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.  \(^1\)\(^-\)\(^3\)  

[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 RV wall infarction may include: \(^4\)\(^-\)\(^7\)
  - ST elevation in the inferior leads, II, III, and aVF \(^4\)\(^-\)\(^6\)
    - ST elevation that is greatest in lead III is especially significant \(^5\)\(^-\)\(^8\)\(^-\)\(^9\)
  - ST elevation in V1 (considered to be the only precordial lead that faces the RV on the standard 12-lead ECG) \(^4\)\(^-\)\(^6\), \(^8\)
  - 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 \(^5\)\(^-\)\(^8\)
  - Hypotension and clear lung fields \(^6\)\(^-\)\(^10\)

- Place ECG electrodes (stickers) as follows \(^4\) (Figure 1):

#### Right-sided ECG Electrode Placement

\[
\begin{align*}
V_1R: & \quad 4^{th} \text{ intercostal space, left sternal border} \\
V_2R: & \quad 4^{th} \text{ intercostal space, right sternal border} \\
V_3R: & \quad \text{halfway between } V2R \text{ and } V4R, \text{ on a diagonal line} \\
V_4R: & \quad 5^{th} \text{ intercostal space, right midclavicular line} \\
V_5R: & \quad \text{right anterior axillary line, same horizontal line as } V4R \text{ and } V6R \\
V_6R: & \quad \text{right mid-axillary line, same horizontal line as } V5R \text{ and } V6R
\end{align*}
\]

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

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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.)

- 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
TIP: Right-Sided ECGs – continued

- Label the Right-sided ECG (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 V₁ – V₆ on the printout to V₁R – V₆R

- Presence of a right ventricular wall infarction is seen when there is ST elevation greater than 1 mm in V₄R.

Supporting Rationale: Right-Sided ECGs

- Up to 50% of patients with an inferior wall MI may have RV infarction or ischemia.
  - Occlusion of the right coronary artery proximal to the right ventricular branch is associated with inferior wall MI involving the RV.
  - 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.
  - Patients with coexisting RV infarct have more myocardium involved, increasing their risk of complications up to and including death.
  - Isolated RV infarct is rare; reported to be <3%.

- 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.

- ST elevation > 1mm in lead V₄R is sensitive for RV infarction (88-100% sensitivity, 78-82% specificity, 83-92% diagnostic accuracy).

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. [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 posterior wall infarction may include:
  - Changes in V₁ – V₃ 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 V₁-V₃).
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 V₄₋₆
  - V₈ – midscapular line, same horizontal line as V₇ and V₉
  - V₇ – posterior axillary line, same horizontal line as V₄₋₆
- Place ECG lead cables as follows (using a standard 12-lead machine):
  - Locate lead cables V₁₋₆. 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 V₁₋₃ 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 ECG:
  - 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 V₈₋₉²⁻³,⁵
Right-Sided and Posterior Electrocardiograms (ECGs)

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.\(^1,8,12\) 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.\(^1\)
- ST elevation > 0.5mm in leads V\(_5\)-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>
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<tr>
<th>Level</th>
<th>Recommendation</th>
<th>Based on evidence strength and quality: has relevance and applicability to emergency nursing practice.</th>
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<td>Based on consistent and good quality of evidence: has relevance and applicability to emergency nursing practice.</td>
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<tr>
<td>Level B (Moderate)</td>
<td>Based on some or limited evidence: has limited or no evidence: has relevance and applicability to emergency nursing practice.</td>
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<tr>
<td>Level C (Weak)</td>
<td>Based on some or limited evidence: has limited or no evidence: has relevance and applicability to emergency nursing practice.</td>
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Authors

**2012 ENA Board of Directors Liaison:**
Kathleen Carlson, MSN, RN, CEN, FAEN

**ENA Staff Liaisons:**
Kathy Szumanski, MSN, RN, NE-BC
Jessica Gacki-Smith, MPH

Special thanks to Barbara J. Drew, RN, PhD, FAAN, FAHA, for reviewing and providing feedback regarding this document.

Emergency Nurses Association • 915 Lee Street • Des Plaines, IL 60016-6569 • 847-460-4000 December 2012; Revised September 16, 2013