

## 30-Year-Old Man With Chest Pain and Nausea

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A 30-year-old man with no notable medical history presented to the emergency department with nausea, emesis, and pain in his chest and between the shoulder blades. Three days before presentation, he noted the onset of the back pain with associated vomiting and loose stools. He reported feeling somewhat improved over the course of the night into the next morning but subsequently had development of diaphoresis with return of the back pain. The recurrent episode was associated with chest pain described as nonpositional, nonradiating substernal heaviness. He had no cardiovascular risk factors.

On physical examination, he was afebrile, with a pulse rate of 72 beats/min, blood pressure of 113/77 mm Hg, respiratory rate of 16 breaths/min, and oxygen saturation of 100% while breathing room air. Findings on physical examination, including cardiopulmonary assessment, were unremarkable. Basic laboratory studies yielded the following values (reference ranges shown parenthetically): hemoglobin, 12.7 g/dL (13.5-17.5 g/dL); leukocytes,  $9.2 \times 10^9/L$  ( $3.5-10.5 \times 10^9/L$ ); platelet count,  $138 \times 10^9/L$  ( $150-450 \times 10^9/L$ ); erythrocyte sedimentation rate, 22 mm/h (0-22 mm/h); and C-reactive protein, 43 mg/L ( $\leq 8$  mg/L). His troponin T level increased from 1.28 ng/mL ( $<0.01$  ng/mL) at initial measurement to 1.80 ng/mL at 3 hours and 1.87 at 6 hours, a notable delta troponin.

Initial electrocardiography (ECG) yielded marked evidence of ischemia with ST-segment elevations in the inferior and anterolateral leads. A tombstone pattern was noted on the inferior leads with near-linear ST segments. Patterns on the anterior leads were less dramatic, with concave ST-segment elevations (Supplemental Figure, available online at <http://www.mayoclinicproceedings.org>). Transthoracic echocardiography (TTE) indicated a left ventricular ejection fraction (EF) of 53% and inferolateral hypokinesis at the mid and base aspects of the heart, and the entire apex was hypokinetic.

**1. On the basis of the patient's history and physical examination findings, which *one* of the following diagnoses is of *most concern*?**

- Acute coronary syndrome (ACS)
- Pericarditis
- Myocarditis
- Stress-induced cardiomyopathy
- Gastroenteritis



**See end of article for correct answers to questions.**

The patient presented with acute chest pain, troponin elevation, and ECG changes concerning for ACS, specifically, acute ST-segment elevation myocardial infarction (STEMI) due to intracoronary blockage. It is critical that ACS first be ruled out because of the potential for serious myocardial injury, especially if there are delays in adequate treatment. The patient's history suggests a viral prodrome, with symptoms of vomiting and diarrhea. Despite negative findings on the physical examination and echocardiography, pericarditis and myocarditis should be considered high in the differential diagnosis of this patient; however, based on his presentation, they should only be entertained after ruling out ACS because the greatest benefits of ACS therapy are seen early in the disease process. Although his elevated inflammatory markers support the diagnosis of a carditis, they are nonspecific and can also be elevated in ACS. Stress-induced cardiomyopathy is a diagnosis of exclusion and should not be considered before further work-up. Criteria put forth for diagnosis have included transient hypokinesis of the mid left ventricular segments, regional wall motion abnormalities beyond a single epicardial coronary distribution, stressful trigger, absence of coronary disease, and absence of pheochromocytoma or myocarditis.<sup>1</sup> The increase in the cardiac biomarkers in our patient does not aid in diagnosis, however, because an evolving cardiac biomarker panel can be seen in both ACS and stress-induced cardiomyopathy.<sup>2</sup> The patient reported gastrointestinal symptoms in the days before his presentation, which suggests a pathogen-induced enteritis. At the time of his presentation, these symptoms had largely resolved. Although he had continued nausea and vomiting, the overall acute clinical picture is more concerning for ACS.

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The patient was stabilized, given morphine for the pain, and urgently evaluated by the cardiology service for further recommendations.

**2. Given the suspected diagnosis, which one of the following is the most important next step in the management strategy ?**

- a. Initiation of intravenous lidocaine for the patient's increased risk of ventricular arrhythmias
- b. Nonsteroidal anti-inflammatory drugs (NSAIDs) and colchicine
- c. Admission to a telemetry-monitored unit with serial troponin measurements and ECGs
- d. Dual antiplatelet therapy, symptom control, and catheterization laboratory activation
- e. Initiation of statin therapy,  $\beta$ -blockade, and angiotensin-converting enzyme (ACE) inhibition

During an acute ischemic event, a patient is at a high risk of lethal ventricular arrhythmias including ventricular fibrillation and tachycardia. However, there is currently no role for prophylactic lidocaine in this situation. Conservative management and treatment with NSAIDs and colchicine is recommended in a patient with confirmed pericarditis. At this point, there is still high enough suspicion for ACS that this would not be the best next step. The patient will ultimately require admission to a telemetry-monitored unit for close monitoring of arrhythmias, but coronary catheterization should be performed first. Furthermore, he has already had 3- and 6-hour troponin measurements that indicated a marked change. No further monitoring of troponins would be necessary at this juncture. His presenting ECG meets criteria for STEMI; serial ECG would only delay adequate treatment. This patient is best treated with dual antiplatelet therapy as well as heparin, symptom control, and immediate activation of the catheterization laboratory for alleviation of a possible coronary occlusion and percutaneous intervention as needed. Statin therapy, ACE inhibitors, and  $\beta$ -blockers are indicated in most cases of identified ACS. However,  $\beta$ -blockers should be avoided in patients with cardiogenic shock. ACE inhibitors are specifically indicated for a

large anterior myocardial infarction or if the EF is less than 40%. Percutaneous coronary intervention is the treatment of choice, and the aforementioned interventions need not be performed before the procedure.<sup>3</sup>

Coronary angiography revealed normal coronary arteries. The patient's chest pain abated, and ECG documented resolution of ST-segment elevations over time.

**3. Because the work-up thus far has yielded inconclusive results, which one of the following would be the best next step in establishing a diagnosis?**

- a. Endomyocardial biopsy
- b. Cardiac magnetic resonance imaging (MRI)
- c. Transesophageal echocardiogram
- d. Pericardial biopsy
- e. Catheterization of the right side of the heart

Two important clinical scenarios in which endomyocardial biopsy should be highly considered are fulminant myocarditis or suspected giant cell myocarditis. New-onset heart failure of less than 2 weeks with a dilated left ventricle or hemodynamic compromise and patients who do not respond to usual care within 1 to 2 weeks should also be considered for biopsy.<sup>4</sup> Our patient was clinically stable and did not fit into these categories. Cardiac MRI is being used increasingly for the evaluation of nonischemic causes of cardiac biomarker elevations, and in this patient without coronary disease, this test would be the ideal next step in establishing a diagnosis. Transesophageal echocardiography is unlikely to contribute much more information than that already obtained on initial TTE and should only be entertained if severe valvular disease or endocarditis is suspected. Pericardial biopsy could be considered if recurrent pericarditis or pericardial effusions were evident, especially if there was a high suspicion of malignancy. That was not the case in this patient. In this setting, catheterization of the right side of the heart would not add any further diagnostic value beyond the Doppler hemodynamic assessment provided by the TTE. In cases in which intracardiac shunts or pulmonary hypertension is suspected or there is discordance between clinical and noninvasive imaging findings, catheterization of the right side of the heart may be of

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