

Identification of Acute Coronary Syndrome in the Elderly



Michael McGarry, MD^a, Christina L. Shenvi, MD, PhD^{b,*}

KEYWORDS

• Acute coronary syndrome • Elderly • Geriatric • Chest pain • Atypical symptoms

KEY POINTS

- Consider acute coronary syndrome (ACS) in older patients who present with dyspnea, diaphoresis, syncope, nausea, vomiting, altered mental status, fatigue, or generalized weakness even if they do not have any chest pain.
- Have a low threshold to obtain an electrocardiogram and troponin level in elderly patients with symptoms of possible ACS even without chest pain.
- Once ACS is identified, treat patients with atypical symptoms just as aggressively as you would patients with active chest pain.
- Older adults with a high-risk non-ST-segment elevation myocardial infarction are more likely to have atypical symptoms than younger patients but may benefit more from early invasive therapy.
- Reframe the dichotomy of “typical” and “atypical” symptoms and, instead, consider the continuum and range of symptoms with which patients may present when having ACS.

RAPID FIRE: IDENTIFICATION OF ACUTE CORONARY SYNDROME IN THE OLDER ADULT Case

A 77-year-old woman presented to the emergency department (ED) with a chief complaint of “allergic reaction.” She had a past medical history of hypercholesterolemia and psoriatic arthritis. Per emergency medicine services (EMS) personnel, she had been sitting outside when she suddenly developed diaphoresis, nausea, and shortness of breath. She thought she had seen some ants around but denies any known bites. She denied urticaria or any skin itchiness. She was given intramuscular epinephrine and intravenous diphenhydramine and methylprednisolone by EMS and stated her nausea had improved.

^a Department of Emergency Medicine, Northwest Medical Center, 2801 FL-7, Margate, FL 33063, USA; ^b Department of Emergency Medicine, University of North Carolina, 170 Manning Drive CB 7594, Chapel Hill, NC 27599, USA

* Corresponding author.

E-mail address: cshenvi@med.unc.edu

Twitter: [@mike_mcgarry](https://twitter.com/mike_mcgarry) (M.M.); [@clshenvi](https://twitter.com/clshenvi) (C.L.S.)

At the time of evaluation, the patient reported that she was feeling well. She was in no acute distress and had a normal cardiopulmonary examination. She was placed on a cardiac monitor and monitored for four hours. As the physician was preparing the discharge instructions, as an afterthought, they ordered an electrocardiogram (ECG), which showed a normal sinus rhythm with inverted T waves in leads V1-V3. Laboratory tests were ordered. The physician was not sure if the T-wave inversions were new or old but wondered if the patient did have an anaphylactic response or if there was something else going on.

INTRODUCTION

The Problem

When older adults (aged 65 and over) experience acute coronary syndrome (ACS), they often present with what are considered “atypical” symptoms. Because their symptoms less often match the expected presentation of ACS, older patients can have delayed times to assessment, performance of an ECG, diagnosis, and definitive management. Unfortunately, studies in multiple different countries have shown that this group of patients is at the highest risk for having ACS and for complications from ACS.¹⁻⁴

Definitions of Acute Coronary Syndrome

ACS includes a spectrum of presentations from unstable angina to non-ST-segment elevation myocardial infarction (NSTEMI) and ST-segment elevation myocardial infarction (STEMI) that occur when there is a mismatch between myocardial oxygen supply and demand.

- Unstable angina is defined as worsening symptoms (usually chest pain) with exertion, that are relieved by rest with no elevation of biomarkers.
- An NSTEMI occurs when there is evidence of subendocardial injury based on an elevated biomarker level without ECG findings of a transmural infarct.
- An STEMI occurs when there is transmural ischemia, as evidenced by ST-segment elevation on the ECG.

Epidemiology of Acute Coronary Syndrome

In the United States, the demographics of patients who are diagnosed with ACS are as follows:

- Average age of individuals diagnosed with ACS is 68 years.
- ACS is diagnosed in men and woman in a 3:2 ratio.
- The annual incidence of ACS in the United States is 780,000, of which 70% is due to NSTEMIs.⁵

Acute Coronary Syndrome Risk with Age

Age is a significant risk factor for ACS and an independent predictor of higher mortality.² It is estimated that 60% to 65% of STEMIs occur in patients aged 65 years or older, and 28% to 33% occur in patients aged 75 years or older. In addition, as many as 80% of all deaths related to myocardial infarction (MI) occur in persons 65 years and older.⁶

Older patients who present with NSTEMI⁷ and STEMI⁸ are less likely to present with “typical” chest pain symptoms. Sometimes, symptoms other than chest pain that can be present in a patient with ACS are termed “anginal-equivalent” symptoms. It is important to understand the range of ways in which ACS can present in the older population in order to diagnose and treat them more quickly and effectively.

PRESENTATION AND DIAGNOSIS

To diagnose ACS, clinicians must obtain a thorough history, ECG, and cardiac biomarkers, such as troponin level. Current guidelines recommend an ECG be performed within ten minutes of arrival to identify STEMI among patients presenting to the ED with chest pain.⁹ However, many older adults who are ultimately found to have ACS do not present with chest pain as their primary concern, and so their ECG is often delayed.^{7,8,10}

In a review of more than 430,000 patients with confirmed acute MI, one-third had no chest pain on presentation to the hospital, and those without chest pain were more often older, female, or diabetic.^{11,12} Even in patients who are having an STEMI, the proportion of patients without chest pain increases significantly with age. Chest pain is present in more than 90% of patients having an STEMI who are under age 65, but in only 57% of patients over age 85 (Fig. 1).⁸ Given this, traditional triage protocols may miss geriatric patients with ACS.

PATHOPHYSIOLOGY OF "ATYPICAL" SYMPTOMS

There are many potential reasons for the lack of chest pain in older adults presenting with ACS.⁴ This population may have higher levels of endogenous opioids or increased opioid sensitivity that could blunt the sensation of chest pain.⁴ In addition, they may have impaired peripheral or central pain sensation or neuropathy because of age-related changes or diabetes. Older patients may also have ischemic preconditioning, in which they have had many prior episodes of mild ischemia, which has desensitized them to the chest pain. Older patients also have a higher prevalence of multivessel disease and may have developed collateral flow. In addition, older patients may be *more* likely to experience dyspnea because of underlying lung disease and reduced pulmonary reserve.⁴

COMMON PRESENTATIONS OF ACUTE CORONARY SYNDROME IN OLDER ADULTS

Older adults who have confirmed ACS can present with a range of symptoms. Chest pain remains the most common chief complaint in patients with ACS. However, ACS

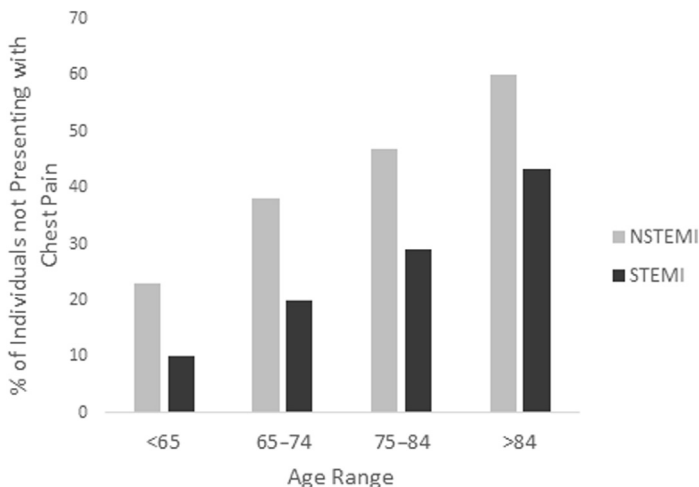


Fig. 1. Percentage of patients not presenting with chest pain as the chief complaint by age, with data from Refs.^{6,7}

can present with a range of other symptoms and without chest pain. Among patients with ACS without a chief complaint of chest pain, the most common presenting symptom is dyspnea, present in about 50%, followed by diaphoresis (26%), nausea/vomiting (24%), and syncope (19%) (Fig. 2). Other possible symptoms include changes in mental status, “indigestion,” and generalized weakness or fatigue.¹³ It is important to identify these symptoms as potential manifestations of ACS, as patients with these symptoms experience a delay in diagnosis and definitive management, and higher morbidity and mortality.¹³

UTILITY OF TROPONIN IN PATIENTS WITH NONSPECIFIC SYMPTOMS

In recommending more liberal ECG or troponin assessments in older adults who lack chest pain, the authors are not necessarily suggesting that *all* older patients need both tests. In a 2019 retrospective study of 412 ED encounters by older adults, Wang and colleagues¹⁴ found that among older patients with “nonspecific complaints” (NSC), there were low rates of ACS. They defined NSC as a chief complaint of “weak or weakness, dizzy or dizziness, fatigue, lethargy, altered mental status, light-headedness, medical problem, examination requested, failure to thrive, or multiple complaints.” In their study, 20% of individuals tested had a positive troponin level, and overall, 1.2% were ultimately diagnosed with ACS. Although 1.2% is a relatively low number with ACS, the 20% who had a positive troponin level tended, as in other prior studies, to have higher mortalities.

The utility of a screening troponin test among patients with these NSC is likely low, but the true risks and benefits of testing have not been fully defined. However, among those with higher-risk symptoms, such as dyspnea, syncope, and the other symptoms listed in Fig. 2, the pretest probability of ACS is higher, and an ECG and troponin test may be helpful to assess for ACS while also performing a workup for other possible causes of the symptoms.

ELECTROCARDIOGRAPHIC INTERPRETATION IN OLDER ADULTS

To complicate matters further, ECG analysis can be more difficult in older adults. Older patients more often have chronic ECG findings or changes that can make diagnosis of the ischemic changes more challenging. For example, older adult patients are more likely to have a pacemaker, a bundle branch block, left ventricular hypertrophy, axis

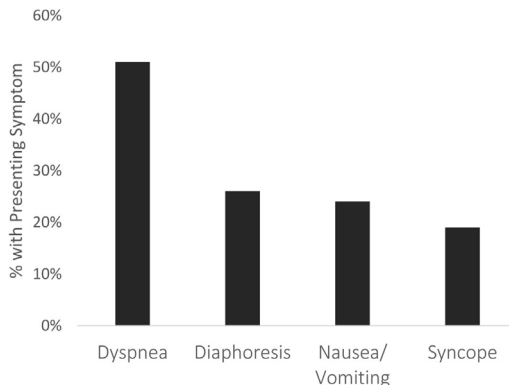


Fig. 2. Common presenting symptoms among older patients with ACS without chest pain as their chief complaint.¹²

deviation, premature ventricular contractions, premature atrial contractions, or prior MI findings, such as chronic inverted T waves or Q waves. Normal aging also frequently leads to first-degree atrioventricular blocks.^{15,16}

OUTCOMES OF ACUTE CORONARY SYNDROME IN OLDER ADULTS WITHOUT CHEST PAIN

There are many significant differences in the rapidity of diagnosis and the outcomes between patients who have chest pain and those who do not at the time of presentation of ACS.^{1,17} Of patients found to have an STEMI, those without chest pain who were transported by EMS received a prehospital ECG 72% of the time, compared with 87% of the time for those with chest pain. Patients who lack chest pain on presentation with ACS tend to have longer door-to-ECG times, and therefore, longer time to definitive management with percutaneous coronary intervention (PCI).¹⁰

For patients with an STEMI, those without chest pain receive fibrinolysis or PCI 37% of the time, compared with 67% of the time for those with chest pain. Patients without chest pain were also less likely to receive an aspirin within 24 hours and less likely to receive statins and beta-blockers at hospital discharge.¹¹

Because of the delays in identification of MIs in patients without chest pain and their undertreatment, it is not surprising that mortality is higher in patients who lack chest pain. Among older women with an MI who present without chest pain, the mortality is 21%, compared with 13% for women with chest pain. For men, the mortality is 22% for those without chest pain and 7% for those with chest pain.¹²

REFRAMING “TYPICAL” SYMPTOMS

Much of the confusion and delay in diagnosis and management for older adults stems from the dogma that patients who have ACS will present with chest pain, and that if they are not having chest pain, the cause of their symptoms is likely nonischemic in nature. However, the data are contrary to this dogma and show that many older adults will present with ACS and have “atypical” symptoms.

Most physicians have a shared understanding of what “typical” ACS symptoms are. However, the individual interpretations of “atypical symptoms” are much broader, and there is poor consensus.¹⁸ In addition, even among patients with chest pain, use of the terms “atypical” and “typical” chest pain can be misleading.

The description of “typical” symptoms of ischemic heart disease dates back to the 1700s when it was described as “a painful sensation in the breast accompanied by a strangling sensation, anxiety, and occasional radiation of pain to the left arm” that was worse with exertion and relieved by rest.^{18,19} Subsequent early studies that defined typical symptoms of ACS were performed primarily in study populations of middle-aged men. Individuals in this younger male population do more often present with chest pain. As a result, those without chest pain were somewhat artificially dubbed “atypical.” However, older adults are the very population who are more likely to have ACS, and who are more likely to lack “typical” chest pain symptoms.

Other investigators have also called for a retirement of the terms “typical” and “atypical” on the basis of their lack of specificity, particularly in women.²⁰ Therefore, the terms “typical” and “atypical” are misleading in the context of ACS and can lead to cognitive bias that could delay a patient’s workup, diagnosis, and management. Instead of dichotomizing patients as having “typical” chest pain or not and treating them differently based on that, one should instead consider the diverse range of symptoms that can manifest in patients with ACS and be aware of the populations

who may tend toward certain manifestations (dyspnea, diaphoresis, nausea) over others (chest pain).

SYSTEMATIC SOLUTIONS

Beyond reframing how individual physicians think about ACS, there are systematic solutions that can be implemented to prevent missing the diagnosis in older adults. ACS must be considered in older patients who present with dyspnea, diaphoresis, syncope, nausea, vomiting, altered mental status, fatigue, or generalized weakness. Clinicians should have a low threshold to obtain an ECG and troponin test in patients with these symptoms, but systems and protocols should also be developed to create safety nets to avoid missed or delayed diagnosis.

Long-term solutions to identification of older adults with ACS need to be systematic and easily implementable and not rely solely on clinician judgment. One option is to follow the prioritization rule developed and validated by Glickman and colleagues⁹ to obtain an immediate ECG in the ED to identify STEMI. They studied 3,575,178 ED patient visits to 107 EDs from 2007 to 2008. The prioritization rule found that those requiring an immediate ECG in the ED included age ≥ 30 years with chest pain, age ≥ 50 years with shortness of breath, altered mental status, upper extremity pain, syncope, or generalized weakness, and those with age ≥ 80 years with abdominal pain or nausea/vomiting in addition to the former symptoms. When the ECG prioritization rule was applied to a validation sample, it had a sensitivity of 91.9% (95% confidence interval [CI] 90.9%–92.8%) for STEMI and a negative predictive value of 99.98% (95% CI 99.98%–99.98%). ECG prioritization rule based on age and presenting symptoms in the ED is one simple, systematic method to better identify patients who are at high risk for STEMI. Similar criteria will need to be developed and validated for NSTEMIs.

Once ACS is identified, physicians should treat patients without “typical” symptoms just as aggressively as they would patients with active chest pain, taking into account individual goals of the patient and their baseline functional status.^{2,21}

CASE REVISITED

Although the care team was not initially concerned for ACS in the patient who presented with purported anaphylaxis, after they noticed the T-wave inversions on the ECG, they send for a troponin test. However, when they thought more about it, they realized her symptoms of dyspnea, diaphoresis, and nausea could be signs of ACS rather than anaphylaxis, even though she never had chest pain. A troponin test is obtained, and the patient is kept on a cardiac monitor. The initial troponin level is 0.45 ng/mL (normal <0.034 ng/mL). The cardiologist is called because of concern for an NSTEMI. The patient is admitted and started on a heparin infusion, and serial troponin levels were obtained. The second troponin level three hours later is 0.83 ng/mL. She undergoes cardiac catheterization the next day, which shows 90% stenosis of the left anterior descending artery. She receives a drug-eluting stent and is discharged two days later.

This case illustrates the need for a high clinical suspicion for ACS in older adults. It also demonstrates the need for emergency physicians to advocate for the appropriate treatment of older adult patients with ACS, as delay in treatment or less aggressive treatment can cause increased morbidity and mortality. A systematic protocol to obtain an ECG among patients with dyspnea and recognizing dyspnea as a symptom of ACS may have expedited her diagnosis.

CLINICS CARE POINTS

- Acute coronary syndrome (ACS) occurs more frequently in older patients. However, with advancing age, patients are more likely to have symptoms other than chest pain as their presenting concern.
- Patients who have ACS but lack chest pain are at higher risk for delayed diagnosis and worse outcomes.
- It is important for clinicians to understand the spectrum of symptoms that can accompany ACS, particularly dyspnea, diaphoresis, nausea and vomiting, or syncope.
- Clinicians should have a low threshold for assessing for ACS with an EKG and troponin in older patients who have potential ACS symptoms, even if they do not have chest pain.

DISCLOSURE

The authors have nothing to disclose.

REFERENCES

1. Simms AD, Batin PD, Kurian J, et al. Acute coronary syndromes: an old age problem. *J Geriatr Cardiol* 2012;9(2):192–6.
2. Saunderson C, Brogan R, Simms A, et al. Acute coronary syndrome management in older adults: guidelines, temporal changes and challenges. *Age Ageing* 2014; 43(4):450–5.
3. Mirghani HO. Age related differences in acute coronary syndrome presentation and in hospital outcomes: a cross-sectional comparative study. *Pan Afr Med J* 2016;24. <https://doi.org/10.11604/pamj.2016.24.337.8711>.
4. Carro A, Kaski JC. Myocardial infarction in the elderly. *Aging Dis* 2011;2(2): 116–37.
5. Basit H, Malik A, Huecker MR. Non ST segment elevation (NSTEMI) myocardial infarction. Treasure Island, FL: StatPearls Publishing; 2020.
6. Yazdanyar A, Newman AB. The burden of cardiovascular disease in the elderly: morbidity, mortality, and costs. *Clin Geriatr Med* 2009;25(4):563–77.
7. Alexander KP, Newby LK, Cannon CP, et al. Acute coronary care in the elderly, part I: non-ST-segment-elevation acute coronary syndromes: a scientific statement for healthcare professionals from the American Heart Association Council on Clinical Cardiology: in collaboration with the Society of Geriatric Cardiology. *Circulation* 2007;115(19):2549–69.
8. Alexander KP, Newby LK, Armstrong PW, et al. Acute coronary care in the elderly, part II: ST-segment-elevation myocardial infarction: a scientific statement for healthcare professionals from the American Heart Association Council on Clinical Cardiology: in collaboration with the Society of Geriatric Cardiology. *Circulation* 2007;115(19):2570–89.
9. Glickman SW, Shofer FS, Wu MC, et al. Development and validation of a prioritization rule for obtaining an immediate 12-lead electrocardiogram in the emergency department to identify ST-elevation myocardial infarction. *Am Heart J* 2012;163(3):372–82.
10. Cannon AR, Lin L, Lytle B, et al. Use of prehospital 12-lead electrocardiography and treatment times among ST-elevation myocardial infarction patients with atypical symptoms. *Acad Emerg Med* 2014;21(8):892–8.

11. Canto JG, Shlipak MG, Rogers WJ, et al. Prevalence, clinical characteristics, and mortality among patients with myocardial infarction presenting without chest pain. *J Am Med Assoc* 2000;283(24):3223–9.
12. Canto JG, Rogers WJ, Goldberg RJ, et al. Association of age and sex with myocardial infarction symptom presentation and in-hospital mortality. *JAMA* 2012;307(8):813–22.
13. Brieger D, Eagle KA, Goodman SG, et al. Acute coronary syndromes without chest pain, an underdiagnosed and undertreated high-risk group: insights from the Global Registry of Acute Coronary Events. *Chest* 2004;126(2):461–9.
14. Wang AZ, Schaffer JT, Holt DB, et al. Troponin testing and coronary syndrome in geriatric patients with nonspecific complaints: are we overtesting? *Acad Emerg Med* 2020;27(1):6–14.
15. Khane RS, Surdi AD, Bhatkar RS. Changes in ECG pattern with advancing age. *J Basic Clin Physiol Pharmacol* 2011;22(4):97–101.
16. Wenger N. STEMI at elderly age. American College of Cardiology. 2016. Available at: <https://www.acc.org/latest-in-cardiology/articles/2016/08/26/08/47/stemi-at-elderly-age>. Accessed May 20, 2020.
17. Gale C, Cattle B, Woolston A, et al. Resolving inequalities in care? Reduced mortality in the elderly after acute coronary syndromes. The Myocardial Ischaemia National Audit Project 2003-2010. *Eur Heart J* 2012;33(5):630.
18. Swap CJ, Nagurney JT. Value and limitations of chest pain history in the evaluation of patients with suspected acute coronary syndromes. *J Am Med Assoc* 2005;294(20):2623–9.
19. Silverman ME. William Heberden and some account of a disorder of the breast. *Clin Cardiol* 1987;10(3):211–3.
20. DeVon HA, Mirzaei S, Zègre-Hemsey J. Typical and atypical symptoms of acute coronary syndrome: time to retire the terms? *J Am Heart Assoc* 2020;9(7):e015539.
21. Lattuca B, Kerneis M, Zeitouni M, et al. Elderly patients with ST-segment elevation myocardial infarction: a patient-centered approach. *Drugs Aging* 2019;36(6): 531–9.