

Most Clinicians Are Still Not Comfortable Sending Chest Pain Patients Home with a Very Low Risk of 30-Day Major Adverse Cardiac Event (MACE)

Urgent message: Patients who present with chest pain but whose tests indicate there is little risk for a major event can leave providers uncertain as to what next steps are appropriate, and raise concerns for bad outcomes and litigation.

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Abstract

Introduction: Patients presenting with a chief complaint of chest pain often present a clinical conundrum for treating providers; after a negative evaluation for a missed major cardiac event (MACE), there is wide variation on the acceptable risk level by providers regarding disposition.

Objective: To determine the percent of clinicians who are comfortable with varying degrees of MACE after a negative chest pain evaluation.

Methods: During the Essentials of Emergency Medicine conference in 2018, a flash survey study was conducted using a convenience sample of attendees. Participants were asked to download an app to their electronic devices. An invitation to participate in a brief survey was sent to those who downloaded the app. The survey consisted of five demographic questions and one clinical opinion question.

Results: Of the 1,391 onsite and livestream attendees at the conference, 985 participants downloaded the app. Of those who downloaded the app, 547 started the survey, with 509 participants completing all six questions (93% response rate of those who started the survey and 52% of those who downloaded the app). Of the 509 participants who completed all six responses (study participants), 333 (65%) were attending physicians, 70 (14%) were residents/registrar/fellows, and 94 (18%) were physician assistants, nurses, or nurse practitioners. Most were from the United States or Canada (91%). A significant number of clinicians 241/509 (47%) would only feel comfortable with a 0.01%-0.1% acceptable miss rate. An acceptable miss rate of 1% to 2%, consistent with the current recommendation from the American College of Emergency Physicians was chosen by 148/509 (29%).

Conclusion: Most clinicians are not comfortable discharging chest pain patients with a 1%-2% rate of 30-day MACE.

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Introduction

Chest pain is the second-leading cause of presentation to the emergency department, accounting for 4.7% of all ED visits and totaling more than 6.5 million visits per year in 2017.¹ Patients presenting with chest pain

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Figure 1. Poll Question About Comfort Level with Missed MACE

What level of possibly missed major adverse cardiac event (MACE) within 30 days do you consider acceptable to allow discharge and cessation of investigation in a patient presenting to the emergency department with symptoms suggestive of acute coronary syndrome?

Most MACEs are NSTEMIs, but there are also a small but significant number of others (death, cardiac arrest, cardiogenic shock, ventricular arrhythmia, or AV block requiring intervention).

Assume an average fit person approximately 50–60 years old with no significant health issues.

- | | |
|---|---|
| <input type="checkbox"/> Missed MACE of 0.01% (1 in 10,000) | <input type="checkbox"/> Missed MACE of 1.0% (1 in 100) |
| <input type="checkbox"/> Missed MACE of 0.10% (1 in 1,000) | <input type="checkbox"/> Missed MACE of 2.0% (in 50) |
| <input type="checkbox"/> Missed MACE of 0.25% (1 in 400) | <input type="checkbox"/> Missed MACE of 4.0% (1 in 25) |
| <input type="checkbox"/> Missed MACE of 0.50% (1 in 200) | <input type="checkbox"/> Missed MACE of 5.0% (1 in 20) |

are evaluated for multiple diagnoses including deadly conditions such as acute coronary syndrome (ACS), pulmonary embolism, and thoracic aortic dissection. However, after these diagnoses have been excluded with bedside evaluation and/or testing, the disposition often represents a clinical conundrum for treating providers; what is the acceptable miss rate for ACS?

In patients presenting with a clear diagnosis of ST elevation myocardial infarction (STEMI) by electrocardiogram or with positive biomarkers indicating myocardial damage (nSTEMI), the medical decision-making pathway is easily established; patients are sent emergently to the cardiac catheterization lab or admitted to a monitored bed. The difficulty in disposition arises when the initial clinical evaluation is reassuring, but subsequent testing reveals unexpectedly positive findings. In an attempt to stratify patients, clinical tools such as the HEART (H=history, E=ECG, A=age, R=risk factors, T=troponin) score have been used to determine additional testing and discharge endpoints.^{2,3}

As with all clinical disposition decisions, the provider weighs the risks, including a missed major adverse coronary event (MACE), defined as death, MI, or revascularization, with the possible risk of harm from over testing and the inherent risks of hospital admission.⁴ Additionally, there are possible legal implications for the provider; among medical litigation cases in the United States, missed MI is the condition associated with the highest number of claims.^{5,6}

After a negative evaluation for MI, the question present in the mind of the clinician at the bedside is: *What level of a MACE is acceptable among practicing providers?* The 2018 American College of Emergency Physicians (ACEP) clinical practice guideline estimates an acceptable missed diagnosis rate of 1%–2% for a 30-day MACE in nSTEMI ACS.⁷ Prior to release of the ACEP statement,

this question was posed to participants at the Essentials of Emergency Medicine conference in Las Vegas in 2018. We sought to determine the percent of clinicians who are comfortable with varying degrees of MACE after a negative ED chest pain evaluation.

Methods

This study was approved by the Adena Health Systems IRB #18-05-024 prior to the poll. Essentials of Emergency Medicine is an annual, 3-day, continuing medical education conference certified by the American Medical Association for Physician's Recognition Award Category 1 CME credit. During the Essentials of Emergency Medicine conference in 2018, with 1,391 onsite and livestream attendees, a pilot survey was sent to a convenience sample of attendees. Conference participants were asked to download an app to their electronic devices. An invitation to participate in a brief survey was sent to those who downloaded the app. There were also announcements during the conference encouraging conference attendees to complete the survey. The survey consisted of five demographic questions and one clinical opinion question adapted from a similar study by Than, et al.⁸ The survey was closed on the third day of the conference, before results were revealed to the attendees.

All data were collected electronically and anonymously and compiled on a Microsoft Excel spreadsheet. After collecting demographic data, including practice location, professional role, primary work environment, years of clinical experience, and practice setting, the participants were asked the single question detailed in **Figure 1** (identical to the final question in the study by Than, et al⁸).

Results

Respondents included practitioners from the United States (78%), Canada (13%), Australia/New Zealand

(4%), and other countries (4%). Most participants were attending physicians (65%), with the majority having 0 to 5 years of clinical experience post-residency (36%). A majority of the respondents (65%) were from nonacademic settings. Most respondents worked primarily in emergency medicine (94%), while 4% worked primarily in the urgent care setting. (See **Table 1**.)

Among the participants, 47% would accept a miss rate of 1/1,000 or 1/10,000 (0.01%–0.1%). Less than 1/3 of participants (29%) would accept a miss rate of 1%–2%. (**Table 2**).

When looking specifically at the 19 clinicians who work in urgent care (see **Table 1**), 14 were from the United States, four from Canada, and one from Australia. Attendings/specialists comprised 12, nurse practitioners five, physician assistants one, and EMS one. There were seven clinicians who considered a 1/10,000 (0.01%) level of MACE acceptable, six who considered 1/1,000 (0.1%) acceptable, two at 1/200 (0.25%), one at 1/200 (0.5%), and two at 1/100 (1%), and 1 at 1/50 (2%).

Discussion

Among the participants, almost half (47%) would only accept a miss rate of MACE of 1/1,000 or 1/10,000, far lower than the threshold established by the 2018 ACEP clinical policy⁷ (released after this study was concluded). In fact, only 29% of the 509 participants in this study were comfortable with the 1%–2% level of MACE deemed to be acceptable by the ACEP statement.

Though the participants who work in the urgent care were a minority of the participants in the study, 13/19 (68%) would only accept a miss rate of MACE of 1/1,000 or 1/10,000, higher than the 47% when looking at all participants in the study.

There is much practice variation in evaluation and management of patients with chest pain, based on the clinician's comfort with risk,⁹ the possible risk to the patient (though not necessarily with being involved in a past malpractice action.)¹⁰ Concern for malpractice is understandable; a 2010 study of closed malpractice claims, over a 23-year period, involving emergency medicine physicians found acute myocardial infarction (MI) and undifferentiated chest pain to be the two leading reasons for claims with associated indemnity.⁶

Historically, the rate of missed MI among patients presenting with chest pain to the emergency department is quoted as 2% based on a paper by Pope, et al, in which the authors conclude that those patients discharged with undifferentiated chest pain have higher mortal-

Table 1. Participant Demographics (N=509)

| | |
|-------------------------------|---|
| Country in which you practice | United States: 397 (78%) Canada: 68 (13%) Australia/New Zealand: 21 (4%) United Kingdom: 7 (1%) Other (Netherlands, Sweden, Chile, Saudi Arabia, Costa Rica, Brazil): 16 (4%) |
| Professional role | Attending/specialist: 333 (65%) Resident/registrar/Fellow: 70 (14%) PA: 54 (11%)NP + nurse: 40 (8%) Paramedic: 7 (1%)Student: 4 (<1%) Retired EM: 1 (<1%) |
| Years of clinical experience | 0-5: 185 (36%) 6-10: 131 (26%) 11-15: 77 (15%) 16-20: 47 (9%) >20 years: 69 (14%) |
| Current work environment | Nonacademic: 330 (65%) Academic: 172 (34%) Military: 4 (1%) Other: 3 (1%) |
| Current practice setting | Emergency department: 477 (94%) Urgent care: 19 (4%) EMS/prehospital: 4 (1%) Student: 1 (<1%) |

ity.¹¹ However, a review of the data in the Pope paper indicated that 19 of the 10,689 patients who were discharged from the ED were subsequently diagnosed with MI, which equates to 0.17% rather than the quoted 2%.¹² Additionally, the data are old, collected over a 7-month period of time in 1993 using CK-MB (before the use of conventional or high sensitivity troponin testing).¹¹

More recent data from Backus, et al showed that in patients with a low-risk HEART score, the risk of MACE was 1.7% in the Netherlands.³ An analysis of low-risk HEART patients in North America showed a much lower rate of 0.8%.¹³ Mahler, et al examined over 8,474 adult chest pain patients and found that those with a low-risk HEART score had a 0.4% risk of MI or death.^{3,14} Note that Backus, et al used only one troponin for 6-week outcomes and a MACE which included MI and death in addition to percutaneous coronary intervention, coronary artery bypass grafting, or coronary angiography revealing procedurally correctable stenosis managed conservatively.³ Mahler, et al used two troponins performed 3 hours apart with a 30-day MACE outcome

Table 2. Acceptable Level of Missed MACE at 30 Days – All Participants (N=509)

| | |
|--|-----------|
| Question: “What level of possibly missed major adverse cardiac event (MACE) within 30 days do you consider acceptable to allow discharge and cessation of investigation in a patient presenting to the emergency department with symptoms suggestive of an acute coronary syndrome?” | |
| 0.01% (1 in 10,000) | 72 (14%) |
| 0.10% (1 in 1,000) | 169 (33%) |
| 0.25% (1 in 400) | 51 (10%) |
| 0.5% (1 in 200) | 67 (13%) |
| 1% (1 in 100) | 118 (23%) |
| 2% (1 in 50) | 30 (6%) |
| 4% (1 in 25) | 2 (<1%) |

defined as MI or death.¹⁴

Weinstock, et al examined 7,266 ED cases with interpretable and nonischemic ECGs, nonconcerning vital signs, and two negative troponin tests admitted to the hospital, and found only four had a clinically relevant adverse cardiac event (CRACE) defined as MI, death, life-threatening arrhythmia, or inpatient STEMI during their hospital course.¹⁵

The bedside clinician is forced to grapple with risk assessment and stratification, personal risk threshold of acceptable missed MACE, and the perceived or actual risk of litigation based on case characteristics. The 2018 ACEP clinical practice guideline for management of ED patients with chest pain states that “the majority of patients and providers would agree that a missed diagnosis rate of 1% to 2% for 30-day MACE in NSTEMI ACS is acceptable.” They further state that there are limitations to diagnostic testing and that there is a need to avoid harms associated with false-positive tests.⁷

While these ACEP guidelines are available to all (note that this ACEP Clinical Policy was not yet released at the time of the survey), the ultimate decision-maker of acceptable miss rate of MACE is the clinician responsible for the care of the patient. Our poll indicates that despite all of the clinical reference tools, available evidence, and statements from professional organizations, the threshold for what is an acceptable miss rate of MACE is as variable as this patient population.

The authors were surprised by how low the level of acceptable MACE is for many clinicians. In fact, almost half of clinicians would only accept a risk of MACE of 1/1,000 or 1/10,000. If all of these patients were admit-

ted to the hospital, there would be a risk of significant harm. One study showed that 1/164 admitted patients had a preventable adverse event contributing to their deaths, in addition to nonfatal events such as deep vein thrombosis, nosocomial pneumonia, falls resulting in head injuries or hip fractures, sundowning syndrome (acute delirium in elderly hospitalized patients), and false positive tests, as well as expense to patients and the health care system.⁴

Brooker, et al showed with a hypothetical “acceptable miss rate” of 1%–2%, that 29% of the patients with chest pain in the ED would not be admitted.¹⁶ At the bedside in the ED and the urgent care center, there are many techniques available to improve patient and clinician comfort with outpatient management; shared decision-making, demonstrated by Hess, et al in multiple studies, was an effective technique.¹⁷⁻²⁰

This study furthers our current knowledge about the acceptable rate of missed MACE in chest pain patients. Next steps include attempting to discern if the 2018 ACEP policy statement has changed clinician’s perceptions about the acceptable miss rate for MACE with a planned repeat survey at the 2021 EEM conference in Las Vegas.

Limitations

The attendees of the conference were likely comprised of clinicians motivated enough about their ongoing education to travel to Las Vegas to attend the conference, perhaps providing a sample that is not reflective of urgent care and emergency medicine clinicians nationally. Though the survey was available to everyone who attended the Essentials of Emergency Medicine course in Las Vegas in 2018, slightly more than half of those downloaded the app and completed the survey. This selection bias may limit the external validity of our findings.

There are different definitions and timelines of MACE, depending on whether revascularization is included, such as with the validation HEART study,³ or if only MI and death are included, such as with the 2018 Mahler HEART pathway study.¹⁴ If a patient is sent home with and subsequently has a MACE, this does not necessarily mean there was poor care. For example, if a patient is diagnosed with coronary disease and has appropriate follow-up and has a revascularization procedure, this will still be counted as MACE in some studies, even though there was not an adverse outcome.²¹ It is possible that the participants had varied definitions or did not understand the definition and answered with varied understandings of definition of MACE.

Further research, since publication of the 2018 ACEP guidelines, will be needed to assess whether their recommendation for consideration of a 1%–2% acceptable miss rate leads to changes in practice patterns.

Conclusion

Most clinicians are not comfortable when discharging chest pain patients even with a possible 1%–2% rate of MACE. ■

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