



Cardiac Tamponade

A filling problem · Fluids in, needle out, and keep them off the ventilator

RATE OF ACCUMULATION
matters more than volume

UNDERSTAND THE PHYSIOLOGY *it explains every treatment decision*

THE MECHANISM

Pericardial pressure rises above the **diastolic filling pressure** of the right-sided chambers, so **the ventricles cannot fill**. Stroke volume falls, and cardiac output is maintained only by tachycardia and high filling pressures — until it is not.

SPEED BEATS VOLUME

150–200 mL accumulating over minutes causes tamponade; 1–2 L accumulating over months may not. The pericardium stretches if given time. **Never dismiss a small effusion in an unstable patient** after trauma or a procedure.

WHY IT IS PRELOAD-DEPENDENT

Filling depends entirely on a **high venous pressure** exceeding the pericardial pressure. Anything that reduces preload — diuretics, vasodilators, positive pressure ventilation — **removes the only thing keeping output going**.

RECOGNIZE IT *Beck's triad is neither sensitive nor common*

Finding	Detail
Beck's triad	Hypotension, raised JVP, muffled heart sounds — all three present in only a minority, mostly in acute traumatic tamponade. Its absence excludes nothing.
Pulsus paradoxus	An inspiratory fall in systolic pressure of more than 10 mmHg . Measure it properly with a manual cuff. Can be absent with coexisting aortic regurgitation, severe hypotension, or an atrial septal defect.
ECG	Sinus tachycardia, low voltage complexes , and the specific but uncommon electrical alternans — beat-to-beat variation in QRS amplitude as the heart swings within the effusion.
Echocardiography	The diagnostic test . Effusion plus diastolic right atrial and right ventricular collapse , a plethoric non-collapsing IVC , and exaggerated respiratory variation in mitral and tricuspid inflow — the echo equivalent of pulsus paradoxus.
Remember	Tamponade is a clinical and hemodynamic diagnosis, not merely an echo finding . A large effusion in a well patient is not tamponade; a small one in a shocked patient may be.

TREAT IT *three things to do and three to avoid*

- 1 Give fluid** while preparing for drainage. Volume raises filling pressure and buys time — it is a bridge, not a treatment, and does little once pressures are already very high.
- 2 Echo-guided pericardiocentesis** is the definitive intervention. Use the approach with the largest fluid pocket, usually subxiphoid or apical. **Leave a drain** in place, since re-accumulation is common. Send fluid for **cytology, culture and biochemistry**.
- 3 Avoid intubation and positive-pressure ventilation if humanly possible**. Induction agents drop preload and systemic vascular resistance while positive pressure further impedes venous return — **this combination precipitates arrest**. If it is unavoidable, drain first or have the needle ready, and have vasopressors running.
- 4 Avoid diuretics and vasodilators**. The raised JVP is compensatory, not congestion to be treated. Diuresing a tamponade is a recognized and lethal error.
- 5 Surgical drainage instead** for **traumatic hemopericardium**, purulent pericarditis, loculated or posterior effusions, and where a **pericardial window** is needed for recurrence — commonly in malignant effusion.

TWO SITUATIONS THAT CHANGE THE PLAN *where the standard answer is wrong*

TYPE A AORTIC DISSECTION

Do not perform pericardiocentesis for tamponade caused by a proximal dissection, except as a last resort in extremis. **Draining the tamponade restores blood pressure and can restart the bleeding**, converting a contained rupture into an uncontained one. **The treatment is emergency surgery** — get them to the OR.

LOW-PRESSURE TAMPONADE

In a **hypovolemic** patient — dehydration, hemorrhage, dialysis — tamponade physiology can occur at **relatively low pericardial pressures**, and the **JVP may look normal**. Do not exclude tamponade because the venous pressure is unimpressive; **give fluid and reassess**, and the classical picture may then declare itself.

FIND THE CAUSE *it determines what happens after the drain*

Cause	Clues and what follows
Malignancy	The commonest cause of large chronic effusions — lung, breast, lymphoma, mesothelioma. Send cytology . High recurrence rate, so consider a pericardial window or indwelling drain , and discuss goals of care alongside.
Iatrogenic	After pacemaker insertion, ablation, PCI, central line or biopsy . Sudden hypotension during or shortly after a procedure is tamponade until excluded — get an immediate echo rather than assuming vasovagal or sedation effect.
Post-myocardial infarction	Free wall rupture — typically days 2–7, presenting as sudden PEA arrest. Also Dressler syndrome later. Rupture needs emergency surgery , not pericardiocentesis alone.
Infective & inflammatory	Purulent pericarditis needs surgical drainage and antibiotics, not needle aspiration alone. Tuberculous disease is a leading cause worldwide and carries a high risk of later constriction . Also uremic, autoimmune and post-radiation.
After drainage, watch for	Re-accumulation — keep the drain and repeat the echo. Constrictive physiology emerging later, particularly after tuberculous, purulent or radiation disease. Pericardial decompression syndrome — rare paradoxical hemodynamic deterioration after drainage.

PEARLS & PITFALLS

- Never diurese a raised JVP without knowing why it is raised**. In tamponade the high venous pressure is the only thing sustaining output.
- Keep them off positive pressure**. Intubation of an undrained tamponade is a classic cause of periarrest.
- Rate matters more than volume**. A small, rapidly accumulating effusion after a procedure or trauma is the dangerous one.
- Do not drain a type A dissection tamponade** — it belongs in the OR, not on the end of a needle.
- Absence of Beck's triad or pulsus paradoxus does not exclude it**. Get the echo.
- Leave a drain and send the fluid**. Re-accumulation is common, and cytology changes the oncological plan.

References: 2015 ESC Guidelines for the diagnosis and management of pericardial diseases · ASE guidance on echocardiographic assessment of pericardial disease ·

ACC/AHA aortic disease guidance on tamponade in dissection.

Educational aid; verify against local protocol and patient factors.

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