PURSUIT OF ZΩH — THE WEEKLY

This Week in

Cardiac Sonography

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THIS WEEK

A tricuspid cutoff that rarely fires

A guideline Doppler cutoff for tricuspid leaks rarely trips, an AI reads Takotsubo in diastole, low forward flow hides behind normal ejection fraction, and ultrasound maps microvessels in beating rat hearts.

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01

VALVE DOPPLER

A tricuspid E-wave cutoff that rarely fires

Guidelines treat a tricuspid inflow E-wave above 100 cm/s on pulsed-wave Doppler as a sign of severe tricuspid regurgitation (TR).[1] A team in Milan measured it in 178 consecutive patients with at least mild TR.[1] Only three exceeded 100 cm/s, so the cutoff had 5.5% sensitivity, with 100% specificity, for severe or greater TR.[1] A 47 cm/s cutoff reached 90% sensitivity and 43% specificity.[1]

5.5%

sensitivity of the E-wave >100 cm/s cutoff for severe or greater TR

SOURCE 1

WHY IT MATTERS

The authors propose the lower cutoff as a screening prompt for full multiparametric grading, not as a diagnosis.[1]

CAVEAT *External validation gave 94% sensitivity but only 47% specificity.*[1]

[1] doi:10.1093/ehjci/jeag304

ON THE ROAD?

Listen to this issue

6-minute episode, read aloud: the same four stories, written for the ear. Stream it, or download the MP3, from the Cardiac Sonography page.

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02

AI & ECHO

A neural network finds Takotsubo's signature in diastole

Telling Takotsubo syndrome from an acute heart attack on echo is hard, and the syndrome's mechanics remain poorly understood.[2] A group led from the University of Iowa trained MiNN-Echo, a neural network that reads both the still frames and the motion of echo videos, on multivendor scans from 1142 patients: 596 with Takotsubo and 546 with anterior myocardial infarction.[2] It reached an area under the curve of 0.77, against 0.69 for 68 expert readers.[2] Diastolic motion carried about 71% of the diagnostic weight.[2]

WHY IT MATTERS

Takotsubo hearts spent longer in isovolumic relaxation (28% versus 19% of diastolic time) and less in passive filling (44% versus 54%), pointing to relaxation as a clue to the mechanism.[2]

CAVEAT *The comparison group was anterior myocardial infarction only, so other look-alike conditions were not tested.*[2]

[2] doi:10.1161/CIRCIMAGING.126.020258

0.77

AUC of MiNN-Echo for Takotsubo vs. acute MI (68 expert readers: 0.69)

SOURCE 2

03

HEMODYNAMICS

Normal ejection fraction, low flow after a heart attack

A normal ejection fraction after a heart attack does not guarantee that the heart is moving enough blood forward.[3] Using the MIMIC-IV and MIMIC-IV-Echo databases, a team at Jiangxi Provincial People's Hospital computed stroke volume index from outflow-tract Doppler in 2,142 patients with a first acute MI and LVEF of at least 50%.[3] Low flow, under 35 mL/m², affected 864 (40.3%), whose 30-day mortality was 7.5% against 4.7% with normal flow.[3] The adjusted risk ratio of 1.65 fell to 1.31 (0.95-1.82) once shock and pre-echo support were added.[3]

WHY IT MATTERS

Doppler stroke volume marks a sicker subgroup that ejection fraction misses, but it added little prediction once the severity of acute illness was known.[3]

CAVEAT *Observational analysis of one database; association, not causation, and the authors call for external validation against Killip class and established risk scores.*[3]

[3] doi:10.1111/echo.70676

7.5%

30-day mortality with low flow (SVI <35 mL/m²) and preserved LVEF, vs. 4.7% with normal flow

SOURCE 3

04

ULTRASOUND PHYSICS

Holding a beating heart still to map tiny vessels

Coronary microvascular disease involves vessels under 300 µm, too small for clinical imaging to resolve.[4] Ultrasound localization microscopy gets past the diffraction limit by tracking single microbubbles, but cardiac motion corrupts it.[4] The Physics for Medicine lab in Paris (ESPCI, INSERM, CNRS) built a 3D non-rigid motion correction that uses optical flow guided by Doppler velocities.[4] In perfused ex vivo beating rat hearts imaged with ultrafast 3D ultrasound, it increased bubble-tracking density and revealed microvessels below 100 µm, with velocity measurements at a resolution of at least 40 µm.[4]

WHY IT MATTERS

Correcting motion permits longer acquisitions, a step toward volumetric maps of the coronary microcirculation.[4]

CAVEAT *Isolated, perfused rat hearts, not patients; clinical application is a stated future aim.*[4]

[4] doi:10.1088/1361-6560/aebdfd

MECHANISM

Microbubbles flow through coronary vessels

↓

Ultrafast 3D ultrasound localizes each one

↓

Optical flow plus Doppler undo the motion

↓

Tracks build a map below 100 µm

WORDS THIS WEEK

Pulsed-wave Doppler
An ultrasound mode that measures blood speed at one chosen spot by timing short pulses, giving a velocity trace through each heartbeat.

Takotsubo syndrome
A sudden, usually reversible weakening of part of the left ventricle that can look like a heart attack but without a blocked artery.

Tricuspid regurgitation
Backward leakage through the valve between the right atrium and right ventricle, graded from mild up to massive and torrential.

Stroke volume index
Blood ejected per beat divided by body surface area; by echo it is computed from outflow-tract size and the Doppler velocity-time integral.

Area under the curve
AUC: a score from 0.5 (coin flip) to 1.0 (perfect) for how well a test or model separates two groups across all possible cutoffs.

Localization microscopy
Ultrasound localization microscopy pinpoints thousands of single microbubbles and joins their positions, drawing vessels finer than the sound wavelength.

SOURCES

1. PAPER S. Fisicaro et al., “Tricuspid inflow E-wave velocity for the assessment of severe or greater tricuspid regurgitation: derivation and external validation of threshold values,” European Heart Journal – Cardiovascular Imaging (10 Nov 2026). doi:10.1093/ehjci/jeag304
2. PAPER F. Zaman et al., “Motion-Informed Neural Network Towards Diastolic Mechanics in Takotsubo Syndrome,” Circulation: Cardiovascular Imaging (11 Nov 2026). doi:10.1161/CIRCIMAGING.126.020258
3. PAPER H. Zeng et al., “Low Forward Flow and Early Mortality Despite Preserved Left Ventricular Ejection Fraction After Acute Myocardial Infarction: A MIMIC-IV-Echo Cohort Study,” Echocardiography (12 Nov 2026). doi:10.1111/echo.70676
4. PAPER B. Rideau et al., “3D non-rigid motion correction using Doppler-regularized optical flow for coronary ultrasound localization microscopy in beating heart,” Physics in Medicine & Biology (13 Nov 2026). doi:10.1088/1361-6560/aebdfd

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