Clinical Significance

Prompt identification of ST-elevation myocardial infarction (STEMI) is critical to guide reperfusion therapies that are time-sensitive. Right-Sided and posterior ECGs may be useful in identifying STEMI of the right ventricle and/or posterior wall.

Populations

Applies to the adult and geriatric population. There is insufficient evidence to recommend this in the pediatric population.

Translation Into Practice: TIPs for Right-Sided ECGs

**Recommended Clinical Practice**

To detect right ventricular STEMI associated with occlusion of the right coronary artery, obtain a right-sided ECG.  

[Level A Recommendation]

When a 15-lead &/or 18-lead ECG machine is not available, manipulation of the leads from a standard 12-lead ECG machine allow additional areas of the heart to be imaged.  

- Indications of a RV wall infarction may include:
  - ST elevation in the inferior leads, II, III, and aVF
  - ST elevation that is greatest in lead III is especially significant
  - ST elevation in V1 (considered to be the only precordial lead that faces the RV on the standard 12-lead ECG)
  - Other findings may include: right bundle branch block, second- and third-degree atrioventricular blocks, ST segment elevation in lead V2 50% greater than the magnitude of ST segment depression in lead aVF
  - Hypotension and clear lung fields

- Place ECG electrodes (stickers) as follows (Figure 1):

  **Right-sided ECG Electrode Placement**

  - V1R: 4th intercostal space, left sternal border
  - V2R: 4th intercostal space, right sternal border
  - V2R: halfway between V2R and V4R, on a diagonal line
  - V3R: 5th intercostal space, right midclavicular line
  - V4R: right anterior axillary line, same horizontal line as V4R and V6R
  - V5R: right mid-axillary line, same horizontal line as V5R and V6R

  *Arm and leg electrodes remain unchanged from standard 12-lead ECG*

- Place ECG lead cables as follows (using a 12-lead machine):
  - A right-sided ECG is a “mirror reflection” of the standard left sided 12-lead ECG. Begin with lead cable V1 and attach it to electrode V1R, continue connecting lead cables to electrodes in sequence until lead cable V6 is connected to electrode V6R.
  - Arm and leg electrodes and lead cables remain unchanged from the standard 12-lead ECG placement.

*Figure 1 used with permission from Barbara J. Drew, RN, PhD, FAAN, FAHA [Drew, B. J., & Ide, B. (1995). Right ventricular infarction. Progress in Cardiovascular Nursing, 10, 46.]
TIP: Right-Sided ECGs – continued

- Label the Right-sided ECG\(^4\) (Figure 2):
  - Note “Right-sided ECG” in the machine, if able
  - Handwrite “Right-sided ECG” on the 12-lead ECG printout if not already part of the electronic printout
  - Re-label V\(_1\) – V\(_6\) on the printout to V\(_1\)R – V\(_6\)R

- Presence of a right ventricular wall infarction is seen when there is ST elevation greater than 1 mm in V\(_4\)R\(^5,11\)

Supporting Rationale: Right-Sided ECGs

- Up to 50% of patients with an inferior wall MI may have RV infarction or ischemia\(^6,16\)
  - Occlusion of the right coronary artery proximal to the right ventricular branch is associated with inferior wall MI involving the RV\(^1,3,5,8,9,11,16\)
  - In approximately 10% of the population, the left circumflex artery supplies the right ventricle and may therefore cause an associated lateral wall MI in conjunction with the RV infarction\(^5,8\)
  - Patients with coexisting RV infarct have more myocardium involved, increasing their risk of complications up to and including death\(^8,17\)
  - Isolated RV infarct is rare; reported to be <3%\(^11\)

- Hypotension results from the RV dysfunction – patients are preload dependent / they rely on RV filling pressure to maintain cardiac output – use of vasodilators should be avoided\(^6,8,10,16-17\)

- ST elevation > 1mm in lead V\(_4\)R is sensitive for RV infarction (88-100% sensitivity, 78-82% specificity, 83-92% diagnostic accuracy)\(^6,8\)

Translation Into Practice: TIPs for Posterior ECGs

**Recommended Clinical Practice**

To detect posterior STEMI associated with occlusion of the circumflex artery or dominant right coronary artery, obtain a posterior ECG.\(^2,3\) [Level A Recommendation]

When a 15-lead &/or 18-lead ECG machine is not available, manipulation of the leads from a standard 12-lead ECG machine allow additional areas of the heart to be imaged.\(^4,5\)

- Indications of a posterior wall infarction may include:\(^4,5,13\)
  - Changes in V\(_1\) – V\(_3\) on the standard 12-lead ECG predominantly, which include:
    - Horizontal ST depression
    - A tall, wide R wave
    - A tall, upright T wave
    - R/S wave ratio greater than 1
  - Inferior or lateral wall MI (especially if accompanied by ST depression or prominent R waves in leads V\(_1\)-V\(_3\))\(^2,3,5\)
TIPS: Posterior ECGs – continued

- Place three additional ECG electrodes (stickers) as follows (Figure 3) – TIP: start at V₉ (the last electrode) and work forward⁴,¹⁴
  - V₉ – left spinal border, same horizontal line as V₄₆
  - V₈ – midscapular line, same horizontal line as V₇ and V₉
  - V₇ – posterior axillary line, same horizontal line as V₄₆
- Place ECG lead cables as follows (using a standard 12-lead machine):
  - Locate lead cables V₁-V₆. Connect lead cables to electrodes as follows (Figure 3):
    - Lead cable V₆ connects to electrode V₉
    - Lead cable V₅ connects to electrode V₈
    - Lead cable V₄ connects to electrode V₇
    - Lead cables V₁-V₃ are connected the same way as when obtaining a standard 12-lead ECG:
      - Lead cable V₁ connects to electrode V₁
      - Lead cable V₂ connects to electrode V₂
      - Lead cable V₃ connects to electrode V₃
  - Arm and leg electrodes and lead cables remain unchanged from the standard 12-lead ECG placement
- Label the Posterior ECG⁴:
  - Note “Posterior ECG” in the machine, if able
  - Handwrite “Posterior ECG” on the 12-lead ECG printout if not already part of the electronic printout
  - Re-label V₄–V₆ on the printout to V₇–V₉ (Figure 4)

- Presence of a posterior wall MI is seen when there is ST elevation greater than 0.5 mm⁷,⁹,¹¹-¹²,¹⁵ to 1 mm in V₈-V₉²,³,⁵

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**Posterior ECG Electrode Placement**

- V₆₆: left paraspinal line at the same level as V₄₆
- V₆₄: halfway between V₇ and V₉ / midscapular line
- V₇₆: posterior axillary line at the same level as V₄₆
- V₄₆-V₉₆ remain unchanged from standard 12-lead ECG

**Labeling the Posterior ECG**

Figure 3 is used with permission from Barbara J. Drew, RN, PhD, FAAN, FAHA [Drew, B. J., & Ide, B. (1995). Right ventricular infarction. Progress In Cardiovascular Nursing, 10, 46.]

Figure 4: Labeling the Posterior ECG
Supporting Rationale: Posterior ECGs

- Approximately 15-20% of all myocardial infarctions involve the posterior wall of the left ventricle and when found in conjunction with an inferior or lateral wall MI, it significantly increases mortality.\(^{8,11}\) Up to 11% of all MIs are thought to be isolated posterior wall MIs.\(^ {8,12}\)
  - In the majority of patients, the posterior wall is supplied by the left circumflex artery (and less frequently a dominant right coronary artery with prominent posterior-lateral or posterior descending branches) which means that inferior or lateral MIs frequently occur in conjunction with the posterior wall MI.\(^ {5}\)
- ST elevation > 0.5mm in leads V\(_7\)-V\(_9\) is sensitive for posterior wall infarction (as high as 90%, with predictive accuracy up to 93.8%\(^ {2,3,5,8}\)).
- Due to the distance of the heart (which is more anterior in the chest), voltage recorded in the posterior leads is often less.\(^ {8,11,15,18}\)

References


Key for Level of Evidence Recommendation

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (High)</td>
<td>Based on consistent and good quality of evidence; has relevance and applicability to emergency nursing practice.</td>
<td>Based on current evidence.</td>
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<tr>
<td>B (Moderate)</td>
<td>There are some minor inconsistencies in quality evidence; has relevance and applicability to emergency nursing practice.</td>
<td>Insufficient evidence upon which to make a recommendation.</td>
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<tr>
<td>C (Weak)</td>
<td>There is limited or low-quality patient-oriented evidence; has relevance and applicability to emergency nursing practice.</td>
<td>Insufficient evidence upon which to make a recommendation.</td>
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ENA’s Translation Into Practice

Right-Sided and Posterior Electrocardiograms (ECGs)

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