Role of POCUS in Suspected Aortic Dissection in the Emergency Department: A Case Report

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ABSTRACT

Background: Aortic dissection is a life-threatening condition that requires timely diagnosis and intervention. However, its variable presentation often leads to delayed recognition in the emergency department (ED). Point-of-care ultrasound (POCUS), when performed by a nurse practitioner, can serve as a valuable bedside tool for the rapid assessment of patients with suspected aortic dissection, particularly in cases with atypical presentations.

Case Presentation: We describe the case of a 91-year-old male presenting to the ED for syncope. Initial assessment was challenging due to the patient's altered mental status and atypical presentation. POCUS, performed during the initial clinical evaluation, revealed a dilated aortic root and an intimal flap, raising suspicion for an acute aortic dissection. This prompted urgent confirmatory imaging with computed tomography angiography (CTA), which confirmed a Stanford Type A aortic dissection extending into the great vessels.

Discussion: This case highlights the role of POCUS in the early detection of aortic dissection, particularly when clinical presentation is nonspecific. While CTA remains the gold standard for diagnosis, POCUS offers a rapid, non-invasive means of identifying key findings such as aortic dilation, pericardial effusion and intimal flaps, facilitating early decision-making in critical patients.

Conclusion: POCUS is a valuable adjunct in the evaluation of suspected aortic dissection, allowing for timely diagnosis and intervention. Increased awareness and training in its application may enhance ED clinicians' ability to recognize and manage this life-threatening condition more effectively.

Keywords: Aortic Dissection, Point-of-Care Ultrasound, Emergency Department, Case Report, Nurse practitioner.

Introduction

Aortic dissection is a time-sensitive medical emergency caused by an intimal tear in the aorta, allowing blood to enter the media and form a false lumen. This can result in fatal complications such as rupture, tamponade, or malperfusion. Diagnosis in the emergency department (ED) is challenging due to its variable presentation, often mimicking myocardial infarction, pulmonary embolism, or stroke.[1] Classic signs like tearing pain or pulse deficits are frequently absent. While computed tomography angiography is the diagnostic gold standard, point-of-care ultrasound (POCUS) can aid early diagnosis, especially in unstable patients.[2]

Case Presentation

A 91-year-old man was brought to the emergency department (ED) by ambulance for syncope. On arrival, he was hemodynamically stable and placed on a cardiac monitor.

Patient Description

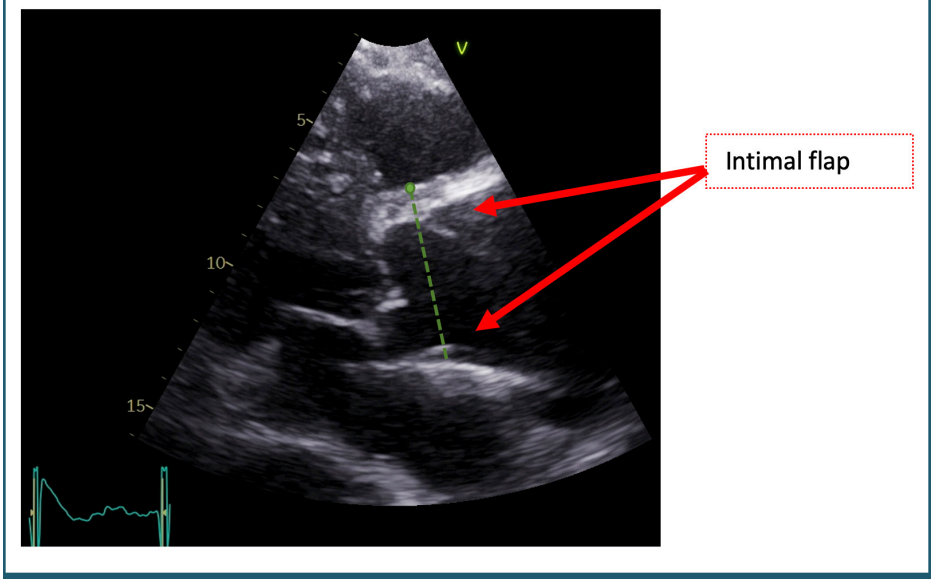
The patient was an active, functionally independent 91-year-old man who continued to work part-time. According to his most recent cardiology follow-up two weeks earlier, he was in good functional health. At the time of ED arrival, he was unaccompanied, with no family at the bedside.

Case History

Past medical history included atrial fibrillation, hypertension, asthma, pericarditis, and a moderate aortic aneurysm.

Current medications:

- Aspirin 81 mg once daily
- Bisoprolol 1.25 mg po once daily
- Apixaban 2.5 mg po BID
- Amlodipine 7.5 mg once daily
- Colchicine 0.6 mg po once daily
- Prednisone 20 mg po once daily
- Dexlansoprazole 60 mg po once daily
- Fluticasone propionate + salmeterol 50/100 mcg, 1 inhalation BID



The parasternal long-axis view demonstrates an intimal flap originating at the aortic root, indicated by the red arrows. The dotted green line highlights aortic root dilation that measures approximately 7 cm. The aortic root should be measured from the leading edge to leading edge at the end of diastole at the level of the sinuses of Valsalva. An aortic root diameter exceeding 4.5 cm is considered aneurysmal.[3]

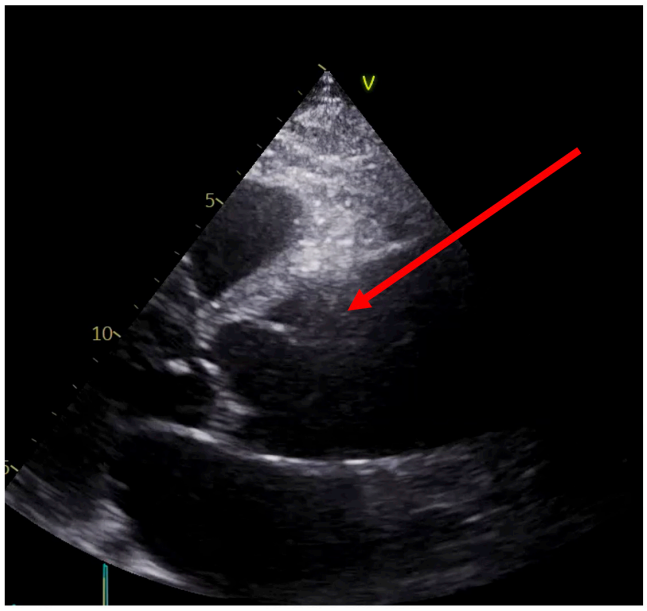
The patient was initially assessed by the ED Nurse Practitioner (NP). On examination, he appeared pale, agitated, and confused. He intermittently followed commands and demonstrated expressive aphasia, speaking in short phrases. He complained of diffuse pain and chills but was unable to provide specifics. He was oriented to person and place. Cardiovascular examination revealed an irregularly irregular rhythm and a grade 3/6 diastolic murmur. Respiratory, abdominal, and peripheral examinations were unremarkable.

Vital signs: blood pressure 110/60 mmHg, heart rate 60 bpm, respiratory rate 16 breaths/min, oxygen saturation 98% on room air, temperature 36.4°C. Electrocardiogram showed atrial fibrillation with frequent premature ventricular complexes and no ischemic changes.

Given the patient's confusion, limited history, and nonspecific presentation, the nurse practitioner performed a point-of-care ultrasound (POCUS) as an adjunct to the physical examination. Both a Focused Assessment with Sonography in Trauma (FAST) scan and a cardiac POCUS were conducted to rapidly evaluate for life-threatening causes of syncope.

At this institution's ED, POCUS is integrated into practice and is commonly available to support rapid diagnostic decision-making. Although not yet universally accessible across EDs, its use by nurse practitioners and physicians has demonstrated particular value in guiding early management when history and examination alone provide limited diagnostic clarity.

The NP-performed POCUS revealed a dilated aortic root and a visible intimal flap, findings highly suspicious for acute aortic dissection. These results immediately prompted urgent advanced imaging and multidisciplinary consultation.



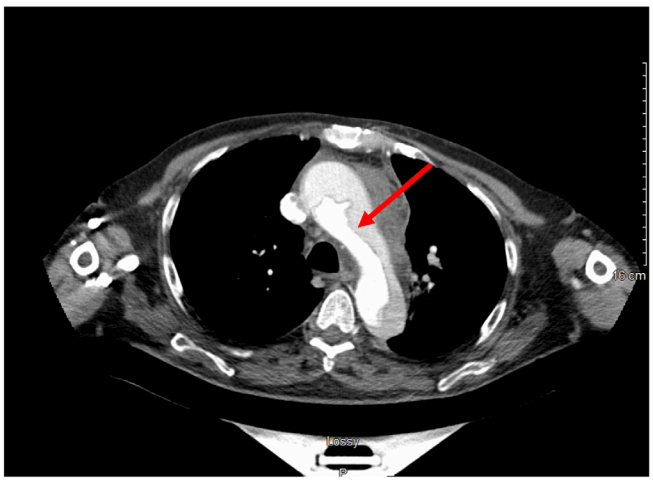
The parasternal long-axis view demonstrates a dissection flap originating at the aortic root.

Computed tomography angiography (CTA) of the thorax and head confirmed a Stanford Type A aortic dissection. The intimal flap originated at the aortic root/sinotubular junction and extended to the left external iliac artery, with involvement of the left common carotid artery and partial extension into the right carotid and brachiocephalic arteries. A trace pericardial effusion was present without evidence of significant hemopericardium.

Head CT revealed no intracranial hemorrhage or infarction.

Laboratory testing revealed leukocytosis (WBC 17.6 × 10^9/L), elevated troponin (40 ng/L), creatinine 94 µmol/L, lactate 2.1 mmol/L, international normalized ratio 1.3, and prothrombin time 15.2 seconds.

The patient was transferred to the resuscitation area, and a cardiac surgeon was urgently consulted. The goals of care were discussed with the patient and his wife, who arrived after the CT scan had already been completed. The patient and the wife expressed the desire to proceed with surgery despite the associated risks. During this discussion, it was clarified that the patient had taken his last dose of apixaban the evening before presentation. A dose of prothrombin complex concentrate was administered preoperatively to reverse the anticoagulation.



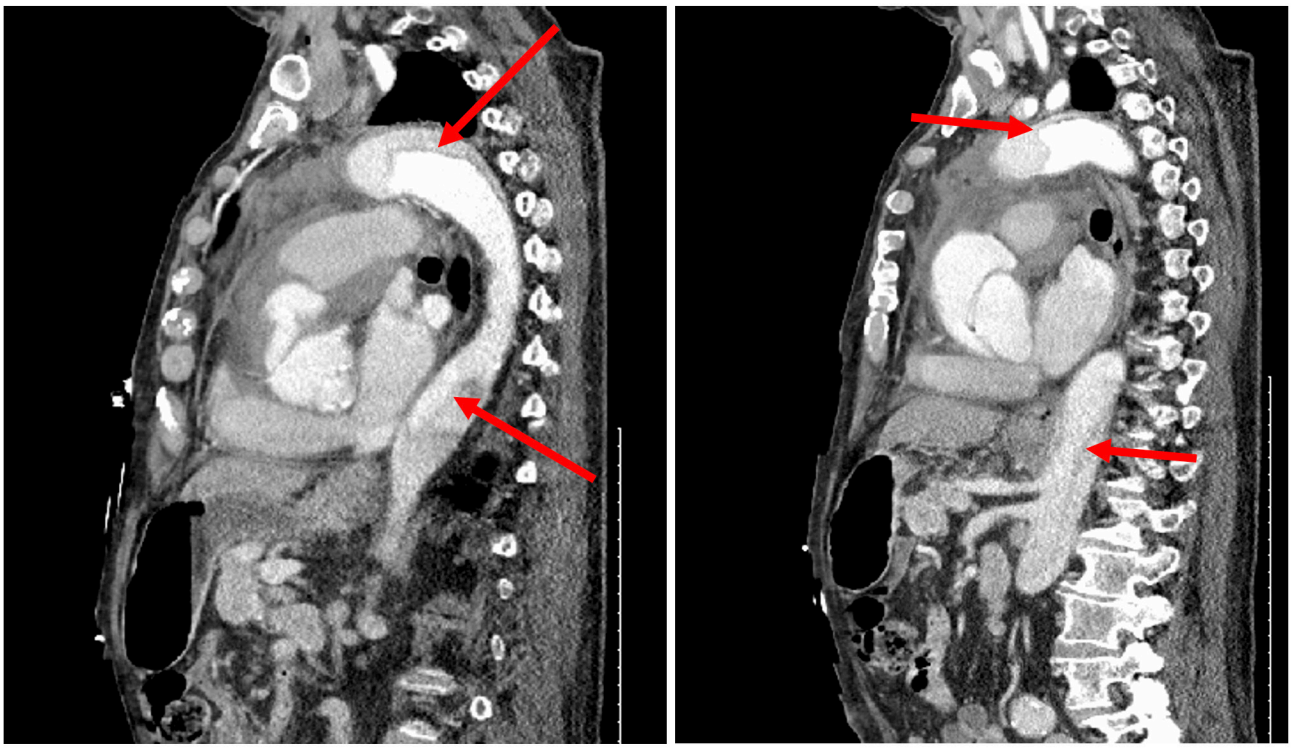
Contrast-enhanced CT scan at the level of the aortic arch demonstrating an aortic dissection/intimal flap.

The patient's heart rate remained stable at 60-80 bpm as he was already on a low-home-dose beta-blocker and his blood pressure was on the soft side and dropped to the 80-90s. No antihypertensive treatment nor additional beta blockers were required. Pain management was achieved with small doses of IV fentanyl.

The patient was transferred to the operating room for emergency surgical repair, which was complicated by massive bleeding. Despite maximal efforts, his condition remained critical and further intervention was not feasible. After discussion with his wife, care was transitioned to a comfort-focused approach, and the patient passed away peacefully in the ICU.

Discussion

The 2022 American College of Cardiology and American Heart Association guidelines recommend immediate surgical repair for all patients with acute Stanford Type A aortic dissection, regardless of age, unless contraindicated by extreme frailty or patient preference.[2] While computed tomography angiography (CTA) remains



Contrast-enhanced CT sagittal MPR view CT demonstrating the extend of the aortic intimal flap that appears to originate from the level of the aortic root/sinotubular junction and extends all the way down to the left external iliac artery.

the diagnostic gold standard, point-of-care ultrasound (POCUS) serves as a valuable bedside adjunct in unstable patients by expediting recognition and facilitating early referral for definitive management. Current recommendations for initial medical therapy include rapid control of blood pressure and heart rate to reduce shear stress on the aortic wall. Target hemodynamics are a heart rate of 60–80 beats per minute and a systolic blood pressure <120 mmHg, while maintaining adequate end-organ perfusion.[2] Intravenous beta-blockers (e.g., esmolol or labetalol) are first-line agents, with vasodilators considered if additional blood pressure reduction is required after adequate heart rate control has been achieved.[2] Prompt surgical consultation should occur in parallel with medical stabilization, as outcomes are strongly time-dependent.[2]

Adequate analgesia is also a critical component of initial management, as uncontrolled pain can increase sympathetic tone and exacerbate hypertension and tachycardia.[2] Intravenous opioids, particularly morphine, are recommended to provide effective pain relief while also blunting the sympathetic response.[2] Non-opioid agents such as NSAIDs are contraindicated due to their limited efficacy in this setting and potential renal effects.[2] In practice, pain control should be initiated concurrently with beta-blockade and blood pressure management to optimize hemodynamic stability prior to definitive surgical repair.[2]

In this case, POCUS led to timely imaging and surgical intervention. However, the patient's advanced age, comorbidities, and intraoperative bleeding contributed to a poor outcome. Management in elderly patients remains complex, but age alone should not exclude surgical consideration.[2] Individualized decision-making and early goals-of-care discussions are essential in high-risk populations.

POCUS in Diagnosing Aortic Dissection

POCUS plays an increasing role in the early diagnosis of aortic dissection. A 2016 study showed that focused cardiac ultrasound reduced time to diagnosis and decreased the rate of missed ascending dissections.[4]

A 2023 review found that POCUS demonstrates high specificity but variable sensitivity for thoracic aortic dissection (TAD) and thoracic aortic aneurysm (TAA): for TAD, sensitivity ranges from 41–91% and specificity from 94–100% when an intimal flap is visualized; for TAA with dilation >40 mm, sensitivity ranges from 50–100% and specificity from 93–100%, and for >45 mm, sensitivity is 64–65% and specificity 95–99%. These findings support using POCUS as a screening tool, particularly when combined with clinical scores and biomarkers such as D-dimer.[5]

Another multicenter study evaluating the Sonographic Protocol for the Emergent Evaluation of Aortic Dissection protocol (combining transthoracic and abdominal ultrasound) reported a sensitivity of 93.2%, specificity of 90.9%, and accuracy of 91%. The presence of any of three findings: pericardial effusion, an intimal flap, or an aortic outflow track diameter >35 mm (measured inner wall to inner wall at the aortic outflow tract) was strongly associated with confirmed aortic dissection.[6]

Many asymptomatic older adults present with a mildly dilated aortic root. A diameter of 3.0–4.0 cm is nonspecific, and for this reason the ultrasound literature remains mixed regarding the optimal cutoff value. Using a threshold of ≥4.0 cm improves specificity.[7]

Although promising, POCUS should not replace computed tomography angiography, which remains essential for anatomical detail and surgical planning. Used as an adjunct, POCUS facilitates triage, stabilization, and resource mobilization in critical care settings.

Challenges in Diagnosing Aortic Dissection: The Role of POCUS and the Nurse Practitioner (NP) Scope

This case is unique in that a NP in the emergency department used POCUS to identify an acute aortic dissection in a 91-year-old patient presenting with nonspecific symptoms. The patient's expressive aphasia, confusion, and history of syncope created diagnostic ambiguity and limited history-taking. Despite these barriers, the NP performed a focused bedside ultrasound that revealed hallmark features of dissection (including a dilated aortic root and intimal flap) prompting urgent radiologic confirmation and surgical consultation. This early use of POCUS helped accelerate the patient's trajectory toward definitive care.

This case highlights not only the diagnostic value of POCUS in emergency settings but also the evolving scope of practice for nurse practitioners. NPs practicing in acute and emergency care settings are increasingly incorporating ultrasound into their assessments, supported by structured training and institutional protocols. In Canada, POCUS use by NPs is allowed under provincial regulatory frameworks, provided the NP has received appropriate education and the practice aligns with institutional policies.[8] In the United States, state-level regulations similarly allow NPs to use POCUS, especially in full-practice states, with credentialing often guided by employer-based requirements.[9,10]

Formal education and competency development are essential to ensure safe and effective POCUS use by NPs. Programs such as the Canadian Point-of-Care Ultrasound Society, the Society of Point-of-Care Ultrasound, and the American Institute of Ultrasound in Medicine offer structured training with supervised scanning, logbooks, and practical assessments. Simulation-based training has shown to improve NP skill and confidence in ultrasound use, with sustained benefits over time.[11]

An integrative review by Totenhofer et al. (2021) confirmed that when NPs and registered nurses are appropriately trained, POCUS can significantly enhance assessment and decision-making in various clinical contexts, though barriers such as inconsistent credentialing and institutional support persist.[12] Similarly, a 2025 study by Yamada et al. identified both facilitators (such as interprofessional collaboration and access to training) and barriers (including limited staffing and unclear policies) to POCUS utilization among nurses and NPs, emphasizing the importance of systemic support to fully integrate POCUS into advanced nursing practice.[13]

This case contributes to a growing body of evidence that supports the use of POCUS by nurse practitioners as a timely and effective tool in emergency diagnosis. By detailing how a trained NP identified a life-threatening aortic dissection at the bedside, the case underscores the importance of integrating structured POCUS education into NP training and developing standardized institutional policies to support NP-led ultrasound practice in emergency care.

The NP involved in this case had prior clinical experience in cardiology and had received mentorship-based POCUS training in cardiac and aortic assessment. Additional training was obtained in lung and abdominal POCUS through formal courses, supervised scanning, and completion of logbooks.

Clinical Pearl	Practical Implication
Maintain a high index of suspicion for acute aortic syndrome	Consider aortic dissection in patients presenting with abrupt chest, back, or abdominal pain, syncope, neurologic deficits, pulse deficits, or unexplained shock.
CTA remains the diagnostic gold standard	Computed tomography angiography should be obtained urgently when clinical suspicion is high and the patient is stable enough for transport.
Initiate anti-impulse therapy promptly	Early reduction of aortic wall stress is critical to limit propagation of the dissection.
Target heart rate and blood pressure goals	Aim for a heart rate of 60–80 bpm and a systolic blood pressure <120 mmHg while maintaining adequate end-organ perfusion.
Use intravenous beta-blockers as first-line therapy	Esmolol or labetalol are recommended initial agents to control heart rate and blood pressure.
Treat pain aggressively	Intravenous opioids are recommended, as uncontrolled pain increases sympathetic stimulation, hypertension, and tachycardia.
Obtain urgent surgical consultation for Stanford Type A dissection	Medical stabilization and surgical evaluation should occur simultaneously, as outcomes are highly time-dependent.
Age alone should not preclude surgical intervention	Treatment decisions should be individualized based on comorbidities, frailty, operative risk, and patient preferences.

Conclusion

POCUS is a powerful diagnostic tool in emergency medicine, especially when rapid recognition of life-threatening conditions is required. In this case, POCUS enabled early diagnosis of aortic dissection despite a complex presentation. As nurse practitioner training and certification in ultrasound expand, their contributions to acute care diagnostics will continue to grow. Broader implementation of POCUS can help reduce diagnostic delays and improve patient outcomes in time-critical emergencies.

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