ECG made easy

Presented by:
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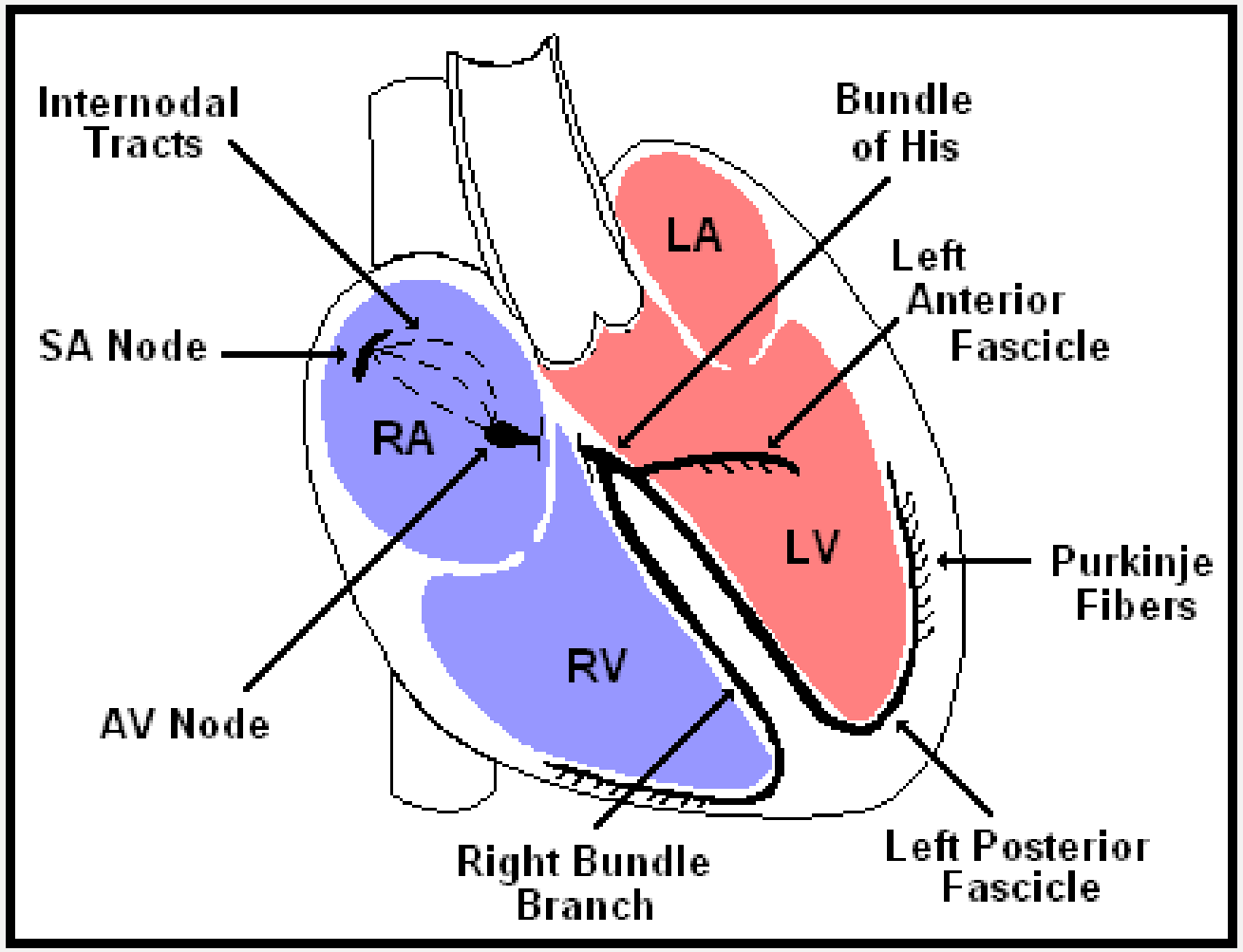
GenesisCare

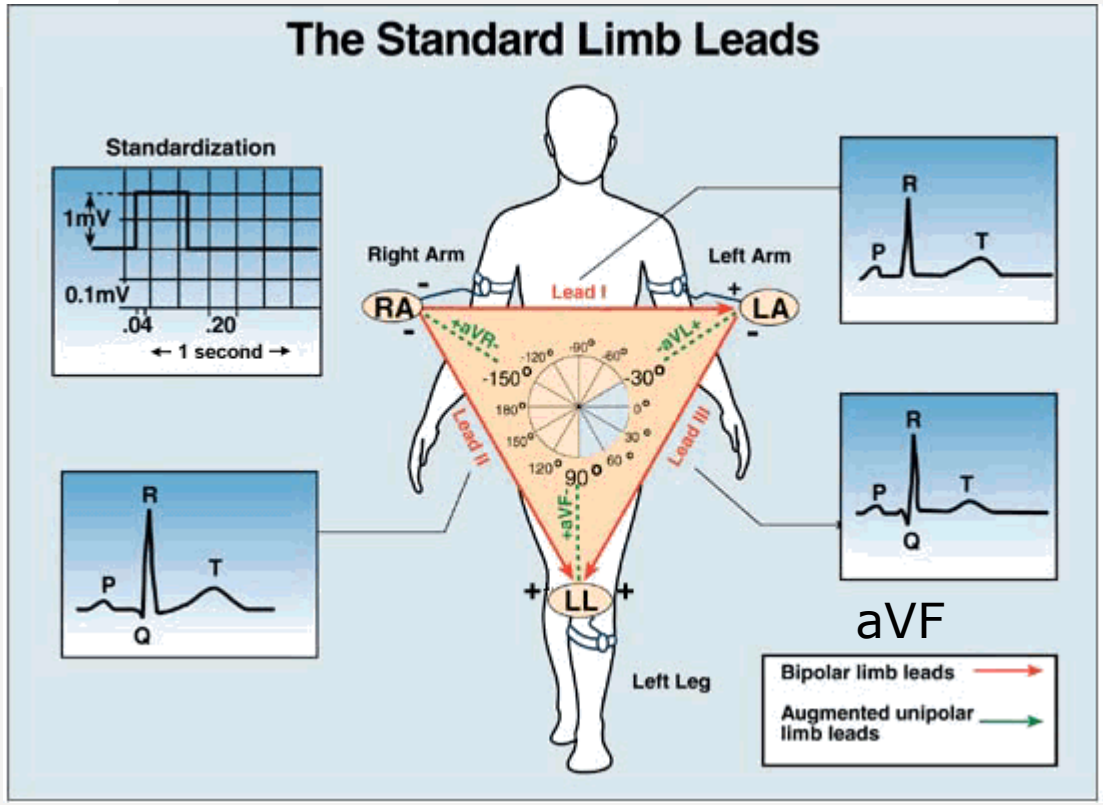
Reading an ECG

- The ECG does not have to be intimidating
- Establish a consistent approach to interpreting ECGs
- Do not rely on machine reads
- Interpret the ECG in the context of the clinical history

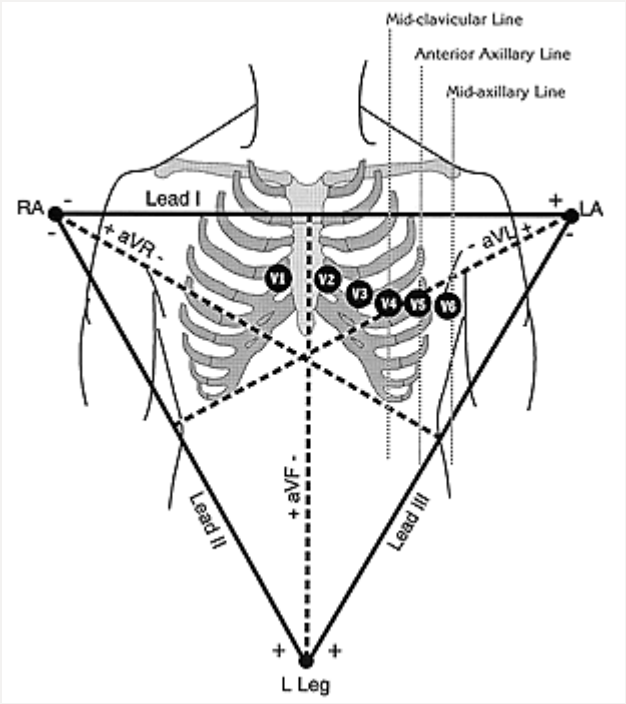
The Normal Conduction System



Lead Placement



aVF



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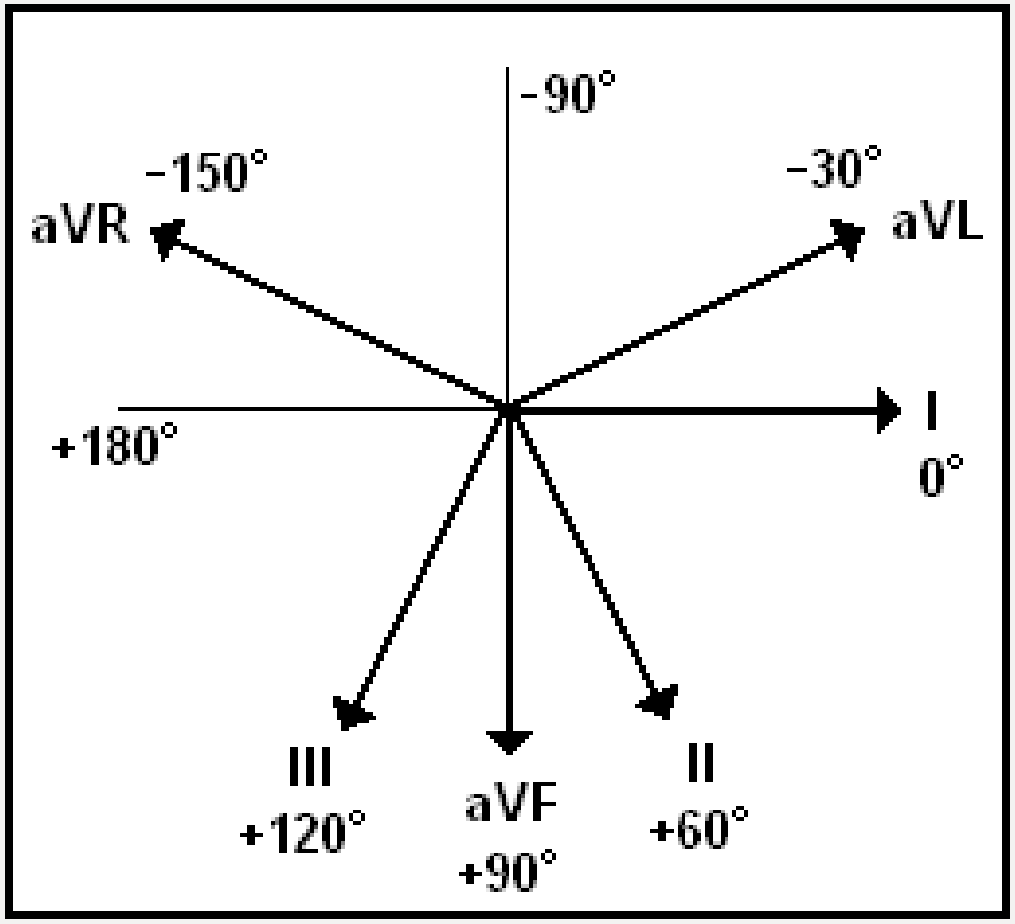
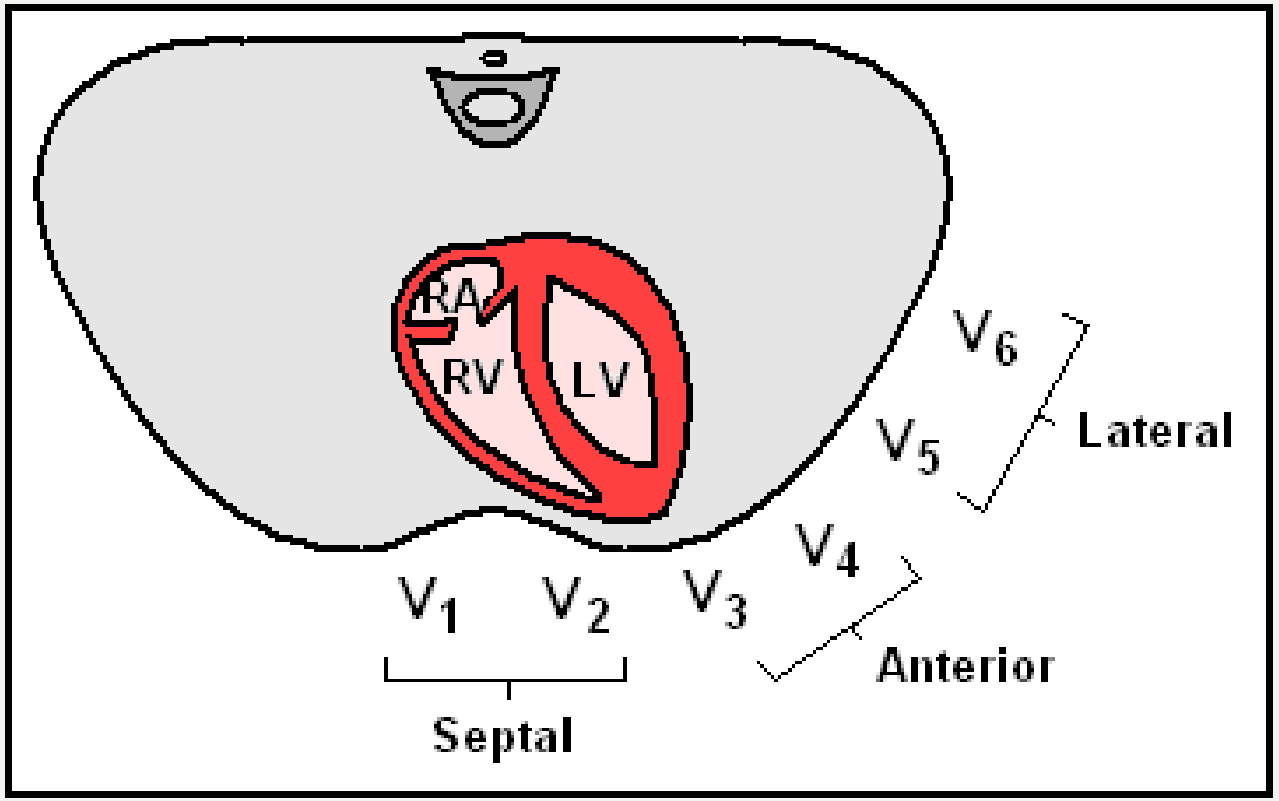
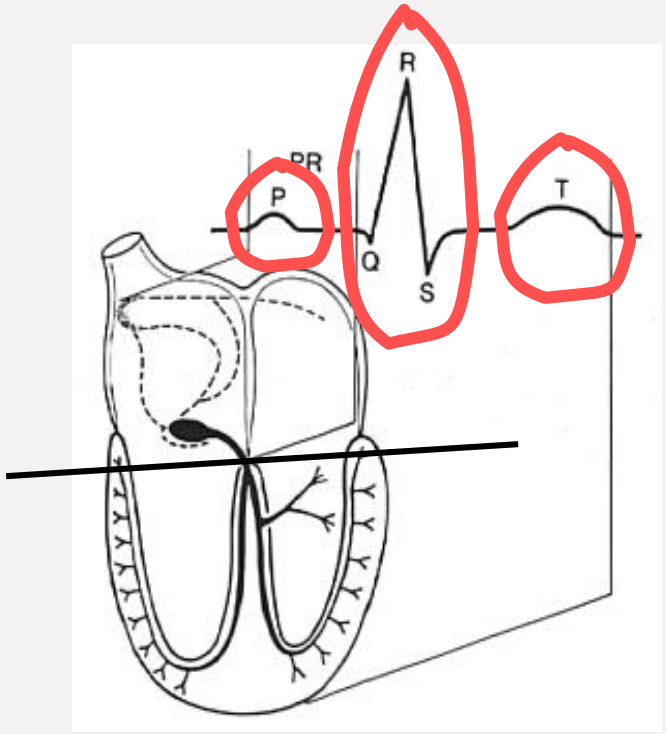
All Limb Leads



Precordial Leads



Components of a normal ECG



- P wave - atrial depolarisation
- PR interval - AV node + His-P
- QRS - ventricular depolarisation
- T wave - ventricular repolarisation

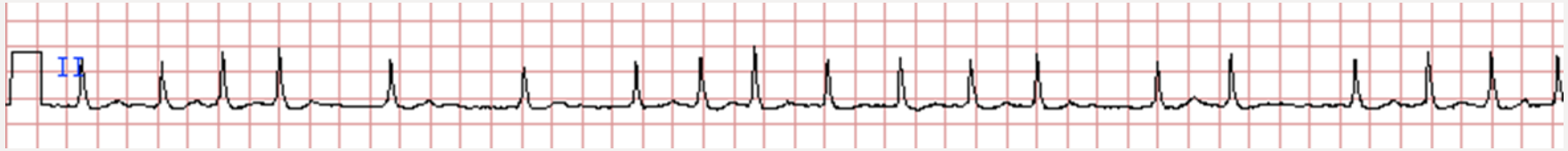
ECG interpretation

- **Rate**
- Rhythm
- Axis
- P wave
- Intervals
  - PR interval
  - QRS duration
  - QT interval
- Q waves
- R wave transition
- ST segments
- T waves (and others)

Rate

- Rule of 300 - divide 300 by the number of boxes between each QRS = rate

- Count QRS in10 second rhythm strip x 6



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Rate

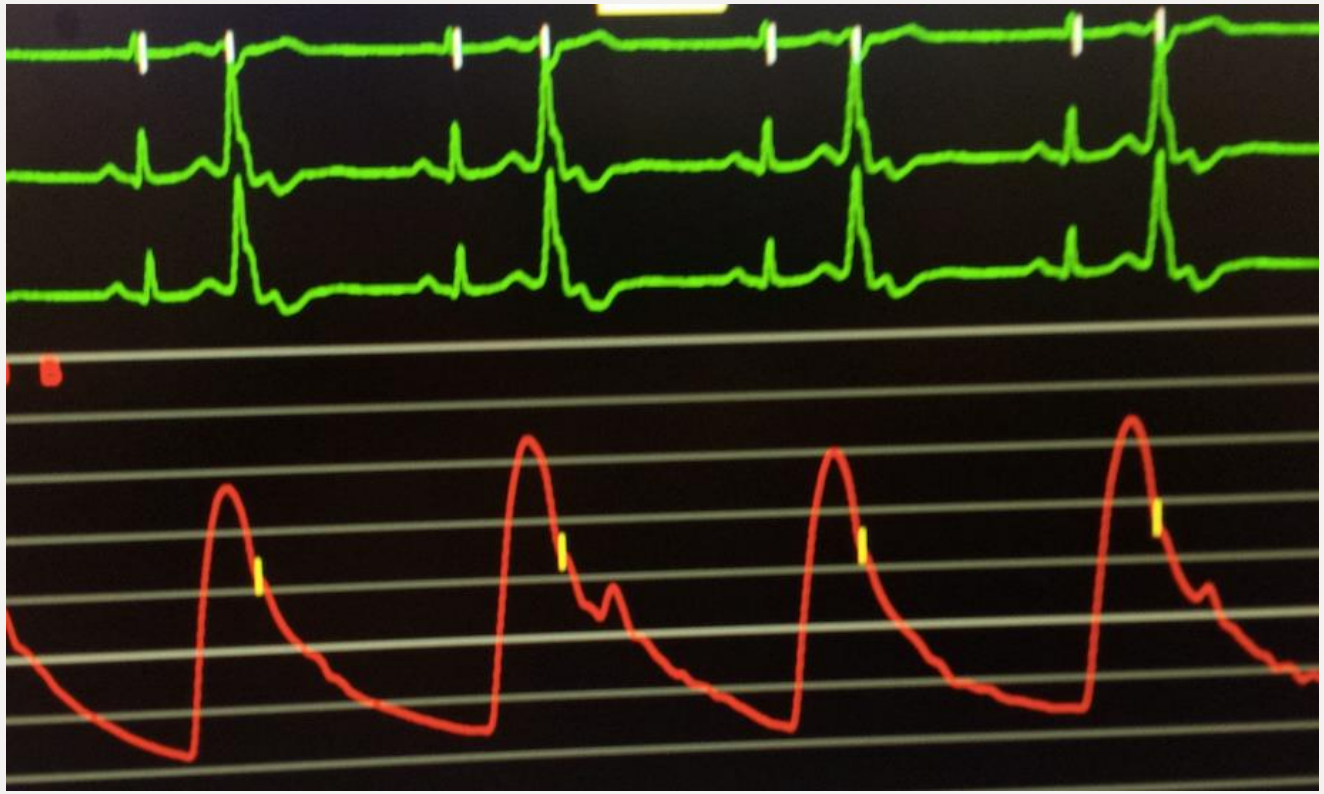
- HR of 60-100 per minute is normal
- HR > 100 = tachycardia
- HR < 60 = bradycardia

Single Lead ECG: Provides

Heart rate: normal 60 – 100

Remember:

Pulse rate may not equal heart rate



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ECG interpretation

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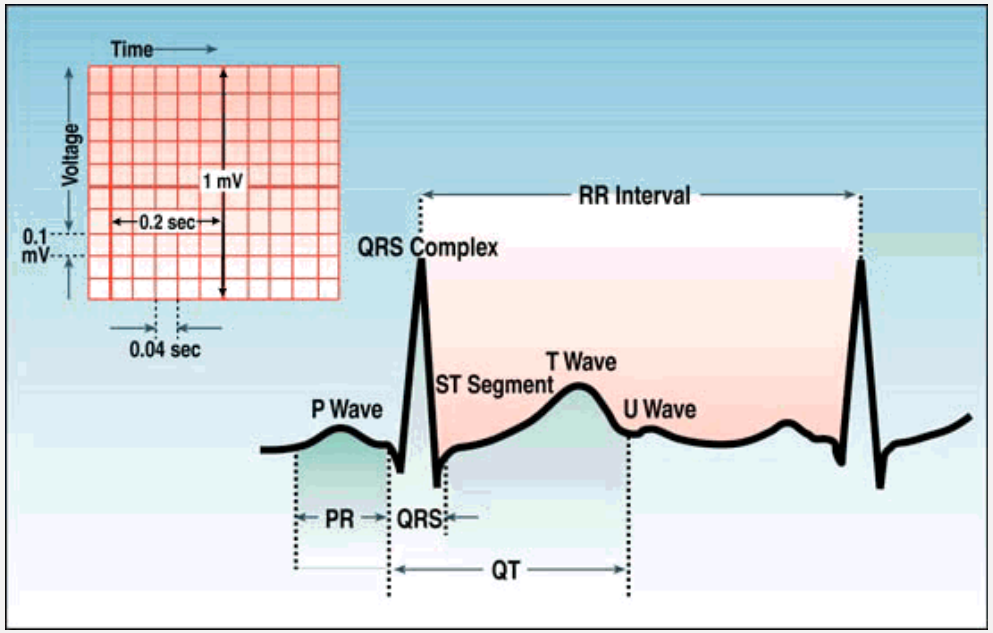
Rhythm

- Sinus
  - Originating from SA node
  - P wave before every QRS
  - P wave in same direction as QRS



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ECG interpretation

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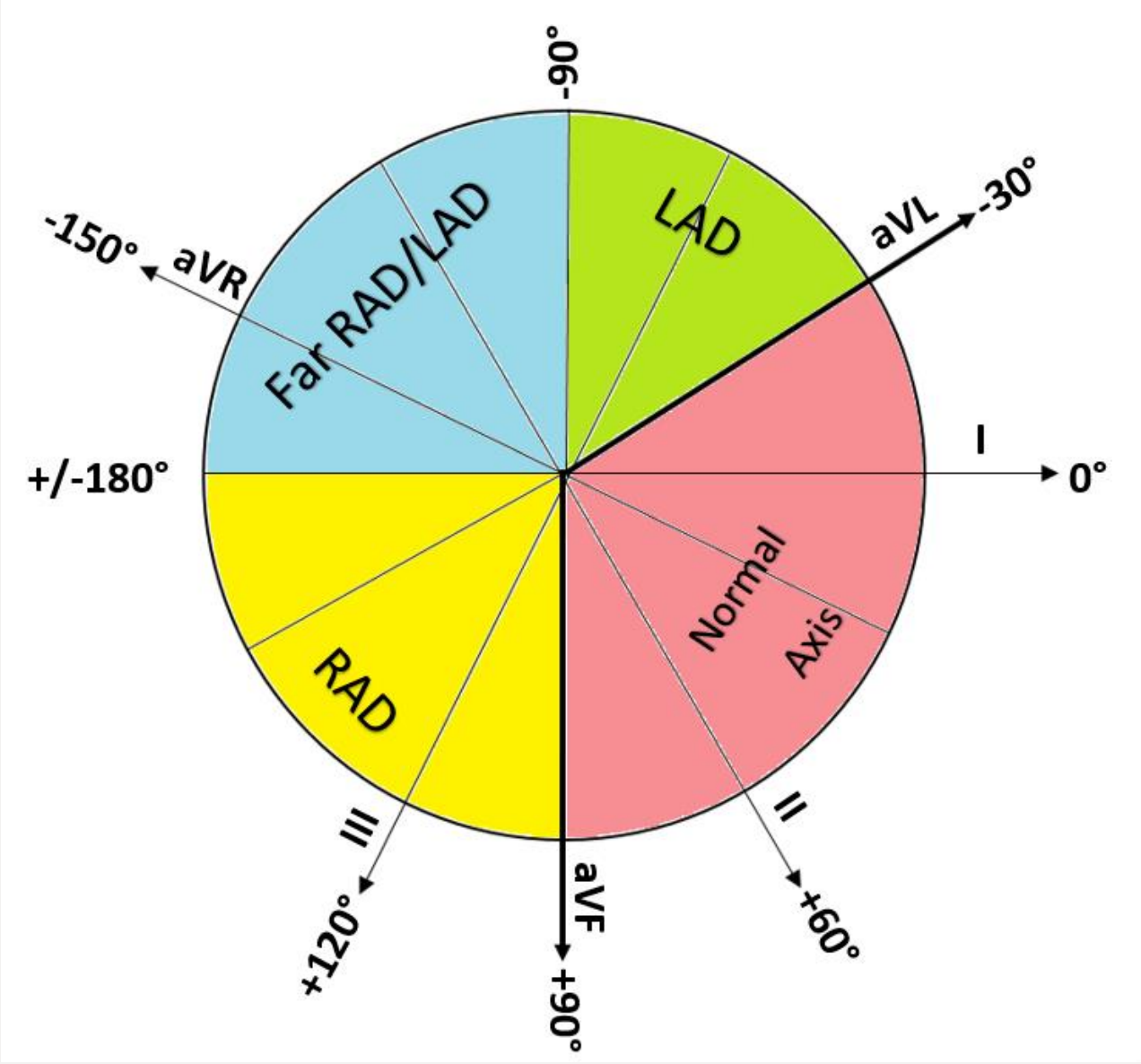

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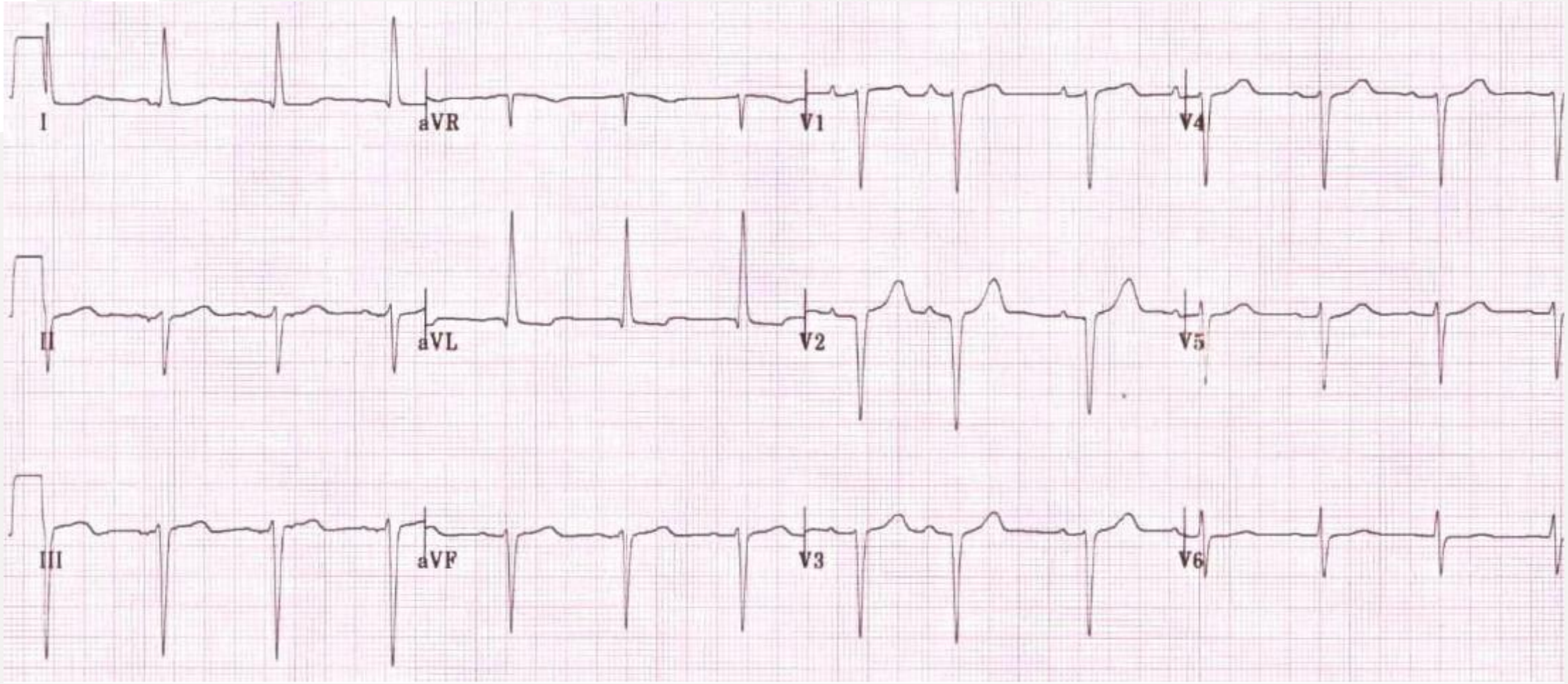
Left axis deviation: check lead II



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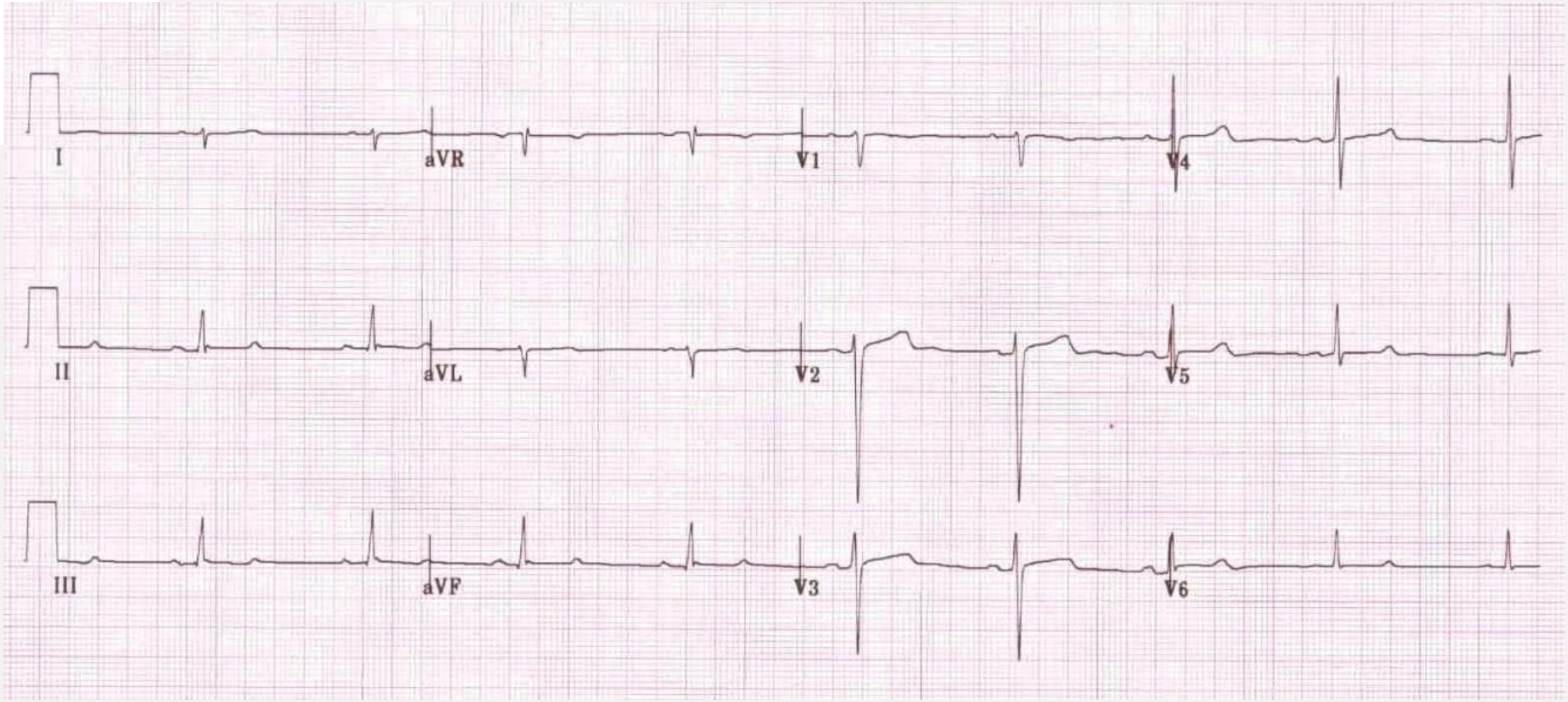
Right axis deviation: check lead I



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ECG interpretation

- Rate
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- Axis
- **P wave**
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  - PR interval
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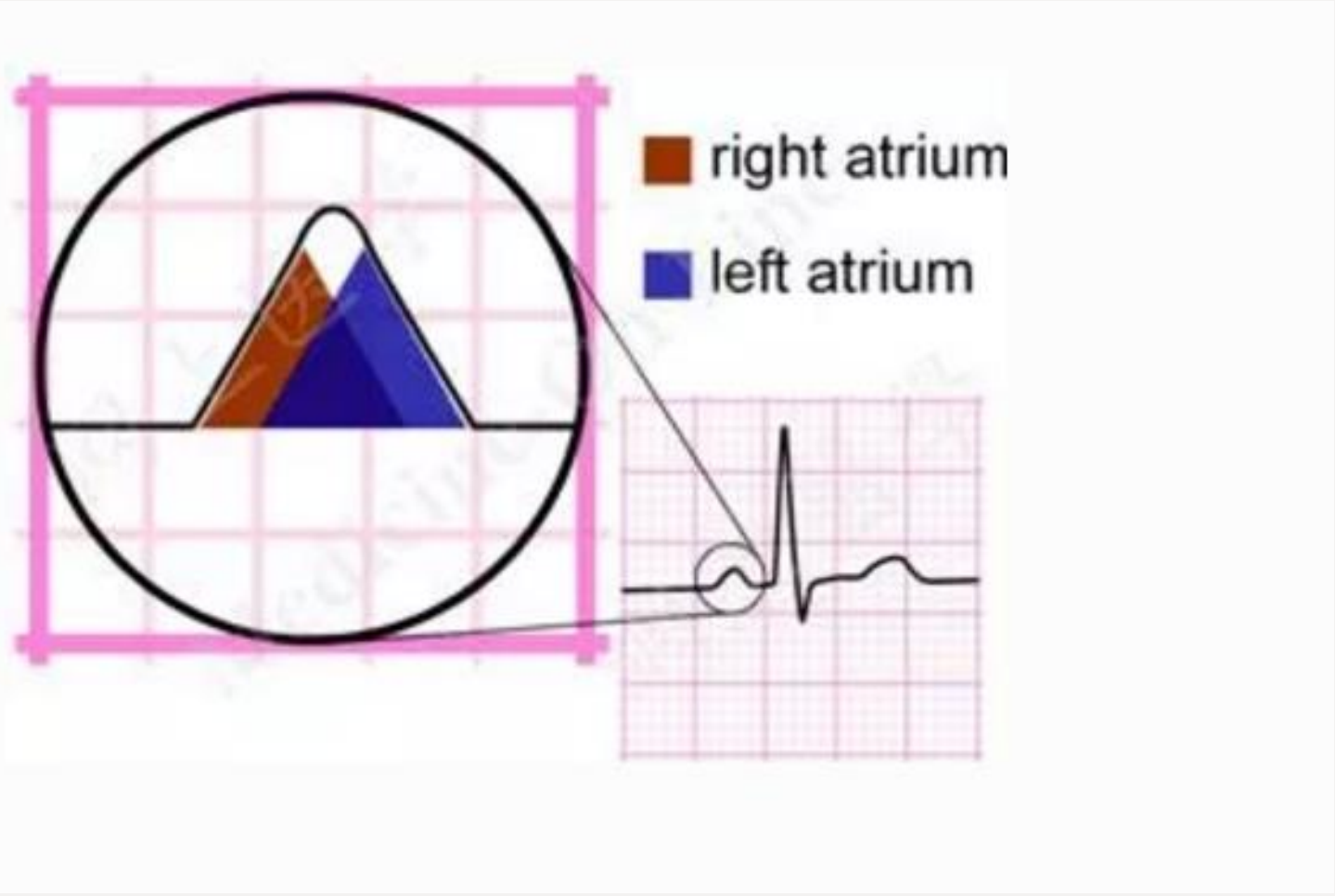
P wave



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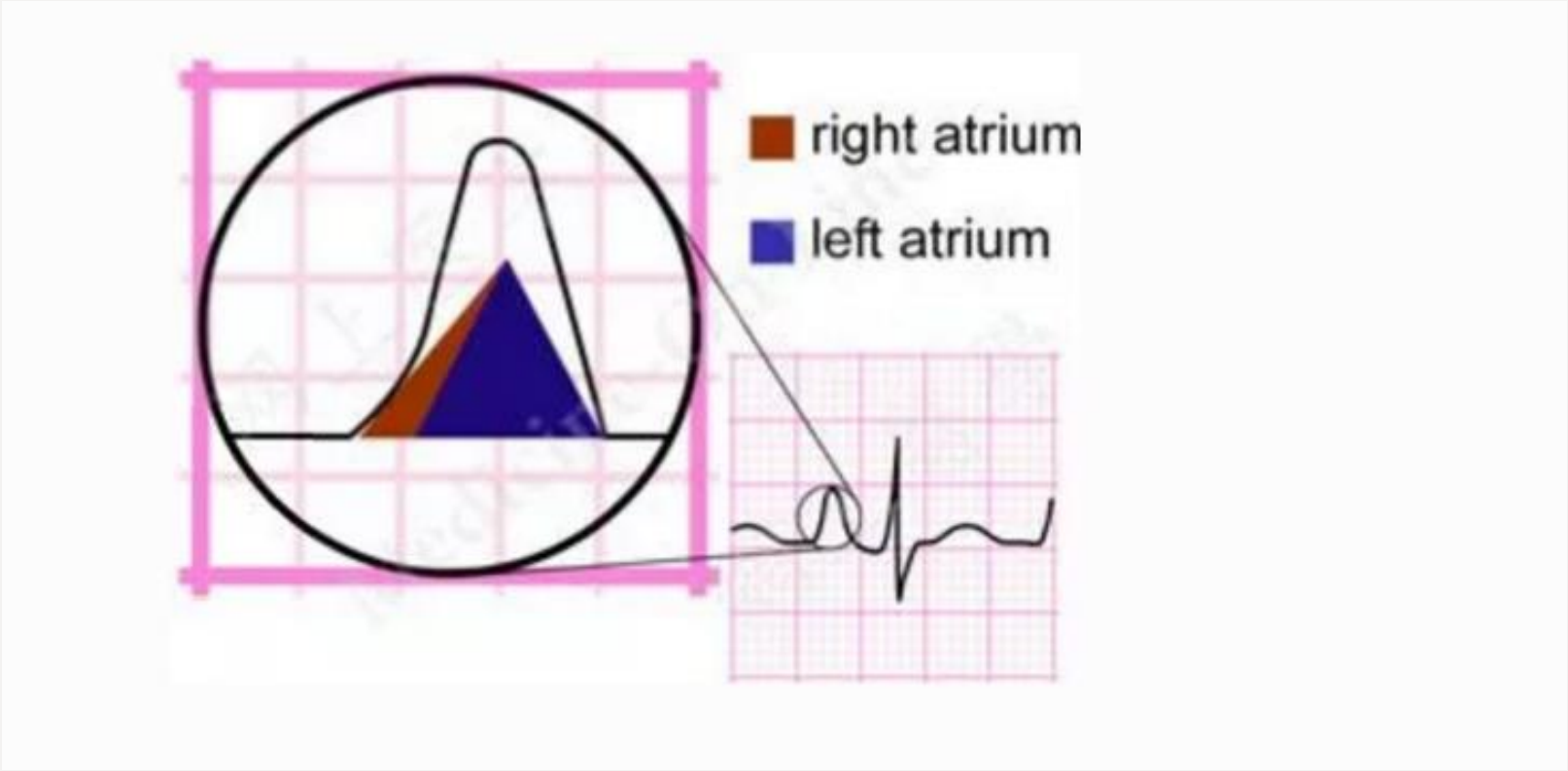
RA enlargement



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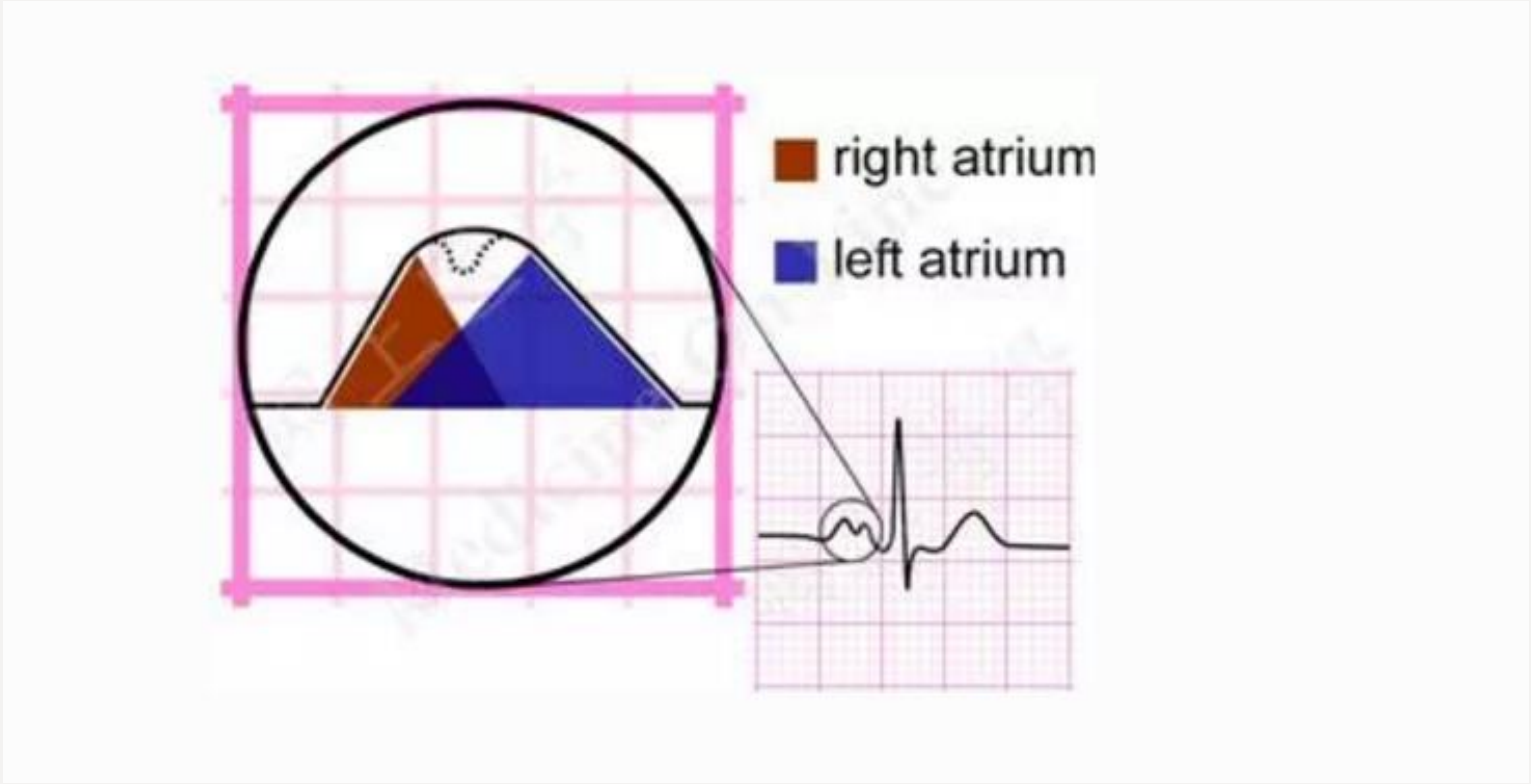
LA enlargement



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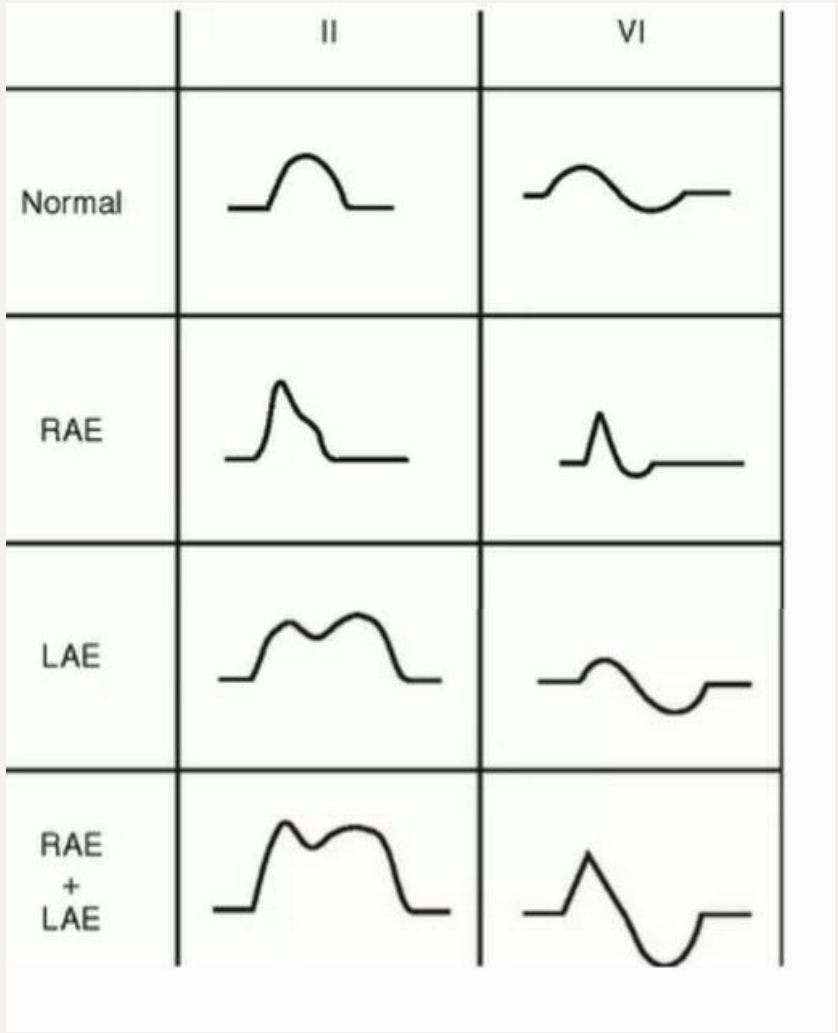
Bi-atrial enlargement



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ECG interpretation

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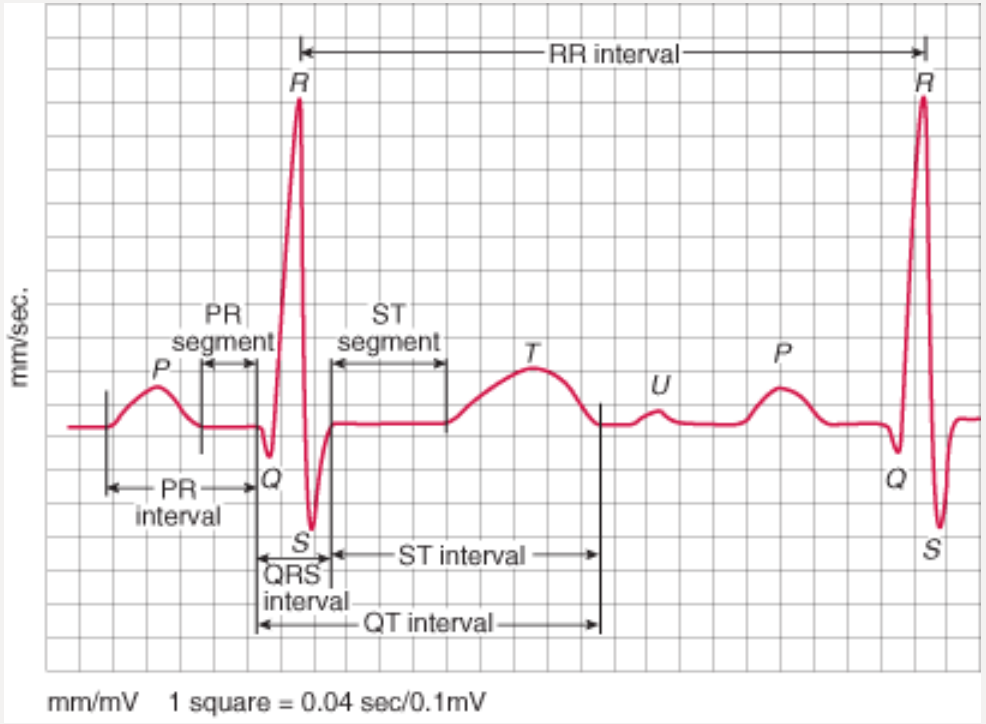
Normal Intervals

- **PR**
  - 0.20 sec (less than one large box)



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Blocks

- AV blocks
  - First degree block
    - PR interval fixed and > 0.2 sec
  - Second degree block, Mobitz type 1
    - PR gradually lengthened, then drop QRS
  - Second degree block, Mobitz type 2
    - PR fixed, but drop QRS randomly
  - Type 3 block
    - PR and QRS dissociated

First Degree Heart Block

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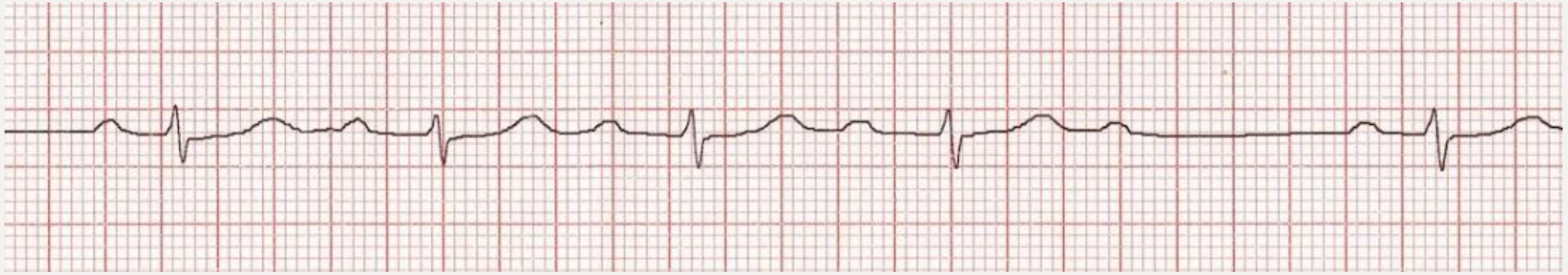
2nd degree, Mobitz I (Wenckebach phenomenon)



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2nd degree, Mobitz II

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2nd degree, "high-grade AV block"

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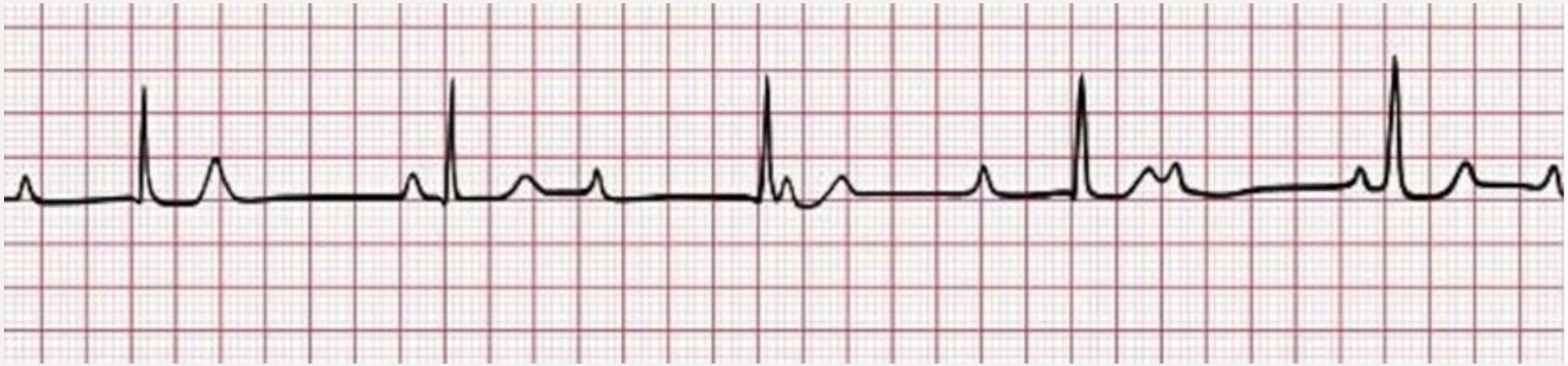
3rd degree (complete heart block)



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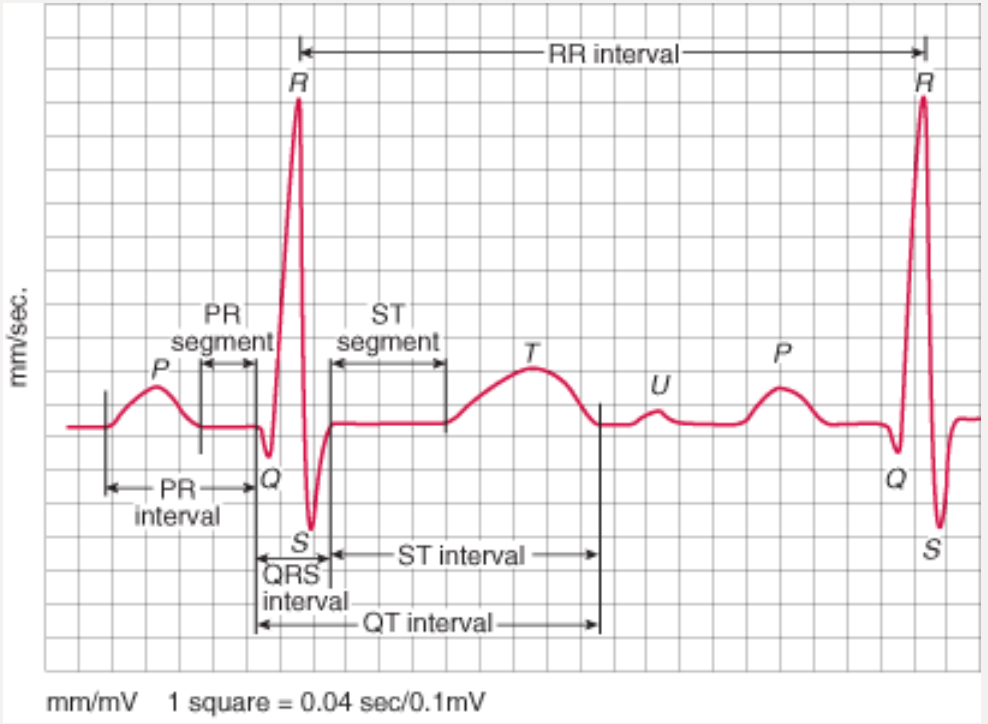
Normal Intervals

- PR
  - 0.20 sec (less than one large box)
- **QRS**
  - 0.08 – 0.10 sec (1-2 small boxes)



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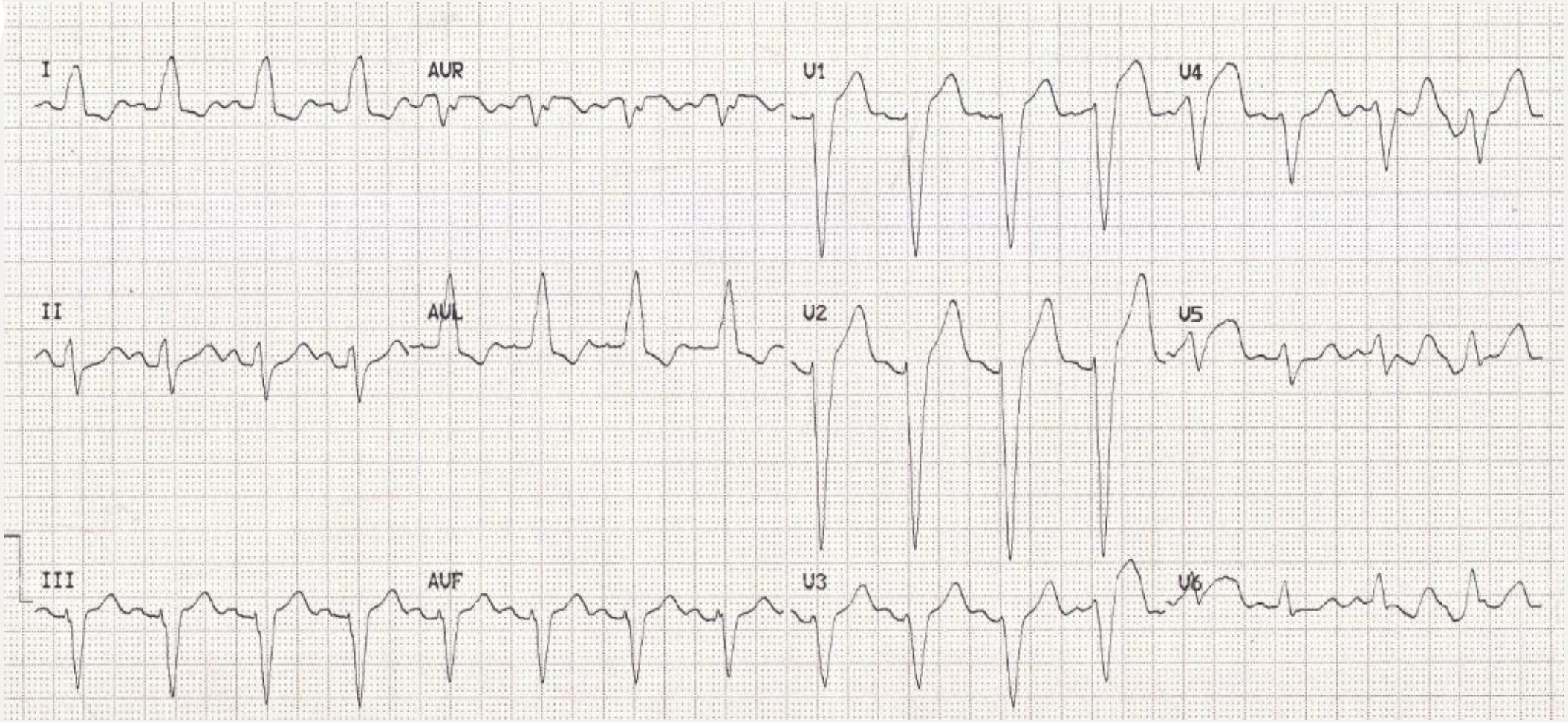
LBBB: QRS >120ms



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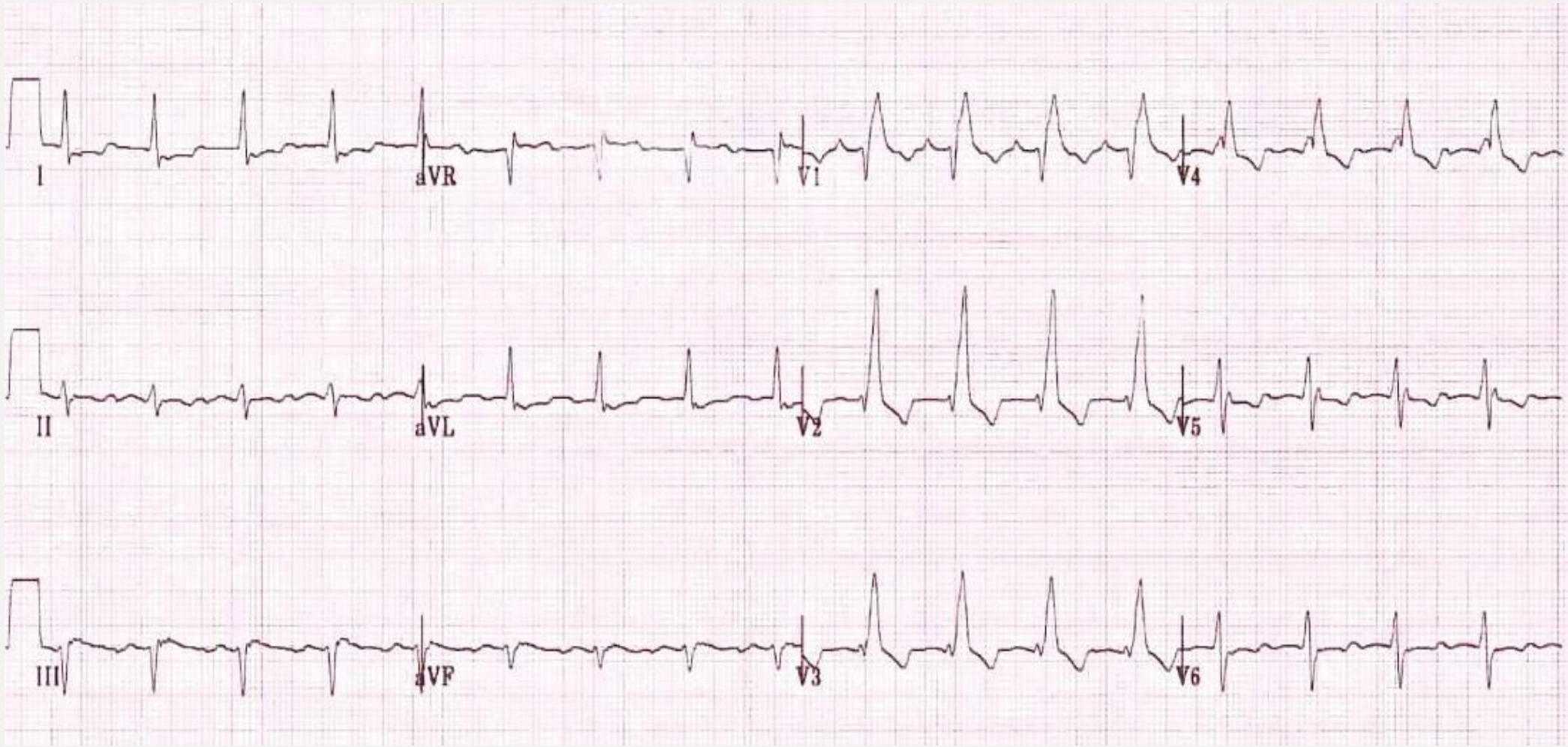
RBBB: QRS >120ms



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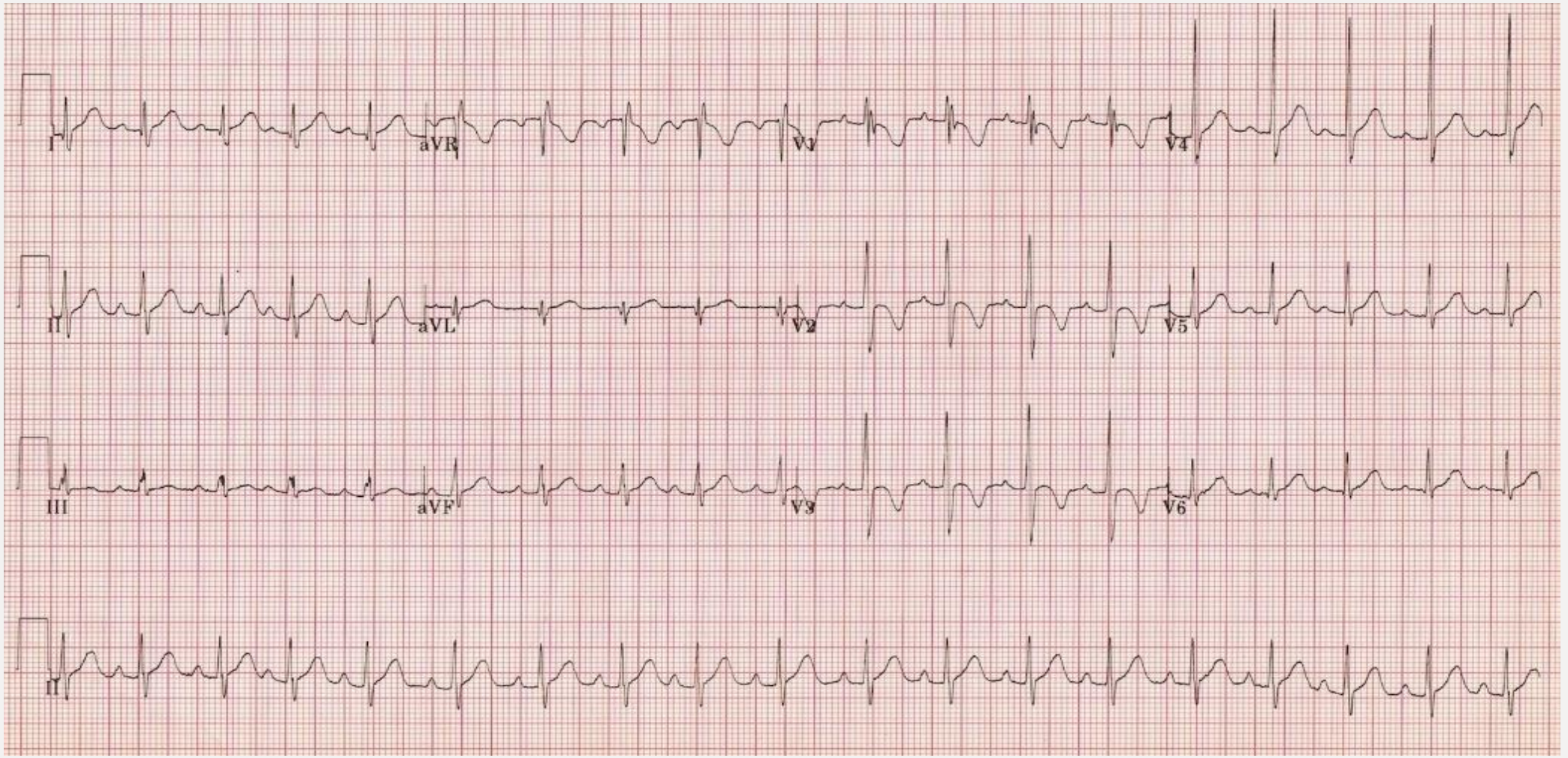
Incomplete RBBB: QRS < 120ms



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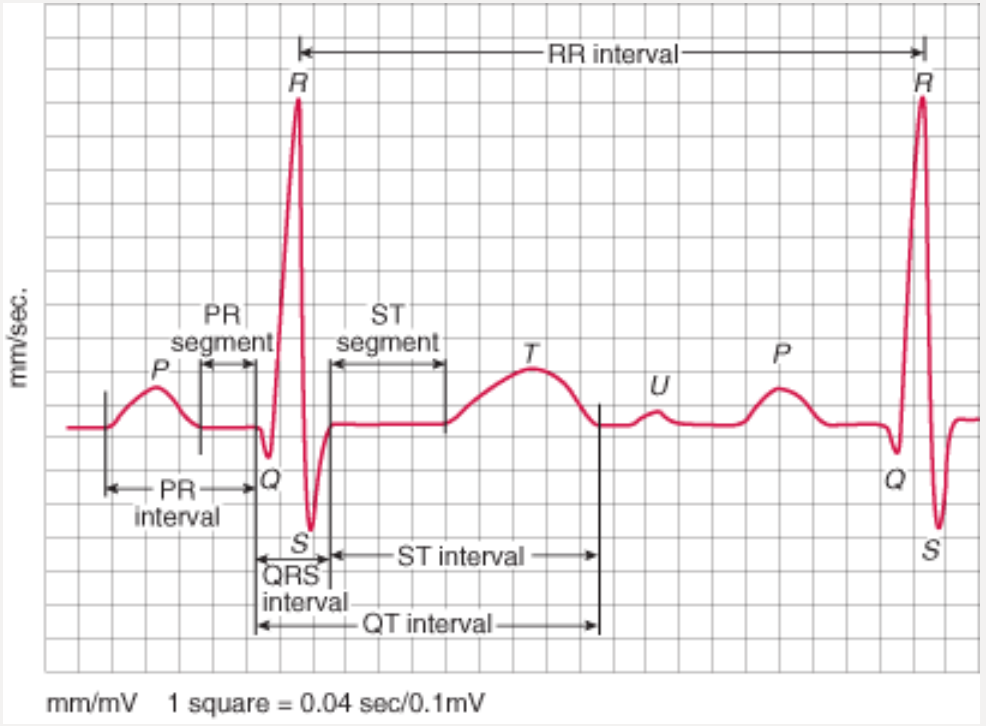
Normal Intervals

- PR
  - 0.20 sec (less than one large box)
- QRS
  - 0.08 – 0.10 sec (1-2 small boxes)
- **QT**
  - 450 ms in men, 460 ms in women
  - Based on sex / heart rate
  - Half the R-R interval with normal HR



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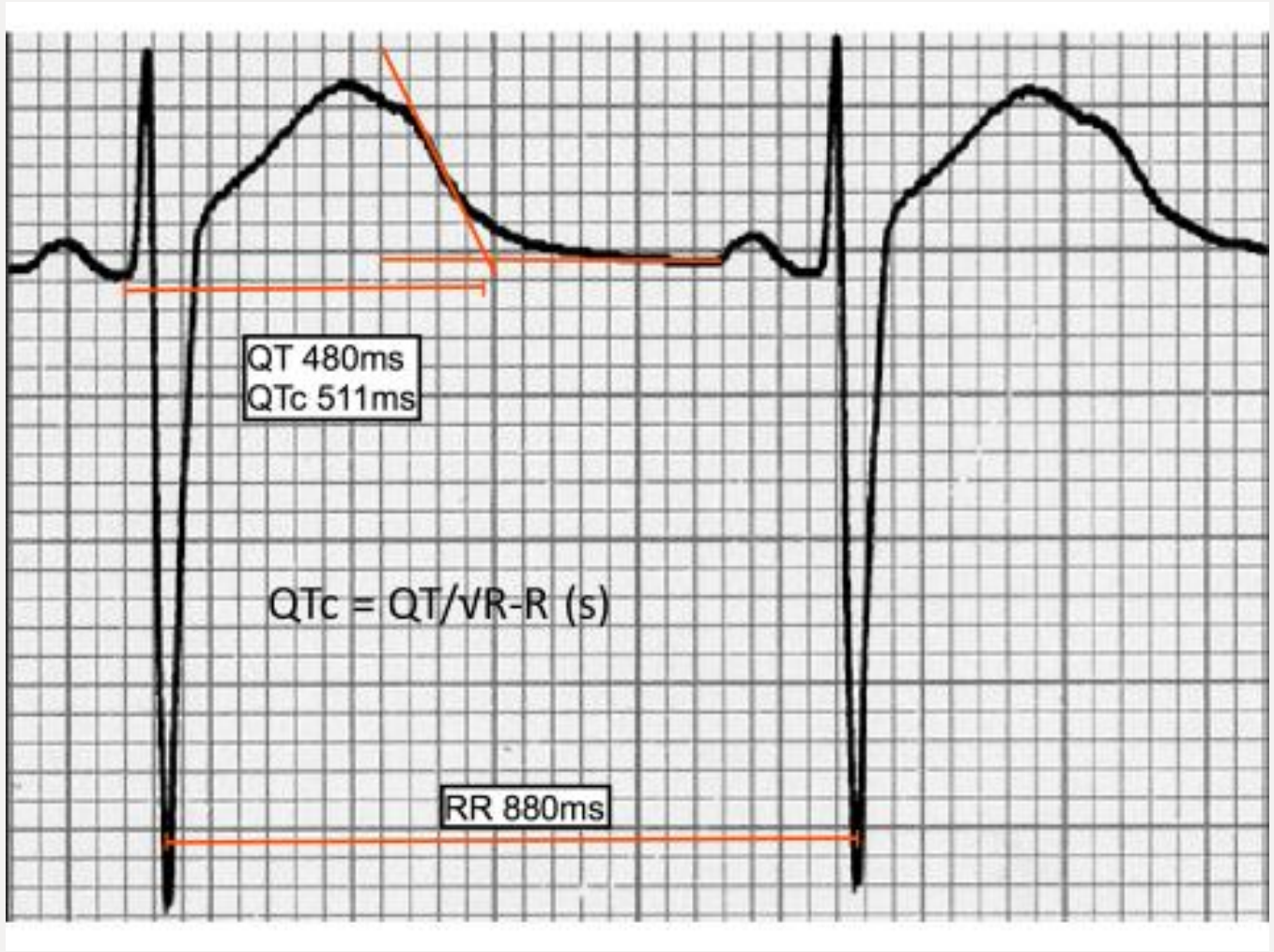
QT interval (lead II or V5-6)



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Prolonged QT

- Normal
  - Men 450ms
  - Women 460ms
- Corrected QT (QTc)
  - QTm/√(R-R)
- Causes
  - Drugs (Na channel blockers)
  - Hypocalcemia, hypomagnesemia, hypokalemia
  - Hypothermia
  - AMI
  - Congenital
  - Increased ICP

ECG interpretation

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Pathological Q waves

- > 40 ms (1mm) wide
- > 2 mm deep
- > 25% of depth of QRS complex
- Seen in leads V1-3

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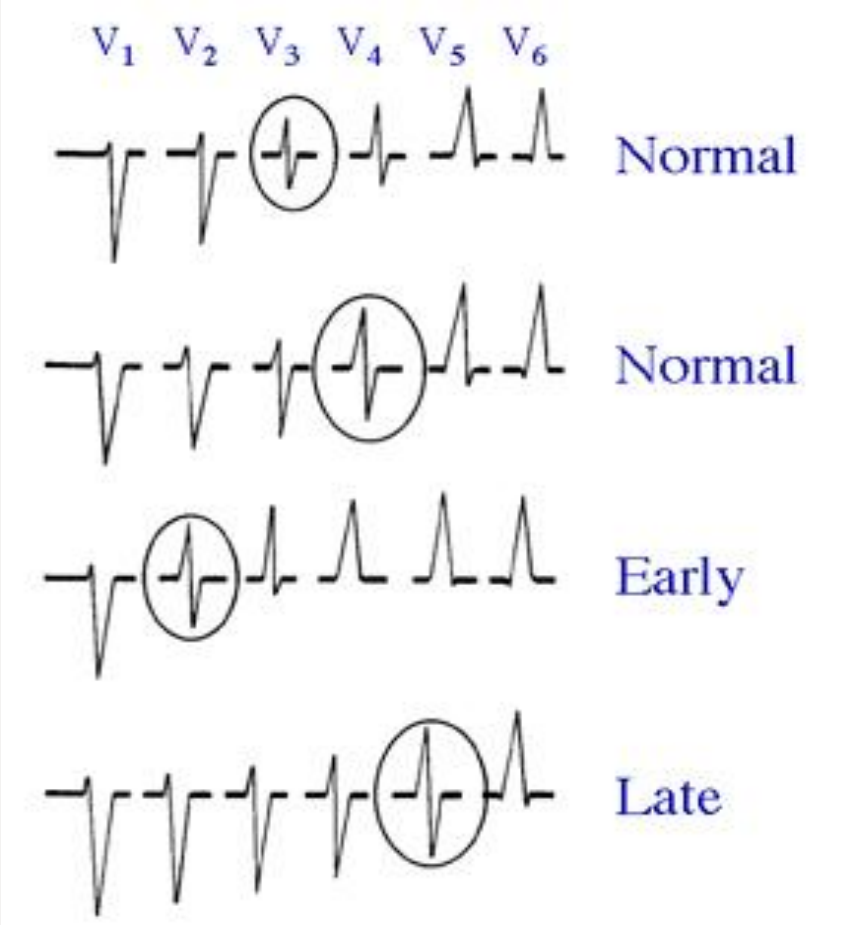
R wave transition



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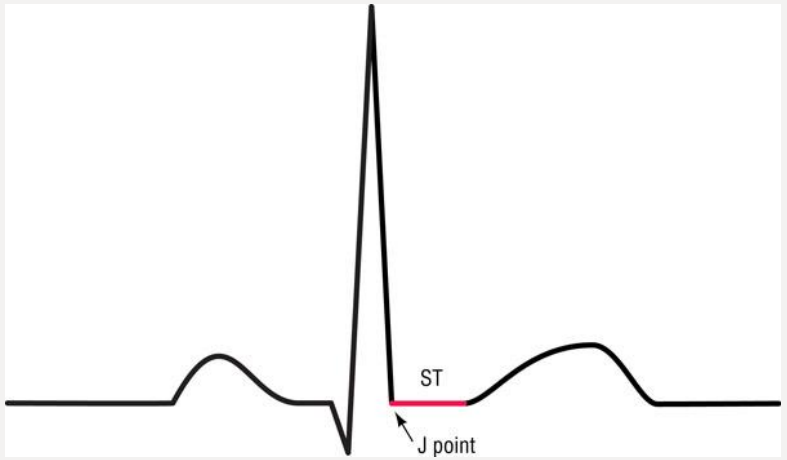
ST Segment



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ECG interpretation

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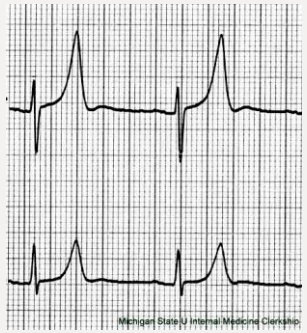
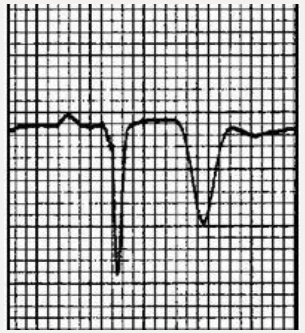
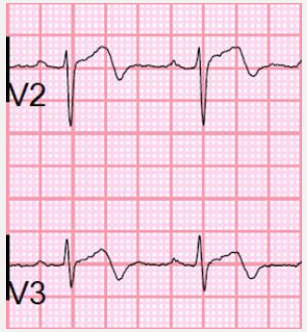
- **T waves (and others)**

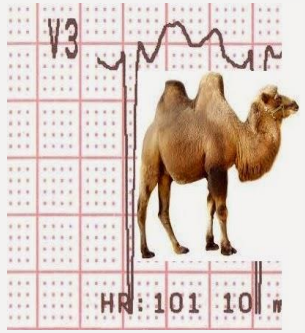
T waves

- Hyperacute / peaked
- Inverted (symmetrical and deep: > 3mm)
  - Children (normal), MI, ischaemia, BBB, ventricular hypertrophy, PTE, HCM, raised ICP
- Biphasic
  - Myocardial ischaemia, hypokalaemia
- "Camel hump"
  - Prominent U or hidden P wave
- Flattened
  - Nonspecific, ischaemia, hypokalaemia









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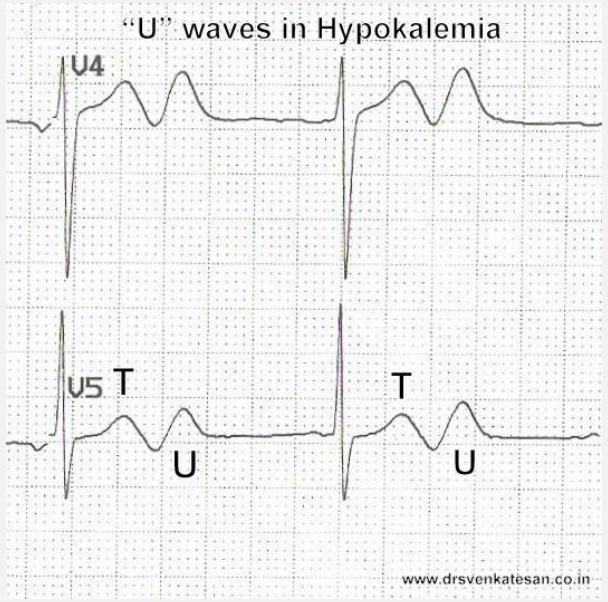
U waves

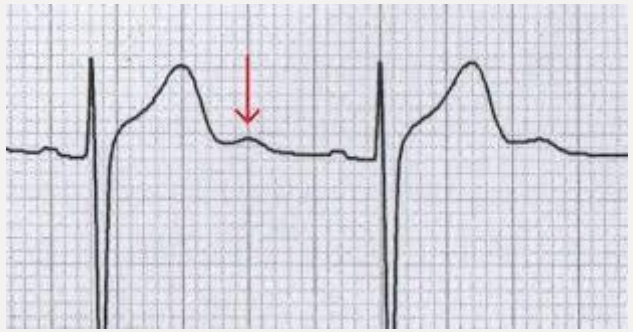
- ? Delayed Purkinje fibre repolarisation
- Prolonged repolarisation of mid-myocardial "M-cells"
- After potentials from mechanical forces in ventricular wall

- Same direction as T wave
- < 25% of T wave voltage
- Max amplitude is 1-2 mm

U waves

- Prominent
  - Bradycardia, hypokalaemia, hypocalcaemia, hypomagnesaemia, hypothermia, raised ICP, LVH, HCM, digoxin
- Inverted
  - IHD, HBP, valvular HD, congenital HD, cardiomyopathy, hyperthyroidism





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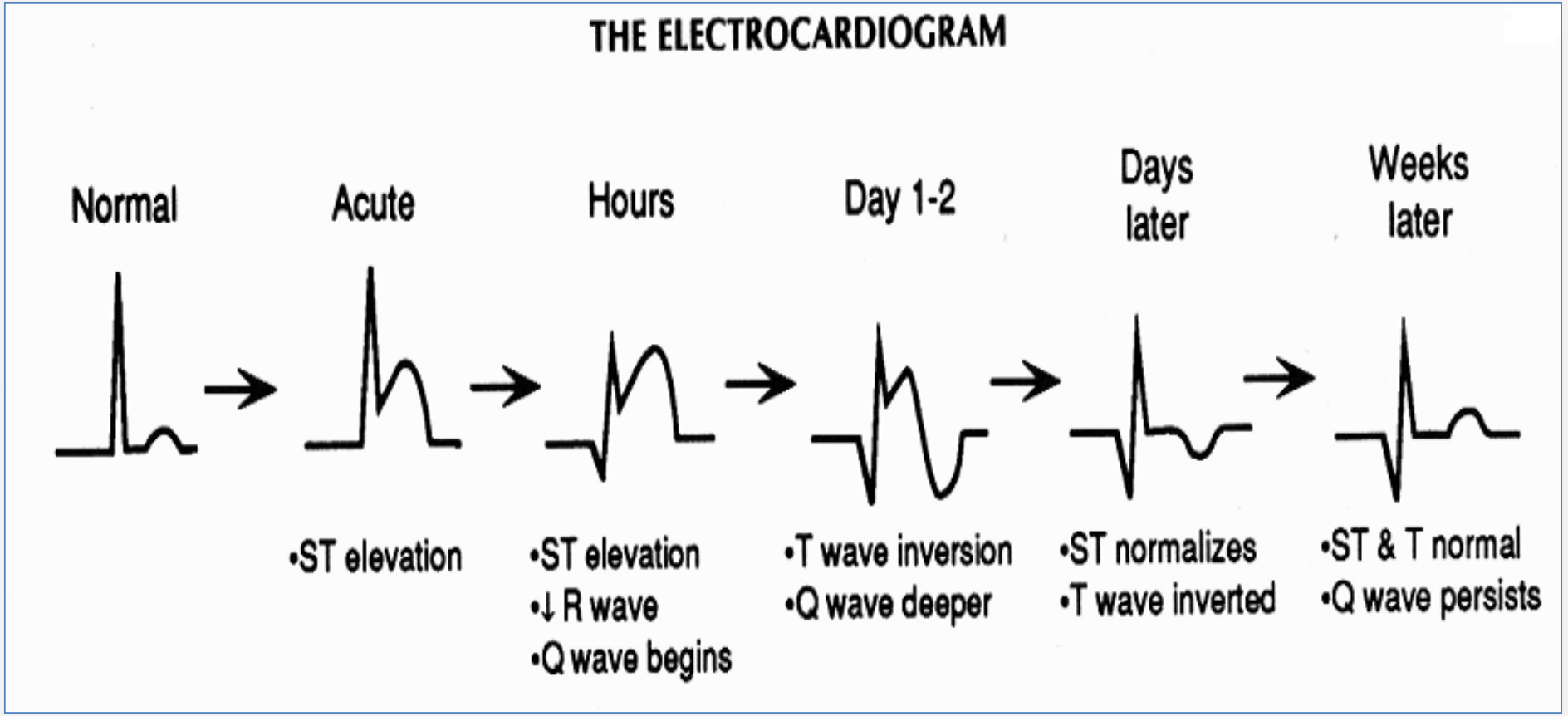
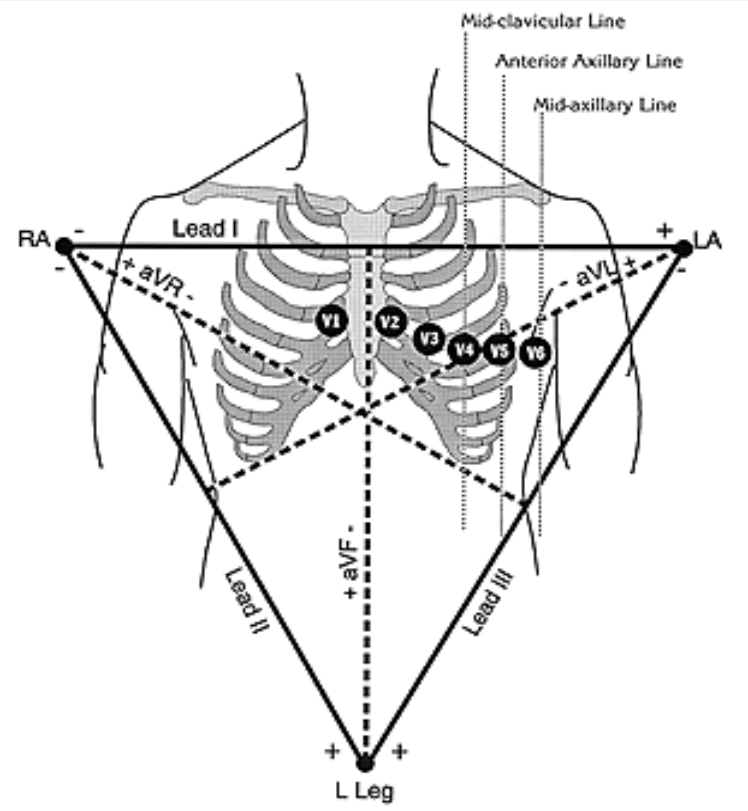
AMI evolution

AMI ECG evolution



ECG Distributions

- Septal: V1, V2
- Anterior: V3, V4
- Anteroseptal: V1, V2, V3, V4
- Anterolateral: V4–V6, I, aVL
- Lateral: I and aVL
- Inferior: II, III, and aVF
- Inferolateral: II, III, aVF, and V5 and V6



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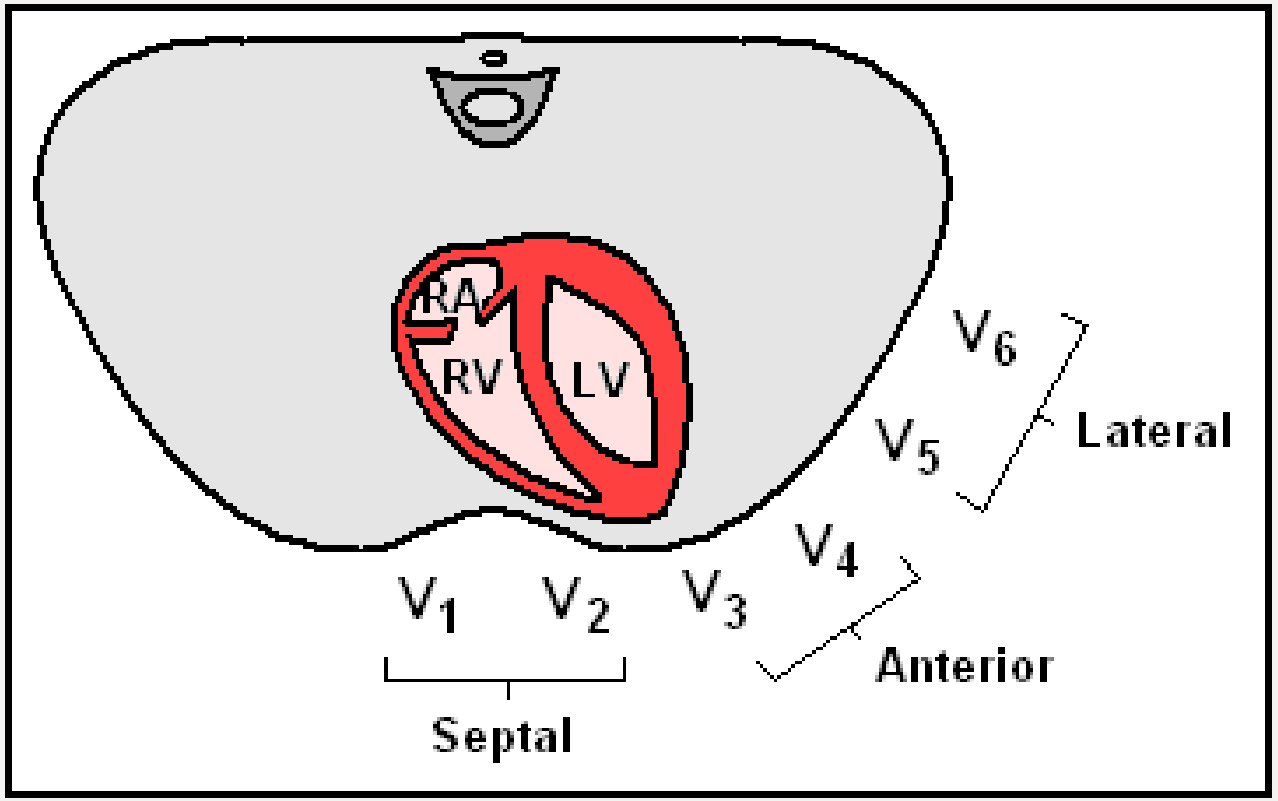
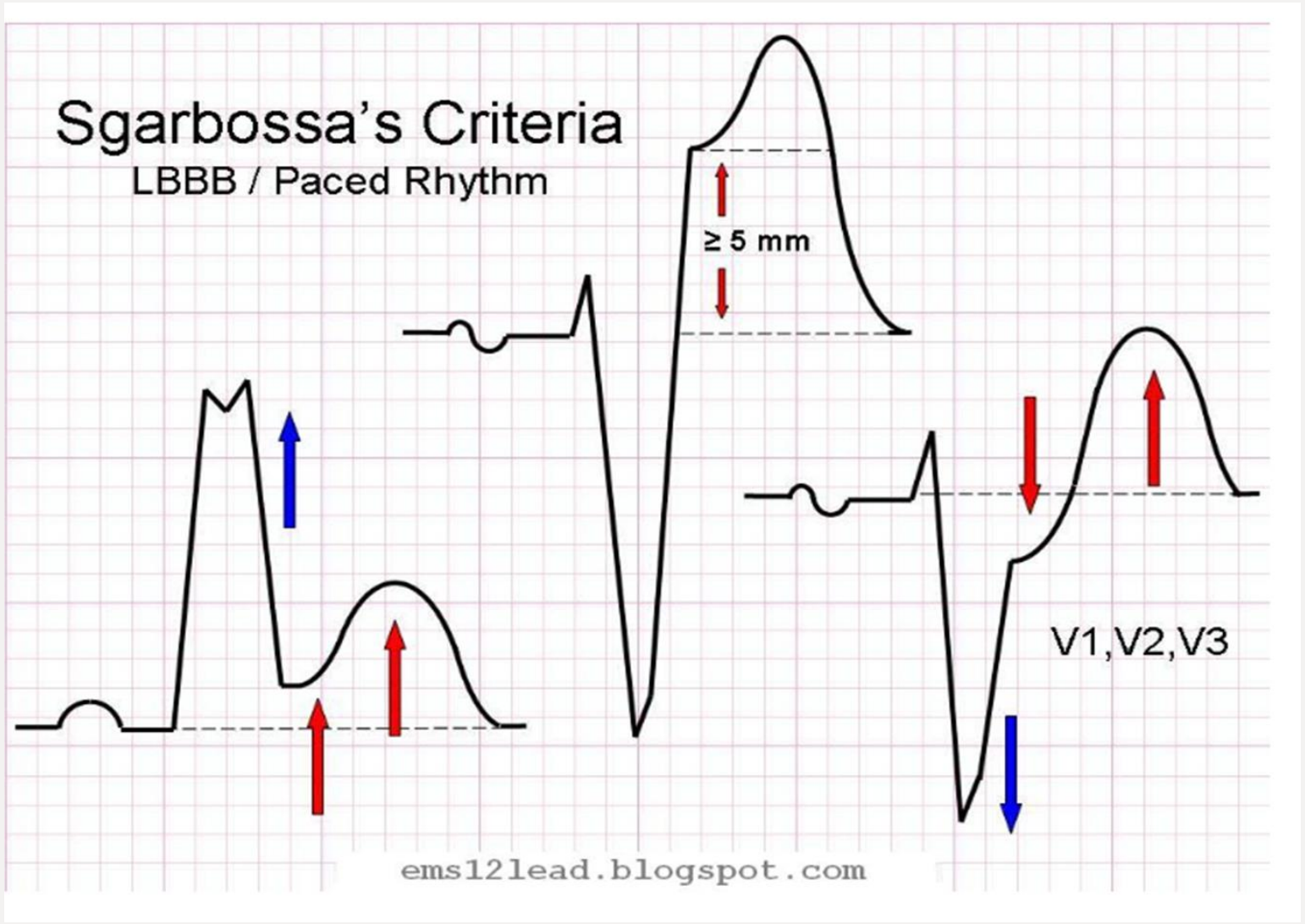
Precordial Leads



Sgarbossa's criteria



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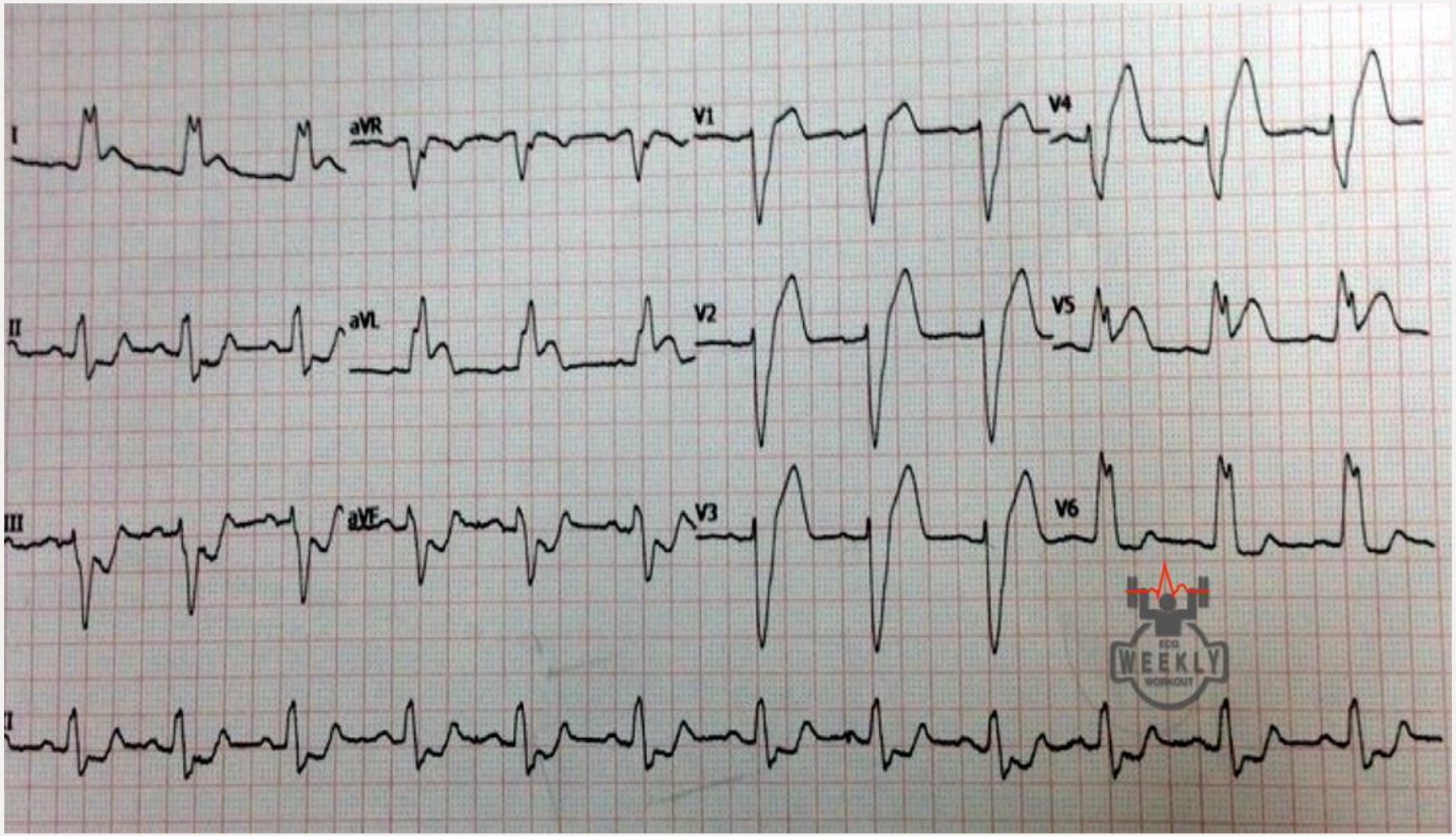
Sgarbossa's criteria

- Concordant ST depression > 1mm in V1-3 (score 3)
- Concordant ST elevation > 1mm in leads with positive QRS complex (score 5)
- Excessively discordant ST elevation > 5mm with a negative QRS complex (score 2)

- A score ≥ 3 has a specificity of 90% for diagnosing myocardial infarction

Sgarbossa's criteria



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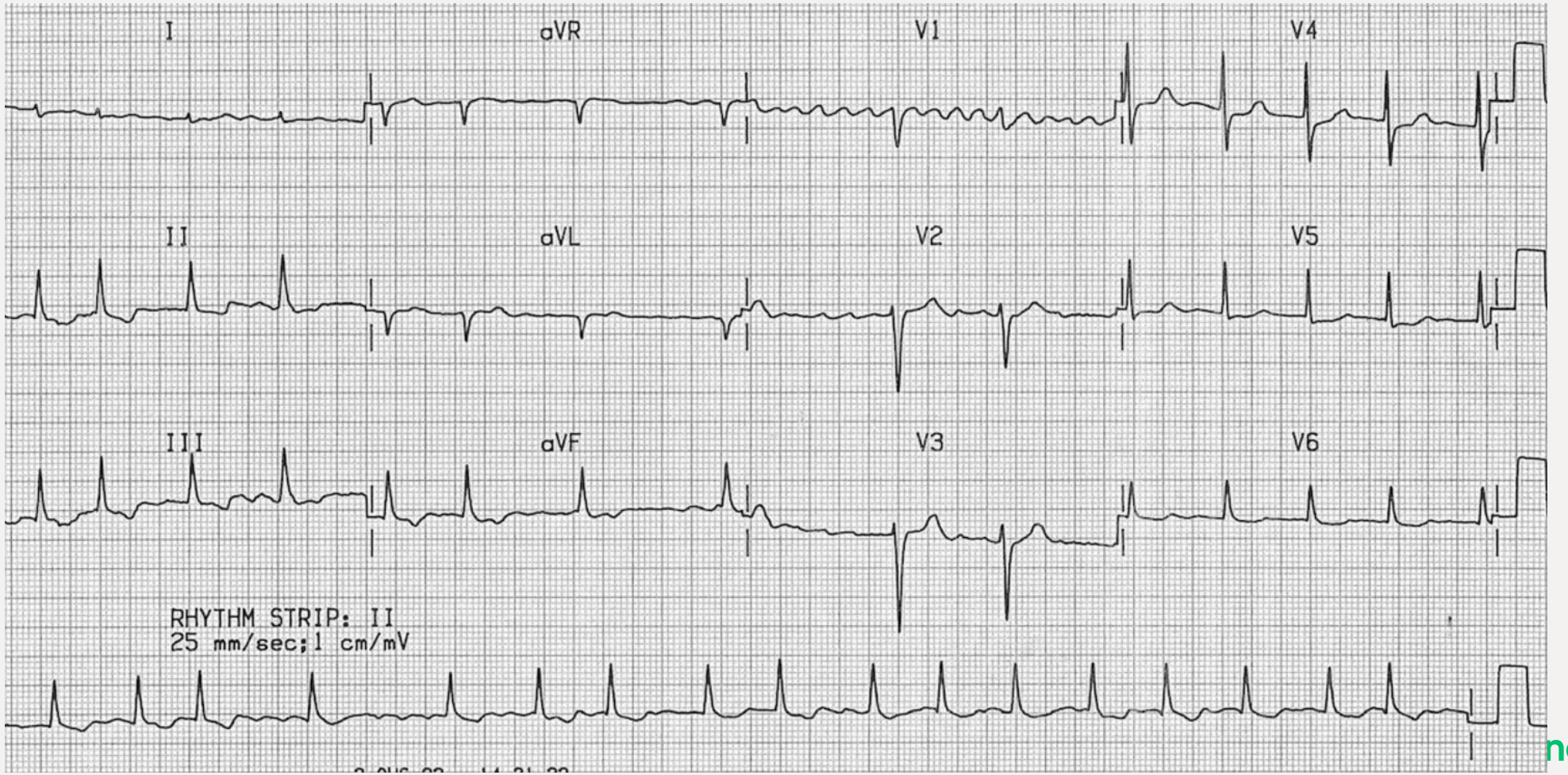
Supraventricular arrhythmias

Supraventricular arrhythmias

- Atrial fibrillation
- Atrial flutter
- Supraventricular tachycardias
  - Atrioventricular nodal re-entrant
  - Atrioventricular re-entrant
  - Atrial
  - Sinus
    - Physiological
    - Inappropriate
    - Postural orthostatic tachycardia syndrome
  - Others
    - Permanent junctional reciprocating
    - Junctional ectopic
    - Mahaim

Atrial fibrillation



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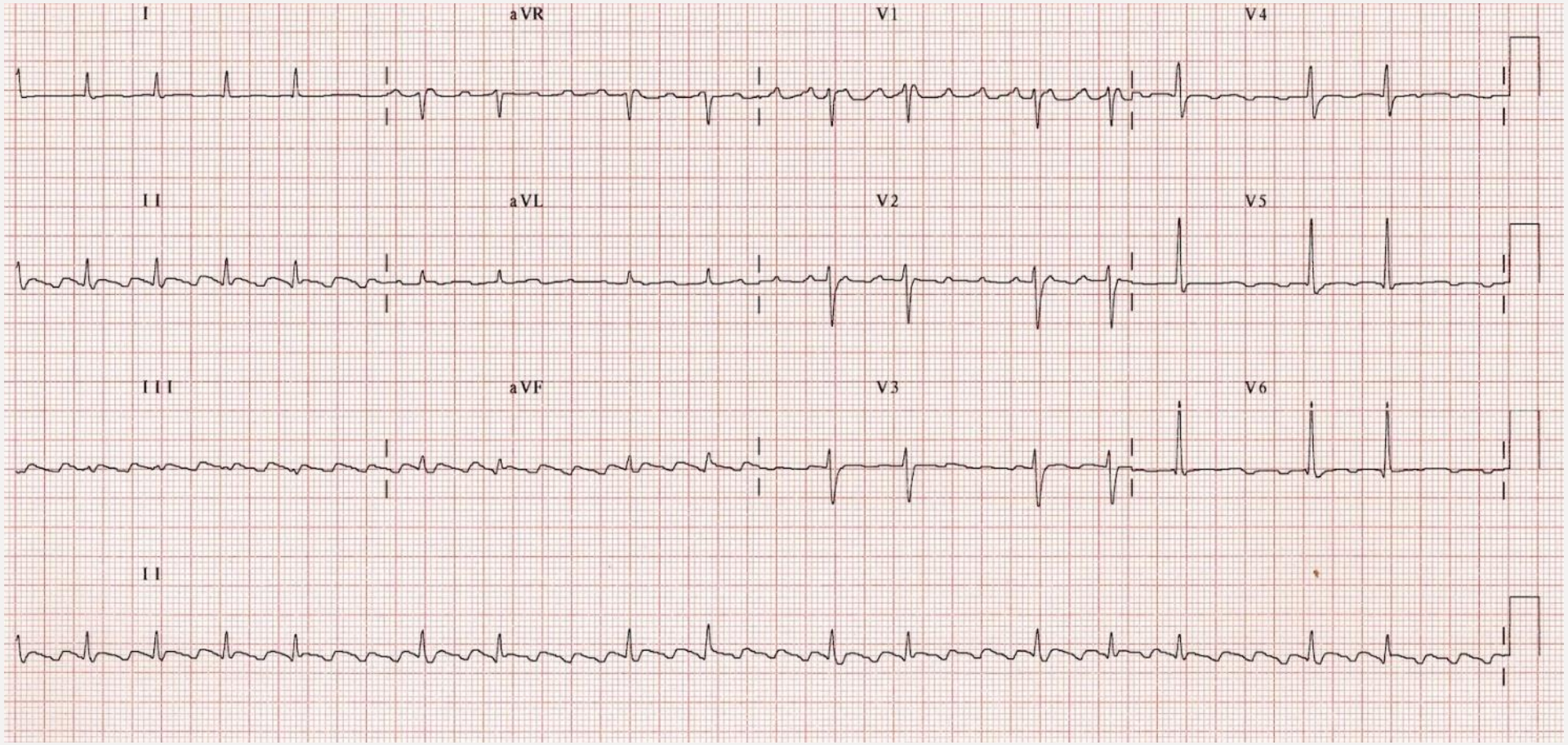
Atrial flutter



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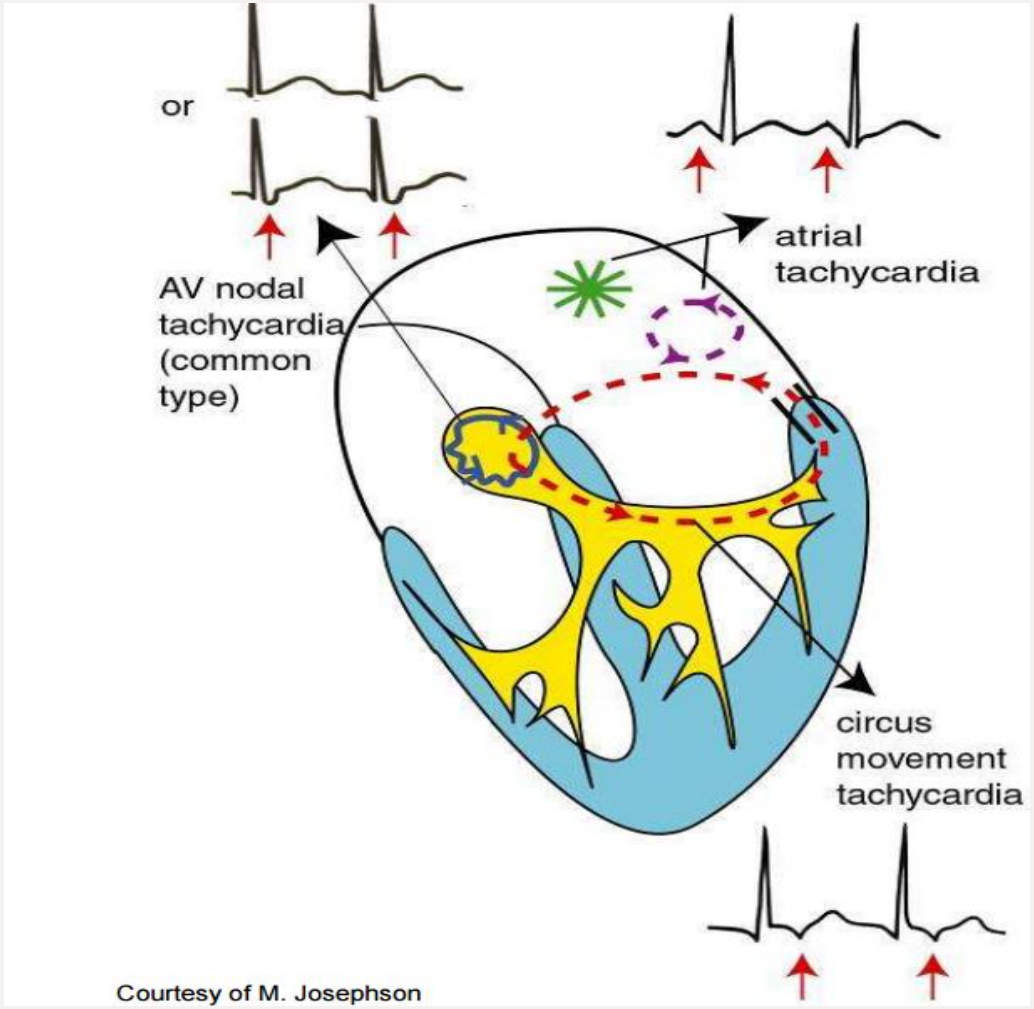
Supraventricular tachycardias

- Most common SVT is AVNRT (60%), followed by AVRT (30%) and AT (10%)
- AVNRT is more common in women (70%)
  - Mean age of onset 32 years
- AVRT is more common in men
  - Mean age of onset 23 years
- AT is more common in older age and structural disease

Supraventricular tachycardias (P wave)



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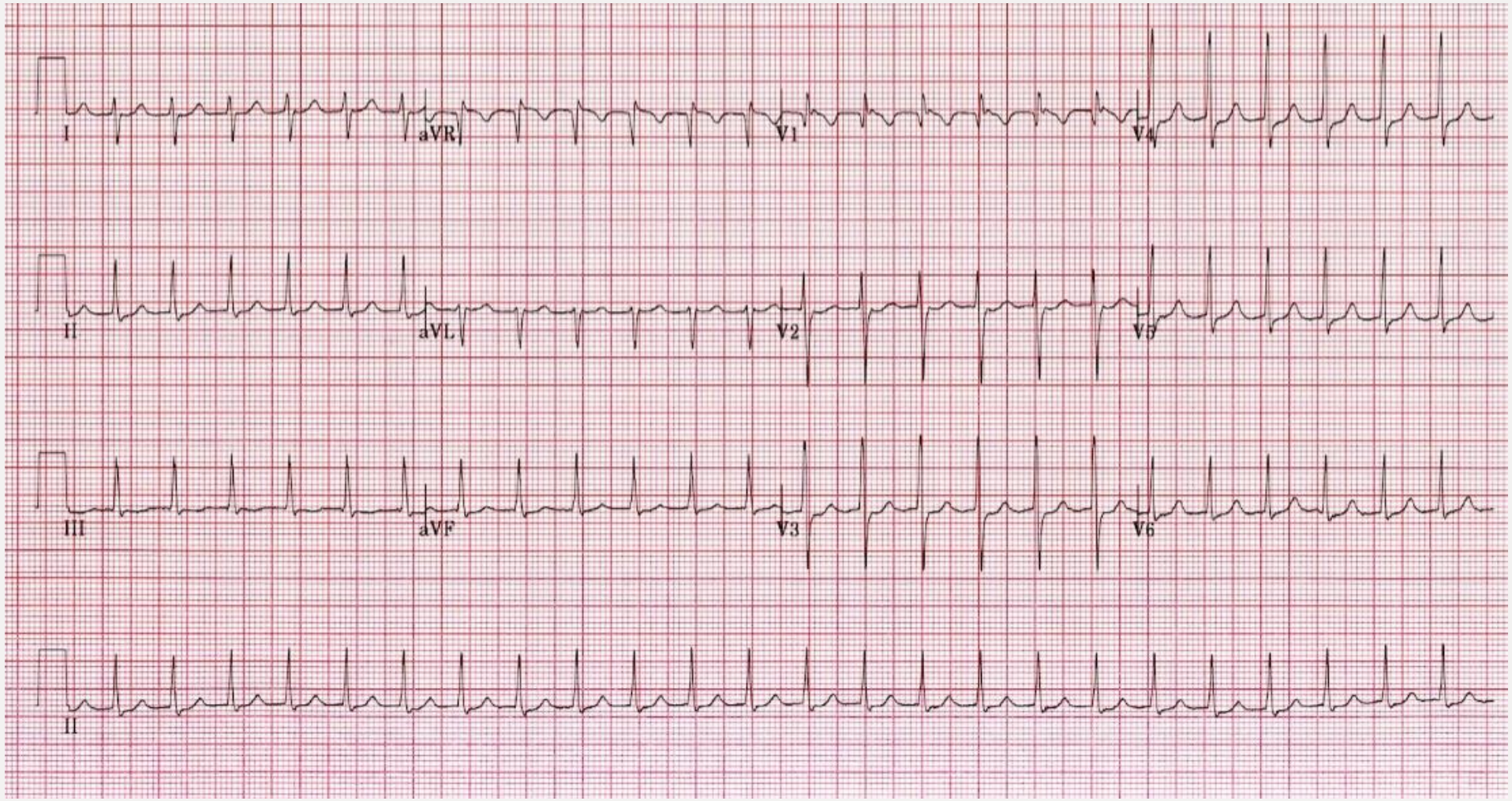
AVNRT



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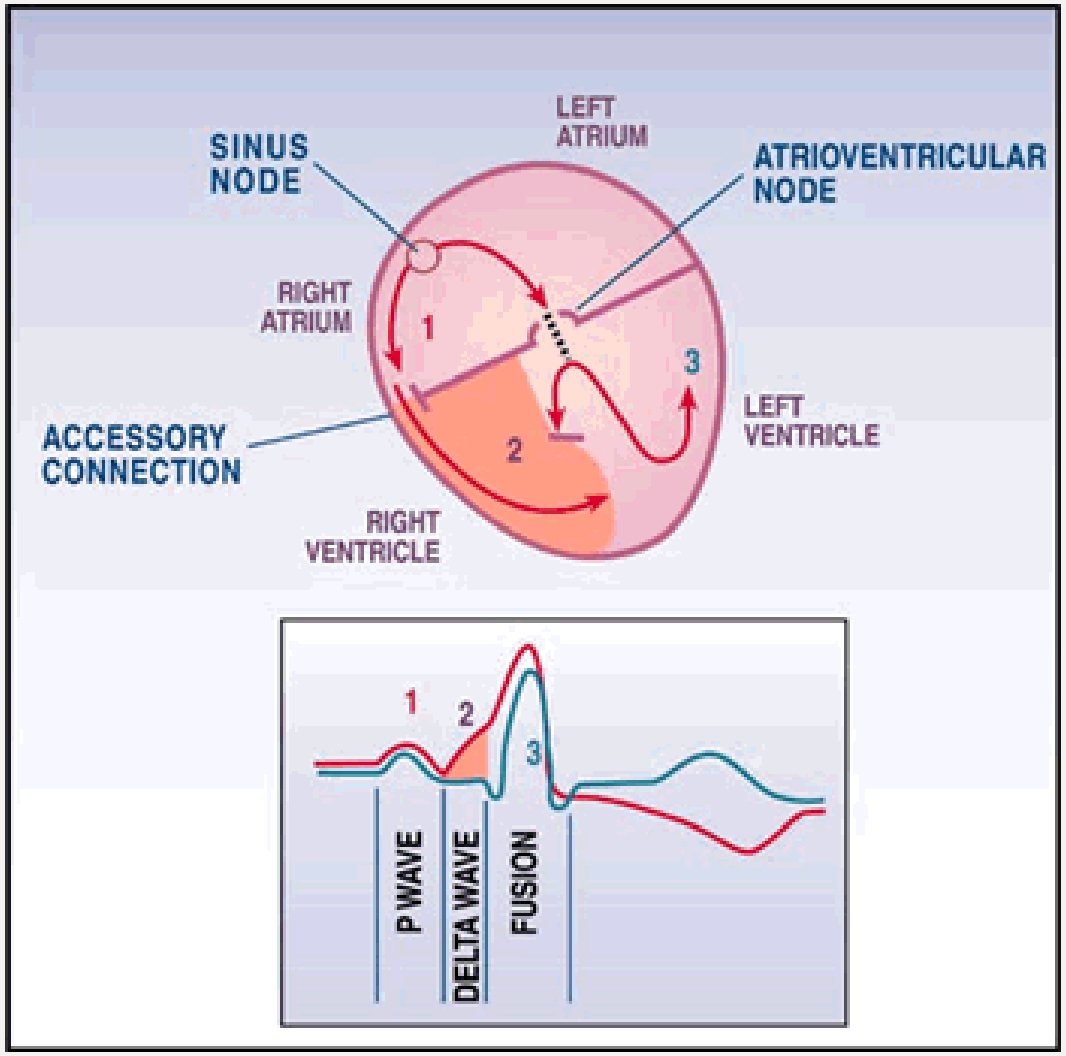
Wolff-Parkinson-White syndrome



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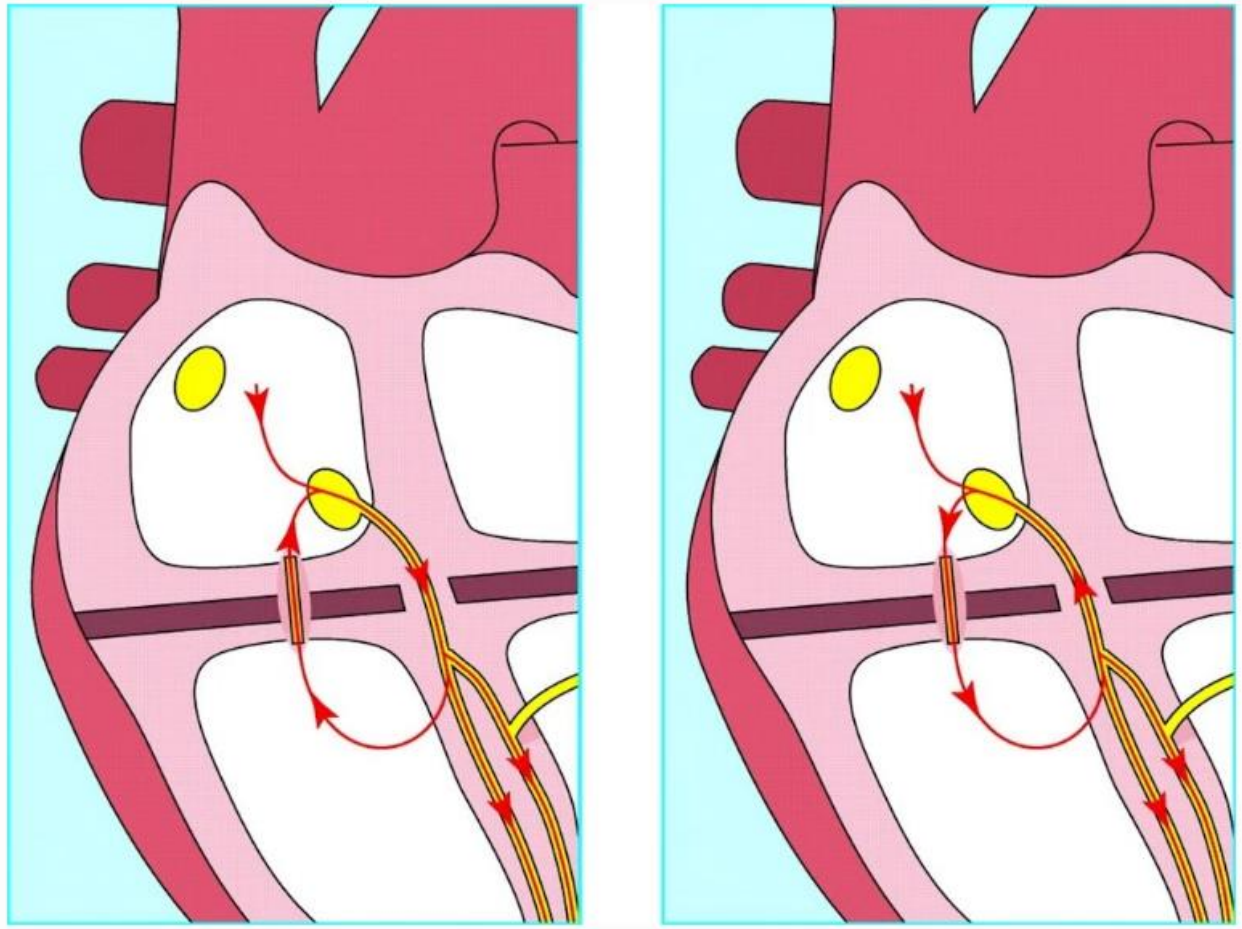
Wolff-Parkinson-White syndrome



AVRT with orthodromic (left) and antidromic (right) AV nodal conduction

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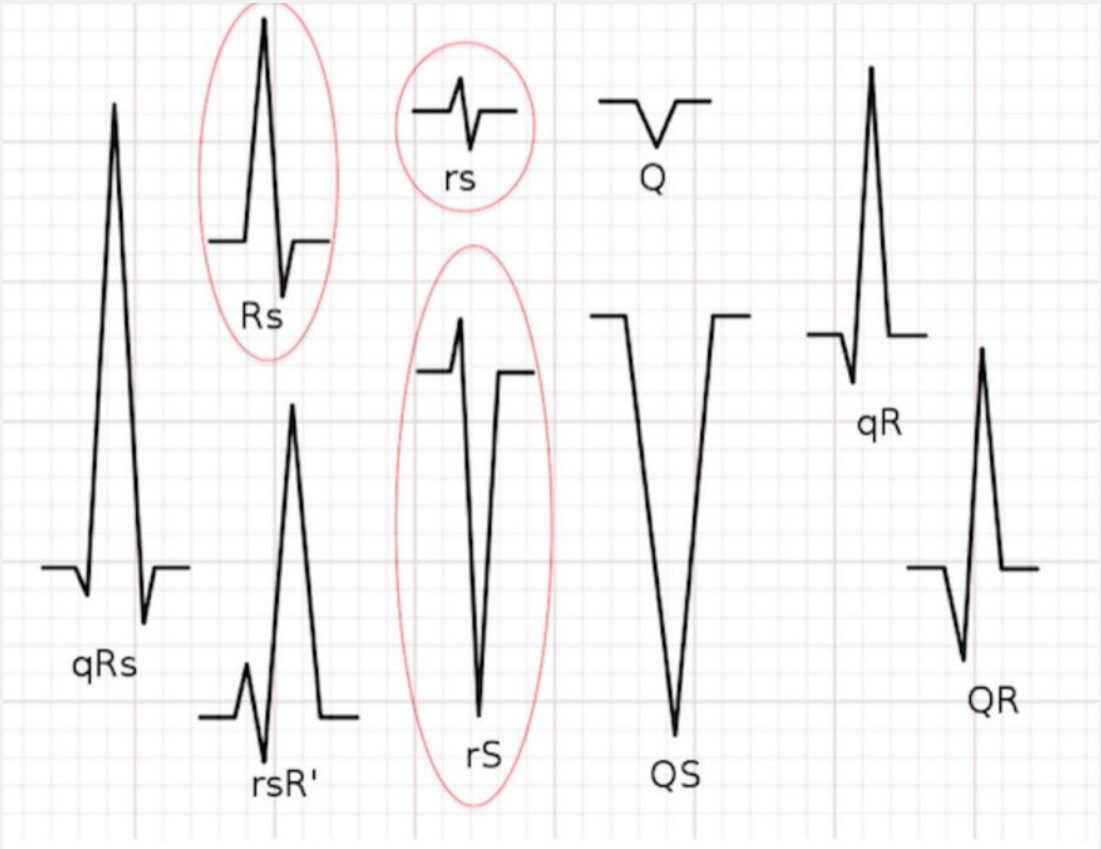
Broad complex tachycardias

Broad complex tachycardia

- VT
- SVT with aberrant conduction due to bundle branch block
  - Pre-existing BBB
  - Rate related BBB
- SVT with aberrant conduction due to Wolff-Parkinson-White Syndrome

VT Versus SVT with aberrancy - Brugada

- 1. Is there an absence of an RS complex in all precordial leads?
  - Yes = VT, No = next question



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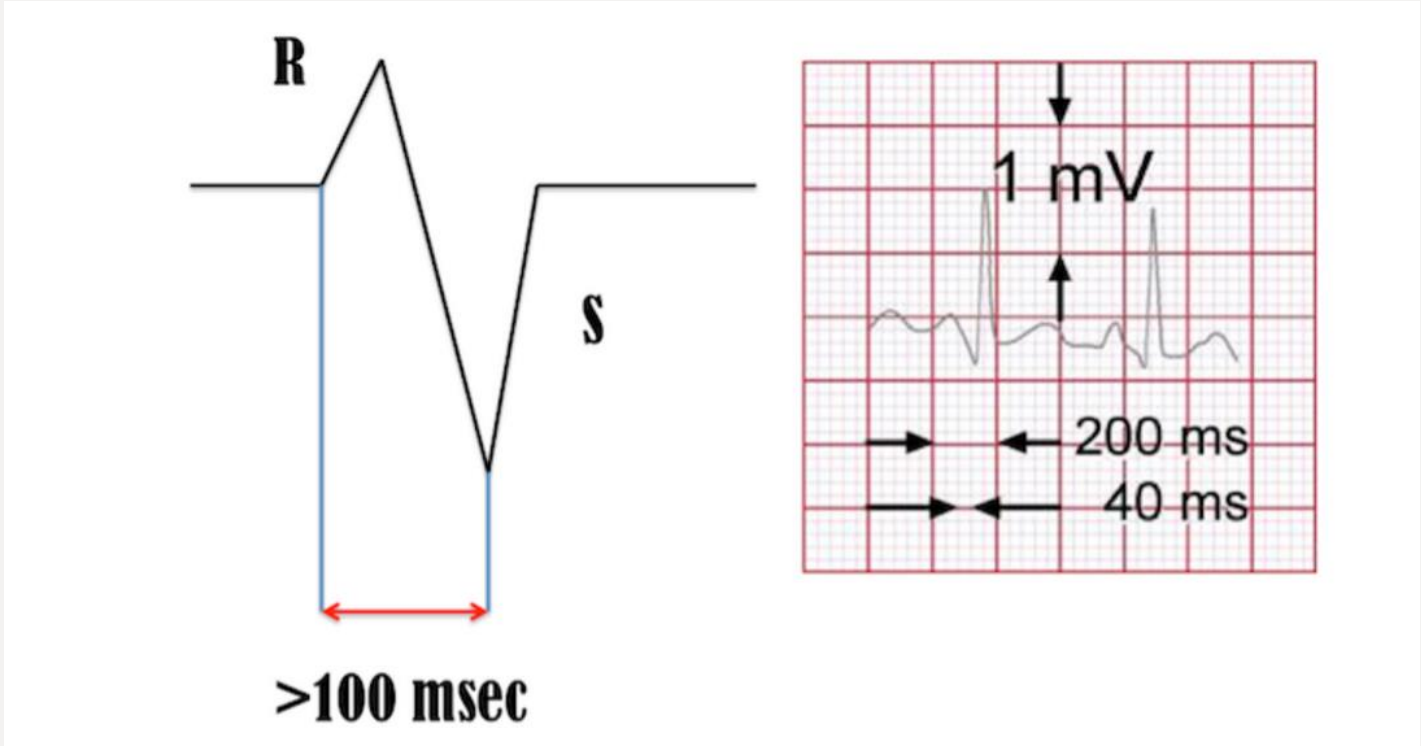
VT Versus SVT with aberrancy - Brugada

- 2. Is the R to S interval >100 msec?
  - Yes = VT, No = next question



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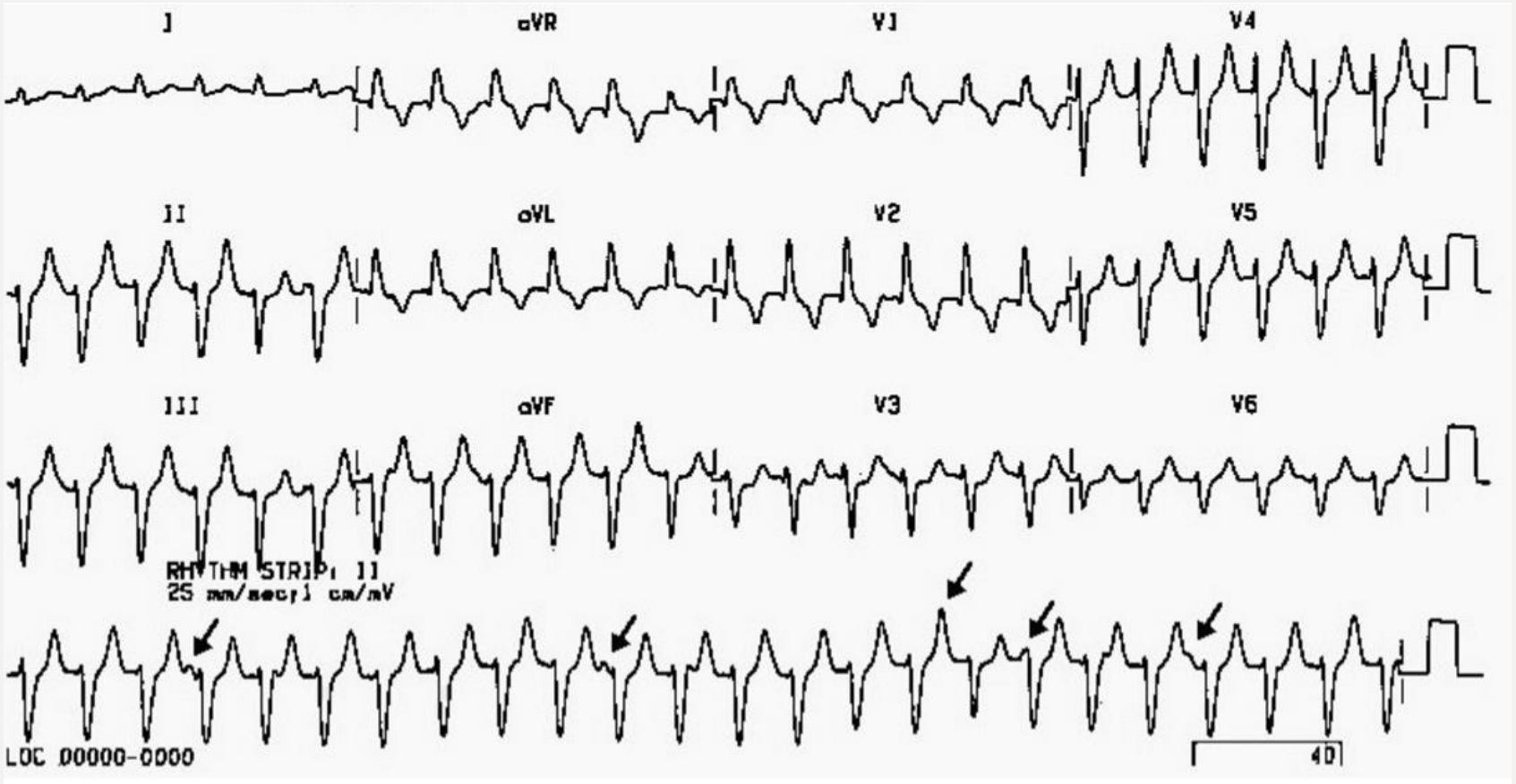
VT Versus SVT with aberrancy - Brugada

- 3. Is there atrioventricular (AV) dissociation?
  - Yes = VT, No = next question



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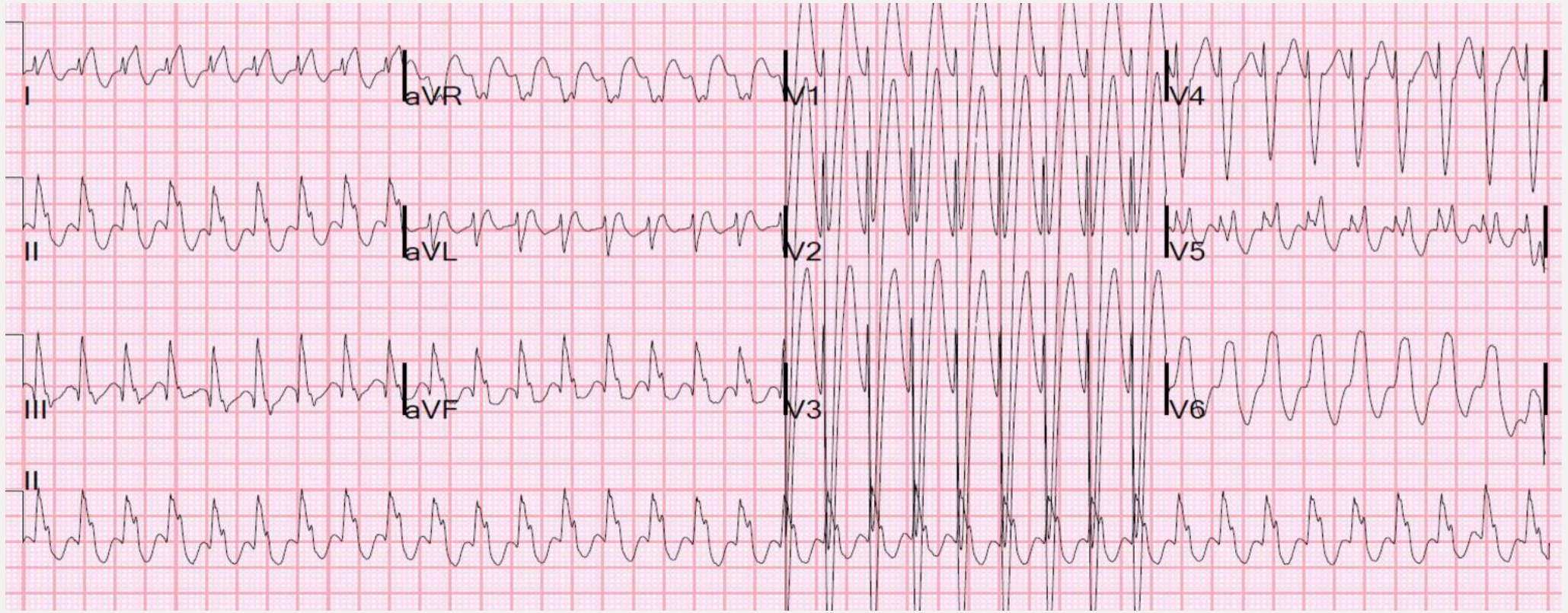
4. Is there morphology criteria for VT present in precordial leads V1/V2 and V6?

LBBB morphology VT



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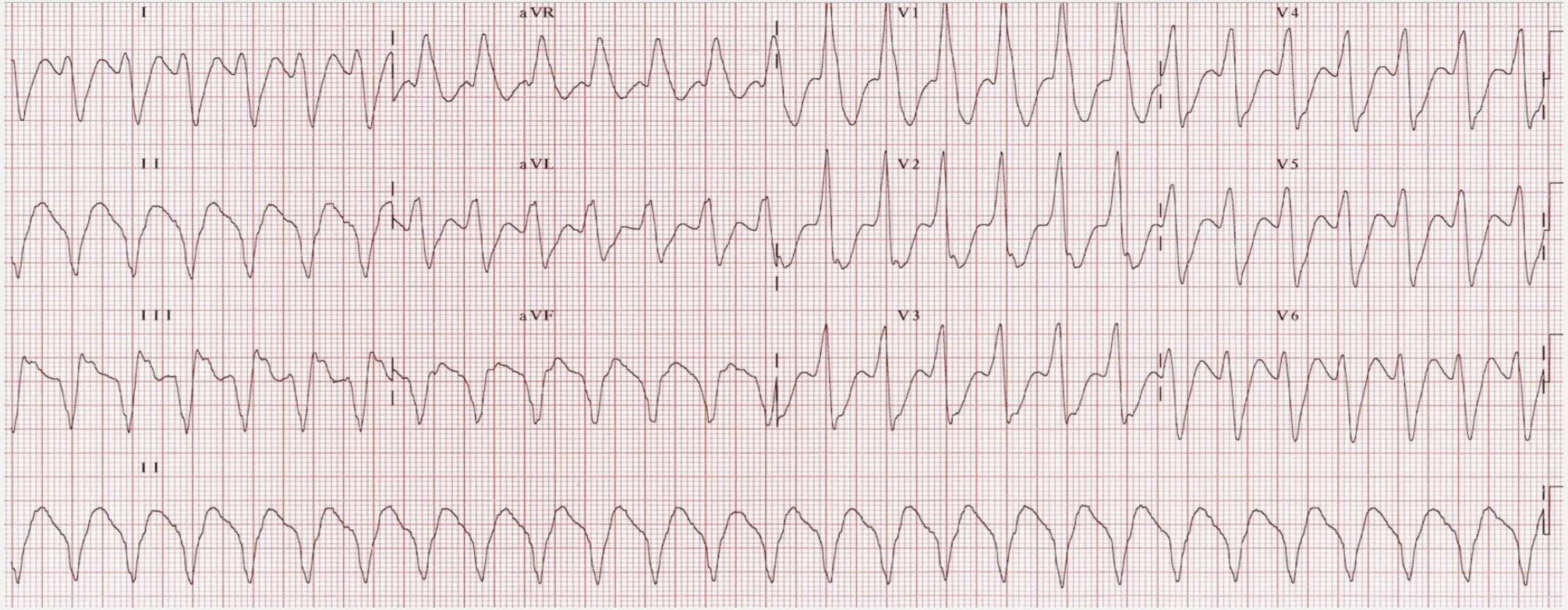
4. Is there morphology criteria for VT present in precordial leads V1/V2 and V6?

RBBB morphology VT



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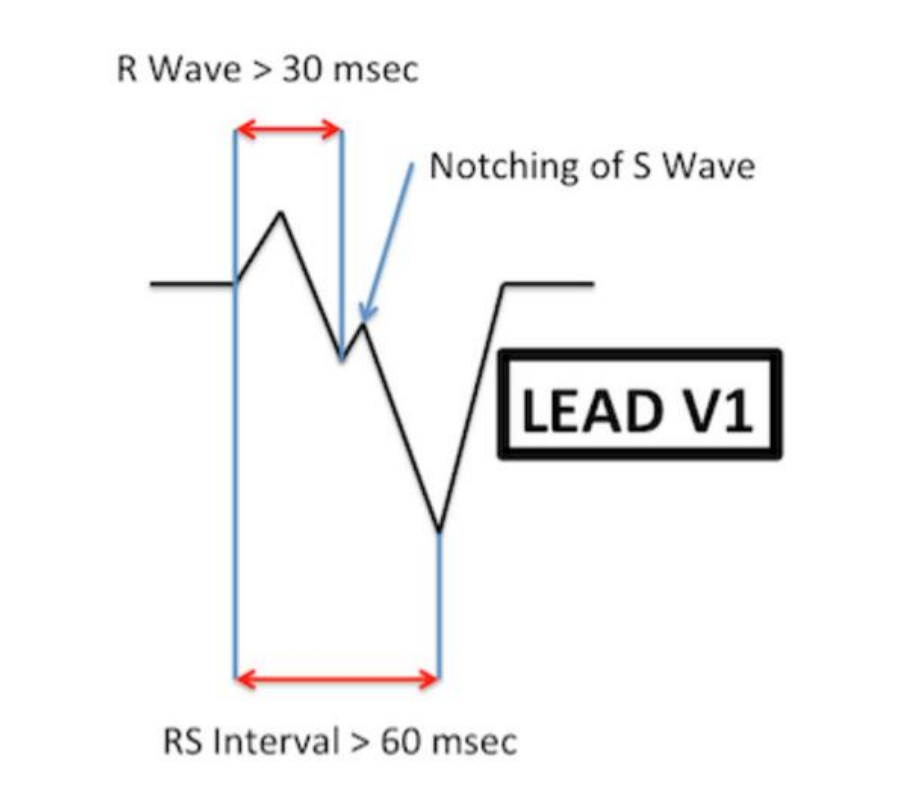
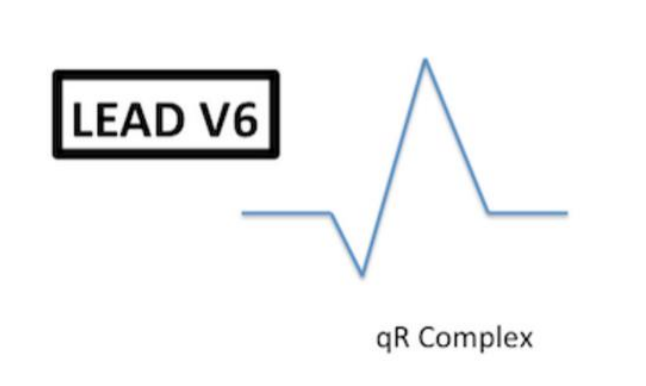
4. Is there morphology criteria for VT present in precordial leads V1/V2 and V6?

- LBBB morphology: dominant S wave in V1 or V2
- LBBB morphology: V6





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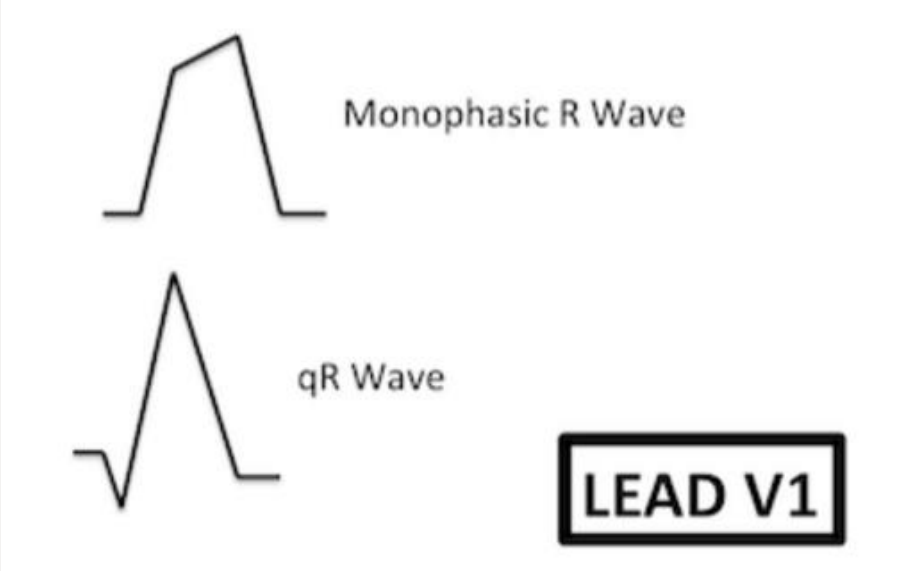
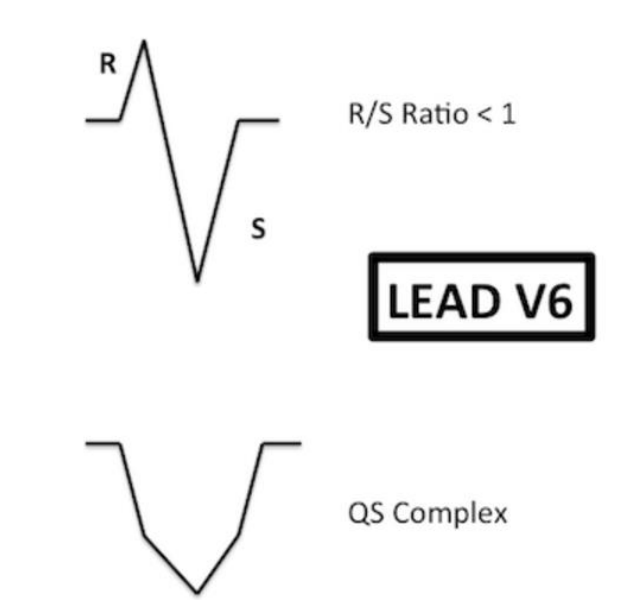
4. Is there morphology criteria for VT present in precordial leads V1/V2 and V6?

- RBBB morphology: dominant R wave in V1 or V2



- RBBB morphology: V6



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VT Versus SVT with aberrancy

- IF IN DOUBT, TREAT AS VT

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ECG Quiz
available as separate download

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