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THE BRASS TACKS: CONCISE REVIEWS OF PUBLISHED EVIDENCE

Accuracy of the European Society of Cardiology 0/1-, 0/2-, and 0/3-hour algorithms for diagnosing acute myocardial infarction

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Summary heading	The European Society of Cardiology algorithms have high sensitivity (0/1- and 0/2-h) and high specificity (0/1-, 0/2-, and 0/3-h) for AMI
Positive LR findings	LR+: 14 for 0/1-h algorithm for ruling in AMI LR+: 21 for 0/2-h LR+: 13 for 0/3-h
Negative LR findings	LR−: 0.01 for 0/1-h algorithm for ruling out AMI LR−: 0.02 for 0/2-h LR−: 0.09 for 0/3-h
Who was in the studies	32 studies comprising 30,066 patients with suspected AMI

NARRATIVE

Chest pain is a common presentation to the emergency department (ED), representing over 5 million annual ED visits in the United States.[1] However, only 10%–20% of ED patients with chest pain are ultimately diagnosed with acute myocardial infarction (AMI).[2] Evaluation using accelerated diagnostic protocols with high-sensitivity cardiac troponin (hs-cTn) tests can provide more rapid detection of AMI and earlier discharge for patients in whom AMI has been excluded when compared to standard troponin assays.[3,4] Recent guidelines utilize hs-cTn in evaluation for AMI,[5] while prior guidelines incorporated standard troponin assays at the initial time of presentation and at 3 h.[6–8] The most recent European Society of Cardiology (ESC) guidelines use specific hs-cTn T or I thresholds at 0 h and 1 or 2 h and absolute changes to determine who may be ruled in or ruled out for AMI as well as those who require observation.[5]

The systematic review and meta-analysis discussed here included prospective observational cohort studies, implementation studies, and randomized controlled trials (RCTs) evaluating ESC hs-cTn protocols. Studies included adult patients in the ED or chest pain unit with suspected non-ST elevation myocardial infarction or acute coronary syndrome.[9] The authors only included studies evaluating the 0/1-, 0/2-, and 0/3-h ESC protocols utilizing the Elecsys hs-cTnT (Roche), Architect hs-cTnI (Abbott), and Centaur/Atellica hs-cTnI (Siemens) assays based on 2015 ESC guideline thresholds.[7] Diagnosis of AMI was determined based on the Third or Fourth Global Task Force Universal Definition of Myocardial Infarction.[10,11] The primary outcome was diagnostic accuracy for AMI using the 0/1-, 0/2-, and 0/3-h protocols.

The systematic review identified 32 publications (n = 30,066 patients; 4246 cases of AMI) conducted in Asia, Australasia, Europe, and North America that met the inclusion criteria.[9] Among these 32 papers, they identified 33 total cohorts, of which 20 were unique subgroups. Sixteen cohorts evaluated the 0/1-h algorithm, seven cohorts the 0/2-h algorithm, and 10 cohorts the 0/3-h algorithm. Eighteen subgroups were evaluated using an observational study type, while one was evaluated with an RCT and one was quasi-experimental. The authors obtained primary data from the principal investigators for 16 subgroups and aggregate data from published articles for four subgroups. The prevalence of AMI ranged from 4% to 37% in the included studies.

The 0/1-h algorithm demonstrated high diagnostic accuracy to rule in (specificity = 94.0%, 95% confidence interval [CI] =

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90.7%–96.2%; positive likelihood ratio [LR+] = 14, 95% CI = 9–20) and to rule out AMI (sensitivity = 99%, 95% CI = 98.5%–99.5%; negative likelihood ratio [LR−] = 0.01, 95% CI = 0.01–0.02), with 17% of patients ruled in and 54% of patients ruled out. The 0/2-h algorithm demonstrated similar test characteristics, with high accuracy for ruling in (specificity = 96%, 95% CI = 92.9%–97.9%; LR+ = 21, 95% CI = 13–35) and ruling out AMI (sensitivity = 98.6%, 95% CI = 97.2%–99.3%; LR− = 0.02, 95% CI = 0.01–0.04), with 15% of patients ruled in and 61% of patients ruled out. The 0/3-h algorithm had similar ability to rule in AMI (specificity = 93%, 95% CI = 86.9%–96.6%; LR+ = 13, 95% CI = 6.7–24), but lower ability to rule out AMI (sensitivity = 93.7%, 95% CI = 87.4%–97.0%; LR− = 0.09, 95% CI = 0.05–0.15), with 19% of patients ruled in and 66% of patients ruled out. The proportion of patients who remained undifferentiated or in the observational zone was 29% for the 0/1-h algorithm, 24% for the 0/2-h algorithm, and 15% for the 0/3-h algorithm. Stratification by assay demonstrated similar sensitivities and specificities.

CAVEATS

This study has several important limitations. While all three ESC algorithms had high specificities, there was significant heterogeneity across the included studies. This heterogeneity may be in part due to variation in AMI prevalence. Populations with a higher prevalence of AMI may also have a higher prevalence of non-AMI conditions associated with troponin elevations. The heterogeneity could also be due to differences in pinclusion and exclusion criteria used by different studies, with studies including only patients with chest pain having higher specificities compared to studies which included patients presenting with other symptoms. There were significant differences in implementation of the 0/3-h protocols among the included studies as well as potential miscalibration of the Elecsys hs-cTnT lots used globally from 2010 to 2012, further contributing to the heterogeneity. The lower sensitivity of the 0/3-h protocol and wide CIs could be due to the fact that some studies used this algorithm without clinical criteria (GRACE score <140 and pain-free) while others studies used it combined with clinical criteria (sensitivity without and with clinical criteria = 90% [95% CI = 82.9%–94.6%] vs. 98% [95% CI = 88.6%–99.8%], respectively). In fact, protocol performance may be suboptimal in some populations such as those at high-risk for AMI clinically.[12] The performance of algorithms for diagnosis of AMI using sex-specific 99th percentile thresholds are still unclear as many studies did not adjudicate based on this factor. Several studies used samples collected in a different timing manner than that recommended in ESC guidelines, such as using a 0–2/3-h blood draw instead of a 0/2- or 0/3-h draw,[13] and the systematic review authors included studies analyzing troponin samples collected over 30 min outside of the stipulated time by the ESC algorithms. The authors were unable to obtain individual patient-level data and could not account for patients falsely ruled in or out by the ESC algorithms. While most of these studies used the third universal definition of AMI, the adjudication criteria in each of these studies likely means that the difference between third and fourth universal definitions are unlikely to substantially bias the results. Finally, patient management was not dictated by the algorithms and, therefore, outcomes may have been influenced by troponin levels and clinical management.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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