

iASD Doppler — Echo Estimate of Peak LA Pressure

iatrogenic atrial septal defect after transseptal puncture (MitraClip, PFA, LAAO, etc.)

PRINCIPLE

After transseptal access, the residual iASD shunts **LA → RA** when LAP > RAP. Apply the simplified **Bernoulli equation** to the peak shunt velocity to recover the instantaneous LA–RA pressure gradient, then add a measured/estimated RAP.

$$LAP_{\text{peak}} = RAP + 4 \times V_{\text{peak}}^2$$

$$\Delta P_{\text{LA-RA}} = 4V^2 \text{ (mmHg, with } V \text{ in m/s)}$$

V_{peak}	Peak L→R shunt velocity across the iASD by PW or CW Doppler (m/s)
RAP	Estimated RA pressure (IVC method, ASE 2010): 3 / 8 / 15 mmHg
LAP_{peak}	Peak left atrial pressure during the cardiac cycle (mmHg)

ACQUISITION PROTOCOL

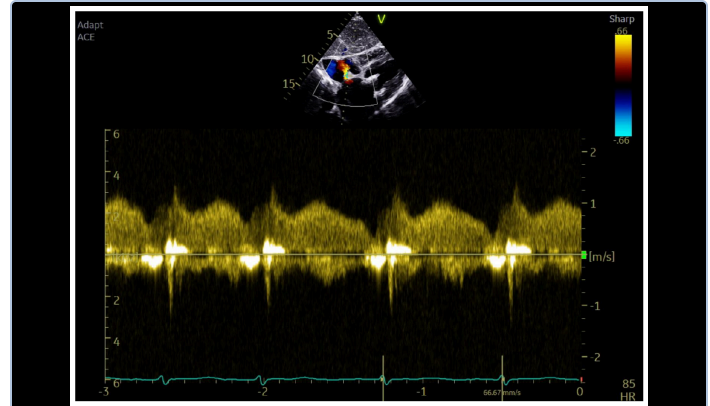
- 1 **Locate the iASD.** Subcostal or low parasternal short-axis at the AV groove gives the most parallel alignment to the L→R jet. TEE bicaval (90°) is the gold standard.
- 2 **Color Doppler** on the septum — identify the jet direction. Narrow the sector and lower Nyquist (~40–60 cm/s) to confirm continuous L→R flow.
- 3 **Align the cursor** with the jet (angle < 20°). Drop a PW sample on the RA side of the defect; switch to CW if velocities exceed PW Nyquist.
- 4 **Set scale** so the peak fits in the display — if the trace clips, **extend the scale** (do not estimate an aliased peak).
- 5 **Trace** the peak L→R velocity. Use the highest reproducible peak across ≥ 3 beats (or 5 in AF).
- 6 **Estimate RAP** from the IVC: collapsible & ≤2.1 cm = 3 mmHg; intermediate = 8; plethoric >2.1 cm with <50% collapse = 15.

ASSUMPTIONS & WHEN IT HOLDS

- **Restrictive defect.** Small, post-transseptal puncture iASD — flow accelerates across a narrow orifice, so peak gradient reflects the LA–RA pressure difference. Large/non-restrictive ASDs equalize pressures and Bernoulli underestimates.
- **Continuous L→R flow** with a clear systolic-dominant peak. Bidirectional flow suggests near-equal pressures or RAP > LAP transiently.
- **Good Doppler alignment.** Off-axis sampling underestimates V; LAP estimate falls quadratically with V.
- **Simultaneous RAP.** Validated cohorts used invasive RA mean; bedside echo uses ASE IVC class.
- Validated against direct LA pressure in patients with post-MitraClip iASDs — $r \approx 0.90$ with invasive measurement.

WORKED EXAMPLE

Post-transseptal iASD, parasternal short-axis with PW sample on the RA side of the defect. Scale extended to **2.0 m/s** after the initial sweep aliased at 1.0 m/s.



Continuous L→R systolic-dominant flow. Peak velocity above baseline ≈ 1.5 m/s.

Inputs

V_{peak}	1.5 m/s (peak L→R, scale uncapped)
RAP	5 mmHg (IVC small & collapsible)

Calculation

$$\Delta P = 4 \times V^2 = 4 \times (1.5)^2 = 4 \times 2.25 = 9 \text{ mmHg}$$

$$LAP_{\text{peak}} = RAP + \Delta P = 5 + 9 = 14 \text{ mmHg}$$

ESTIMATED PEAK LA PRESSURE
14 mmHg

INTERPRETATION

LAP_{peak}	Clinical correlate
≤ 12 mmHg	Normal LA pressure
13–18 mmHg	Mild elevation — reassess loading, MR
19–25 mmHg	Moderate — congestion likely; diurese
> 25 mmHg	Severe — pulmonary edema risk

Quick $V_{\text{peak}} \rightarrow LAP_{\text{peak}}$: $V > 1.6 \text{ m/s} \rightarrow LAP_{\text{peak}} > 15 \text{ mmHg}$ · **$V > 1.9 \text{ m/s} \rightarrow LAP_{\text{peak}} > 20 \text{ mmHg}$**

Tip: Combine with mitral inflow E (here 1.07 m/s, E/A 1.58, DecT 297 ms — consistent with normal-to-mildly-elevated filling pressure) for a coherent diastology read. The iASD gives you the *quantitative anchor* the rest of the algorithm lacks.

PEARLS & PITFALLS

Aliased trace = unusable peak. If the spectral envelope is clipped at the Nyquist limit, extend the scale (or shift baseline). Reading velocity off a clipped trace systematically underestimates LAP. *Page-2 trace in the source PDF illustrates this exact failure.*

Off-axis underestimates. Cosine-θ error is squared by Bernoulli — a 20° off-axis cursor on a 1.5 m/s jet drops the LAP estimate by ~1 mmHg; 30° drops by ~2 mmHg.

Highest peak wins. L→R gradient peaks in late systole / early diastole at the LA v-wave — that instant is what the formula recovers. Bidirectional jet = near-equal LAP/RAP or transient RAP > LAP (severe TR, RV failure); flag result as uncertain.

REFERENCE

Echo estimate of peak LAP in iatrogenic ASDs (vs. invasive LAP). Bernoulli: Hatle & Angelsen 1985. RAP: Rudski, ASE 2010.