The use of point-of-care ultrasound to diagnose infective endocarditis causing an NSTEMI in a patient with chest pain

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[Correction added on 11 February 2020, after first online publication: Jeff Greco is added as the second author to this article, and author order has been corrected.]

Abstract
Infective endocarditis is a severe condition that requires rapid identification and treatment. Early diagnosis is often difficult due to diverse and often vague presenting symptoms. One uncommon complication is acute coronary syndrome that can be secondary to dissemination of septic emboli. Although rare, this coronary complication is life threatening and associated with increased mortality. Point-of-care ultrasound (POCUS) is a useful diagnostic modality in patients with suspected endocarditis because it can attempt to identify vegetations and evidence of cardiac ischemia by identifying regional wall motion abnormalities. The following case demonstrates a patient with infective endocarditis causing a non-ST elevation myocardial infarction diagnosed in the emergency department using POCUS.

KEYWORDS
endocarditis, NSTEMI, POCUS

1 INTRODUCTION
With an annual incidence of approximately 2%, infective endocarditis (IE) is a potentially lethal yet rare condition that requires rapid diagnosis and early treatment. The high morbidity and mortality rate makes it an essential diagnosis for emergency providers to consider.1 This diagnosis is often challenging for emergency provider due to the diverse and nonspecific nature of presenting symptoms. The most common symptom of IE is fever, which is seen in approximately 90% of patients. Other signs and symptoms include the presence of a heart murmur, skin findings of peripheral emboli, and evidence of a systemic infection. Another less commonly associated condition attributed to endocarditis is acute coronary syndrome (ACS).2 Although rare, this known coronary complication is known to cause significant morbidity and mortality.

Point-of-care ultrasound (POCUS) is a useful diagnostic modality as it can attempt to identify both vegetations and evidence of cardiac ischemia. Emergency provider-performed bedside echocardiography is a well-validated clinical tool for evaluating pathologic processes within the emergency department (ED). Emergency provider-performed cardiac POCUS has already been established for detecting pericardial effusions, estimating cardiac contractility, and detecting right ventricular dilation.3 More recently, the use of cardiac POCUS has expanded to evaluating regional wall motion abnormalities to identify evidence of myocardial ischemia.4

2 CASE REPORT
A 61-year-old female with a medical history of hypertension, gallstones, breast cancer, currently in remission, as well as a bicuspid aortic valve with previous bioprosthetic valve repair presented to an outside hospital for epigastric pain associated with nausea, vomiting, and back pain. The patient was previously admitted for biliary colic
and was scheduled for an outpatient hepatobiliary nuclear medicine scan. The patient began having worsening back pain with associated vomiting and therefore went back to the outside ED. There, her initial electrocardiogram (EKG) showed a reportedly new left bundle branch block. Blood work revealed an elevated creatinine kinase of 734 U/L, creatinine kinase muscle/brain of 132.6 ng/mL, and troponin I of 0.5 ng/mL. The patient was given 1000 mL of normal saline, 325 mg of aspirin, 2 mg of Dilaudid, and transferred for concern for non-ST elevation myocardial infarct versus biliary disease. She denied any recent dental procedures, fevers, or shortness of breath. In our ED, the patient was ill-appearing and hemodynamically unstable, with a blood pressure of 93/74 mmHg and heart rate of 84 beats/min. She was tachypneic with a respiratory rate of 24 breaths/min and hypoxic with an oxygen saturation of 89% on room air. The patient was afebrile. Upon arrival, a POCUS was performed to further evaluate the patient. POCUS showed evidence of moderate reduction in the cardiac contractility with akinesis of the anterior and septal walls as well as diffuse B lines, which in this clinical context were thought to indicate pulmonary edema. On the parasternal long view and apical four chamber view, an irregularly shaped mobile echogenicity was visualized on the aortic valve, concerning for a possible valvular vegetation (Figures 1 and 2).

Both cardiology and cardiothoracic surgery were consulted for concern of possible endocarditis. The patient was started on vancomycin and ceftriaxone after three sets of blood cultures were obtained. During the patient’s course within the ED, the patient had transient episodes of tachycardia, during which she complained of epigastric and back discomfort. During these episodes, her EKG revealed wide complex tachycardia (Figure 3); however, when the pain resolved, the morphology reverted to a normal sinus rhythm (Figure 4).

The cardiologist performed a comprehensive transthoracic echocardiogram that re-demonstrated a vegetation on the aortic valve, as well as a thickened aortic root suspicious for abscess. The patient was admitted to the cardiac intensive care unit for further management of prosthetic valve endocarditis and ongoing ischemia. There, a transesophageal echocardiogram showed multiple vegetations, the largest measuring 1.7 x 1.0 cm to the bioprosthetic aortic valve as well as an abscess cavity. Additionally, there was moderate-to-severe left segmental ventricular systolic dysfunction with akinesis of the septum and anterior walls of the left ventricle. The left-sided cardiac catheterization revealed a 95% occlusion of the left anterior descending artery due to septic emboli. The patient was seen by infectious disease who recommended continuing ceftriaxone 2 g/d and vancomycin for antibiotic therapy pending sensitivities. The four sets of blood cultures all grew Streptococcus mitis/oralis. While in the cardiac care unit, the
patient became hypotensive and went into cardiogenic shock requiring norepinephrine for blood pressure support. She remained awake and alert throughout her stay in the cardiac care unit. The patient was then transferred to an outside hospital for definitive surgical repair. The patient required an aortic valve replacement, coronary artery bypass graft surgery, ventricular septal defect closure, and aortic root repair. She had a complex post-operative course. Post-operatively, she developed atrial fibrillation requiring amiodarone and eventual pace-maker/automatic implantable cardioverter defibrillator placement. Her course was further complicated by infection with Pseudomonas pneumonia requiring treatment with additional ciprofloxacin. She also required chest tube placement for drainage of a left pleural effusion. She was eventually discharged on ceftriaxone through a peripherally inserted central catheter 14 days after her admission.

This case describes a patient with an atypical presentation of ACS secondary to septic emboli from an aortic valve vegetation and concurrent IE. POCUS was essential in making a rapid diagnosis for this patient, who was initially transferred from an outside ED for further workup of biliary colic versus ACS.

3 | DISCUSSION

IE is a rare disease that is often difficult to diagnose. Delay in diagnoses has been associated with increased rates of complication and worse clinical outcomes. Currently, the gold standard for diagnosis of endocarditis is with a transesophageal echocardiogram (TEE). However, this diagnostic modality is not often available in most EDs. Point-of-care transthoracic echocardiograms (TTE) represent an alternative to expedite diagnosis and are easily accessible in most EDs. Although the sensitivity of TTE is reported between 50% and 70%, with larger vegetations that are greater than 10 mm, the sensitivity increases to 80%. Even though sensitivities may vary, TTE is still the initial diagnostic modality because it is less invasive than TEE and can still provide valuable additional information. On TTE, the classic ultrasonographic appearance of a vegetation is an irregularly shaped mobile structure that is typically located upstream of the valve. Sonographic findings of IE are dependent on the location of vegetation but can include evidence of pulmonary hypertension, premature mitral valve closure, evidence of diastolic dysfunction, and valvular regurgitation. Visualization of vegetation is diagnostic for IE. Although obtaining the cardiac windows necessary to visualize a vegetation may be challenging in certain patient populations, if seen, it can expedite the diagnostic workup.

In this case, the patient was transferred due to concern for cardiac ischemia with the development of a new left bundle branch block on EKG, elevated initial troponin, and a chief complaint of back pain. POCUS showed both an aortic valve vegetation concerning for endocarditis and wall motion abnormalities concerning for myocardial ischemia, which is a potential complication of endocarditis. Although rare, ACS from endocarditis is primarily due to intra-coronary septic emboli causing acute ischemia to the myocardium. Other known causes are secondary to compression of the coronary arteries by periannular complications including the development of worsening abscesses and pseudoaneurysm. The most common valvular vegetation responsible for ACS is the aortic valve. Even though ACS is an uncommon complication of IE, with incidence rates between 2.9% and 10.6%, it is associated with increased mortality rates and complicated hospital stays with high morbidity. Early diagnosis and prompt recognition of acute coronary syndrome secondary to IE is critical for emergency providers, because these patients require aggressive resuscitation and early cardiothoracic involvement. An indicator of the severity of the disease is an elevated troponin. A previous study demonstrated that an elevated troponin T was an independent predictor of mortality in these patients. It most commonly occurs in the acute phase of the disease and is associated with virulent organisms. POCUS can aid emergency physicians in rapidly identifying patients with cardiac ischemia by visualizing regional wall motion abnormalities. These abnormalities are described by visualizing a segment of contracting myocardium that is either akinetic or hypokinetic compared to the remaining cardiac chamber. Hypokinesis or akinesis of wall segment can be due to a number of different etiologies including active cardiac ischemia, coronary thrombus, a previous coronary scar, or prior infarct. Previous studies have shown that the presence of a regional wall motion abnormality indicates a high risk for myocardial ischemia and therefore needs to be evaluated urgently. Previous studies have shown the use and ability of emergency provider-performed echocardiography to identify wall motion abnormalities to identify patients at risk for coronary ischemia.

4 | CONCLUSION

IE still remains a challenging diagnosis for emergency providers due to its heterogeneous clinical presentations and physical examination findings. Delay in diagnosis can lead to increased morbidity and mortality. POCUS is an accessible tool within EDs and can be useful in expediting this challenging diagnosis. Visualization of a valvular vegetation at the bedside can facilitate antibiotic therapy and consultation with treating consultants. Emergency providers should consider performing early point of care transthoracic echocardiography in patients where endocarditis is in the differential to expedite and improve patient care.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to disclose.

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