Risk Stratification of Acute Coronary Syndrome in the ED

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Objectives:
1. Summarize the multiple diagnostic modalities necessary for risk stratification of patients with possible ACS presenting to the ED
2. Identify the key diagnostic triggers to begin therapy for patients with STEMI and NSTEMI acute coronary syndrome
3. Discuss new diagnostic testing such as computed tomographic (CT) coronary angiography and its future role in ED evaluation of chest pain

Introduction

The risk stratification of acute coronary syndrome (ACS) is an extremely important skill for the emergency physician. In the Emergency Department (ED), patients present with chest discomfort and a variety of other symptoms which could represent ACS and have the potential risk of significant loss of myocardial muscle and possible death. As approximately 8 million patients present to EDs each year in the United States with possible ACS, emergency physicians must identify patients with a high likelihood of having this disease process and begin therapy. After risk stratifying the patient using history and physical examination, a number of diagnostic tests are available to identify high risk features and the potential for complications. In the emergency setting, evaluation of the patient with possible ACS should include testing which can identify myocardial necrosis, rest ischemia, and exercise-induced ischemia.

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Emergency physicians are encouraged to read this recent paper to obtain the specific study references for the recommendations provided by this expert panel of emergency physicians and cardiologists.

History And Physical Examination

The history and physical examination are critical to the initial risk stratification process. There is no diagnostic test which will identify ACS in a patient if the clinician fails to consider the diagnosis in the first place. Classic symptomatic features such as crushing substernal chest pain, radiation to the jaw, neck, or left arm, nausea, vomiting and signs such as diaphoresis are inconsistently present in the patient with ACS, therefore the emergency physician must have a high level of suspicion for this disease in patients, particularly women, presenting with less typical symptoms. Risk factors for atherosclerotic coronary artery disease including male sex, age > 70 years, smoking, hypertension, and diabetes mellitus indicate patients who likely will develop coronary artery disease over their lifetime but doesn’t necessarily identify the patient presenting with acute chest pain. Evidence of transient mitral regurgitation murmer, heart failure or extra-cardiac vascular disease helps to identify the patient with ACS emergently.

Electrocardiogram

The 12-lead electrocardiogram (ECG), which by guidelines should be obtained in the patient with possible ACS within 10 minutes after presentation to the ED, is a critically important diagnostic test for ischemia at rest in patients with partial coronary artery occlusion. For patients with a complete coronary artery occlusion causing ST-segment elevation myocardial infarction (STEMI), the ECG drives therapy. Current standards for therapy include either percutaneous coronary intervention (PCI) within 90 minutes after ED presentation, the door to balloon time, or fibrinolytic therapy within 30 minutes after presentation if the delay in providing PCI exceeds the 90 minute ideal. The presence of ischemic ST-segment depression 0.5 mV or greater or deep symmetrical T-wave inversion 0.20 mV or greater typically identifies patients with non-ST-segment elevation (NSTEMI) ACS. In the ED chest pain center (CPC), serial ECGs can be obtained every 30-60 minutes to detect evolving ischemia and identify patients for treatment with anti-thrombotic and anti-platelet therapies.
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In some centers, rest radionuclide imaging with agents such as sestamibi serve to identify the patient with rest ischemia in need of anti-thrombotic and anti-platelet therapy with hospital admission.

Cardiac Biomarkers

During the last two decades cardiac biomarkers, in particular the troponins, have become the single most powerful diagnostic test for patients with possible ACS in the ED. An elevated troponin level is indicative of myocardial necrosis and typically portends cardiac complications such as myocardial infarction and death not only in the initial hospitalization but up to 1 year later. Recent advances in the assays for troponins allow reliable detection of myocardial necrosis within 3 hours after ED arrival, making serial testing in an ED, along with serial 12-lead ECGs, essential for accurate ACS diagnosis in the emergency setting.6-9 Multiple studies have shown that in high risk NSTEMI ACS patients, an elevated troponin level identifies patients who will benefit from treatment using anti-thrombin agents such as heparin or low molecular weight heparin as well as anti-platelet drugs such as clopidogrel, prasugrel, or glycoprotein IIb/IIIa inhibitors.

Provocative Testing

After serial ECG and cardiac biomarker testing has excluded rest ischemia and myocardial necrosis, respectively, in an ED CPC over a 3-6 hour period, graded exercise testing or myocardial radionuclide perfusion imaging is then used to detect exercise-induced ischemia. In some institutions, stress echocardiography is routinely used to identify ischemia with exercise.10-13 The expertise of the cardiologists at an institution will typically determine the modality used for testing. If during any portion of the 3-6 hour evaluation the patient has a positive diagnostic test, admission for treatment using anti-thrombotic and anti-platelet agents with further evaluation is necessary.

Computed Tomographic Coronary Angiography

In the last several years, multiple studies have examined the use of computed tomographic coronary angiography (CTA) for patients presenting to the ED with chest pain and possible ACS.14 In the past, electron beam CT or multidetector computed tomography have been used to provide a quantitative calcium score which provided evidence of atherosclerotic coronary artery disease. While useful to identify patients with chronic atherosclerotic disease burden, the calcium score test was less useful in identifying patients with ACS. With the development of 64-slice multidetector CT and even faster scanners, very rapid imaging of the coronary arteries in patients with possible ACS allows detection of not only plaque and calcium in the walls, but also partial occlusion of the lumen of the coronary artery. In addition, the CTA allows for diagnosis of non-coronary artery disease in acute chest pain such as pulmonary embolus and aortic dissection. This modality has the potential to rapidly exclude the diagnosis of cardiac chest pain in an ED population of low risk patients but has the negative aspects of significant radiation exposure and the necessity of having real time expertise available for reading CT coronary angiograms 24 hours per day either by radiologists or cardiologists.

Clinical Risk Scores

The use of clinical risk scores has not been routinely successful in the ED.
The TIMI risk score, for example, was developed from a high-risk ACS trial and has not been found to be routinely useful for low-risk patients in the emergency setting.15

Conclusion

It is essential for emergency physicians to risk stratify patients with possible ACS presenting to the ED. Familiarity with the diagnostic modalities available for detecting ACS is necessary for the clinician. Triggers such as ST-segment elevation on the ECG and elevated troponin levels drive treatment with anti-thrombotic and anti-platelet therapy.

References


