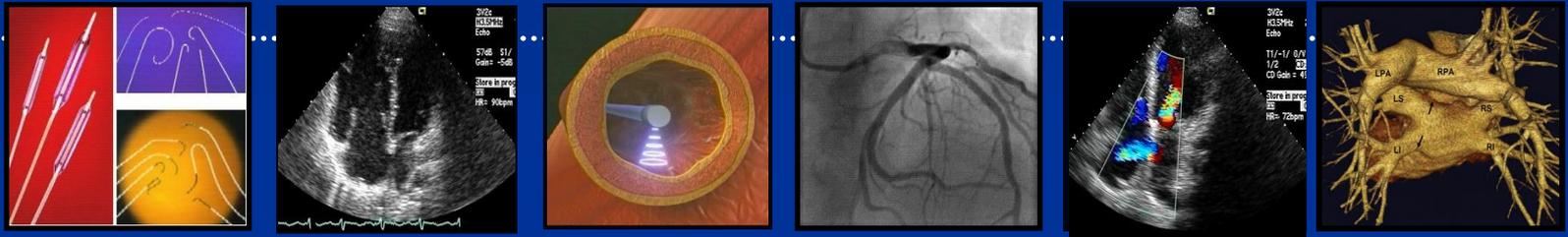


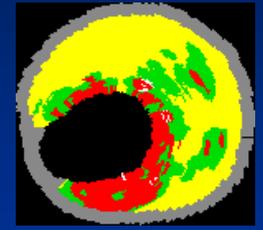
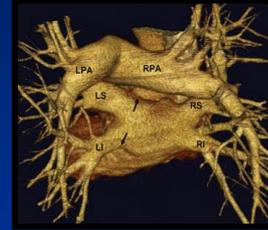
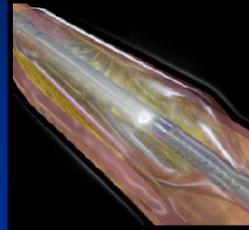
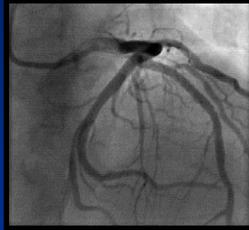
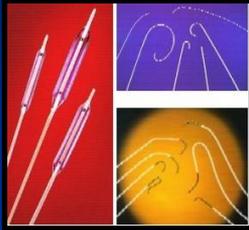
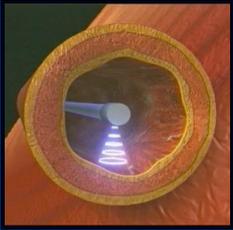
Cath Lab Essentials: “Pericardial effusion & tamponade”



*Pranav M. Patel, MD, FACC, FSCAI
Chief, Division of Cardiology
Director, Cardiac Cath Lab & CCU
University of California, Irvine
Division of Cardiology*



Acknowledgments



- No financial disclosures

Case

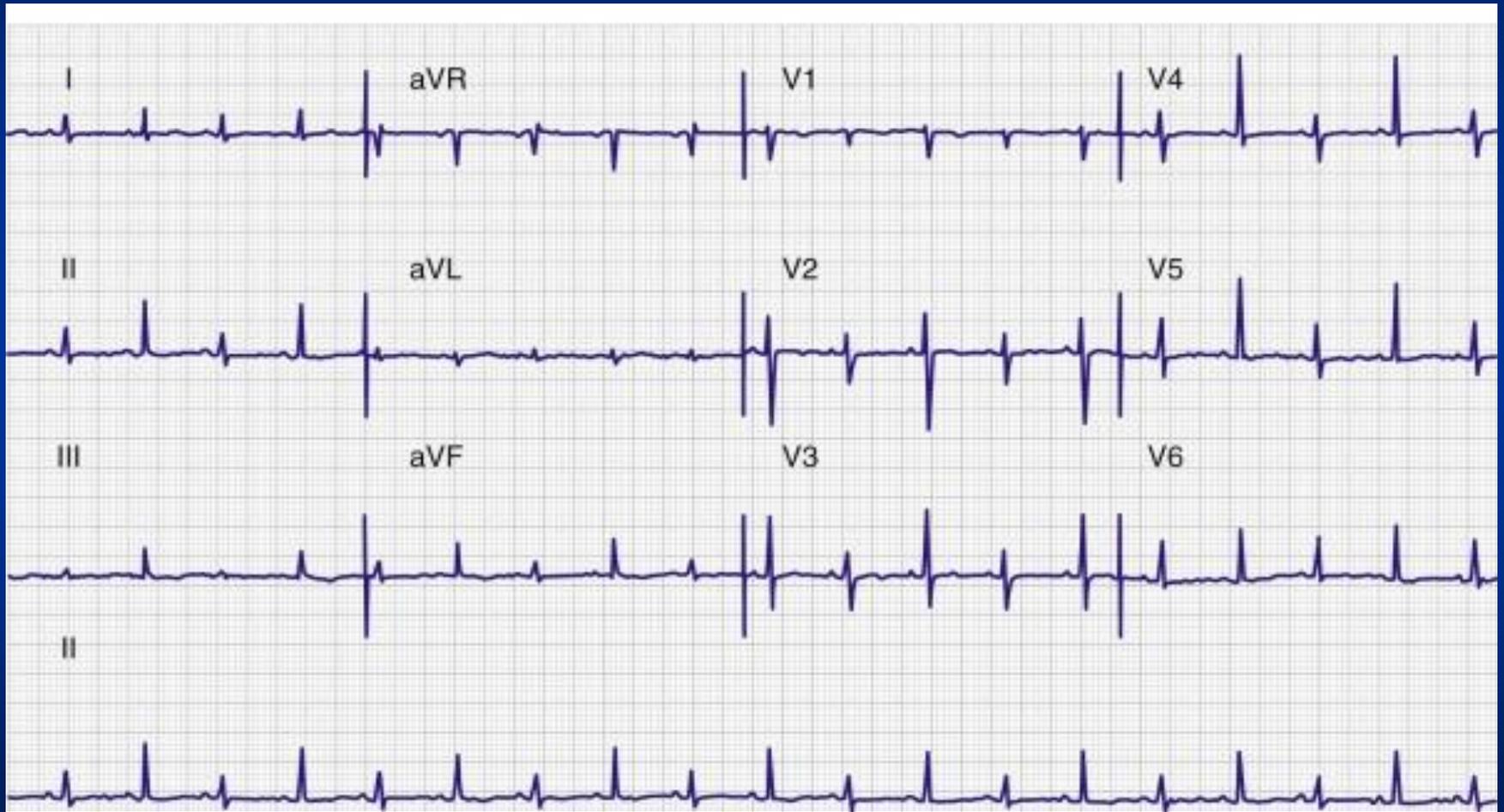
- A 52-year-old man with a 3-day history of progressively worsening dyspnea on exertion to the point that he is unable to walk more than one block without resting. He has had sharp intermittent pleuritic chest pain and a nonproductive cough. He is taking no medications.

Case

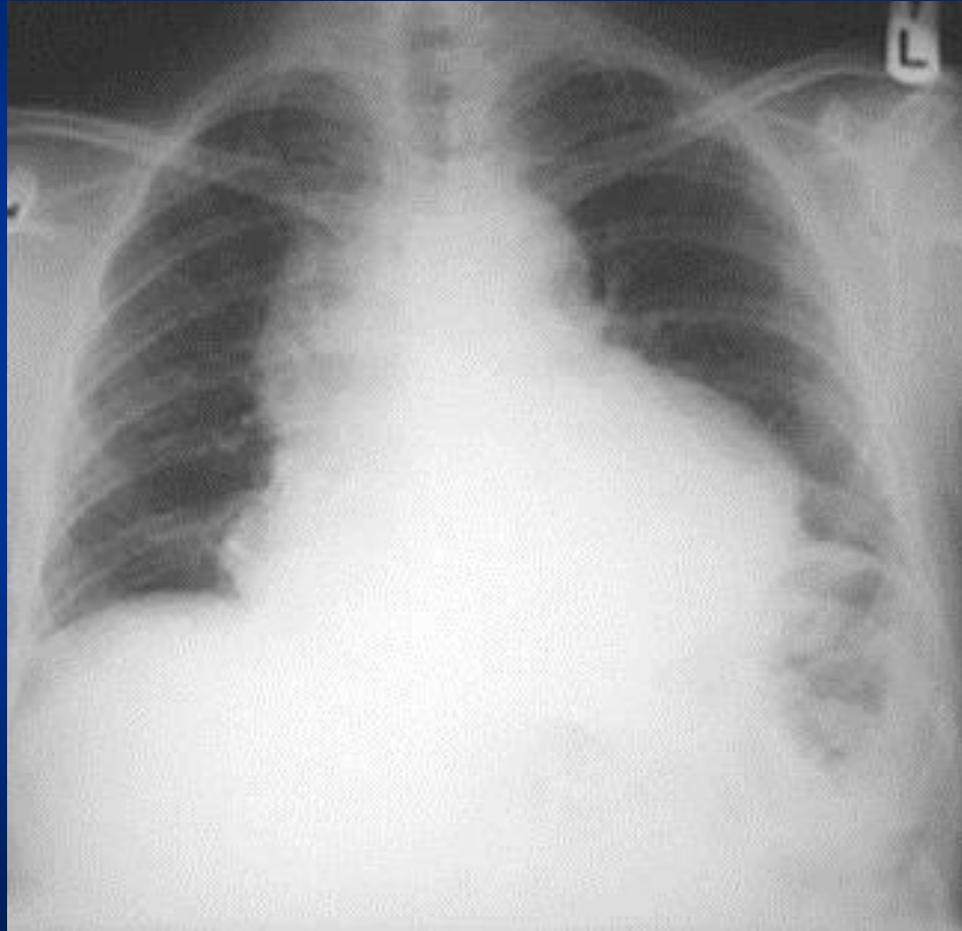
- Temp is 37.7 °C (99.9 °F), blood pressure is 88/44 mm Hg, pulse is 125/min, and respiration rate is 29/min; BMI is 27. Oxygen saturation is 95%.
- Pulsus paradoxus is 15 mm Hg. JVP is 12 cm H₂O. Cardiac examination discloses muffled heart sounds with no rubs. Lung auscultation reveals normal breath sounds and no crackles. There is 2+ pedal edema.



ECG-electrical alternans



Chest X-ray

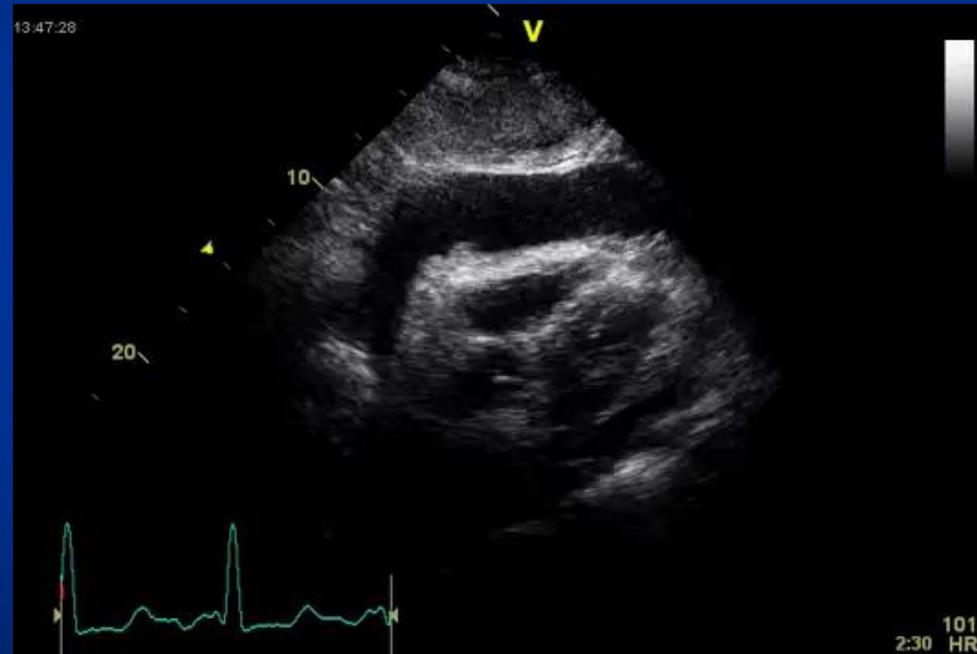


Question

- What is the most appropriate treatment?
 - A. Dobutamine to increase BP
 - B. Broad spectrum antibiotics
 - C. Pericardiocentesis
 - D. Surgical pericardiectomy

Echocardiogram: RV collapse in diastole

- Most commonly involves the RV outflow tract (more compressible area of RV)
- Occurs in early diastole, immediately after closure of the pulmonary valve, at the time of opening of the tricuspid valve
- When collapse extends from outflow tract to the body of the right ventricle, this is evidence that intrapericardial pressure is elevated more substantially

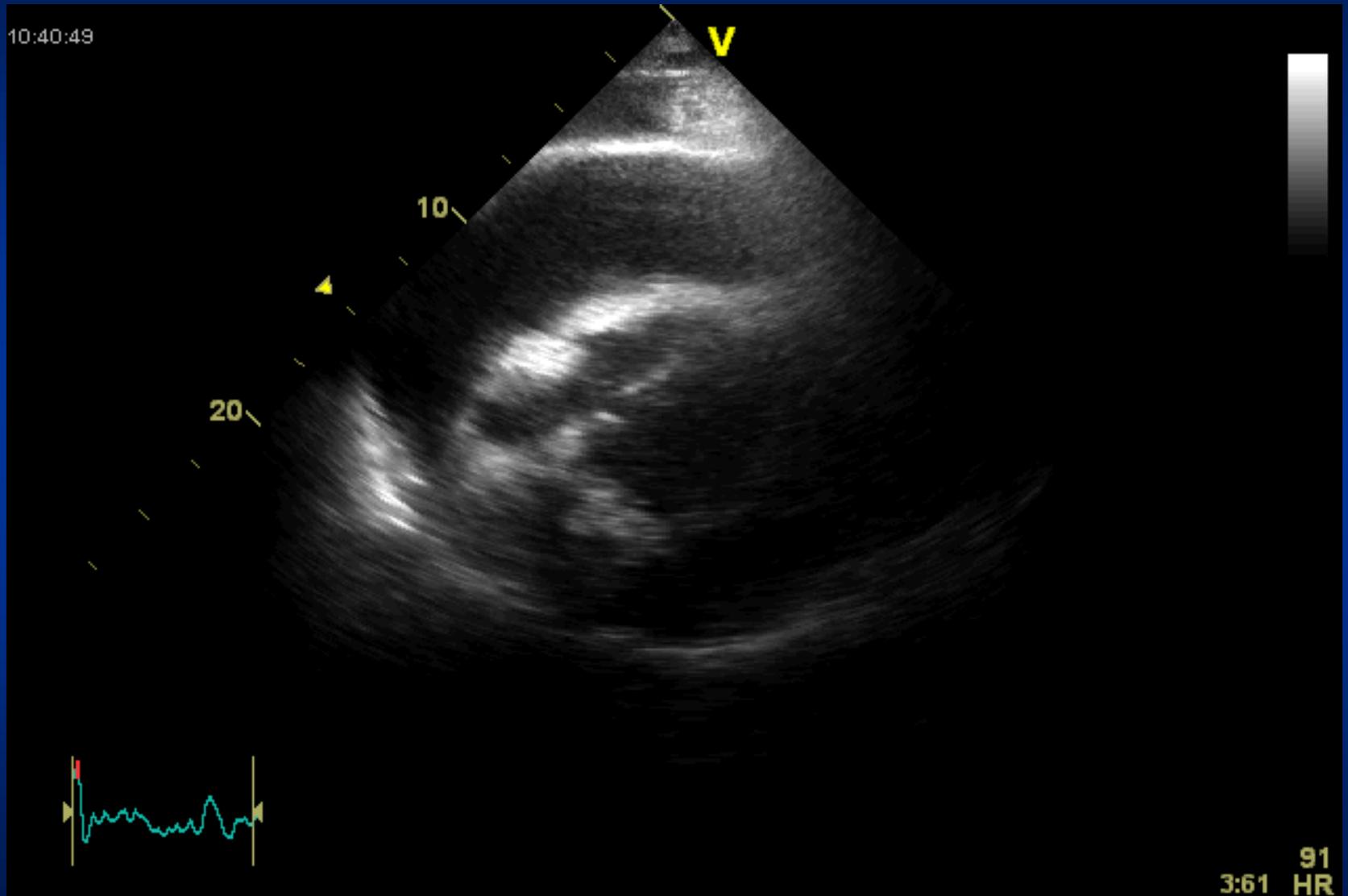


<https://www.youtube.com/channel/UCPgiLLKxXci7WX8VrZ9g0wQ>

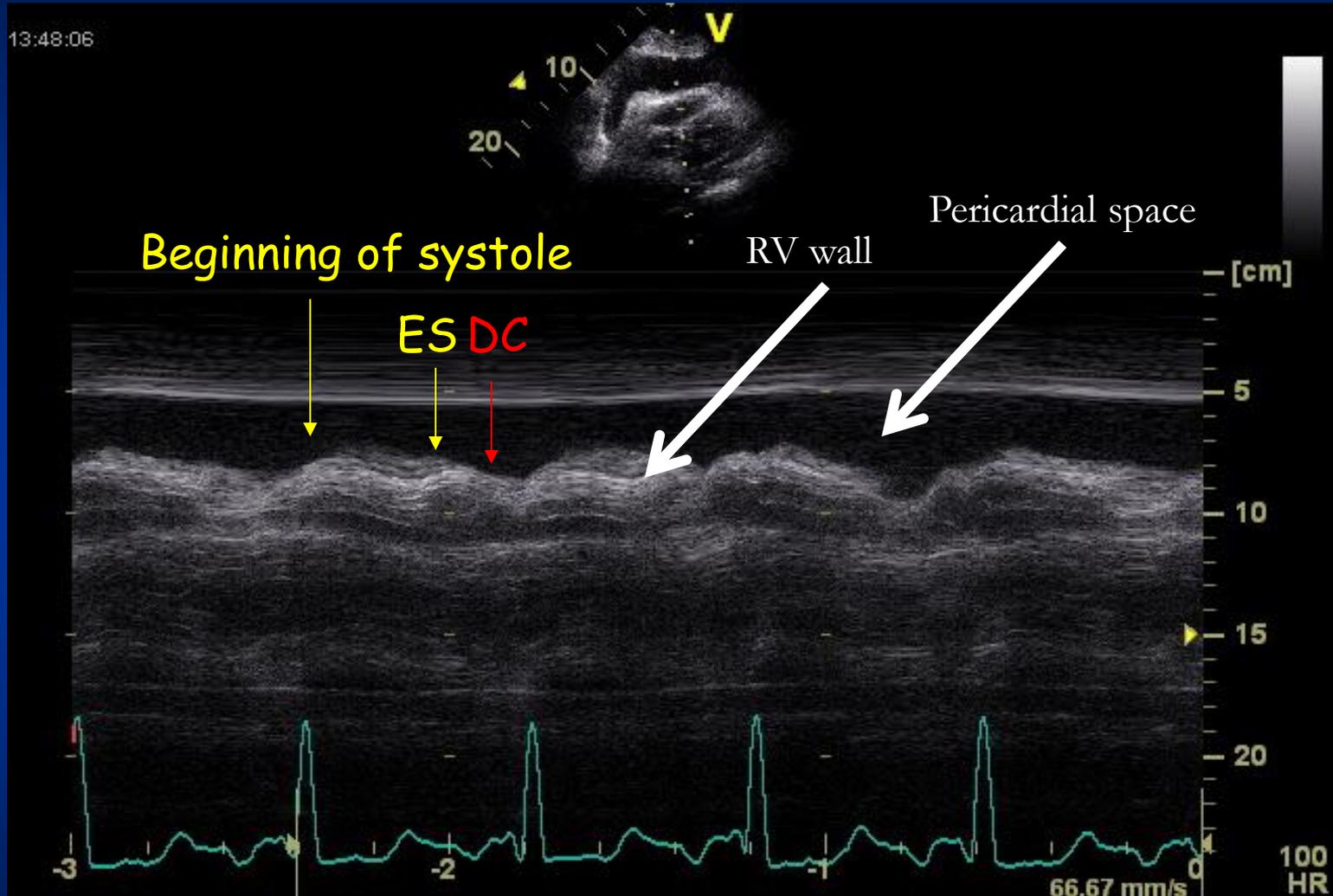
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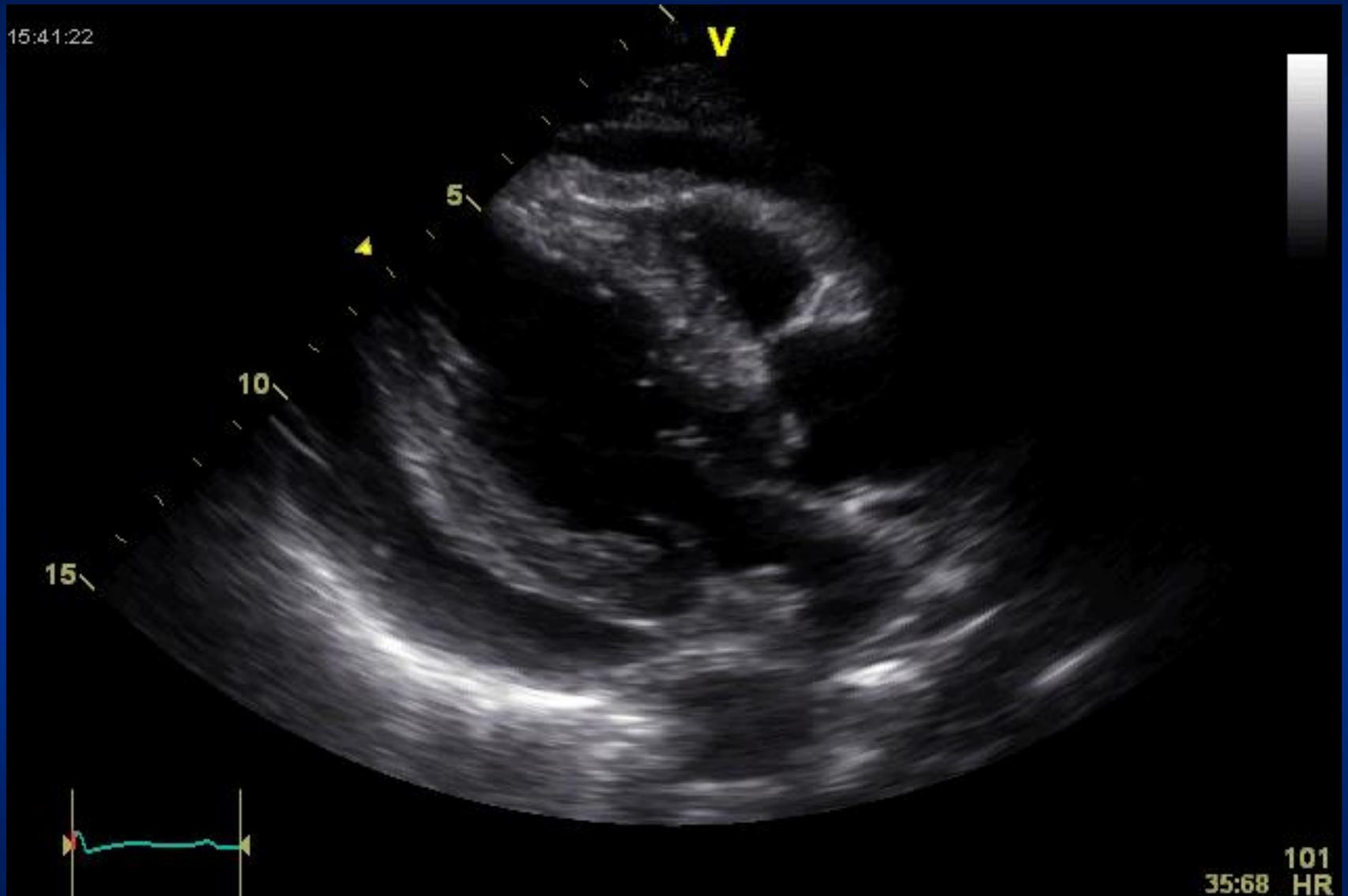
Subcostal view



M-mode

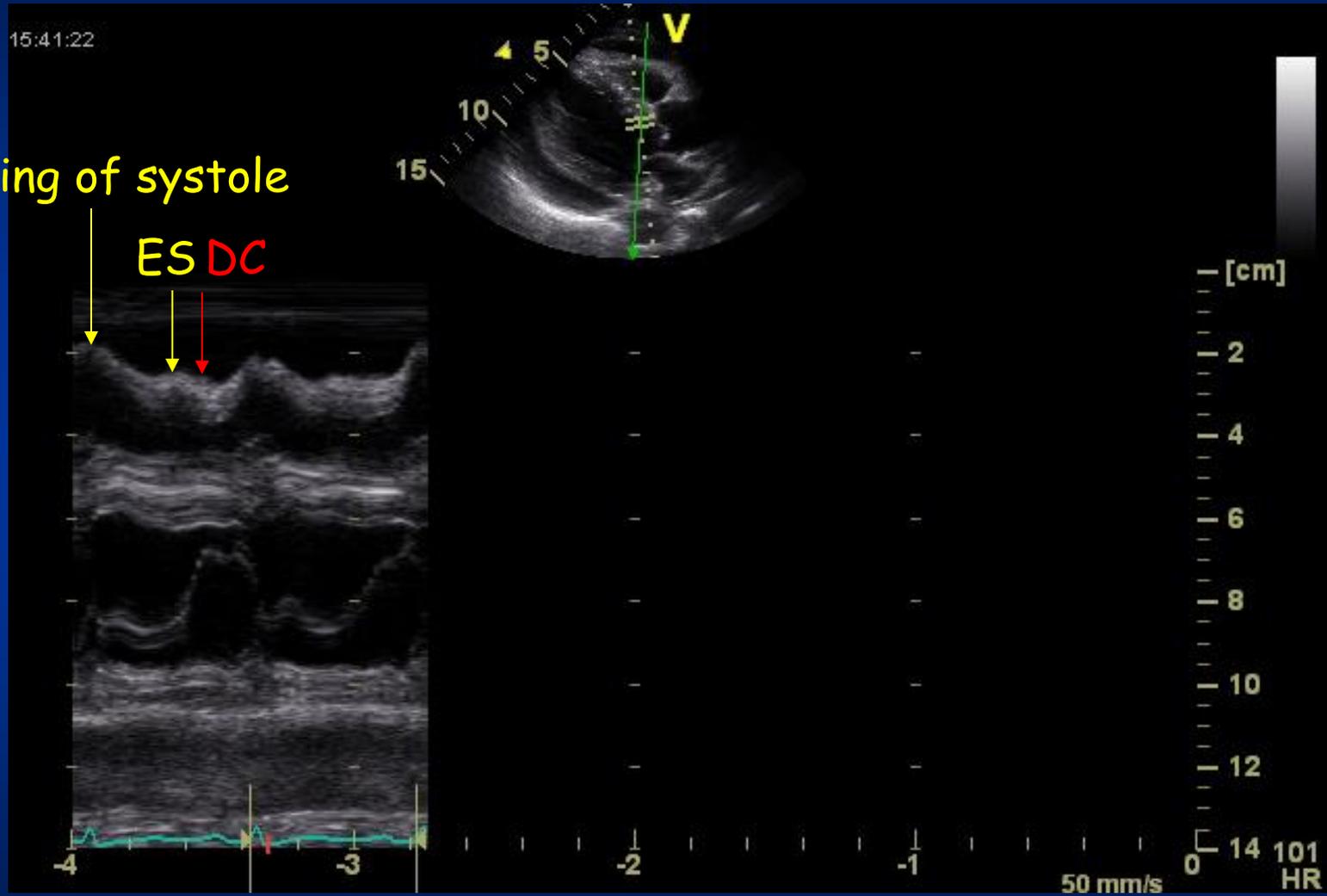


Parasternal long axis view



M-mode

Beginning of systole

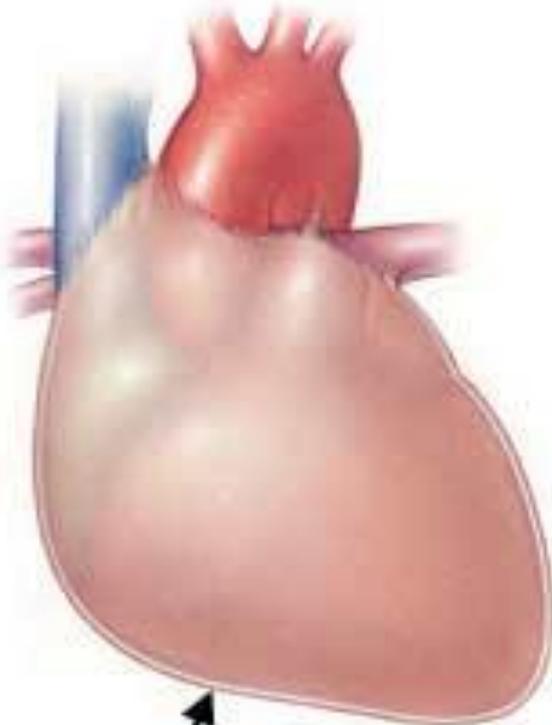


Pericardial Effusion

- Can occur rapidly or slowly
- Pulmonary compression-cough, dyspnea, and tachypnea
- Phrenic nerve compression-hiccups
- Heart sounds distant, muffled
- Slow fluid build-up; no immediate effects;
- Rapid fluid build up --> compression of heart --> tamponade

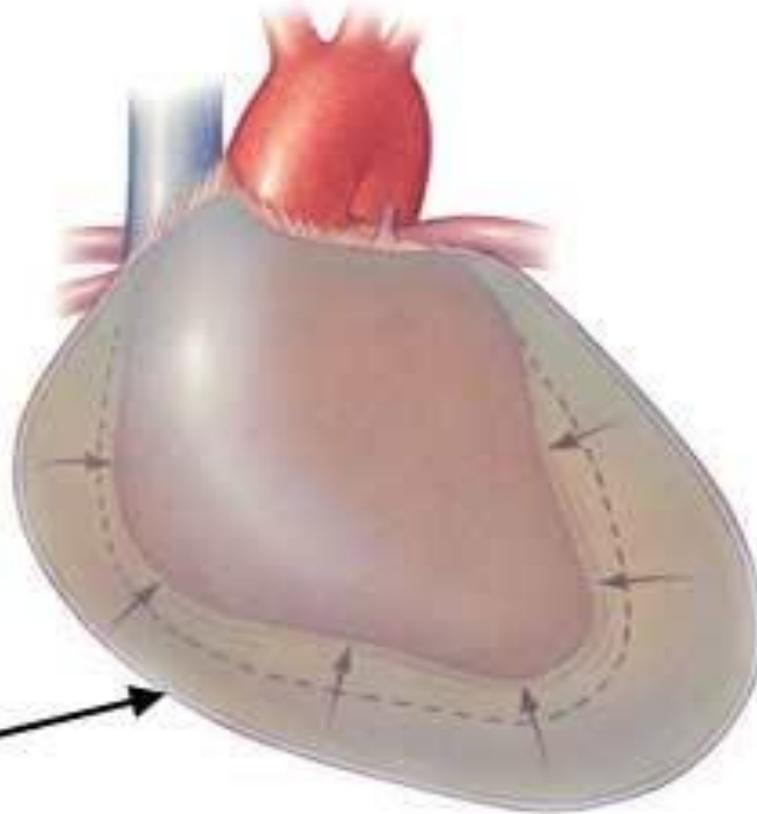
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Normal pericardium



Pericardial sac

Pericardial effusion



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Cardiac Tamponade

- Compression of heart
- Occur acutely (trauma) or sub-acutely (malignancy)
- Symptoms- chest pain, confusion, anxious, *elevated CVP/JVD*, restless, *muffled heart sounds*
- Later- tachypnea, tachycardia, and decrease CO, and *pulsus paradoxus*
- With slow onset- dyspnea may be only symptom
- If rapid compression-Medical Emergency

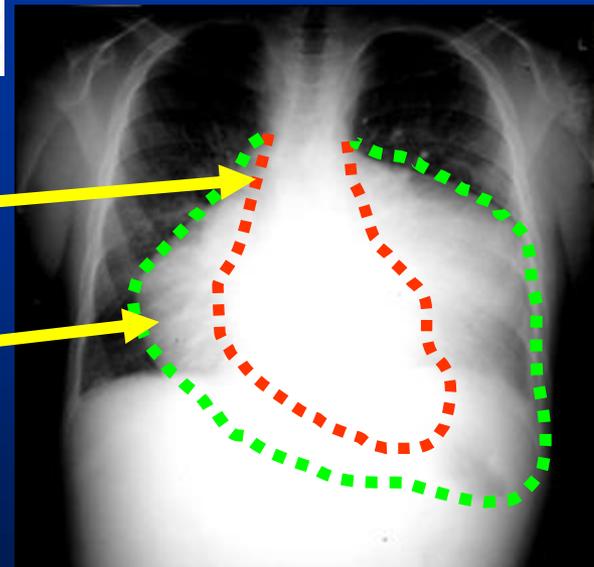




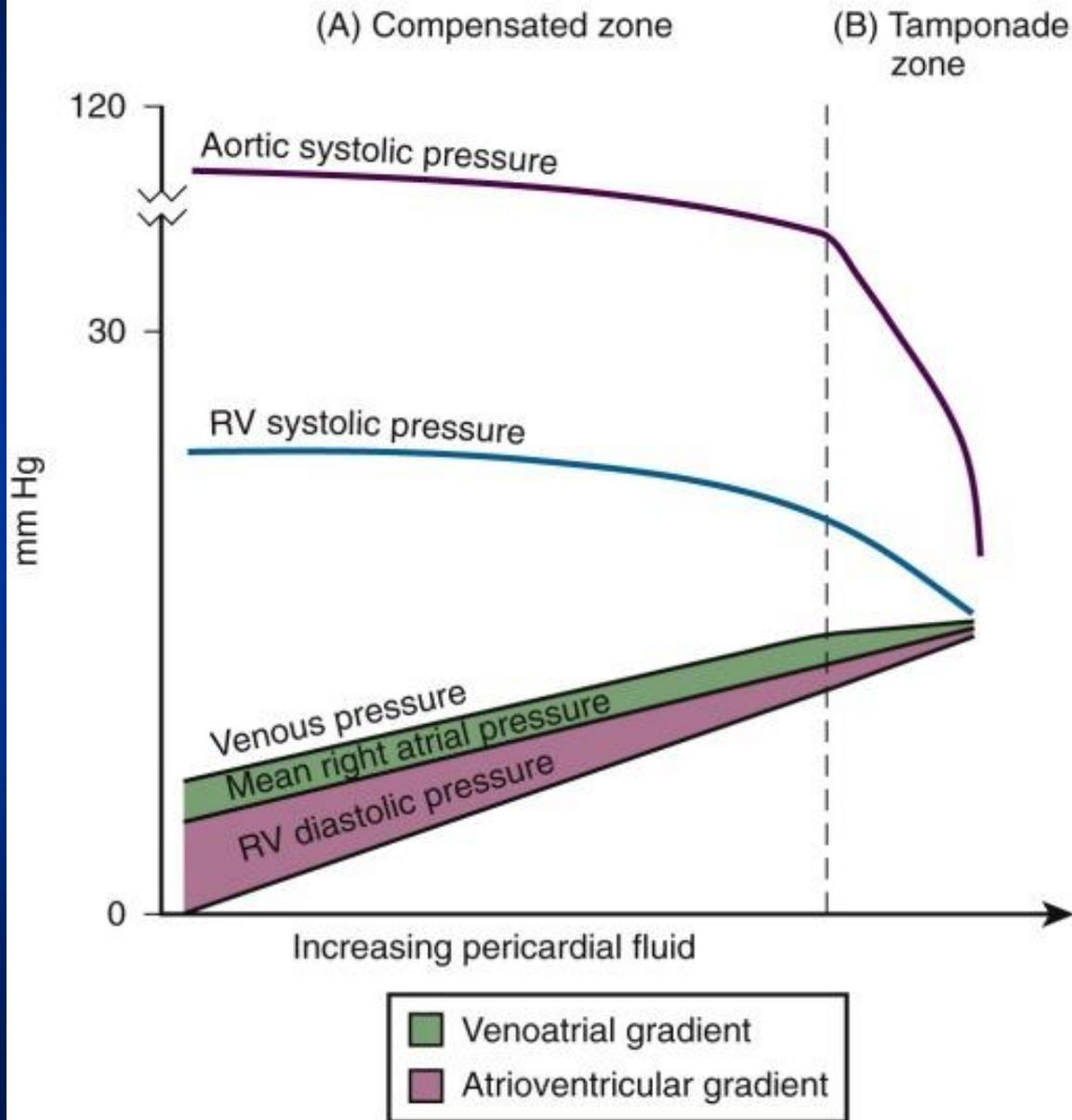
The X-Ray on the left shows a normal heart.
On the right, the heart is enlarged.

Original heart size

Excess pericardial fluid



Time: Hours, days or weeks depending on rapidity of accumulation and multiple patient variables

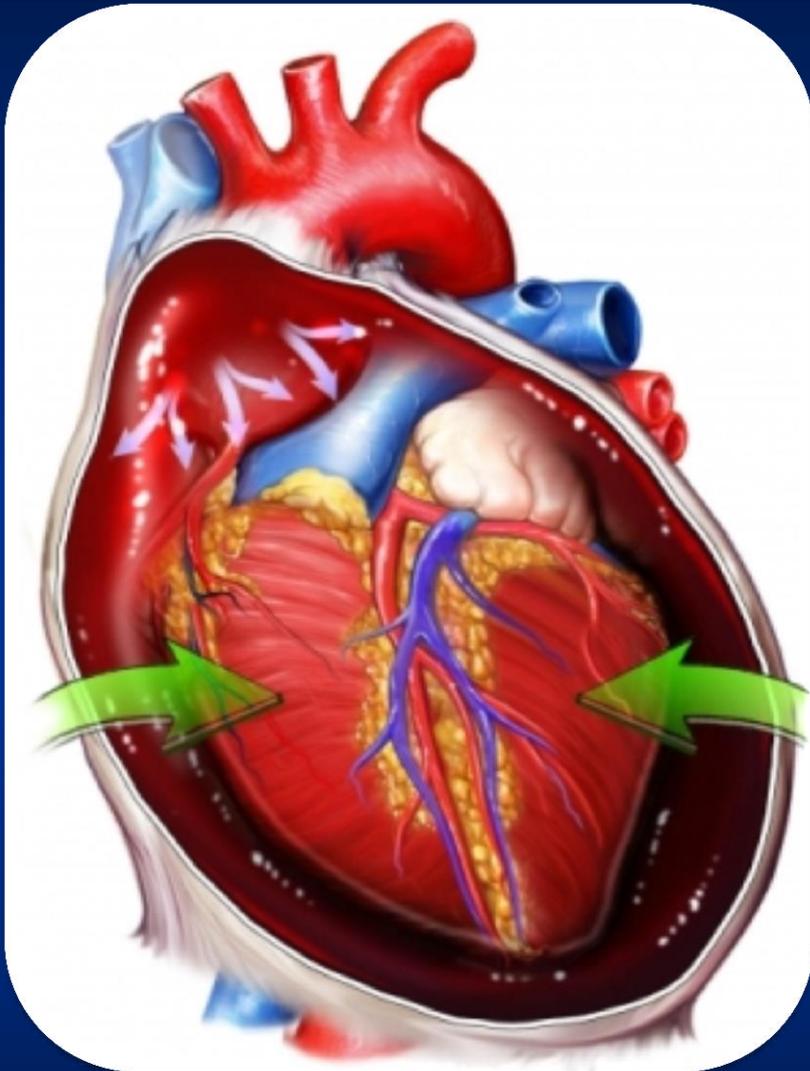


Summary of physiologic changes in tamponade. RV, right ventricle. (From Shoemaker WC, Carey JS, Yao ST, et al: Hemodynamic monitoring for physiological evaluation, diagnosis, and therapy of acute hemopericardial tamponade from penetrating wounds. *J Trauma* 13:36, 1973; and Spodick D: Acute cardiac tamponade: Pathologic physiology, diagnosis, and management. *Prog Cardiovasc Dis* 10:65, 1967.)

Grade	Pericardial Volume (mL)	Cardiac Index	MAP	CVP	HR	Beck's Triad
I	<200	Normal or ↑	Normal	↑	↑	usually not present
II	≥200	↓	Normal or ↓	↑ (≥12 cm H ₂ O)	↑	May or may not be present
III	>200	↓↓	↓↓	↑↑ (≤30–40 cm H ₂ O)	↓	Usually present

From Shoemaker WC, Carey SJ, Yao ST, et al: Hemodynamic monitoring for physiologic evaluation, diagnosis, and therapy of acute hemopericardial tamponade from penetrating wounds. J Trauma 13:36, 1973.





**Increased
venous
pressure**



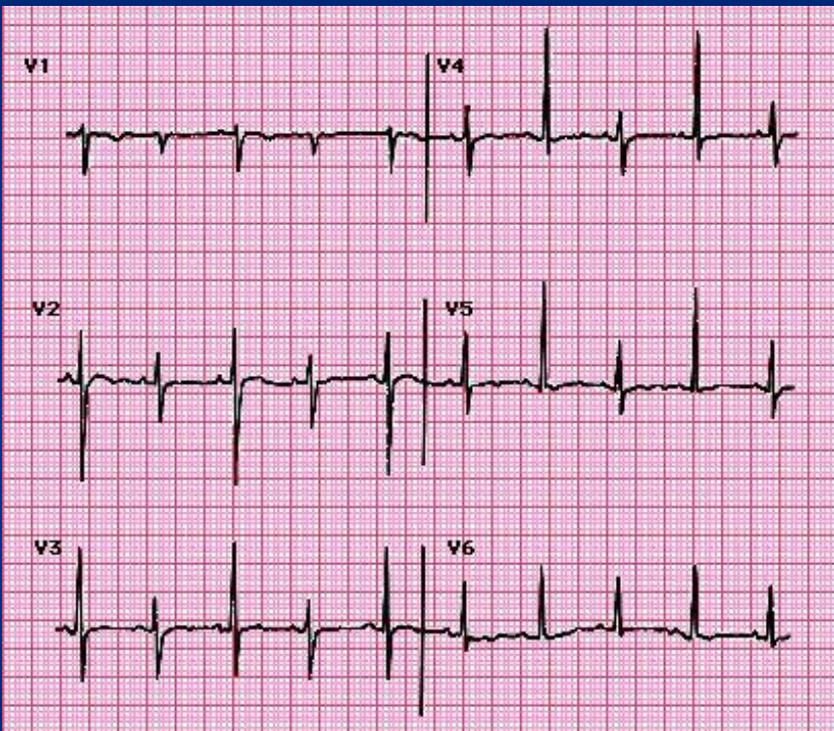
**Decreased
arterial
pressure**



**Muffled
heart
sounds**

Becks Triad

Swinging heart-Electrical alternans



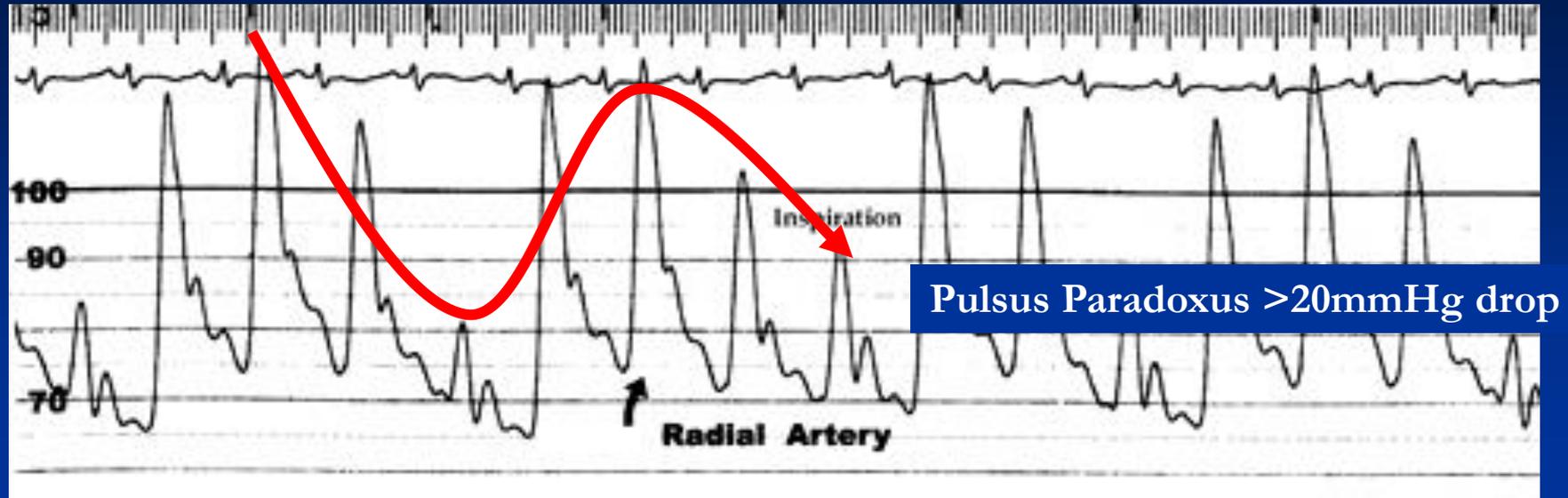
F N Delling



Courtesy of Dept. of Echocardiography AMC
J.S.S.G. de Jong

ECHOCARDIOLOGY.PEDIA.ORG





RA pressure = Pericardial pressures with blunted wave forms

Nursing Care

1. **Dyspnea: from hypoxia, decreased CO and decreased lung expansion.**
2. **Retrosternal chest pain that increases when patients are supine and decreases when leaning forward because of compression of the heart**
3. **Cough, hoarseness, or hiccups caused by mechanical compression of nerves of the esophagus, bronchi, and trachea**
4. **Weakness, fatigue, and malaise resulting from decreased cardiac output**
5. **Vague gastrointestinal complaints because of visceral congestion and venous stasis**



Nursing Care

- 1. Monitor for dysrhythmia which may result of myocardial ischemia from epicardial coronary artery compression.**
- 2. Monitor the BP every 5 to 15 minutes during acute phase**
- 3. Monitor for pulsus paradoxus via arterial tracing or during manual BP reading. Monitor for increased JVP**
- 4. A drop in urine output indicates decreased renal perfusion as a result of decreased stroke volume secondary to cardiac compression.**
- 5. Assess level of consciousness for changes that may indicate decreased cerebral perfusion**

Technologist: Equipment required Pericardiocentesis

1. **Pericardiocentesis kit (contains equipment to perform drain placement via Seldinger technique)**
 1. If kit unavailable: 18ga spinal needle, 20mL syringe
 2. Can also use micro puncture needle and kit
2. **Ultrasound/echocardiogram if available; or,**
3. **Equipment ready to measure pericardial pressure if needed**
4. **Swan Ganz catheter to measure chamber pressure**

- **A Seldinger technique pericardiocentesis set (Wood set by Cook Critical Care Co.)- calsprogram.org**

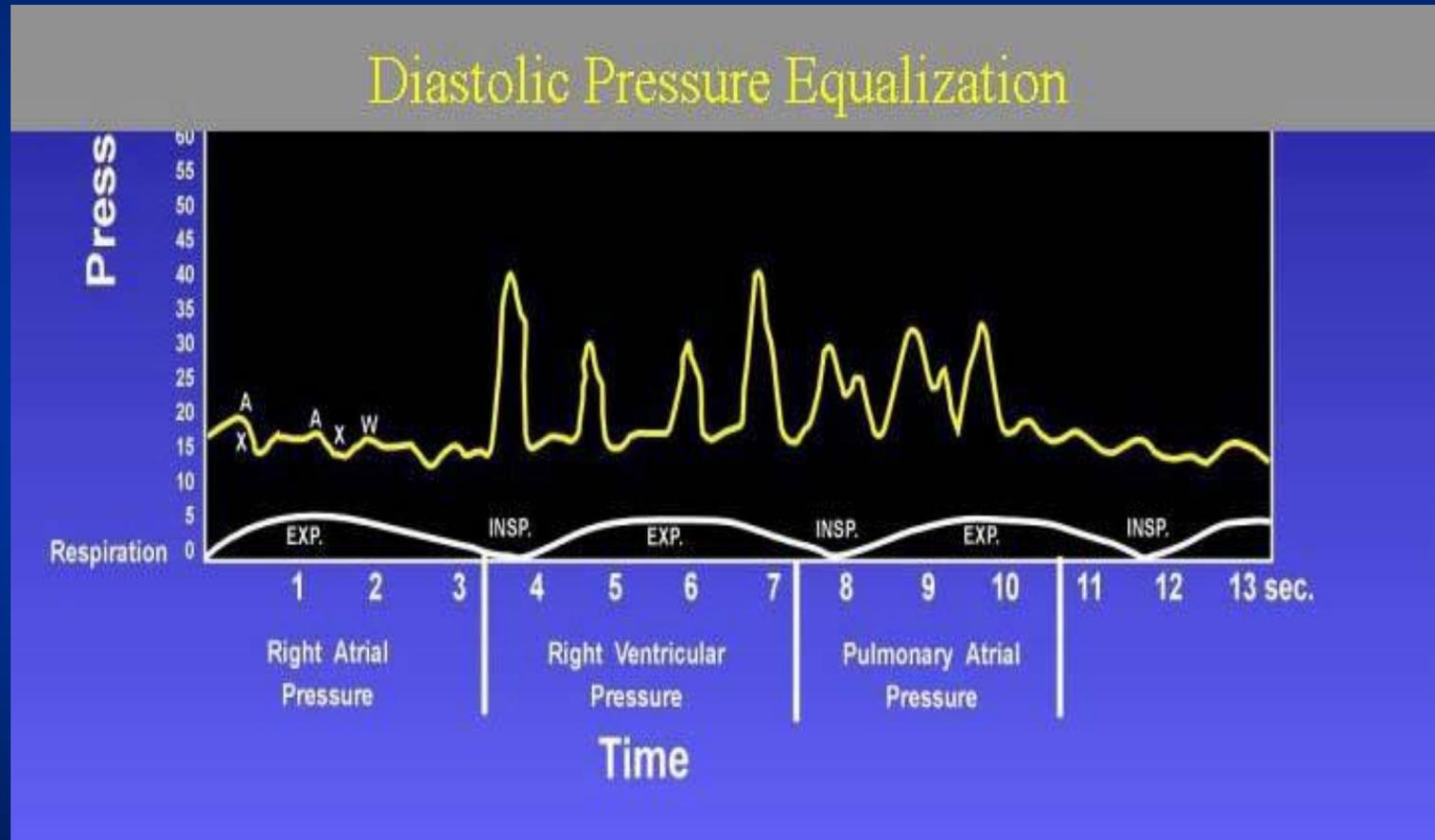


Technologist: Patient preparation- subxyphoid approach

1. Bed to 30-45° angle if patient condition allows (brings heart/pericardium closer to anterior chest wall)
2. **Skin prep with iodine or chlorhexidine, followed by sterile drape**
3. Consider sedation or local anesthesia but do not delay procedure
4. **Continuous monitoring (BP, HR, sPO2, etc) during procedure. Art-line preferable, but do not delay procedure.**
5. Atropine may be helpful to prevent vasovagal reaction



**Pericardial pressure is an external pressure which pushes on the cardiac chambers.
... An effusion is equally distributed and thus equalize filling/diastole pressures
across chambers. Therefore no gradient for flow exists except during atrial
contraction. In early diastole filling does not occur = absence of the y descent.**

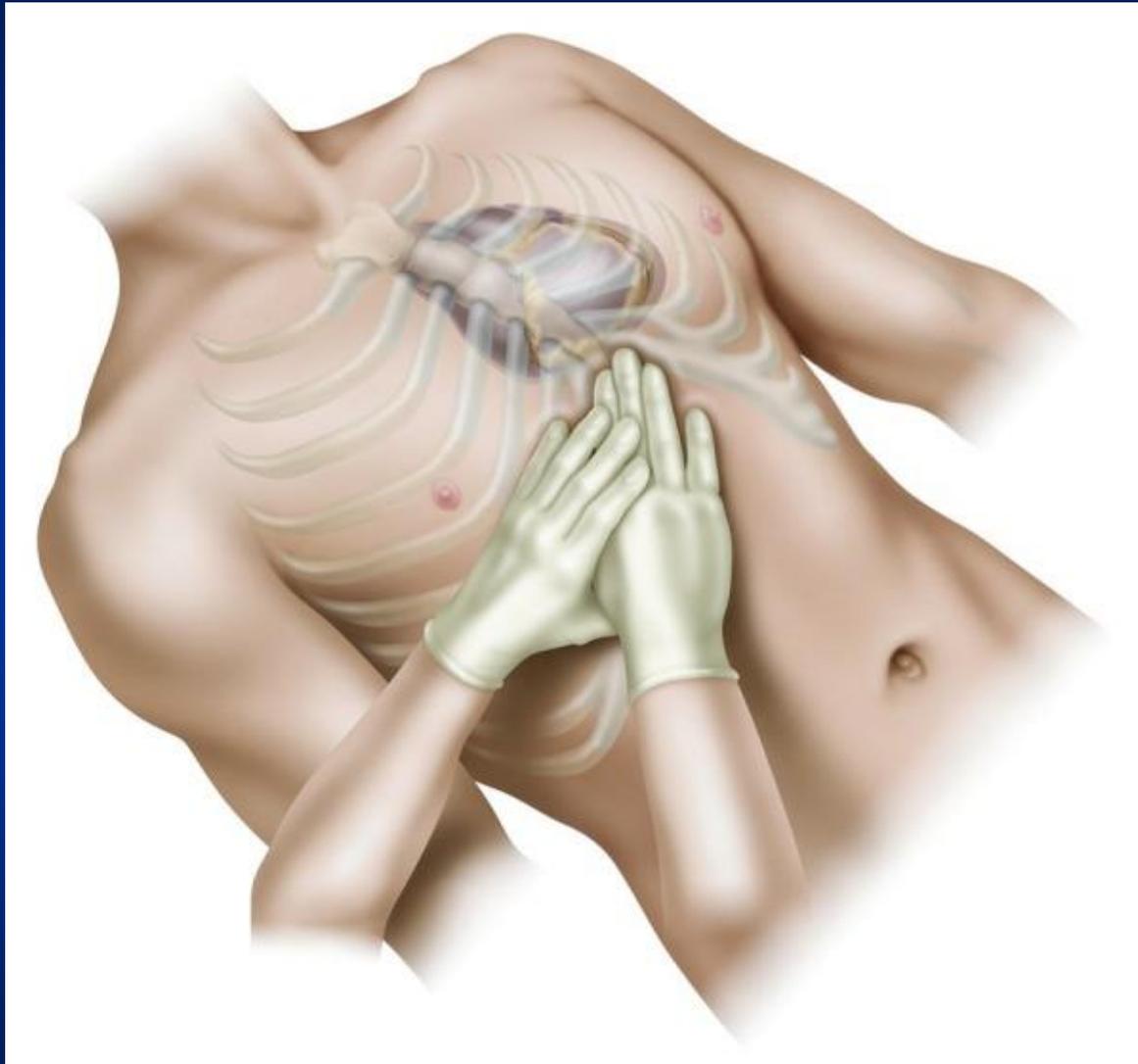


Bojan Paunovic, MD and Sat Sharma, MD, FRCPC,
www.blog.naver.com

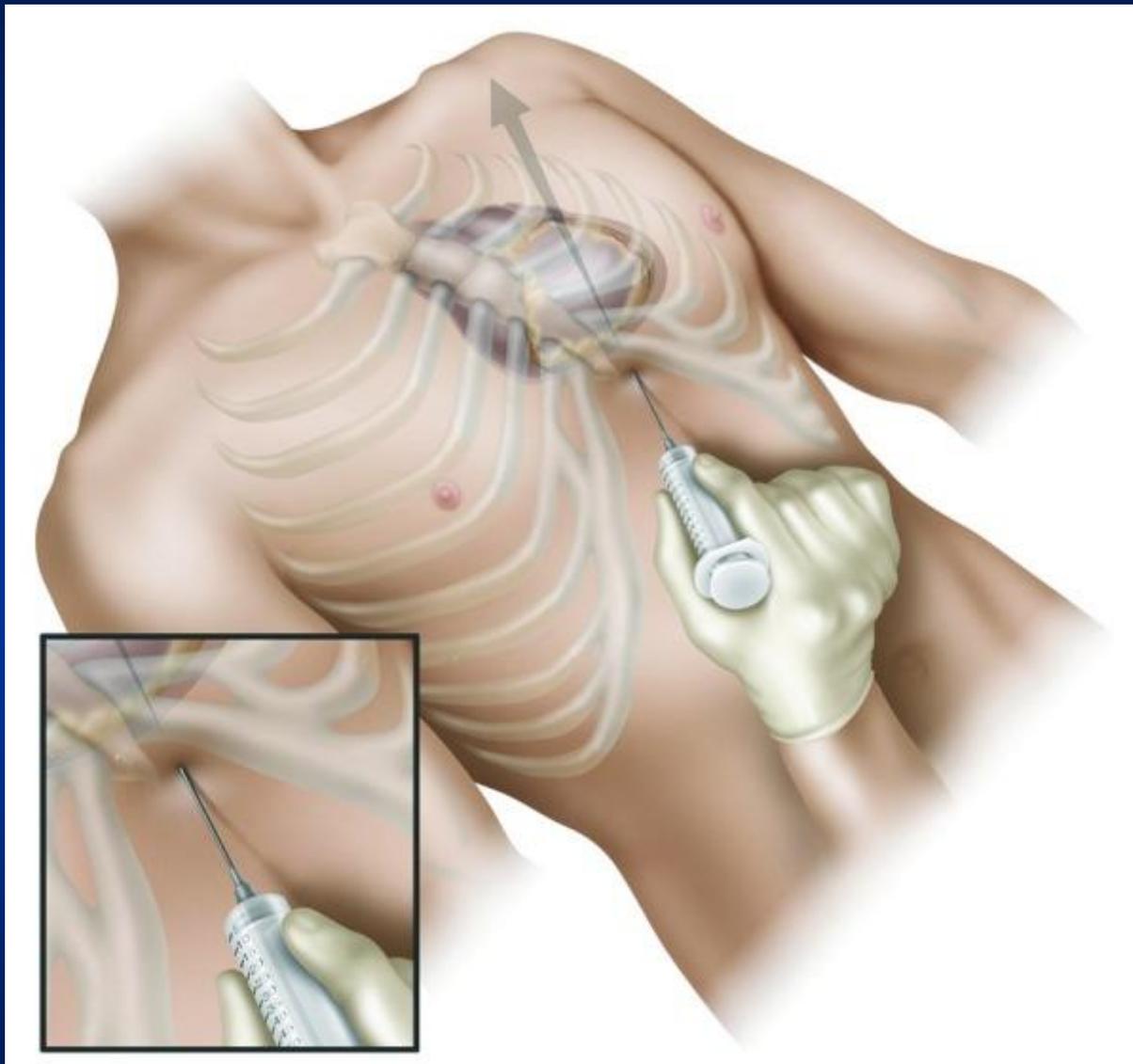
Case

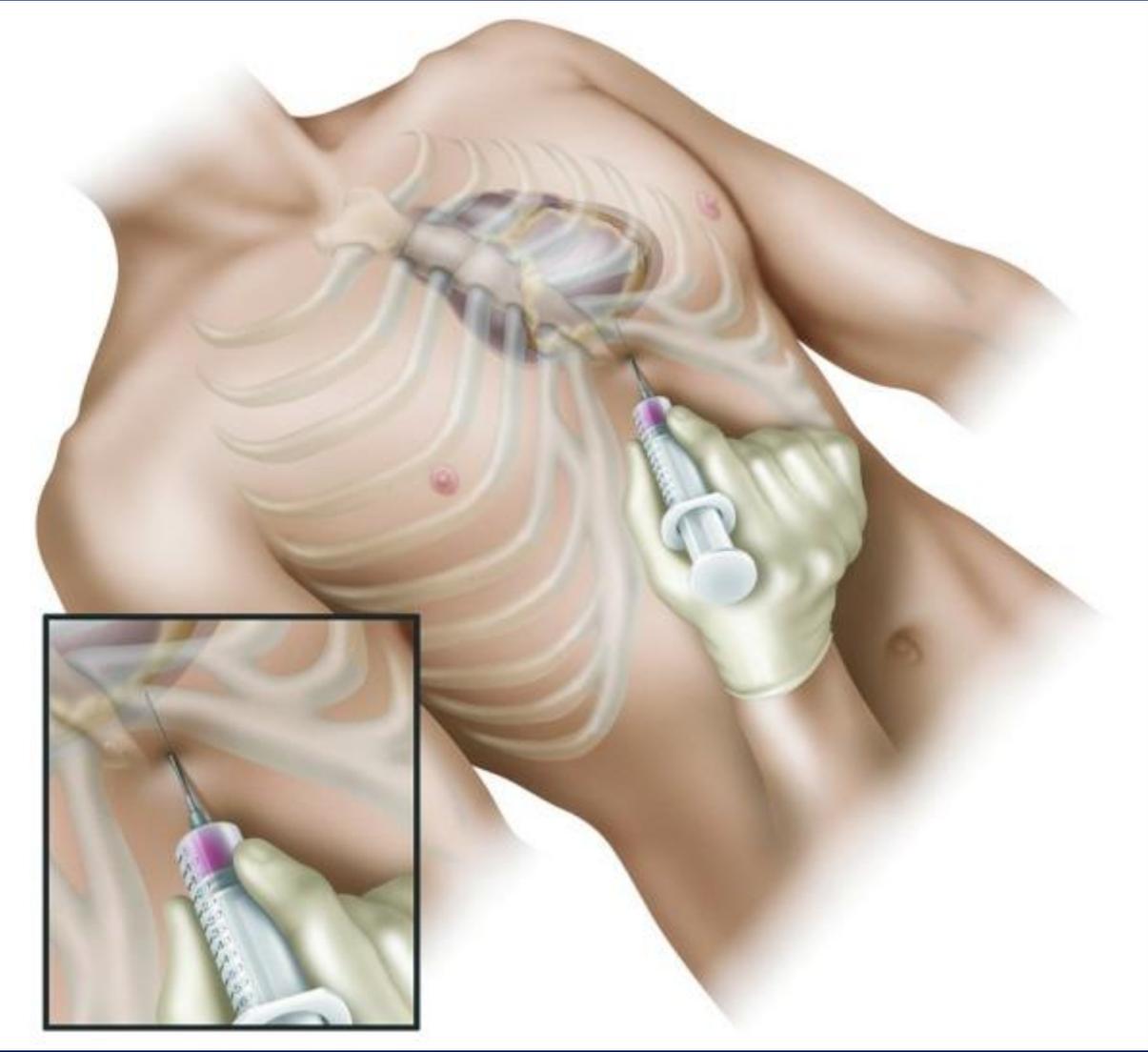
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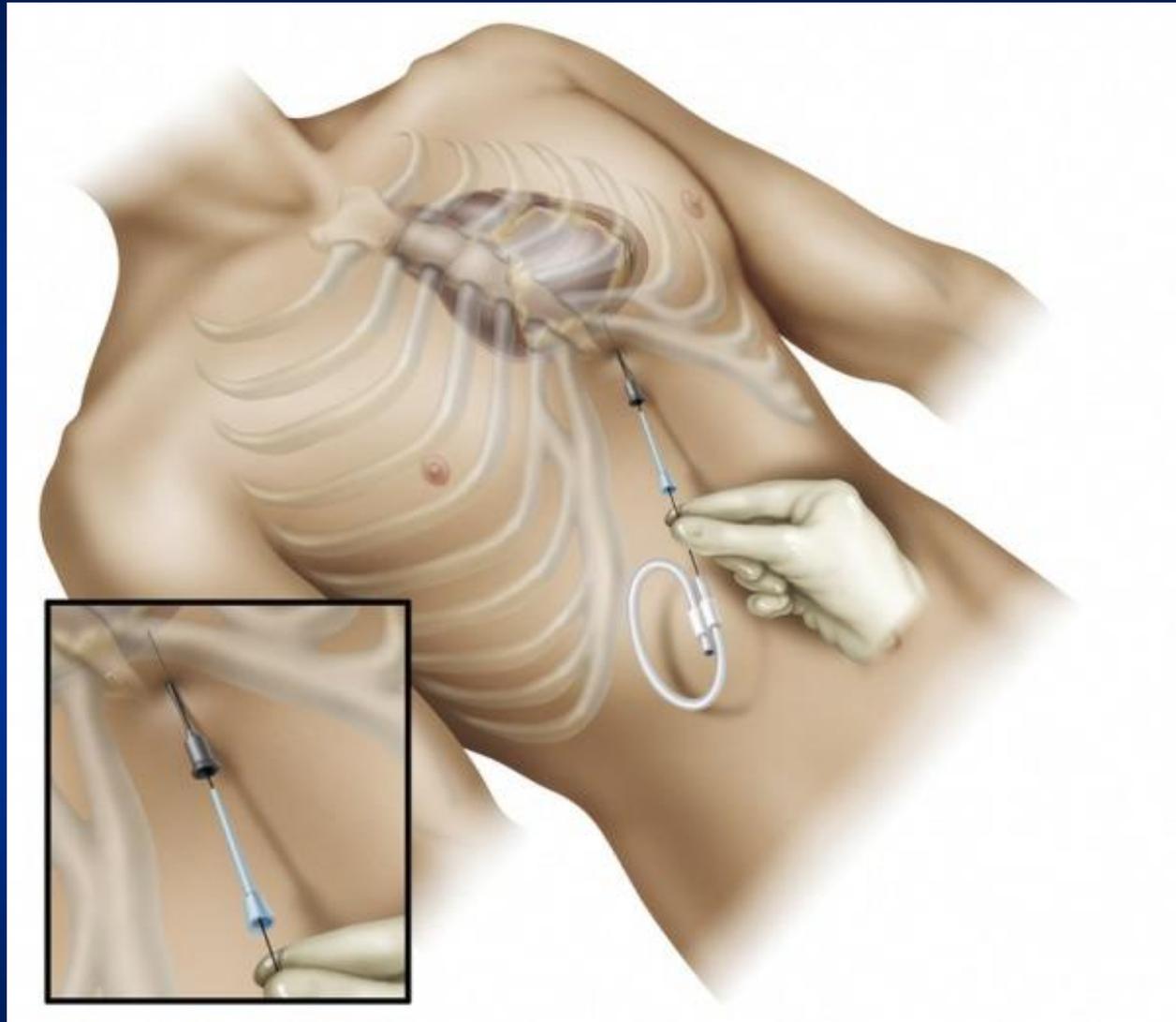
Pericardiocentesis

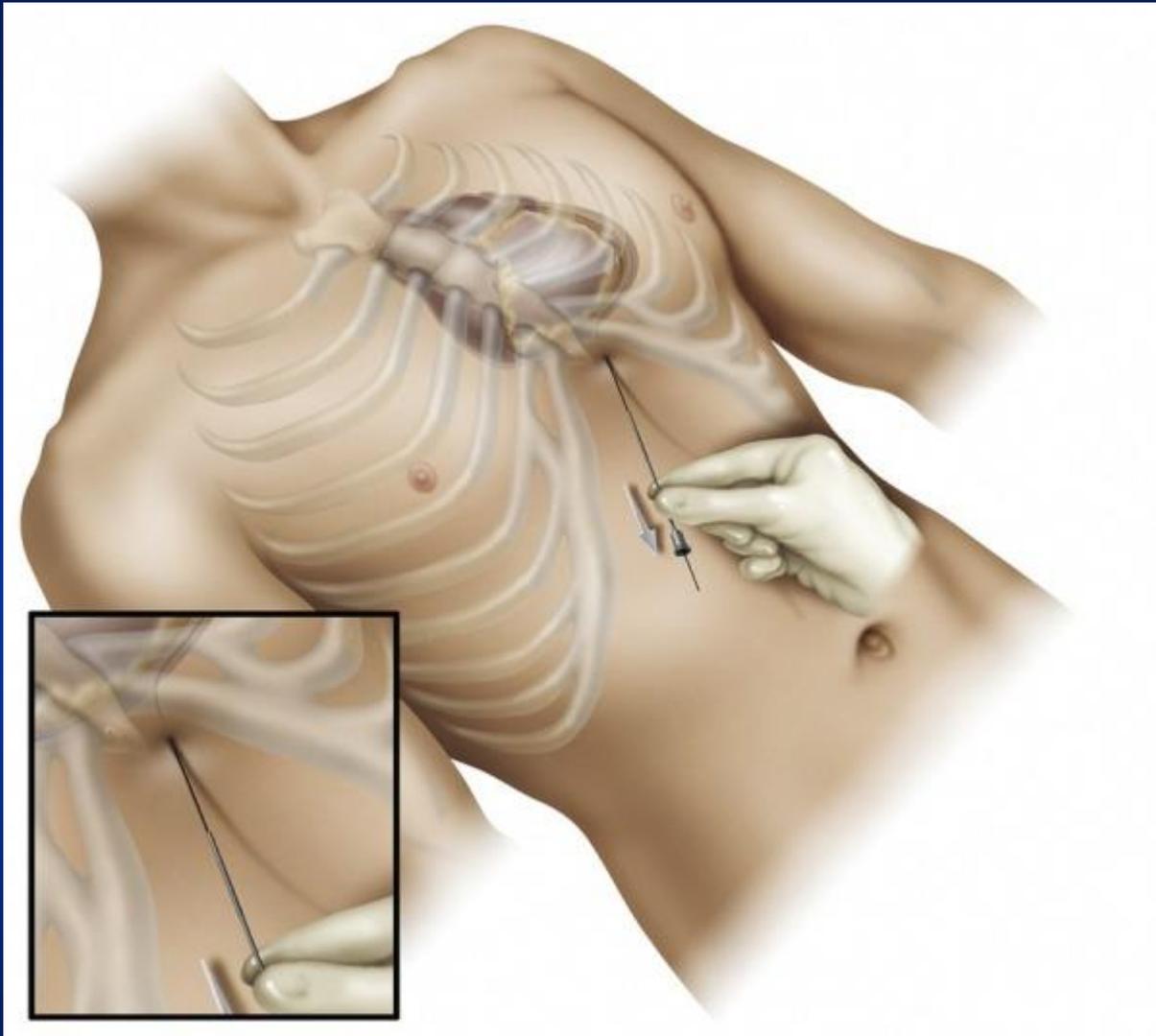


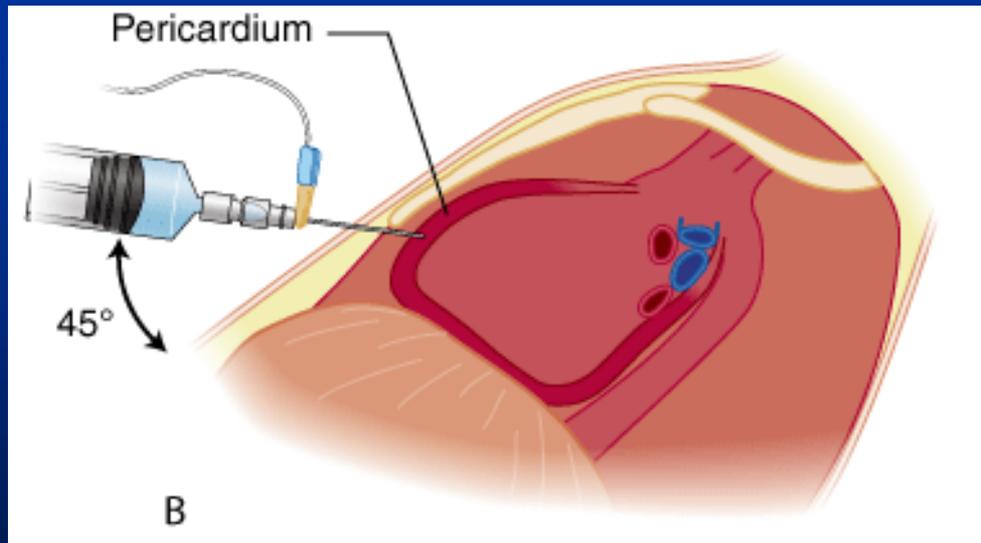
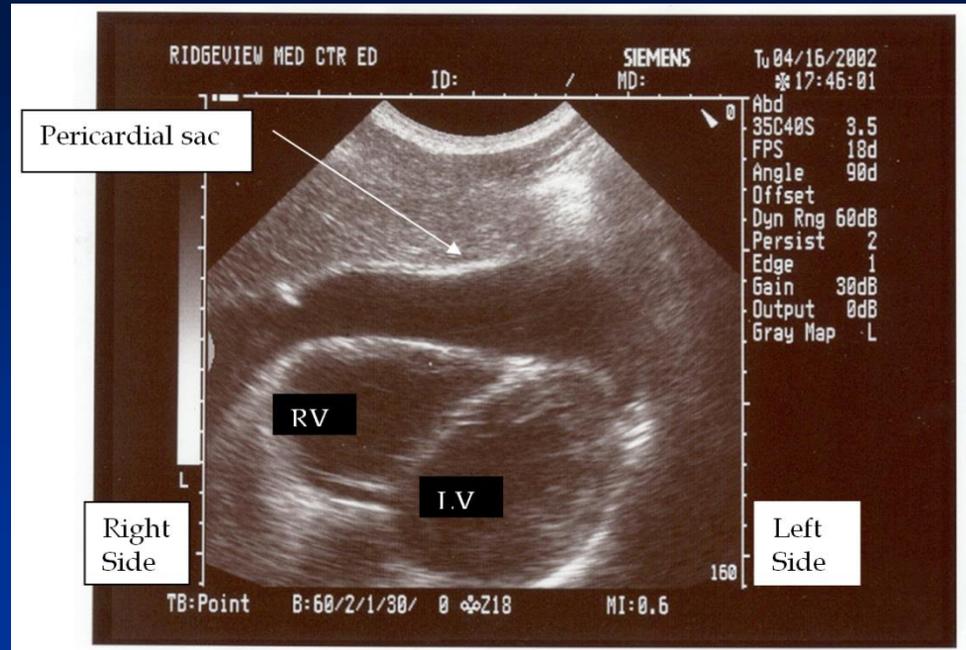
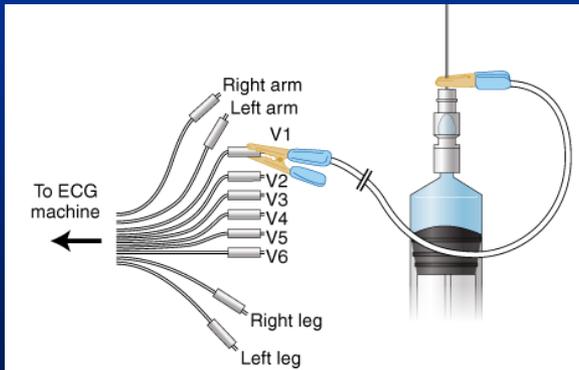
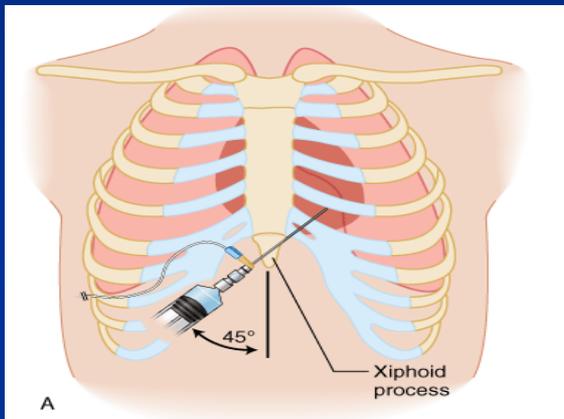
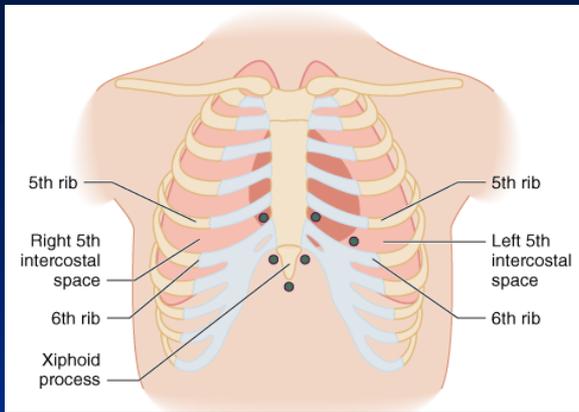
From Custalow CB: Color Atlas of Emergency Department Procedures. Philadelphia, Elsevier Saunders, 2005, p 123.





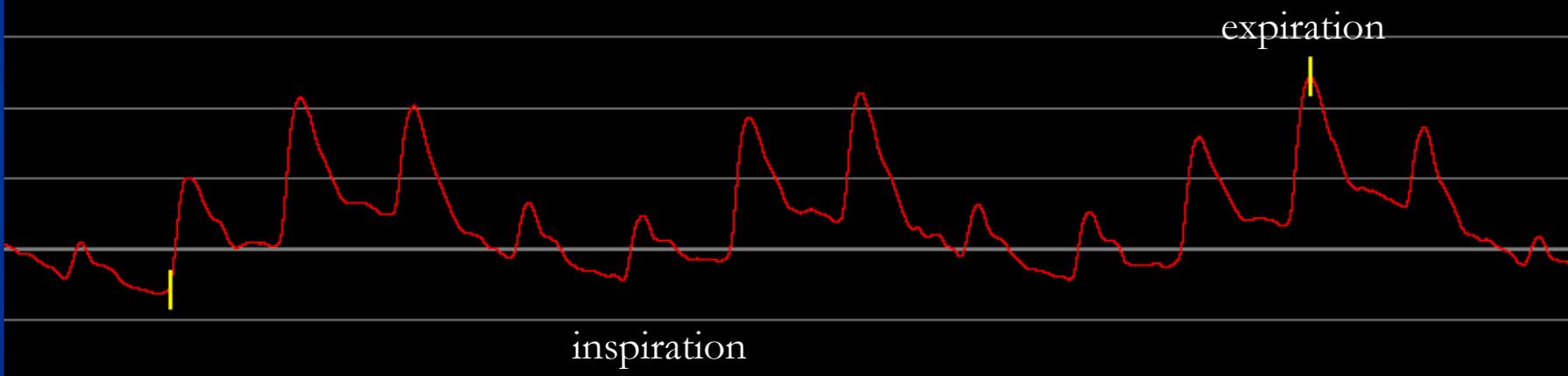




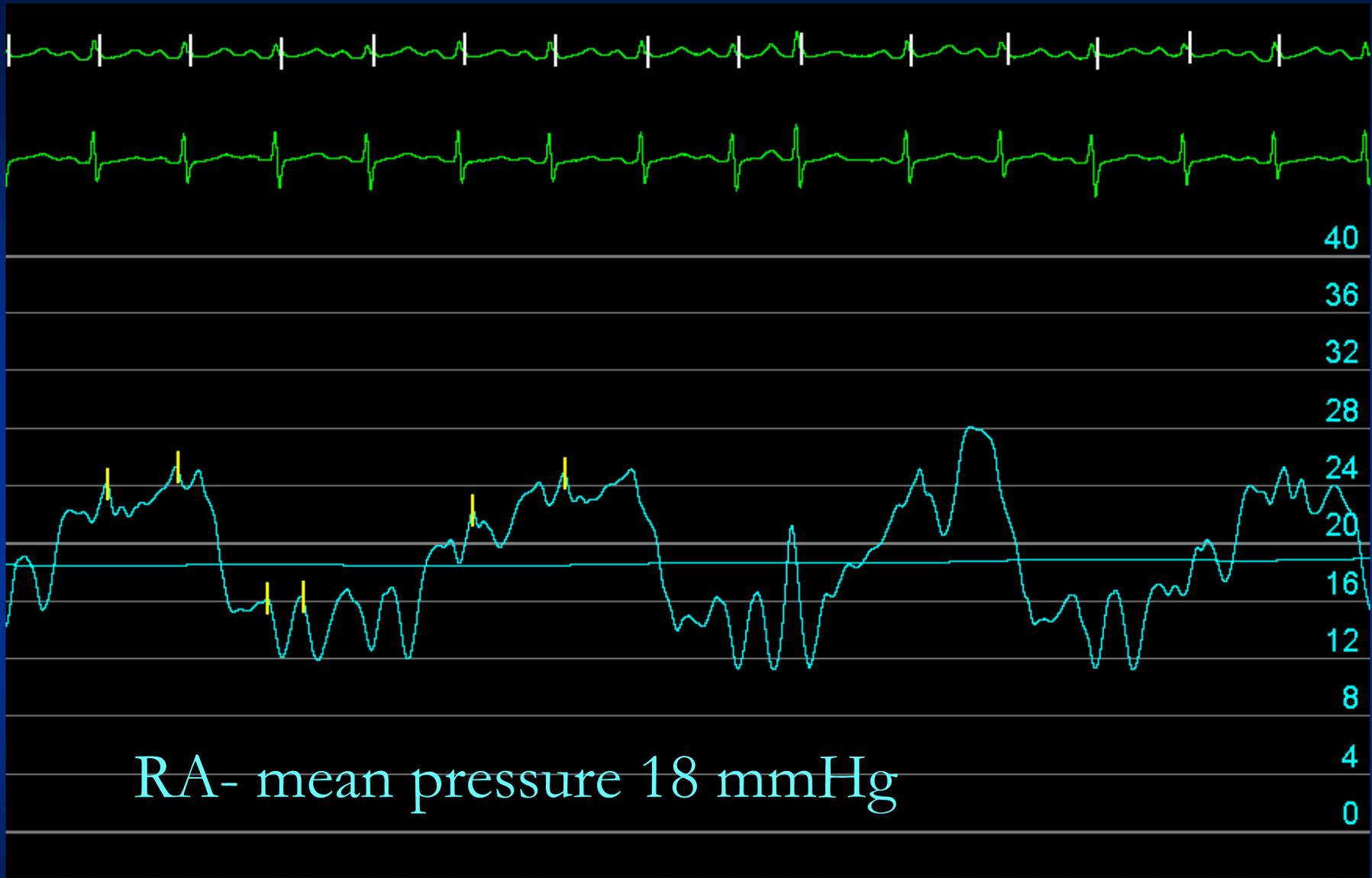


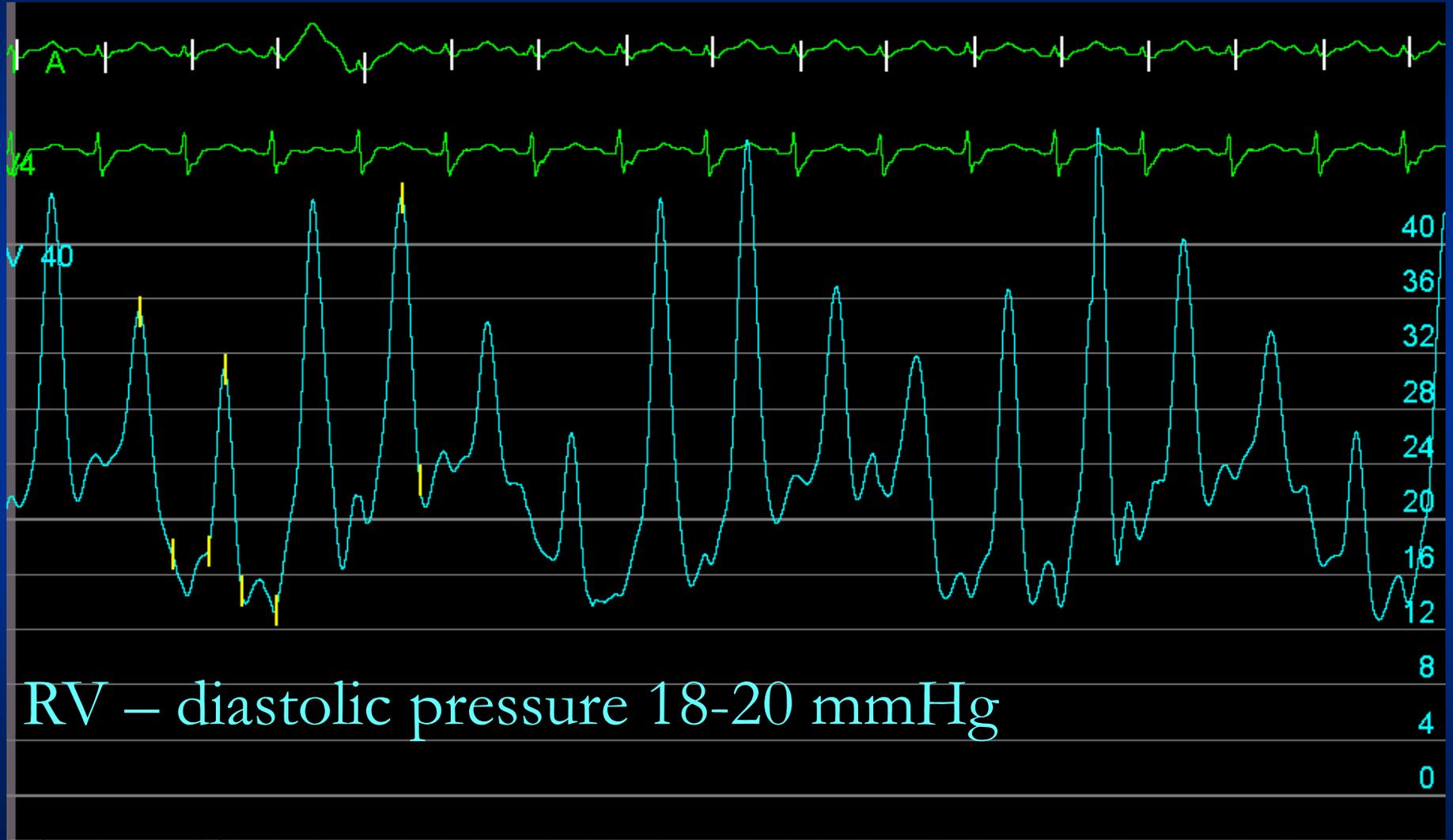


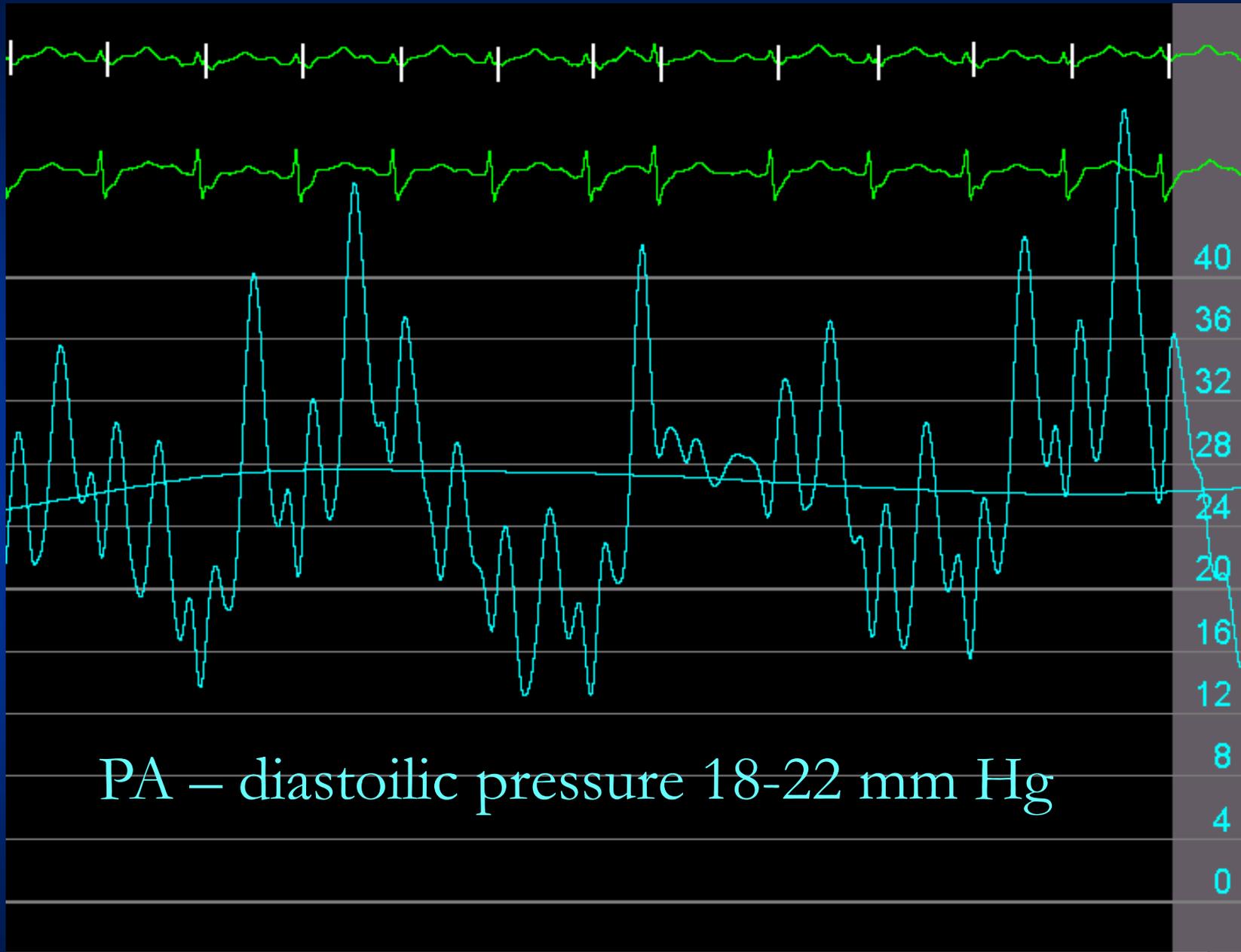
AO 200 B

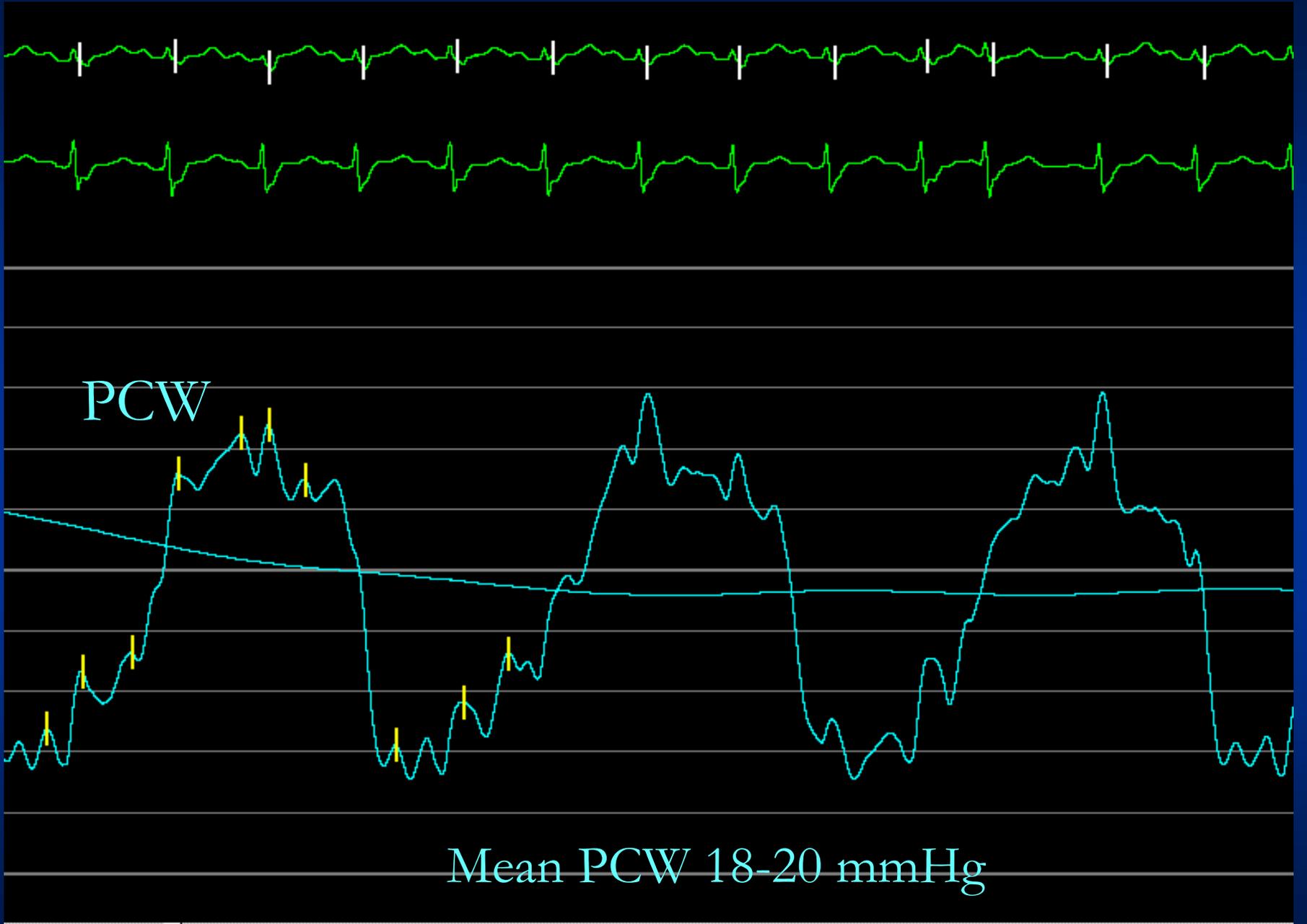


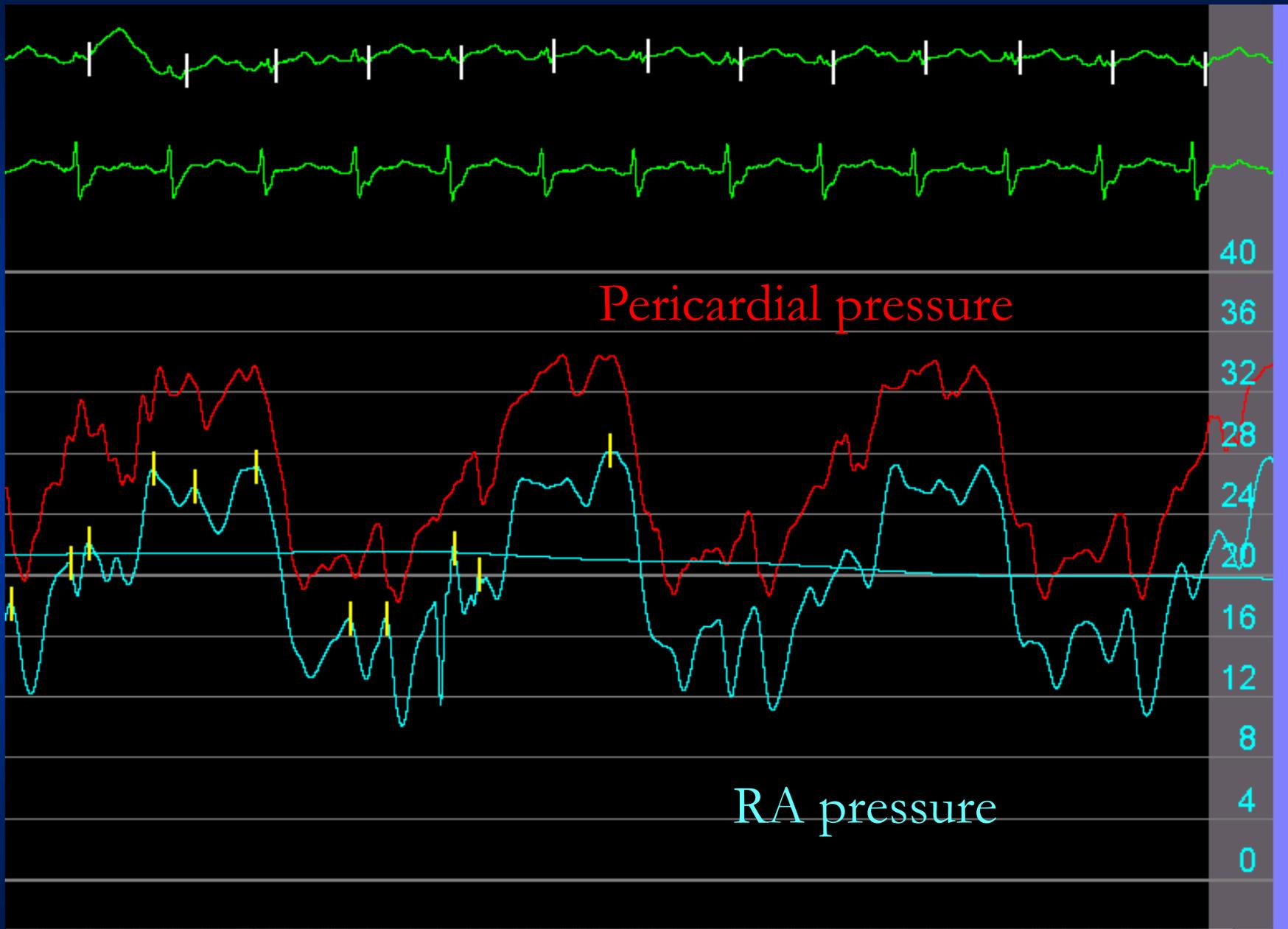
Femoral artery pressure

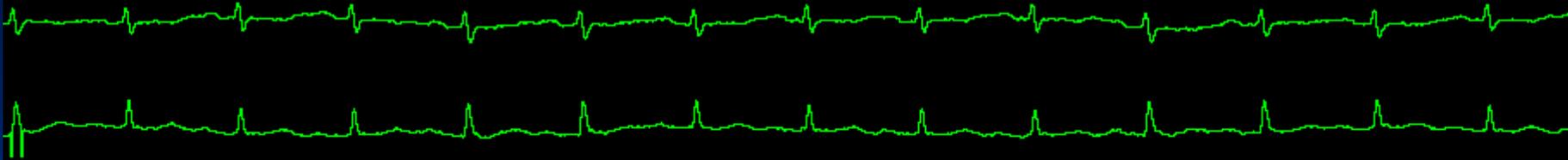






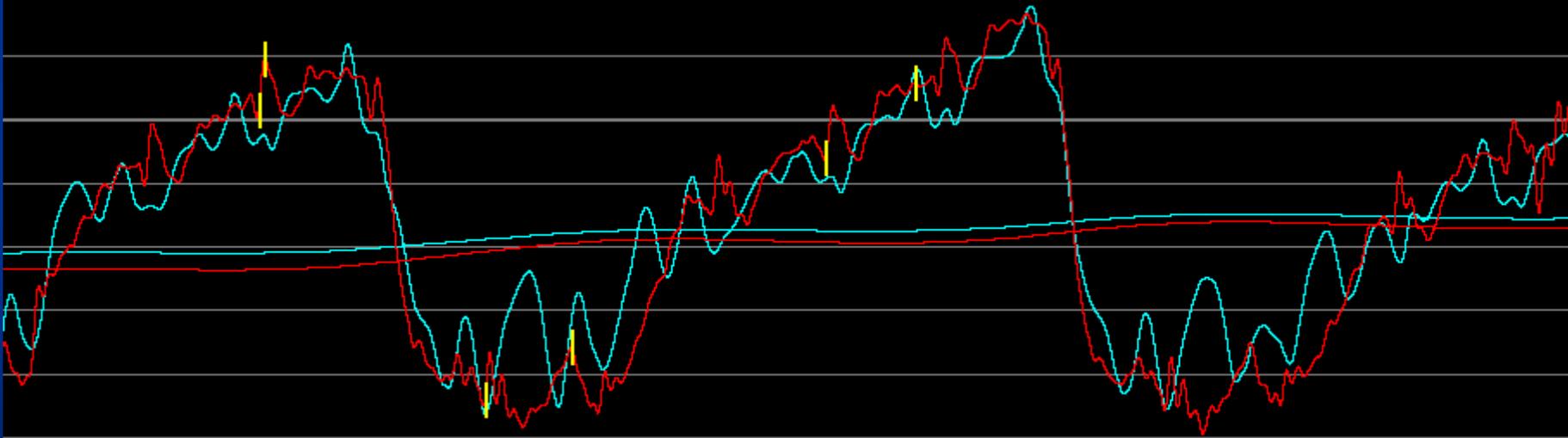


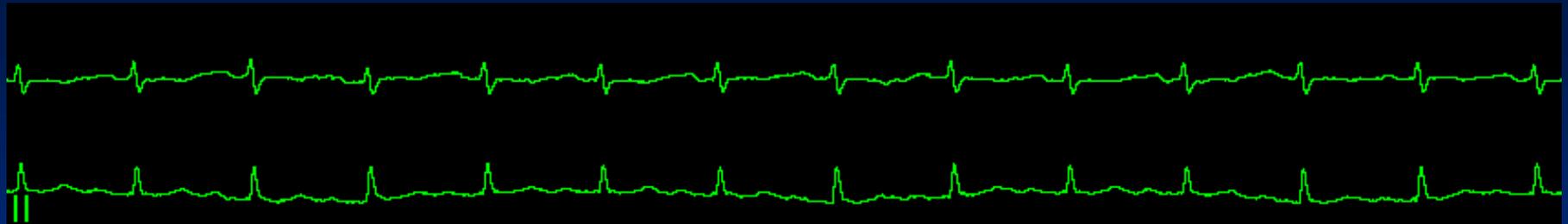




O 40 B
2 40

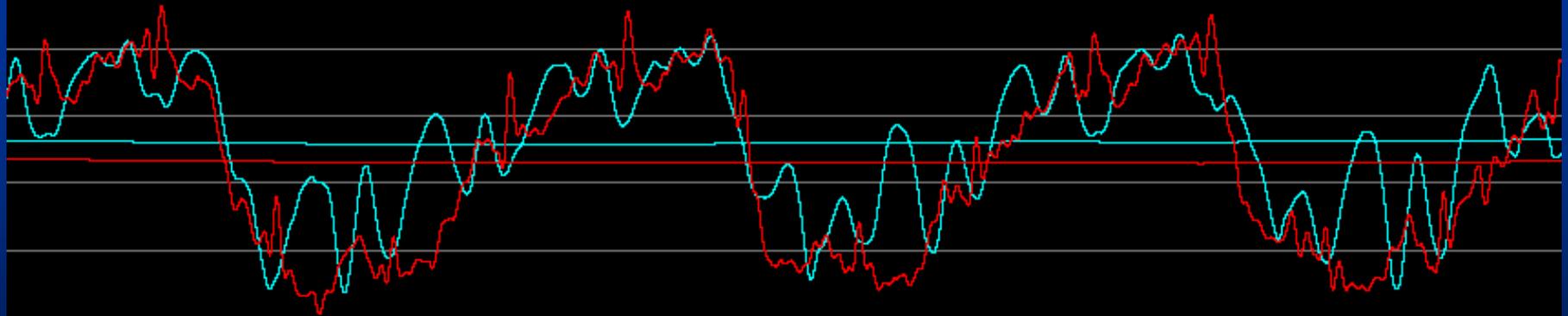
Removal of 60 ml of pericardial fluid - RA and pericardial pressures are equal and falling





O 40 B
2 40

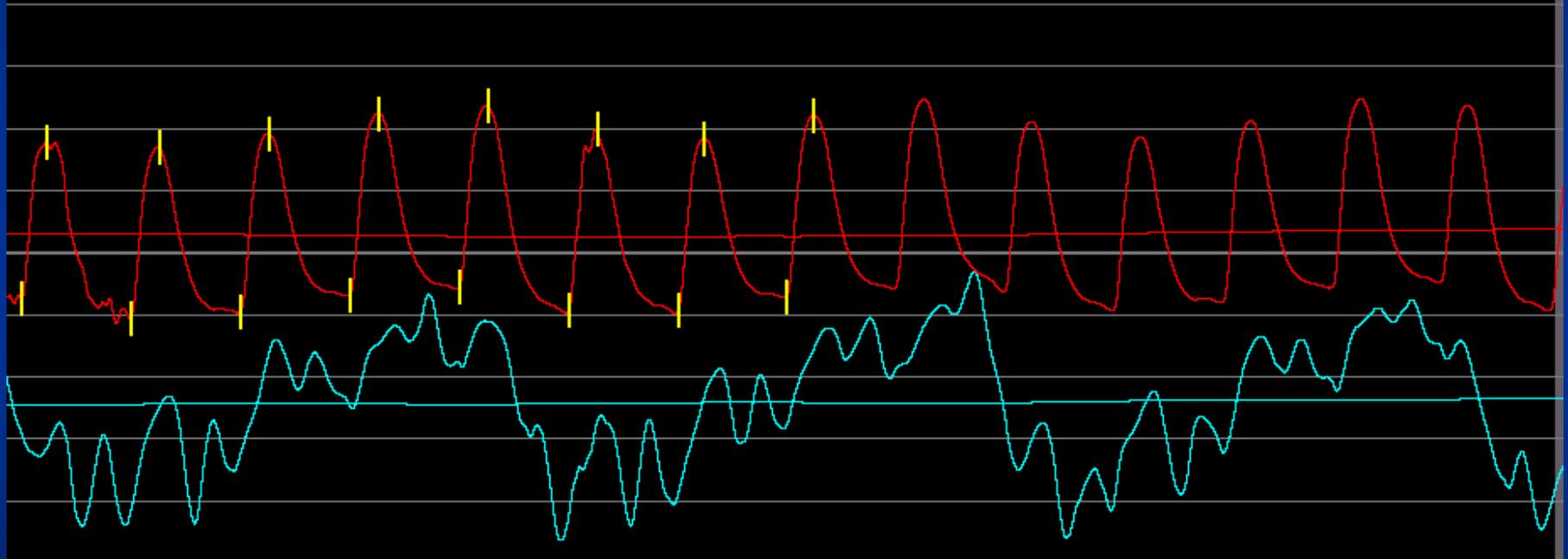
Removal of 120 ml of fluid – pericardial pressure < RA pressure





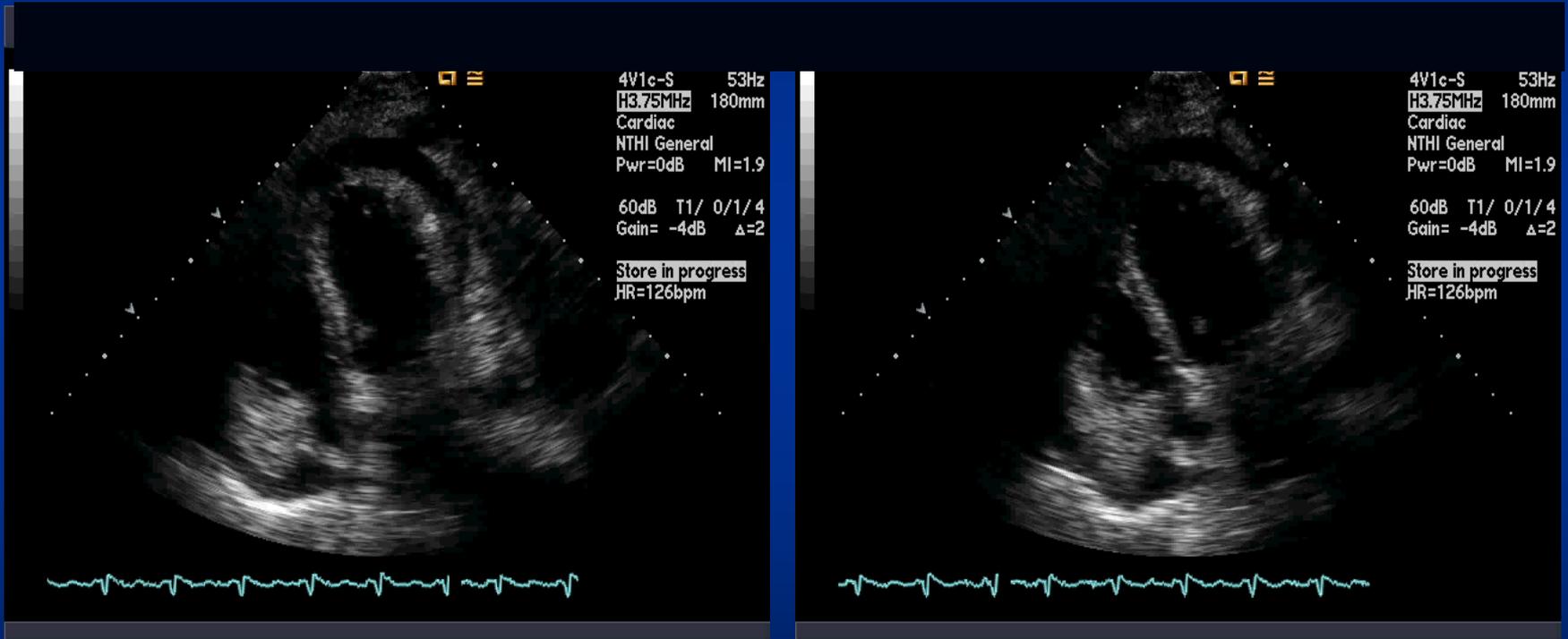
AO 200 B
P2 40

Femoral artery pressure – no pulses paradoxus

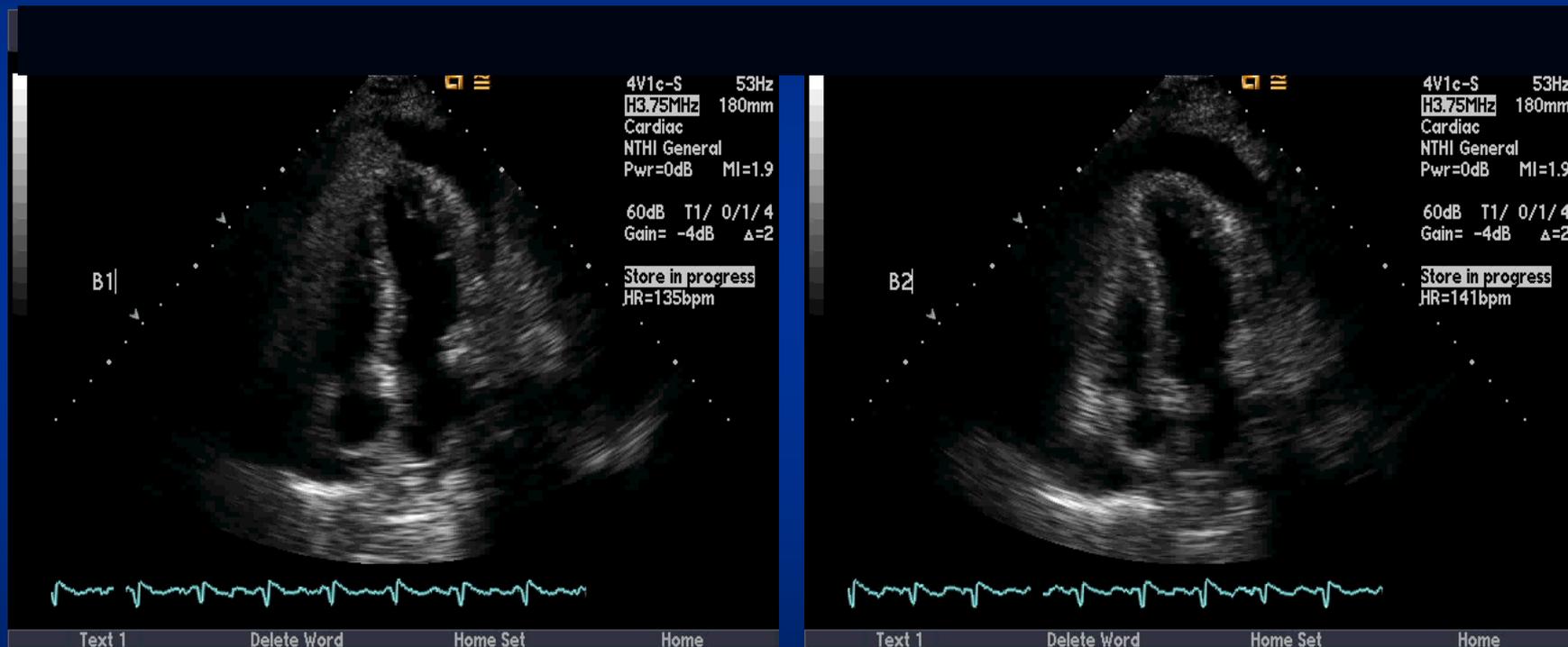


Mean RA pressure = 10 mm Hg after 240 ml fluid removed

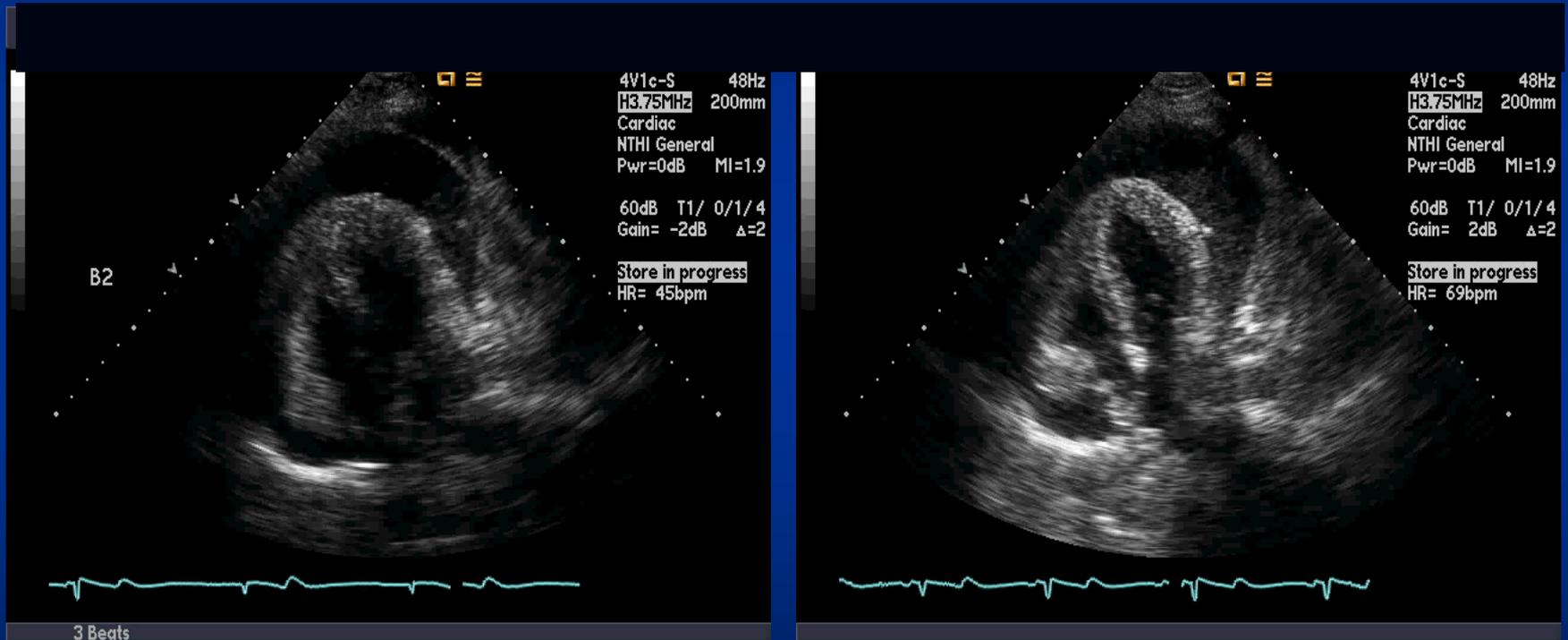
Pericardial effusion — impending tamponade



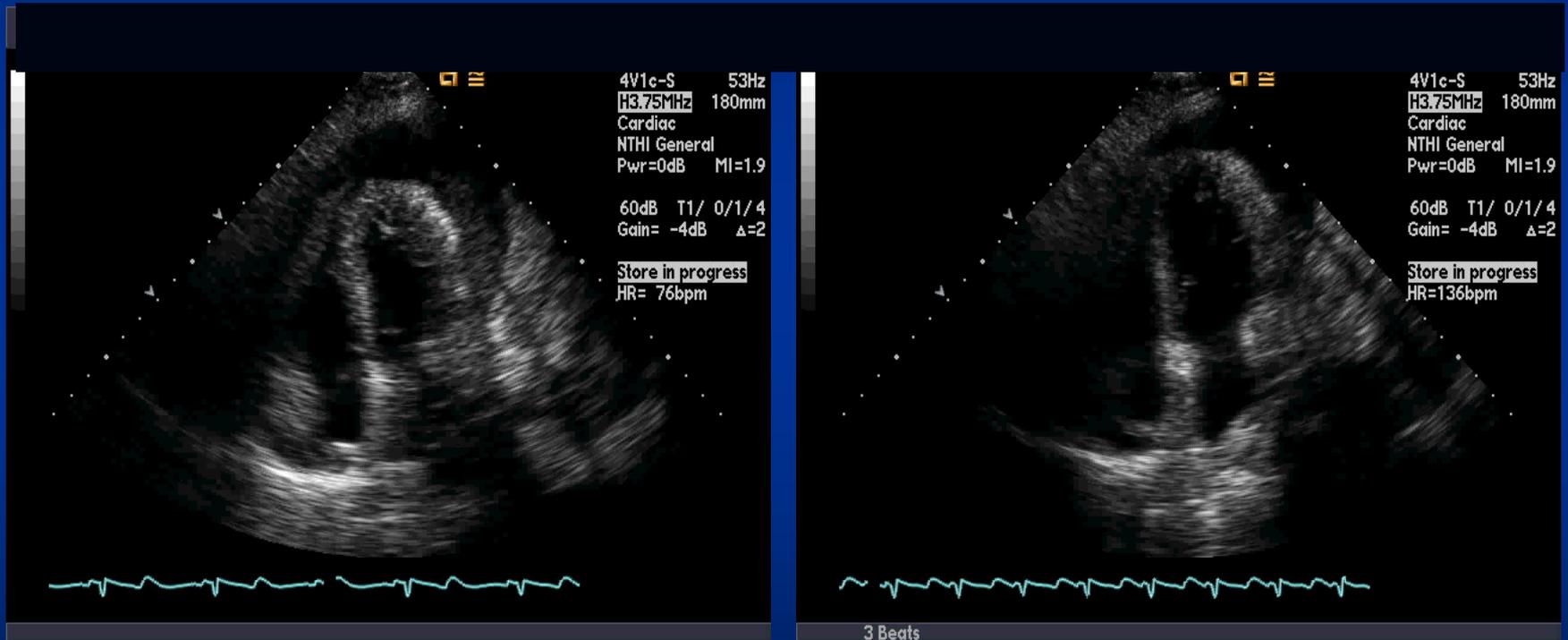
Removed 3ml of pericardial fluid and then added 3ml of agitated saline in pericardial space...but before that the needle had entered the RV



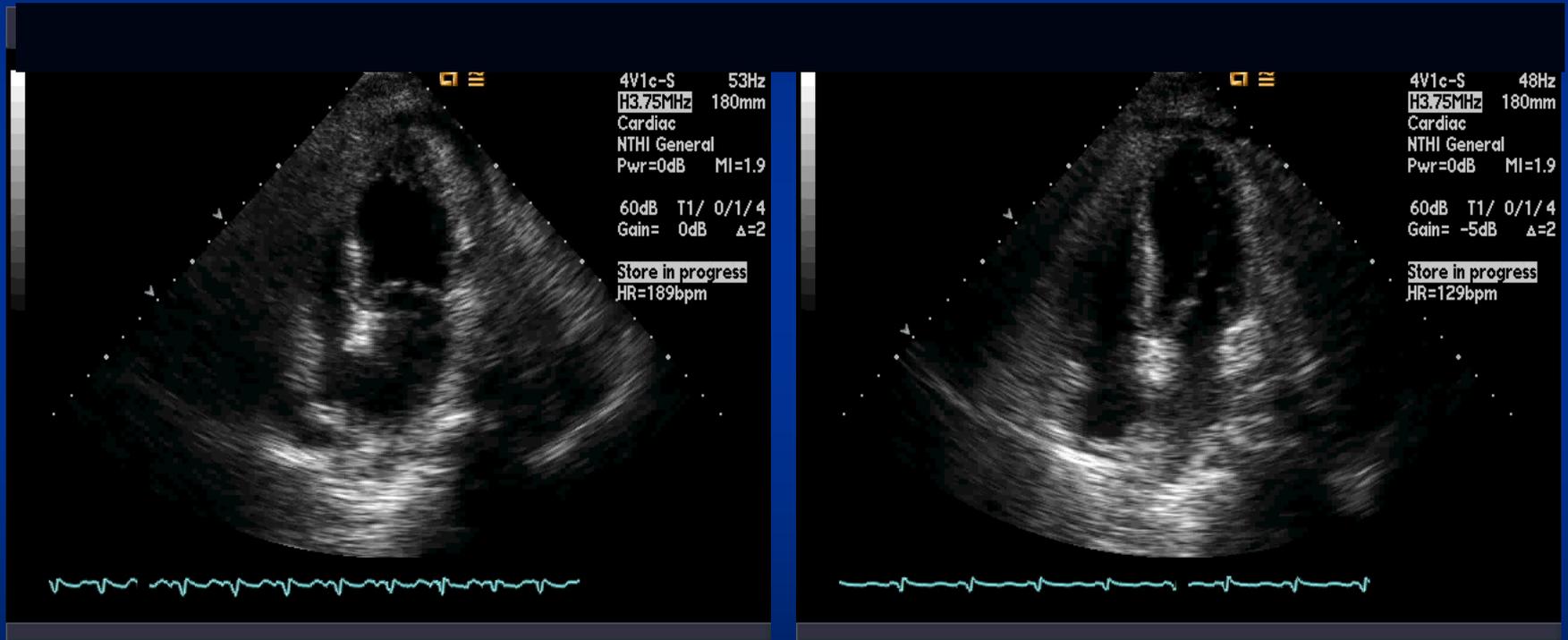
Now increased pericardial effusion...fall in HR and
BP...loss of
consciousness...**TAMPONADE**...imminent death



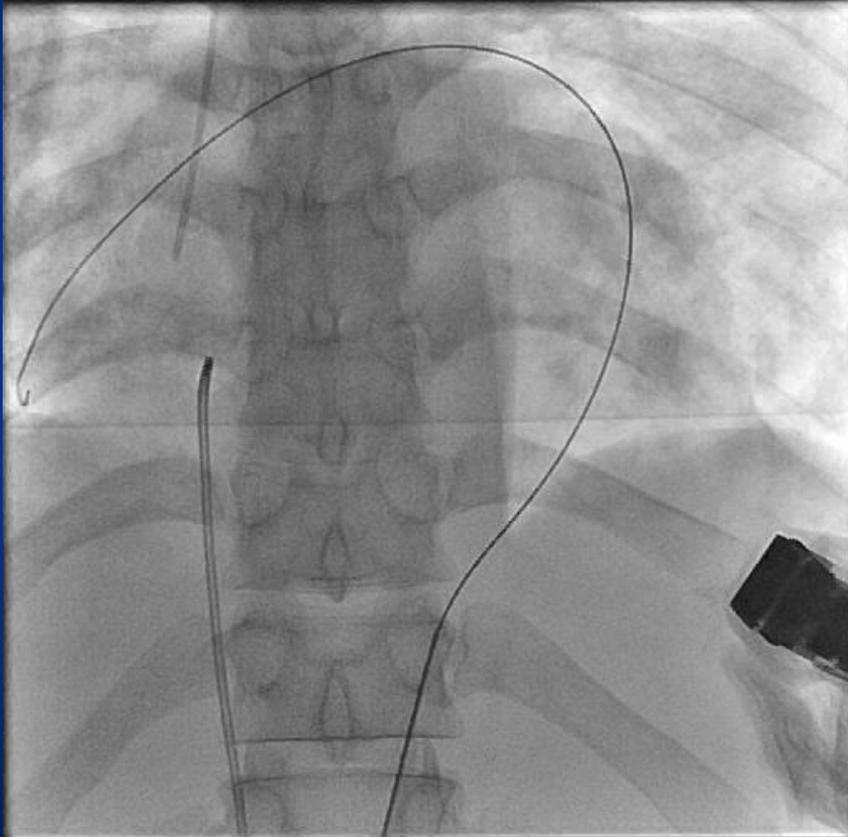
Removal of bloody pericardial fluid



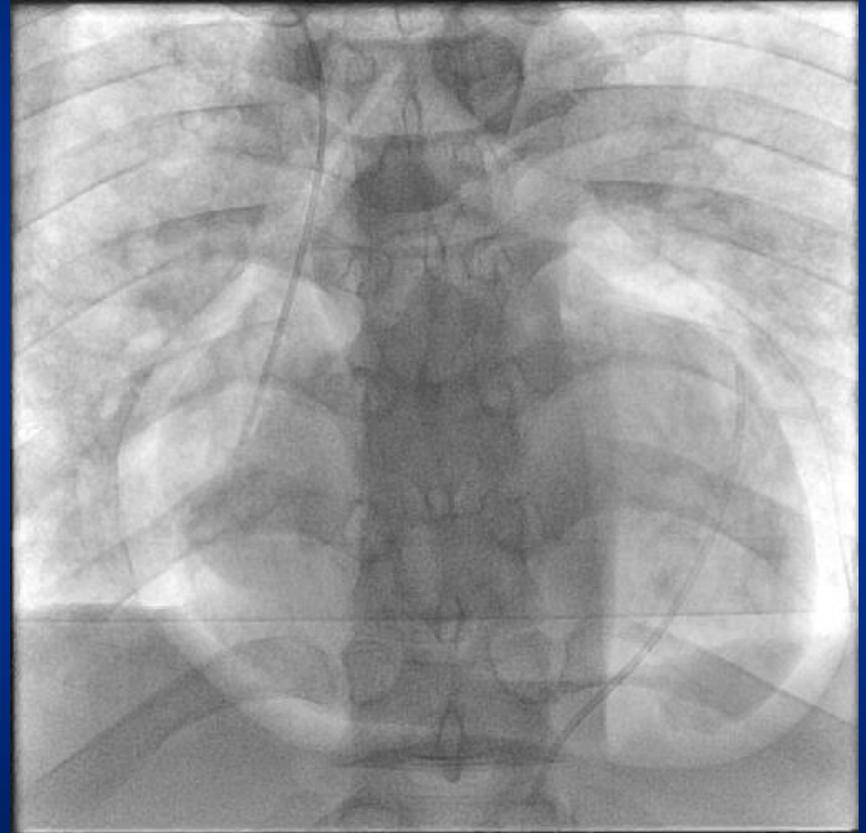
Pericardial drain in place...more fluid removed...patient doing well and talking one hour after procedure



Seen under fluroscopy after pericardiocentesis

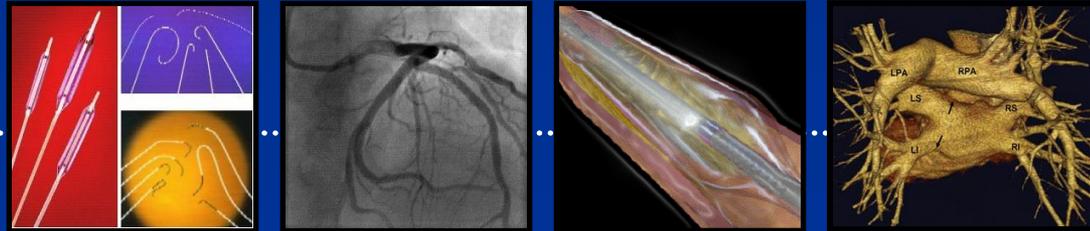


Initial Pericardiocentesis



What is seen after Pericardiocentesis

End – *questions?*



Thanks!

