ABSTRACT
Chest pain visits to the Emergency Department among the young adult population are rarely caused by cardiac etiologies. This case focuses on a 19-year-old man who developed an inferior ST-segment elevation myocardial infarction as a result of a previously undetected large atrial septal defect. This cardiac anomaly facilitated the transport of a paradoxical embolism that occluded the right coronary artery. This rare case highlights the importance of a thorough evaluation to rule out cardiac-related chest pain in young adults, despite the low incidence in this population.

INTRODUCTION
Coronary artery disease (CAD) remains the number one cause of death in the US, and chest pain is one of the most common reasons patients go to the Emergency Department (ED) for medical care. The vast majority of chest pain evaluations occur in the adult population; however, chest pain visits among young adults (younger than age 35 years) are not uncommon. The leading causes of chest pain among teens and young adults are idiopathic, musculoskeletal, pulmonary, gastrointestinal, anxiety, and drug-related in origin. Although cardiac-related chest pain is uncommon and rarely caused by myocardial infarction (MI) in this age group, identifying high-risk individuals during their ED visits is critical.

CASE REPORT
A 19-year-old man presented to the ED with 3 hours of constant chest pressure. He described the pain as 8 out of 10 on the pain scale, located in the substernal area and radiating throughout his entire chest. The pain started suddenly at rest and he denied any associated symptoms. The patient did not use tobacco but admitted to occasionally smoking marijuana. He also denied other drug use, including cocaine or methamphetamines. There was no associated trauma. According to the patient, he had had a cardiac murmur since he was a child, but it was never fully evaluated.

On physical examination, vital signs were stable with a temperature of 36.4°C, blood pressure 128/74 mm Hg, pulse 58 beats/min, respiratory rate 18 breaths/min, and pulse oximetry 98% on room air. The patient appeared moderately distressed. His cardiovascular examination revealed a regular rhythm and a 2/6 systolic murmur. Pulmonary examination demonstrated clear breath sounds bilaterally. The rest of his examination, chest radiograph, and laboratory results (including complete blood count, chemistries, and troponin) were unremarkable.

Initial electrocardiogram (ECG) showed sinus bradycardia at 52 beats/min and 5 mm ST-segment elevations in leads II, III, and aVF with reciprocal ST-segment depressions in V1-V2 (Figure 1). This ECG was consistent with an ST-segment elevation MI, and he was immediately given an aspirin, nitroglycerin, and morphine for his pain. A heparin bolus was given and the patient was transferred for emergent cardiac catheterization.

Upon initial fluoroscopy of the cardiac silhouette, the right ventricle appeared enlarged. Coronary angiography revealed complete occlusion of the two terminal branches of the right coronary artery. There were dual posterior descending artery branches, both having evidence of clot and abrupt closure (Figure 2). The patient was then given a bolus and infusion of eptifibatide. Coronary angioplasty, stenting, and aspiration thrombectomy were considered but, owing to the small caliber and the very distal location of the occluded arteries, these therapies were felt to carry more risk than benefit.

Jonathan Kei, MD, MPH, is an Emergency Physician at the San Diego Medical Center in CA. E-mail: jonathankei@kaiser-ed.com. Jennifer Kiss Avilla, MD, is an Emergency Physician at the San Diego Medical Center in CA. E-mail: jenniferpkiss@yahoo.com. Jeffrey J Cavendish, MD, is a Cardiologist at the San Diego Medical Center in CA. E-mail: jeffrey.j.cavendish@kp.org.
CASE REPORTS

Rare Case of Myocardial Infarction in a 19-Year-Old Caused by a Paradoxical Coronary Artery Embolism

After cardiac catheterization, a trans-thoracic echocardiogram revealed a large secundum atrial septal defect (ASD) measuring 2.9 cm with bidirectional shunting (Figure 3). The initial cardiac markers, including troponin, were normal. Serial cardiac markers showed a peak creatine kinase of 1521 IU/L and peak myoglobin of 32.5 ng/mL. The patient was monitored over the next 48 hours with no dysrhythmias noted. Aspirin 81 mg daily, metoprolol 25 mg twice daily, and warfarin were initiated. The patient was discharged on hospital day 3 with a referral to cardiothoracic surgery, as the nature and size of the ASD was not amenable to percutaneous repair. Six weeks after MI, the patient underwent uneventful surgical repair of his ASD (Figure 4) and recovered with no additional sequelae.

DISCUSSION

Coronary artery embolism has been shown to cause acute MI in the setting of an existing ASD, tissue or mechanical valve replacement, and atrial fibrillation.4-7 Congenital defects of the atrial septum are common and account for approximately 7% of all congenital heart disorders.8 Most ASDs less than 6 mm in diameter close spontaneously and rarely require surgical correction.9 The patient in this case had a known cardiac murmur but it had never been fully evaluated. It was not until after the MI that the ASD was discovered on echocardiography. Like many individuals with ASDs, this patient was asymptomatic for years. As a result, the MI was the first time he became aware of his cardiac defect. Studies show that transthoracic and even more sensitive transesophageal echocardiography can be used quite effectively to diagnose cardiac sources of embolization.10
On presentation to the ED, the patient had a clearly abnormal ECG with ST-segment elevations in multiple contiguous leads. Although musculoskeletal, psychological, and other noncardiac etiologies are often attributed to chest pain in the teen population, it is critical that emergency physicians consider cardiac causes in these patients. This case report reinforces the common practice of performing ECGs on all patients with chest pain regardless of their age.

One of the main challenges in the recognition of cardiovascular-related chest pain is the age-related differences in the pediatric and young adult population compared with adults. When one is evaluating chest pain in young patients, their risk factors, clinical presentations, and prognoses can vary from those of the typical older patients who present with the same chief complaints.12-14 MI in young patients (younger than age 35 years), although rare, has been described in the literature. Cases of atherosclerotic MI occur predominantly in men, and important risk factors include smoking, positive family history of MI, hypertension, and familial hyperlipidemia.15 Nonatherosclerotic etiologies, such as drug-induced coronary artery spasm, can cause MI in young patients with cocaine being the most common culprit.16 Unlike the previous examples that occur predominantly in males, spontaneous coronary artery dissection is a very rare cause of acute coronary syndrome in young otherwise healthy patients, with a striking predilection for the female sex. 17 Coronary embolism, coronary vasospasm, Takotsubo cardiomyopathy, hypercoagulable states, trauma, arterial inflammatory (autoimmune) conditions, and very rarely myocarditis can all produce ECG findings that mimic acute MI.

Detailed history taking and comprehensive physical examinations may help elucidate a cardiac cause for chest pain in young adults. In these patients where cardiopulmonary-related causes are on the differential, an ECG should be performed at a minimum and chest radiographs may be useful. Studies looking at the most effective way to evaluate chest pain in young adults and pediatric patients suggest that a careful history, physical examination, screening ECGs, and targeted echocardiograms are the best way to identify serious causes of chest pain and can reduce the number of unnecessary studies.18 The cardiac murmur heard on the initial physical examination was a very important physical finding. In the setting of acute chest pain in a young patient with a new or undocumented murmur, an ECG should be obtained. Although this case highlights the importance of always ruling out cardiac chest pain in young patients and teens, no matter how uncommon it may be in this population, it is just as important to pay careful attention to the details of routine examinations. If the murmur in this patient had been picked up earlier by his primary physician and if he had been further evaluated with an ECG, this case of MI might have been avoided.

CONCLUSION
This case describes the rare event of an ST-segment elevation MI in a 19-year-old man who presented to an ED. Although MI-related chest pain is rare in the young adult population, it must always be considered because it has the potential for poor outcomes if not promptly recognized. 

Disclosure Statement
The author(s) have no conflicts of interest to disclose.

Acknowledgment
Mary Corrado, ELS, provided editorial assistance.

References