Missed occlusions: diagnostic accuracy of ECG STEMI criteria for identifying occlusive myocardial infarction. A systematic review and meta-analysis

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Abstract

The ECG-STEMI criteria are widely used to identify Acute Myocardial Infarction (AMI) patients who need urgent revascularization. However, recent evidence shows that up to one-third of Occlusive Myocardial Infarctions (OMIs) may go undetected using these criteria. While still a cornerstone of current triage protocols, doubts remain about their diagnostic accuracy, particularly their sensitivity in detecting OMI. This systematic review and meta-analysis aimed to assess the diagnostic accuracy of ECG-STEMI criteria in identifying patients with OMI. A comprehensive search of MEDLINE, EMBASE, and Scopus was conducted up to February 2024. Included studies enrolled patients with confirmed AMI and provided data to construct 2×2 tables comparing ECG-STEMI results (index test) with angiographic findings (reference standard) for OMI. Risk of bias was assessed using QUADAS-2. We calculated pooled sensitivity, specificity, diagnostic odds ratio (DOR), and generated SROC curves using random-effects models. Nine studies (11,757 patients) were included. ECG-STEMI criteria showed a pooled sensitivity of 0.635 (95% CI: 0.549-0.713) and specificity of 0.780 (95% CI: 0.645-0.873). The DOR was 5.94 (95% CI: 3.81-9.27), with an AUC of 0.752 (95% CI: 0.714-0.795). Definitions of OMI varied across studies; composite definitions yielded higher specificity and DOR but lower sensitivity than angiographic definitions alone. ECG-STEMI criteria offer high specificity but only moderate sensitivity for detecting OMI, potentially missing one-third of patients needing urgent care. These criteria are more reliable for confirming rather than excluding OMI. Diagnostic accuracy depends on how OMI is defined, highlighting the need for a standardized definition to better assess both current and emerging ECG criteria.

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Introduction

"Time is muscle" has become a key mantra in emergency medicine, rooted in the work of Maroko et al., who showed that early intervention—within three hours of symptom onset – can significantly reduce myocardial injury caused by coronary occlusion.[1]

Over the past decades, considerable efforts have aimed to improve early detection of Acute Coronary Occlusion (ACO) to maximize the benefits of timely reperfusion. The Fibrinolytic Therapy Trialists' meta-analysis of nine randomized trials established the current STEMI/NSTEMI paradigm by demonstrating a significant mortality benefit of thrombolytic therapy in patients with ST-segment elevation, an effect not observed in those without. Consequently, ST-segment elevation on ECG became a surrogate marker for ACO – a concept that remains widely accepted. Notably, these early studies were based on clinical outcomes without angiographic validation. Today, primary Percutaneous Coronary Intervention (PCI) has replaced systemic thrombolysis as the standard treatment.[2,3]

Since 2000, ECG criteria for STEMI have been revised multiple times, largely based on observational data, after it became clear that traditional criteria missed many cases of ACO. This led to the inclusion of "STEMI equivalents" and hemodynamically unstable

patients among those eligible for emergent reperfusion.[4-8]

Despite their key role in AMI triage, studies assessing the diagnostic accuracy of STEMI criteria have only recently emerged, and no comparative analyses have yet determined which are most effective for identifying ACO.[9-11]

The aim of this systematic review is to assess the diagnostic accuracy of ECG-based STEMI criteria in identifying Occlusive Myocardial Infarction (OMI) in patients with Acute Myocardial Infarction (AMI).

Materials and Methods

Protocol and registration

This systematic review was conducted following Cochrane methodology and is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses of Diagnostic Test Accuracy Studies (PRISMA-DTA) guidelines. The study protocol was registered with PROSPERO (registration number: CRD42024541580).[12,13]

Inclusion criteria and definitions

Studies were eligible for inclusion if they enrolled patients with a high suspicion or confirmed diagnosis of Acute Coronary Syndrome (ACS).

The index test assessed was the standard 12-lead Electrocardiogram (ECG), specifically evaluating the presence or absence of ST-Segment Elevation (STE), as defined by international guidelines. All studies were included regardless of the specific STE criteria used.

Coronary angiography was used as the reference standard, with particular emphasis on the Thrombolysis in Myocardial Infarction (TIMI) flow grade.

ACO was defined as the presence of an acute culprit lesion with TIMI flow grade 0-2.

We included all human studies that reported results for both the index and reference tests, allowing for the construction of a 2 × 2 contingency table.

Studies were excluded if they: i) reported only test-positive or test-negative participants; ii) focused exclusively on specific subpopulations (*e.g.*, patients with cardiac arrest, cardiogenic shock, or those undergoing PCI); iii) were animal studies, case reports, case series, or review articles; iv) were published in languages other than English.

Search strategy and study selection

A systematic search of MEDLINE and EMBASE was conducted from inception to February 5, 2024. No restrictions were placed on study design. Only studies published in English were considered. Additional reference and citation searches for included studies were conducted using Scopus on September 28, 2024. The detailed search strategy for all databases is provided in *Supplementary materials, Supplemental Digital Content 1*.

After removal of duplicates using Zotero 6.0, two reviewers (MP and MV) independently screened titles and abstracts to exclude clearly irrelevant records. The full texts of potentially eligible studies were then independently assessed for eligibility by the same reviewers. Discrepancies at both stages were resolved through discussion or, when needed, adjudicated by a senior author (GR).

Data collection

Data were independently extracted by two reviewers (IC and AB). Any disagreements were resolved through discussion with a senior author (GR). For each study, we collected general characteristics (first author, year of publication, country, study design), the STE criteria used, and the ACO definition or angiographic criteria applied.

Risk of bias assessment

The methodological quality of each included study was independently assessed by two reviewers (I.C. and A.B.) using the Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) tool (14). The results were summarized in graphical format.

Data analysis and synthesis

STE on ECG was defined as a test-positive result, while angiographically confirmed ACO represented a disease-positive status. For each study, outcomes were classified as true/false positives or negatives and recorded in Excel (Version 2016, Microsoft Corp.).

Statistical analyses were performed in RStudio (Version 4.2.3) using the *meta* and *mada* packages. A univariate random-effects meta-analysis pooled sensitivity, specificity, and DORs. Bivariate models estimated the SROC curve. Stratified analyses were conducted based on different ACO definitions. Forest and ROC plots illustrated the distribution of diagnostic accuracy across studies. All estimates included 95% confidence intervals. A univariate meta-analysis of Positive and Negative Likelihood Ratios (PLR and NLR) was performed using a random-effects model (DerSimonian-Laird method).[15]

Results

Study selection

The database search yielded 4,933 records, and an additional 675 were identified through other sources. After removing 342 duplicates, 4,591 titles and abstracts were screened. Of these, 242 full-text articles were assessed for eligibility, and 8 studies met the inclusion criteria. Reasons for excluding the remaining 234 articles are provided in *Supplementary materials, Supplemental Digital Content 2*.

An additional 675 records were identified through reference and citation searches via Scopus. After 205 duplicates were removed, 470 titles and abstracts were screened, resulting in 13 full-text articles reviewed. Among these, 1 study met the inclusion criteria, while 12 were excluded (reasons provided in *Supplementary materials, Supplemental Digital Content 2*).

The study selection process is illustrated in Figure 1.

Included studies

This systematic review and meta-analysis included a total of 9 studies, all of which were observational. Five studies were prospective,[11,16-19] while four were retrospective.[9,20-22]

Four studies used ECG STEMI criteria consistent with the Third or Fourth Universal Definition of Myocardial Infarction.[9,11,21,22] Three studies followed the ACC/AHA STEMI guidelines (2004),[16,17,19] one study applied both definitions depending on the time of patient enrollment, based on the definition in use at that time,[20] and one study adopted an alternative definition of ECG STEMI criteria (≥0.1 mV ST-segment elevation in two contiguous limb leads and/or ≥0.2 mV ST-segment elevation in two

contiguous precordial leads).[18] In five studies,[16,20] true-positive OMI cases were classified based on angiographic findings alone (TIMI flow 0-2), while in the remaining four[9,11,21,22] classification was based on angiographic criteria in combination with additional diagnostic elements such as elevated troponin levels or echocardiographic abnormalities. In these studies, markedly elevated troponin levels beyond certain thresholds were interpreted as indicative of transmural infarction, and therefore used to classify patients as OMI rather than NOMI.

Five studies explicitly aimed to evaluate the diagnostic accuracy of ECG STEMI criteria for identifying OMI.[9,11,18,21,22] In four of these, OMI was defined using a composite approach combining angiographic features with troponin levels and/or echocardiographic findings.[9,11,21,22] The total number of participants across the 9 included studies was 11,757. Full details of the studies are presented in Table 1.

Risk of bias

The results of the methodological quality assessment are summarized in Table 2 and Figure 2.

Several studies showed high risk of bias, particularly in patient selection and flow/timing domains. Often, it was unclear whether all eligible AMI patients underwent angiography, and many were excluded without clear justification. Missing angiographic data

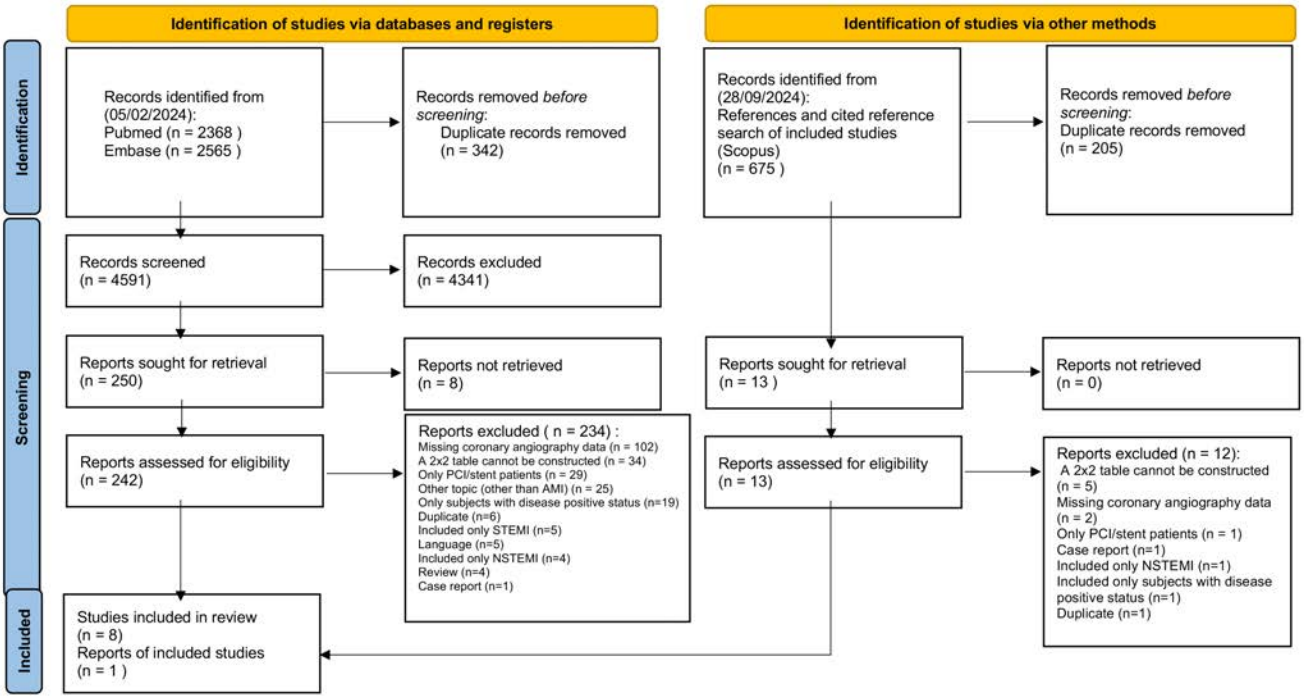

Figure 1. PRISMA flow chart.

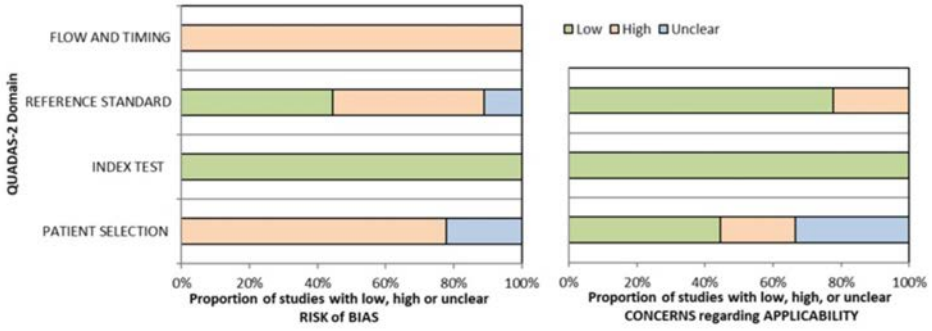

Figure 2. Summary of risk of bias and applicability concerns across QUADAS-2 domains. This figure shows the proportion of included studies rated as having low (green), high (orange), or unclear (blue) risk of bias (left panel) and applicability concerns (right panel) across the four QUADAS-2 domains. The greatest risk of bias was identified in the "Flow and Timing" and "Patient Selection" domains, mainly due to retrospective study designs and unclear inclusion criteria. In contrast, the "Index Test" domain consistently exhibited low risk of bias and minimal applicability concerns, reflecting standardized and appropriate ECG interpretation across studies.

Table 1. Summary of study characteristics. CU, Cardiology Unit; ED, Emergency Department; ICU, Intensive Care Unit; TP, True Positive; FP, False Positive; TN, True Negative; FN, False Negative.

Study	Country, Study period	Study design	Setting	Index test (STEMI definition)	Reference standard (OMI definition)	TP	FP	TN	FN	Sample size
Aslanger, 2020[9]	Turkey, May 2017-December 2018	Observational study, Consecutive, retrospective	ED	Third/Fourth Universal definition of infarction	TIMI 0 or any TIMI with a peak troponin I level equal to or greater than 1.0 ng/ml plus an at least 20% rise within 24 h or a highly elevated peak troponin (greater than 5.0 ng/mL) or cardiac arrest before any troponin	833	144	638	349	1964
Bailleul, 2018[16]	France, October 2010	Consecutive, prospective multicenter registry	CU	ACC/AHA STEMI guidelines (2004)	TIMI flow 0-1-2	1445	590	742	560	3337
Bruno, 2021[20]	Switzerland, 2009-2017	Observational study, Consecutive, retrospective	CU	ACC/AHA STEMI / guidelines (2004) Third Universal definition of infarction	TIMI flow 0-1-2	1942	526	1126	791	4385
Ino, 2011[17]	Japan, July 2008-March 2009	Observational study, Consecutive, prospective	CU	ACC/AHA STEMI) guidelines (2004	TIMI flow 0-1-2	34	6	34	15	89
Kola, 2024[21]	Albania, January-May 2023	Observational study, Consecutive, retrospective	CU	Fourth Universal definition of infarction	Acute culprit lesion with TIMI 0–2 flow or acute culprit lesion with TIMI 3 flow and highly elevated troponin I (>10,000 ng/L)	143	20	73	98	334
Koyama, 2002[18]	Australia, July 1997 -	Observational study, Consecutive, prospective	CU	≥0.1 mV ST-segment elevation in 2 contiguous limb leads and/or ≥0.2 mV ST-segment elevation in 2 contiguous precordial leads	TIMI flow 0-1-2	208	71	46	79	404
McLaren, 2023[22]	Canada, June 2021-May 2022	Observational study, Consecutive, retrospective	ED	Fourth Universal definition of infarction	Acute culprit lesion with TIMI 0–2 flow or acute culprit lesion with TIMI 3 flow and highly elevated troponin I (>10,000 ng/L), or if no angiography, then highly elevated troponin with new regional wall motion abnormality on echocardiogram.	15	226	84	382	57
Meyers, 2021[11]	USA, 1 year period in 2017	Retrospective case-control study	ED	Third Universal definition of infarction	Acute culprit and either TIMI 0–2 flow or TIMI 3 flow plus peak troponin T > 1.0 ng/mL.	108	34	509	157	807
Toutouzas, 2011[19]	Greece	Observational study, Consecutive, prospective	CU	ACC/AHA STEMI guidelines (2004)	TIMI flow 0-1-2	23	7	16	9	55

may have introduced selection bias, affecting diagnostic accuracy estimates. Additional bias in the reference standard domain arose from heterogeneous definitions of OMI across studies.

Synthesis of results

In this systematic review, a stratified meta-analysis was performed to assess the diagnostic accuracy of ECG-based STEMI criteria in identifying OMI in patients with AMI.

The pooled sensitivity and specificity of ECG STEMI criteria were 0.635 (95% CI: 0.549-0.713) and 0.780 (95% CI: 0.645-0.873), respectively. Subgroup estimates based on the definition of OMI are presented in the corresponding forest plots (Figures 3 and 4). Studies using an angiographic definition of OMI demonstrated higher sensitivity (0.715; 95% CI: 0.703-0.727), while those using a composite definition showed higher specificity (0.887; 95% CI: 0.804-0.937). Substantial heterogeneity was observed across studies for both sensitivity (I^2=95.1%) and specificity (I^2=97.9%), as well as between subgroups (p=0.003 for sensitivity; p=0.001 for specificity). The overall diagnostic performance, measured by the diagnostic odds ratio (DOR), was 5.94 (95% CI: 3.81-9.27). Higher diagnostic accuracy was observed in studies using composite definitions (DOR=9.31; 95% CI: 7.14-12.15), compared to those using angiographic criteria alone (DOR=4.17; 95% CI: 2.28-7.65), with a significant difference between subgroups (p=0.0175) (Figure 5). These findings are visually summarized in the forest plots and in the summary receiver operating characteristic (SROC) curve (Figures 3 and 4). The SROC curve yielded an area under the curve (AUC) of 0.752 (95% CI: 0.714-0.795), indicating moderate diagnostic accuracy (Figure 6). The pooled positive likelihood ratio (PLR) of ECG STEMI criteria for diagnosing OMI was 2.86 (95% CI: 2.13-3.83). The pooled negative likelihood ratio (NLR) was 0.50 (95% CI: 0.43-0.59).

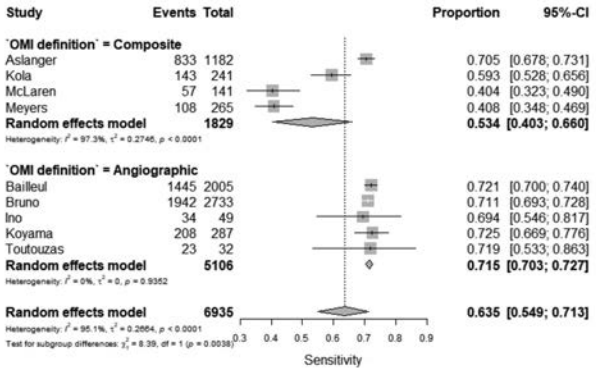

Figure 3. Forest plot of sensitivity estimates stratified by Occlusion Myocardial Infarction (OMI) definition. The overall pooled sensitivity across all studies was 0.635 (95% CI: 0.549-0.713). Studies using an angiographic definition (TIMI flow 0-2 *vs* 3) showed higher pooled sensitivity (0.715; 95% CI: 0.703-0.727) with no heterogeneity (I^2=0%). In contrast, studies using a composite definition (angiographic plus biomarkers or echocardiography) showed lower sensitivity (0.534; 95% CI: 0.403-0.660) and high heterogeneity (I^2=97.3%). Subgroup difference was statistically significant (p<0.05). Events: TP; Total: TP+FN; CI: confidence interval; I^2 and τ^2: heterogeneity metrics.

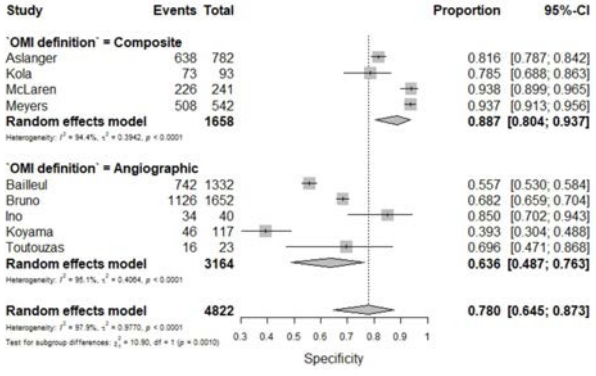

Figure 4. Forest plot of specificity estimates stratified by Occlusion Myocardial Infarction (OMI) definition. Studies using a composite definition (angiographic plus biomarkers or echocardiography) showed higher pooled specificity (0.887; 95% CI: 0.804-0.937) with substantial heterogeneity (I^2=94.4%, τ^2=0.3942, p< 0.0001). In contrast, studies using an angiographic definition (TIMI flow 0-2 *vs* 3) showed lower pooled specificity (0.636; 95% CI: 0.487-0.763) and similar heterogeneity (I^2=95.1%, τ^2= 0.4084, p<0.0001). The overall pooled specificity was 0.780 (95% CI: 0.645-0.873). Subgroup difference was statistically significant (p=0.0010). Events: TN; Total: TN+FP; CI: confidence interval; I^2 and τ^2: heterogeneity metrics.

Table 2. Risk of bias assessment using the QUADAS-2 tool.

	Risk of bias				Applicability		
	Patient selection	Index test	Reference standard	Flow and timing	Patient selection	Index test	Reference standard
Aslanger, 2020[9]	High	Low	High	High	High	Low	High
Bailleul, 2018[16]	High	Low	Unclear	High	Low	Low	Low
Bruno, 2021[20]	High	Low	Low	High	Low	Low	Low
Ino, 2011[17]	Unclear	Low	Low	High	Unclear	Low	Low
Kola, 2024[21]	High	Low	High	High	Low	Low	Low
Koyama, 2002[18]	Unclear	Low	Low	High	Unclear	Low	Low
McLaren, 2023[22])	High	Low	High	High	Unclear	Low	Low
Meyers, 2021[11]	High	Low	High	High	Low	Low	High
Toutouzas, 2011[19]	High	Low	Low	High	High	Low	Low

Discussion

This systematic review and meta-analysis assessed the diagnostic accuracy of ECG STEMI criteria in detecting OMI among patients with AMI. A total of nine observational studies were included, encompassing 11,757 patients. Although the 12-lead ECG remains a cornerstone in the early evaluation of ACS, our findings highlight important limitations in its ability to identify OMI. The pooled sensitivity of 63.5% (95% CI: 54.9-71.3) indicates that over one-third of OMIs may go undetected using standard STEMI criteria. This low sensitivity is likely driven by a substantial proportion of false negatives.[11,21,22] Importantly, transmural ischemia may present with ECG changes that fall short of STEMI thresholds, leading to delayed or missed reperfusion therapy. Reflecting this, the 2023 ESC guidelines recommend immediate revascularization also for patients with signs of ongoing ischemia consistent with STEMI equivalents.[8] Conversely, specificity was relatively high at 78.0% (95% CI: 64.5-87.3), suggesting that patients meeting STEMI criteria are indeed more likely to have a true coronary occlusion. However, false positives were common, especially in studies relying solely on angiographic TIMI 0-2 flow to define OMI.[16-20] Several non-occlusive conditions can mimic myocardial infarction on ECG, including myocarditis, myopericarditis, MINOCA, and INOCA.[23] In such cases, Cardiac Magnetic Resonance (CMR) can help clarify the underlying etiology and distinguish true infarction from mimics.[24]

Accordingly, although ECG STEMI criteria remain valuable for confirming the presence of OMI, their moderate sensitivity and a negative likelihood ratio of 0.50 (95% CI: 0.43-0.59) limit their effectiveness as a standalone screening tool.

Current clinical guidelines for the management of acute coronary syndromes recommend emergent coronary angiography not only in STEMI-positive patients, but also in those presenting with hemodynamic instability, regional wall motion abnormalities, or STEMI-equivalent ECG patterns. This broader approach reflects a growing awareness that relying exclusively on ST-segment elevation may miss a significant proportion of patients with acute coronary occlusion.[8,25,26]

Recent evidence further supports this perspective. A systematic review and meta-analysis by McFadden *et al.* evaluated the diagnostic performance of STEMI criteria in patients with ROSC following cardiac arrest, reporting a pooled sensitivity of 70% and specificity of 85% - figures closely aligned with those observed in the present analysis.[27] These findings reinforce concerns about underdiagnosis when ECG criteria are applied in isolation. However, major randomized trials investigating the role of emergent coronary angiography in OHCA patients without ST-segment elevation - such as the TOMAHAWK, EMERGE, and COUPE trials - have failed to demonstrate a clinical benefit.[28-30] As a result, current guidelines do not recommend routine emergent coronary angiography for post-ROSC patients without ST elevation on the initial ECG.[31] Despite the pivotal role of ECG in the early diagnosis of myocardial infarction, few studies have been specifically designed to assess the diagnostic accuracy of STEMI criteria for detecting OMI. Of the nine studies included in this review, only five had the primary objective of evaluating ECG performance in identifying coronary occlusion n the remaining four, classification of OMI versus non-OMI was feasible based on reported data, but diagnostic accuracy was not the principal focus.[16,17,19,20] This reflects a gap in the current literature and introduces potential bias, as these studies were not originally intended to assess ECG diagnostic performance in this specific context. The studies by Meyers and Aslanger both carried a high risk of selection bias, as they were case-control analyses specifically designed to compare the diagnostic performance of STEMI versus OMI/ACOMI criteria. In Meyers *et al.*, sensitivity of STEMI criteria was underestimated due to an increased proportion of false negatives, as shown by the lower sensitivity observed in the case-control cohort (41%) compared with their earlier prospective study (62%).[11,32] Similarly, Aslanger et al. selected patients based on index test outcomes (STEMI *vs*. NSTEMI) rather than on the target condition, further limiting the validity of diagnostic accuracy estimates.[9] The retrospective studies by McLaren and Kola, which enrolled patients consecutively in the emergency department and cardiology ward, provided more robust estimates of diagnostic performance com-

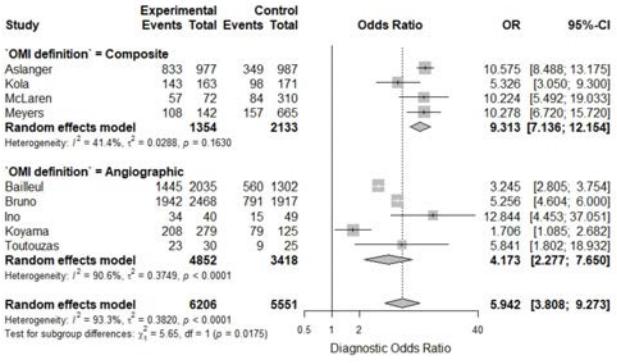

Figure 5. Forest plot of diagnostic odds ratios (DOR) stratified by Occlusion Myocardial Infarction (OMI) definition. Studies using a composite definition (angiographic plus biomarkers or echocardiography) showed a higher pooled DOR of 9.313 (95% CI: 7.136-12.154) with moderate heterogeneity (I^2=41.4%, τ^2=0.0288, p=0.1630). In contrast, studies using an angiographic definition (TIMI flow 0-2 *vs* 3) showed a lower pooled DOR of 4.173 (95% CI: 2.277-7.650), with substantial heterogeneity (I^2=90.6%, τ^2=0.3749, p<0.0001). Overall pooled DOR was 5.942 (95% CI: 3.808-9.273). Subgroup difference was statistically significant (p=0.0175).

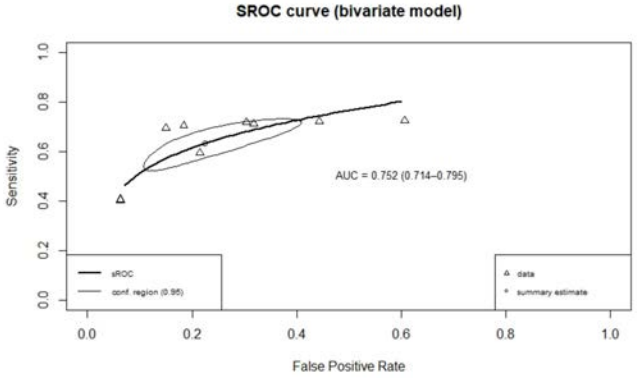

Figure 6. Summary Receiver Operating Characteristic (SROC) curve. This figure illustrates the ROC curve depicting the relationship between sensitivity (true positive rate) and 1-specificity (false positive rate). The Area Under the Curve (AUC) indicates the test's overall accuracy. The area under the curve (AUC) is 0.752 (95% CI: 0.714-0.795), indicating moderate overall diagnostic accuracy.

pared with case-control designs. McLaren et al. reported low sensitivity (40.4%) but high specificity (93.8%), results consistent with Meyers despite methodological differences.[22] Kola *et al.*, by contrast, observed higher sensitivity (59.3%) but lower specificity (78.5%), likely reflecting differences in study populations, as their cohort included a broader spectrum of ACS patients.[21] The prospective multicenter study by Bailleul was less affected by selection bias; however, it was limited by a high dropout rate (only 3337 of 4169 patients underwent coronary angiography) and by delays in angiography among NSTEMI patients, potentially leading to misclassification of OMI status.[16]

The studies by Ino and Toutouzas were prospective with consecutive enrollment, but their relatively small sample sizes limited the precision and generalizability of their findings.[17,19]

The study by Bruno covered a long enrollment period and applied different definitions of ECG STEMI criteria according to the guidelines available at the time, introducing variability in case classification.[20] Operational definitions of OMI varied notably across studies. For instance, Kola and Meyers defined OMI as TIMI 0-2 flow or TIMI 3 flow with elevated troponin;[11,21] Aslanger included cases of cardiac arrest with suspected occlusion;[9] McLaren incorporated echocardiographic regional wall motion abnormalities.[22] Such discrepancies likely contributed to the observed variability in diagnostic accuracy. A recent systematic review and meta-analysis by de Alencar Neto *et al.* reported different estimates of diagnostic accuracy for ST-segment elevation in detecting acute coronary occlusion. Their pooled sensitivity was 43.6% (95% CI: 34.7-52.9), with a specificity of 96.5% (95% CI: 91.2-98.7). In contrast, the present review found a higher sensitivity of 63.5% (95% CI: 54.9-71.3) but a lower specificity of 78.0% (95% CI: 64.5-87.3).[33] This discrepancy is likely due to several methodological differences. The present review included a greater number of studies (9 *vs*. 3) by not excluding studies based on the specific STEMI criteria applied. Additionally, the study by Lindow *et al.*, which was included in de Alencar Neto *et al.*'s meta-analysis, was excluded from the current review because it did not meet predefined inclusion criteria. Specifically, Lindow *et al.* employed a composite angiographic endpoint – defined as AMI with either coronary occlusion or near-occlusion (stenosis ≥90%) – rather than the pre-PCI TIMI flow grade used as the reference standard in this review. These differences in outcome definitions and study selection likely contributed to the observed variation in pooled sensitivity and specificity between the two meta-analyses.

Limitations

The primary limitation of this review is the substantial heterogeneity among included studies, largely attributable to inconsistent definitions of OMI. Some studies employed composite definitions that integrated angiographic, biochemical, and echocardiographic criteria, while others relied exclusively on angiographic findings.

Studies employing composite definitions generally reported lower sensitivity but higher specificity, potentially reflecting more precise identification of true positives. False positives in cases with TIMI 3 flow may result from pre-angiographic treatment or spontaneous reperfusion. Moreover, conditions like sepsis, Takotsubo syndrome, and INOCA can mimic myocardial infarction.[34-36]

Additional variability stems from heterogeneity in the application of STEMI criteria, study design, and patient populations, with diagnostic performance differing between cohorts with confirmed versus suspected acute coronary syndrome. These methodological and operational differences should be considered when interpreting pooled results.

Conclusions

Exclusive reliance on ECG-based STEMI criteria for identifying candidates for immediate reperfusion leads to underdiagnosis of nearly one-third of OMI cases. While STEMI criteria exhibit high specificity, their moderate sensitivity limits their effectiveness as a screening tool, making them better suited for confirming rather than excluding OMI. Crucially, the absence of a standardized definition of OMI across studies compromises the precision of diagnostic accuracy estimates. Establishing a universal definition of ACO is essential for enabling consistent comparisons, reliable replication, and improved diagnostic evaluation. Such standardization would also aid in identifying false negatives and determining whether certain ECG patterns or myocardial territories are more frequently "silent".[37-39]

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Online supplementary materials
Supplemental Digital Content 1.pdf
Supplemental Digital Content 2.pdf