

Cardiac Tamponade

Pathophysiology and Assessment

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 - Assessment of pericardial effusion

Normal Pericardial Physiology

- Mechanical function
 - Limits vent. filling: affects chamber compliance
 - More significant vis-à-vis RV than LV
 - Even distribution of pressure over the ventricles → Balancing RV/LV outputs
 - Decreasing friction
 - Mechanical barrier to contiguous spread of infection
- Normal pericardium contains 20-30 cc of lymphoid fluid

Suspect it!



Clinical Situation

- Trauma
- Cardiac Arrest(PEA)
- Unexplained hypotension
- Shortness of Breath
- Chest Pain



Clinical Features

Symptoms:

Acute: (trauma, LV rupture)

profound hypotension

confusion/agitation

Slow/Progressive large effusion (weeks)

Fatigue (↓CO)

Dyspnea

JVD

Signs:

Tachycardia

Hypotension

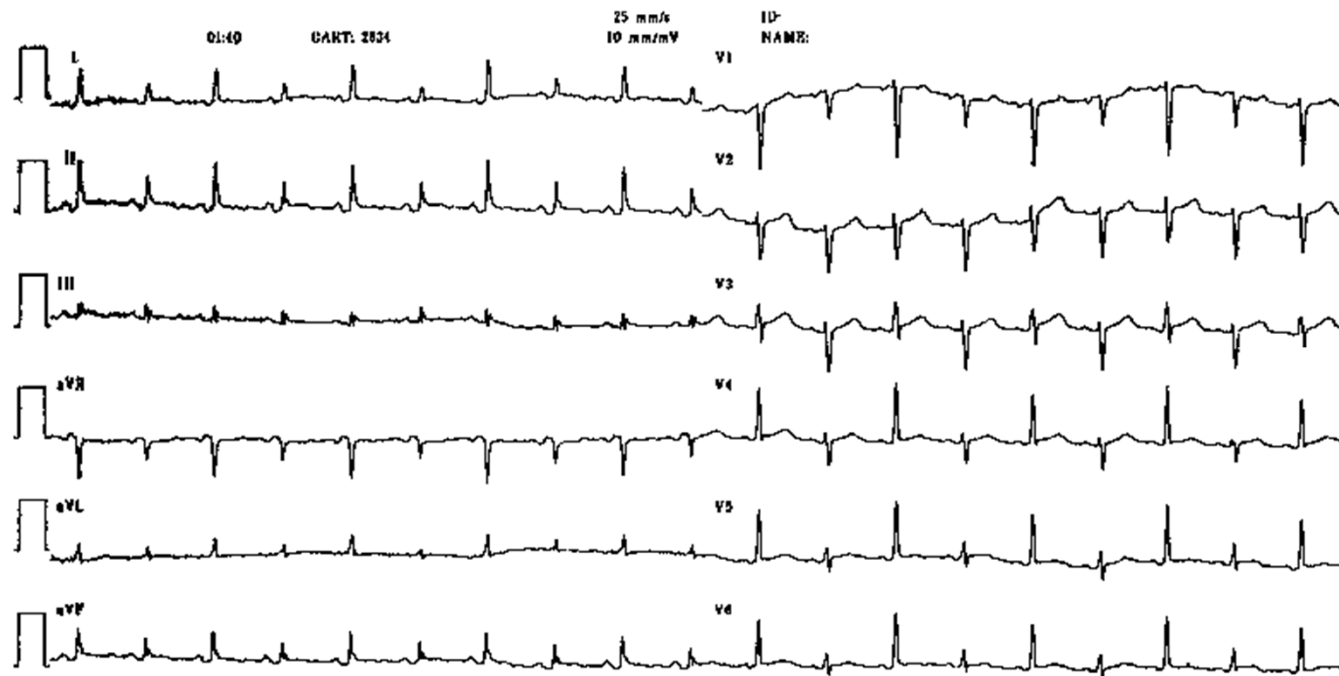
rales/edema/ascites

muffled heart sounds

pulsus paradoxus

Diagnosis – Laboratory Finding

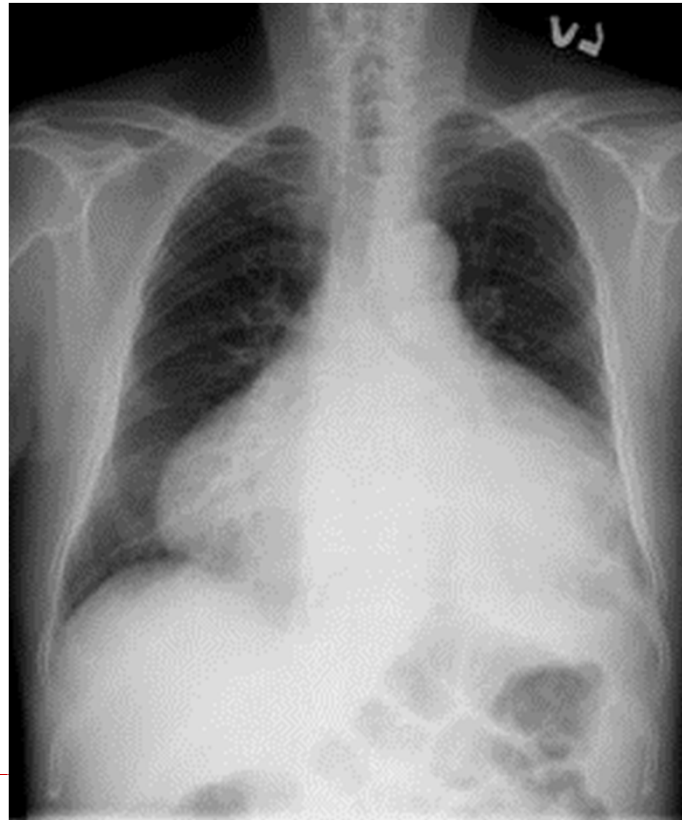
- EKG – low voltage, sinus tach, PR depression, electrical alternans



Diagnosis – Laboratory Finding

□ CXR

- enlarged, water bottle shaped heart



Diagnose it!



In the mean-time in Echo Lab

It's time to go home.

Let's finish it
in 5 minutes!

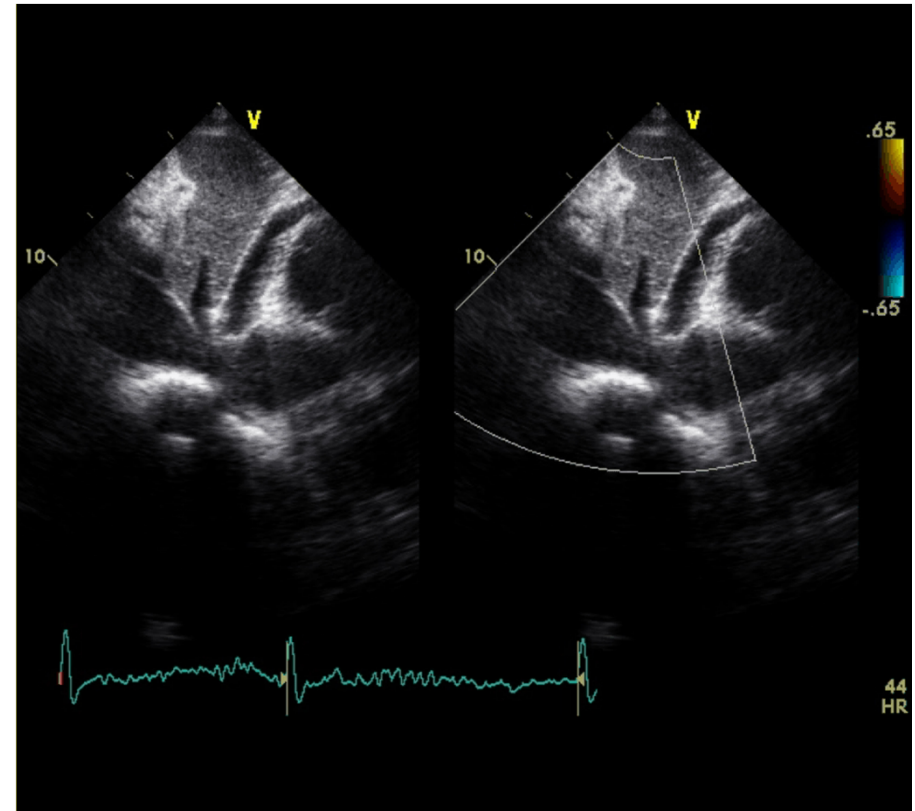
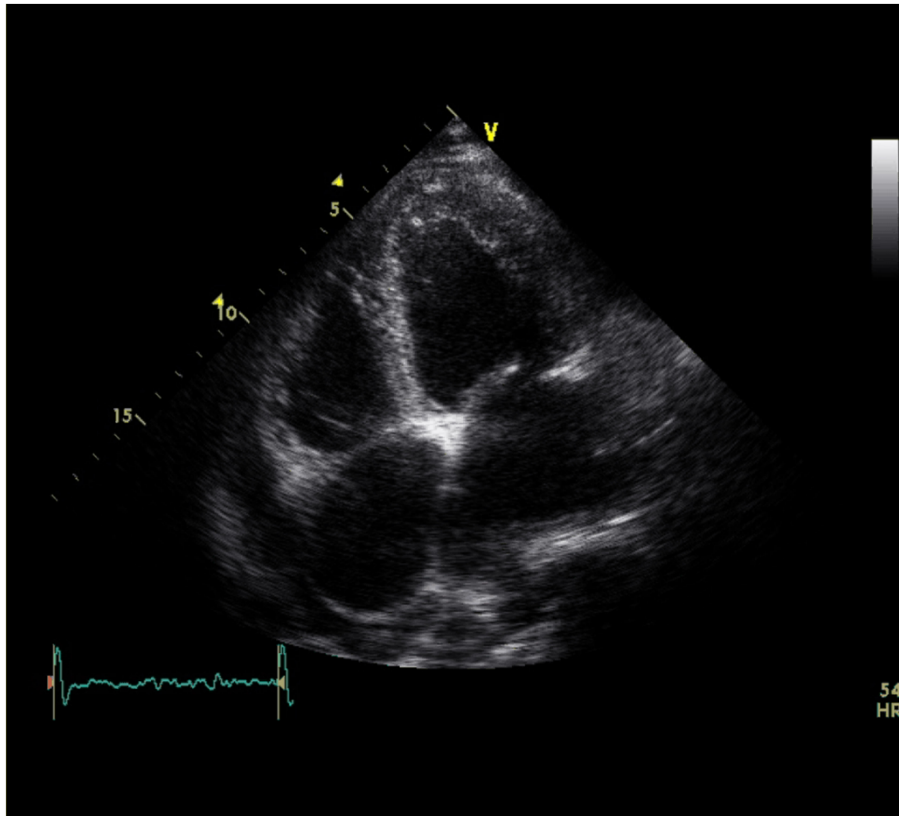


Echocardiography Report

- Normal LV cavity size and systolic function, calculated EF 64%
- No regional wall motion abnormality
- Normal valves
- Grade I diastolic dysfunction of the LV
- Trivial TR with mild pulmonary hypertension, estimated PA systolic pressure: 43mmHg
- moderate amount of pericardial effusion without RA inversion
- IVC plethora (+)

- 끝

Echocardiography



What are to be reported for PE?

- Amount
 - Minimal < 5mm
 - Small 5~10mm
 - Moderate 10~20mm
 - Large > 20mm
- Distribution: Generalized vs. Localized
- Consistency of the fluid: Echo free vs. genic
- Sign of tamponade
- Best window and depth for pericardiocentesis

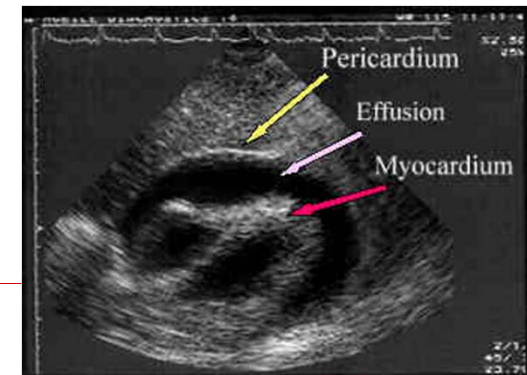
Tamponade physiology

- Impairment of diastolic filling of the LV during inspiration, caused by abnormally elevated intrapericardial pressure.
 - Pressure effect
 - RA compression (JVD)
 - RV compression
 - IVC plethora (systemic congestion)
 - Ventricular interdependence and pressure effect
 - Respiratory variation of ventricular filling (pulsus paradoxus)

Diagnosis

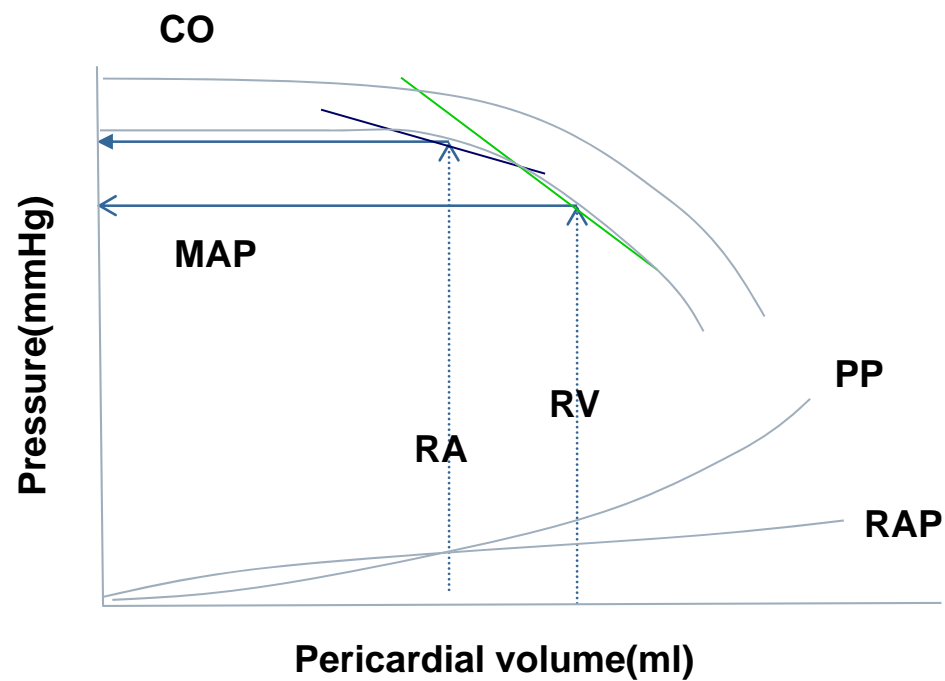
□ Echocardiogram

- Pericardial effusion
- Early diastolic collapse of the RV free wall
- Late diastolic collapse of the RA
- Respiratory change in RV and LV filling
- IVC plethora
- Swinging of the heart in its sac
- LV pseudohypertrophy



Spectrum of Tamponade Physiology

Tamponade physiology is not an “all-or-non” phenomenon



RA Compression

- “The most common finding is diastolic invagination of the RA wall during diastole.”

- Feigenbaum

RA Compression

RA inversion

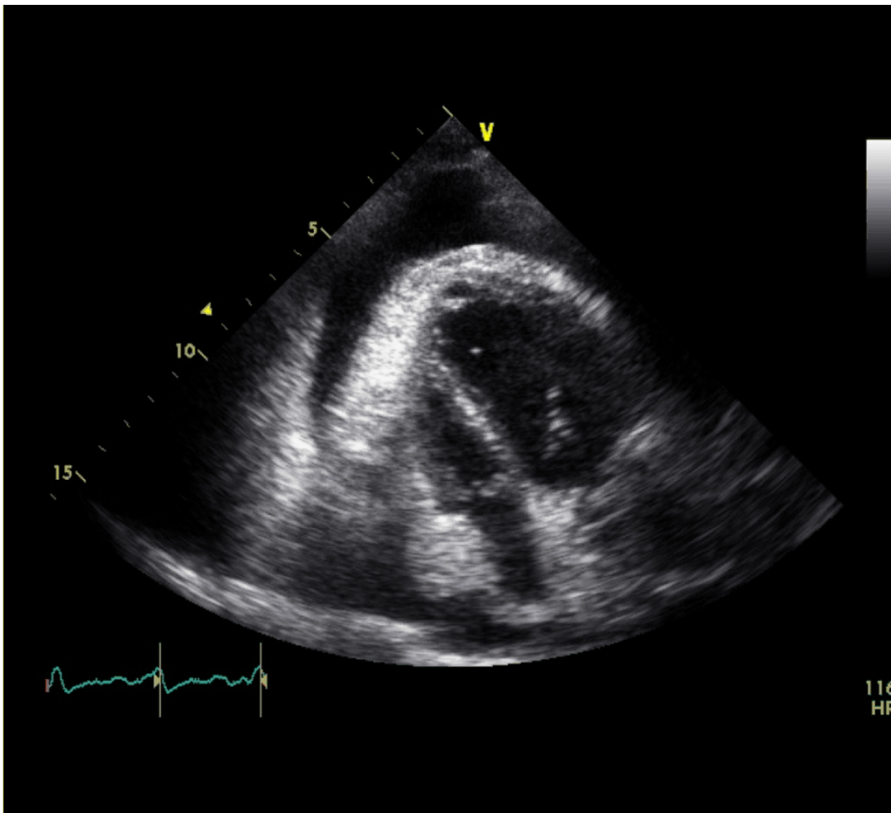
- Extremely sensitive sign of clinical tamponade
- Specificity only 50%
- Correlation with likelihood of tamponade:

Extent of inversion : NO

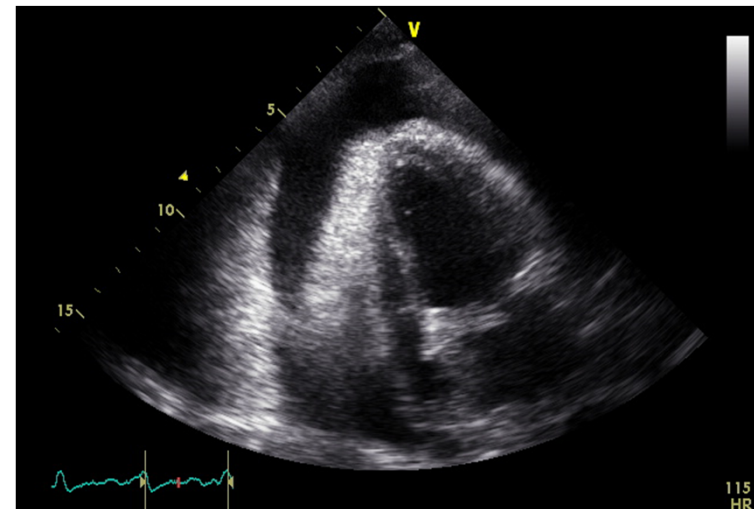
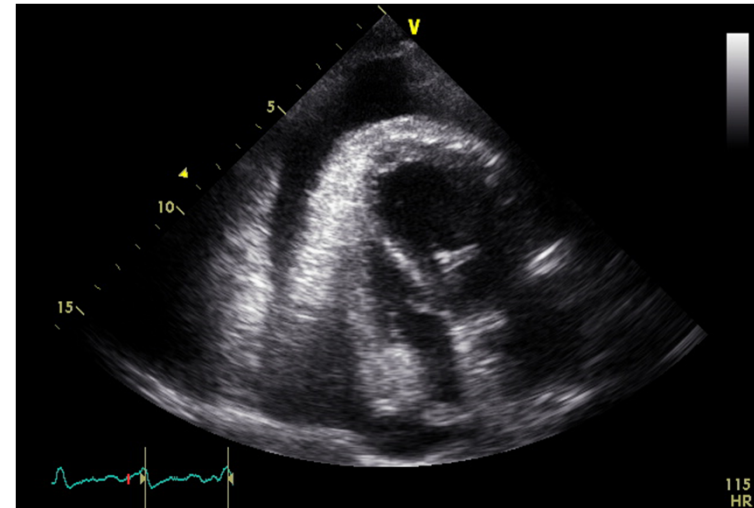
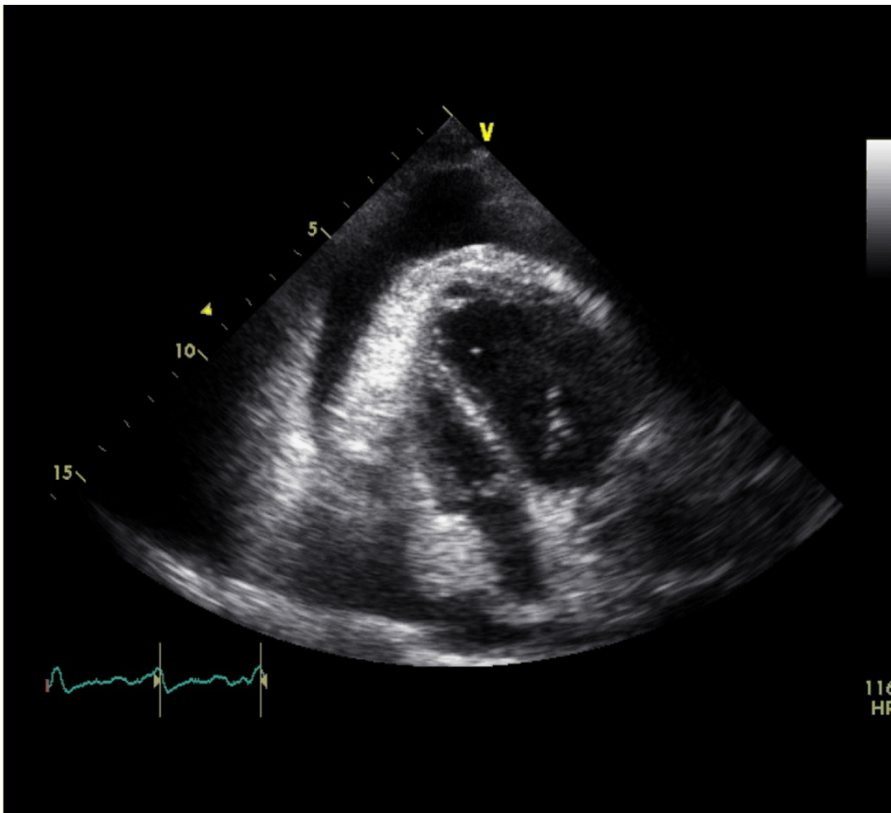
Duration of inversion : YES

- RA inversion lasting $> 1/3$ of the cycle has a specificity of 100% and Sensitivity of 94% for clinical tamponade

RA compression



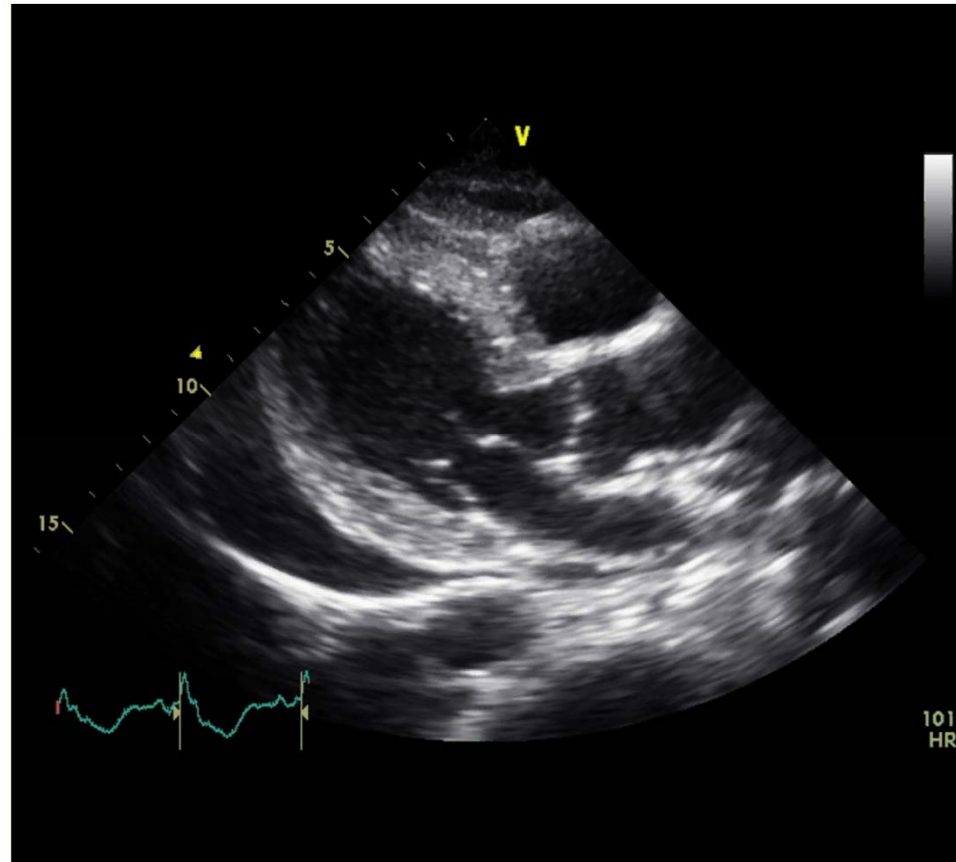
RA compression



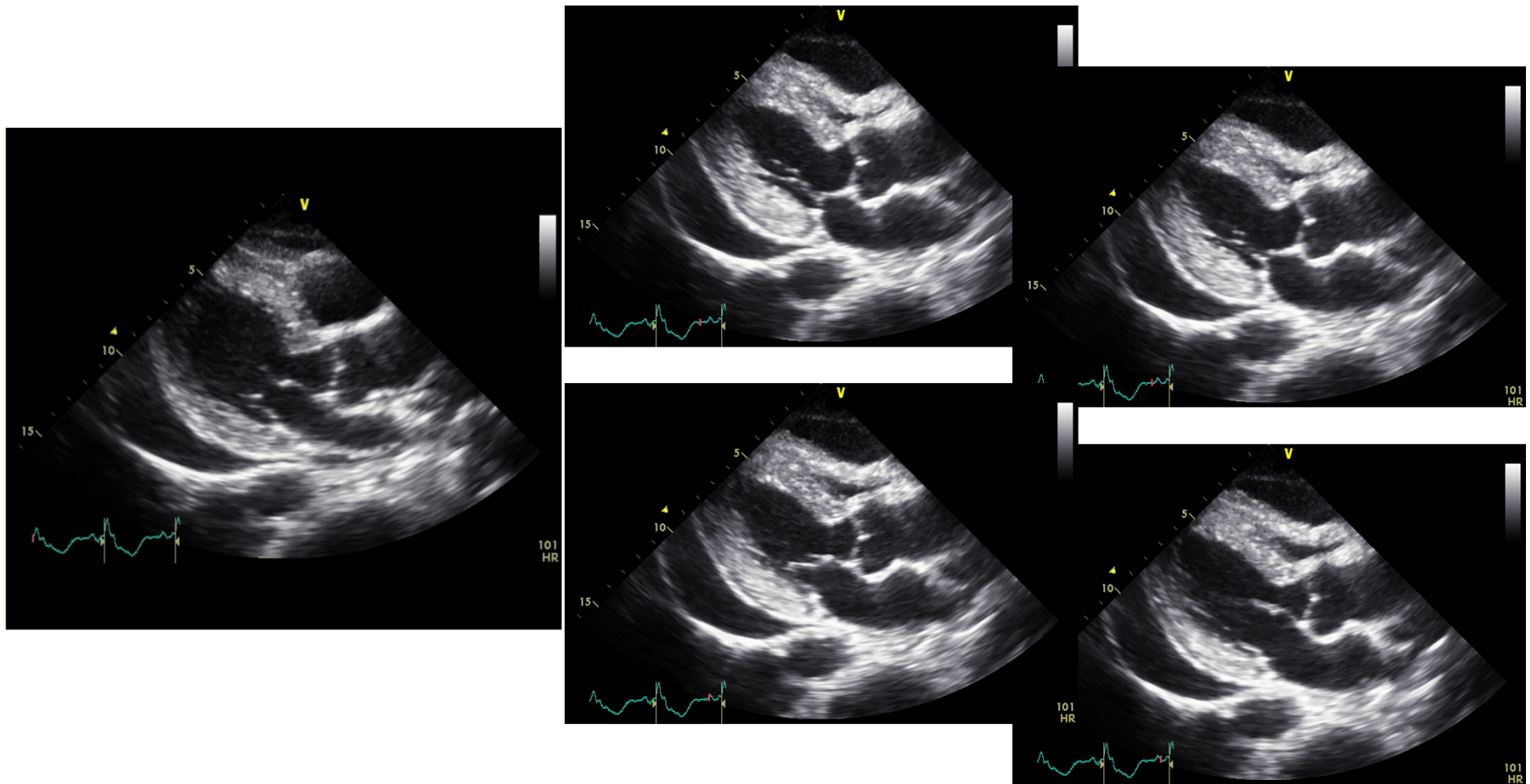
RV Compression

- Timing of RV free wall inversion
 - Early diastole
 - transient or persist throughout diastole.
- Also affected by:
 - Intravascular volume
 - Low pressure tamponade
 - RV Pressure
 - RVH and PHTN => RVDC at higher pressures
 - Chamber compliance
 - Post op, LV < RV

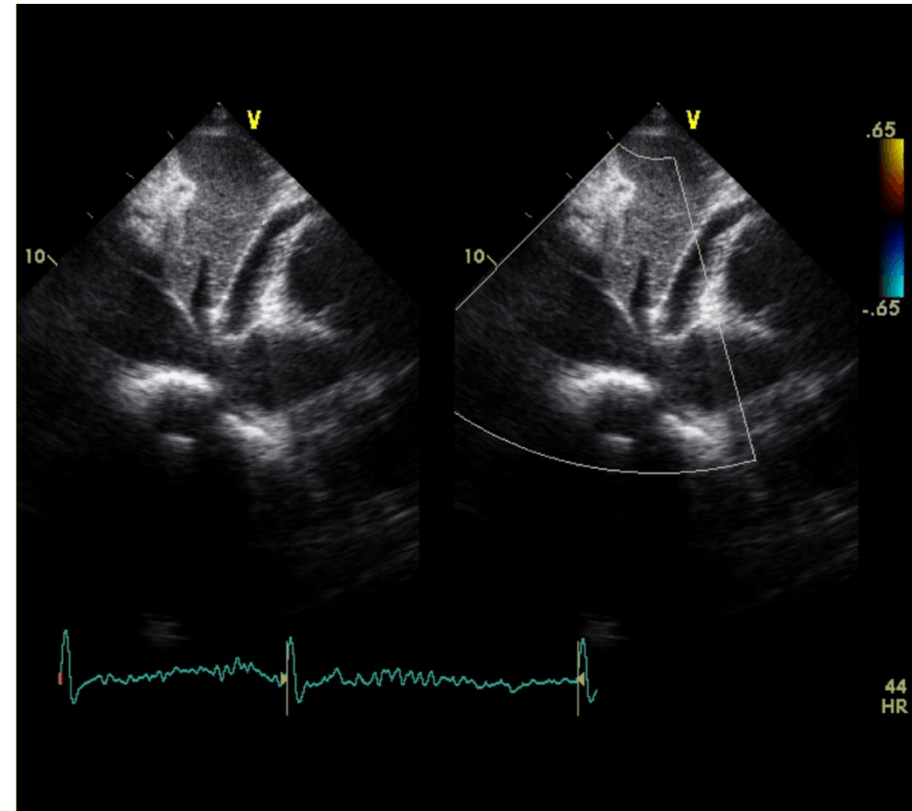
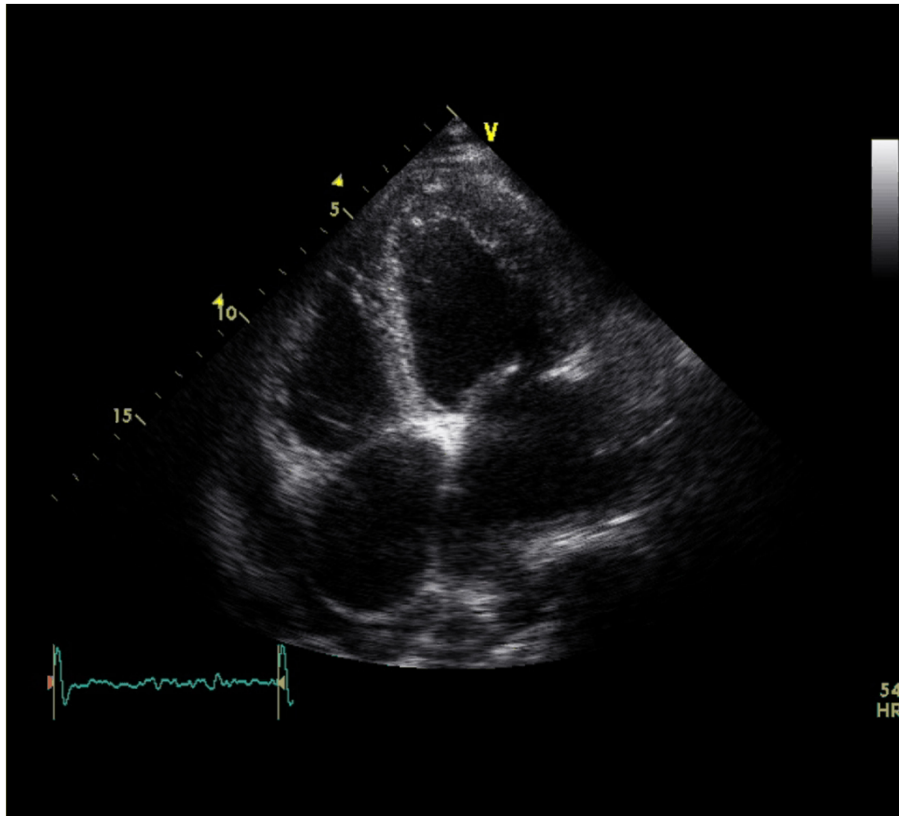
RV compression



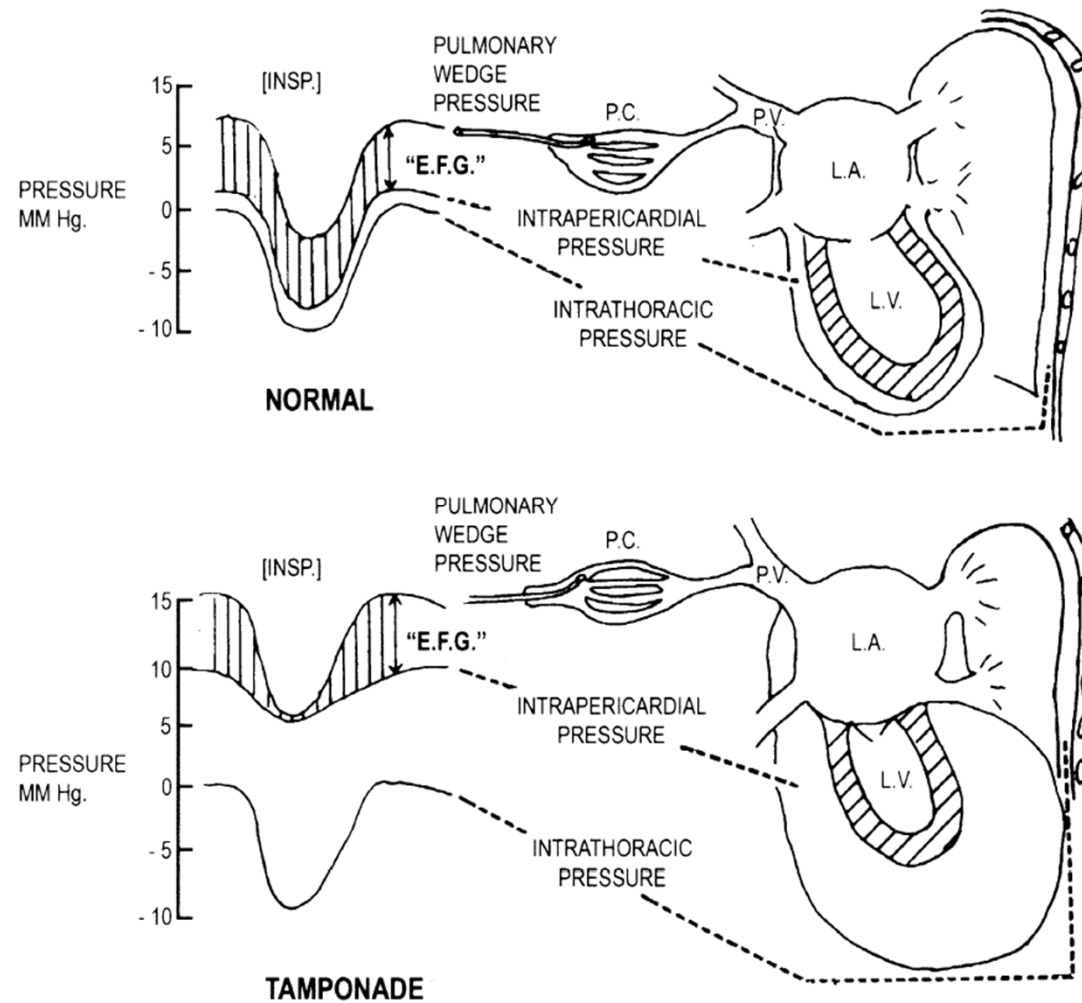
RV compression



Echocardiography: Decision?



Pathophysiology of Pericardial Tamponade



Pulsus Paradoxus

Intrapericardial pressure (IPP) tracks intrathoracic pressure.

Inspiration:

negative intrathoracic pressure is transmitted to the
pericardial space

↓ IPP

↑ blood return to the right ventricle

↓ jugular venous and right atrial pressures

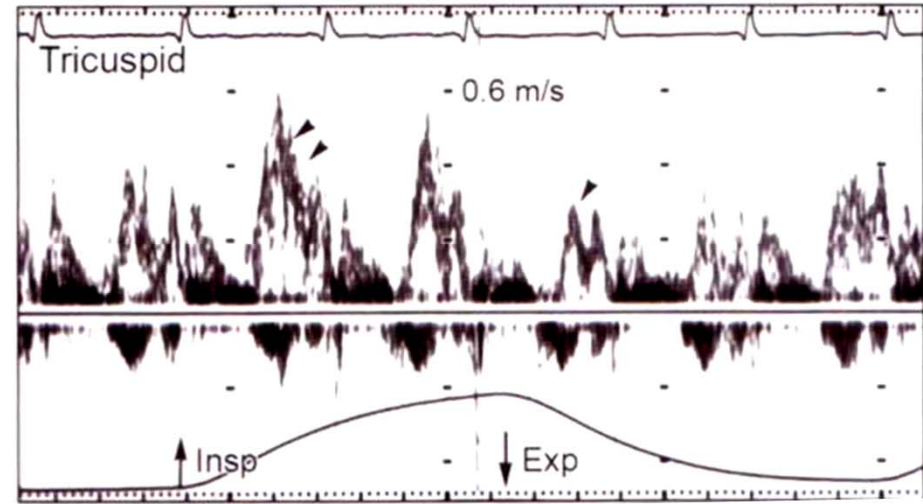
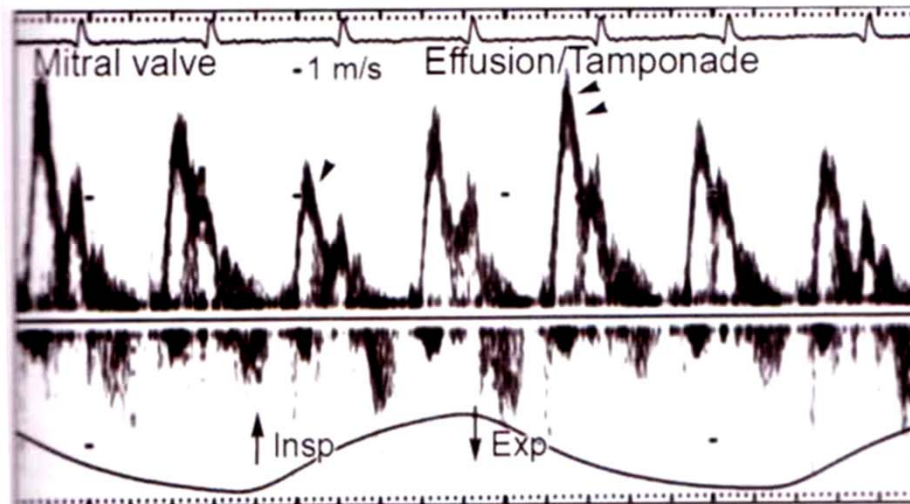
↑ right ventricular volume → interventricular septum
shifts towards the left ventricle

↓ left ventricular volume

↓ LV stroke volume

⇒ ↓ blood pressure (<10mmHg is normal) during inspiration

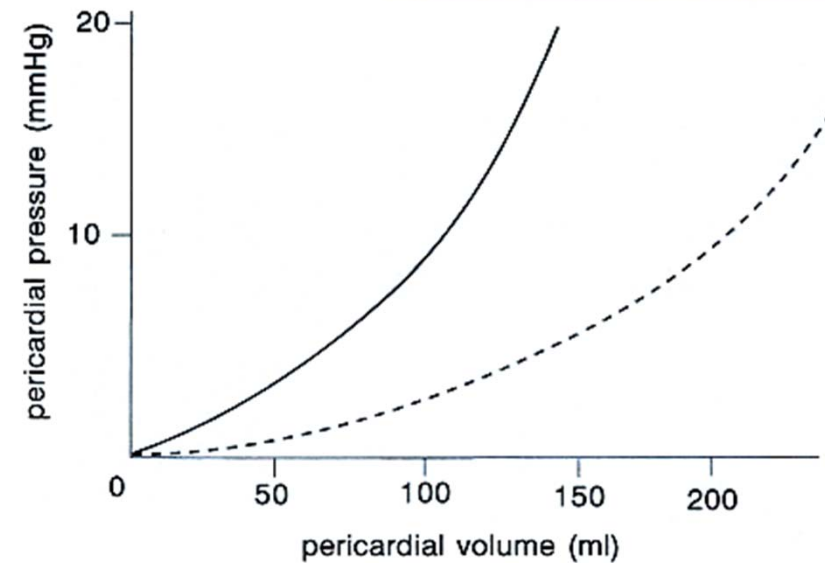
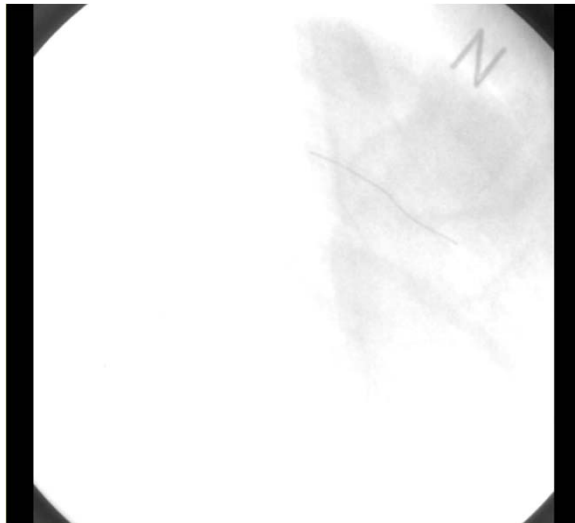
Respiratory variation of ventricular filling



>25% Variation

Rate of Accumulation

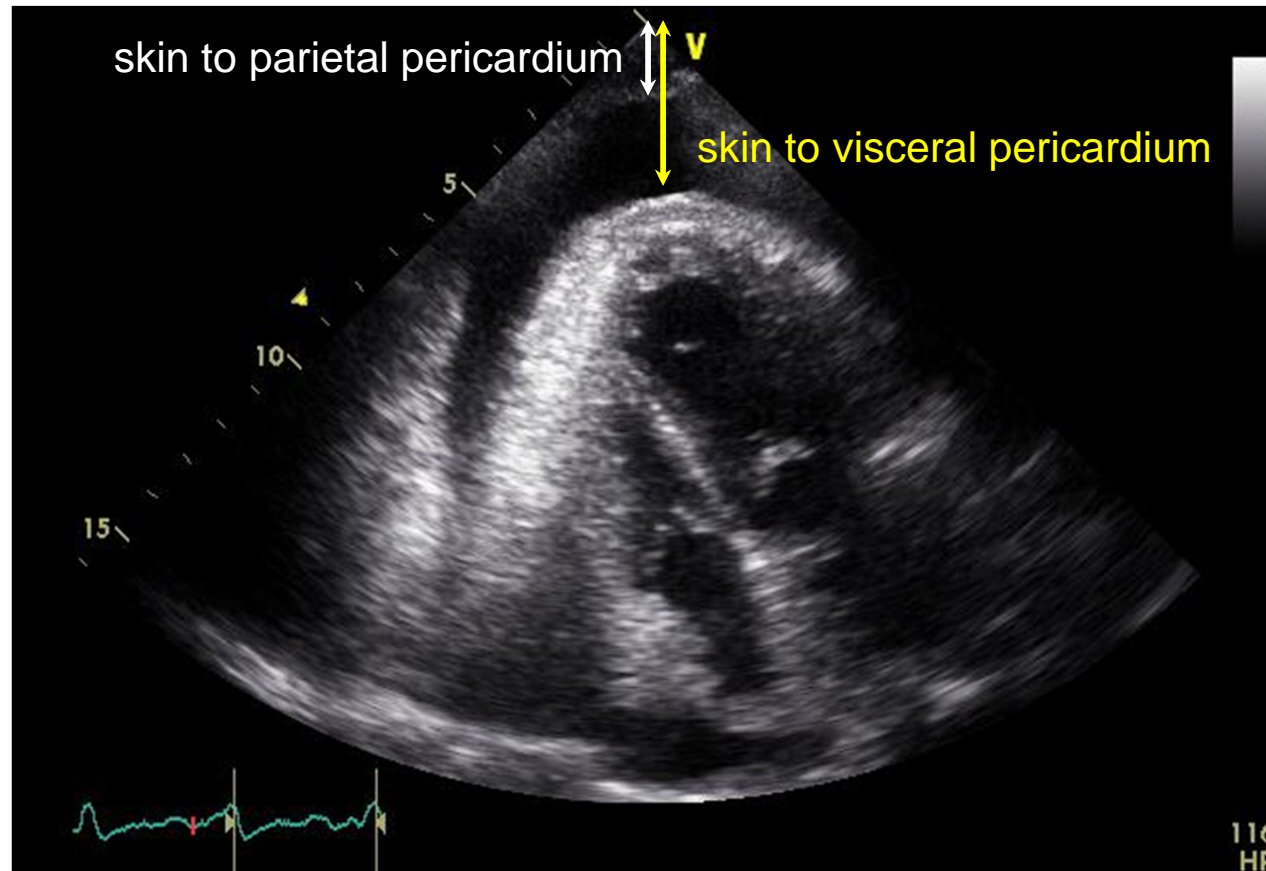
- Volume of the fluid
- Rate of accumulation
 - Slowly accumulating >1L
 - Rapid accumulation of 50-100 cc



Decide it!

- Drain or not!
- How to drain?
 - Percutaneous vs. Surgical
- Guide for percutaneous approach
 - Window, angle and depth
 - Correct position of catheters

Window, Angle and Depth



Apical window

Role of EchoCG for Pericardial Effusion

- Suspect it!
- Diagnose it!
 - Diagnose pericardial effusion
 - Determine the hemodynamic effect
 - Consideration for confounding factors!
 - Rate of accumulation
 - Volume status and Chamber compliance
- Decide it!
 - Planning the pericardiocentesis: Window, Angle, Depth
 - Plan after pericardiocentesis
 - Tube removal, pericardiodesis

Thank you!

