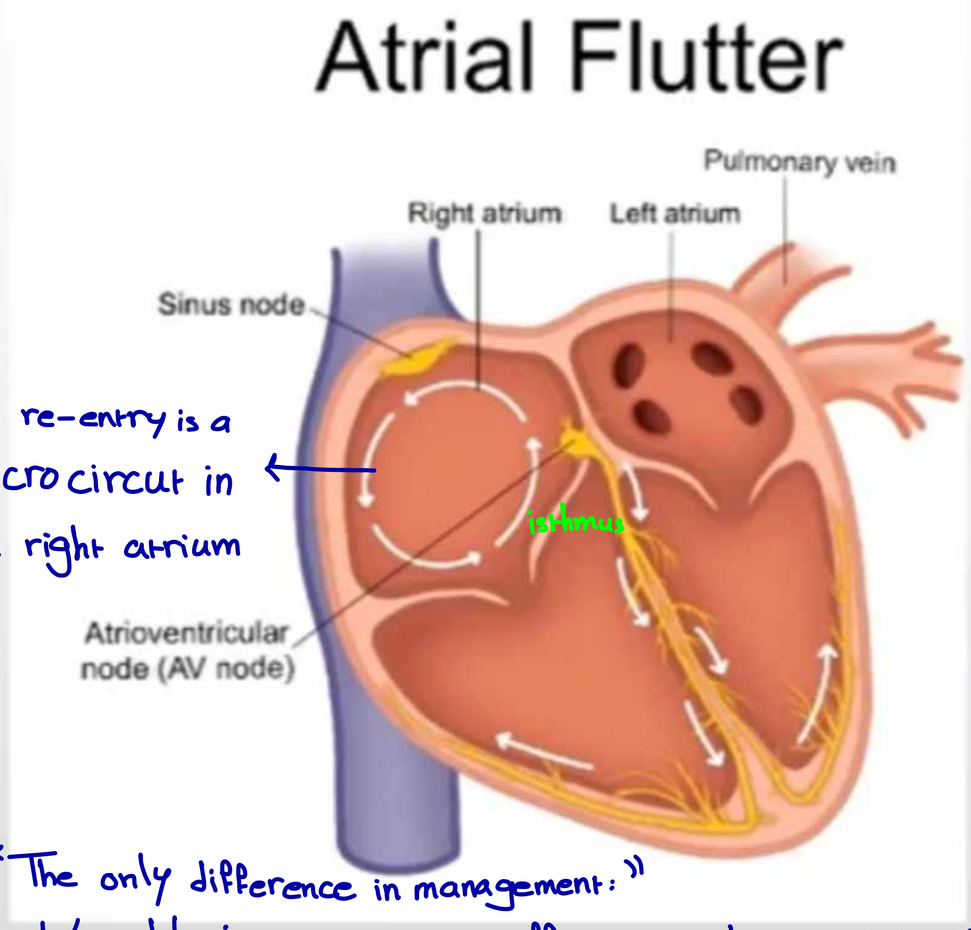
CHA2DS2-VASc Score	
CHF or LVEF ≤ 40%	1
HTN	1
Age ≥ 75	2
DM	1
CVA/TIA/TE	2
Vascular	1
Age 65-74	1
Female	1

If

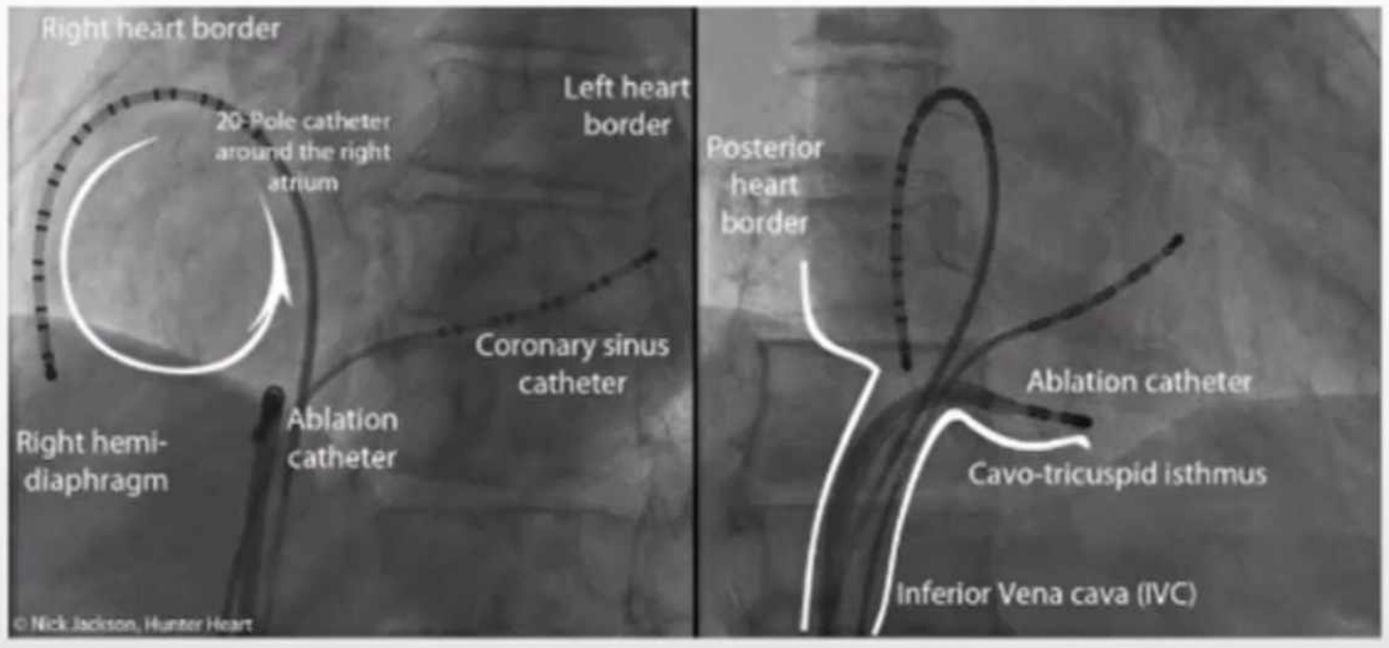
- Unstable
- Symptomatic
- Rate not controlled
- Young / New Onset

- **Rhythm Control**
  - Electrical
  - Pharmacological
  - Ablation

Atrial Flutter - Pearls



The re-entry is a Macro circut in the right atrium



"The only difference in management:"

* It's ablation: 1. easy 2. efficient 3. lower risk than AFib

Multifocal Atrial Tachycardia (MAT)

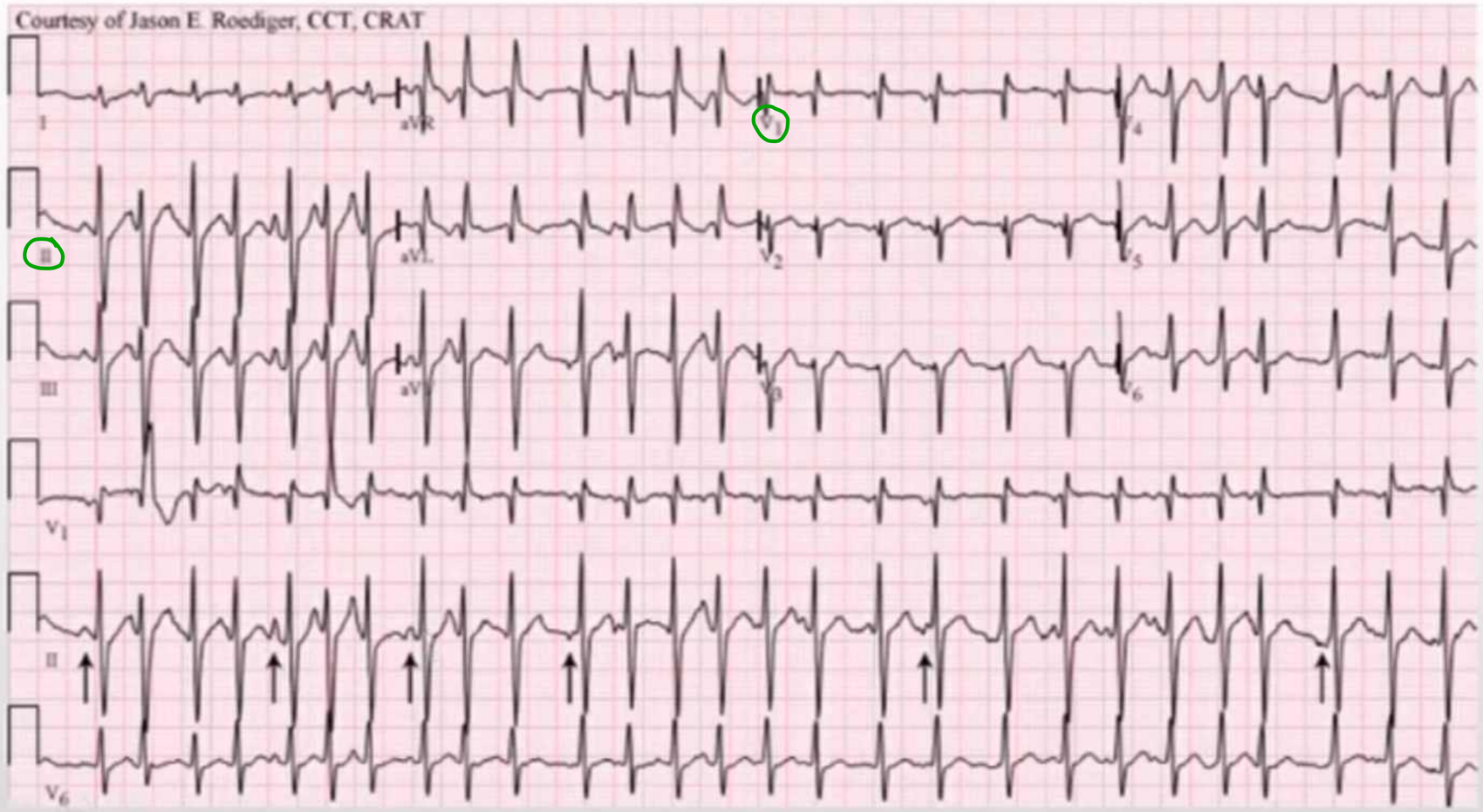
*Very common in pts. with severe COPD

*Managed the same as COPD

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

*Looks like an AFib
that it's: ①irregular
②narrow QRS
③tachycardic

But there are P-waves



Multifocal Atrial Tachycardia (MAT)

- Treatment:
  - **Improve oxygenation and ventilation**

    then use other things:

    ↳ Medications: CCBs, β-blockers, digoxin, amiodarone

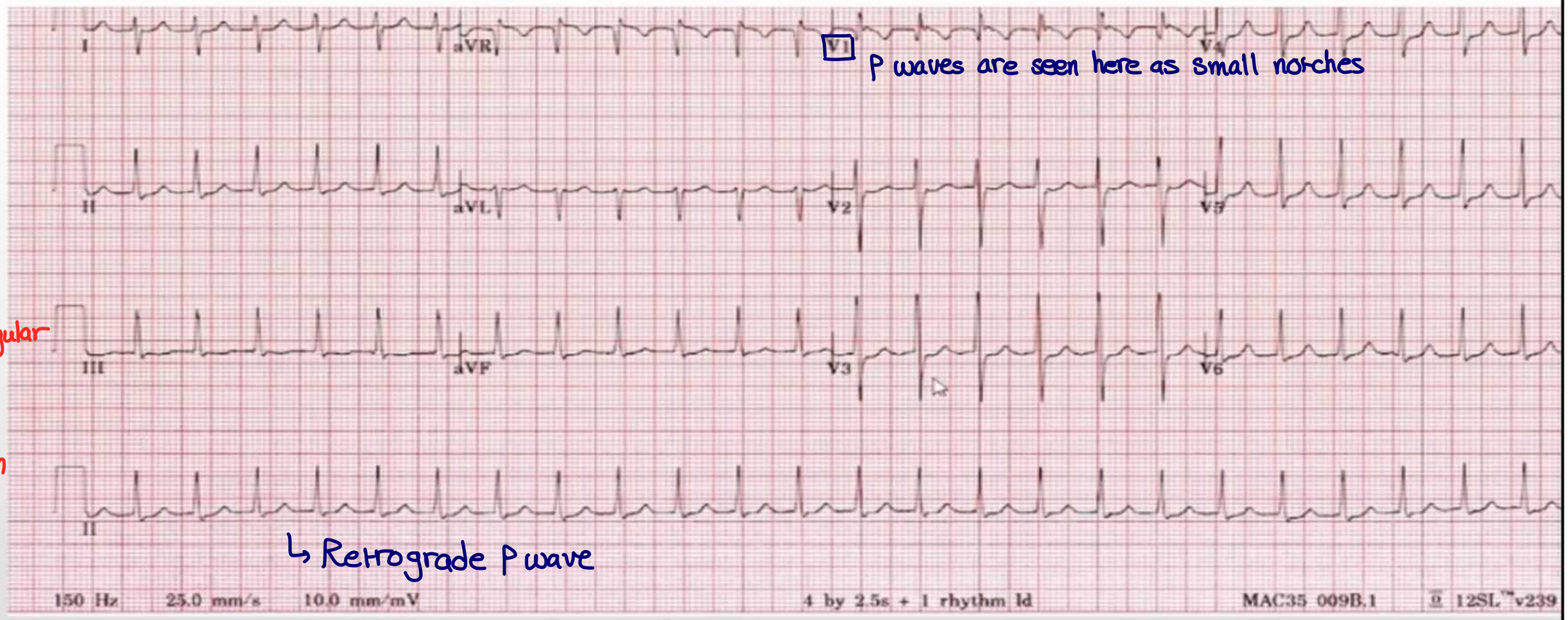
* even if not stable We don't do cardioversion هي الوحيدة

- *Electrical cardioversion is ineffective* and should not be used

  ↳ bcs the cause is the pulmonary disease not the heart

Supraventricular Tachycardia (SVT)

- Tachycardic
- Narrow QRS complexes
- Regular
  *AFib isn't regular
  ↳ if no sawtooth appearance, then it is SVT



P waves are seen here as small notches

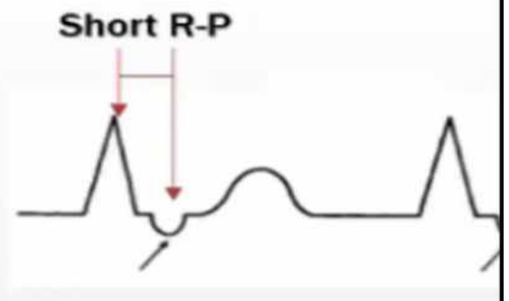
↳ Retrograde P wave

Supraventricular Tachycardia (SVT)

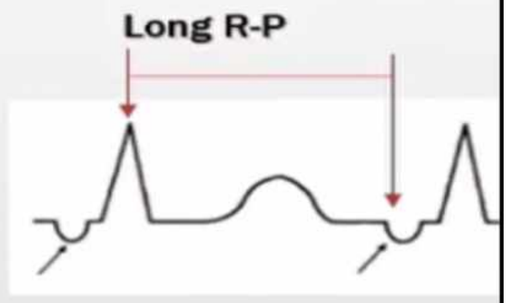
- **DDx of SVT**

2 types:

① *Short RP Tachycardias (RP<PR):*
- Typical AV ~~Nodal~~ Re-entry Tachycardia (AVNRT)
- Junctional Tachycardia
- Orthodromic Atrioventricular Tachycardia (OD – AVRT)
- *Atrial Tachycardia*



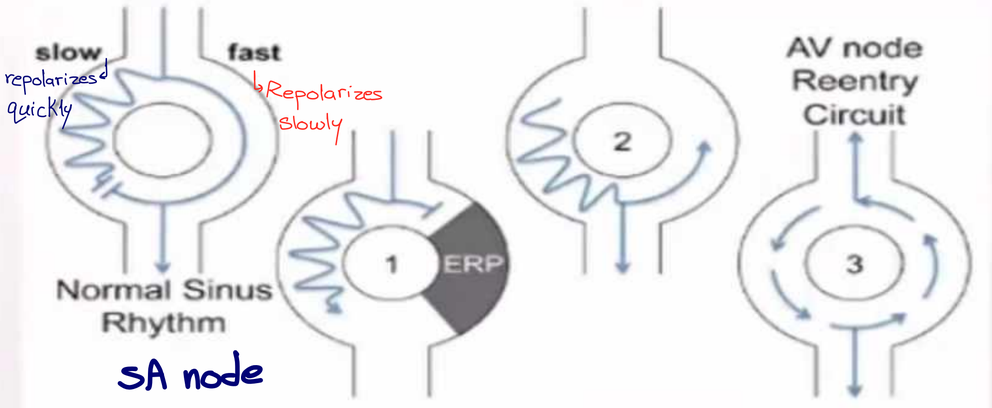
② *Long RP Tachycardias (RP>PR):*
- Sinus Tachycardia (ST)
- Atrial Tachycardia (AT)
- *Atypical Orthodromic Atrioventricular Tachycardia (OD – AVRT)*
- *Atypical AV Nodal Re-entry Tachycardia (AVNRT)*
- *Junctional Tachycardia*

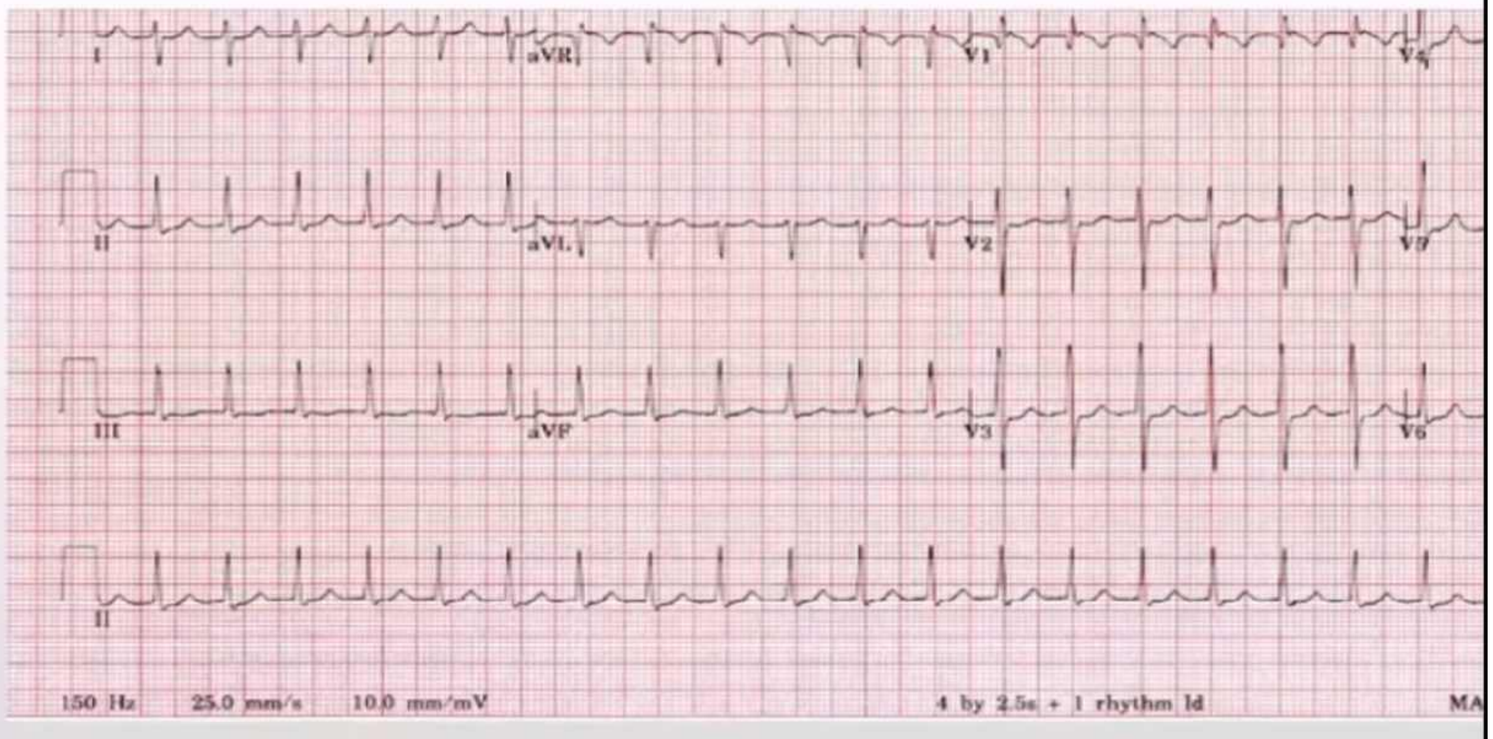


- *Mimickers:*
  - Atrial Flutter with rapid conduction
  - A. Fibrillation with very rapid conduction

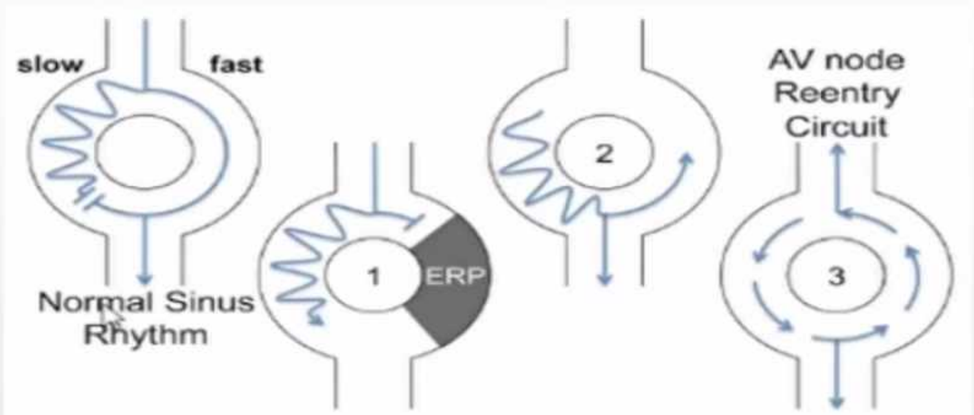
① SVT: AV Nodal Re-entrant Tachycardia (AVNRT)

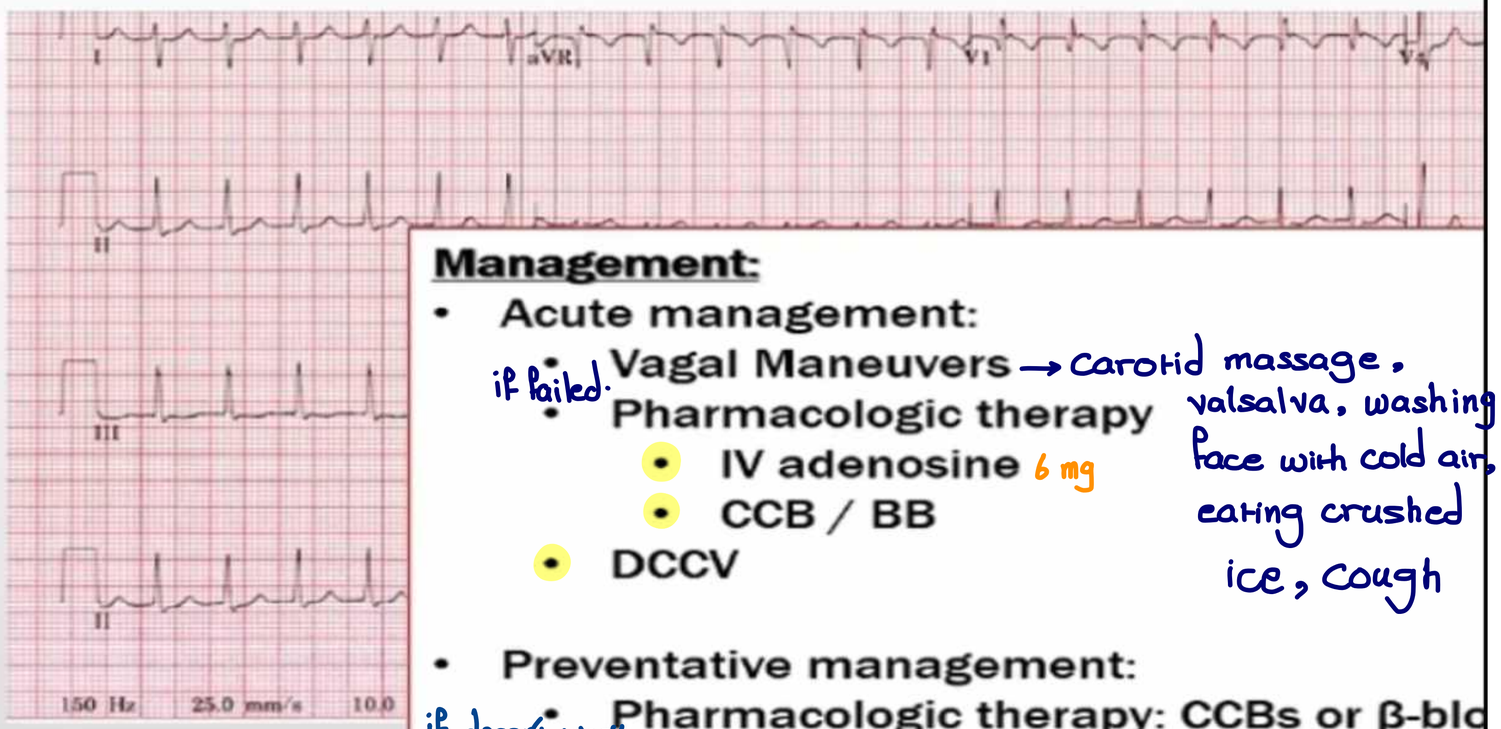
short RP





SVT: AV Nodal Re-entrant Tachycardia (AVNRT)





Management:

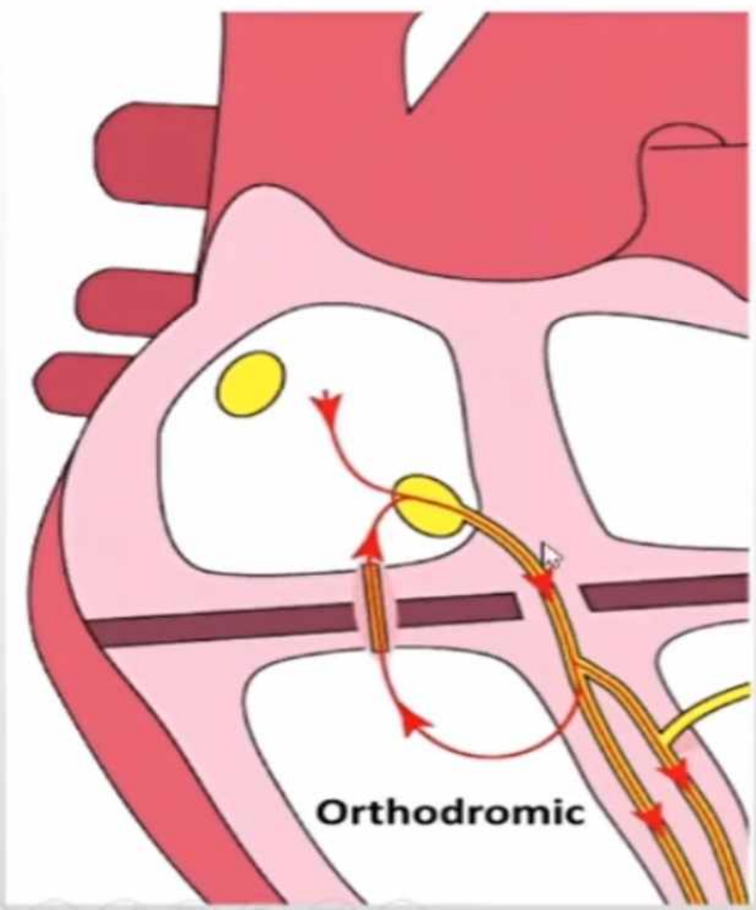
- Acute management:
  - Vagal Maneuvers → carotid massage, valsalva, washing face with cold air, eating crushed ice, cough
  - Pharmacologic therapy (if failed)
    - IV adenosine 6 mg
    - CCB / BB
  - DCCV
- Preventative management:
  - Pharmacologic therapy: CCBs or β-blc
  - Ablation → we ablate one of the abnormal pathways (if doesn't work)

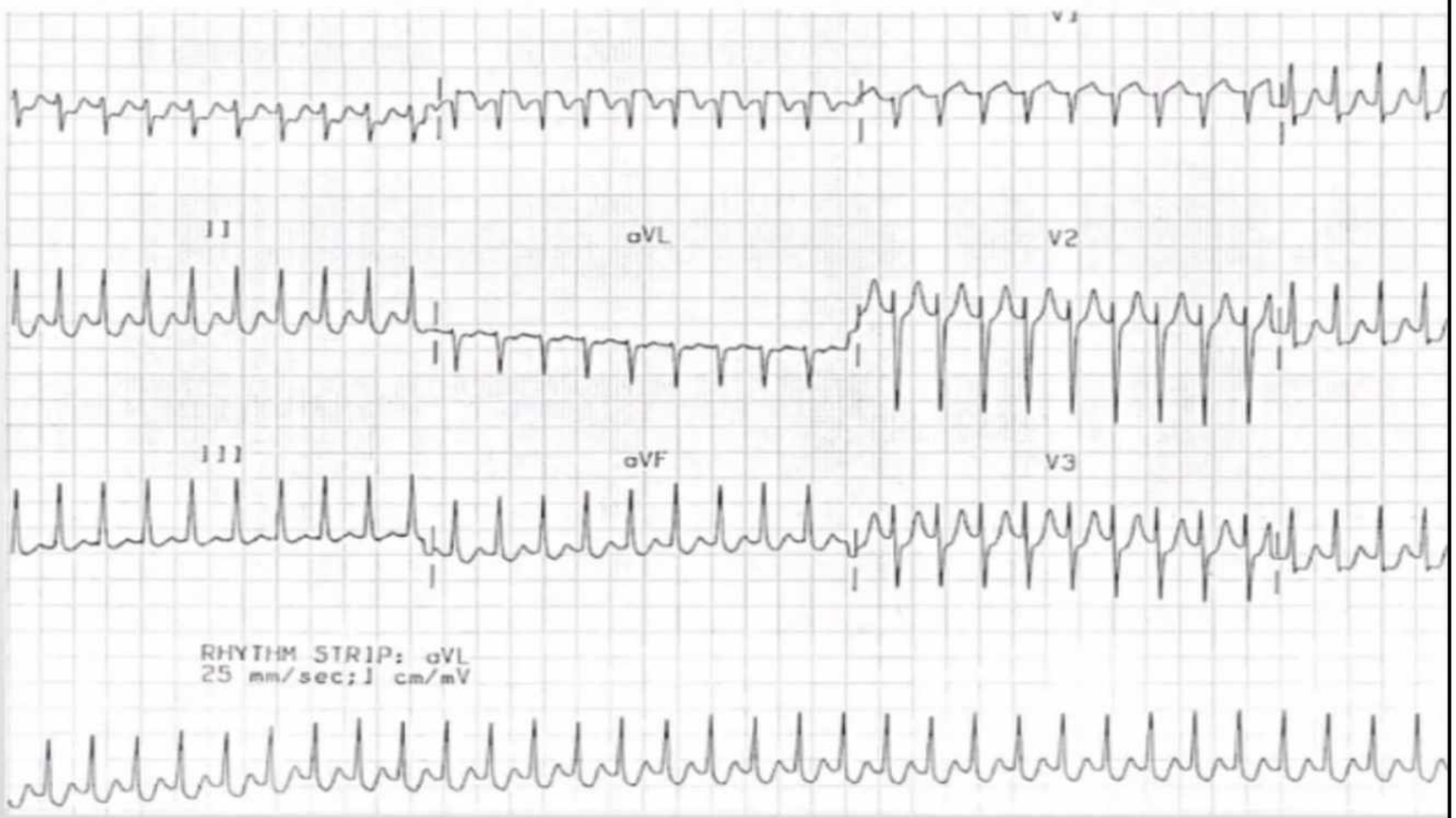
②

↳ bcs the conduction is through the normal conduction system & it back retrograde in the accessory pathway

SVT: Orthodromic AV Re-entrant Tachycardia (AV

short RP





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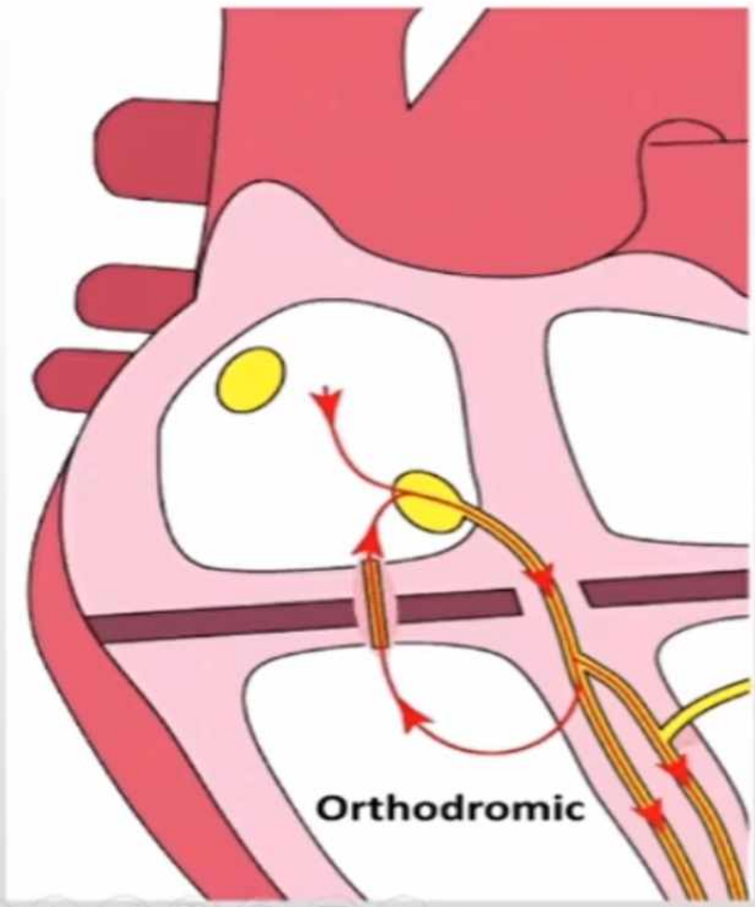
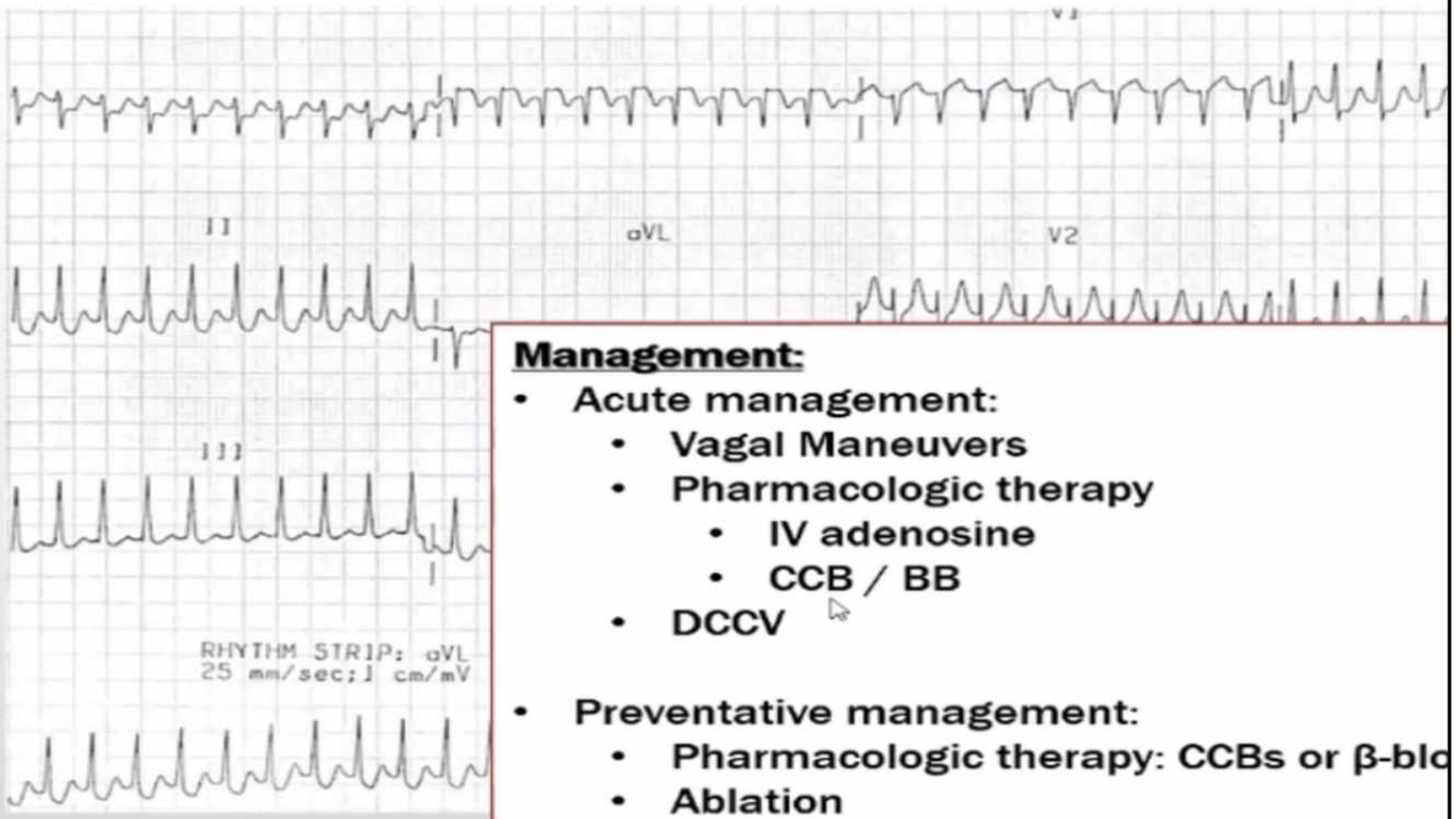
Macro re-entery (sometimes it's hidden → called concealed)

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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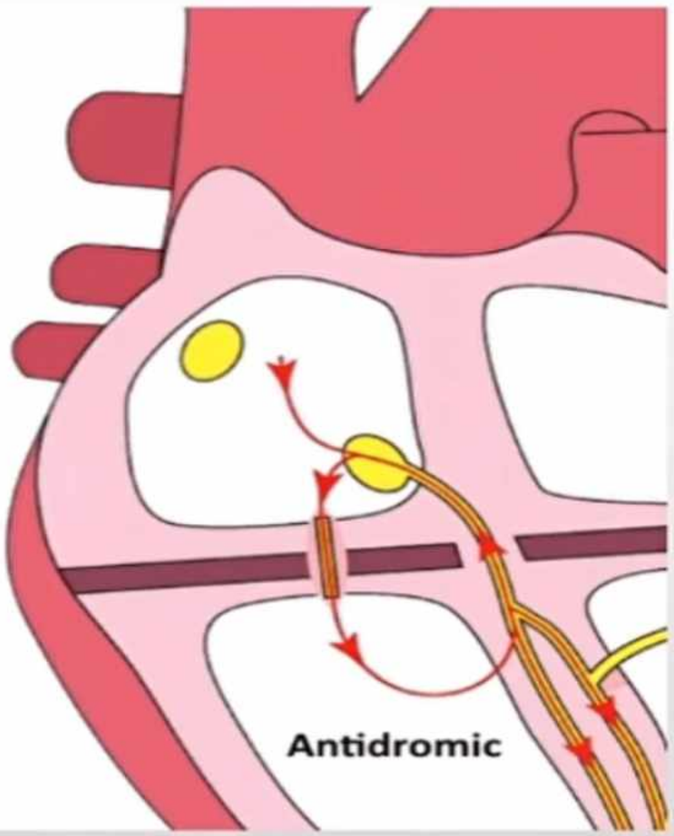
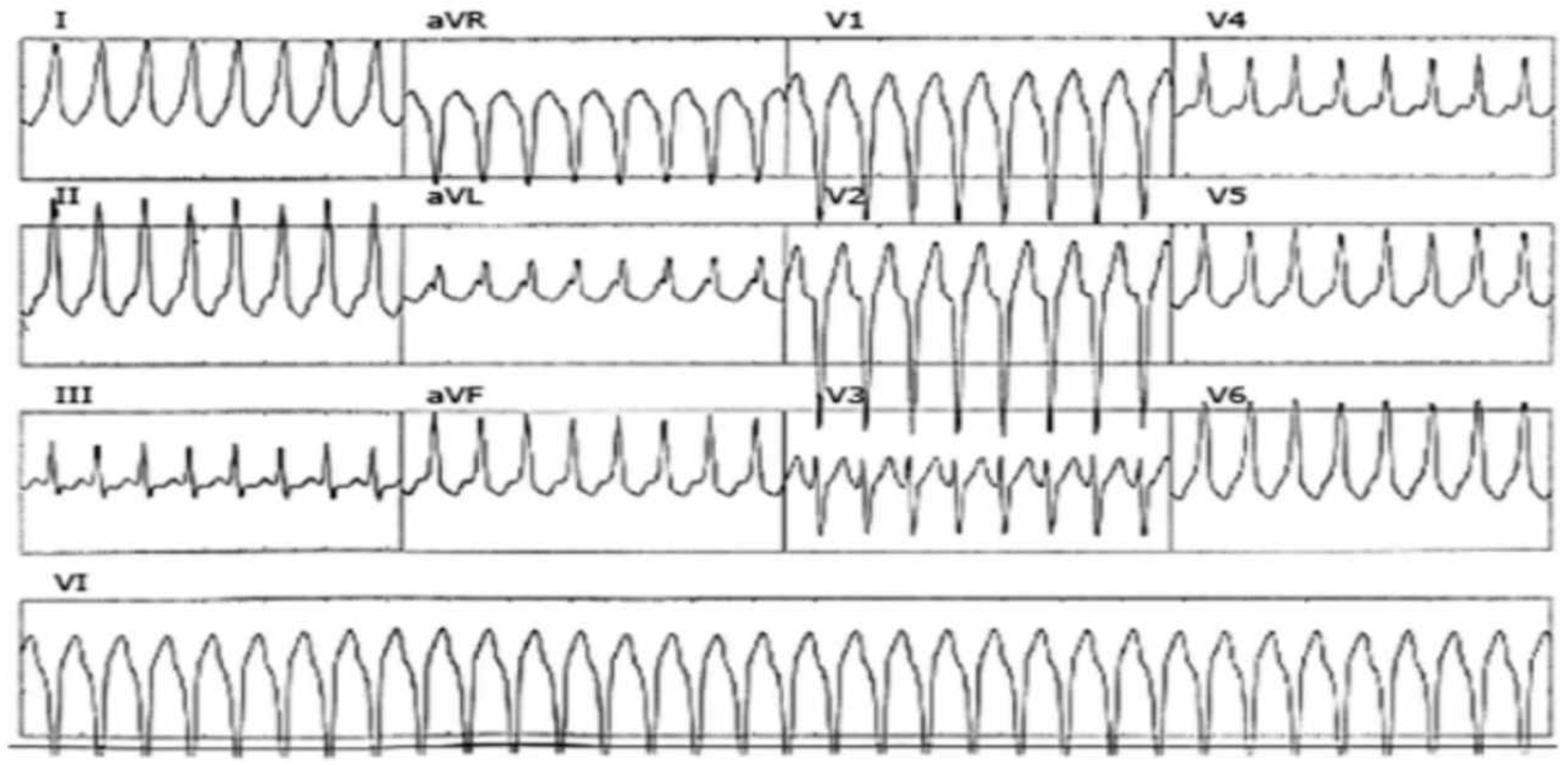
↳ the conduction goes through the accessory pathway (antegrade) and then back up through the normal conduction system

SVT: Antidromic AV Re-entrant Tachycardia (AVR

↳ Wide complex tachycardia





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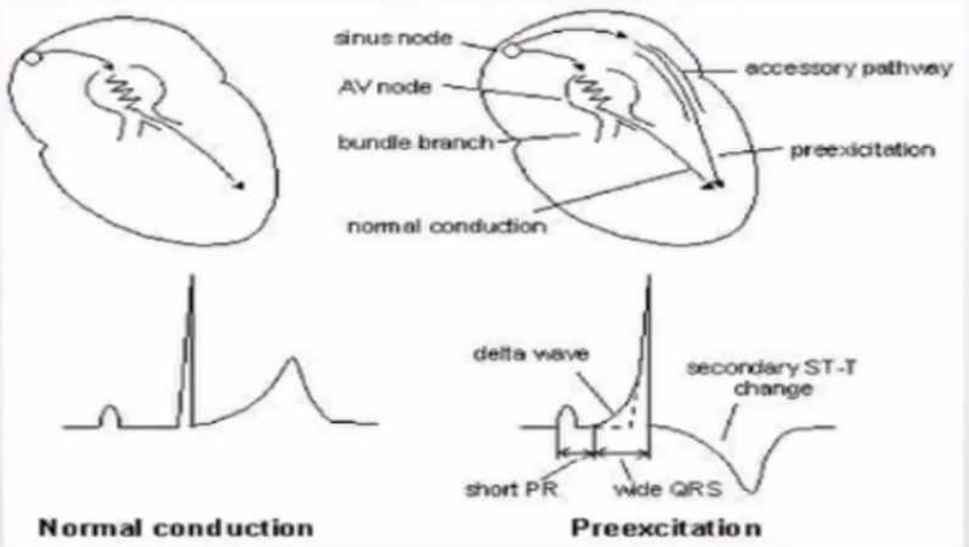
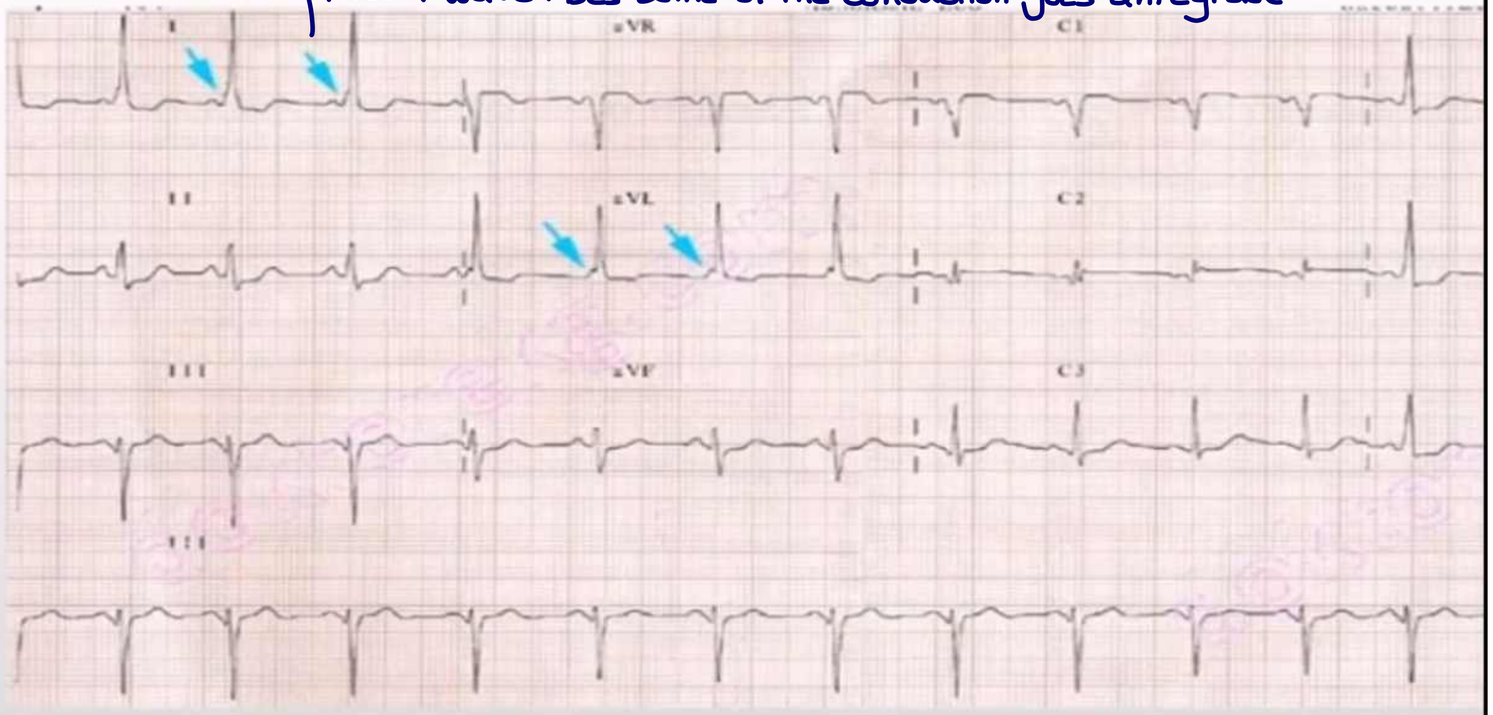
SVT: Wolf Parkinson White Syndrome (WPW)

Pre-excitation



↳ delta wave : bcs some of the conduction goes anregrade



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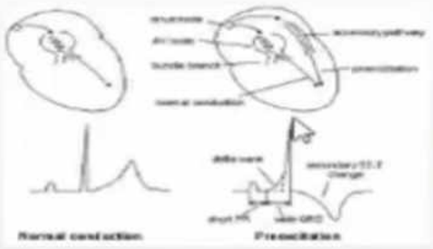
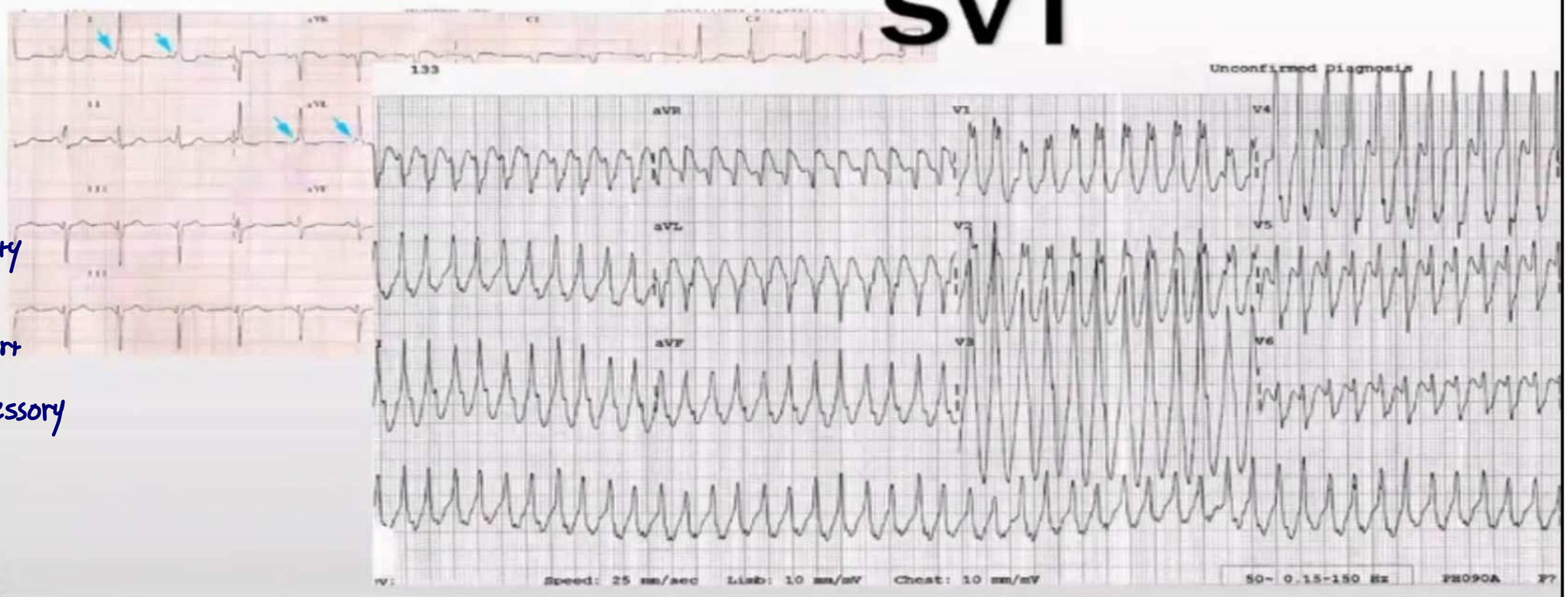
SVT: Wolf Parkinson White Syndrome (WPW)

Pre-excitation + SVT = WP





↳ part of the atrial activity goes down the normal conduction system & part of it goes down the accessory pathway

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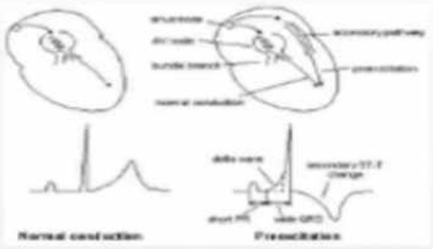
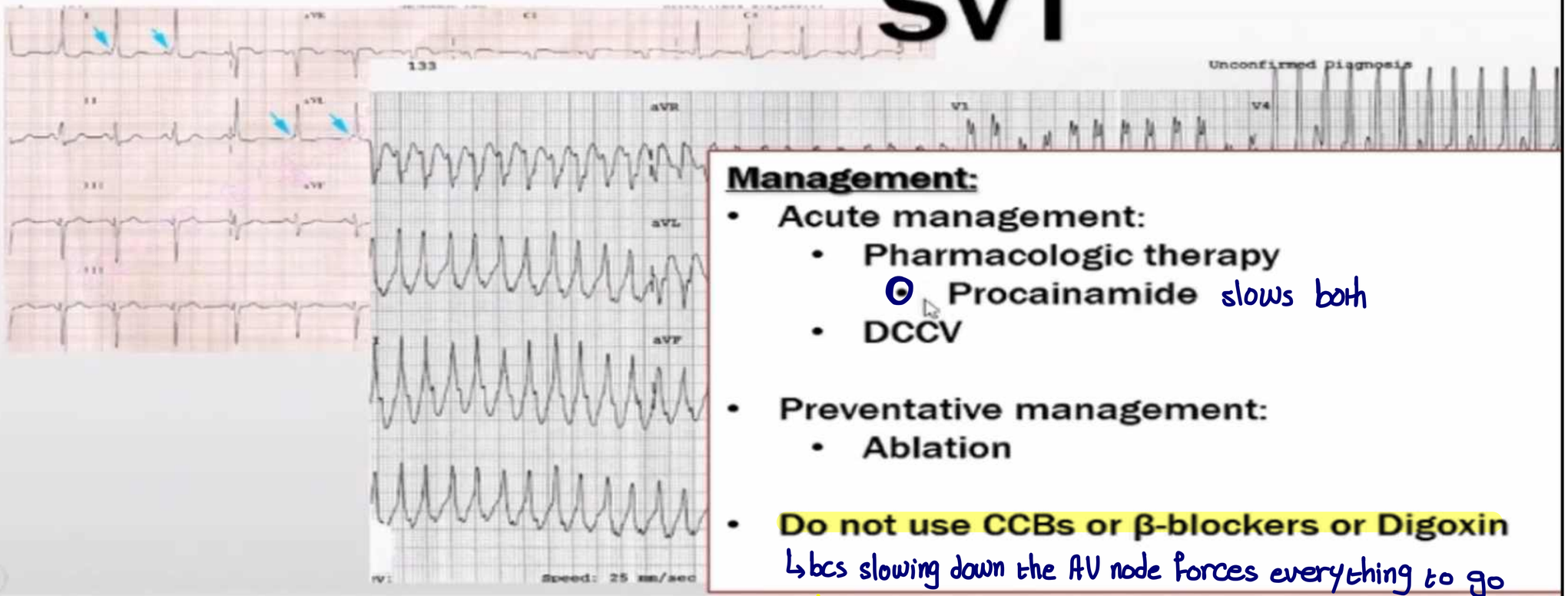
SVT: Wolf Parkinson White Syndrome (WPW)

Pre-excitation + SVT = WP





Management:

- Acute management:
  - Pharmacologic therapy
    - Procainamide slows both
  - DCCV
- Preventative management:
  - Ablation
- Do not use CCBs or β-blockers or Digoxin
  ↳ bcs slowing down the AV node forces everything to go down the accessory which will increase the arrhythmia

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Ventricular Tachycardia (VT)

- Causes:
  - Ischemia
  - CAD with prior MI is the most common cause
  - Cardiomyopathies
  - Ventricular scar tissue had MI before, underwent surgery
  - Congenital defects
  - Long QT syndrome congineral (problem in repolarization)
  - Electrolyte Abnormalities
  - Drug toxicity (antiemetics, antipsychotics, SSRIs, TCAs, macrolide and fluoroquinolone antibiotics)
    - ↳ Levofloxacin
    - ↳ Azithromycin

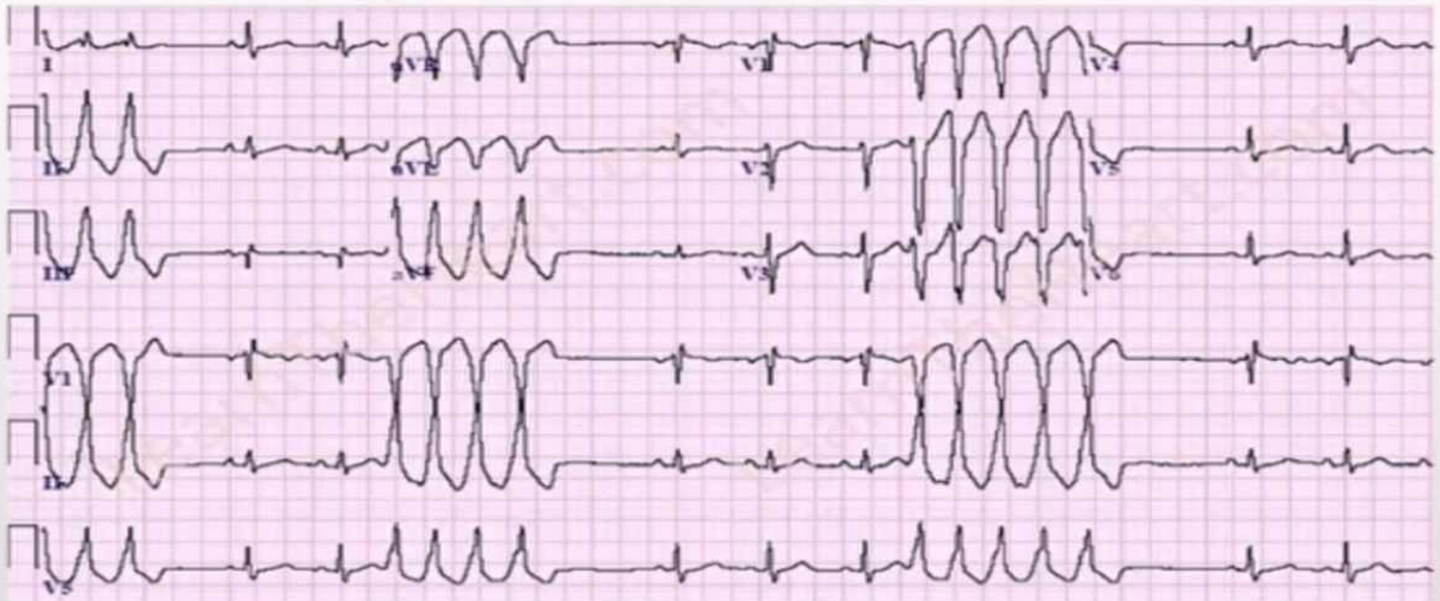
*Mostly they are Causes of monomorphic

Ventricular Tachycardia (VT)

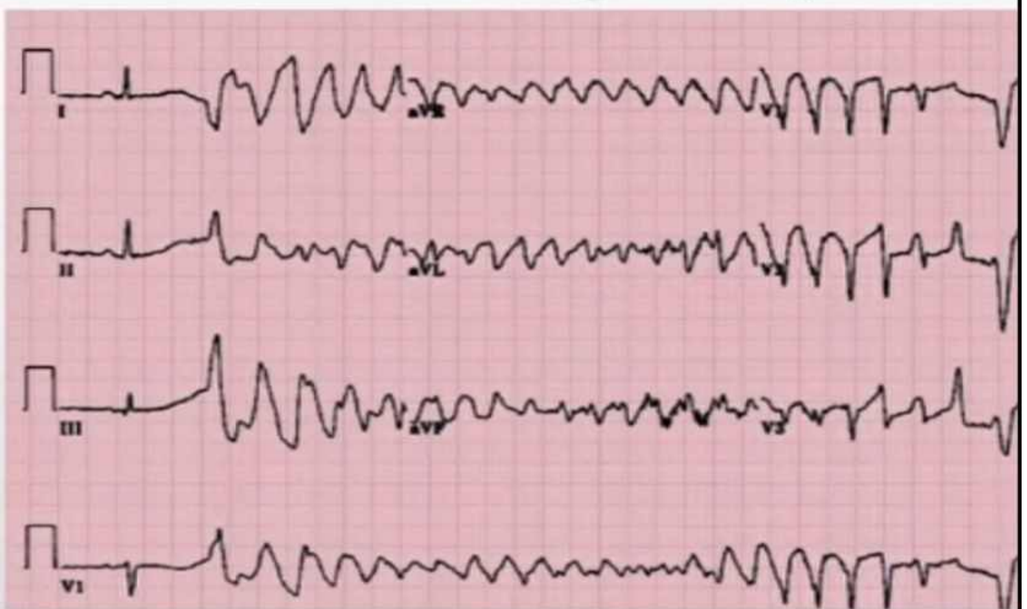
- Non-Sustained Ventricular Tachycardia (NSVT): < 30 seconds

if >30 seconds → sustained

Monomorphic



Polymorphic



↳ Causes: *prolonged QT issues

*Hypomagnisemia

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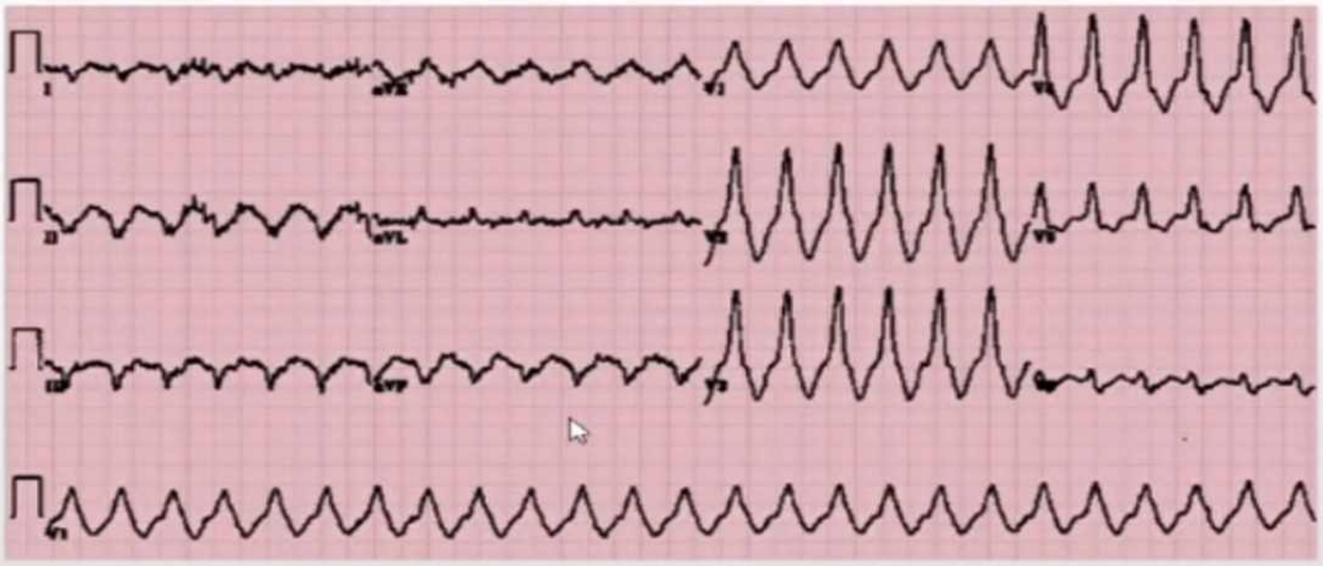
↳ if >30 seconds + polymorphic → Torsades de pointes

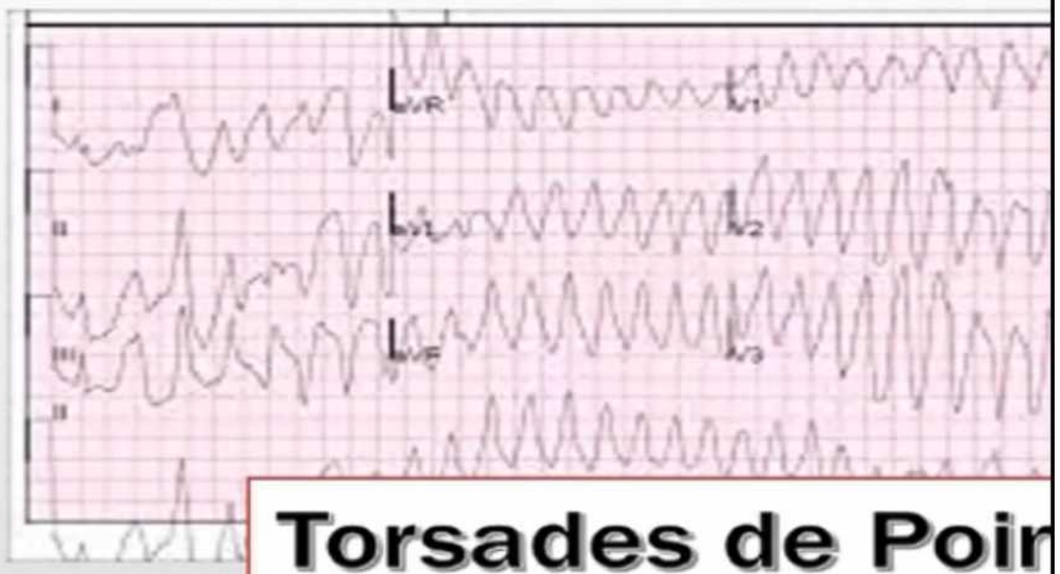
Ventricular Tachycardia (VT)

- Sustained Ventricular Tachycardia (NSVT): > 30 seconds

Monomorphic



Polymorphic



Torsades de Poin

Stable vs. Unstable?

Ventricular Tachycardia (VT) - Stable

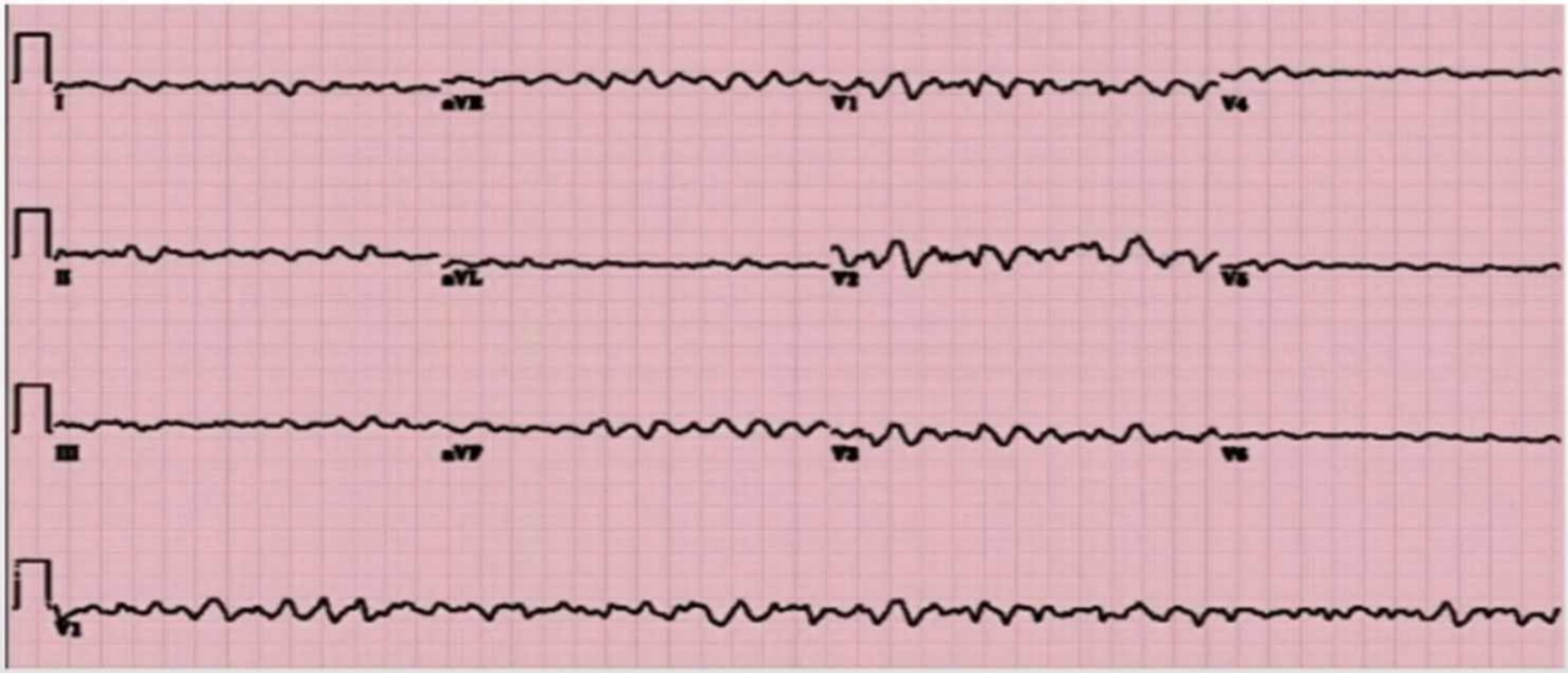
Management:

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

- Preventative management:
  - Consider ICD
  - Consider EPS → to ablate the area of tachycardia

Ventricular Vibrilation (VF)

Medical emergency
Code blue
Defibrillate immediately



Code

Defibrill

- is the pt. awake?
if yes make sure it's not an artifact

& Unstable Sustained V

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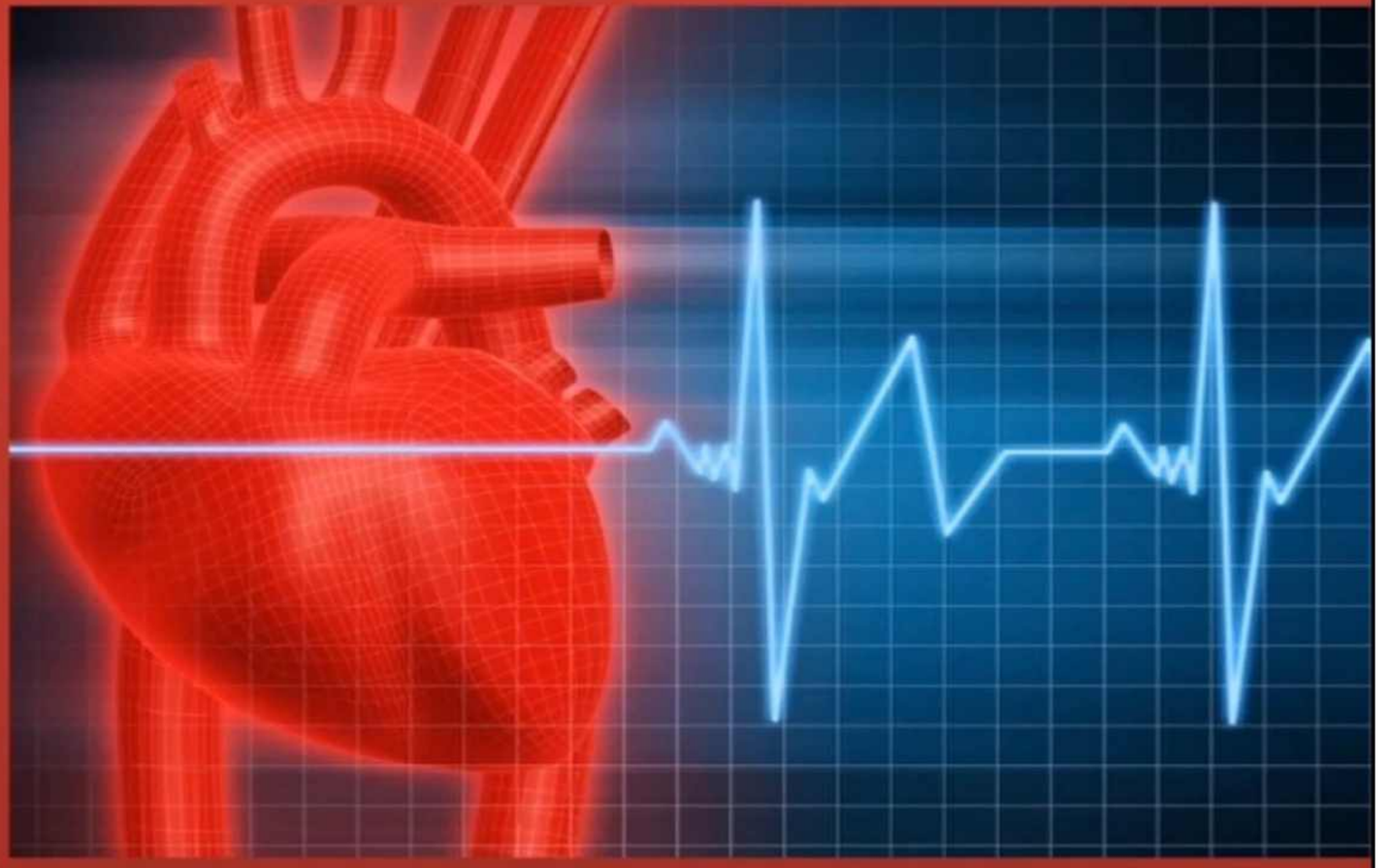
Bradyarrhythmias



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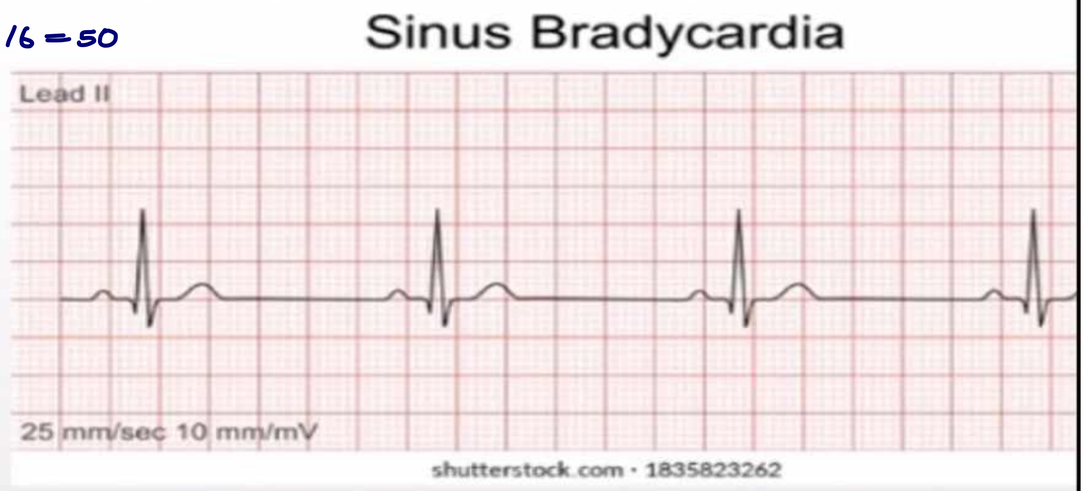
Bradycardia

- 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 could be due to stress, pain
  - Structural Heart Disease (Infiltrative, IE, ACHD)
  - Medications β-blockers, CCBs, digoxin
  - Athletes

300/6 = 50

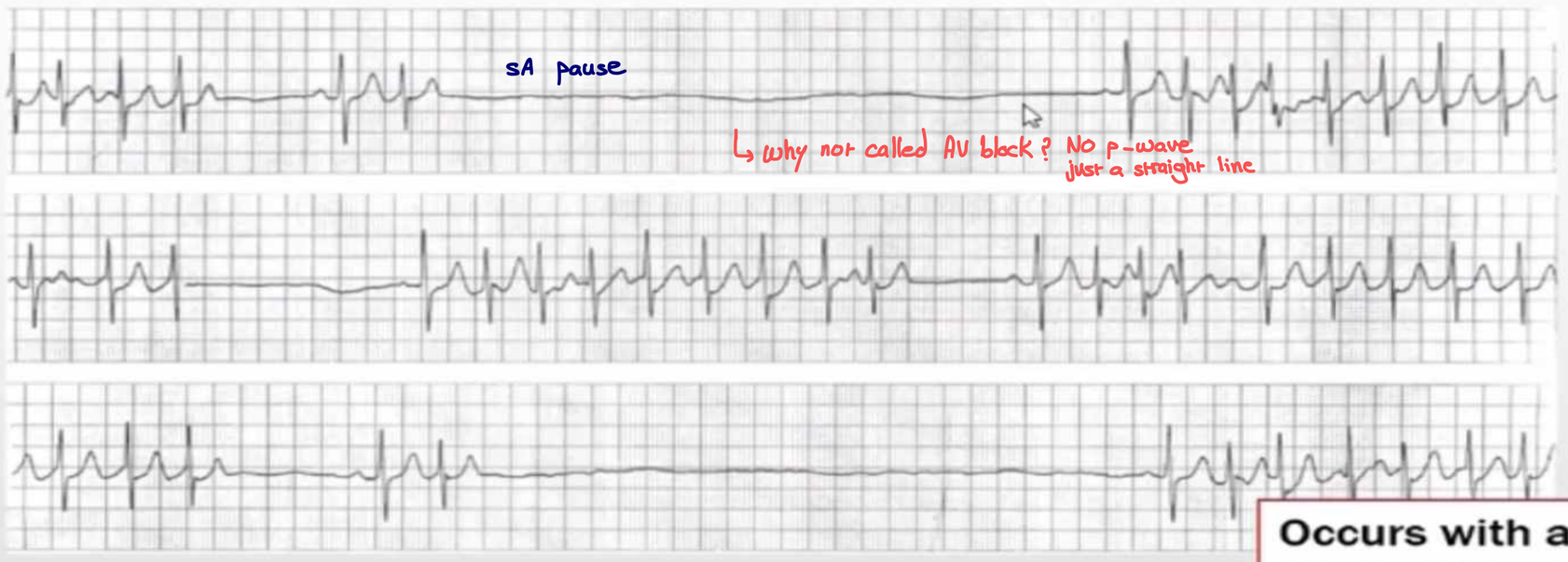


Clinical Status	Management
Asymptomatic	Observation
Symptomatic (Fatigue, Exercise Intolerance, Angina, Dizziness, Syncope)	Rx Cause acute: ↳ Atropine / B Agonist (Acute Pacemaker ↳ like vassopressor: dopamine, isoproterenol old people/ consistant ↵

Sick Sinus Syndrome (SSS) Electrical system olding

↳Tachy-Brady syndrome ↳SA pauses blocks ↳advanced age ↳usually they have marked sinus bradycardia

- **SA Dysfunction**



- Management:
  - Pacemaker placement

Occurs with advanced age
Marked Persistent Sinus Bradycardia
SA Pauses and Blocks
Frequently associated with Tachy-Bra
Usually co-exists with AV nodal disea

Atrio-Ventricular (AV) Block

Above the AV node, very innocent

Causes:

- Ischemia
- Increased Vagal tone
- Structural Heart Disease (Infiltrat
- Medications

- 1st Degree AV Block — Almost normal looking
  - Prolonged PR Interval > 0.2 second — > 1 big square
  - No dropped beats (*No P without QRS*)

- Management:

Clinical Status	Management
Asymptomatic	Observation
Symptomatic (Fatigue, Exercise Intolerance, Angina, Dizziness, Syncope)	Rx Cause Atropine / B Agonist (Acu Pacemaker

First degree AV Block → missed

Atrio-Ventricular (AV) Block

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

Causes:
- Ischemia
- Increased
- Structural
- Medicatio

- Management:

Clinical Status	Management
Asymptomatic	Observation
Symptomatic (Fatigue, Exercise Intolerance, Angina, Dizziness, Syncope)	Rx Cause Atropine / B Agonist (Acu Pacemaker

↳ last thing to do

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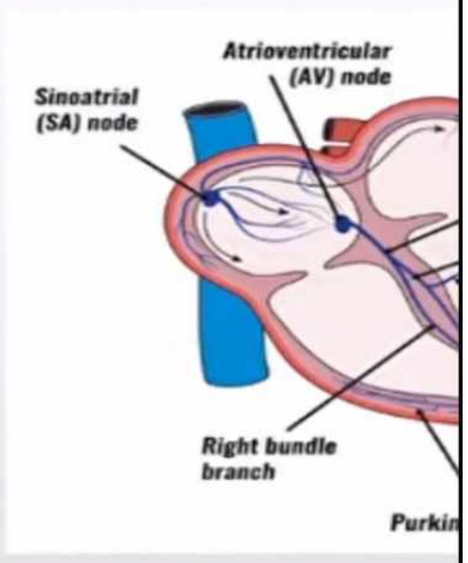
Atrio-Ventricular (AV) Block

High risk

- 2nd Degree AV Block – Mobitz Type II
  - ↑ Not Progressive PR Prolongation followed by a dropped QRS
    - ↳ It's fixed prolonged PR and then dropped QRS



- Management:
  - Pacemaker placement indicated
    - ↳ early, whether symptomatic or not

Atrio-Ventricular (AV) Block

- 2nd Degree AV Block (2:1 Block) I can't determine if it's type I or II
  - Alternating conducted QRS followed by a dropped QRS

- Management:
  - Needs further evaluation
    - ↳ More prolonged monitoring

Atrio-Ventricular (AV) Block

↳ complete heart block ↳ Complete dissociation btw the P waves & QRSs → narrow (if from the junction, bundle of his) / → Wide (if from the ventricle)

- 3rd Degree AV Block
  - P > QRS
  - AV Dissociation

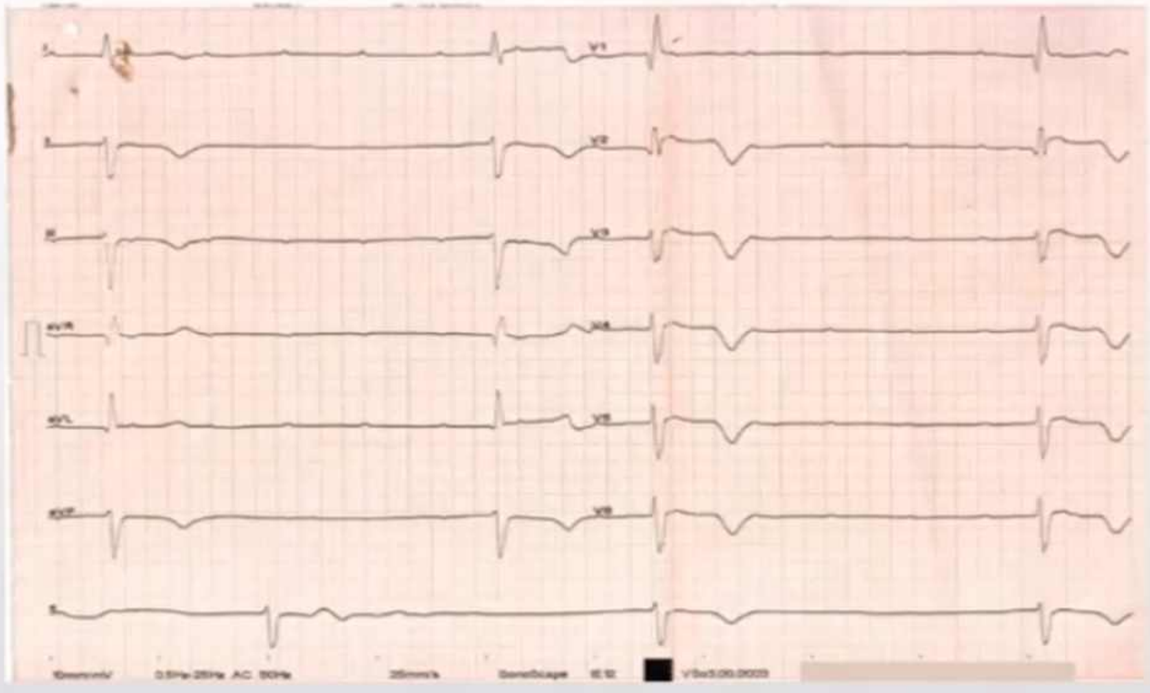
  - Management:
    - Medical Emergency
    - Emergent Pacer placement

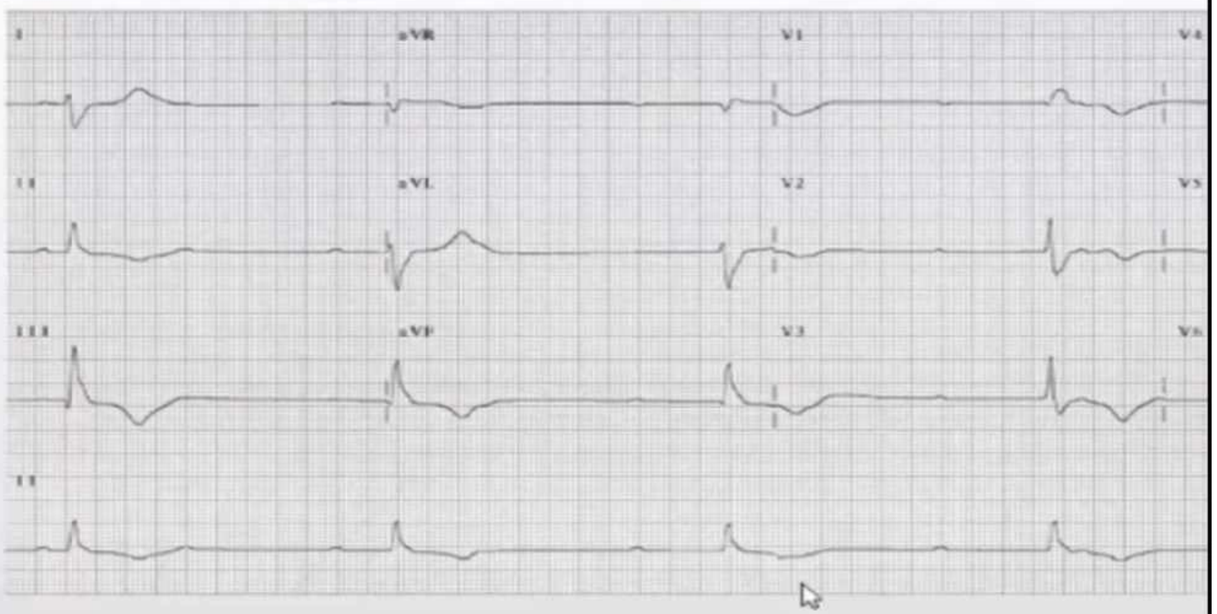
Ps > QRSs in V tachy → QRS > P

↳ narrow QRS

Atrio-Ventricular (AV) Block

- 3rd Degree AV Block





↳ Wide QRS

Atrio-Ventricular (AV) Block

- 3rd Degree AV Block

↳ no p waves → mostly an artifact

↳ here, QRSs are regular in a patient who has baseline A Fib (it was irregular and then changed to regular) → he developed a complete heart block on top of his A Fib which caused a junctional escape.

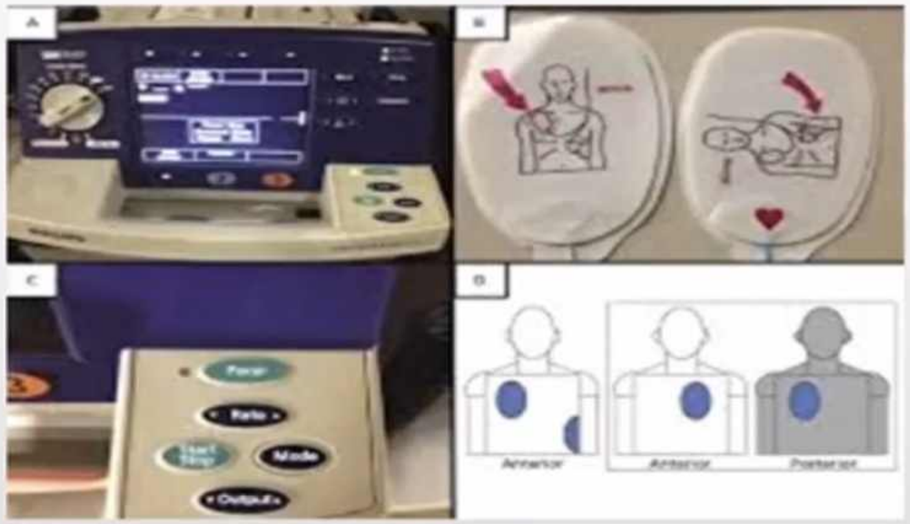
↳ but he didn't convert bcs there is no p wave

↳ very important sign of digoxin toxicity which is given to treat A Fib → could develop renal failure → become dig. toxic → change from irregular to regular

Pacemakers & Cardiac Device

Temporary فترة قصيرة

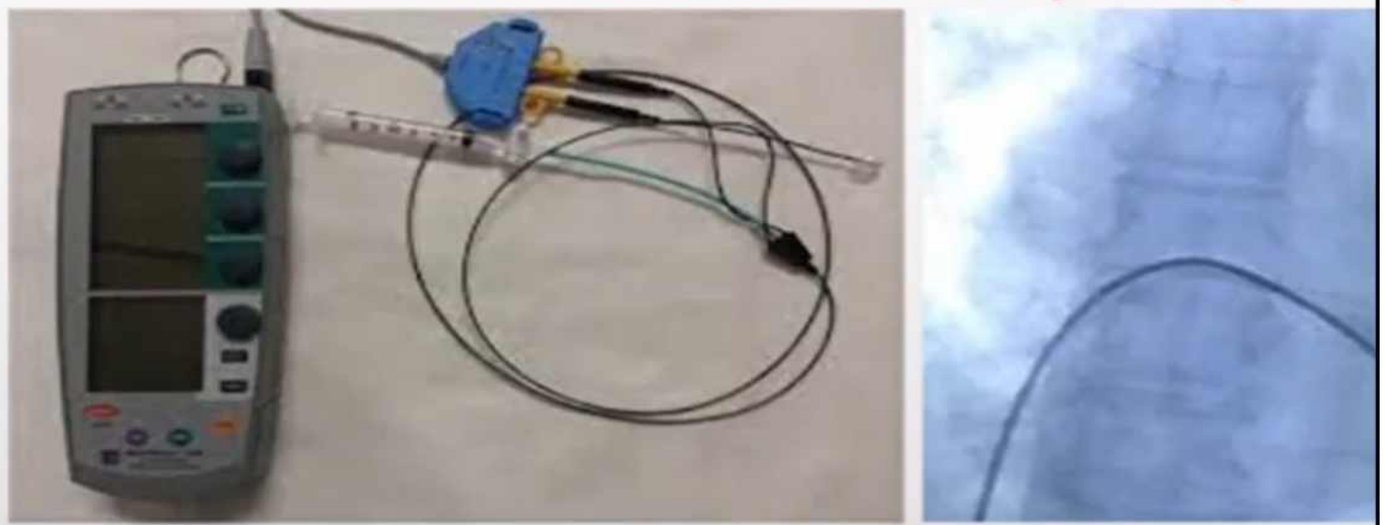
Transcutaneous



↳ for extreme emergency
↳ very painful
↳ not reliable

Life saving until you get →

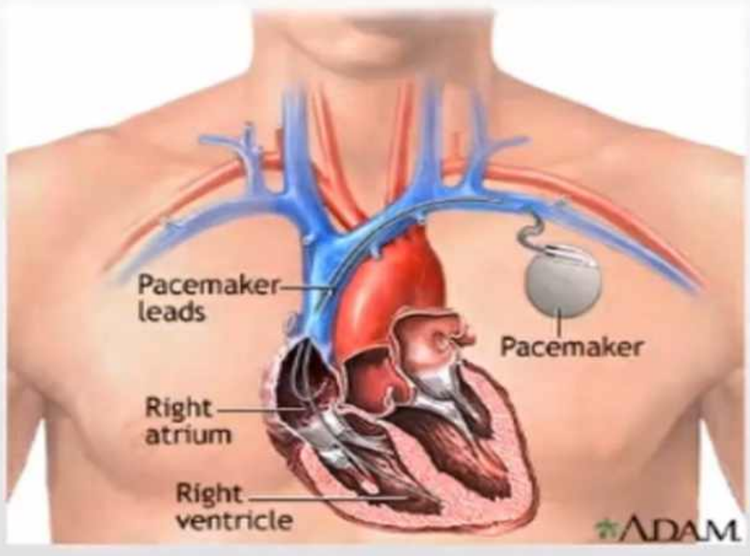
Transvenous (TVP)

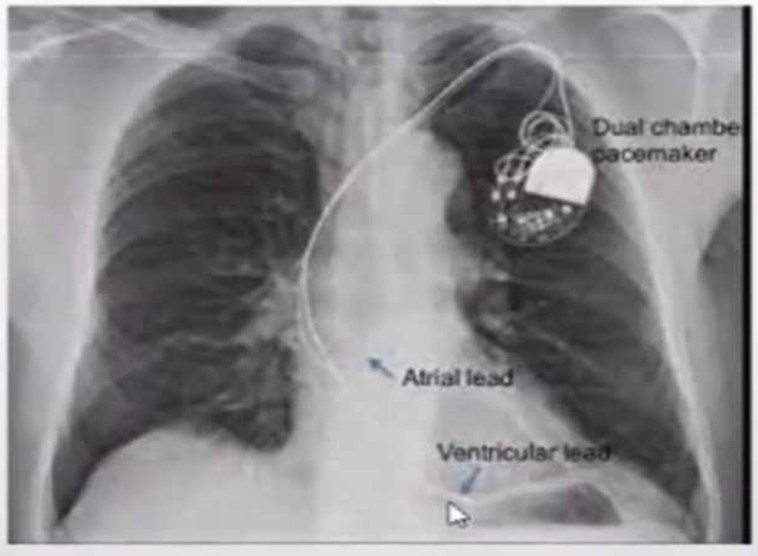


↳ used especially if there is a reversible cause

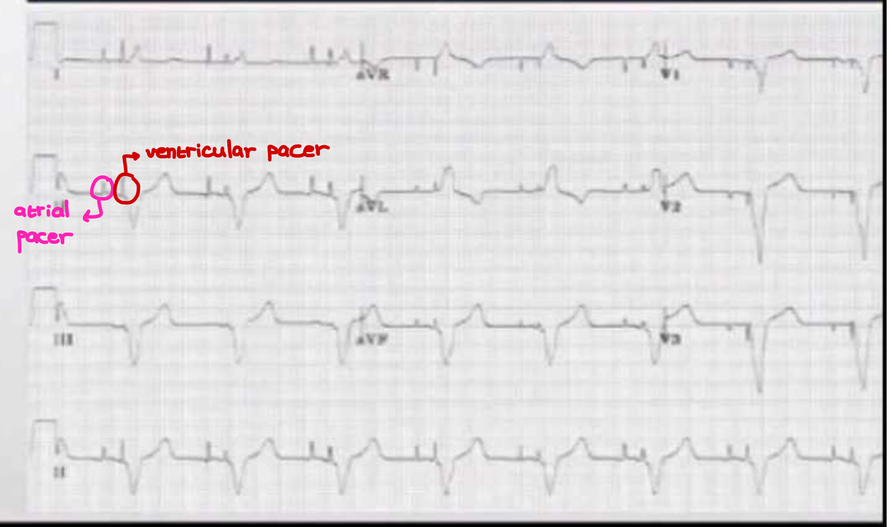
Pacemakers & Cardiac Devices

Permanent Pacemaker (PPM)





Letter 1	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



↳ could be single / dual chamber

↳ Mostly used in bradyarrhythmias

↳ A paced rhythm = wide rhythm

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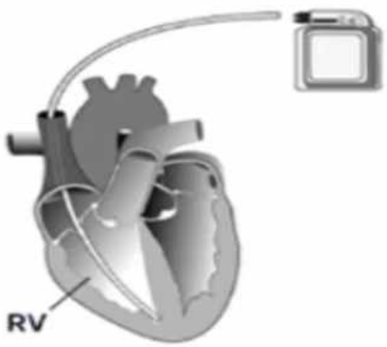
Pacemakers & Cardiac Devices

↳ have the pacemaker function ↳ Mostly used for ventricular tachycardias

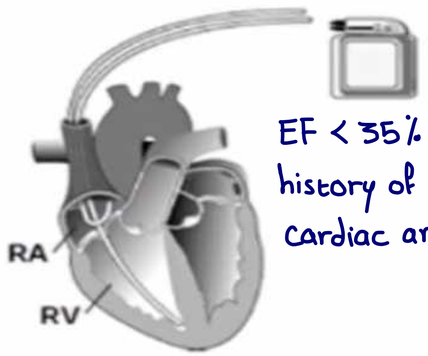
Implantable Cardiac Defibrillator (ICD)

Single Chamber ICD



A lead is attached in the right ventricle (RV). If needed, energy is delivered to the ventricle to help it contract normally.

Dual Chamber ICD

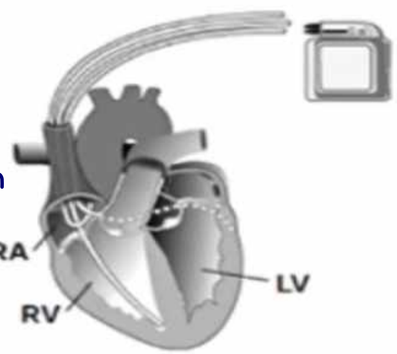


EF < 35%
history of sudden cardiac arrest

Leads are attached in the right atrium (RA) and the right ventricle (RV). Energy is delivered first to the right atrium and then to the right ventricle, helping your heart to beat in a normal sequence.

↳ Anti-Tachycardia Pacing (ATP)

Biventricular Device



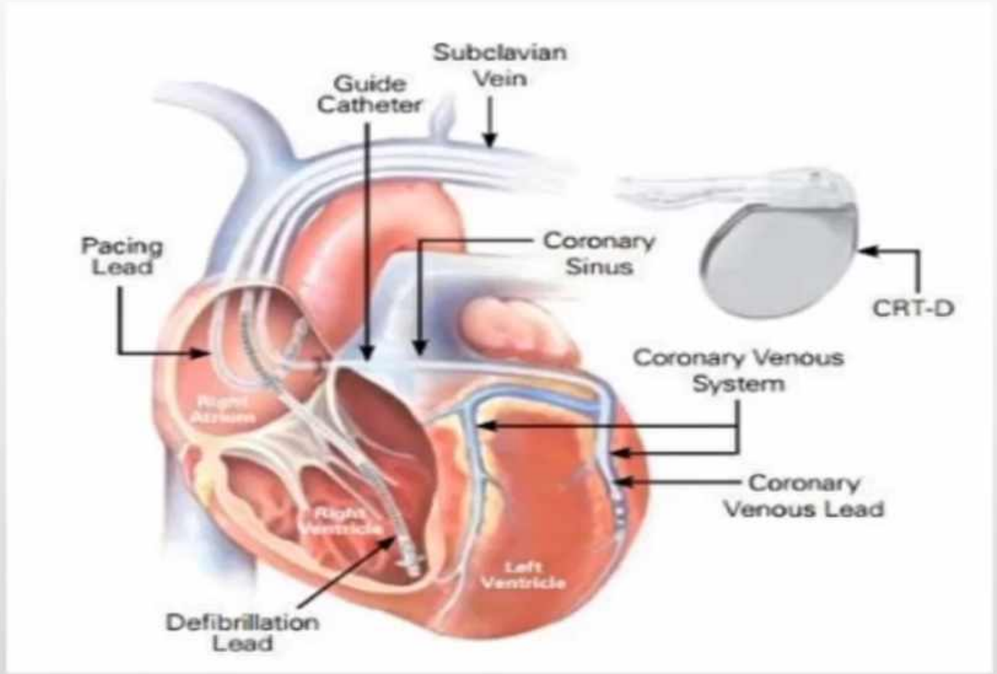
Two or three leads are positioned in the right atrium (RA), the right ventricle (RV) and the left ventricle (LV) via the coronary sinus vein. This device helps the heart beat in a more [illegible]cally heart failure.

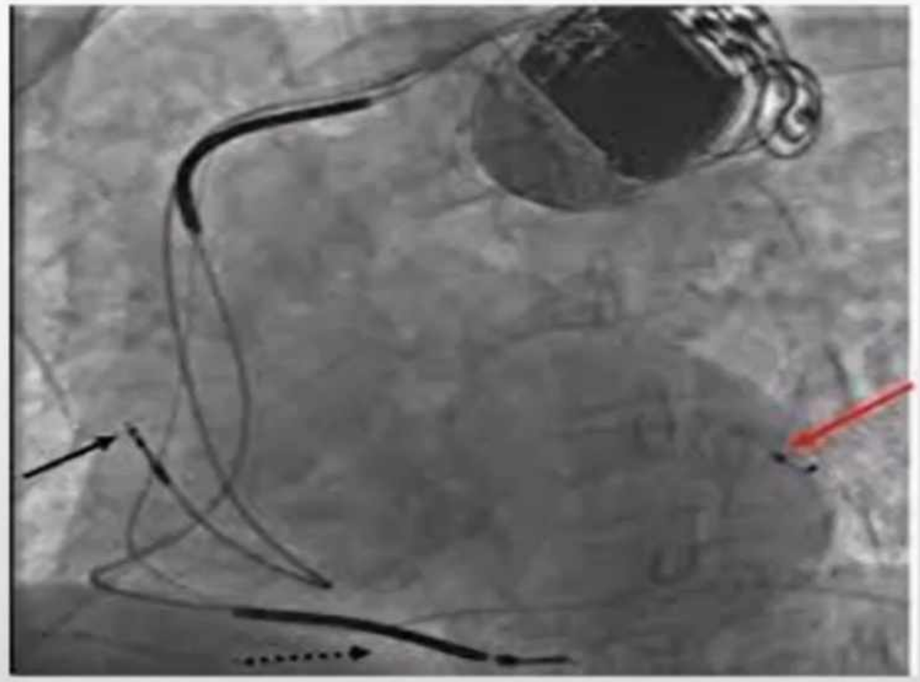
Pacemakers & Cardiac Devices

Cardiac Resynchronization Therapy (CRT)

↳ used in severe HF

↳ 3 leads: ① in right ventricle
② in right atrium
③ through the coronary sinus down the cardiac vein to reach the lateral left ventricle wall





AKA
Bi Ventricul
(BiV P

Type
CRT - P
CRT only

Pacemakers & Cardiac Devices

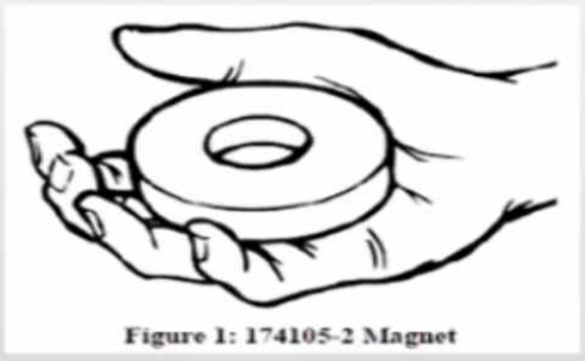


Figure 1: 174105-2 Magnet

Magnet Mode

بتجيب مغناطيس وبتحطه فوق الـ pacemaker فبجيس يعمل
↳ pacing continuously without looking at any electricity around it

	Magnet Mode ON
Pacemaker	Asynchronous Pacing
ICD	Defibrillator OFF

Indications:

↳ in surgeries, you sometimes may use electrocauteries which can confuse the pacemaker and cause arrhythmias

↳ ICD → cardiac arrest pt. needs a shock

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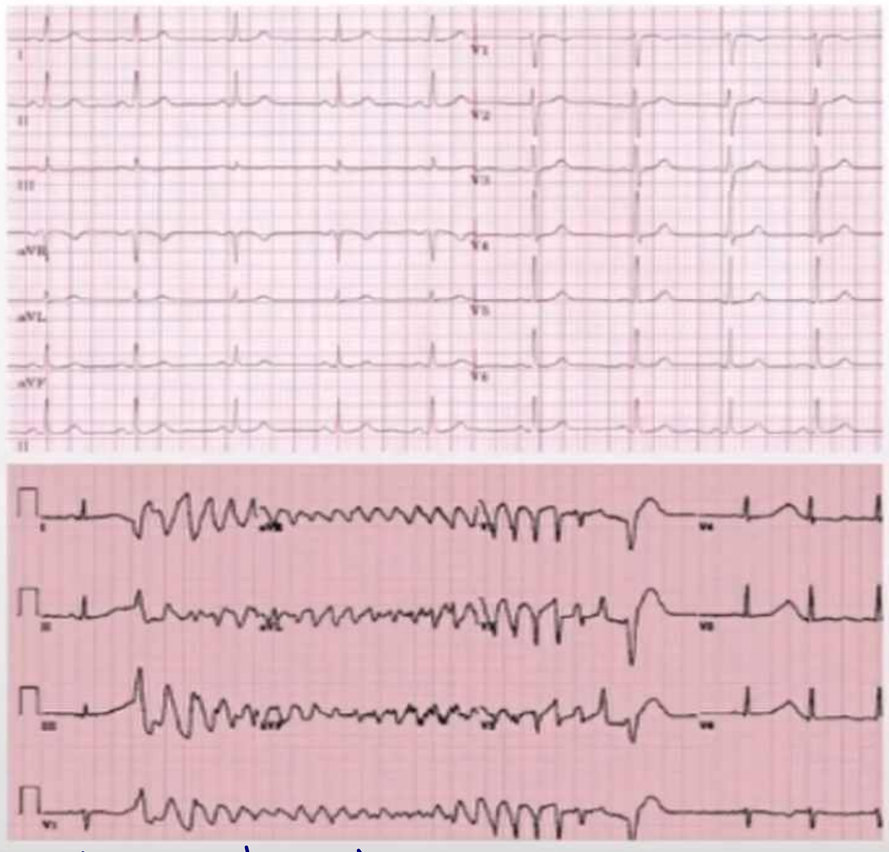
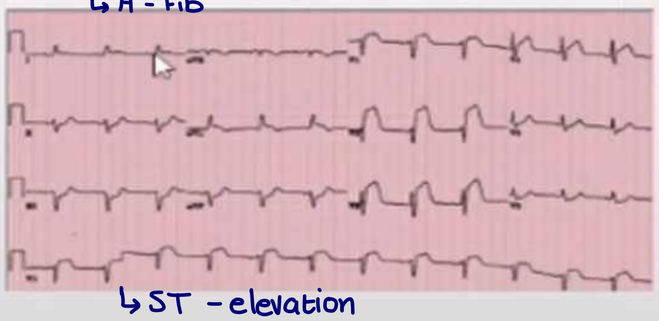
↳ Until you done, you move the magnet so the pacemaker gets back to it's normal program

Cardiac Arrhythmias



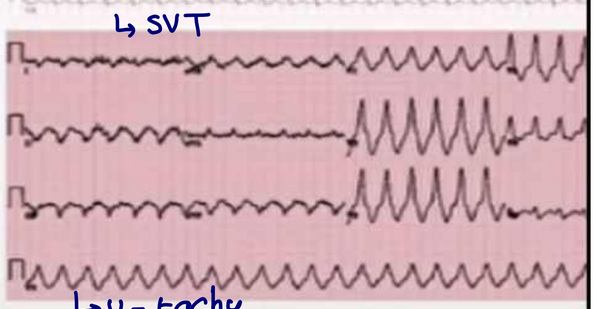
↳ Torsades de pointes

↳ A - Fib



↳ ST - elevation

↳ SVT



↳ V - tachy

↳ V - Fib