

MORNING REPORT

"Be Still My Heart"

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A 30-year-old male presents to the emergency department with 24 hours of intermittent, substernal, non-radiating chest pain associated with diaphoresis. EKG demonstrates ST segment elevation in leads I, aVL, and V4-V6. Cardiac enzymes reveal a troponin of 23.9 ng/mL and CK-MB of 47.9 ng/mL.

The patient's significant troponin elevation and EKG changes are concerning for possible acute anterolateral myocardial infarction. One should determine if there is a history of structural heart disease, early coronary artery disease, or cocaine/amphetamine usage. Despite the patient's young age and potential lack of risk factors, an acute ST-elevation myocardial infarction must be considered until proven otherwise. Thus, immediate cardiac catheterization is required. Alternatively, a more common cause of chest pain and diffuse ST-elevation in a young adult is pericarditis, but one would not expect this degree of troponin elevation from that condition alone. The marked elevation of his cardiac biomarkers suggests considerable myocardial inflammation and necrosis raising suspicion for acute myocarditis. This condition presents most commonly in young males and often mimics acute myocardial infarction. Severe myocarditis can also result in acute dilated cardiomyopathy. If coronary angiography proves to be normal, the results of his left ventriculogram may point to this alternative diagnosis. Global left ventricular dysfunction would support a diagnosis of acute, diffuse myocarditis and should be investigated further with trans-thoracic echocardiography.

The patient is taken immediately to the cardiac catheterization laboratory for suspected acute myocardial infarction. Coronary angiography reveals no intraluminal deficits. Left

ventriculogram demonstrates globally diminished left ventricular contractility. Trans-thoracic echocardiography confirms diffuse left ventricular hypokinesis with an ejection fraction of 35% and normal diastolic function.

These findings support a diagnosis of acute myocarditis. This condition can lead to acute heart failure, arrhythmias, and sudden cardiac death from ventricular tachycardia. Therefore, supportive care should be provided in the setting of continuous cardiac monitoring.

A detailed history and physical should attempt to determine an underlying etiology. Viral infections, including coxsackievirus, adenovirus, echovirus, and parvovirus, are among the most common causes of acute myocarditis in developed countries. The history may uncover symptoms consistent with a recent viral prodrome. One should ask about exposure to sick contacts or children with the classic "slapped-cheek" rash of parvovirus. In addition, risk factors for HIV and other immunocompromised states should be assessed as this would introduce less common etiologies such as acute HIV, tuberculosis, or mycotic organisms into the differential. Recent vaccination or the addition of a new medication could suggest a hypersensitivity myocarditis. A detailed exposure and travel history are necessary to exclude rickettsial disease and rare causes of acute cardiomyopathy, such as Chagas disease, dengue, or yellow fever. In addition, one should inquire about illicit drug use and confirm with a urine drug screen to exclude a cocaine-induced cardiomyopathy.

On physical exam, signs of fluid overload or an S3 gallop could indicate impaired ventricular function. Furthermore, if right or left ventricular dilation is severe, cardiac auscultation may reveal a murmur of mitral or

tricuspid insufficiency. Finally, a cardiac friction rub would indicate concomitant pericardial involvement. A thorough skin exam is important, looking for rash, nodules, or signs of peripheral embolic phenomena.

Given his depressed ejection fraction, a beta-blocker and ACE-inhibitor should be instituted if his hemodynamic status will allow.

After cardiac catheterization, the patient is transferred to the intensive care unit. His past medical history is unremarkable. He works as an accountant and denies any recent travel outside the southeastern United States. He denies any sick contacts or known tick exposure. He does note constitutional symptoms of fever, pharyngitis, and myalgias for approximately two weeks prior to admission.

On physical exam, his lungs are clear. He is tachycardic but has no murmurs, rubs, or gallops. There is no evidence of jugular venous distention or peripheral edema. No skin rash, nodules, or splinter hemorrhages are appreciated.

Laboratory data demonstrate a white cell count of 16.8 k/uL with 98% segmented neutrophils, hemoglobin 12.9 g/dL, and platelets 218 k/uL. Sedimentation rate is 89 mm/hr with a CRP of 20 mg/dL. Urine drug screen testing is negative.

His antecedent constitutional symptoms could be consistent with a viral prodrome. The marked WBC left shift, however, is less suggestive of a viral etiology. One would expect an acute viral myocarditis to increase the sedimentation rate and CRP but perhaps not to the degree illustrated above. Hence, endocarditis, acute rheumatic fever, rickettsial disease, or a collagen vascular disease also must be considered.

Soon after admission, the patient develops fever to 102.9° F, moder-
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ate tachycardia, tachypnea, and hypotension with BP dropping to 80/65 mmHg.

His fever and unstable vital signs are worrisome for severe myocarditis or a serious infection such as endocarditis accompanied with developing sepsis and/or worsening heart failure. Blood cultures should be obtained immediately, and empiric broad-spectrum antibiotics that include coverage for staphylococcal and streptococcal species should be initiated. Although no valvular vegetations were seen on initial imaging, trans-esophageal echocardiography would be indicated if his blood cultures become positive. In addition, his cardiac telemetry tracings should be reviewed carefully to exclude periods of unrecognized arrhythmias that could explain his tachycardia and hypotension.

Cardiac MRI can support the diagnosis of myocarditis and may provide clues as to the underlying etiology. This technology, however, is expensive, not widely available, and often not necessary for diagnosis. Furthermore, cardiac MRI should not be pursued at this time given the patient's hemodynamic instability. Endomyocardial biopsy is rarely pursued in cases of acute myocarditis as the diagnostic yield is low and findings often do not change management. Nevertheless, it could be considered if his symptoms are refractory and a specific etiology remains undetermined.

Acute and convalescent viral antibody titers also may be considered in cases of acute myocarditis. These are not ordered routinely, however, as serologic interpretation may be difficult and the results often do not influence management decisions.

The patient is started on NSAIDs and colchicine for possible viral perimyocarditis. In addition, broad-spectrum antibiotics are initiated and infectious disease consultation is ob-

tained. Blood and urine cultures show no growth. Throat culture and anti-streptolysin O antibody titers are negative. HIV ELISA, HIV viral load testing, and monospot testing are all negative. CMV IgG antibody returns positive, but IgM antibody is within normal limits. Viral titers for coxsackie, hepatitis, and parvovirus also return negative. Rocky Mountain Spotted Fever antibody titers are normal as well.

The negative blood cultures are reassuring that the patient does not have endocarditis, and empiric antibiotics can be stopped unless another source of bacterial infection is suspected. Acute rheumatic fever also is unlikely at this point. His CMV serologies are consistent with past exposure. A viral etiology remains possible, but his normal viral antibody titers may suggest another underlying cause.

NSAIDs and colchicine are the treatment of choice for viral pericarditis. Their use in acute myocarditis, however, is not as well established. In fact, animal models have shown that NSAIDs are not effective and may actually enhance the myocarditic process and thereby worsen mortality. Oral corticosteroids should be avoided if possible as their use has been shown to increase the risk of recurrence in patients with undifferentiated pericarditis.

The patient's fever and hemodynamic instability resolve with ongoing supportive care. His symptoms of chest pain and myalgias improve, and his troponin values normalize. Repeat echocardiogram one week later shows significant left ventricular improvement with an ejection fraction of 55%. The patient is discharged with a presumed diagnosis of viral myocarditis.

Three days later, however, the patient returns to the emergency de-

partment with persistent intermittent fevers to 103° F, pleuritic chest discomfort, and worsening arthralgias. Repeat laboratory testing demonstrates a persistently elevated WBC count of 24.6 k/uL and a sedimentation rate >140 mm/hr. Cardiac enzymes remain normal. Liver function tests reveal an elevation of alkaline phosphatase 197 IU/L, ALT 232 IU/L, and AST 144 IU/L.

Physical exam now reveals a maculopapular rash on his right flank along with tenderness at his left shoulder, right knee, and bilateral wrists with no obvious joint deformities.

The patient has persistent fever and worsening polyarthralgia. In addition, he now has abnormal transaminases and a localized maculopapular rash. The differential is broad and includes collagen vascular diseases such as systemic lupus erythematosus, rheumatoid arthritis, or cryoglobulinemia. Hence, ANA, rheumatoid factor, cryoglobulin, and acute hepatitis testing should be strongly considered. Endocarditis, acute rheumatic fever, and rickettsial disease remain consistent with this presentation but are unlikely given prior laboratory results. Extra-intestinal complications of inflammatory bowel disease should be considered, but this diagnosis is unlikely in the absence of GI symptoms. A reactive arthritis or seronegative spondyloarthropathy are possible as well.

At this point, however, his clinical presentation is most suspicious for adult Still's disease. This condition classically is associated with an evanescent, salmon-colored maculopapular rash. It most commonly presents in a young adult male with unexplained fever, polyarthralgia, lymphadenopathy, elevated LFTs, and antecedent pharyngitis. Adult Still's disease is characterized by a marked

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elevation in serum ferritin level. Often, high dose oral corticosteroids are effective at improving symptoms. Adult Still's disease typically is not associated with acute myocarditis, but a few cases have been reported in the literature.

ANA, rheumatoid factor, cryoglobulin, and acute hepatitis testing are negative. Serum ferritin level returns markedly elevated at 6340 ng/mL. The patient is diagnosed with adult Still's disease and is started on 80 mg of oral prednisone daily with rapid improvement in his symptoms.

Learning Points

- Acute myocarditis often mimics acute myocardial infarction by presenting with chest pain, ST-segment elevation, and marked elevation of cardiac biomarkers.
- Adult Still's disease classically presents with a maculopapular rash, unexplained fever, leukocytosis, polyarthralgia, lymphadenopathy, elevated liver function tests, and antecedent pharyngitis.
- Adult Still's disease is characterized by a marked

elevation in serum ferritin level and usually responds to high-dose oral corticosteroids.

- Acute myocarditis is a rare complication of adult Still's disease.

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