

Right-Sided and Posterior Electrocardiograms (ECGs)

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.

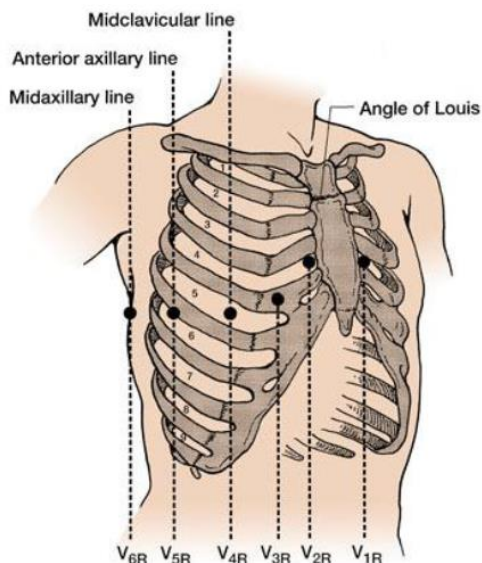
Translation Into Practice: TIPS for Right-Sided ECGs

Recommended Clinical Practice

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

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

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

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

Right-Sided and Posterior Electrocardiograms (ECGs)

TIP: Right-Sided ECGs – continued

Right-Sided ECG

- Label the Right-sided ECG⁴ (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^{5,11}

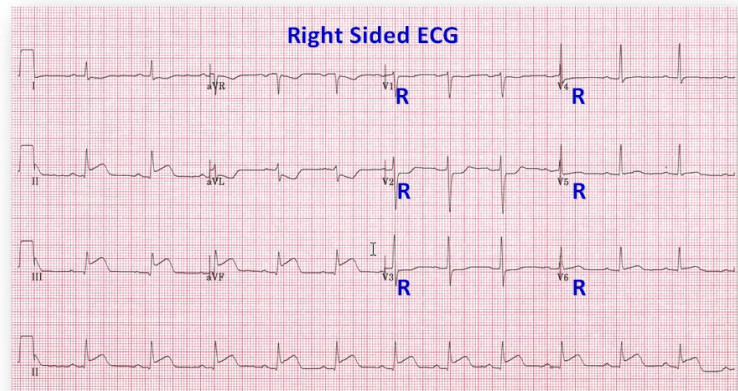


Figure 2: Labeling the Right-Sided ECG

Supporting Rationale: Right-Sided ECGs

Right-Sided ECG

- 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 V₄R is sensitive for RV infarction (88-100% sensitivity, 78-82% specificity, 83-92% diagnostic accuracy)^{6,8}

Translation Into Practice: TIPS for Posterior ECGs

Posterior ECG

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]**

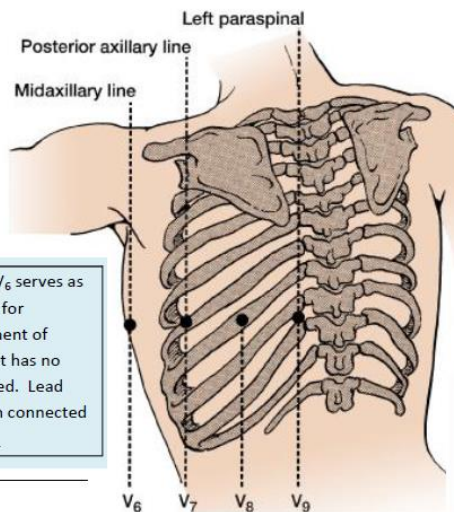
When a 15-lead &/or 18-lead ECG machine is not available, manipulation of the leads from a standard 12-lead ECG machine allow additional areas of the heart to be imaged.⁴⁻⁵

- Indications of a posterior wall infarction may include:^{4-5,13}
 - Changes in V₁ – V₃ on the standard 12-lead ECG predominantly, which include:
 - Horizontal ST depression
 - A tall, upright T wave
 - A tall, wide R 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)^{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 forward:*^{4,14}
 - V₉ – left paraspinal 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-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 ECG:⁴
 - 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)

Posterior ECG



Note: Electrode V₆ serves as a reference point for horizontal placement of electrodes V₇₋₉ but has no lead cable attached. Lead cables V₁₋₃ remain connected to electrodes V₁₋₃.

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.]

Posterior ECG Electrode Placement

- V₉: left paraspinal line at the same level as V₄₋₆
- V₈: halfway between V₇ and V₉ / mid scapular line
- V₇: posterior axillary line at the same level as V₄₋₆
- V₁-V₃: remain unchanged from standard 12-lead ECG

Labeling the Posterior ECG

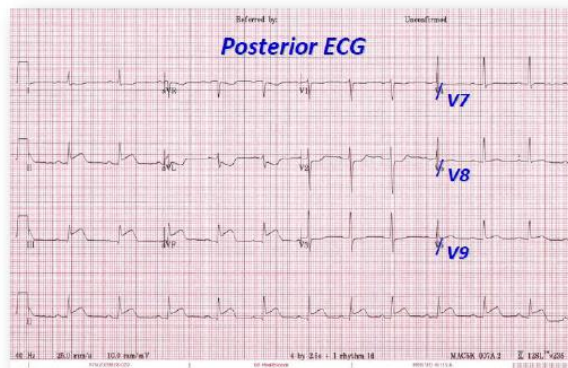


Figure 4: Labeling the Posterior ECG

- Presence of a posterior wall MI is seen when there is ST elevation greater than 0.5 mm^{7,9,11-12,15} to 1 mm in V₈-V₉^{2-3,5}

Right-Sided and Posterior Electrocardiograms (ECGs)

Supporting Rationale: Posterior ECGs

- Posterior ECG**
- 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.^{5,8,12} 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 MI⁵
 - ST elevation > 0.5mm in leads V_{8,9} 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}

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Key for Level of Evidence Recommendation

A	Level A (High) Recommendation:	Based on consistent and good quality of evidence; has relevance and applicability to emergency nursing practice.	NR	Not Recommended:	Based upon current evidence.
B	Level B (Moderate) Recommendation:	There are some minor inconsistencies in quality evidence; has relevance and applicability to emergency nursing practice.	I/E:	Insufficient evidence upon which to make a recommendation.	
C	Level C (Weak) Recommendation:	There is limited or low-quality patient-oriented evidence; has relevance and applicability to emergency nursing practice.	N/E:	No evidence upon which to make a recommendation.	

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