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Cardiac Point-of-Care Ultrasound for the Diagnosis of Infective Endocarditis in a Patient with Non-Specific Rheumatologic Symptoms and Glomerulonephritis

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Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
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Patient: Male, 57
Final Diagnosis: Infective endocarditis
Symptoms: Dyspnea on exertion • fatigue • rash • weight loss
Medication: —
Clinical Procedure: Point-of-care ultrasound
Specialty: General and Internal Medicine

Objective: Mistake in diagnosis
Background: Point-of-care ultrasound (POCUS) is performed at the bedside by a healthcare professional who is directly caring for the patient. Subacute infective endocarditis can be challenging to diagnose, as patients often present with non-specific symptoms. The modified Duke criteria include echocardiographic findings as a major criterion, but the role of POCUS has not been established. This report is of a case of infective endocarditis diagnosed using POCUS.

Case Report: A 57-year-old man was admitted to hospital with a presumptive diagnosis of rapidly progressive glomerulonephritis secondary to vasculitis associated with a non-specific rheumatologic condition that had developed during the previous three months. Several specialist physicians had previously examined him. On hospital admission, POCUS was performed by the internal medicine physician, which showed mitral valve endocarditis resulting in a change in clinical management from steroid therapy to antibiotic therapy. Blood cultures were performed, which grew *Streptococcus mutans*.

Conclusions: To our knowledge, this is the first reported case of infective endocarditis diagnosed by an internist using POCUS in a patient admitted to hospital with an alternative diagnosis and management plan in place. This case highlights the potential role of POCUS in the acute hospital setting and supports the need for studies to compare the diagnostic performance of POCUS with transthoracic echocardiography for the detection of valvular vegetations. POCUS may be considered for patients with a possible diagnosis of infective endocarditis that cannot be excluded using the modified Duke criteria, potentially resulting in earlier diagnosis and management, with an improved clinical outcome.

MeSH Keywords: Early Diagnosis • Echocardiography • Endocarditis • Internal Medicine • Point-of-Care Systems • Ultrasonography

Full-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/914708>

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Background

Point-of-care ultrasound (POCUS) is performed at the bedside by a healthcare professional who is directly caring for the patient. Subacute infective endocarditis can be challenging to diagnose, as patients often present with non-specific symptoms [1]. The modified Duke criteria include echocardiographic findings as a major criterion, but the role of POCUS has not been established [2]. The emergence of POCUS use by internal medicine clinicians has allowed real-time integration of additional diagnostic information with routine history and physical examination, but the potential role for POCUS to accelerate diagnosis and management in patients with infective endocarditis remains unknown [3]. This report is of a case of infective endocarditis diagnosed using cardiac POCUS.

Case Report

A 57-year-old man was referred to the Emergency Department by a nephrologist with a diagnosis of acute kidney injury associated with a three-month history of symptoms that included progressive dyspnea on exertion, fatigue, rash, and weight loss. He had initially presented to his primary care physician with a cough. At that time, a chest X-ray was unremarkable, and a proton pump inhibitor had been prescribed, resulting

in a partial improvement in his symptoms. Over the next few weeks, he developed dyspnea on exertion, fatigue, and weight loss. Laboratory investigations showed mild anemia and elevated C-reactive protein (CRP) and rheumatoid factor (RF) (Table 1). The patient had a past medical history of malignant melanoma of the left foot that had been resected. For this reason, a positron emission tomography-computed tomography (PET-CT) scan was undertaken, which was unremarkable.

Seven weeks before hospital admission, a cardiology referral was made as the patient continued to complain of dyspnea on exertion. A grade III/VI systolic murmur was noted. Transthoracic echocardiography showed mild to moderate mitral valve regurgitation with moderate prolapse of the anterior mitral valve leaflet but was otherwise normal. A nuclear stress test was normal. Given the elevated CRP and RF, and without a clear cardiac etiology for his symptoms, the cardiologist referred the patient to a rheumatologist, who saw him three weeks before his hospital admission. The patient reported worsening symptoms and a new lower extremity petechial rash. Laboratory investigations showed an elevated erythrocyte sedimentation rate (ESR) and increasing CRP and RF (Table 1). A skin biopsy performed by a dermatologist demonstrated perivascular and interstitial neutrophilic infiltrates compatible with a diagnosis of suppurative folliculitis. The rheumatologist prescribed prednisone 30 mg daily for a non-specific rheumatologic condition,

Table 1. Summary of laboratory investigations.

Laboratory test	February 1 st	March 6 th	March 29 th	March 31 st	Reference range
WBCs (10 ³ cells/mcL)	9.0	8.1	14.1	13.3	3.8–10.8
Hemoglobin (g/dL)	11.4	8.9	8.2	8.5	13.2–17.1
Platelets (10 ³ cells/mcL)	151	189	159	138	140–400
Neutrophils (%)	89.9	87.6	96.7	96.1	38–80
Creatinine (mg/dL)	0.89	1.02	3.20	3.43	0.70–1.33
BUN (mg/dL)	20	17	65	77	7–25
CRP (mg/dL)	4.1	8.2	–	8.2	<0.8
ESR (mm/h)	–	65	–	26	≤20
Ferritin (ng/mL)	572	–	–	487	20–380
RF (IU/mL)	15	23	–	27	<14
C3 (mg/dL)	–	118	–	75	90–180
C4 (mg/dL)	–	25	–	15	10–40
Urine RBCs (cells/hpf)	–	3–10	41–60	>50	≤2
Urine Protein/Cr (mg/g)	–	486	968	–	22–128
BNP (pg/mL)	–	–	–	670	≤100

WBCs – white blood cells; BUN – blood urea nitrogen; CRP – C-reactive protein; ESR – erythrocyte sedimentation rate; RF – rheumatoid factor; RBCs – red blood cells; Cr – creatinine; BNP – B-type natriuretic peptide.

Figure 1. Point-of-care ultrasound (POCUS) cardiac imaging (parasternal long-axis view). Point-of-care ultrasound (POCUS) imaging shows thickening of the mitral valve leaflets with a valve vegetation, seen on the parasternal long-axis view. LV – left ventricle; RV – right ventricle; Ao – aorta; LA – left atrium; MV – mitral valve.

Figure 2. Point-of-care ultrasound (POCUS) cardiac imaging (parasternal short-axis view). Point-of-care ultrasound (POCUS) imaging shows thickening of the mitral valve leaflets with a valve vegetation, seen on the parasternal short-axis view. RV – right ventricle; LV – left ventricle; MV – mitral valve.

which resulted in some symptomatic improvement and weight gain, but the patient did not tolerate an attempt to taper the steroid dose. The rheumatologist referred the patient to a pulmonologist for further evaluation of the symptoms of dyspnea on exertion, and to a nephrologist following detection of proteinuria and microscopic hematuria (Table 1).

Three days prior to the patient's hospital admission, pulmonary function tests showed mild restriction. The following day, the patient underwent initial nephrology evaluation. Repeat laboratory investigations showed worsening proteinuria and microscopic hematuria, and a newly elevated creatinine level of 3.20 mg/dL from a baseline of 0.89–1.02 mg/dL (Table 1), which prompted referral to the Emergency Department.

On arrival in the Emergency Department, the patient continued to complain of dyspnea on exertion and fatigue. Review of systems was otherwise negative. The patient's initial vital signs included a blood pressure of 155/75. He was afebrile and appeared comfortable. Cardiopulmonary examination was notable for crackles at both lung bases and a grade III/VI apical systolic murmur that radiated to the left axilla. Non-blanching petechiae were present over the bilateral lower extremities and torso. The results of the laboratory investigations on admission are summarized in Table 1. Given the findings of hypertension, acute kidney injury, microscopic hematuria, and a low C3 level, the patient was diagnosed with rapidly progressive glomerulonephritis, secondary to vasculitis, and treatment was begun with intravenous methylprednisolone 1000 mg daily. Because the patient had been admitted to hospital on a Friday afternoon, a renal biopsy was planned for the following Monday. Given the findings on cardiopulmonary examination, a transthoracic echocardiogram was also arranged for the following

Figure 3. Point-of-care ultrasound (POCUS) cardiac imaging (apical four-chamber view). Point-of-care ultrasound (POCUS) imaging shows thickening of the mitral valve leaflets with a valve vegetation, seen on the apical four-chamber view. RV – right ventricle; LV – left ventricle; MV – mitral valve; LA – left atrium; RA – right atrium.

Monday, as non-emergency echocardiograms were unavailable at the weekend.

However, the following morning, the medical team performed a cardiac point-of-care ultrasound (POCUS) (Figures 1–3, Videos 1–3). Imaging showed that left ventricular systolic function appeared normal. However, the mitral valve had markedly thickened leaflets, prolapse, and moderate to severe mitral valve regurgitation. The left atrium was enlarged. The inferior vena cava was dilated with reduced respiratory variation. These findings raised the clinical suspicion for infective endocarditis and heart failure due to valvular insufficiency.

Video 1. Video of the point-of-care ultrasound (POCUS) shows thickening of the mitral valve leaflets and a vegetation seen on the parasternal long-axis view.

Video 2. Video of the point-of-care ultrasound (POCUS) shows thickening of the mitral valve leaflets and a vegetation seen on the parasternal short-axis view.

Video 3. Video of the point-of-care ultrasound (POCUS) shows thickening of the mitral valve leaflets and a vegetation seen on the apical four-chamber view.

Blood samples were sent for culture and the patient was treated with intravenous furosemide. An urgent cardiology consultation was requested and a transthoracic echocardiogram was performed on the same day, which showed thickening of both mitral valve leaflets and a vegetation on the posterior

leaflet. Blood cultures were positive for *Streptococcus mutans*. Treatment with intravenous ceftriaxone was commenced and steroids were rapidly tapered. Infectious disease and cardiothoracic surgery services were consulted.

Following antibiotic treatment, the patient's creatinine slowly improved and his pulmonary edema responded to diuretic treatment. Brain magnetic resonance imaging (MRI), obtained due to transient altered mental status, showed two subacute strokes with petechial hemorrhage and a small subarachnoid hemorrhage. Transesophageal echocardiography demonstrated mitral valve vegetations with rupture of the chordae tendinae. There was 4+ mitral regurgitation and 1–2+ aortic regurgitation, and a Lambl's excrescence was seen on the aortic valve. Early surgical intervention was discussed, but the consensus was to delay surgery due to the patient's high perioperative risk associated with recent cerebral hemorrhage.

On hospital day 10, the patient developed an acute stroke involving the territory of the right middle cerebral artery, resulting in severe neurological deficit with a National Institutes of Health Stroke Scale (NIHSS) score of 18 (moderate to severe stroke). A successful embolectomy was performed, resulting in a return to normal baseline function with an NIHSS score of 0. His antibiotic was switched to intravenous penicillin. On hospital day 14, he underwent a successful bioprosthetic mitral valve replacement and debridement of a 5 mm excrescence on the aortic valve. Histopathology of the mitral valve demonstrated fibrosis, extensive acute and chronic inflammation, and necrosis. Gram's stain showed numerous Gram-positive cocci in pairs and short chains. The aortic valve lesion that was initially interpreted as a Lambl's excrescence also demonstrated necrosis, inflammation, and Gram-positive cocci.

The patient had a good postoperative course. On hospital day 25, he was discharged to an acute rehabilitation center with a plan to complete four weeks of intravenous penicillin from the date of surgery. His creatinine had decreased to 1.2 mg/dL.

Discussion

Infective endocarditis was first described in the 16th century and typically has presented as a subacute illness that is associated with an abnormal valve, often following rheumatic heart disease [4]. Recently, with the increasing use of cardiac and intravascular prosthetic materials, there has been a shift to a more acute presentation, with an increased association with *Staphylococcus aureus* as the predominant causative organism [4]. Therefore, the previously described classic presentation of infective endocarditis has become less common, making the diagnosis even more difficult [4]. This case report has highlighted that the diagnosis of subacute infective

endocarditis can be challenging, as the patient required several specialist evaluations prior to diagnosis.

The current American Heart Association (AHA) guidelines emphasize the use of the modified Duke criteria, which include echocardiographic findings as a major criterion, for the diagnosis of infective endocarditis [2]. Transthoracic echocardiography is recommended in all cases of suspected infective endocarditis, since it is often more readily available than transesophageal echocardiography, although it is diagnostically less sensitive [2].

Recently, point-of-care ultrasound (POCUS) has become increasingly used in diagnosis across multiple specialties [5,6]. Evidence from several published studies has supported that cardiac POCUS improves the diagnostic accuracy of physical examination, which has resulted in some cardiologists recommending routine integration of POCUS into the physical examination [3,7]. Also, POCUS performed by healthcare professionals has been shown to be highly accurate diagnostically when compared with transthoracic echocardiography [8]. However, to our knowledge, there have been no published studies that have compared POCUS with transthoracic echocardiography for the diagnosis of infective endocarditis, and it is possible that cardiac POCUS would be no more limited diagnostically than standard transthoracic echocardiography [9].

In several previously reported cases, cardiac POCUS has raised concern for infective endocarditis, but in all but one of these cases, POCUS was performed in the Emergency Department [10–19]. Common to all cases was that the finding of a vegetation on POCUS raised suspicion of a diagnosis of infective endocarditis and accelerated the most appropriate patient management. To the best of our knowledge, the case described in the present report is unique because it is the first case reported where cardiac POCUS was performed on the internal medicine ward in a patient admitted to hospital with an alternative diagnosis and management plan in place. Specifically, use of POCUS in this case changed the diagnosis and management plan from rapidly progressive glomerulonephritis that was treated with pulsed steroid therapy to infective endocarditis that was treated with appropriate antibiotics.

For patients admitted to an internal medicine service in our hospital, the time from the request for a transthoracic echocardiogram to when the test is completed might take up to several days. On evenings and weekends, only emergency transthoracic echocardiography is available by consulting the on-call cardiology fellow. Therefore, the potential for cardiac POCUS to have a major impact on patient management and outcome by facilitating earlier diagnosis of infective endocarditis is worth considering. Transthoracic echocardiography has increased diagnostic sensitivity to detect larger valvular vegetations than smaller ones, and it would be reasonable to believe that the same would apply to cardiac POCUS [20,21]. Larger vegetations are associated with an increased risk of embolic events and increased patient mortality [22]. Also, embolic events, including stroke, are the most common complication associated with infective endocarditis, and early surgery, within 48 hours, has been shown to reduce embolic events in patients with large vegetations and severe valvular disease [4,23]. Therefore, cardiac POCUS performed by the internal medicine physician may hold promise as a high-impact diagnostic method to detect the most dangerous vegetations earlier in a patient's course, allowing for prompt initiation of appropriate management, and accordingly, has the potential to prevent serious embolic events.

Conclusions

In a case of subacute infective endocarditis presenting as a non-specific rheumatologic condition with rapidly progressive glomerulonephritis, cardiac point-of-care ultrasound (POCUS) performed by the internal medicine physician after admission to the general medicine ward altered patient management, leading to more prompt diagnosis and treatment of *Streptococcus mutans* endocarditis. The use of cardiac POCUS in patients presenting with non-specific symptoms, and in whom infective endocarditis cannot be excluded by the modified Duke criteria, has the potential to have a major impact by accelerating appropriate care and reducing morbidity from embolic events.

Conflict of interest

None.

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