Clinical Practice Procedures:
Cardiac/12-Lead ECG acquisition and interpretation

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Date	June, 2026
Purpose	To ensure a consistent procedural approach to 12-lead ECG acquisition and interpretation.
Scope	Applies to Queensland Ambulance Service (QAS) clinical staff.
Health care setting	Pre-hospital assessment and treatment.
Population	Applies to all ages unless stated otherwise.
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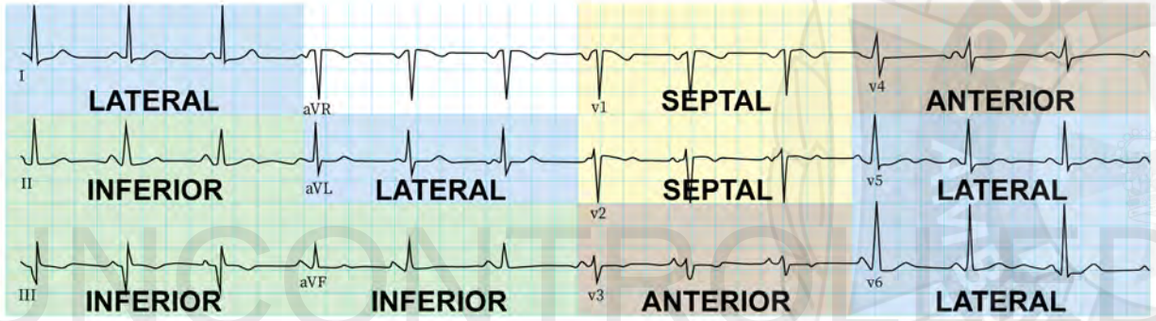
12-Lead ECG acquisition and interpretation

June, 2026

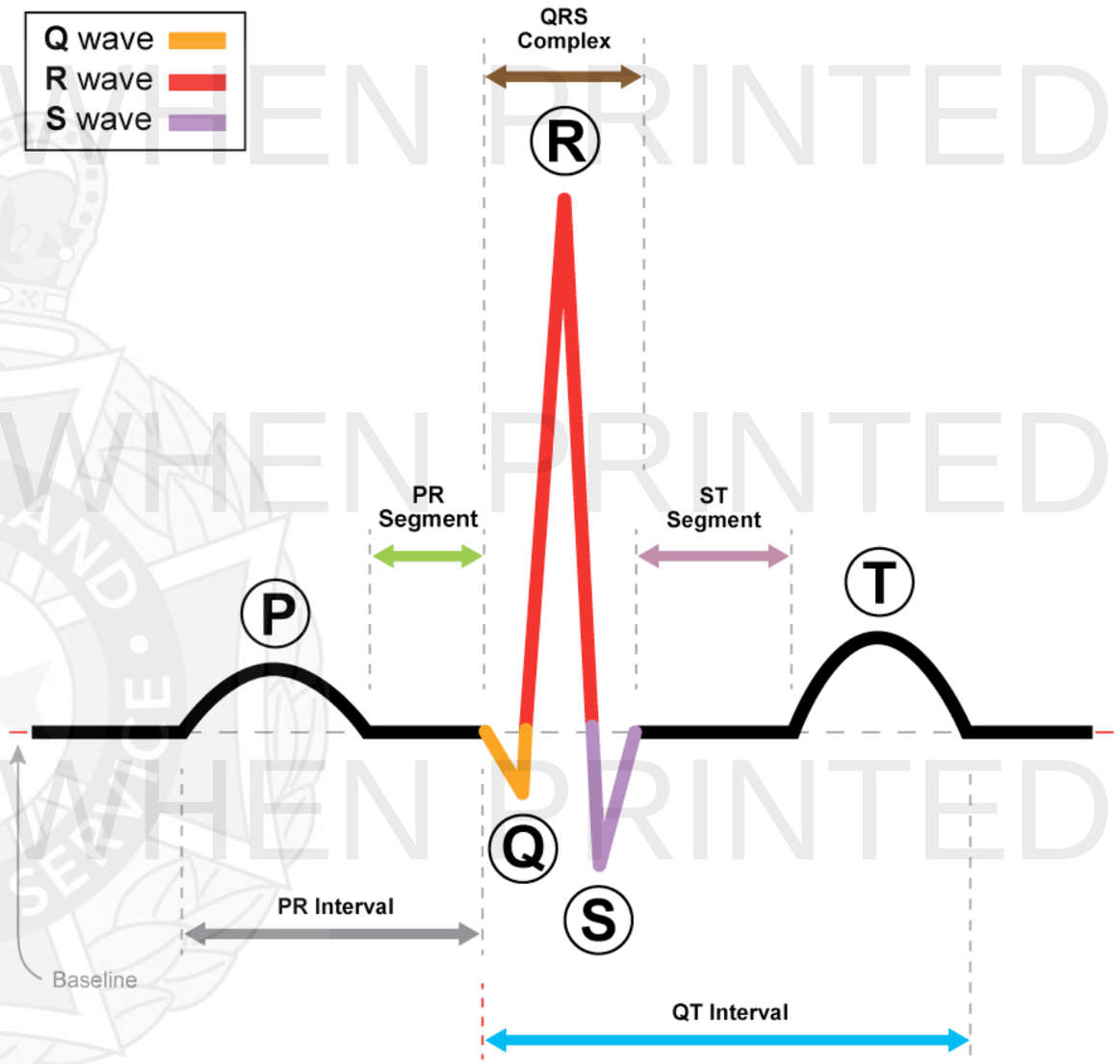
An electrocardiogram (ECG) is a non-invasive diagnostic tool that records the electrical activity of the heart. It provides essential information regarding cardiac rhythm, rate, axis, and conduction pathways. Interpretation of ECG findings may assist in identifying acute myocardial infarction (AMI), ischemic changes, electrolyte disturbances, conduction abnormalities, drug toxicity, dysrhythmias, and certain structural changes. Each ECG complex is comprised of several parts including a P wave, PR interval, QRS complex, ST segment, T wave and QT interval.

A 12-lead ECG is the gold standard for comprehensive cardiac assessment and uses 10 electrodes to produce 12 distinct views of the heart's electrical activity.



Timely acquisition of a 12-lead ECG must be completed for all patients presenting with signs or symptoms suggestive of AMI (e.g., chest pain or chest tightness).

ECG interpretation must always be integrated with clinical assessment and other diagnostic findings to guide appropriate patient management. If any doubt exists regarding 12-lead ECG acquisition and/or interpretation, ambulance clinicians should contact the *QAS Clinical Consultation and Advice Line*.



Indications

- Any patient requiring detailed ECG analysis:
  - Suspected ACS
  - Cardiac dysrhythmias
  - Conduction disturbances
  - Electrolyte imbalances
  - Drug toxicity
  - Altered level of consciousness/ loss of consciousness
  - Syncope

Contraindications

- Nil in this setting

Complications

- Nil in this setting

PROCEDURE – acquisition:

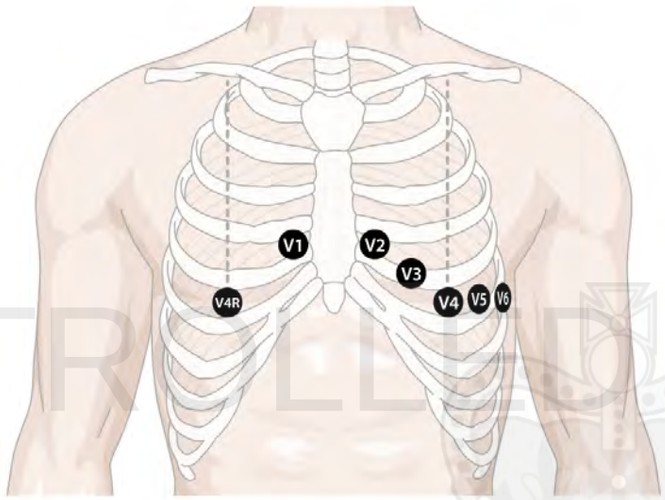
1. Explain to the patient what is required, ensure privacy and obtain consent to place electrodes.
2. If required, remove excessive hair to ensure electrodes have full contact with the patient's skin.
3. Clean and dry the skin.
4. Position the patient preferably supine or semi-recumbent, (without arms or legs crossed).
5. Attach electrodes to the connector on each lead, ensuring electrodes are in date and gel is moist.
6. Accurately position the limb electrodes on the patient. (refer to *CPP: Cardiac monitoring*)
7. Accurately position the chest electrodes on the patient.

Placement of ECG Chest Electrodes

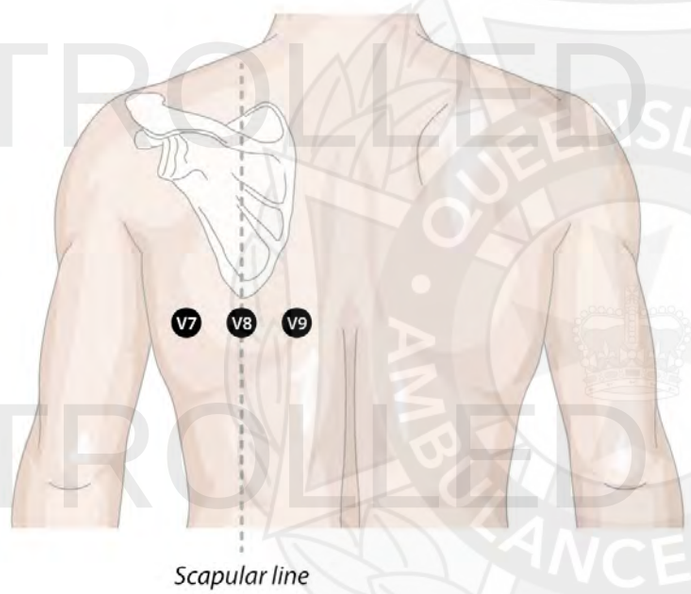
Placement order	Chest lead	Anatomical position
1st	V1	4th Intercostal space, right of the sternum
2nd	V2	4th Intercostal space, left of the sternum
3rd	V4	5th Intercostal space, on left midclavicular line
4th	V6	On the left mid-axillary line, level with V4
5th	V3	Midway between V2 and V4
6th	V5	Midway between V4 and V6
Optional*	V4R	5th Intercostal space, on the right midclavicular line
Optional**	V7	Left posterior axillary line, horizontal with V6 placement
Optional**	V8	Tip of the left scapula, horizontal with V6 placement
Optional**	V9	Left paraspinal region, horizontal with V6 placement

Refer to next page.

* For evaluation of right ventricular involvement with inferior STEMI. Consider acquiring a 12-Lead ECG with V4 repositioned to V4R. If V4R is acquired, the 12-Lead ECG must be annotated to indicate that V4 is now representing V4R. Furthermore when V4R is acquired, the defibrillators interpretive statement must not be relied upon.[1]

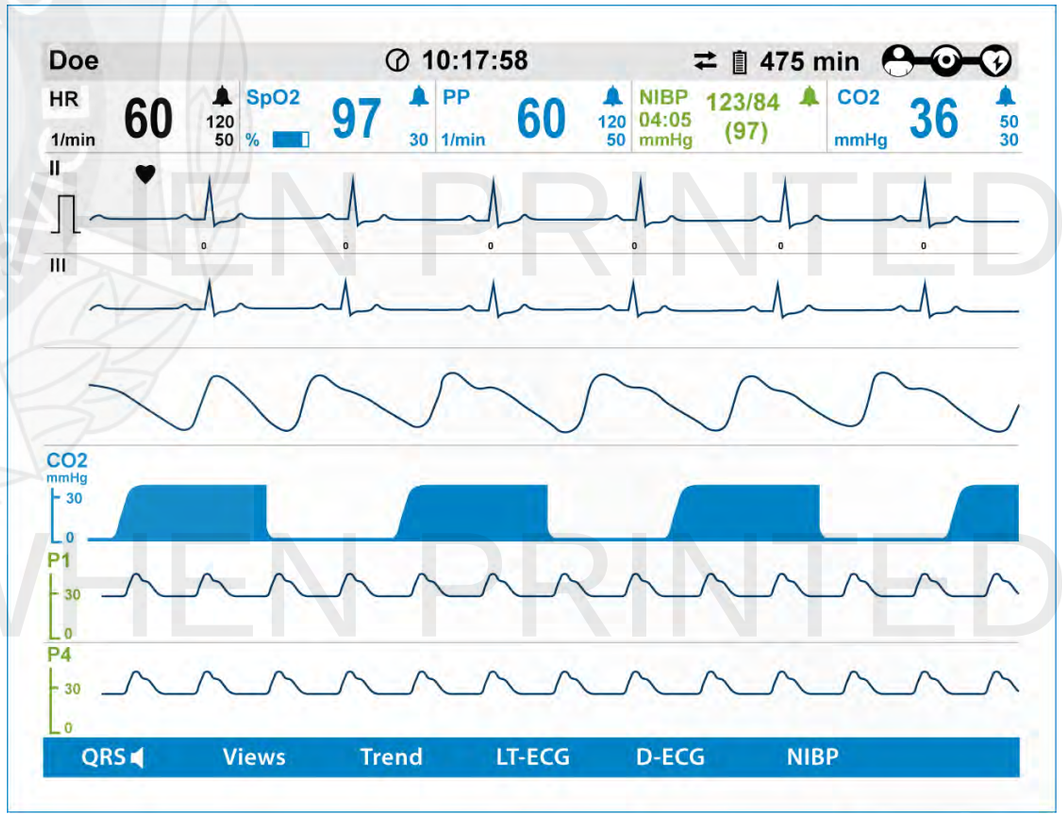


** In instances where posterior myocardial infarction is suspected, ambulance clinicians should consider acquiring a posterior ECG. Reposition leads V4, V5 and V6 to V7, V8 and V9, respectively. All posterior ECGs must be clearly annotated to indicate that it is a posterior ECG. The defibrillator's interpretive statement must not be relied upon in these situations. Ambulance clinicians must transmit the ECG and contact the *QAS Clinical Consultation and Advice Line* for case-specific management when posterior myocardial infarction is suspected.



corpuls3: For comprehensive instructions refer to the corpuls3 operating instructions – acquisition:

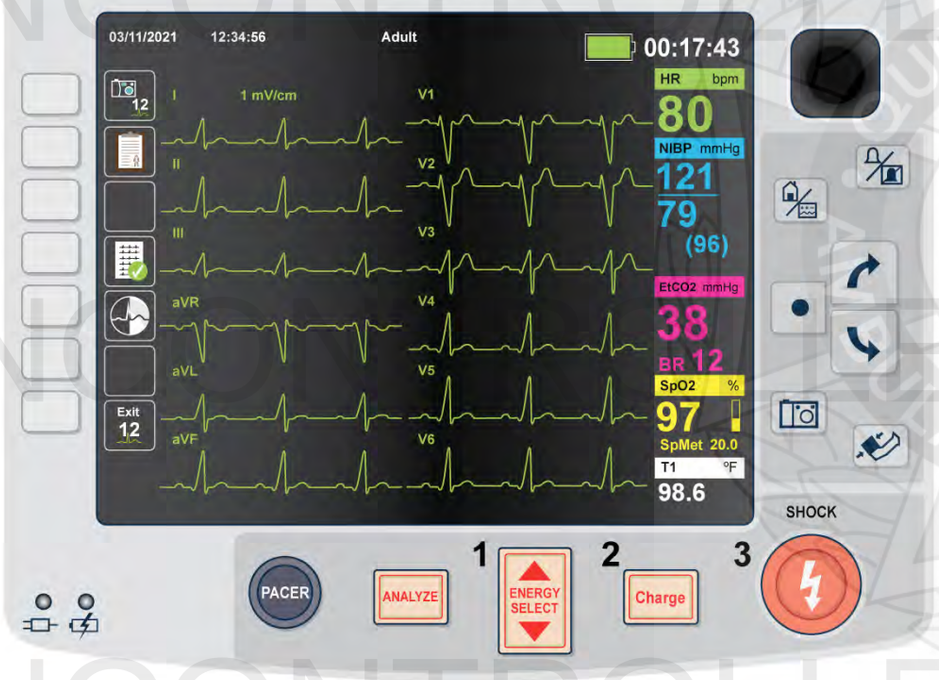
1. Ensure the corpuls3 is on.
2. Press the Monitor Key.
3. Press the D-ECG soft-key.
4. Encourage the patient to remain as still as possible.
5. Ensure that all leads are displayed and that the signal quality is appropriate. If the signal quality is poor, confirm correct electrode positioning and contact.
6. Confirm that the diagnostic frequency of 0.05–150 Hz is displayed (this is the preferred corpuls3 setting).



7. When the message ‘Ready for D-ECG’ is displayed, press the Start soft-key. The 12-lead ECG recorded up to this moment is discontinued and saved.
8. When requested, enter the patient’s gender and age, confirm the details by pressing the OK soft key.
9. Press the Print soft-key.

ZOLL® X Series® and Zoll® X Series Advanced®: For comprehensive instructions refer to the ZOLL®X Series® or Zoll® X Series Advanced® operating instructions.

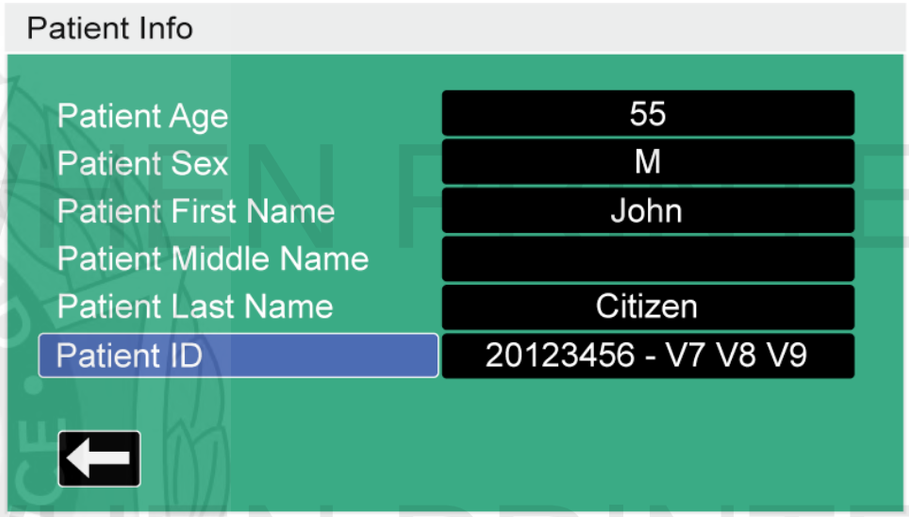
1. Ensure the ZOLL® X Series® or Zoll® X Series Advanced® is on.
2. Encourage the patient to remain as still as possible.
3. Press the 12-Lead key  to enter the 12-lead mode.



4. Ensure that all leads are displayed and that the signal quality is appropriate. If the signal quality is poor, confirm correct electrode positioning and contact.
5. To begin 12-Lead interpretive analysis, press the Acquire key. 

6. Enter the age and sex of the patient. Use the Arrow keys  &  to highlight the  icon and press the **Select** key. The 12-lead will automatically acquire and print.
7. In instances that 12-lead ECG transmission for decision-support thrombolysis or STEMI equivalent is required, repeat steps 1–2 and enter the QAS Case Number into the ‘Patient ID’ field.

   Where a V4R or V7, V8, V9 12-lead ECG has been acquired, ambulance clinicians are required to annotate this information in the ‘Patient ID’ field in addition to the incident number *(see below)*.



8. Press the Transmit key  and select ‘QAS STEMI Group’. To visualise the transmit key, ambulance clinicians must first select a 12-lead ECG. In areas of poor internet connectivity, ambulance clinicians may be required to email the 12-lead to QAS.STEMIgroup@ambulance.qld.gov.au

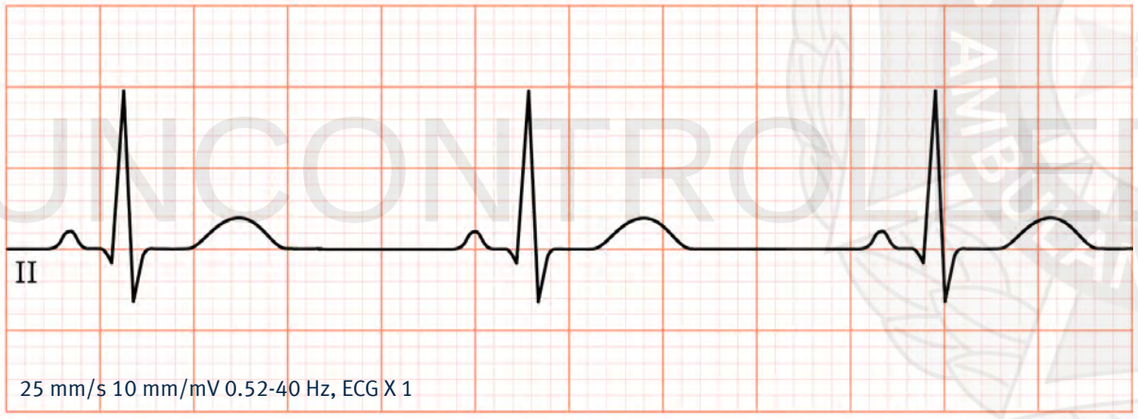
PROCEDURE – Interpretation:

1. Confirm the ECG is of diagnostic quality:

- ECG waveform = 10 mm/1 millivolt
- Frequency range = 0.52 – 40 Hz
- Paper speed = 25 mm/sec
- All 12-lead ECG tracings are present, legible and aVR indicates correct limb lead orientation.

2. Determine 12-lead ECG rhythm and rate:

- What is the heart rate? Is it within normal limits?
- Is the rhythm regular?
- Is the P wave upright and rounded?
- Is the PR interval normal (0.12–0.20 seconds)
- What is the width of the QRS complex? Is it within normal limits? (<0.12)



Lead II – Normal sinus rhythm

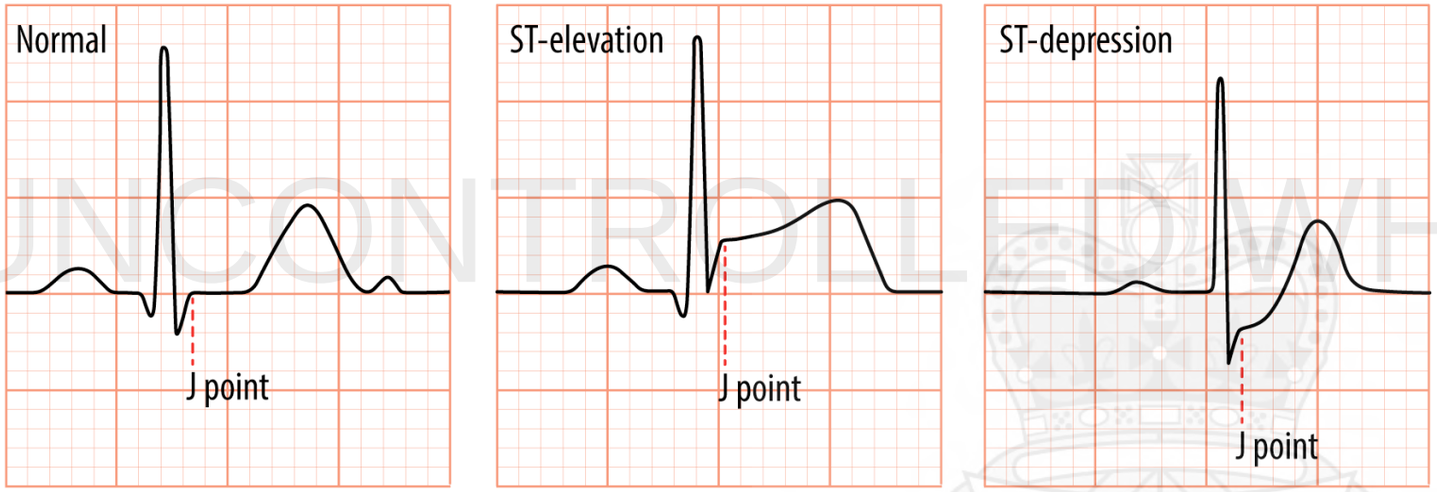
3. Systematically scan each lead grouping for ST-elevation:

The QAS defines ST-elevation as equal to or greater than 1 mm of elevation in at least 2 contiguous limb leads and/or 2 mm in at least 2 contiguous chest leads (V1-V6). This is measured at the 'J point' which is the demarcation between the QRS complex and the ST-segment.[2,3] Contiguous refers to two or more leads that look at the same anatomical region of the heart or adjacent myocardial surfaces. The table below the page identifies contiguous lead groupings.

	Contiguous lead groupings	
Region	**Facing (ST-elevation)**	**Reciprocal (ST-depression)**
Septal	V1, V2	Nil
Anterior	V3, V4	Nil
Anteroseptal	V1, V2,V3, V4	Nil
Lateral	I, aVL, V5, V6	II, III, aVF
Anterolateral	I, aVL, V3, V4, V5, V6	II, III, aVF
Inferior	II, III, aVF	I, aVL
Posterior	V7, V8, V9	V1, V2, V3

4. Systematically scan lead groupings for ST-depression, T wave inversion or peaked T waves:

ST-segment depression may be indicative of acute myocardial injury.



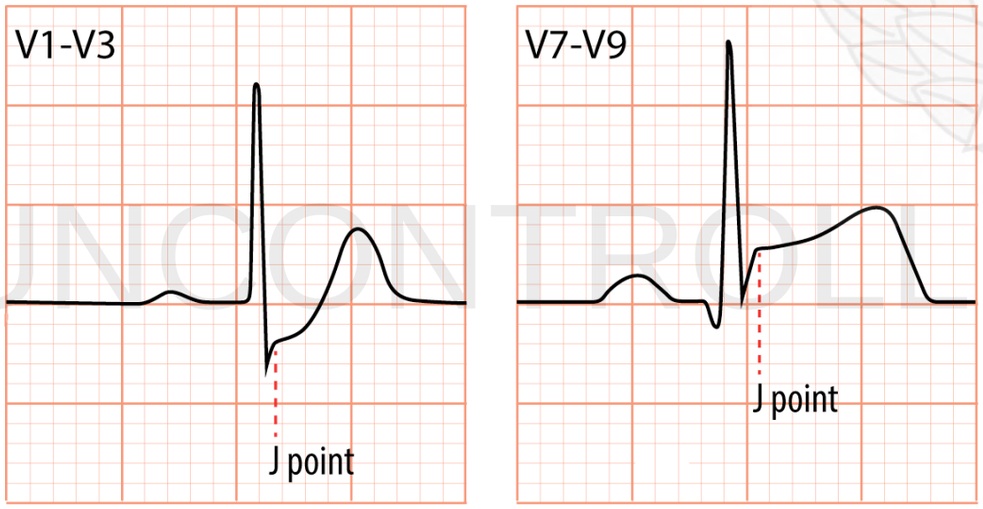
Examples of J point location, ST-elevation and ST-depression

5. Consider STEMI equivalents

STEMI equivalents are ECG patterns that do not meet the classic criteria for STEMI but still indicate a coronary occlusion requiring urgent intervention. Examples include left bundle branch block (LBBB) with modified Sgarbossa criteria, posterior myocardial infarction and De Winter's T wave pattern.

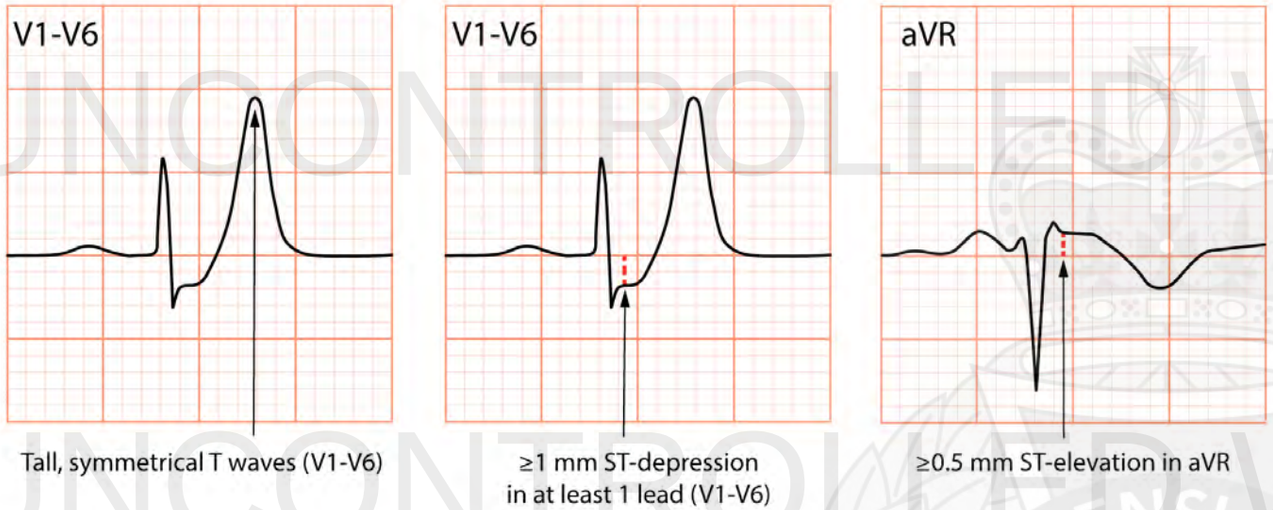
I. Posterior myocardial infarction

- ST-depression equal to or greater than 0.5 mm in all leads (V1–V3) **AND**
- ST-elevation equal to or greater than 0.5 mm in at least 1 lead (V7–V9)



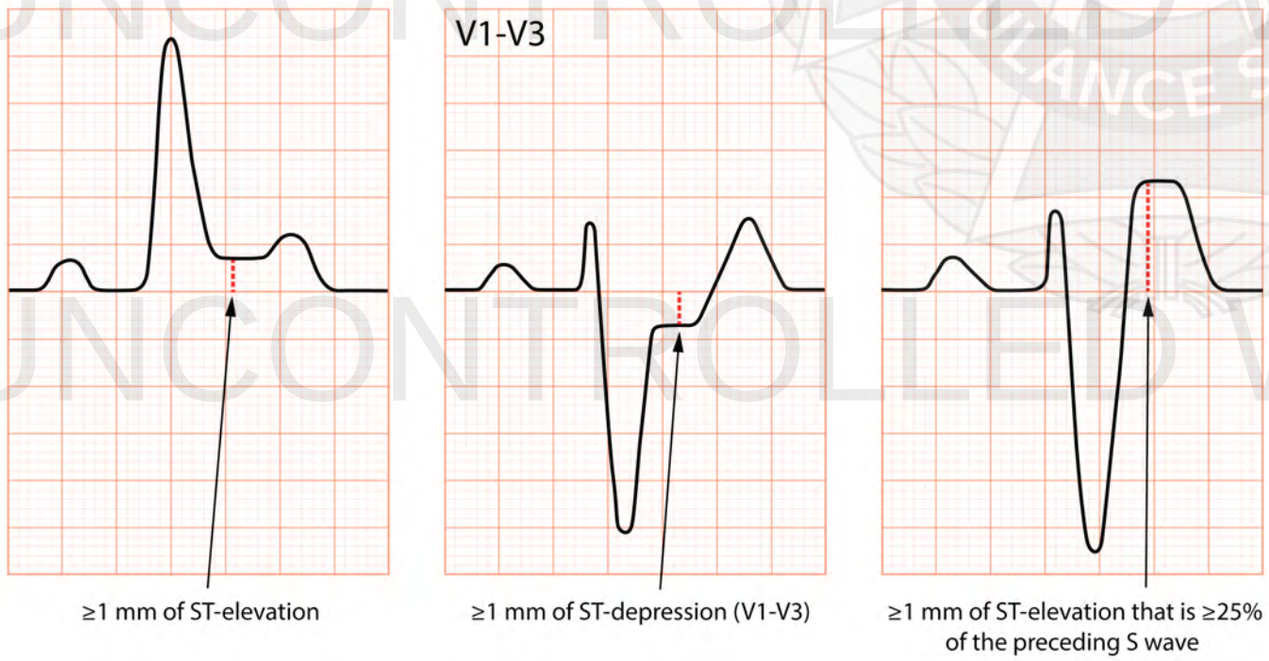
II. De Winter's T wave pattern

- Tall, symmetrical T waves in V1–V6 **AND**
- Upsloping ST-depression equal to or greater than 1 mm in at least 1 lead (V1–V6) **AND**
- ST-elevation equal to or greater than 0.5 mm in aVR



III. LBBB with modified Sgarbossa criteria

- Concordant ST-elevation equal to or greater than 1 mm in at least 1 lead with a positive QRS complex **OR**
- Concordant ST-depression equal to or greater than 1 mm in at least 1 lead (V1–V3) **OR**
- Discordant ST-elevation equal to or greater than 1 mm in at least 1 lead that is greater than or equal to 25% of the preceding S wave.



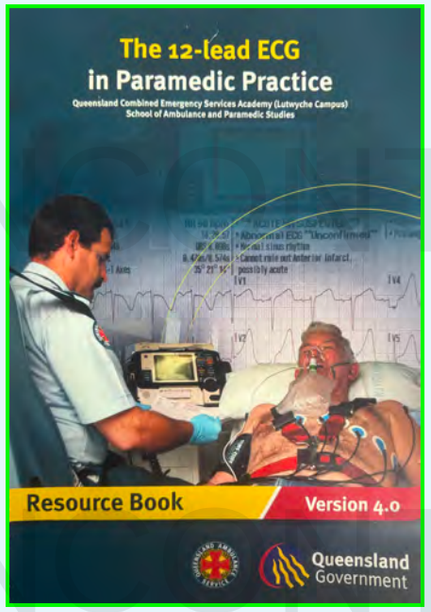
6. **Consider STEMI mimics**

STEMI mimics refer to conditions that produce ST-elevation on an ECG but are not caused by an acute coronary artery occlusion, such as pericarditis, benign early repolarization, left ventricular hypertrophy, or Brugada syndrome.

In rare instances, ST-elevation may be secondary to non-infarction elevation which include but are not limited to coronary artery spasm, sudden coronary artery dissection and takotsubo cardiomyopathy.

Additional information

- 12-lead ECG electrodes should remain in position to facilitate serial 12-lead ECGs.
- Electrodes must be placed in their anatomically designated positions in order for an ECG to be of diagnostic quality.
- Clinicians should ensure the 12-lead ECG is of diagnostic quality (size, frequency and paper speed) before analysing and interpreting.
- Copies of the patient's 12-lead ECG(s) (annotated with the patient's name, date of birth and brief description of symptoms if appropriate) MUST be provided with the eARF to the receiving health care facility. A photo or image must also be captured and stored as a clinical image in DARF.



The QAS would like to acknowledge the following individuals who were instrumental in championing ECG interpretation into paramedic practice:

- *Brett Rogers ASM*
- *John Murray ASM*
- *Dennis Jess ASM*