Electrocardiogram ECG

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ECG

- **Measurement of Electrical activity on heart in graphic form is called ECG.**
- **This is done by a Machine called ECG machine.**
- **The electrocardiogram (ECG) is a plot of voltage on the vertical axis against time on the horizontal axis.**
- **Surface electrodes record electrical activity deep within body -** *How possible?*
- **Reflects electrical activity of whole heart not of single cell!**

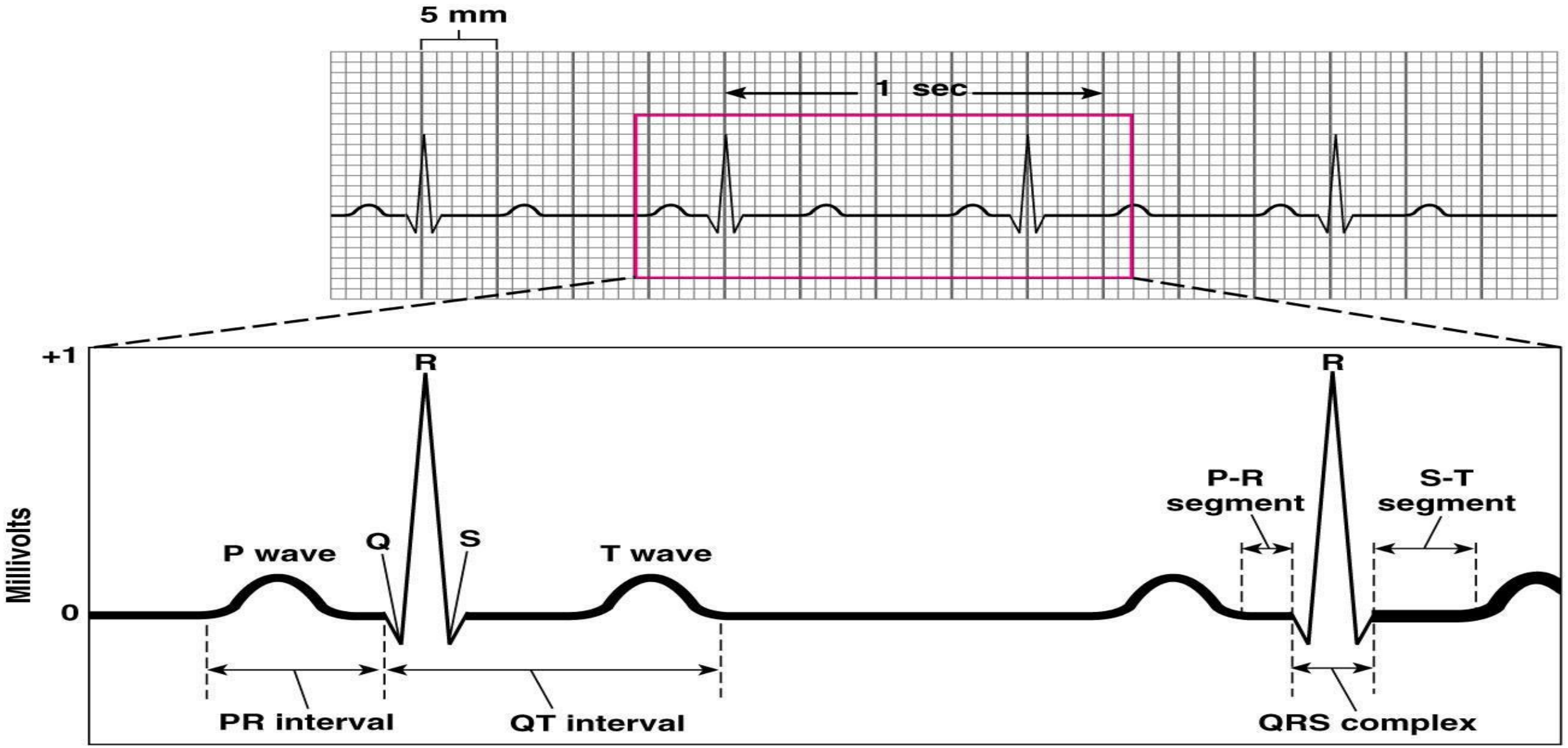
•EC fluid = "salt solution" (NaCl) ⟹ good conductor of electricity to skin surface

•Signal very weak by time it gets to skin

- ✓ **ventricular AP = ? mV**
- ✓ **ECG signal amplitude = 1mV**

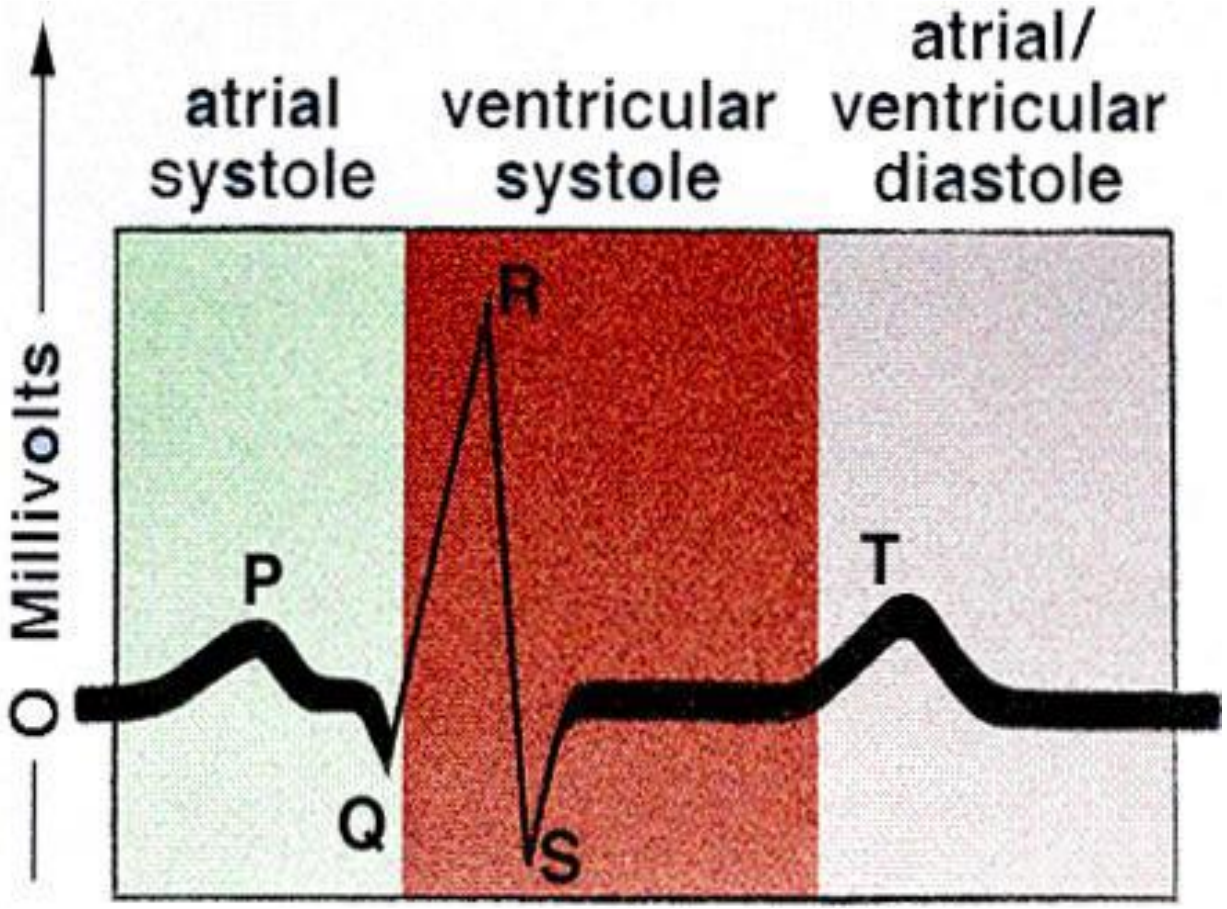
ECG tracing = ∑of all electrical potentials generated by all cells of heart at any given moment

Fig. Showing Normal ECG of Adult Person

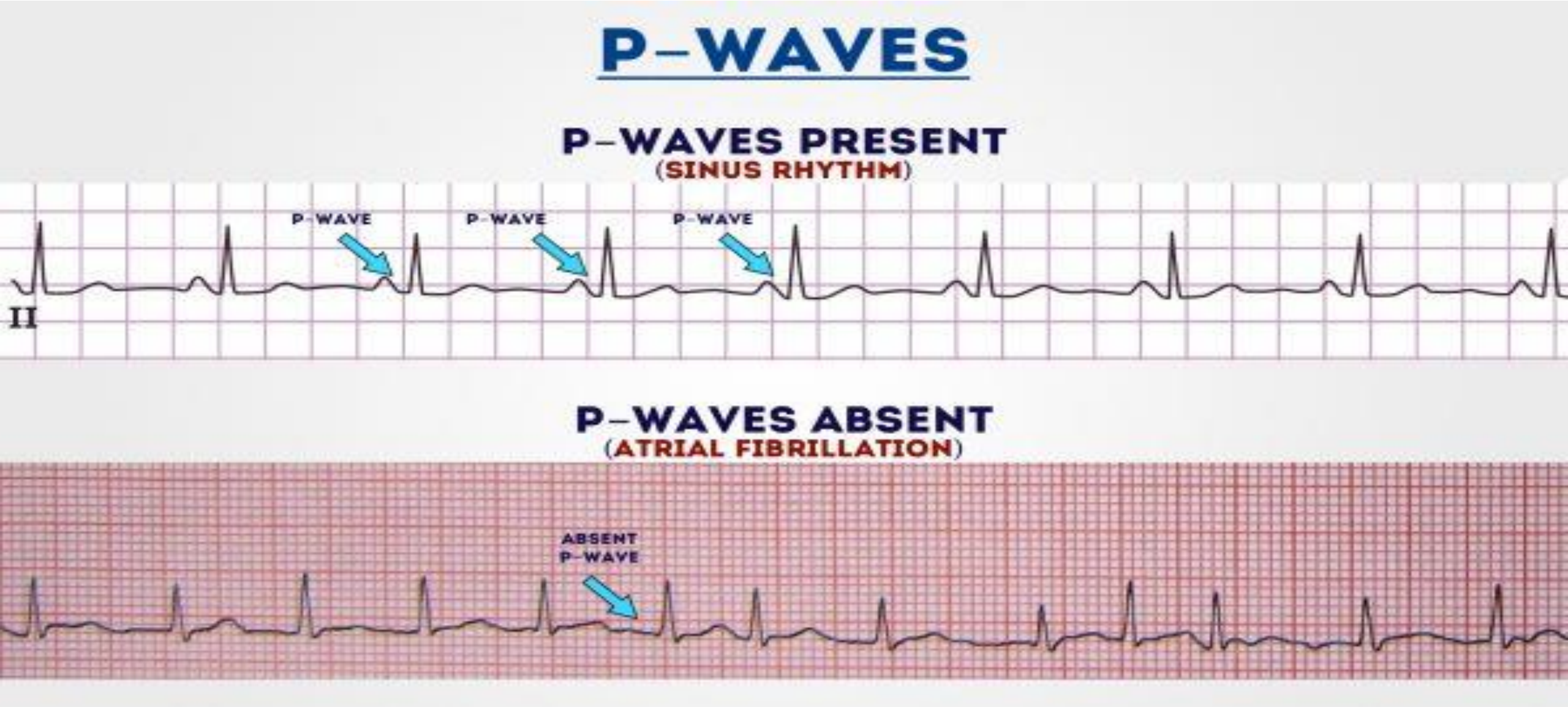


Conduction Pathways

- P wave = atrial depolarization.
- PR Interval = impulse from atria to ventricles.
- QRS complex = ventricular depolarization.
- ST segment = isoelectric – part of repolarization.
- T wave = usually same direction as QRS – ventricular repolarization.
- QT Interval = This interval spans the onset of depolarization to the completion of repolarization of the ventricles.

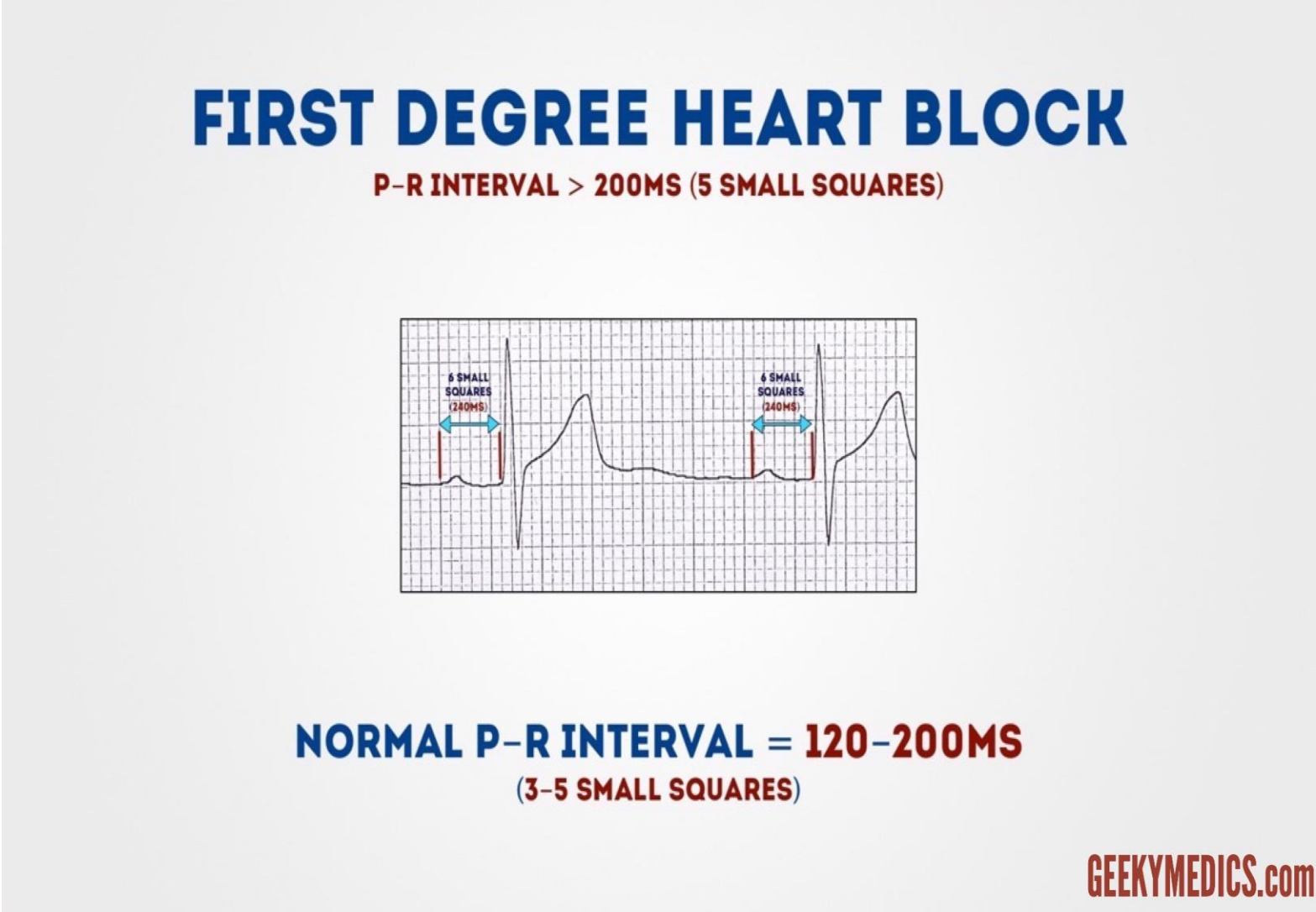


- *If P-waves are absent and there is an irregular rhythm it may suggest atrial fibrillation*



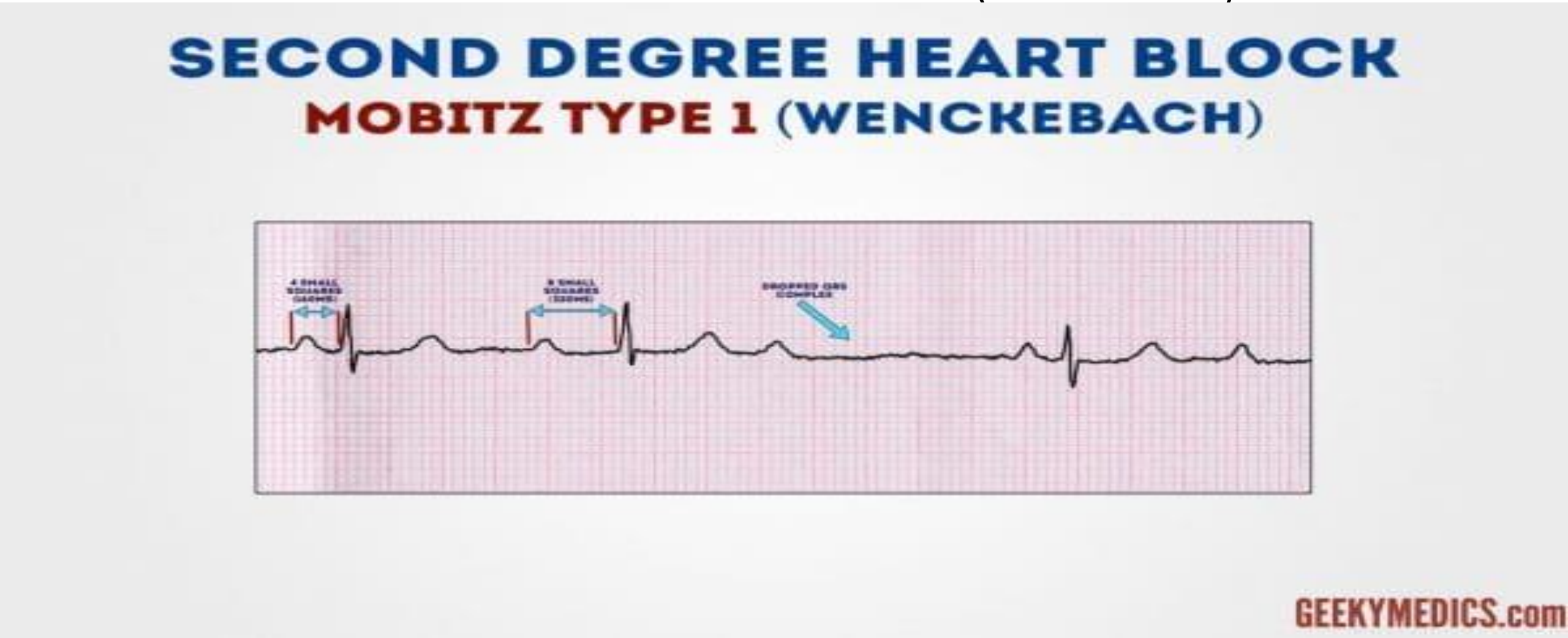
P-R interval

- **The P-R interval should be between 120-200 ms** *(3-5 small squares)*
- **<u>Prolonged PR interval (>0.2 seconds)</u>**
  - **A prolonged PR interval suggests there is atrioventricular delay (AV block).**
- **First degree heart block**
  - First degree heart block involves a fixed prolonged PR interval (>200 ms).



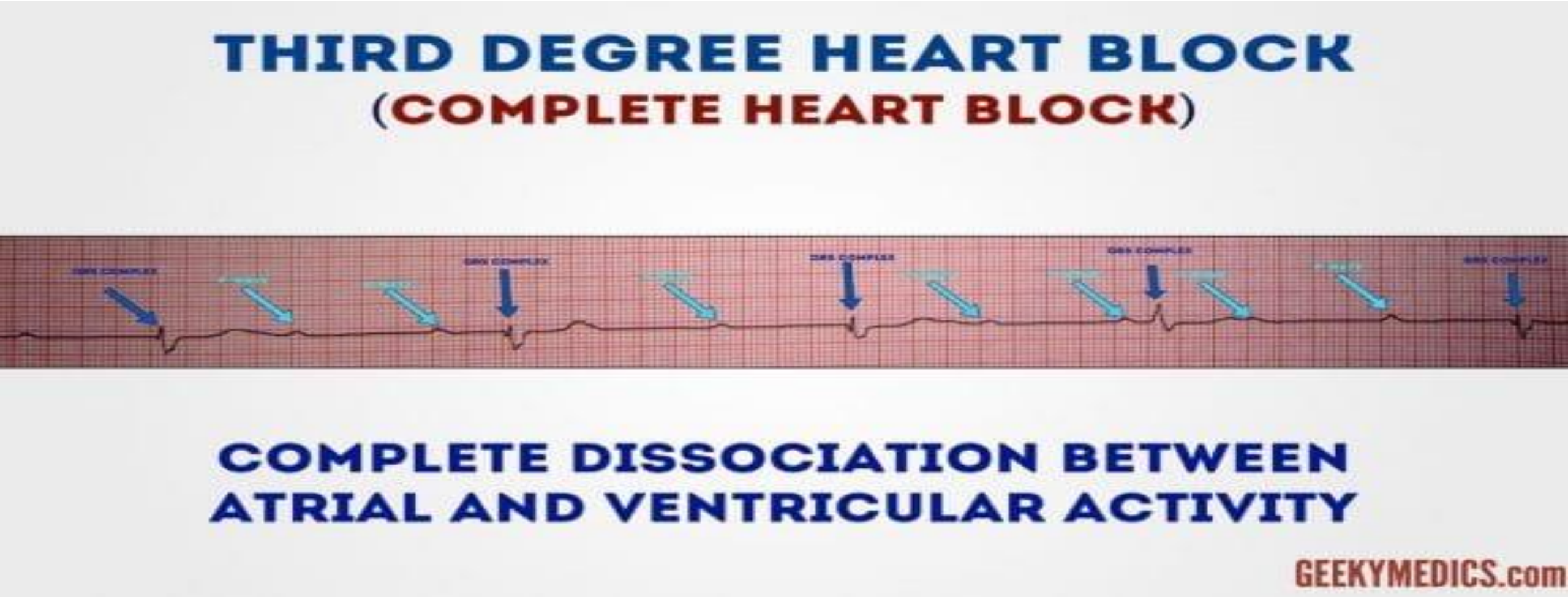
Second degree heart block (Mobitz type 1)

- If the PR interval slowly increases then there is a dropped QRS complex (beat), this is **MOBITZ TYPE I SECOND DEGREE AV BLOCK** (Wenckebach).



Third degree heart block (complete heart block)

- If the P waves and QRS complexes are completely unrelated, this is THIRD DEGREE AV BLOCK (complete heart block)



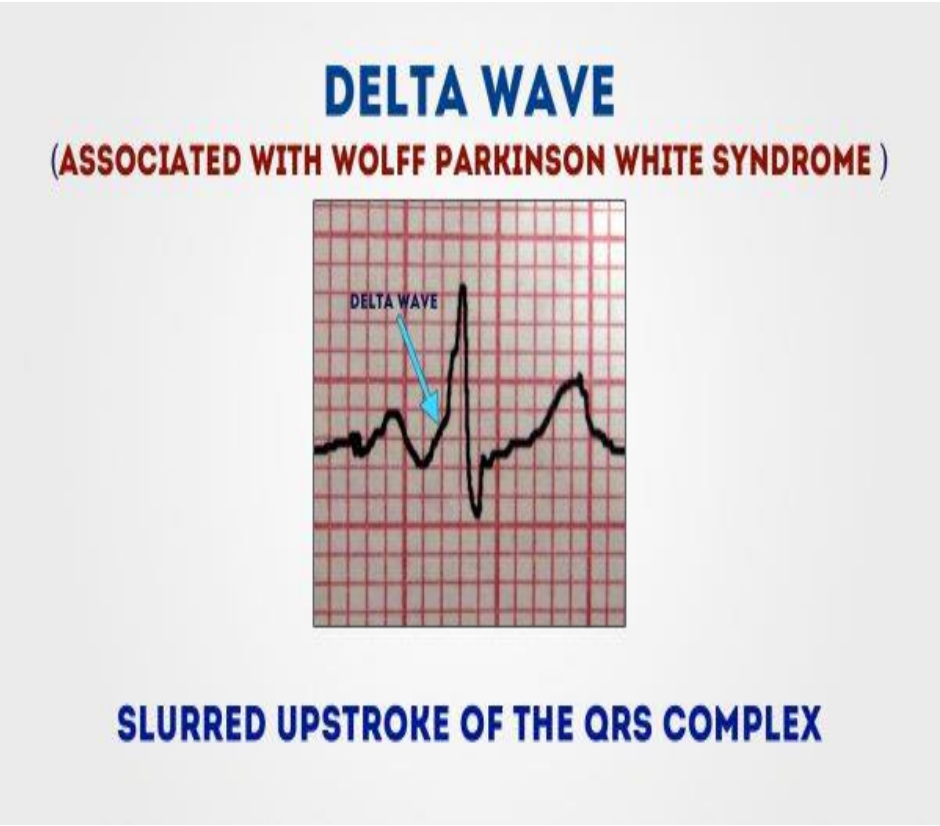
- **First degree AV block:**
  - Occurs between the SA node and the AV node *(i.e. within the atrium)*

- **Second degree AV block:**
  - **Mobitz I (Wenckebach) –** occurs IN the AV node. This is the only piece of conductive tissue in the heart which exhibits the ability to conduct at different speeds
  - **Mobitz II –** occurs AFTER the AV node in the bundle of His or Purkinje fibers

- **Third degree AV block:**
  - Occurs anywhere from the AV node down causing complete blockage of conduction

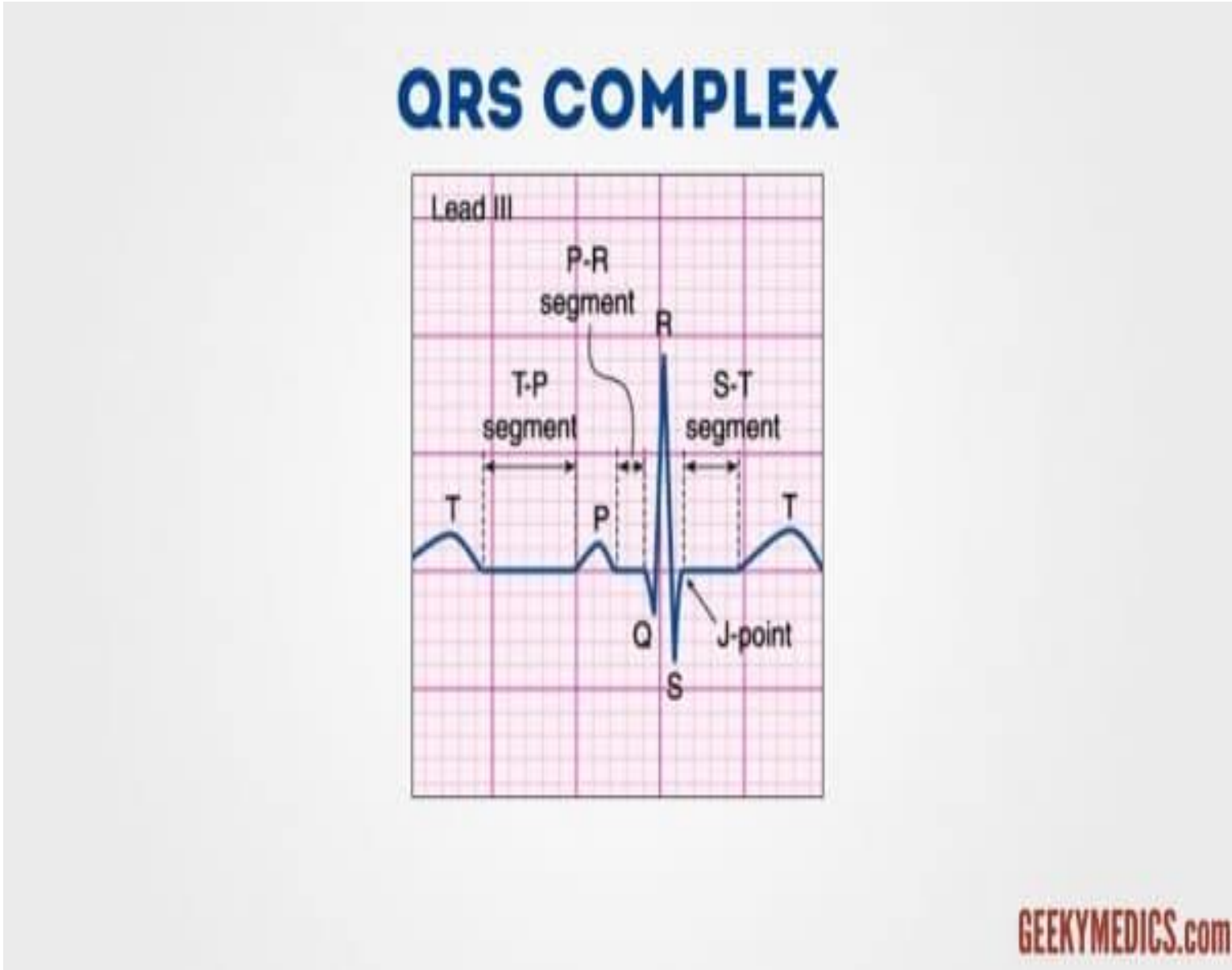
Shortened PR interval

- **If the PR interval is short, this means one of two things:**
- Simply, the P-wave is originating from somewhere closer to the AV node so the conduction takes less time (the SA node is not in a fixed place and some people's atria are smaller than others!)
- The atrial impulse is getting to the ventricle by a faster shortcut instead of conducting slowly across the atrial wall. This is an accessory pathway and can be associated with a delta wave *(see below which demonstrates an ECG of a patient with Wolff Parkinson White syndrome)*



QRS complex

- **There are several aspects of the QRS complex you need to assess:**
  - Width
  - Height
  - Morphology



Width

- **Width can be described as NARROW (< 0.12 seconds) or BROAD (> 0.12 seconds)**

- **A narrow QRS complex** occurs when the impulse is conducted down the bundle of His and the Purkinje fibre to the ventricles. This results in well organized synchronized ventricular depolarization.
- **A broad QRS complex** occurs if there is an abnormal depolarization sequence – for example, a ventricular ectopic where the impulse spreads slowly across the myocardium from the focus in the ventricle. In contrast, an atrial ectopic would result in a narrow QRS complex because it would conduct down the normal conduction system of the heart. Similarly, a bundle branch block results in a broad QRS because the impulse gets to one ventricle rapidly down the intrinsic conduction system then has to spread slowly across the myocardium to the other ventricle.

Height

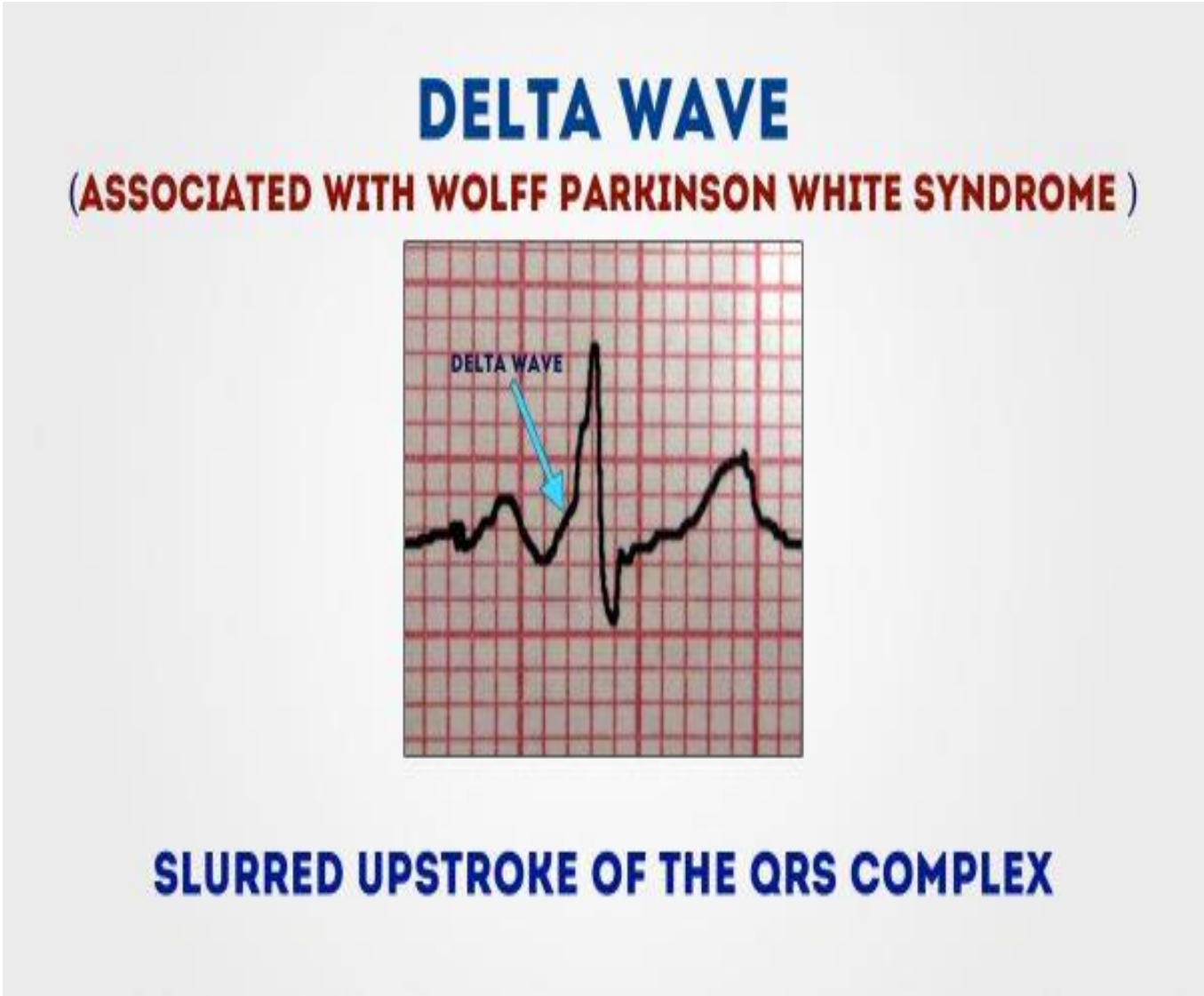
- **Describe this as SMALL or TALL:**

  - Small complexes are defined as < 5mm in the limb leads or < 10 mm in the chest leads.

  - Tall complexes imply ventricular hypertrophy (although can be due to body habitus e.g. tall slim people).

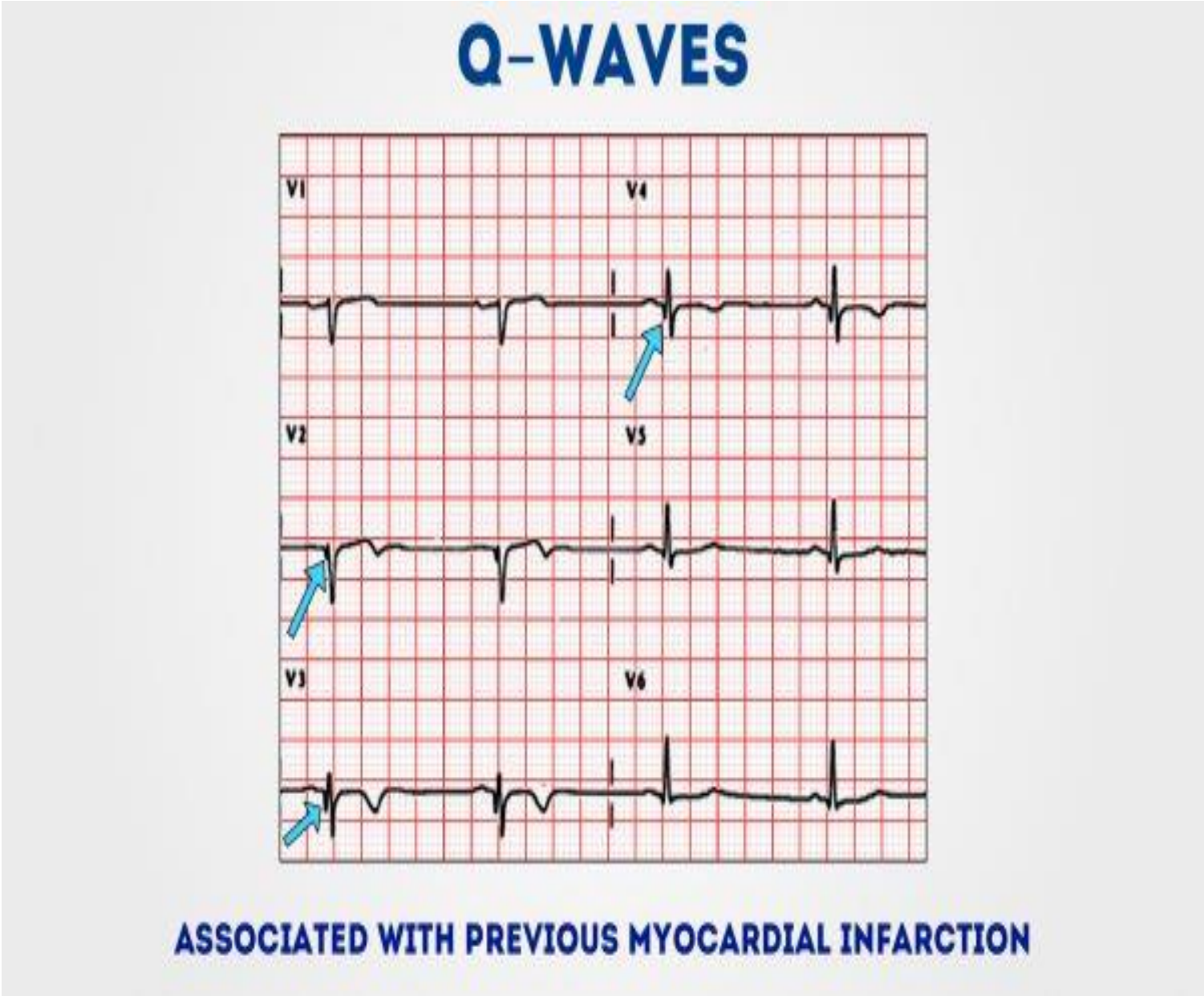
Morphology

- **Delta wave**
- The mythical ‘delta wave’ is a sign that the ventricles are being activated earlier than normal from a point distant to the AV node. The early activation then spreads slowly across the myocardium causing the slurred upstroke of the QRS complex. Note – the presence of a delta wave does NOT diagnose Wolff-Parkinson-White syndrome. This requires evidence of tachyarrhythmia's AND a delta wave.



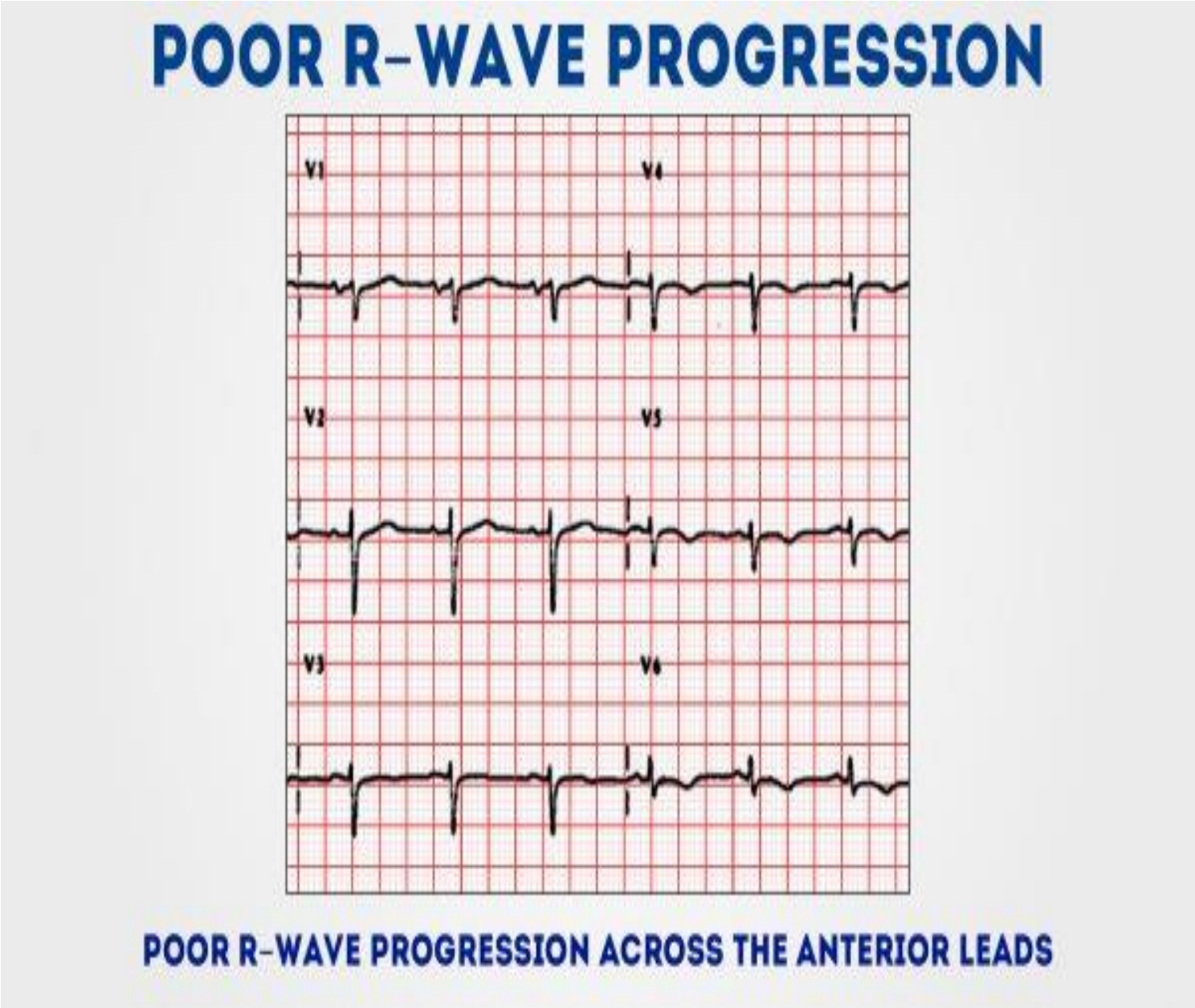
Q-waves

- Isolated Q waves can be normal. A pathological Q wave is > 25% the size of the R wave that follows it or > 2mm in height and > 40ms in width. A single Q wave is not a cause for concern – look for Q waves in an entire territory (anterior / inferior) for evidence of previous MI.



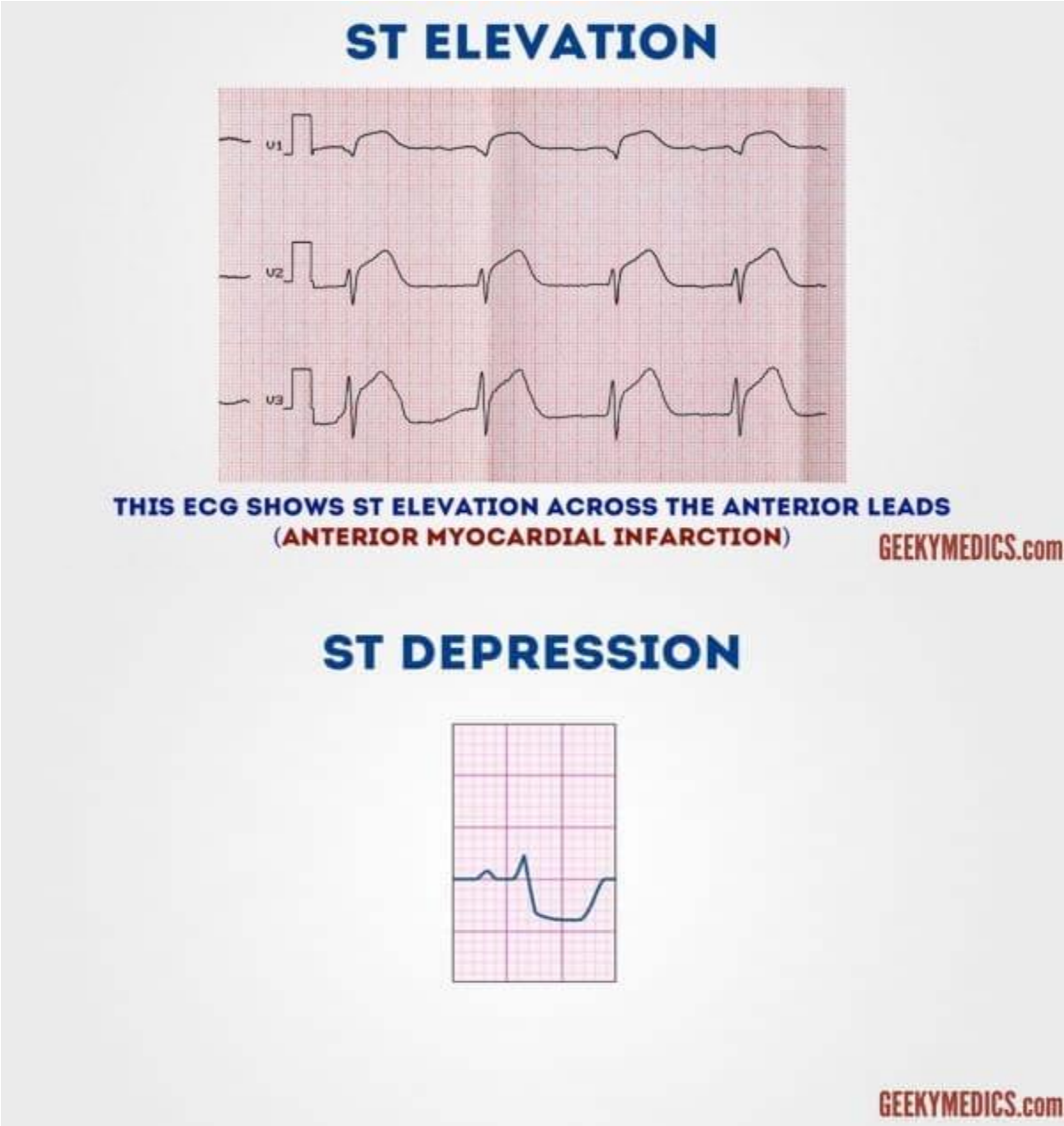
R and S waves

- Look for R wave progression across the chest leads (from small in V1 to large in V6). The transition from **S > R wave** to **R > S wave** should occur in V3 or V4. Poor progression (i.e. S > R through to leads V5 and V6) can be a sign of previous MI but can also occur in very large people due to lead position.



ST segment

- **The ST segment is the part of the ECG between the end of the S wave and start of the T wave.**
- **ST elevation is significant when it is greater than 1 mm** (1 small square) **in 2 or more contiguous limb leads or >2mm in 2 or more chest leads.**
- **ST depression ≥ 0.5 mm in ≥ 2 contiguous leads** indicates myocardial ischaemia.



T waves

- **The T waves represent repolarization of the ventricles**
- **<u>Tall T waves</u>**
- **T waves are tall if they are:**
- > 5mm in the limb leads AND
- > 10mm in the chest leads (the same criteria as ‘small’ QRS complexes)
- **Tall T waves can be associated with:**
- **Hyperkaliemia** (“Tall tented T waves”)
- **Biphasic T waves have two peaks and can be indicative of ischemia and hypokalemia**
- **Another non-specific sign, this may represent ischemia or electrolyte imbalance.**
- **The U wave (Rare seen) is a > 0.5mm deflection after the T wave best seen in V2 or V3.**

- For Further studies please consult any Book or internet sources available to you
- Thank you