

# AI-Enabled ECG for Acute Myocardial Infarction Triage: Promise, Limitations, and Next Steps

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## SUMMARY OF KEY RESEARCH FINDINGS

This diagnostic systematic review and meta-analysis assessed AI-enabled ECG (AI-ECG) for detecting acute myocardial infarction (AMI), including ST-segment elevation myocardial infarction and non-ST-segment elevation myocardial infarction (NSTEMI). Ten observational studies including 94,510 participants were analysed. For overall AMI detection, AI-ECG showed a pooled sensitivity of 89.4%, specificity of 96.0%, negative predictive value of 98.7%, positive predictive value of 73.3%, and a summary receiver operating characteristic area under the curve (AUC) of 0.97. Performance was stronger for ST-segment elevation myocardial infarction, with a pooled sensitivity of 94.4%, specificity of 97.5%, and AUC of 0.98, than for NSTEMI, where pooled sensitivity was

65.0%, specificity was 87.5%, and AUC was 0.71. These findings support AI-ECG as a potentially useful adjunctive triage and clinical decision support tool, although predictive values remain prevalence-dependent and AI-ECG should not be interpreted as a standalone rule-out test.<sup>1</sup>

## WHAT CHALLENGE DOES THIS ADDRESS?

AMI pathways remain highly time-sensitive, yet first-contact assessment is often complicated by non-ST-segment elevation presentations, atypical symptoms, baseline ECG abnormalities, and variable access to expert interpretation. The clinical challenge is not simply obtaining an ECG rapidly, but interpreting it alongside symptoms, serial ECGs, high-sensitivity troponin testing, and structured acute coronary syndrome pathways.<sup>2</sup>

AI-ECG may add a probabilistic signal at this early stage by identifying subtle electrophysiological patterns that are not consistently visible to clinicians or rule-based algorithms. However, the available evidence supports an adjunctive role: AI-ECG should guide prioritisation and escalation decisions, not replace clinical judgement, biomarkers, imaging, or invasive evaluation when clinically indicated.<sup>1</sup>

## RELEVANCE TO EUROPEAN PRACTICE

For European practice, the findings are relevant because acute coronary syndrome care depends on coordinated pre-hospital, emergency department, and regional reperfusion networks. A decision support ECG tool could be attractive where rapid specialist interpretation is not immediately available, particularly if embedded within pathways aligned with European Society of Cardiology (ESC) guidance rather than deployed as a standalone diagnostic gatekeeper.<sup>2</sup>

Nonetheless, direct European implementation requires caution. The meta-analysis included heterogeneous, predominantly observational studies, with cohorts mainly from North America, East Asia, and Latin America; 5 out of 10 studies had high overall risk of bias, and heterogeneity was substantial, particularly for NSTEMI. Pre-hospital machine-learning ECG work and all-day AI triage implementation studies show feasibility in selected systems, but these data do not establish generalisable European clinical benefit.<sup>1,3,4</sup> External validation is therefore essential across European populations, ambulance systems, ECG devices, troponin algorithms, and regulatory settings.<sup>2</sup>

## WHAT ARE THE NEXT STEPS FOR THE RESEARCH?

Future research should move from retrospective or controlled diagnostic accuracy studies to prospective, multicentre European implementation studies. These should test whether AI-ECG meaningfully changes care processes without compromising safety, with outcomes including missed AMI, time to appropriate pathway decisions, catheterisation laboratory activation accuracy, emergency department flow, cost-effectiveness, equity, and downstream clinical outcomes.<sup>1,4</sup>

The weaker NSTEMI performance requires particular attention, as does subgroup performance by sex, age, ethnicity, comorbidity, and ECG confounders such as bundle branch block or pacing. Transparent reporting of calibration, explainability, thresholds, failure modes, and algorithmic bias will be necessary for trust and governance. The most clinically plausible future role for AI-ECG is integration with high-sensitivity troponin testing, validated clinical risk scores, serial ECG interpretation, and established acute coronary syndrome pathways, with clinician oversight retained throughout.<sup>1,2</sup>

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