


ThinkAskLearn
Health Professional Education

ECG Fundamentals

David Corkill
Emergency Nurse Educator
MEmergN, MAdvPrac (Hth Prof Edu), BN, Dip App Sc
www.thinkasklearn.com.au

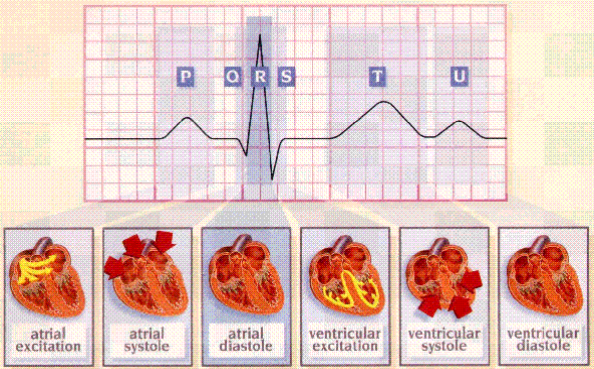


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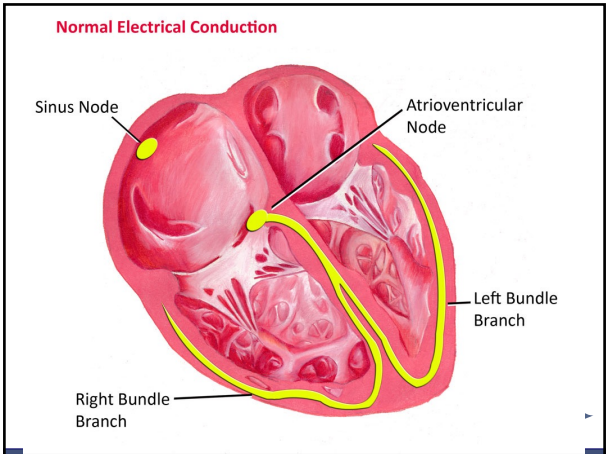


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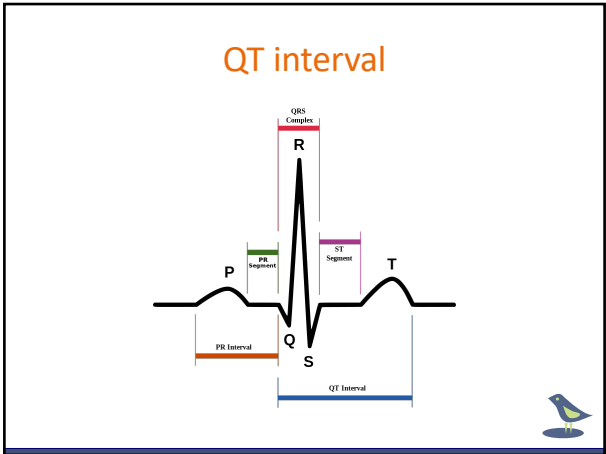
The Normal Cardiac Cycle



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Interpreting a rhythm strip

- Rate – how fast?
- Rhythm – regular or irregular?
- PR interval
 - normal 120 -200 milli-seconds
- QRS width
 - Normal <120 msec
 - Is it narrow or broad?
 - Are there Q waves present?

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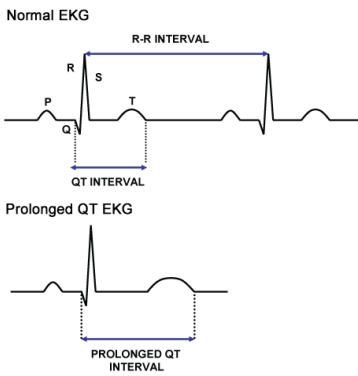
Interpreting a rhythm strip

- T Waves
 - Are there peaked T waves?
 - Are the T waves
 - Normal?
 - Inverted?
- ST segments
 - Is there ST elevation or depression?
- QT interval
- U waves



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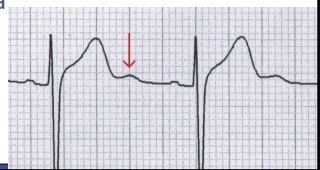
QT = < 1/2 R-R interval



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U waves

- <1-2mm or 25% of the height of the T wave.
- Prominent U waves commonly found with:
 - Bradycardia
 - Severe hypokalaemia



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Prominent U wave - Hypokalaemia



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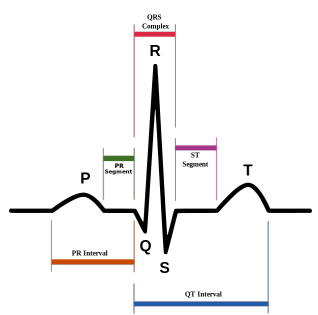
Prominent U waves

- Hypocalcaemia
- Hypomagnesaemia
- Hypothermia
- Raised intracranial pressure
- Left ventricular hypertrophy
- Hypertrophic cardiomyopathy
- Digoxin
- Phenothiazines (thioridazine)
- Class Ia antiarrhythmics (quinidine, procainamide)
- Class III antiarrhythmics (sotalol, amiodarone)



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QT interval



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Normal Sinus Rhythm (NSR)



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Sinus Tachycardia



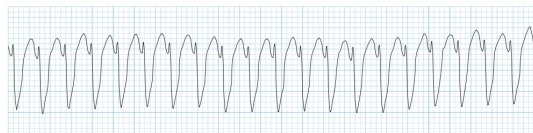
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Sinus Bradycardia



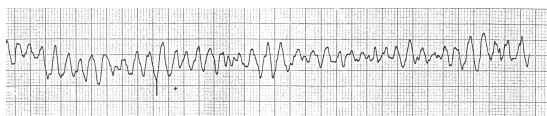
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Ventricular Tachycardia (VT)



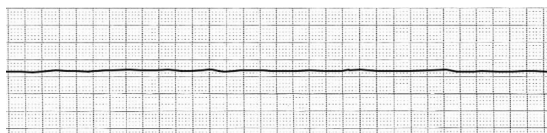
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Ventricular Fibrillation (VF)

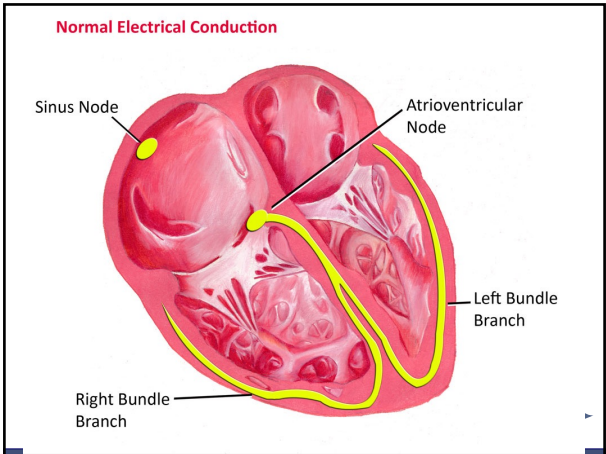


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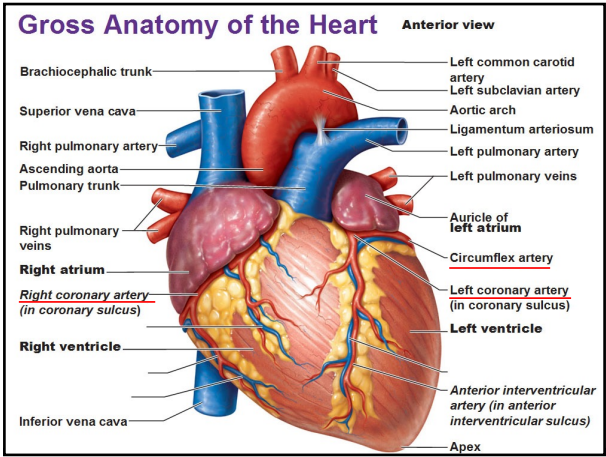
Asystole



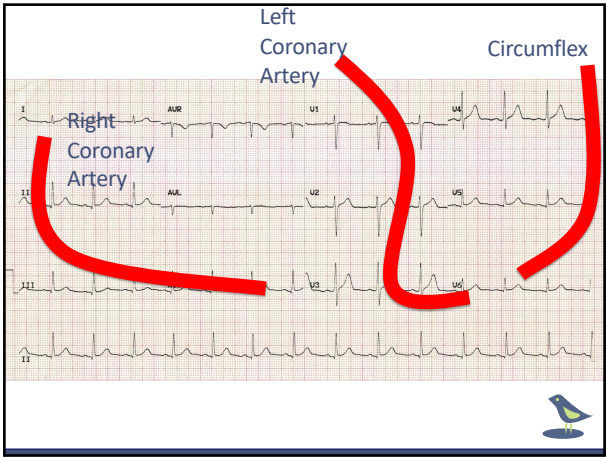
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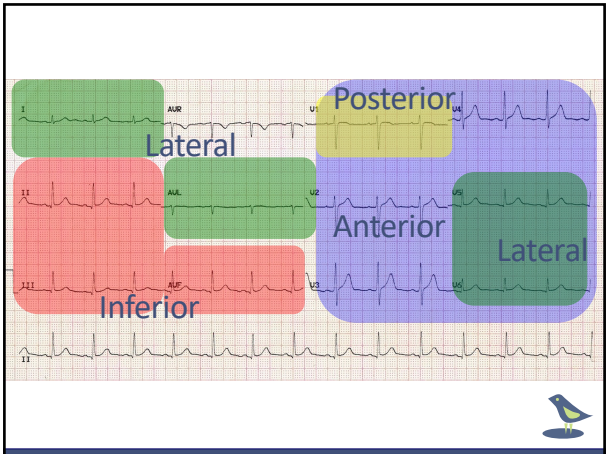
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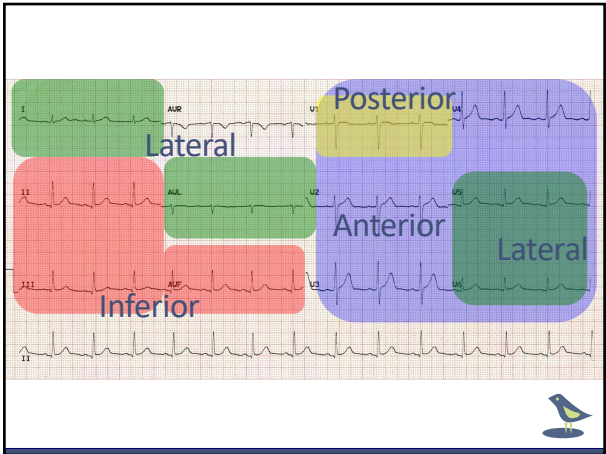
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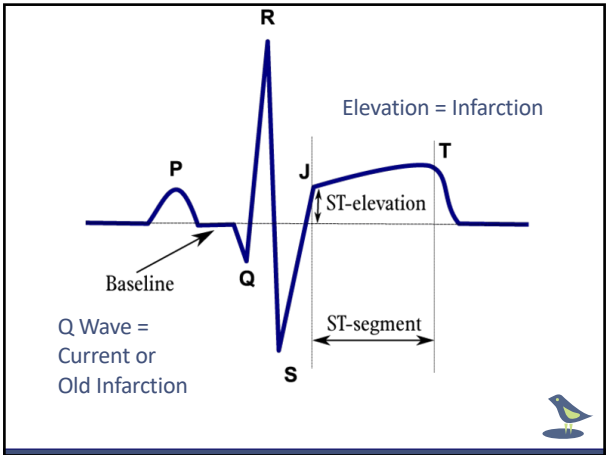
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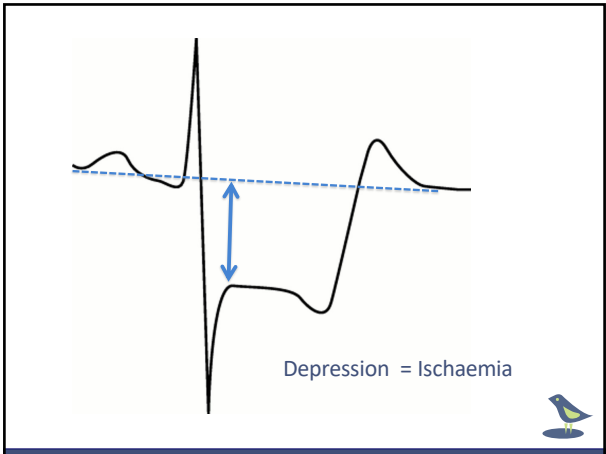
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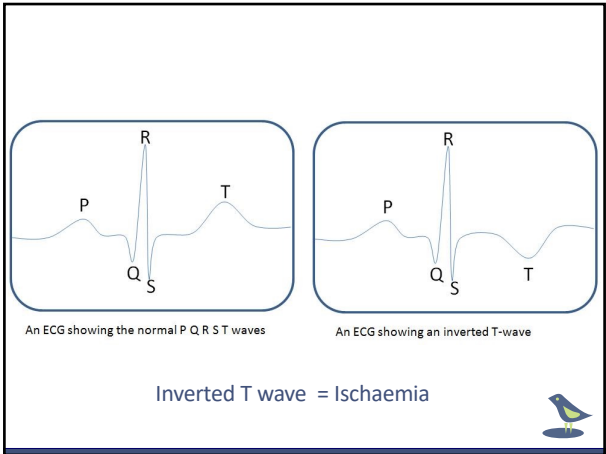
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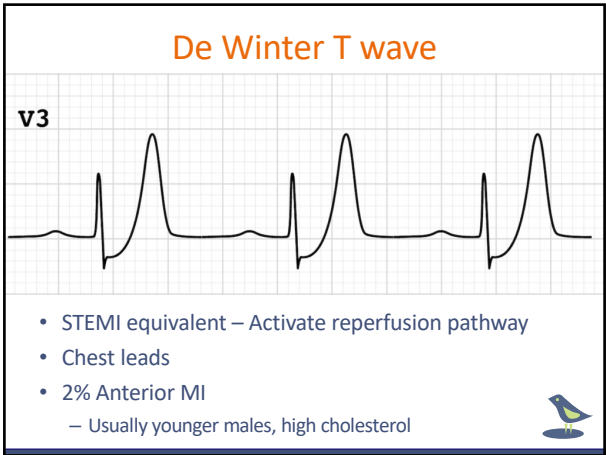
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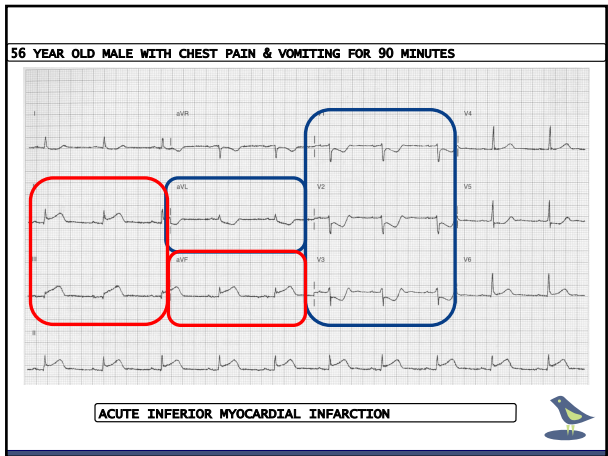
	Criteria	Supporting information and illustration	Recommendation for clinical action
A. Regional STE with reciprocal STD	STE ≥1 mm at the J-point in two contiguous leads in all leads other than V5-V6. V2-V4 STE criteria: ≥1.5 mm in women ≥2 mm in men ≥40 years ≥2.5 mm in men <40 years		Activate reperfusion pathway
B. High lateral MI	STE I, aVL, V2 STD III (-V1, -II, -aVF) Subtle STE in V1-V4 and reciprocal changes in aVL may be seen.		Activate reperfusion pathway
C. Posterior MI	Precordial STD ≥0.5 mm V1-3 Conform with posterior leads (V7-V9) with findings of STE • ≥0.5 mm in women and men ≥40 years • ≥1 mm in men <40 years	V7 & 9 supplementary lead placement 	Activate reperfusion pathway
D. Right ventricular MI	STE ≥0.5 mm in any right-sided chest lead (V3R-V6R), but particularly V4R. STE ≥1 mm in men <40 years	Right precordial supplementary lead placement 	Activate reperfusion pathway
E. De Winter T waves	J-point depression with up-sloping ST segments and tall, peaked, asymmetric T waves in precordial leads, with STE (≥0.5 mm) in aVL and an absence of STE in precordial leads.		Activate reperfusion pathway
F. Modified Sgarbossa criteria (BBB or paced rhythm)	Any of the following: A) Concordant STE >1 mm in leads with positive QRS complex B) Concordant STD ≥1 mm V1-3 C) STE ≥1 mm in one or more leads at the J-point which is proportionally discordant to the preceding S wave by ≥25%.		Activate reperfusion pathway



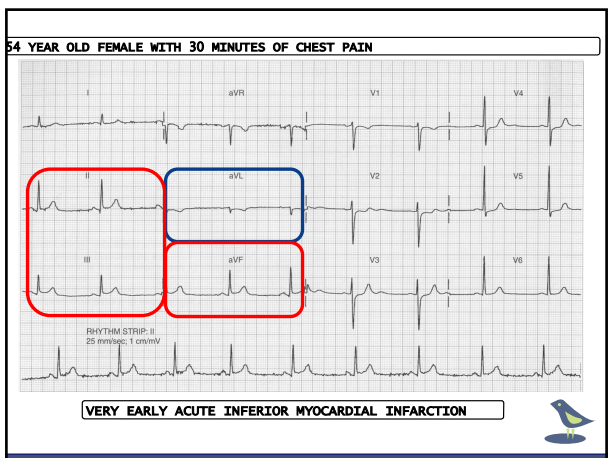
Australian clinical guideline for diagnosing and managing acute coronary syndromes 2025



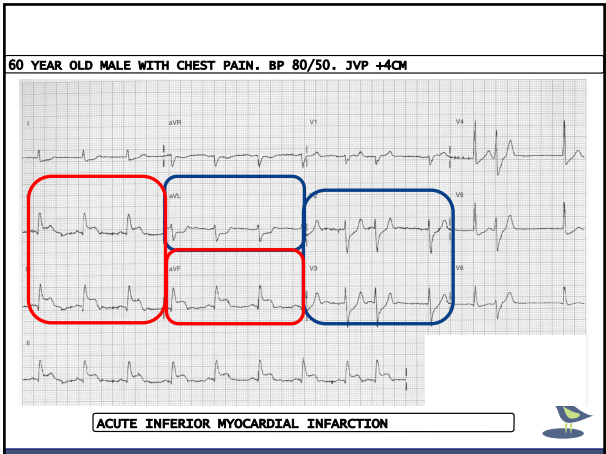
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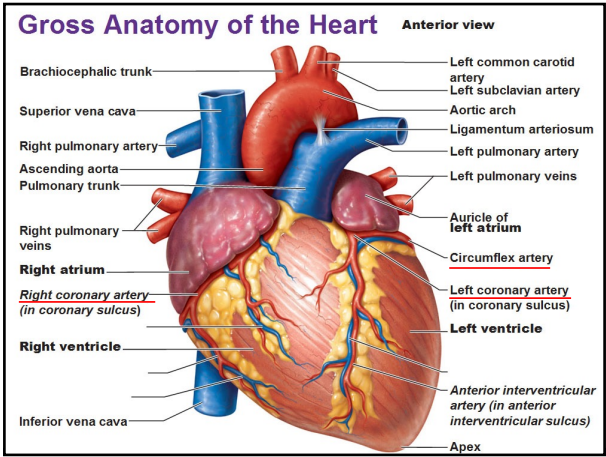
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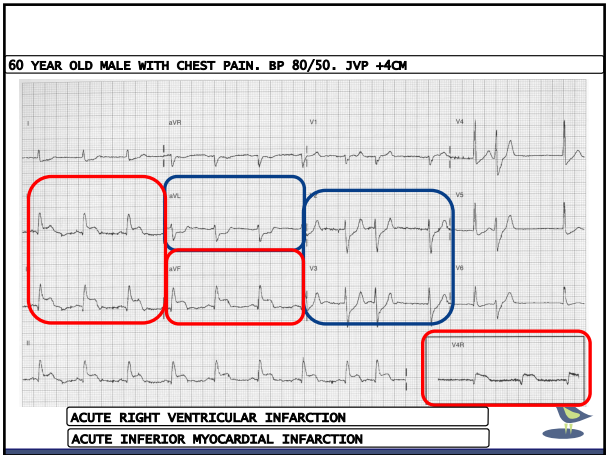
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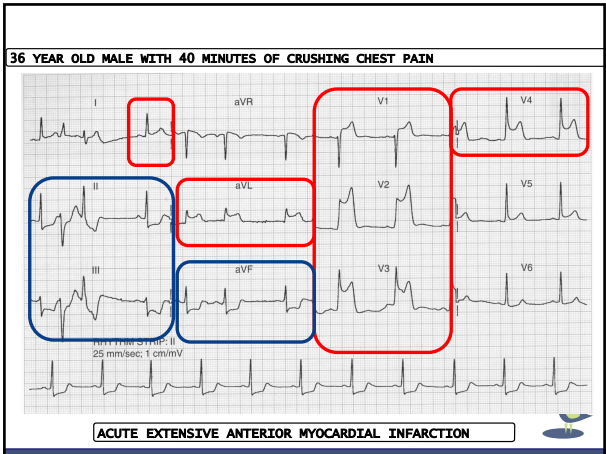
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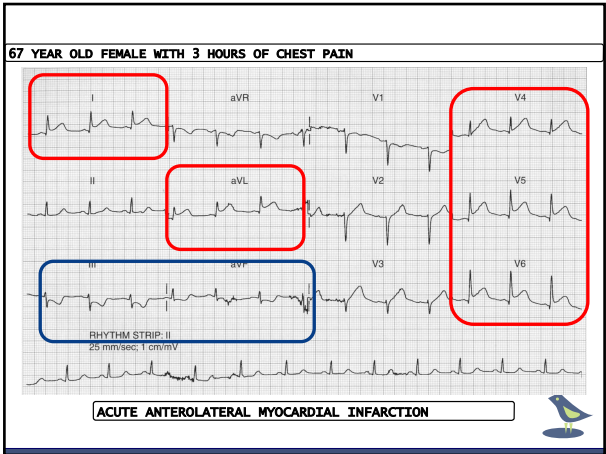
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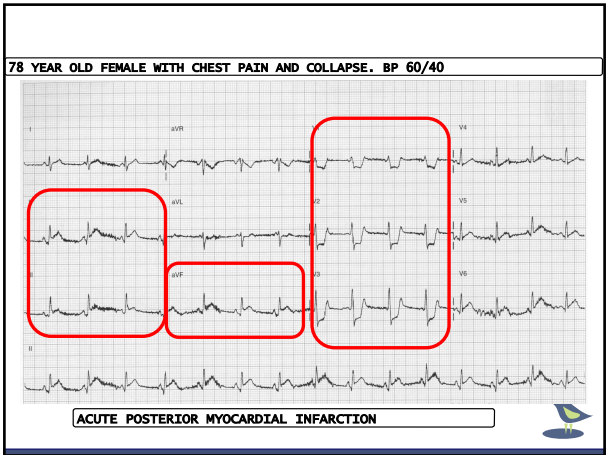
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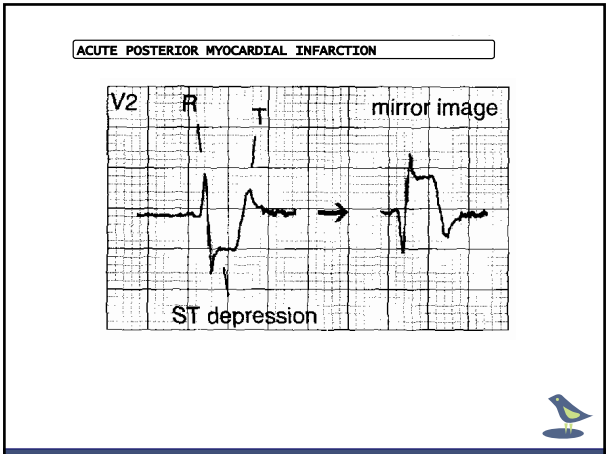
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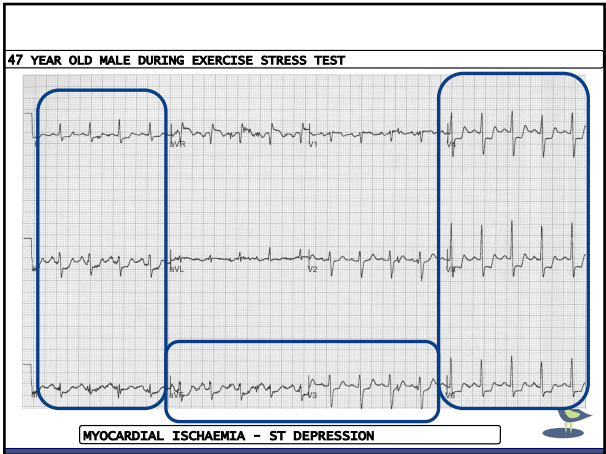
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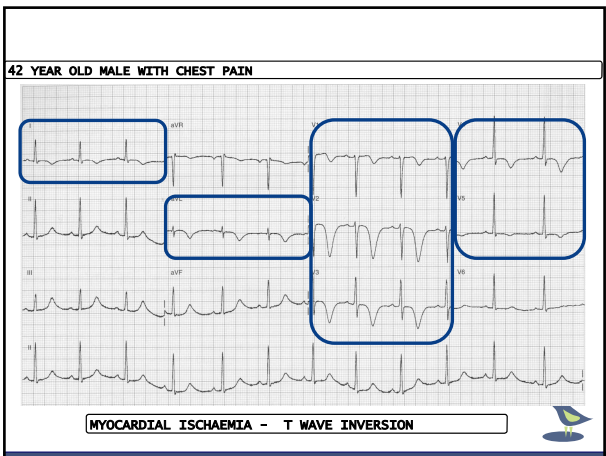
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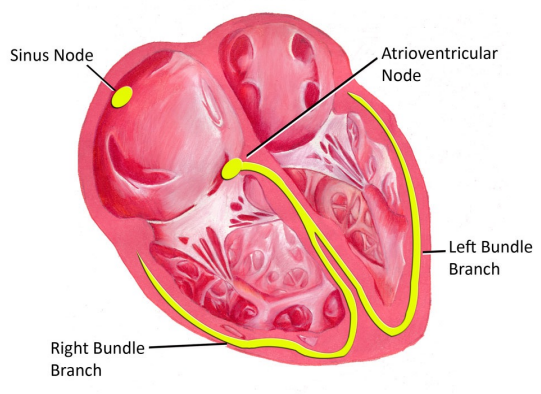
Atrioventricular block

- First Degree Block
- Second Degree Mobitz type 1 (Wenckebach)
- Second Degree Mobitz type 2
- Third Degree Block (CHB)



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Normal Electrical Conduction

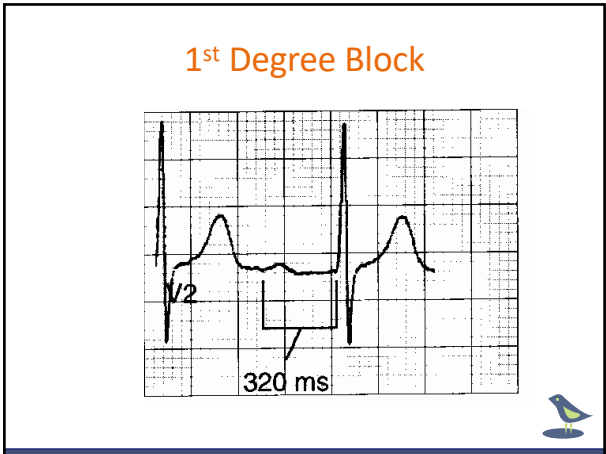


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73 YEAR OLD WITH DIABETES




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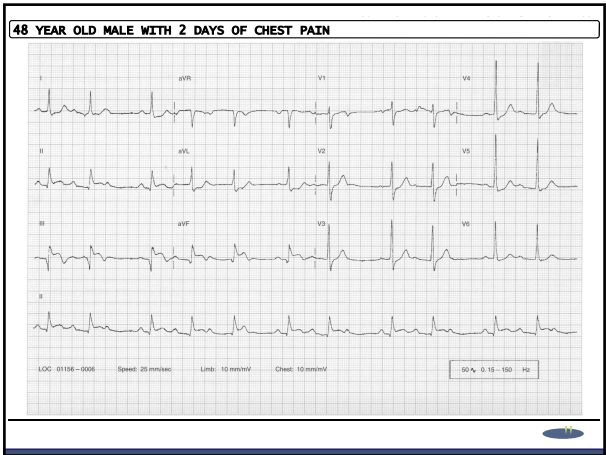
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1st Degree Block

- Normal
 - 0.12 – 0.20sec (120-200ms)
- Treatment
 - ‘Depends’
 - Usually asymptomatic – AV nodal delay
 - Caution cardiac drugs, MI esp anterior infarct
 - Rarely may lead to 3rd Degree

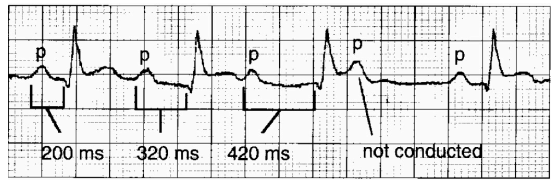


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Short, Long, Longer, Drop



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48 YEAR OLD MALE WITH 2 DAYS OF CHEST PAIN



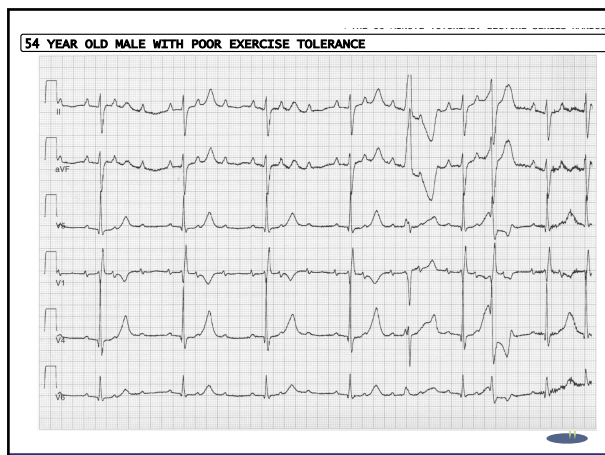
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2nd Degree Block Mobitz Type 1

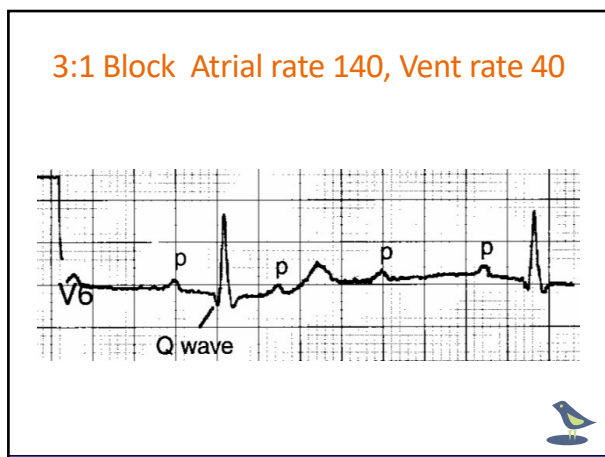
- Treatment
 - ‘Depends’
 - Mostly asymptomatic, well tolerated rhythm
 - Caution cardiac drugs, MI
 - Rarely may lead to 3rd Degree



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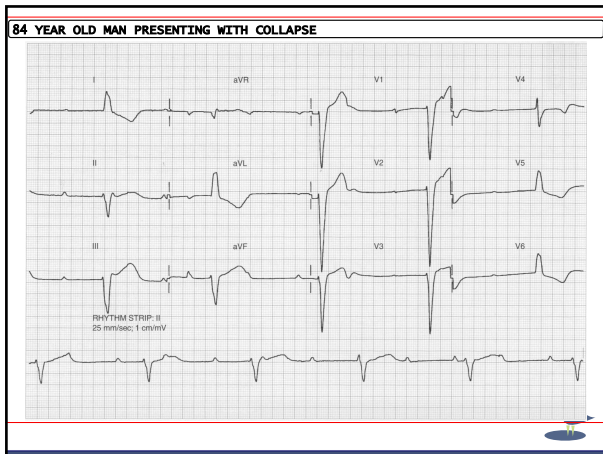


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2nd Degree Block Mobitz Type 2

- Treatment
 - Often symptomatic
 - At risk of cardiac standstill
 - May need pacing – chemical or electrical
 - Needs high care admission – usually CCU

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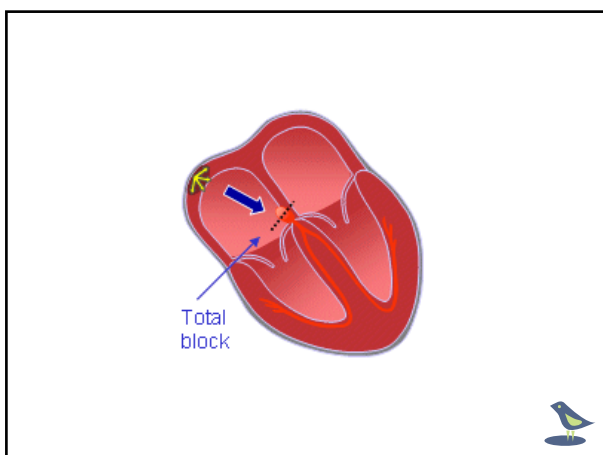
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3rd Degree – Complete Heart Block

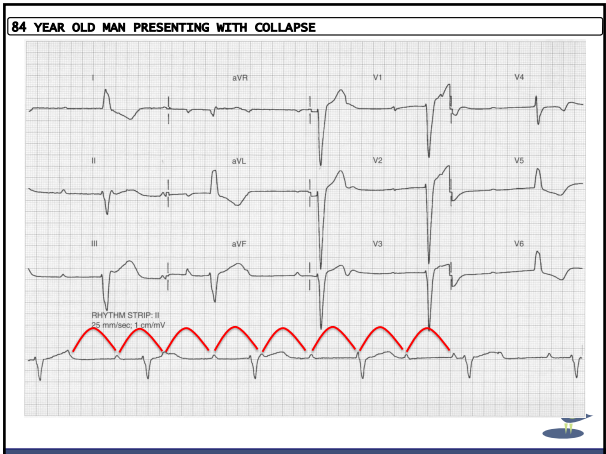
- Atrial contraction is normal but no beats are conducted to the ventricles, i.e. there is complete AV dissociation
- When the AV block occurs in the lower parts of the His-Purkinje system the ventricular escape complexes have wide QRS morphology



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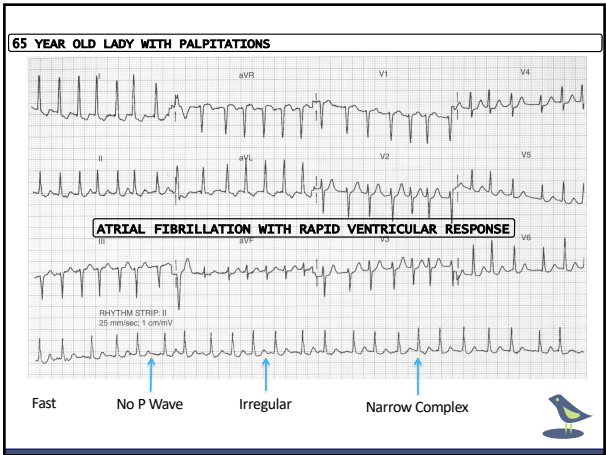
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Treatment of 3rd Degree AV block

- Atropine
- Isoprenaline
 - Bolus or infusion
 - Lives in fridge
 - Beta receptor stimulation
 - Similar to adrenaline but more cardiac rate specific



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Most common sustained Arrhythmia

At risk of embolic events and stroke

Atrial Fibrillation

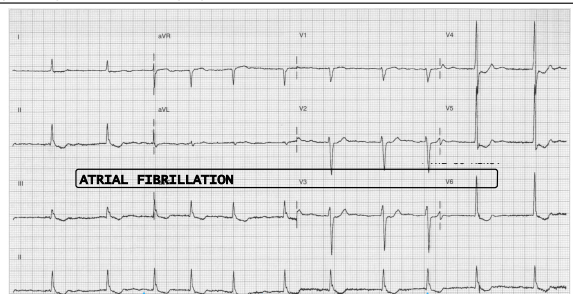
Steadily Rising over last 20 years

Asymptomatic to severe life threatening



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70 YEAR OLD LADY WITH A STROKE



ECG tracing for a 70-year-old lady with a stroke. The tracing shows Atrial Fibrillation. Key features labeled: Not Fast, No P Wave, Irregular, and Narrow Complex.

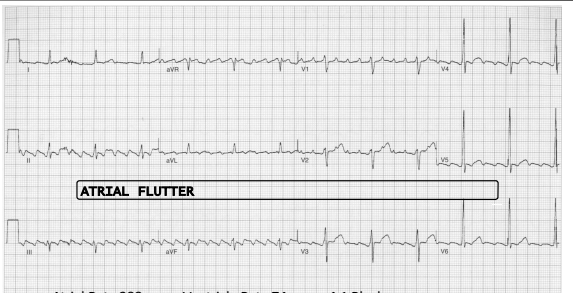
ATRIAL FIBRILLATION

Not Fast No P Wave Irregular Narrow Complex



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55 YEAR OLD MAN WITH HYPERTENSION



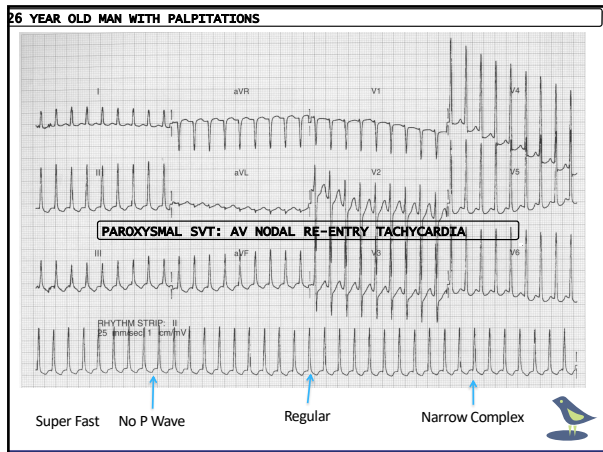
ECG tracing for a 55-year-old man with hypertension. The tracing shows Atrial Flutter. Key features labeled: Atrial Rate 288, Ventricle Rate 74, and 4:1 Block.

ATRIAL FLUTTER

Atrial Rate 288 Ventricle Rate 74 4:1 Block



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Postural modification to the standard Valsalva manoeuvre for emergency treatment of supraventricular tachycardias (REVERT): a randomised controlled trial

Andrew Appelboom, Adam Reuben, Clifford Mann, James Gagg, Paul Ewings, Andrew Barton, Trudie Lobban, Mark Dayer, Jane Vickery, Jonathan Benger, on behalf of the REVERT trial collaborators

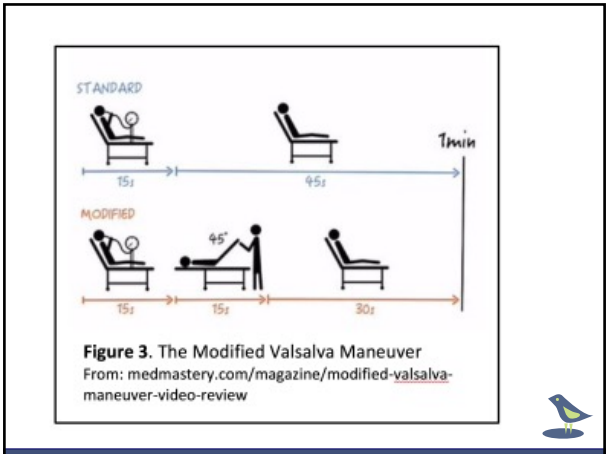
Vol 386 October 31, 2015

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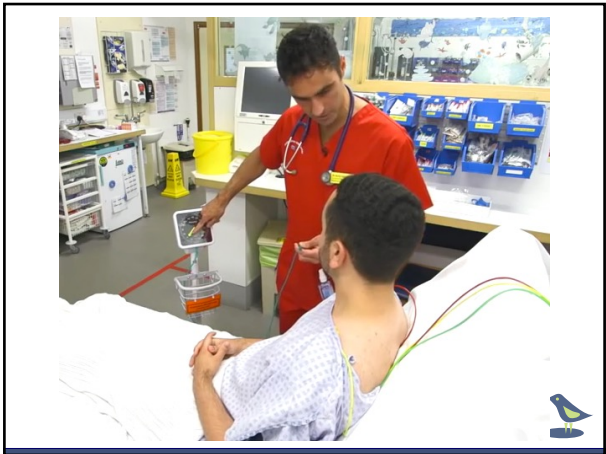
What did they do?

- 433 pts across 10 UK ED's
- Standard Valsalva vs Modified Valsalva manoeuvre
 - 40 mm Hg pressure, 15 sec standardised strain was used in both groups

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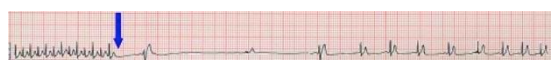


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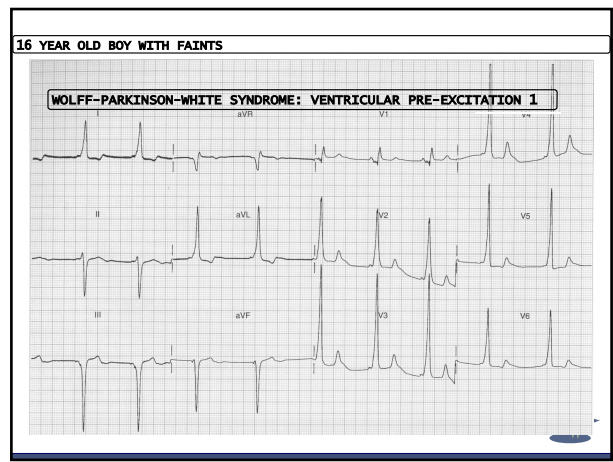


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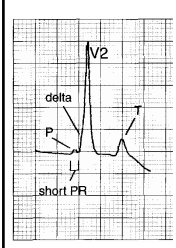
Fast Then A Long Pause



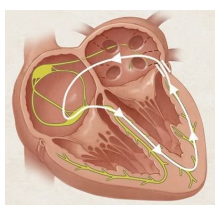
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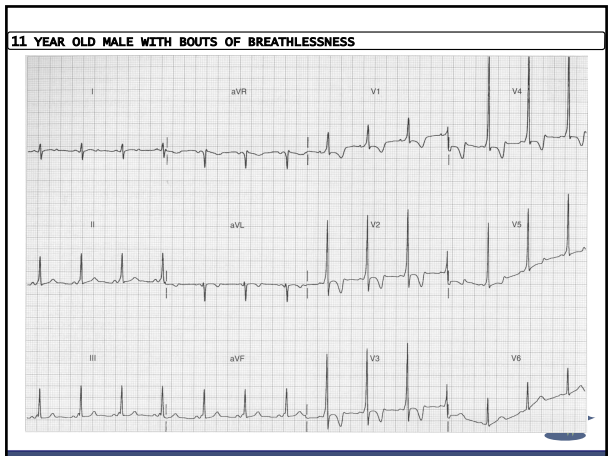
Bundle of Kent



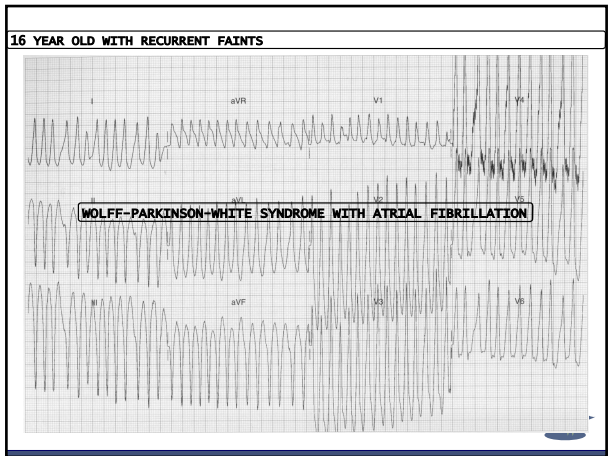
Unusual conductive tissue
Allows bypass of AV node



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AF with WPW

- Atrial fibrillation can occur in up to 20% of patients with WPW.
- Atrial flutter can occur in up to 7% of patients with WPW.
- Rapid ventricular rates may result in degeneration to VT or VF
- Defibrillation is the key to unstable patients



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Take Home Message

- Structured Approach to interpretation
- Identification of
 - Myocardial Infarction
 - AV blocks
 - Supraventricular rhythms
- Practice, Practice, Practice