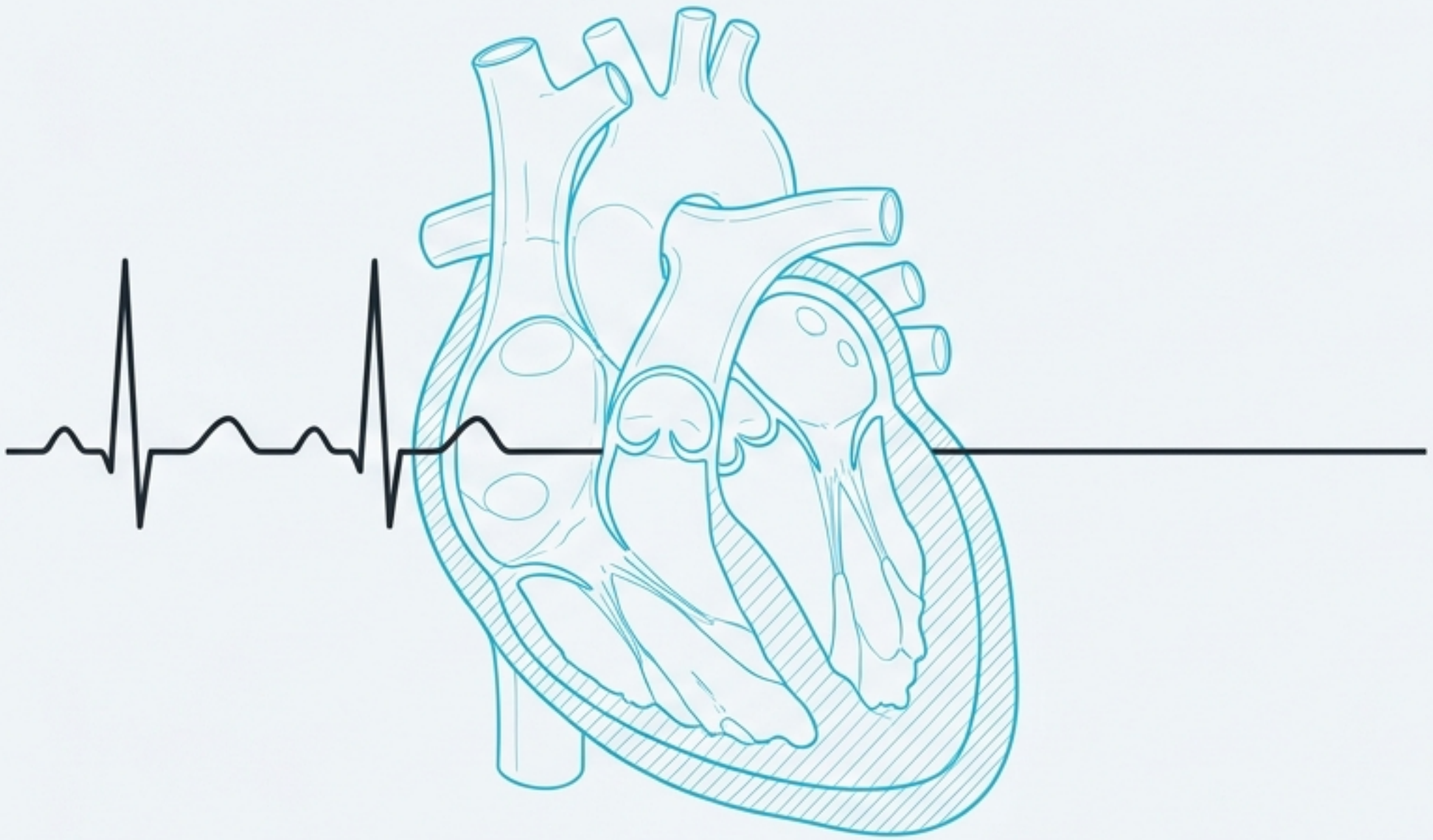
Cardiac Tamponade: Clinical Pathway & Procedural Blueprint

A visual manual for the recognition, resuscitation, and resolution of pericardial emergencies.

Med2Date Clinical Guidelines

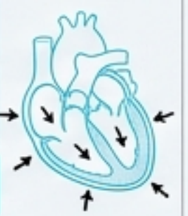


CLINICAL PRESENTATION MATRIX (ALERT RED)

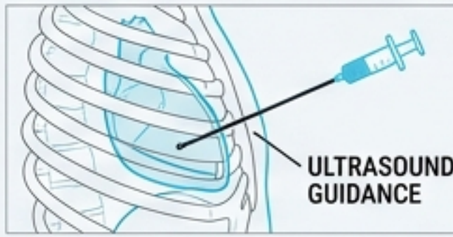
SYMPTOM	STATUS	INDICATOR
JUGULAR VENOUS DISTENSION	PRESENT	OBSTRUCTION
HYPOTENSION	CRITICAL	SHOCK
MUFFLED HEART SOUNDS	AUDIBLE	FLUID BARRIER
PULSUS PARADOXUS (>10 mmHg)	SIGNIFICANT	TENSION

SHOCK PROGRESSION: HEMODYNAMIC DATA

PHYSIOLOGY (MONITOR GREEN)	COMPROMISE (ECHO CYAN)
CARDIAC OUTPUT: DECREASING	PERICARDIAL PRESSURE: ELEVATED
STROKE VOLUME: REDUCED	RIGHT VENTRICULAR DIASTOLIC COLLAPSE: PRESENT
HEART RATE: COMPENSATORY TACHYCARDIA ↑	INFERIOR VENA CAVA: DILATED / NON-COLLAPSIBLE



PROCEDURAL INSIGHTS: PERICARDIOCENTESIS



URGENT DECOMPRESSION

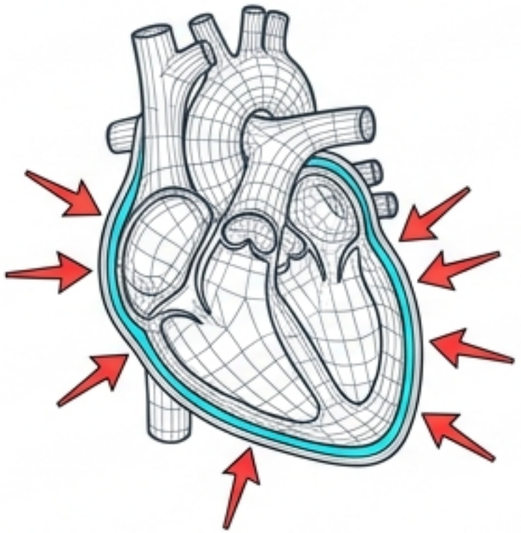
SUBXIPHOID APPROACH

ASPIRATION & DRAINAGE

The Mechanics of Compression

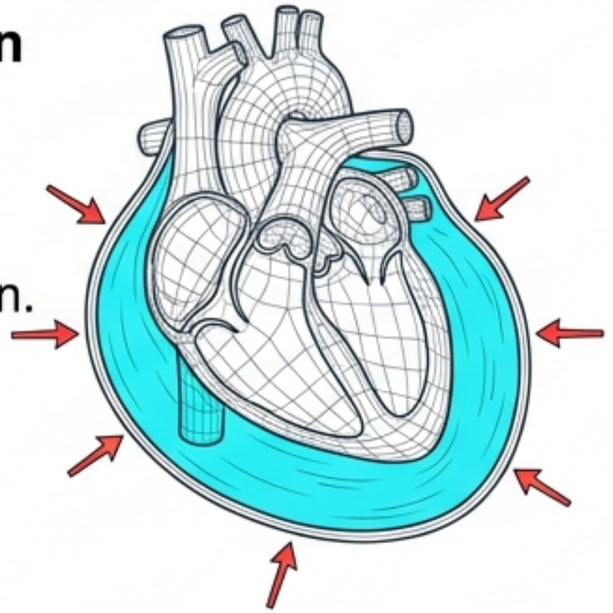
Acute Accumulation

100–200 mL causes sudden tamponade (e.g., trauma). Pericardium cannot stretch fast enough.

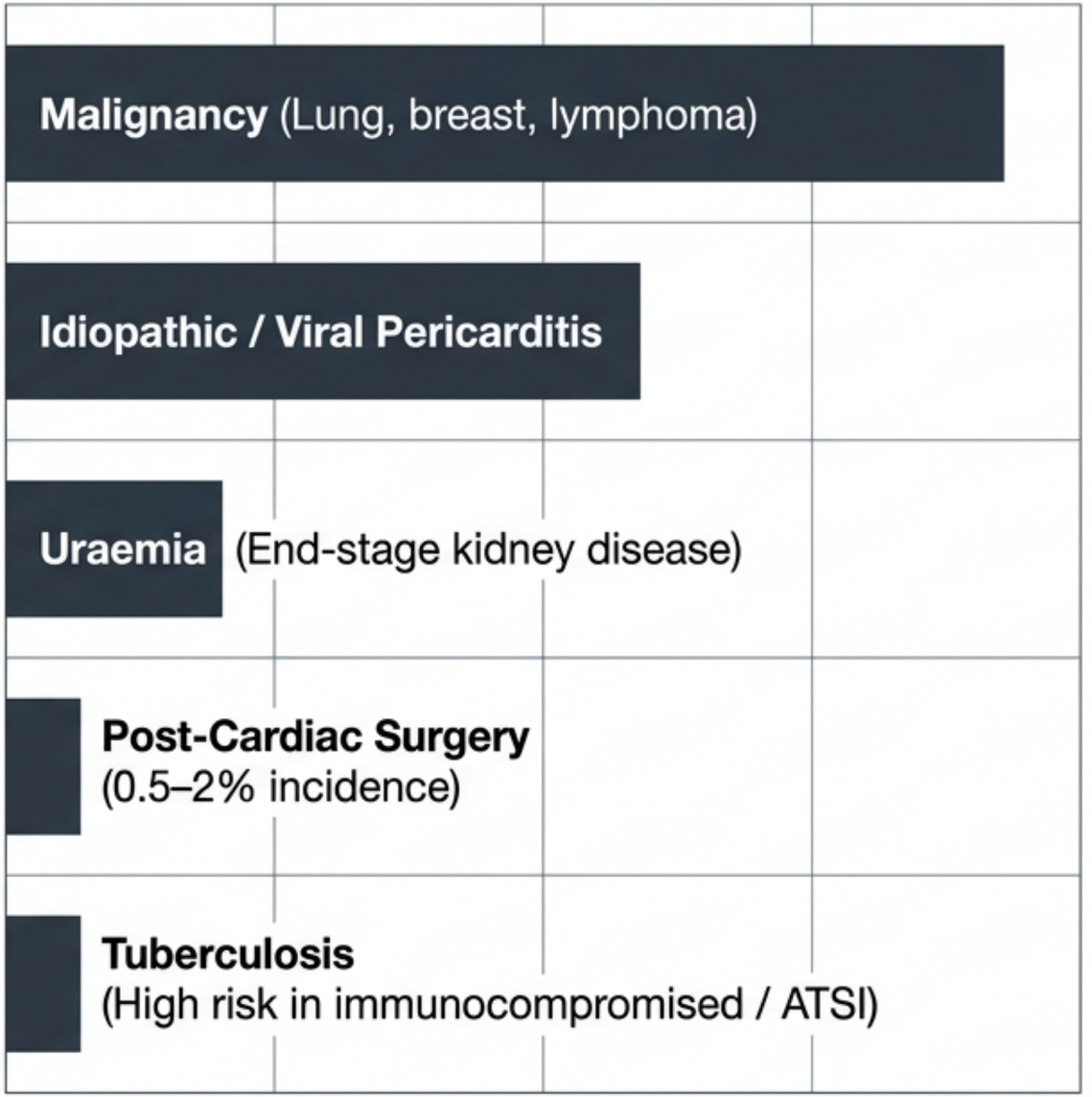


Chronic Accumulation

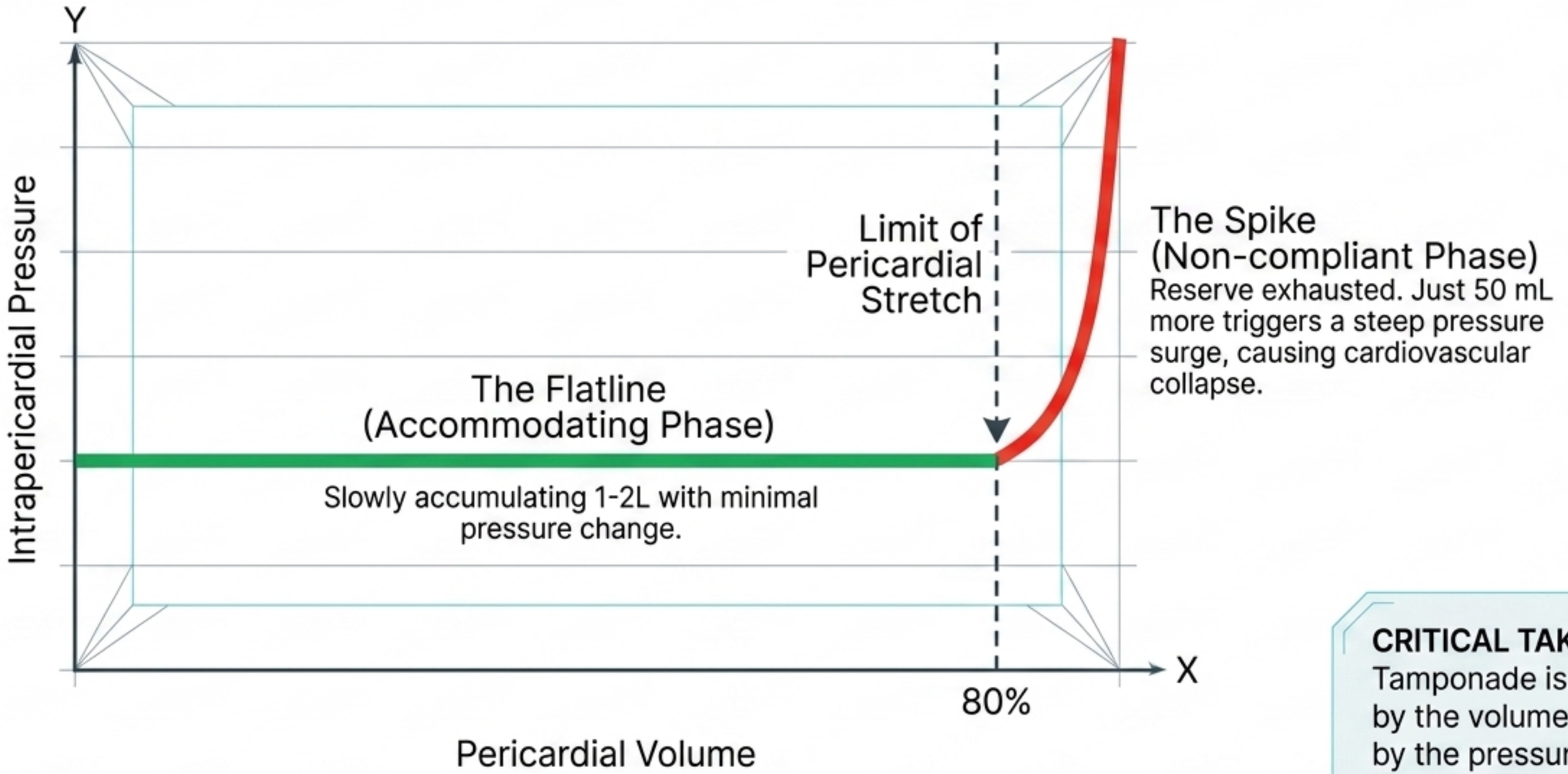
>1–2 L required. Pericardium stretches over weeks, delaying catastrophic compression.



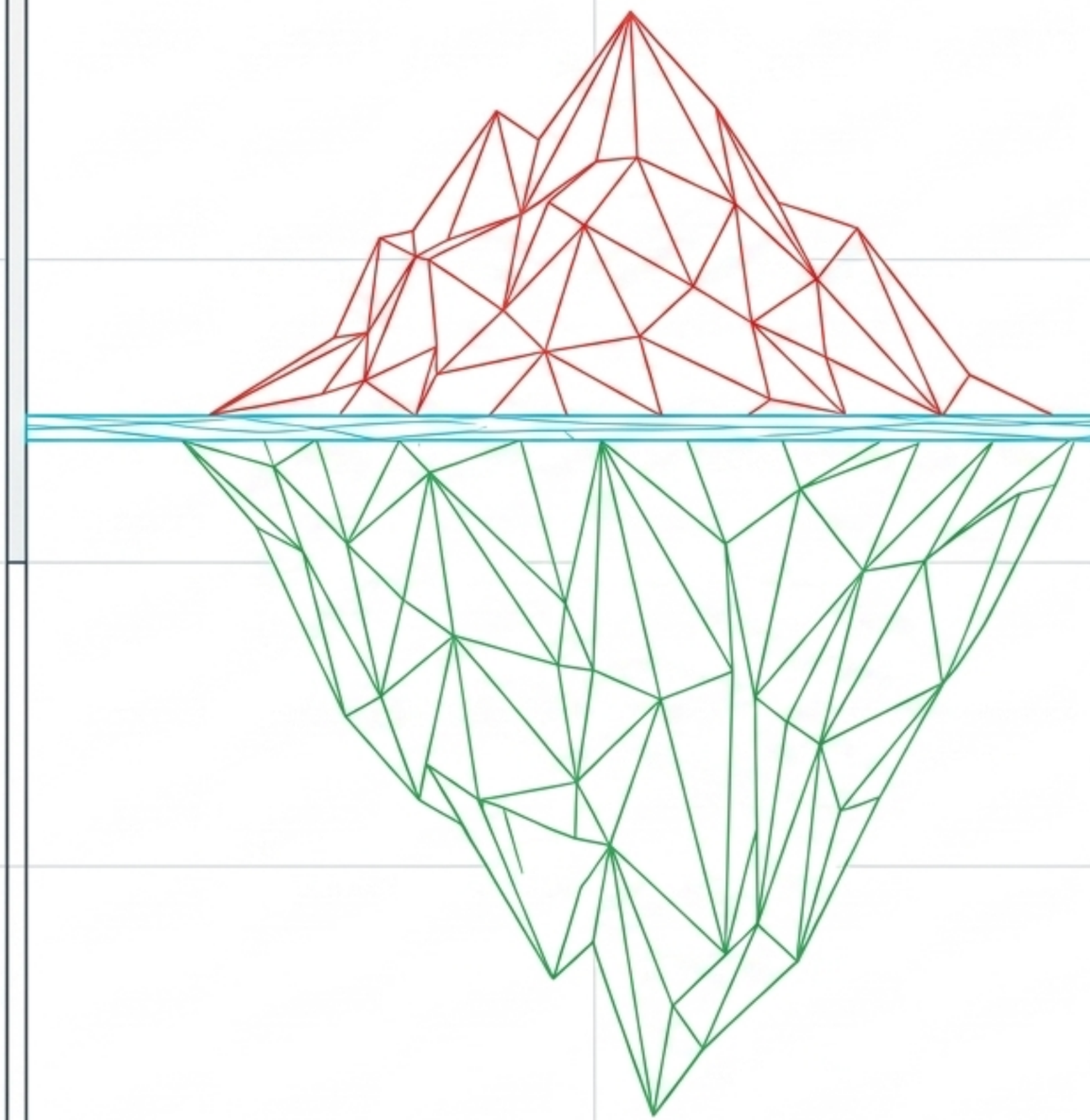
Primary Aetiologies (Australia)



The Pressure-Volume Cliff



CRITICAL TAKEAWAY:
Tamponade is not defined by the volume of fluid, but by the pressure it exerts on the cardiac chambers.



Beck's Triad (Present in only 30-40% of cases)

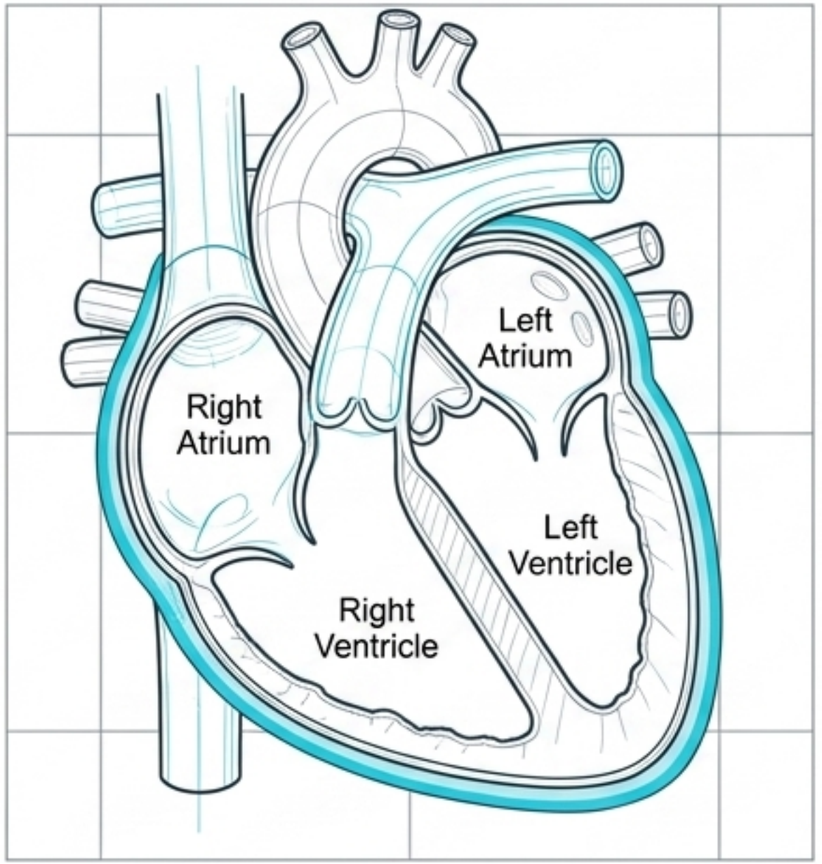
- **Hypotension** (Stroke volume failing)
- **Muffled Heart Sounds** (Fluid cushioning)
- **Jugular Venous Distension** (Elevated central venous pressure)

Early Compensatory Mechanisms (Seek these out to prevent arrest)

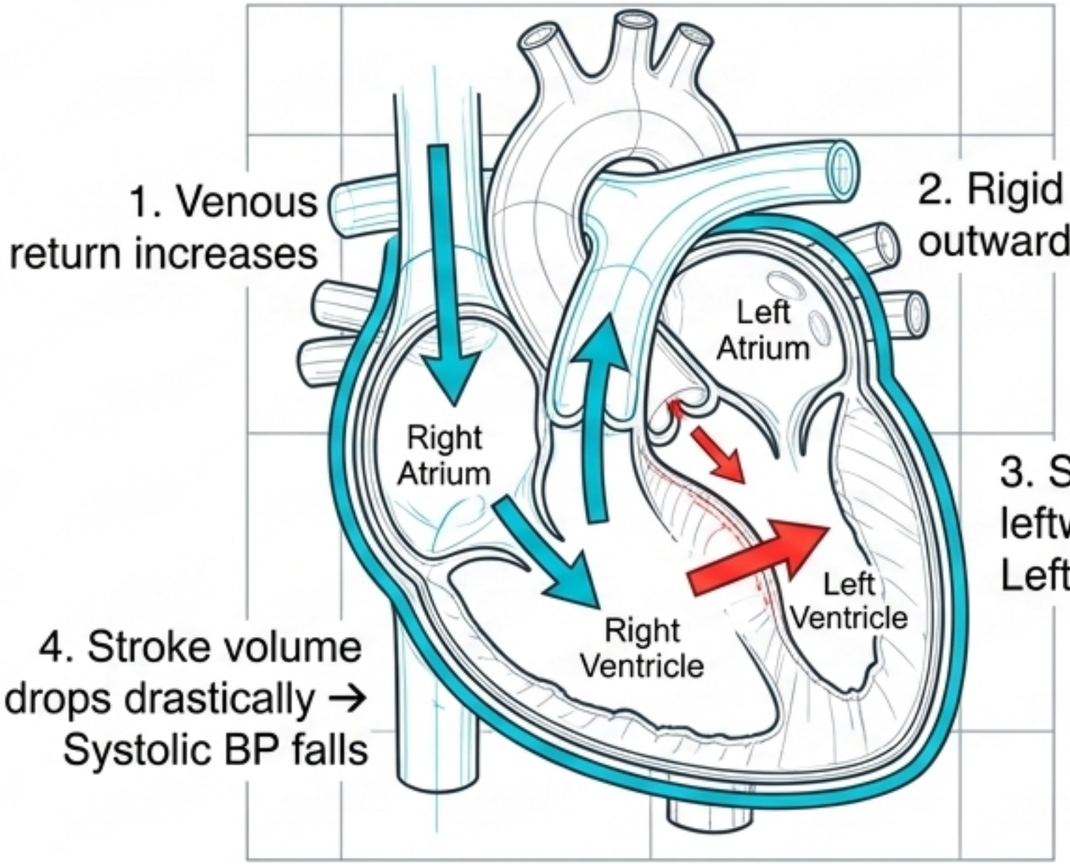
- **Tachycardia** (Baroreceptor-mediated response to maintain CO)
- **Narrow Pulse Pressure** (<30 mmHg due to vasoconstriction)
- **Tachypnoea** (Diaphragmatic compression)
- **Pulsus Paradoxus** (>10 mmHg systolic drop on inspiration)

The Mechanic of Pulsus Paradoxus

Sensitive in up to 80% of cases: >10 mmHg systolic drop during inspiration.



Expiration (Normal Output)

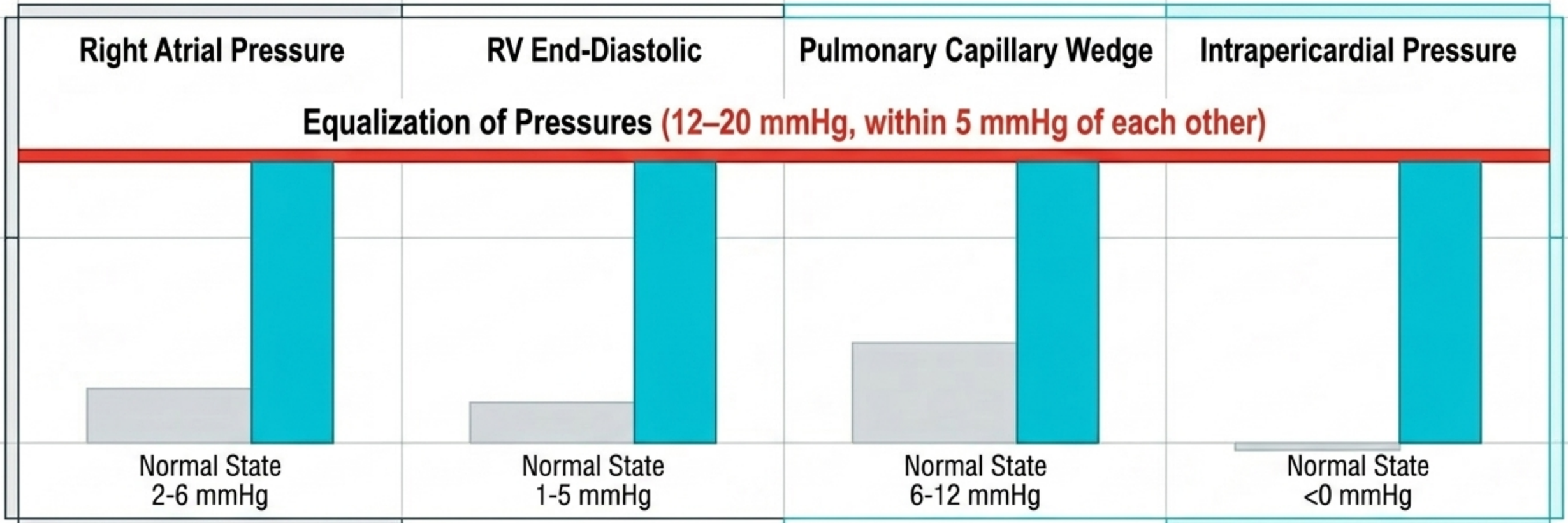


Inspiration (Ventricular Interdependence)

Measurement Protocol: Measure with sphygmomanometer; note gap between first Korotkoff sound (expiration only) and continuous sounds. Unreliable in severe hypotension (<90 mmHg).

The Haemodynamic Hallmark: Equalization

Right-sided chambers are compliant and collapse first. Elevated intrapericardial pressure forces all diastolic pressures to converge, halting filling.



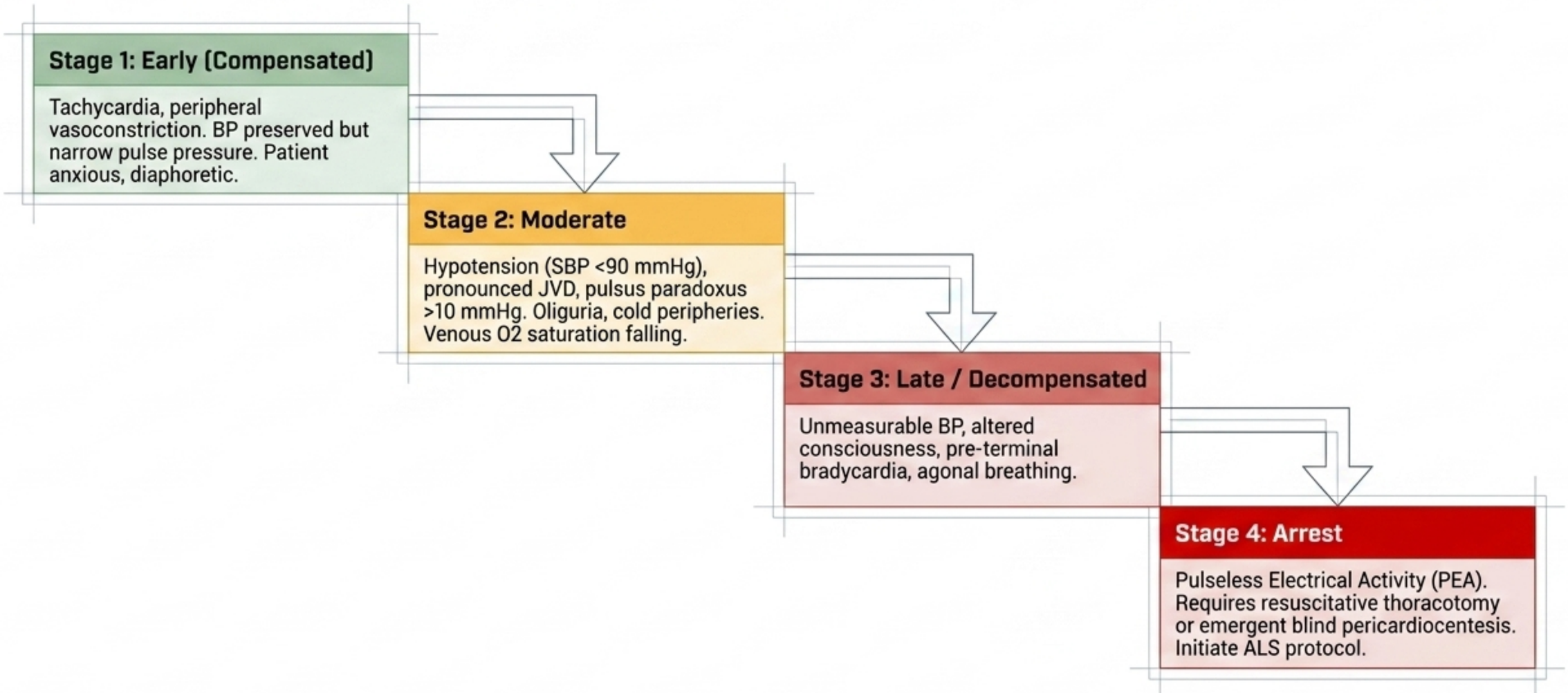
Takeaway: This loss of pressure gradients entirely halts diastolic filling. Stroke volume plummets. Right Heart Catheterisation is the gold standard for confirmation.

TTE Diagnostic Matrix (Point-of-Care Ultrasound)

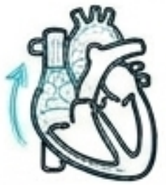
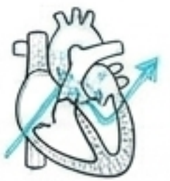
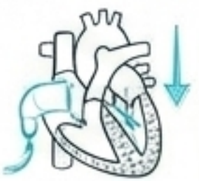
Echocardiographic Sign	Timing in Cardiac Cycle	Sensitivity / Specificity
Right Atrial (RA) Collapse 	Late diastole / early systole (>1/3 of cycle)	Sens 50–60%, Spec ~95%
Right Ventricular (RV) Collapse 	Early diastole (Indicates higher pressures)	Sens 60–90%, Spec 80–90%
IVC Plethora 	Continuous (Diameter >2.1 cm, <50% inspiratory collapse)	Sens ~90%, Spec ~50%
Respiratory Variation 	Flow Velocities (>25% Mitral E, >40% Tricuspid E)	Sens ~80%, Spec ~85%

EMERGENCY ECHO SHOULD NOT BE DELAYED. Do not wait for formal cardiology. Treat via bedside POCUS.

The Trajectory of Obstructive Shock



Immediate Resuscitation Parameters

DO: Temporizing Measures	DO NOT: Lethal Interventions
✓ **Volume:** 500–1000 mL crystalloid bolus to increase right-sided filling pressures. 	✗ **Positive-Pressure Ventilation:** Increases intrathoracic pressure → obliterates right heart venous return. 
✓ **Position:** Sitting upright / leaning forward to relieve venous compression. 	✗ **Beta-Blockers / Non-DHP CCBs:** Eliminates life-saving compensatory tachycardia. 
✓ **Vasopressors:** Noradrenaline (0.05–0.5 mcg/kg/min) to maintain SVR while preserving heart rate. 	✗ **Diuretics / Vasodilators:** Reduces preload/afterload → precipitous drop in cardiac output. 

Drainage Triage Pathways

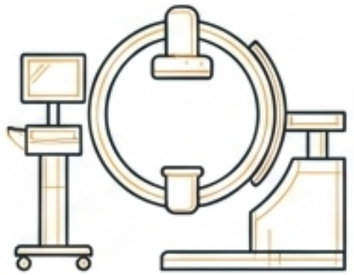
Emergent (Immediate Pericardiocentesis)

Indication: Haemodynamic instability (SBP <90), PEA arrest, altered consciousness.

Setting: Bedside in ED/ICU.

DO NOT DELAY FOR TRANSFER.

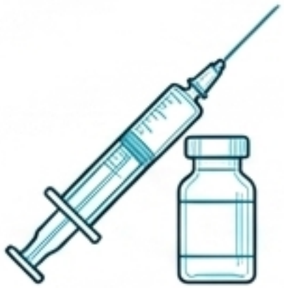
Urgent (Within Hours)



Indication: Stable haemodynamics but echo signs of tamponade (RA/RV collapse) + moderate/large effusion.

Setting: Catheterisation lab or procedural suite under echo guidance.

Elective (Planned)

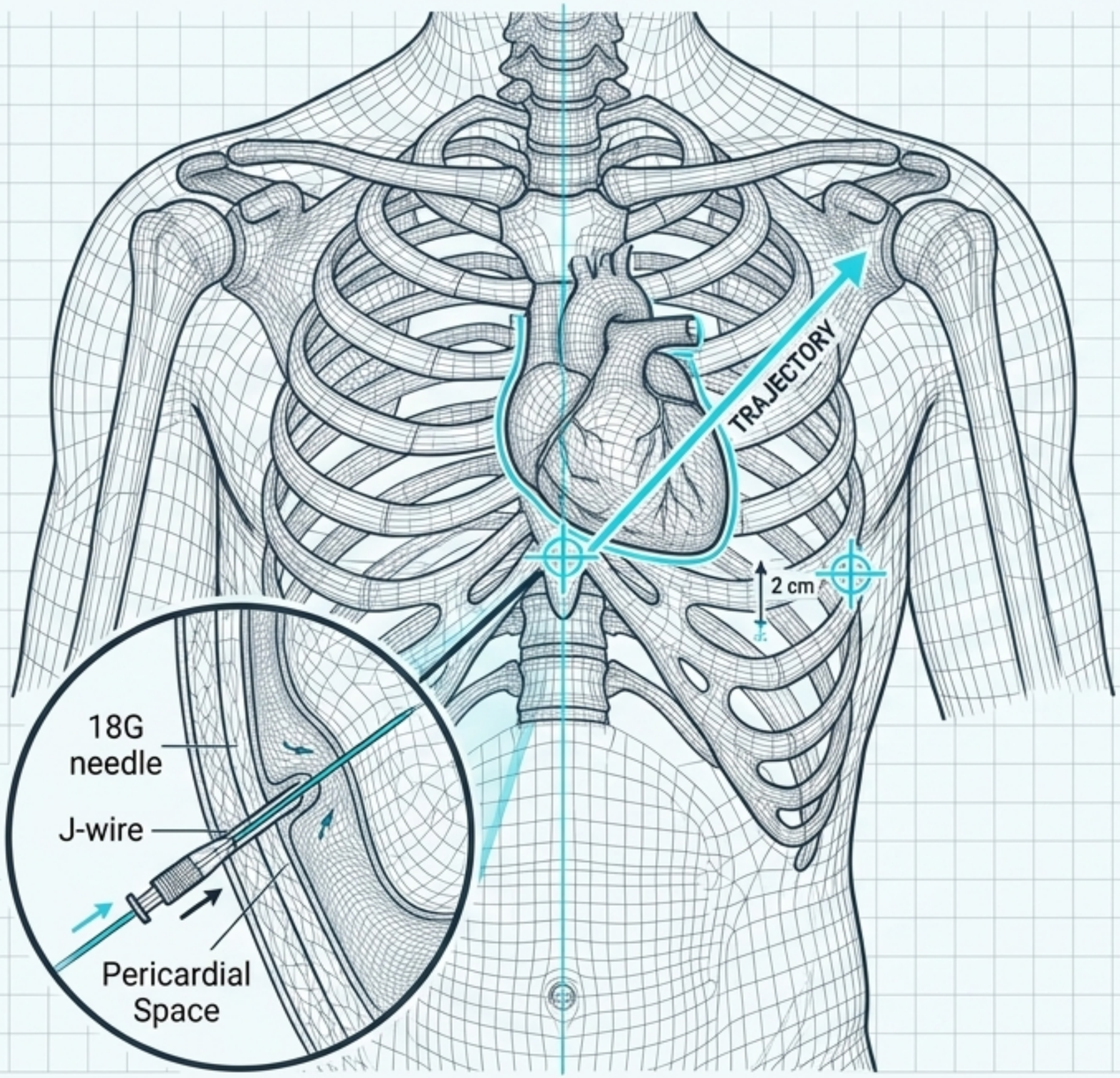


Indication: Large effusion without tamponade physiology (No chamber collapse, normal IVC).

Purpose: Diagnostic fluid analysis.

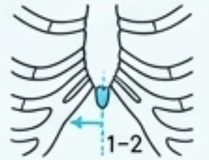
Setting: Cardiology procedural suite.

Procedural Blueprint: Subxiphoid Approach

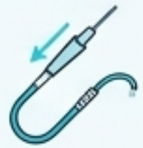


1. Position: Head-up 30–45°. Establish IV access & ECG monitoring.

2. Landmark: 1–2 cm inferior and 1–2 cm left of the xiphoid process.



3. Trajectory: Advance 16-18G needle towards the left shoulder at a 30–45° angle to the skin. Continuous aspiration.



4. Catheterization: Pass J-wire through needle. Dilate tract. Insert 6-8 Fr pigtail catheter.

5. Drainage: Drain slowly. Max 500 mL initially to prevent acute RV dilatation.

ECG Trick: If using blind ECG guidance, attach V-lead to needle. ST elevation = epicardial contact. Withdraw slightly.

Imaging Guidance & Complication Management

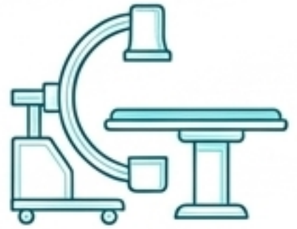
Imaging Modalities

Echocardiography (Preferred)

Real-time, confirms entry. Complication rate <1%. ACSQHC standard of care.

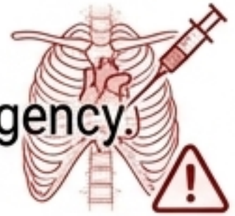
Fluoroscopy

Good for cath lab positioning. No direct needle-heart visualization.



Blind (Landmark)

Reserved for PEA arrest/extreme emergency. ~5% complication rate.

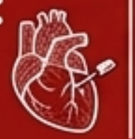


Surgical Window

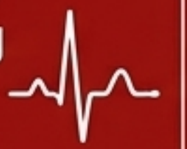
Required for loculated, recurrent, or haemorrhagic effusions.

Complications Tracker & Response

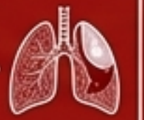
Chamber Puncture (RV most common): Withdraw needle, observe.



Arrhythmia (1-3%): Usually self-limiting ventricular ectopy.



Pneumothorax (0.5-1%): Observe; intercostal catheter if significant.



Vagal Reaction (1-2%): Atropine 600mcg IV if bradycardic.

Pericardial Fluid Analysis Matrix

Gross Appearance

Serous

↳ **Viral/Idiopathic**
Indicates viral or idiopathic etiology.

Haemorrhagic

↳ **Malignancy, Trauma**
Suggests malignancy or traumatic tap.

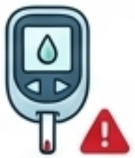
Purulent

↳ **Bacterial**
Indicates bacterial infection.

Biochemistry (Exudate Criteria)

Protein & LDH (Light's criteria) → **Exudate Criteria**

- Ratio **>0.5** Protein or **>0.6** LDH = **Exudate**



Glucose

↳ **<1.1 mmol/L** indicates Bacterial, TB, or Rheumatoid aetiology.

Cell Count & Cytology

Cell Count

- **Neutrophils**: Point to Bacterial infection.
- **Lymphocytes**: Point to TB, Malignancy, or Viral.

Cytology

↳ **70-90%** sensitivity for malignant effusion. (Ensure **≥50 mL** sent).

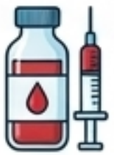
Microbiology & TB Biomarkers

ADA

>40 U/L is highly suggestive of Tuberculosis.

GeneXpert MTB/RIF

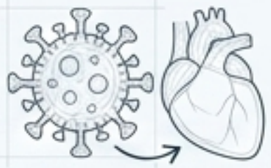
Rapid TB PCR (**60-70%** sensitivity).



Blood Cultures

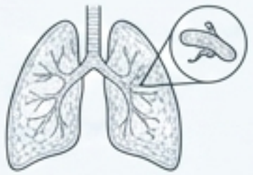
Send simultaneous blood cultures for bacterial suspicion.

AETIOLOGICAL TREATMENT PROTOCOLS



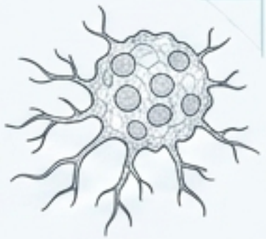
VIRAL / IDIOPATHIC

Regimen: NSAIDs (Ibuprofen 600mg TDS) + Colchicine (500mcg BD) for 3 months.



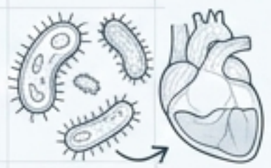
TUBERCULOSIS

Regimen: Anti-TB regimen (2HRZE/4HR) + Adjunctive Prednisolone (60mg taper).



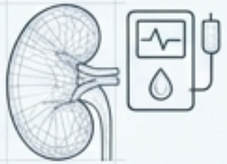
MALIGNANCY

Regimen: Systemic chemo/immuno + Pericardiodesis (Bleomycin) or indwelling catheter to prevent recurrence.



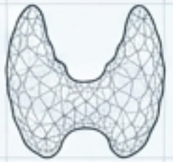
BACTERIAL (PURULENT)

Regimen: IV Vancomycin (trough 15-20 mg/L) + Ceftriaxone 2g IV. Surgical debridement usually required.



URAEMIC

Regimen: Intensify haemodialysis. Avoid heparin in the dialysis circuit if haemopericardium is present.



HYPOTHYROIDISM

Regimen: Levothyroxine (50-100mcg initially). Effusions resolve slowly; rarely causes tamponade.

Procedural & Pharmacological Adjustments by Population

 Pregnancy	Left lateral tilt (15-30°) to avoid aortocaval compression. AVOID Colchicine (Teratogenic).
 Paediatrics	Use smaller needle (18-20G). Fluid bolus capped at 20 mL/kg. Tachycardia & hepatomegaly are early signs.
 Elderly	Atypical presentation (confusion/falls). Cautious volume resuscitation (250 mL increments) due to underlying LV dysfunction/heart failure risk.
 Renal Impairment	Avoid NSAIDs (if eGFR <30). Dose reduce/avoid colchicine in dialysis. High risk of post-drainage pulmonary oedema.
 Hepatic Impairment	Correct coagulopathy (FFP/Platelets) prior to drainage if INR >2.0 or Plt <50. Reduce hepatically cleared drug doses.

First Nations Health: Epidemiology & Remote Retrieval

Tuberculosis (Endemic Risk)

TB incidence is 6–8x higher in ATSI peoples. Mandatory testing: send fluid for GeneXpert PCR, AFB culture, and ADA.

Rheumatic Heart Disease

RHD is disproportionately prevalent (NT, QLD, WA). Pericardial effusion in young patients must prompt Acute Rheumatic Fever investigation.

Remote Access & Aeromedical Retrieval

Emergent retrieval (RFDS) is critical. POCUS is available remotely—if patient is deteriorating pre-flight, remote bedside POCUS-guided pericardiocentesis is indicated.

Uraemia & Cultural Safety

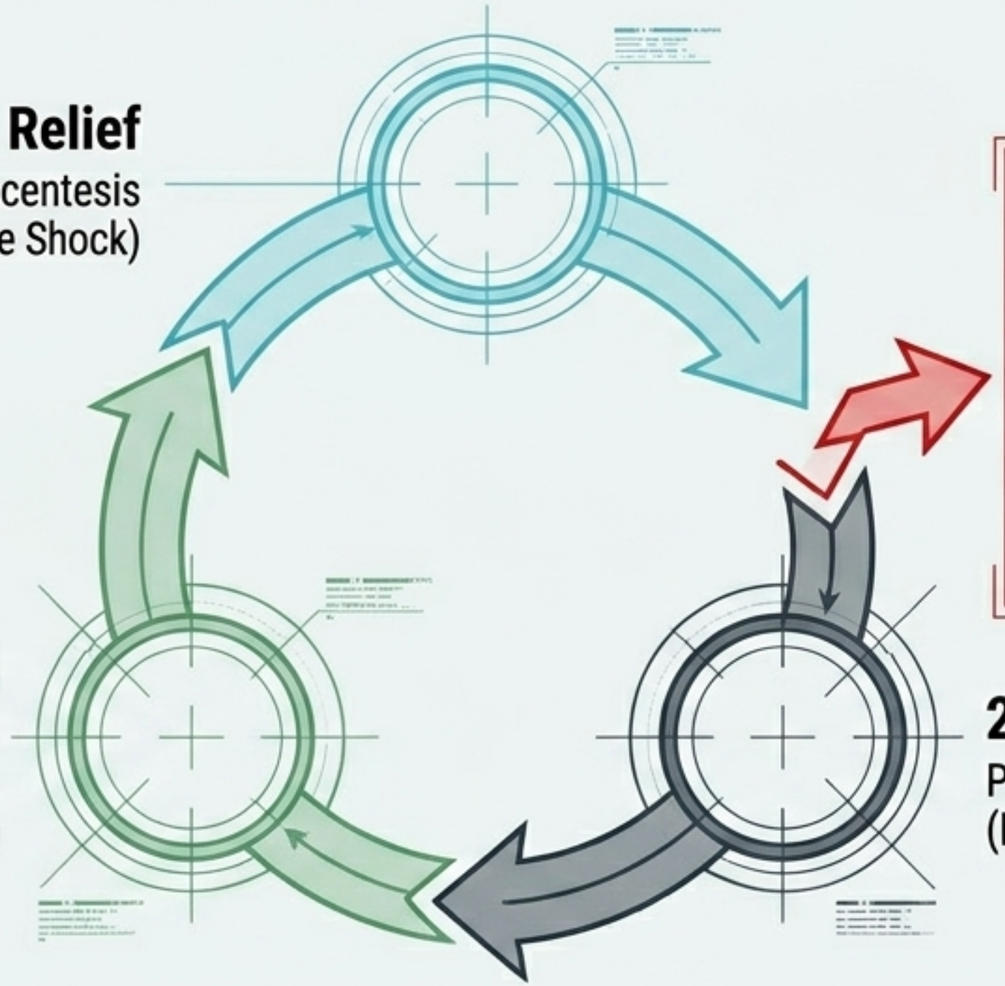
ESKD is 4-6x more prevalent; maintain high vigilance for uraemic tamponade. Ensure cultural safety and use interpreter services during rapid interventions.

The Synthesis: Breaking the Cycle of Recurrence

Tamponade is a mechanical problem requiring a mechanical solution, but preventing recurrence requires a medical one.

1. Mechanical Relief

Emergency Pericardiocentesis
(Resolves Obstructive Shock)



⚠ The Broken Link: Recurrent Tamponade

Draining fluid without definitive systemic treatment guarantees a high recurrence rate (e.g., 30-50% in untreated malignancy).
Treat the patient, not just the pericardium.

2. Diagnostic Investigation

Pericardial Fluid Analysis & Cytology
(Identifies Pathogen/Pathology)

3. Targeted Aetiological Treatment

Anti-TB / Oncology / Dialysis / NSAIDs
(Eliminates the Source)