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Detecting Aortic Stenosis Using Point-of-Care Ultrasound (POCUS)

in the Emergency Department

Yashita Pediredla, Audrey Whitney

Joshua Wasmund, MD | Bharath Chakravarthy, MD, MPH | Soheil Saadat, MD, MPH, PhD

School of Medicine, University of California, Irvine

What Is Aortic Stenosis?

Aortic stenosis (AS) is the narrowing of the aortic valve, restricting blood flow from the heart.

It is a common and often under-recognized cause of syncope (fainting), especially in older adults.

- Graded on a severity scale: mild, moderate, severe
- Severe AS can cause significant morbidity and mortality
- Prevalent among the elderly population
- Gold standard diagnosis:
    - formal echocardiogram but requires specialized staff, equipment, and time not always available in the ED

SEVERITY GRADING

	Mild	Moderate	Severe
Peak Aortic Velocity (m/s)	2.6 - 2.9 m/s	3.0 - 4.0 m/s	≥ 4.0 m/s
Mean Pressure Gradient (mmHg)	<20 mmHg	20-40 mmHg	≥ 40 mmHg
Valve Area (cm^2)	>1.5 cm^2	1.0-1.5 cm^2	<1.0 cm^2

Severe AS is the critical threshold this study focuses on identifying early before formal echo is available.

Can Emergency Physicians Rule Out Severe Aortic Stenosis at the Bedside?

Hypothesis

Peak aortic jet velocity obtained from an Apical 5-Chamber (A5C) POCUS view can be used, with sufficient sensitivity, to rule out severe aortic stenosis.

Speed

Assess AS at the bedside means no wait for formal echo

Accuracy

Evaluate how well POCUS identifies severe AS

Impact

Enable faster risk stratification and intervention

Methods

Patients are screened, enrolled, and scanned through a structured pathway before formal echocardiography.

1 Screen

Student researchers from EMRAP screen ED patients via Epic EHR against inclusion criteria

2 Enroll

Research associate approaches eligible patients and obtains informed consent (HIPAA-compliant)

3 Scan

Ultrasound-trained EM physician is contacted to perform the POCUS exam

Inclusion	Exclusion
• Patients 60 and older • Chief complaint: syncope, light headedness, dizziness • Patient does NOT have posted Echo results • Patient is going to be admitted	• Patient has had an Echo, AND the results have been posted • Previous aortic stent/aortic replacement surgery • Inability to provide informed consent • 5150, pregnant, incarcerated

Finding Jet Velocity with Doppler Ultrasound

- Mindray ultrasound machine, set to continuous-wave Doppler
- Physician acquires the Apical 5-Chamber (A5C) view across the aortic valve
- Peak aortic jet velocity (m/s) is a key indicator of blood flow speed and stenosis severity and is measured
- Feasibility is timed (in seconds) from start of scan to obtaining the peak velocity value
- Student researcher freezes the screen once the A5C view is set and records the value

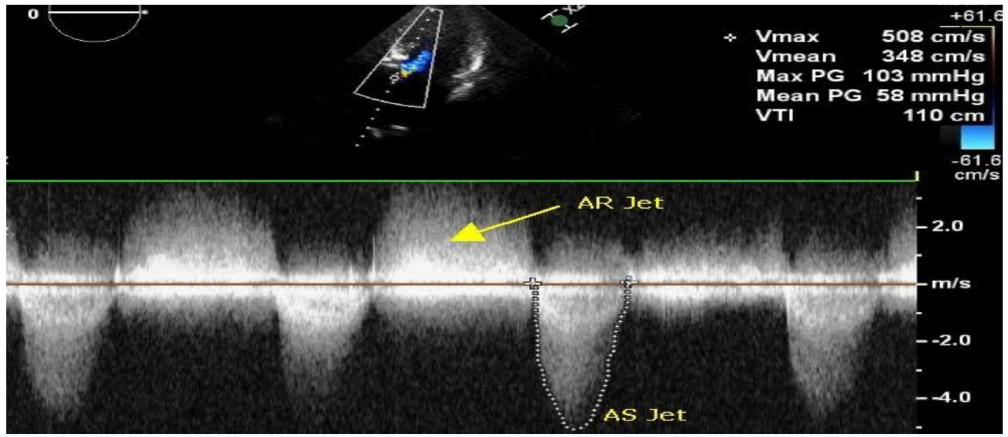

Figure 3. Peak aortic jet velocity via POCUS

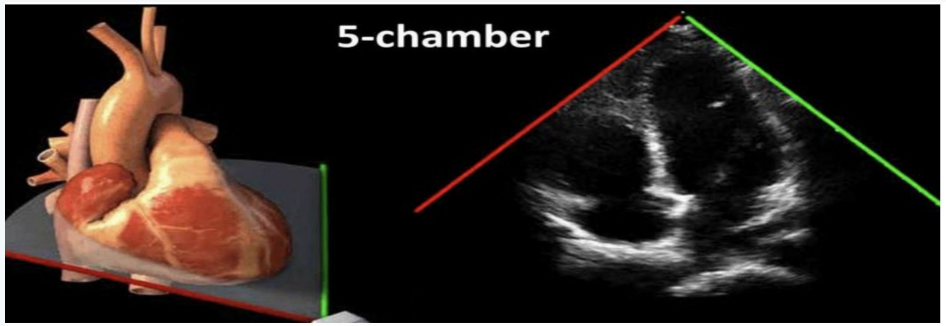

Figure 4. Apical 5-Chamber (A5C) view

Data Collection with RedCap

Every scan and its matching echo results are logged to the same secure survey — enabling direct, patient-level comparison.

POCUS Result

Recorded immediately after the bedside exam

- Peak aortic jet velocity (m/s) via A5C Doppler
- Time-to-value: seconds from scan start to result
- Physician performing the exam

This is the field under investigation for its accuracy against formal echo.

Formal Echocardiogram

Once completed, added to the same survey for comparison:

- Peak aortic velocity (m/s)
- Aortic valve area
- Aortic mean gradient
- Final diagnosis
- Ejection fraction (EF)

Limitations

Ejection Fraction Skews the Results

- Decreased cardiac output and ejection fraction can significantly skew peak aortic jet velocity and mean pressure gradient readings.
- In patients with low ejection fraction, the recorded peak jet velocity may **underestimate true stenosis severity.**
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However:

- We are recording the EF in REDCap but have **not yet adjusted** for its effects on the peak aortic jet velocity
- Additionally if POCUS proves effective for moderate severe AS, it should be paired with a bedside ejection-fraction assessment, not used alone which would ensure accurate diagnoses.

CONCLUSIONS

Where This Study Stands

Ongoing Data Collection	Enrollment and scanning are still in progress at UCI's ED.
Supporting Evidence	Similar studies show POCUS can deliver immediate diagnostic information for severe valvular emergencies.
Anticipated Value	Peak aortic jet velocity via POCUS is expected to show sufficient negative predictive value to help rule out severe AS.
Used in conjunction instead of a replacement	POCUS won't replace formal echocardiography, but early bedside identification can speed assessment and enable quicker intervention.