

## Clinical overview

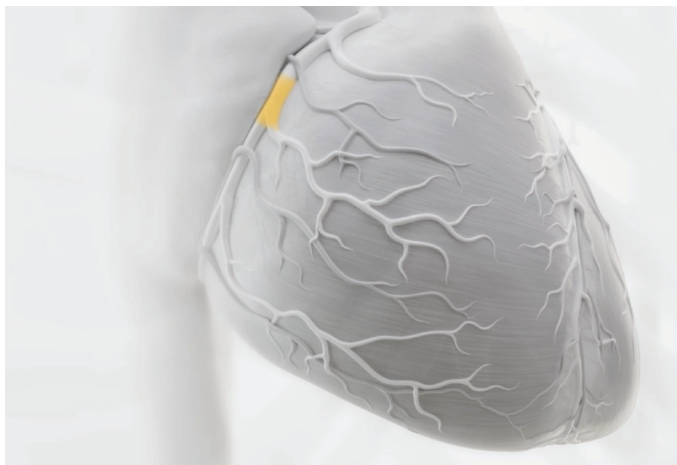
# Integrated 15-lead ECG

Right-sided and posterior leads with the LIFEPAK® 35 monitor/defibrillator

### Current challenges

12-lead ECGs are the standard practice test used to screen patients for cardiac pathologies. Four myocardial walls can be viewed directly: The anterior, inferior, septal and lateral walls. The right ventricular and posterior walls cannot be directly viewed. Approximately 10% of acute myocardial infarctions (MI) that present are isolated to the posterior wall.<sup>1</sup> While up to 50% of acute inferior wall myocardial infarctions involve a significant portion of the right ventricle, such involvement can have substantial implications for patient outcomes.<sup>2</sup> With

standard 12-lead placement, clinicians rely on other ECG observations that can be challenging to identify. The LIFEPAK 35 provides an additional lead set, allowing for the placement of three extra leads in various locations to provide a direct view of the right and posterior walls. The LIFEPAK 35 also enables clinicians to label additional lead locations prior to acquisition, making them identifiable later when either transmitted to an electronic patient care record, LIFENET Care, CODE STAT or when printed for patient transfer of care.



### Right-sided myocardial infarctions

Due to its anatomical location, the standard 12-lead ECG does not directly visualize the right ventricle. An occlusion of the right coronary artery (or in some cases a dominant right circumflex artery) may result in decreased right ventricular systolic function, ultimately leading to reduced left ventricular preload and decreased cardiac output.<sup>3</sup> This presents challenges in patients with inferior wall MI, when right ventricular involvement places them at increased risk of shock, arrhythmias and death.<sup>4</sup> Some research suggests that some pharmacological interventions, such as administration of beta-blockers and nitroglycerin, should be avoided.<sup>3</sup>

The American Heart Association (AHA) recommendation for using right-sided leads to detect right ventricular involvement is simplified by the LIFEPAK 35, which offers an additional lead set and on-screen options labeling.<sup>5</sup>

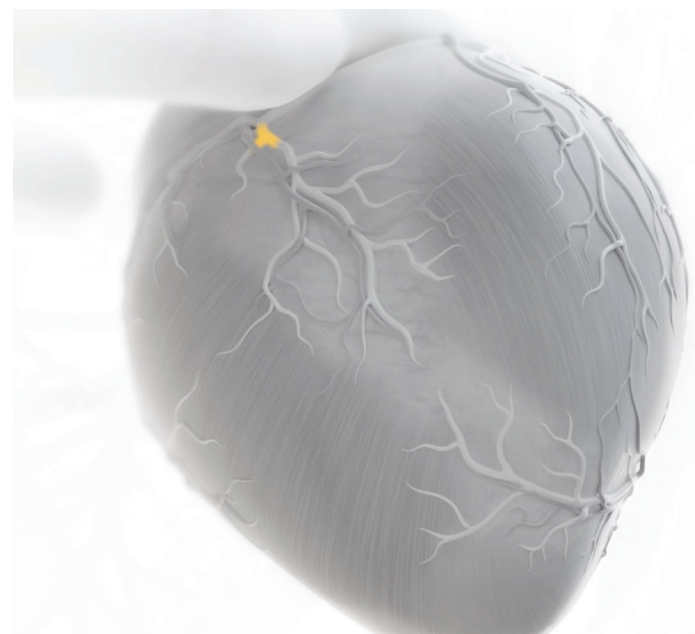
### Posterior wall myocardial infarctions

The standard 12-lead ECG also does not directly visualize the posterior wall. Identifying reciprocal ST-segment depression in the anterior leads can be overlooked.<sup>6</sup> Signs of a posterior wall infarction are subtle, which can make it challenging to distinguish them from other conditions without additional information from other leads.<sup>7</sup>

According to the 4th Universal Definition of Myocardial Infarction, ECG evidence of myocardial ischemia of the left circumflex artery is commonly overlooked. Evidence of such ischemia can best be identified using posterior ECG leads.<sup>6</sup>

The lack of early detection and delays in care for these cases could lead to worse clinical outcomes, including higher mortality rates, a greater risk of complications and delays in receiving definitive treatment.<sup>8</sup>

The AHA also recommends using posterior leads to detect isolated left ventricular involvement. The LIFEPAK 35 simplifies this process with an additional lead set and on-screen options available for labeling.<sup>5</sup>



## Using additional leads for 15-lead

The additional three leads that can be used with the LIFEPAK 35 enable the provider to view the right and posterior walls directly. Using a 15-lead ECG may increase sensitivity for detecting a right-sided MI or a posterior wall MI compared to a traditional 12-lead.<sup>7</sup>

These three additional leads can be used in various configurations. All three can be placed for right-sided views or posterior views. Taking it a step further, these leads can be applied simultaneously to both right-sided and posterior locations, potentially driving a change in practice when screening patients for cardiac emergencies.

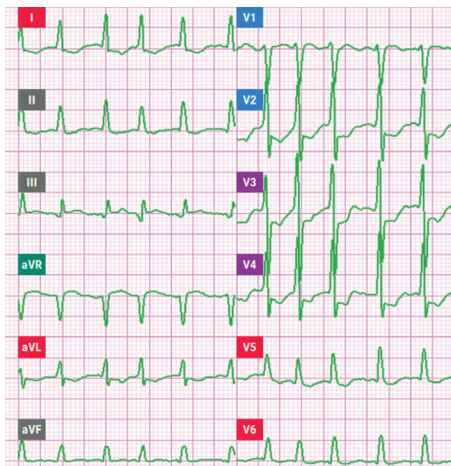


## Confirm STEMI

Posterior leads for isolated posterior MI or posterior wall involvement

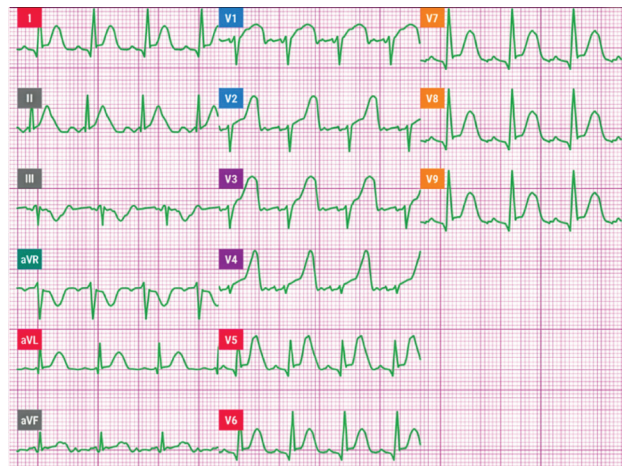
### Scenario 1

A 70-year-old woman presents to the emergency room, referred from urgent care, with substernal chest pain and nausea. She states that she began feeling this way during her afternoon exercise. A 12-lead ECG obtained by EMS and urgent care (Figure 1) shows atrial fibrillation with ST-segment depression in leads V2-V4 greater than 2 mm. The patient was brought to the local hospital since her ECG did not meet local STEMI criteria. This patient is part of the 15-20% of patients who present with an isolated posterior wall myocardial infarction (MI).<sup>1</sup> As a result of these circumstances, cath lab activation was delayed, and additional transport to a PCI center will be needed.



### Scenario 2

Consider the same patient with the same presentation. This time, EMS is equipped with a LIFEPAK 35 and has the capability of obtaining a 15-lead. After noting the ST-segment depressions from the ECG acquired by the urgent care team, the crew decided to use the additional lead set and place three posterior leads on the patient: V7, V8 and V9. (Figure 2) With the additional leads, they observe ST-segment elevation in leads V7-9. They confirm that this is likely an isolated posterior wall MI. This leads to appropriate Cath-lab activation and direct transport to definitive care.



Isolated posterior wall myocardial infarction (MI) can be more challenging to diagnose. However, early identification is critical, as with any STEMI. The LIFEPAK 35 monitor/defibrillator addresses this clinical challenge by offering integrated 15-lead ECG capability, allowing clinicians to quickly acquire additional posterior leads (V7, V8, V9) without the need to relocate existing leads.

By directly viewing the posterior wall of the heart, the 15-lead ECG may enhance the clinician's ability to identify a posterior wall MI. It may assist in the provider's triage decisions, guide reperfusion strategies and enhance patient care.

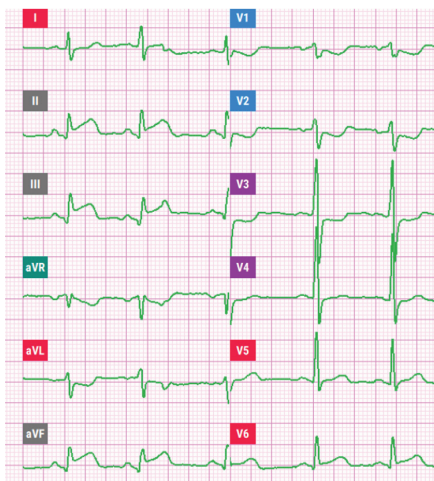


## Direct treatment

### Right-sided leads for right ventricular involvement

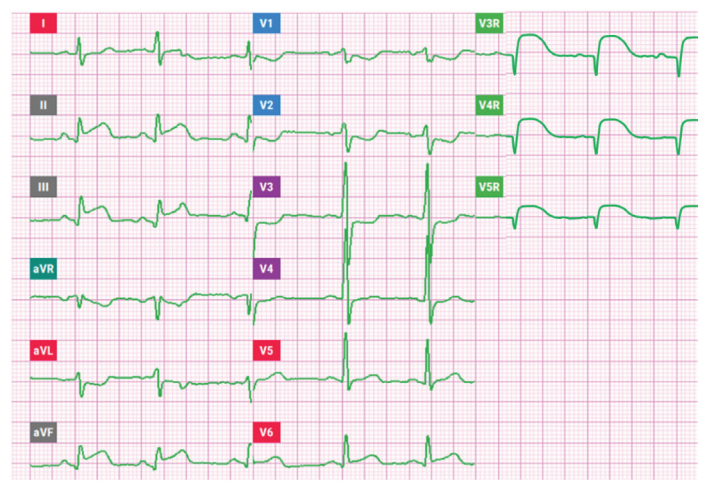
#### Scenario 1

A 62-year-old man presents to the ER triage with crushing chest pain and dizziness. The patient has a history of coronary artery disease and had a stent placed in his RCA last year. He has a blood pressure of 110/58 mmHg, SpO<sub>2</sub> of 88%, and a heart rate of 115 bpm. The initial 12-lead shows ST elevation in leads II, III and aVF greater than 2 mm. (Figure 3) There are Q waves in lead III, and the underlying rhythm is a Type II second-degree AV block. He has already taken aspirin and has been placed on oxygen. How should the care team approach this patient's initial treatment? Can his pain be treated? Is it safe to administer nitroglycerin? Does he need a fluid bolus? Each of these interventions may benefit or harm the patient. Without additional information, it may be difficult to make an informed decision.



#### Scenario 2

Now, the same patient presents to the ER, but a LIFEPAK 35 is available at triage. Given the patient's history, the staff decides to use the additional lead set with the LIFEPAK 35 to acquire a 15-lead ECG that includes three right-sided leads. (Figure 4) The staff can obtain the ECG and determine that this patient is experiencing an inferior wall MI with potential right ventricular wall involvement. This finding may inform decision-making regarding specific treatment options. No extra time was dedicated to securing a second ECG, and communication with other hospital teams is clear with appropriately labeled right-sided leads on the 15-lead ECG.

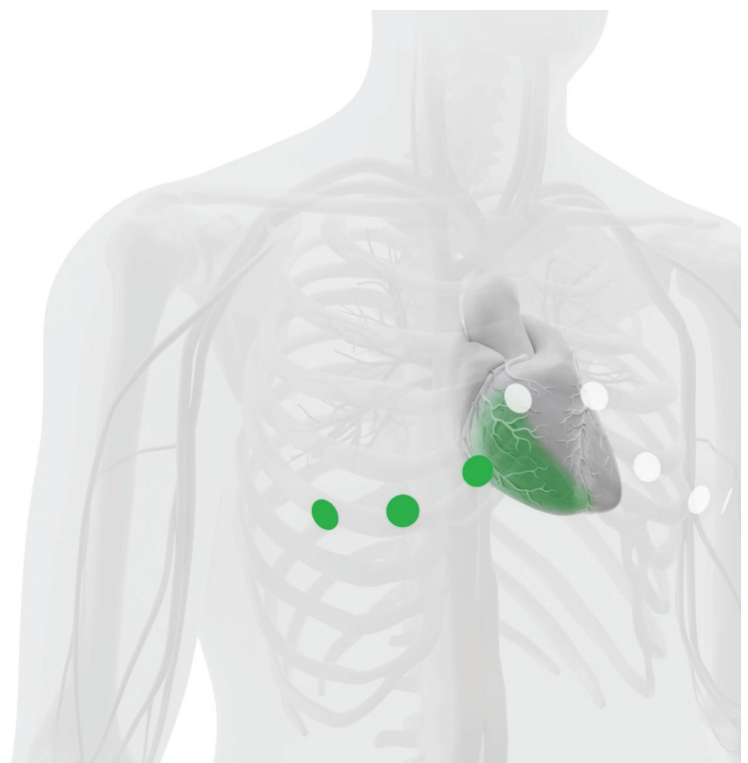


The American College of Cardiology recommends using right-sided leads when right-sided ischemia is suspected because "a normal ECG may be associated with left circumflex or right coronary artery occlusions."<sup>9</sup> A single right-sided chest lead (V4R) offers one view of the right ventricle, whereas a complete right-sided ECG with leads V3R-V5R may provide the clinician with more detailed information. Early capture of right precordial leads in patients with inferior and suspected right ventricular involvement should be performed, given the supporting criteria currently available for diagnosing right ventricular involvement.<sup>6</sup>

#### Conclusion

15-lead capability was integrated into the LIFEPAK 35 with the aim to reduce the time needed to manually relocate existing chest electrodes when evaluating additional areas of potential myocardial ischemia. This integration enables the viewing of all 15-leads on screen and in printouts with proper labeling, potentially enhancing documentation and awareness of lead location across care teams

This next step in the evolution of cardiac assessment for monitor defibrillators revolutionizes initial cardiac screening and enhances confidence in treatment directions and STEMI identification.<sup>7</sup>



#### References:

1. Oraii S, Maleki M, Tavakolian AA, Eftekharzadeh M, Kamangar F, Mirhaji P. Prevalence and outcome of ST-segment elevations in posterior electrocardiographic leads during acute myocardial infarction. *J Electrocardiol.* 1999;32(3):275-278. 2. O'Connor R, Brady W, Brooks S, et al. Part 10: Acute Coronary Syndromes: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation.* 2010;122[suppl 3]:S787-S817. 3. Goldstein, J. A., Lerakis, S. & Moreno, P. R. Right Ventricular Myocardial Infarction—A Tale of Two Ventricles *JACC Focus Seminar* 1/5. *J. Am. Coll. Cardiol.* 83, 1779–1798 (2024). 4. Mehta, S. R. et al. Impact of right ventricular involvement on mortality and morbidity in patients with inferior myocardial infarction. Drs. Mehta and Eikelboom were recipients of Heart and Stroke Foundation of Canada Research Fellowship Awards. Professor Yusuf is the recipient of a Medical Research Council of Canada Senior Scientist Award and holds a Heart and Stroke Foundation of Ontario Research Chair. *J. Am. Coll. Cardiol.* 37, 37–43 (2001). 5. Rao SV, O'Donoghue ML, Ruel M, et al. 2025 ACC/AHA/ACEP/NAEMSP/SCAI guideline for the management of patients with acute coronary syndromes: A report of the American college of cardiology/american heart association joint committee on clinical practice guidelines. *Circulation.* ;0(0). <https://doi.org/10.1161/CIR.0000000000001309>. doi: 10.1161/CIR.0000000000001309. 6. Thygesen K, Alpert J, Jaffe A, et al. ESC/ACC/AHA/WHF Fourth Universal Definition of Myocardial Infarction (2018). *JACC.* 2018;72:2234-2260. 7. Khan, J. N., Chauhan, A., Mozdiak, E., Khan, J. M. & Varma, C. Posterior myocardial infarction: are we failing to diagnose this? *Emerg. Med. J.* 29, 15 (2012). 8. Park, J. et al. Prognostic Implications of Door-to-Balloon Time and Onset-to-Door Time on Mortality in Patients With ST-Segment–Elevation Myocardial Infarction Treated With Primary Percutaneous Coronary Intervention. *J. Am. Hear. Assoc.: Cardiovasc. Cerebrovasc. Dis.* 8, e012188 (2019). 9. Gulati M, Levy P, Mukherjee D, et al. 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *JACC.* 2021 Nov, 78 (22) e187–e285.

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