

# **PERICARDIAL DISEASES and EFFUSION – CAUSES and MANAGEMENT**

**Dr. Kam Tim, Chan**

Queen Elizabeth Hospital

Hong Kong College of Cardiology

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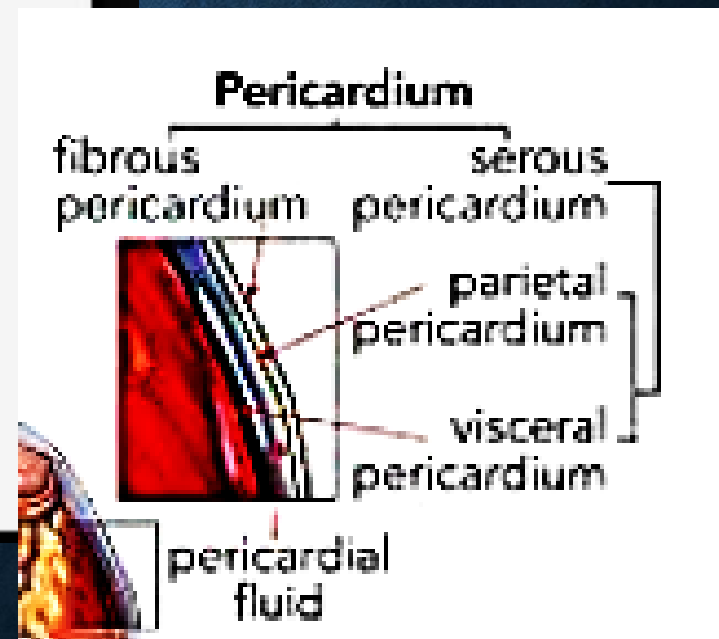
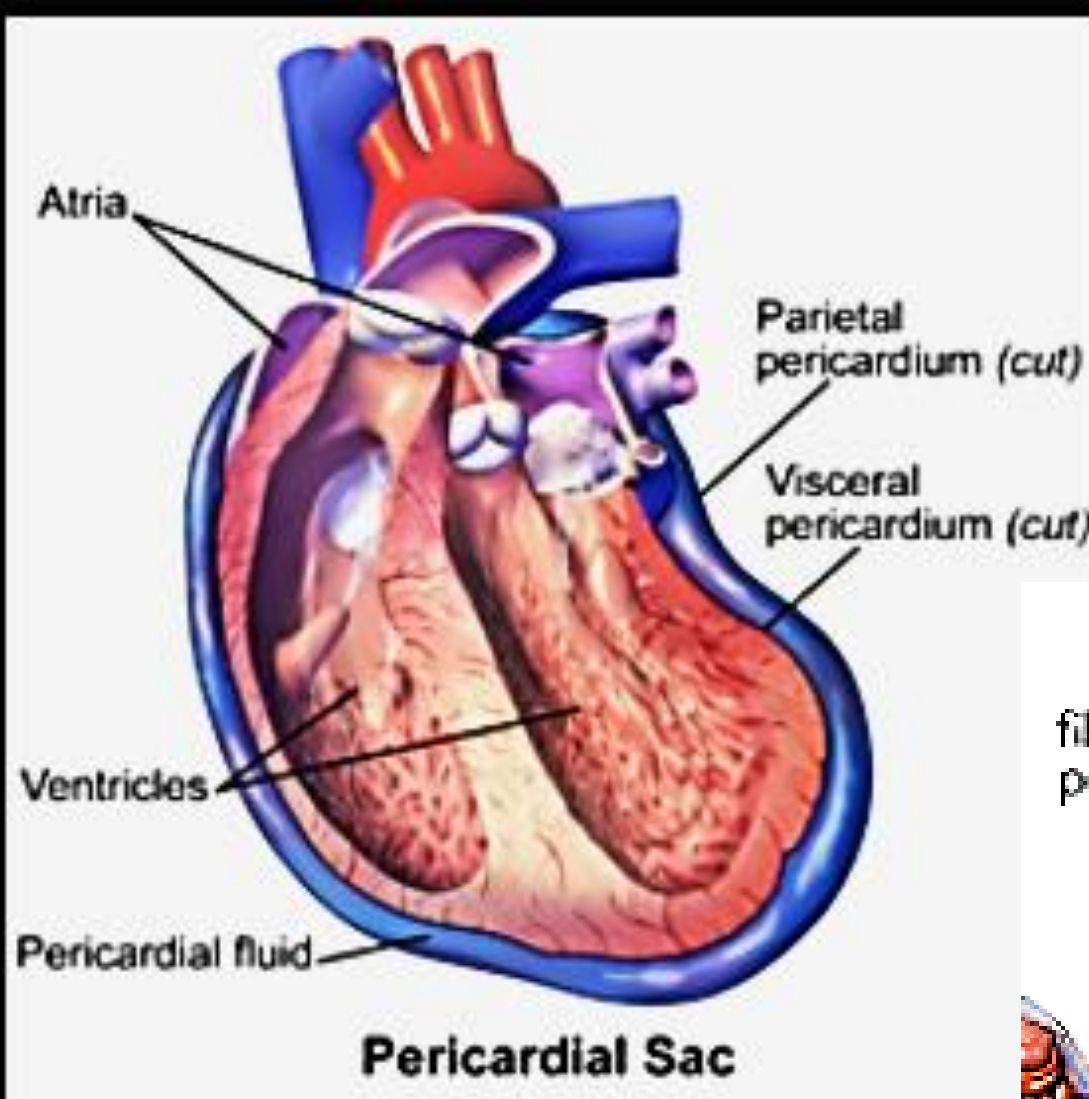
# CONFLICTS OF INTEREST

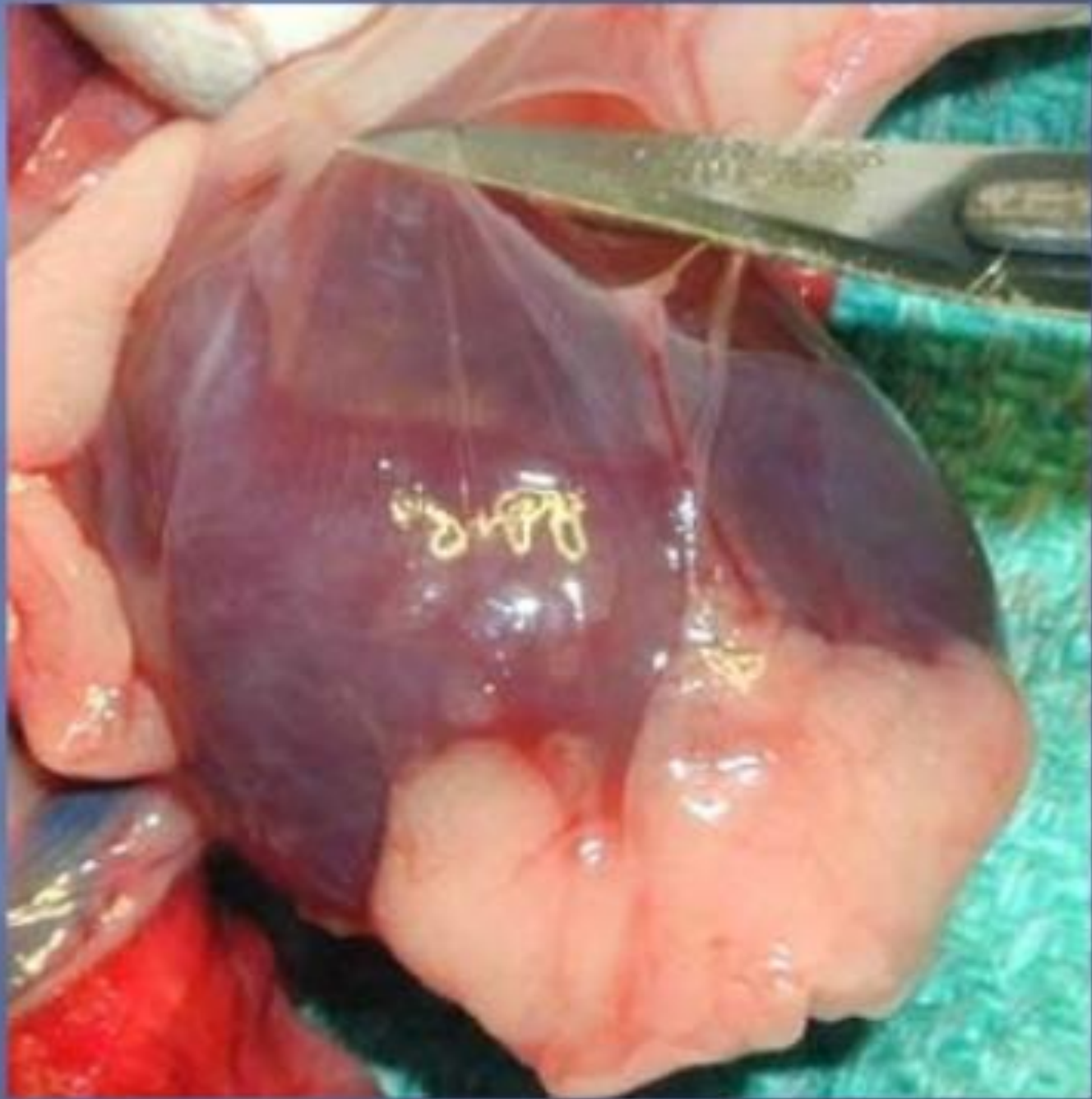
- I have *Nothing* to disclose concerning this presentation

# PERICARDIUM - ANATOMY

- Serous pericardium - a closed sac of two layers:
  - Visceral pericardium contiguous with epicardium
  - Parietal layer contiguous with fibrous pericardium
- Visceral pericardium Reflects near origins of great vessels :
  - few cm proximal to junctions of Caval vessels with RA
  - posterior to LA : oblique sinus of the pericardium
- The left atrium is largely **Extra-pericardial**
- Pericardial cavity normally contains up to 15-50 ml of serous fluid

# PERICARDIUM







GUIDELINES

# 2015 ESC Guidelines for the diagnosis and management of pericardial diseases: The Task Force for the Diagnosis and Management of Pericardial Diseases of the European Society of Cardiology (ESC)

Endorsed by: The European Association for Cardio-Thoracic Surgery (EACTS) 

Yehuda Adler , Philippe Charron , Massimo Imazio, Luigi Badano, Gonzalo Barón-Esquivias, Jan Bogaert, Antonio Brucato, Pascal Gueret, Karin Klingel, Christos Lionis, ... [Show more](#)

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<https://doi.org/10.1093/eurheartj/ehv318>

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# Various Pericardial Syndromes

1. Pericarditis (*acute, subacute, chronic and recurrent*)
2. Pericardial Effusion
3. Cardiac Tamponade
4. Constrictive Pericarditis
5. Pericardial Masses.

**Cover in NEXT SESSIONS**

# Aetiology of pericardial diseases

## A. Infectious causes

**Viral (common):** Enteroviruses (coxsackieviruses, echoviruses), Herpesviruses (EBV, CMV, HHV-6), Adenoviruses, Parvovirus B19 (possible overlap with aetiological viral agents of myocarditis).

**Bacterial:** *Mycobacterium tuberculosis* (common, other bacterial rare), *Coxiella burnetii*, *Borrelia burgdorferi*, rarely: *Pneumococcus spp*, *Meningococcus spp*, *Gonococcus spp*, *Streptococcus spp*, *Staphylococcus spp*, *Haemophilus spp*, *Chlamydia spp*, *Mycoplasma spp*, *Legionella spp*, *Leptospira spp*, *Listeria spp*, *Providencia stuartii*.

**Fungal (very rare):** *Histoplasma spp* (more likely in immunocompetent patients), *Aspergillus spp*, *Blastomyces spp*, *Candida spp* (more likely in immunocompromised host).

**Parasitic (very rare):** *Echinococcus spp*, *Toxoplasma spp*.

Spp = Species



# Aetiology of pericardial diseases (*continued*)

## B. Non-infectious causes

### Autoimmune (common):

Systemic autoimmune and auto-inflammatory diseases (systemic lupus erythematosus, Sjögren syndrome, rheumatoid arthritis, scleroderma), systemic vasculitides (i.e. eosinophilic granulomatosis with polyangiitis or allergic granulomatosis, previously named Churg-Strauss syndrome, Horton disease, Takayasu disease, Behçet syndrome), sarcoidosis, familial Mediterranean fever, inflammatory bowel diseases, Still disease.

### Neoplastic:

Primary tumours (rare, above all pericardial mesothelioma). Secondary metastatic tumours (common, above all lung and breast cancer, lymphoma).

### Metabolic:

Uraemia, myxoedema, anorexia nervosa, other rare.

### Traumatic and Iatrogenic:

- Early onset (rare):
  - Direct injury (penetrating thoracic injury, oesophageal perforation),
  - Indirect injury (non-penetrating thoracic injury, radiation injury),
  - Delayed onset: Pericardial injury syndromes (common) postmyocardial infarction syndrome, postpericardiotomy syndrome, post-traumatic, including forms after iatrogenic trauma (e.g. coronary percutaneous intervention, pacemaker lead insertion and radiofrequency ablation).

## Aetiology of pericardial diseases (*continued*)

### B. Non-infectious causes (*continued*):

#### Drug-related (rare):

Lupus-like syndrome (procainamide, hydralazine, methyldopa, isoniazid, phenytoin); antineoplastic drugs (often associated with a cardiomyopathy, may cause a pericardiopathy): doxorubicin (adriamycin), daunorubicin, cytosine arabinoside, 5-fluorouracil, cyclophosphamide; penicillins as hypersensitivity pericarditis with eosinophilia; amiodarone, methysergide, mesalazine, clozapine, minoxidil, dantrolene, practolol, phenylbutazone, thiazides, streptomycin, thiouracils, streptokinase, p-aminosalicylic acid, sulfadruugs, cyclosporine, bromocriptine, several vaccines, GM-CSF, anti-TNF agents.

**Other (common):** Amyloidosis, aortic dissection, pulmonary arterial hypertension and chronic heart failure.

**Other (uncommon):** Congenital partial and complete absence of the pericardium.

Spp = Species

# ACUTE PERICARDITIS – DIAGNOSIS

- 1/ Pericarditic chest pain
- 2/ Pericardial Rub
- 3/ New widespread ST elevation or PR depression
- 4/ New or worsening pericardial effusion

**AT LEAST “2 out of 4 ” Criteria**

## Supporting Findings :

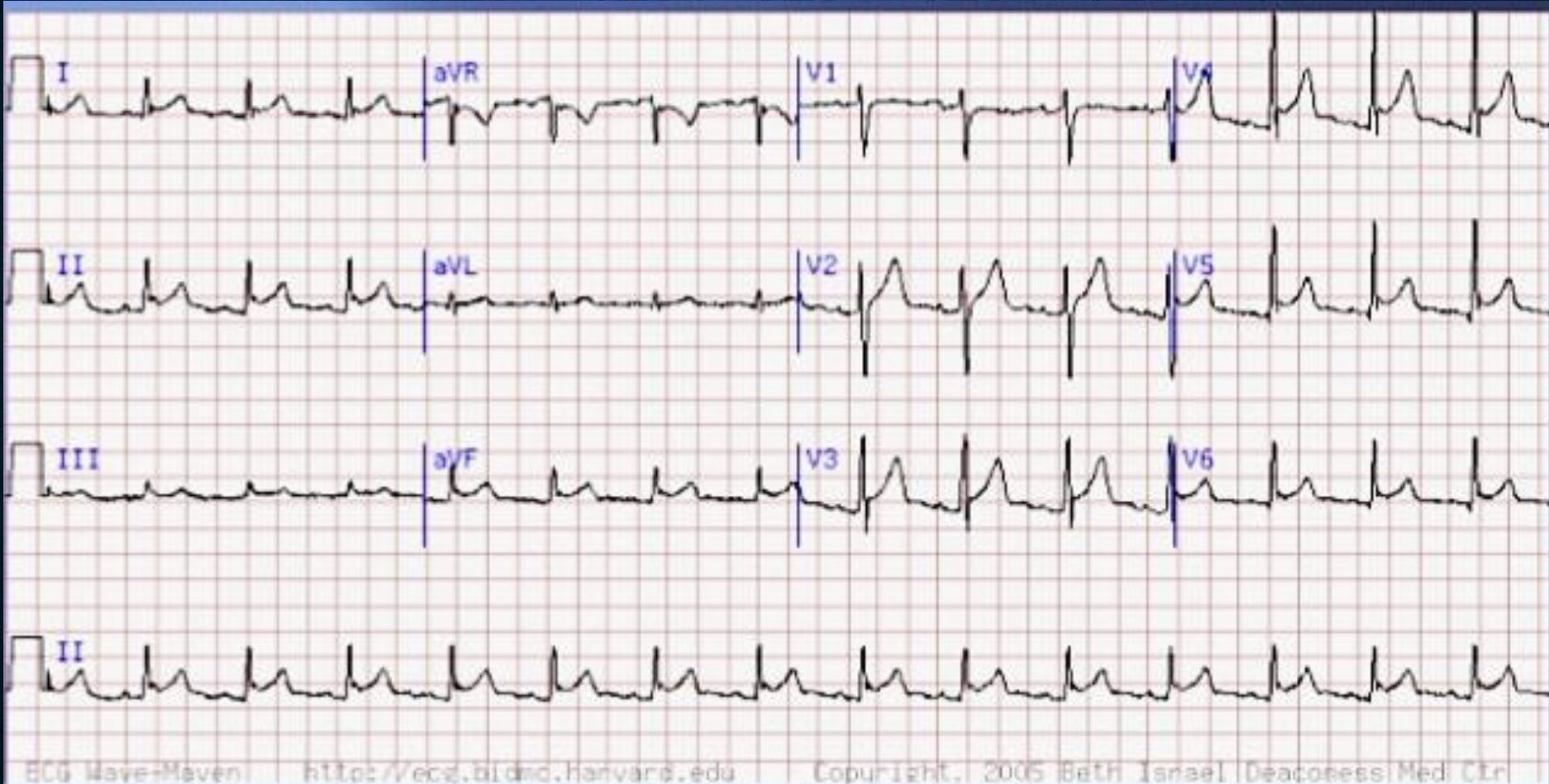
- Elevation inflammatory markers ( CRP, ESR, WC)
- Evidence of pericardial inflammation by imaging (CT , CMR)

# Acute Pericarditis

Recommendations	Class	Level
ECG is recommended in all patients with suspected acute pericarditis.	<b>I</b>	<b>C</b>
Transthoracic echocardiography is recommended in all patients with suspected acute pericarditis.	<b>I</b>	<b>C</b>
Chest X-ray is recommended in all patients with suspected acute pericarditis.	<b>I</b>	<b>C</b>
Assessment of markers of inflammation (i.e. C-reactive protein) and myocardial injury (i.e. CK, troponin) is recommended in patients with suspected acute pericarditis.	<b>I</b>	<b>C</b>





ECG = electrocardiogram; CK = creatinine kinase.

# ECG -ACUTE PERICARDITIS



- 51yo man with acute onset sharp substernal chest pain two days prior

# ACUTE PERICARDITIS – ECG EVOLUTION

Stage	PR segments	ST segments	T waves	
<b>1</b> 1-2 weeks	Depressed	Elevated (Diffuse)	Upright	
<b>2</b> 2-3 weeks	Isoelectric	Isoelectric	Flat, upright	
<b>3</b> 3 to several weeks	Isoelectric	Isoelectric	Inverted	
<b>4</b> Several weeks onwards	Isoelectric	Isoelectric	Upright	

# **ACUTE PERICARDITIS- PROGNOSTIC FACTORS**

## **Major Risk Factors :**

- **High fever > 38 degrees C**
- **Subacute course ( symptoms over several days )**
- **Large pericardial effusion ( >20mm)**
- **Cardiac Tamponade**
- **Failure to respond to NSAID within 7 days**

## **Minor Risk factors :**

- **Myopericarditis**
- **Immunodepression**
- **Trauma**
- **Oral anticoagulant therapy**

# Acute Pericarditis

Recommendations	Class	Level
Hospital admission is recommended for high-risk patients with acute pericarditis (at least one risk factor).	<b>I</b>	<b>B</b>
Outpatient management is recommended for low-risk patients with acute pericarditis. <b>(NO Risk Factors)</b>	<b>I</b>	<b>B</b>
Evaluation of response to anti-inflammatory therapy is recommended after 1 week.	<b>I</b>	<b>B</b>



# Commonly prescribed anti-inflammatory drugs for acute pericarditis

Drug	Usual Dosing <sup>a</sup>	Tx duration <sup>b</sup>	Tapering <sup>a</sup>
<b>Aspirin</b>	750–1000 mg every 8 hours.	1-2 weeks.	Decrease doses by 250-500 mg every 1-2 weeks.
<b>Ibuprofen</b>	600 mg every 8 hours.	1-2 weeks.	Decrease doses by 200-400 mg every 1-2 weeks.
<b>Colchicine</b>	0.5 mg once (<70 kg) or 0.5 mg <i>b.i.d.</i> (≥70 kg).	3 months.	Not mandatory, <b>(Tapering)</b> alternatively 0.5 mg every other day (<70 kg) or 0.5 mg once (≥70 kg) in the last weeks.

*b.i.d* = twice daily; NSAIDs = non-steroidal anti-inflammatory drugs; Tx = treatment.

<sup>a</sup>Tapering should be considered for aspirin and NSAIDs.

<sup>b</sup>Tx duration is Symptoms and CRP guided but generally 1 to 2 weeks for uncomplicated cases. Gastroprotection should be provided. Colchicine is added on top of aspirin or ibuprofen.



# Acute Pericarditis

Recommendations	Class	Level
Aspirin or NSAIDs are recommended as first line therapy for acute pericarditis with gastroprotection.	<b>I</b>	<b>A</b>
Colchicine is recommended as first line therapy for acute pericarditis as adjunct to aspirin/NSAIDs therapy.	<b>I</b>	<b>A</b>
Serum CRP should be considered to guide the treatment length and assess the response to therapy.	<b>IIa</b>	<b>C</b>
Low-dose corticosteroids <sup>a</sup> should be considered for acute pericarditis in cases of contraindication/failure of aspirin/NSAIDs and colchicine, and when an infectious cause has been excluded, or when there is a specific indication such as auto-immune disease.	<b>IIa</b>	<b>C</b>

CRP = C-reactive protein; ECG = electrocardiogram; NSAIDs = non-steroid anti-inflammatory drugs.

<sup>a</sup>Added to colchicine.

## Acute Pericarditis (*continued*)

Recommendations	Class	Level
Exercise restriction should be considered for non-athletes with acute pericarditis until symptom resolution, and normalization of CRP, ECG and echocardiogram.	<b>IIa</b>	<b>C</b>
For athletes, the duration of exercise restriction should be considered until resolution of symptoms and normalization of CRP, ECG and echocardiogram, and for at least 3 months.	<b>IIa</b>	<b>C</b>
Corticosteroids are not recommended as first line therapy for acute pericarditis.	<b>III</b>	<b>C</b>

CRP = C-reactive protein; ECG = electrocardiogram; NSAIDs = non-steroid anti-inflammatory drugs.

# Recurrent Pericarditis

## Diagnostic criteria

Pericarditis	Definition and diagnostic criteria
<b>Acute</b>	<p>Inflammatory pericardial syndrome to be diagnosed with at least 2 of the 4 following criteria:</p> <ol style="list-style-type: none"><li>(1) pericarditic chest pain,</li><li>(2) pericardial rubs,</li><li>(3) new widespread ST-elevation or PR depression on ECG,</li><li>(4) pericardial effusion (new or worsening).</li></ol> <p>Additional supporting findings:</p> <ul style="list-style-type: none"><li>- Elevation of markers of inflammation (i.e. C-reactive protein, erythrocyte sedimentation rate, and white blood cell count),</li><li>- Evidence of pericardial inflammation by an imaging technique (CT, CMR).</li></ul>
<b>Incessant</b>	Pericarditis lasting for >4–6 weeks but <3 months <sup>a</sup> without remission.
<b>Recurrent</b>	Recurrence of pericarditis after a documented first episode of acute pericarditis and a symptom-free interval of 4–6 weeks or longer <sup>a</sup> .
<b>Chronic</b>	Pericarditis lasting for >3 months.

CMR = cardiac magnetic resonance; CT = computed tomography; ECG = electrocardiogram.

<sup>a</sup>Usually within 18–24 months but a precise upper limit of time has not been established.

*Circulation* 2007;**115**:2739–2744. - *N Engl J Med* 2013;**369**:1522–1528.

*Lancet* 2014;**S0140-6736**: 62709–9. - *JAMA* 2014;**312**:1016–1023

*J Am Soc Echocardiogr* 2013;**26**:965–1012.e15 - *Eur Heart J Cardiovasc Imaging* 2014;**16**:12–31



# Commonly prescribed anti-inflammatory drugs for recurrent pericarditis

Drug	Usual Initial dose <sup>a</sup>	Tx duration <sup>b</sup>	Tapering <sup>a</sup>
<b>Aspirin</b>	500-1000 mg every 6-8 hours (range 1,5-4 g/day)	weeks-months	Decrease doses by 250-500 mg every 1-2 weeks <sup>b</sup>
<b>Ibuprofen</b>	600 mg every 8 hours (range 1200-2400 mg)	weeks-months	Decrease doses by 200-400 mg every 1-2 weeks <sup>b</sup>
<b>Indomethacin</b>	25-50 mg every 8 hours: start at lower end of dosing range and titrate upward to avoid headache and dizziness	weeks-months	Decrease doses by 25 mg every 1-2 weeks <sup>b</sup>
<b>Colchicine</b>	0.5 mg twice or 0.5 mg daily for patients <70 kg or intolerant to higher doses	At least 6 months	Not necessary, alternatively 0.5 mg every other day (<70 kg) or 0.5 mg once (≥70 kg) in the last weeks

Tx = treatment. <sup>a</sup>Tapering should be considered for aspirin and NSAIDs.

<sup>b</sup>Longer tapering times for more difficult, resistant cases may be considered.



# Immunosuppressants and biological drugs for refractory cases

	Dose	Geriatric	Renal impairment	Hepatic Impairment	Pediatric	Comment
<b>Azathioprine</b>	Initial: 1 mg/kg/day given once daily or divided twice daily, gradually increased till 2-3 mg/kg/day.	Refer to adult dosing.	No dose adjustments provided in manufacturer's label.	- No dose adjustments provided in manufacturer's label. - Caution however since possible hepatotoxicity	Limited data available: children and adolescents: oral: 2-2.5 mg/kg Dose once daily.	- Haematologic and hepatic toxicity. - Allopurinol concomitant use contraindicated (severe myelosuppression). - Useful as a sparing corticosteroids agent.
<b>IVIG</b>	400-500 mg/kg/day for 5 days, or 1 g/kg/day for 2 days, eventually repeated every 4 weeks.	Refer to adult dosing.	Use with caution due to risk of immune globulin-induced renal dysfunction; the rate of infusion and concentration of solution should be minimized.	No dose adjustments provided in manufacturer's label.	Refer to adult dosing.	Generally well tolerated. Expensive. Effective in the acute episode.
<b>Anakinra</b>	1-2 mg/kg/day up to 100 mg once daily subcutaneously.	Refer to adult dosing.	No dose adjustment is necessary.	No dose adjustments provided in manufacturer's label.	1-2 mg/kg/day subcutaneously max 100 mg/day.	Generally well tolerated. Expensive. Effective in the acute episode.

**Anakinra** – recombinant non-glycosylated human interleukin 1 Receptor antagonist

# Management of recurrent pericarditis

Recommendations	Class	Level
Aspirin and NSAIDs are mainstays of treatment and are recommended at full doses if tolerated, until complete symptom resolution.	<b>I</b>	<b>A</b>
Colchicine (0.5 mg twice daily or 0.5 mg daily for patients <70 kg or intolerant to higher doses) use for 6 months is recommended as an adjunct to aspirin/NSAIDs.	<b>I</b>	<b>A</b>
Colchicine therapy of longer duration (>6 months) should be considered in some cases, according to clinical response.	<b>IIa</b>	<b>C</b>
CRP dosage should be considered to guide the treatment duration and assess the response to therapy.	<b>IIa</b>	<b>C</b>
After CRP normalization a gradual tapering of therapies should be considered, tailored to symptoms and CRP, a single class of drugs at a time.	<b>IIa</b>	<b>C</b>
Drugs such as IVIG, anakinra or azathioprine may be considered in cases of corticosteroid dependent recurrent pericarditis in patients not responsive to colchicine.	<b>IIb</b>	<b>C</b>

## Management of recurrent pericarditis (continued)

Recommendations	Class	Level
Exercise restriction should be considered for non-athletes with recurrent pericarditis until symptom resolution and CRP normalization, taking into account the previous history and clinical conditions.	<b>IIa</b>	<b>C</b>
Exercise restriction for a minimum of 3 months should be considered for athletes with recurrent pericarditis until symptom resolution and normalization of CRP, ECG and echocardiogram.	<b>IIa</b>	<b>C</b>
If ischaemic heart disease is a concern or antiplatelet therapy is required, aspirin should be considered, at medium high doses (1-2.4 g/daily) (Web-box).	<b>IIa</b>	<b>C</b>
If symptoms recur during therapy tapering, the management should consider not to increase the dose of corticosteroids and to control symptoms by increasing to the maximum dose of aspirin or NSAIDs, well distributed, generally every 8 hours, intravenously if necessary, adding colchicine, and adding analgesics for pain control.	<b>IIa</b>	<b>C</b>
Corticosteroid therapy is not recommended as a first line-approach.	<b>III</b>	<b>B</b>



# Therapeutic algorithm for acute and recurrent pericarditis

## Diagnosis of acute pericarditis

(2 of 4 clinical criteria: pericardial chest pain, pericardial rubs, ECG changes; pericardial effusion)

### First line

Aspirin or NSAID + colchicine + exercise restriction

### Second line

Low-dose corticosteroids  
(in case of contraindications to aspirin/NSAID/colchicine  
and after exclusion of infectious cause)

## Recurrent pericarditis

(after symptom-free interval 4–6 weeks)

### First line

Aspirin or NSAID + colchicine + exercise restriction

### Second line

Low-dose corticosteroids  
(in case of contraindications to aspirin/NSAID/colchicine  
and after exclusion of infectious cause)

### Third line

i.v. immunoglobulin or anakinra or azathioprine

### Fourth line

Pericardiectomy

# • MYOPERICARDITIS

# Pericarditis with myocardial involvement

Recommendations	Class	Level
In cases of pericarditis with suspected associated myocarditis, coronary angiography (according to clinical presentation and risk factor assessment) is recommended in order to rule out acute coronary syndromes.	<b>I</b>	<b>C</b>
Cardiac Magnetic Resonance (CMR) is recommended for the confirmation of myocardial involvement.	<b>I</b>	<b>C</b>
Hospitalization is recommended for diagnosis and monitoring in patients with myocardial involvement.	<b>I</b>	<b>C</b>
Rest and avoidance of physical activity beyond normal sedentary activities is recommended in non-athletes and athletes with myopericarditis for a duration of 6 months.	<b>I</b>	<b>C</b>
Empirical anti-inflammatory therapies (lowest efficacious doses) should be considered to control chest pain.	<b>IIa</b>	<b>C</b>

# HEMORRHAGIC PERICARDITIS

- Exudate of blood admixed with fibrinous to suppurative effusion
- Most commonly it follows cardiac surgery or associated with tuberculosis or malignancy
- It organize with or without calcification



- **PERICARDIAL  
EFFUSION**

# Classification of pericardial effusion

<b>Onset</b>	Acute Subacute Chronic (>3 months)
<b>Size</b>	Mild <10 mm Moderate 10-20 mm Large >20 mm
<b>Distribution</b>	Circumferential Loculated
<b>Composition</b>	Transudate Exudate

# Pericardial Effusion

## DEFINITION

- Presence of an abnormal amount of fluid and/or an abnormal character to fluid in the pericardial space.
- The pericardial space normally contains 15-50 mL of fluid
- Cardiac tamponade is acute heart failure due to compression of heart by a large or rapidly developing effusion.

# HOW MUCH PERICARDIAL FLUID is NORMAL ?

- Pericardial Effusion and Cardiac Tamponade.  
The pericardial sac normally contains up to 50 mL of fluid; it can hold 80 to 200 mL of fluid acutely, and even up to 2 L if the fluid accumulates slowly.

## Type of pericardial effusion

- 1) transudative
- 2) exudative
- 3) hemorrhagic
- 4) malignant (due to fluid accumulation caused by metastasis)



# PATHOPHYSIOLOGY

- Clinical manifestations are highly dependent on the rate of accumulation of fluid in the pericardial sac.
- Pericardial effusion ➡ increased pericardial pressure ➡ overcomes ventricular filling pressure ➡ decreased stroke volume ➡ reduced COP

# ETIOLOGIES

- **Pericarditis** (infectious and idiopathic)
- **Neoplastic** (Lung CA-37%, Breast CA-22%, Leukemia/lymphoma-17%)
- **Uremia**
- **Hypothyroidism**
- **Connective Tissue Diseases**
- **Post operative**
- **Others**
  - Myxedema
  - Severe pulmonary Hypertension
  - Trauma
  - **Autoimmune** (SLE, RA, Sarcoidosis, Ankylosing spondylitis)
  - **Drugs** (procainamide, Hydralazine, Isoniazid, Minoxidil, Phenytoin, methylsergide, Anticoagulants)

# CLINICAL PRESENTATION

- Chest pain – relieved by sitting up and leaning forward, aggravated by lying supine
- Light-headedness, syncope
- Palpitations
- Cough, dyspnea, hoarseness
- Anxiety and confusion
- hiccoughs

# Physical Examination

- **Beck triad** - 3 Ds
  - Decreased pulse pressure (hypotension)
  - Decreased/Muffled heart sounds
  - Distended neck veins (Raised JVP)
- **Pulsus paradoxus**
- Pericardial friction rub
- Tachycardia, Tachypnea
- Weakened peripheral pulses, cyanosis and edema
- **Ewart Sign**- dullness to percussion beneath the angle of left scapula from compression of left lung by pericardial effusion

# INVESTIGATIONS

- **Baseline**–CBC, Electrolytes, cardiac enzymes, ESR, CRP
- **Pericardiocentesis** (diagnostic and therapeutic)
- **Pericardial fluid Analysis** (R/E, C/S, Adenosine deaminase and Carcinoembryonic Antigen)
- **Thyroid profile**
- **Rheumatoid Factor, Immunoglobulin complexes, Antinuclear Ab test**
- **Chest Radiography** – enlarged cardiac silhouette (water bottle heart) and pericardial fat stripe
- **CT scan and MRI**

# Pericardial Effusion

Recommendations	Class	Level
Transthoracic echocardiography is recommended in all patients with suspected pericardial effusion.	<b>I</b>	<b>C</b>
Chest X-ray is recommended in patients with a suspicion of pericardial effusion or pleuropulmonary involvement.	<b>I</b>	<b>C</b>
Assessment of markers of inflammation (i.e. CRP) are recommended in patients with pericardial effusion.	<b>I</b>	<b>C</b>
CT or CMR should be considered in suspected cases of loculated pericardial effusion, pericardial thickening and masses, as well as associated chest abnormalities.	<b>IIa</b>	<b>C</b>

CMR = cardiomyopathy; CRP = C-reactive protein; CT = computed tomography.

# CXR



- Normal in patients with acute pericarditis unless pericardial effusion is present
- Requires 200cc of fluid

**CXR**

water bottle configuration





# CXR



**PERICARDIAL  
CALCIFICATION**



**CONSTRICTIVE  
PERICARDITIS**

# ECG

## Low Voltage QRS

- **Low Voltage**
- The QRS is said to be low voltage when:
- The amplitudes of all the QRS complexes in the limb leads are  $< 5$  mm; or
- The amplitudes of all the QRS complexes in the precordial leads are  $< 10$  mm

# ECG - VOLTAGE CRITERIA



Fig. 1 ECG shows low voltages in the QRS complexes, especially in precordial leads V1 to V6.

# Electrocardiography

- Low voltage QRS complexes
- Electrical Alternans



- **Echocardiography : diagnostic test**

Effusion	Echo-free space	location
Small	<10mm	posteriorly
Medium	10-20mm	circumferential
Large	>20mm	circumferential

**False positive findings** : due to pleural effusions, pericardial thickening, increased epicardial fat tissue, mediastinal lesions

# ECHOCARDIOGRAPHY

Pericardial effusion

```
graph TD; A[Pericardial effusion] --> B["Intrapericardial pressure > intracardiac pressure"]; B --> C["Intra-pericardial pressure > RA diastolic pressure"]; B --> D["Intra-pericardial pressure > RV diastolic pressure"]; C --> E[Late diastolic RA inversion]; D --> F[Early diastolic RV collapse];
```

Intrapericardial pressure > intracardiac pressure

Intra-pericardial  
pressure > RA diastolic  
pressure

Intra-pericardial  
pressure > RV diastolic  
pressure

Late diastolic RA inversion

Early diastolic RV collapse

# ECHO- TAMPONADE SIGNS

## ECHO SIGNS OF TAMPONADE

@ULTRASOUNDJELLY



VALVES CLOSED  
RA COLLAPSE



PLETHORIC IVC  
<50% COLLAPSE



VALVES OPEN  
RV COLLAPSE



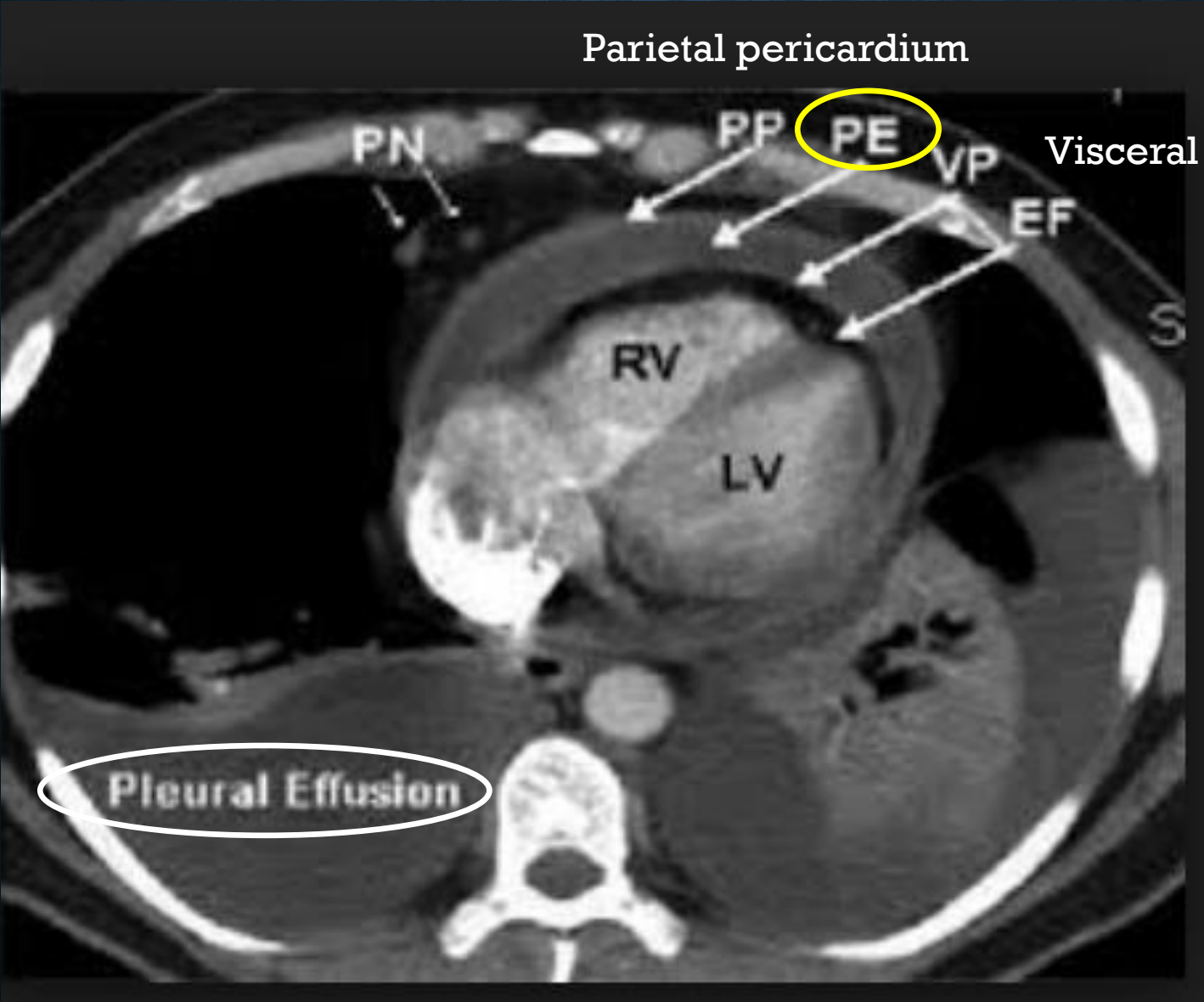
MY INFLOW  
VARIATION >25%

# CT SCAN

- Can detect as little as 50 ml pericardial fluid
- Less false +ve findings than echo
- Determine the composition of fluid
- Excellent for pericardial thickening / calcification
- Imaging of lungs pathologies and great vessels
- CT signs of Tamponade :
  - IV Septum bowing
  - Dilated IVC
  - Contrast reflux to azygous veins
  - Compression of heart chambers
- Limitations in emergency situation

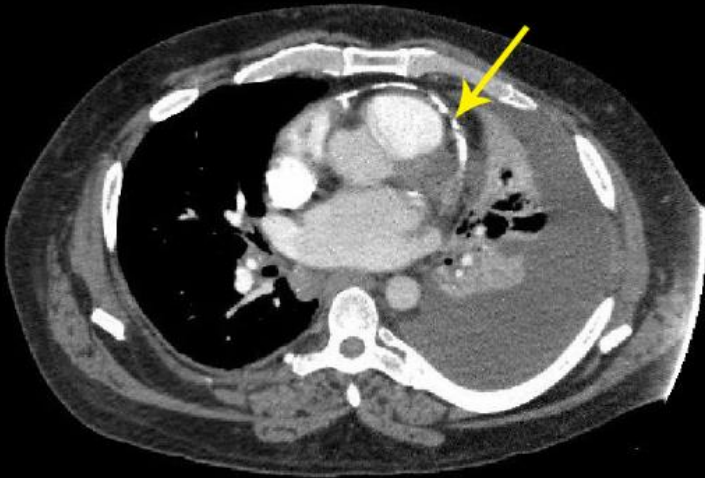


# CT SCAN

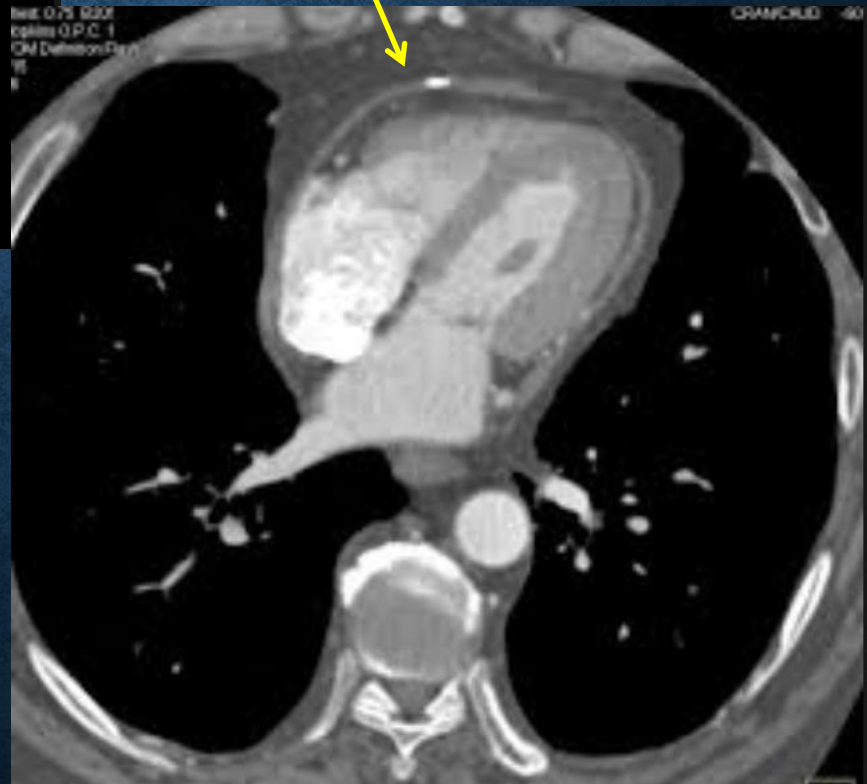


# CT SCAN

Calcification



Pericardial thickening

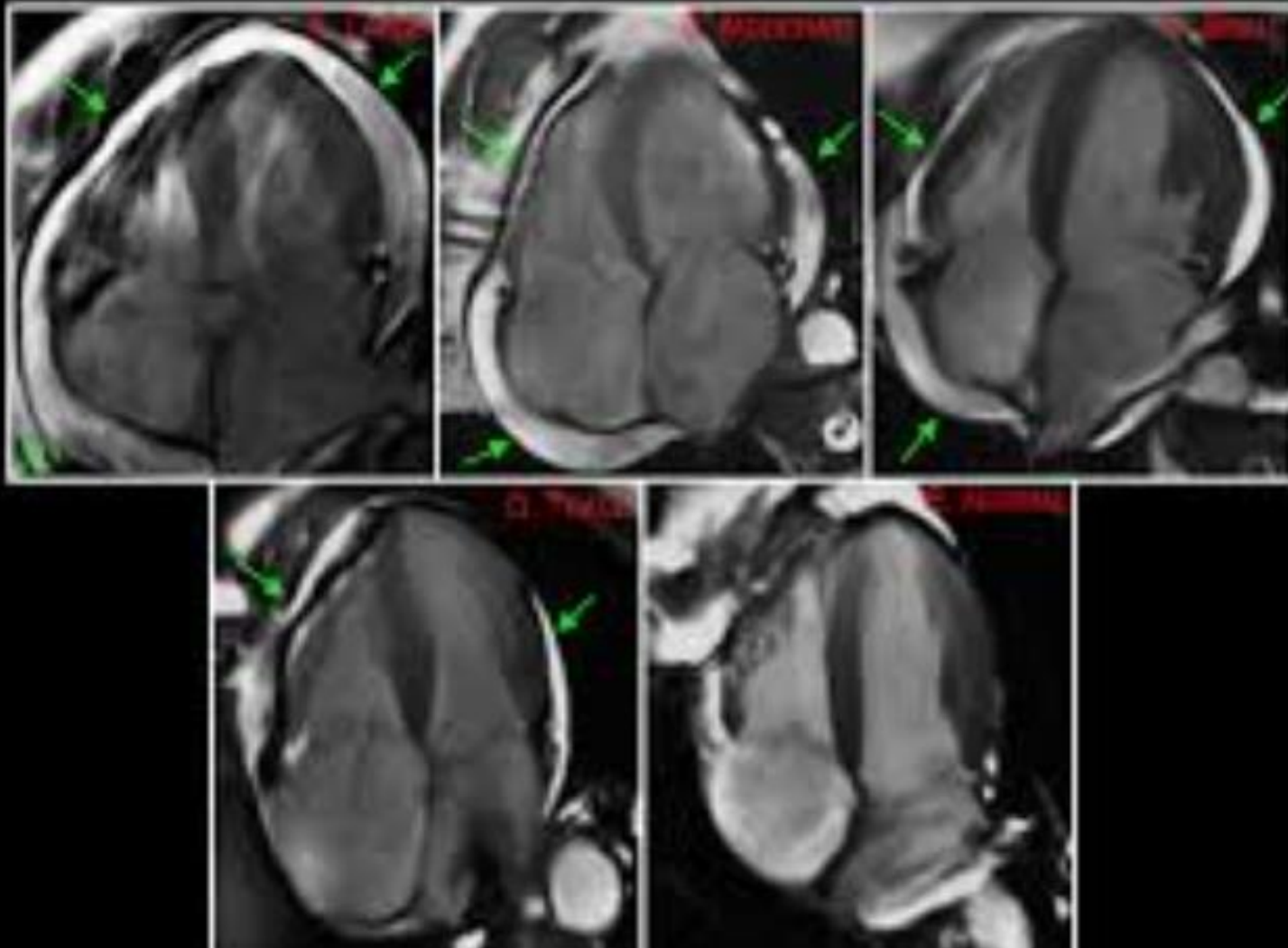


# CARDIAC MRI

- Can detect as little as 30 cc pericardial fluid
- Differentiate blood and non-hemorrhagic fluid
- Nodularity and irregularities of pericardium may suggest malignant effusion
- Abnormalities of other thoracic structures
- **LGE ( Late Gadolinium Enhancement )** – reveal areas of inflammation in pericardium
  - Can guide treatment response and diagnosis of effusive-constrictive pericarditis
- **LIMITATIONS in Emergency situations**

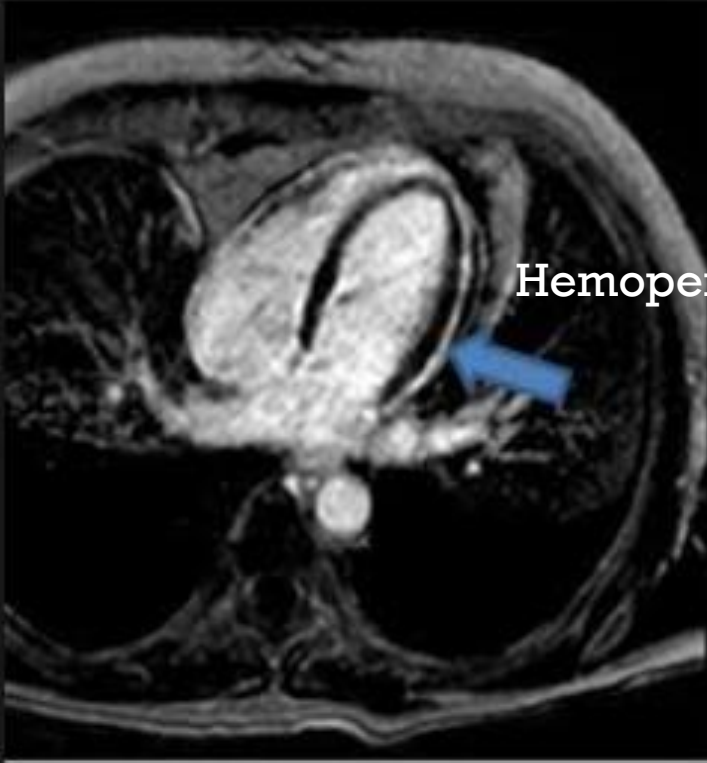
# CARDIAC MRI

## F2. EFFUSIONS: 4-CHAMBER SEQUENCE

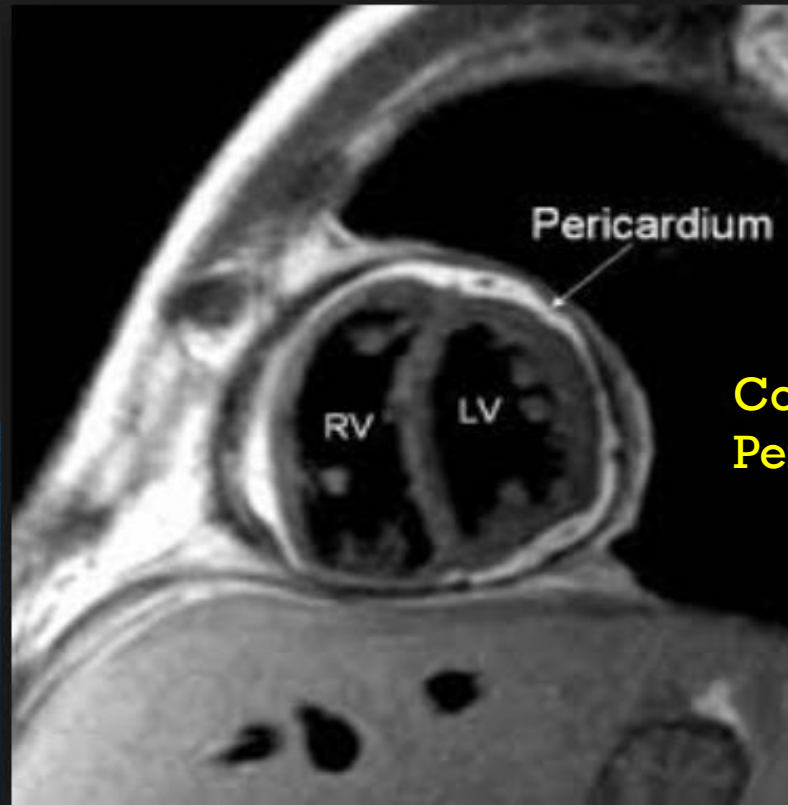


**Pericardial  
Effusion**

# CARDIAC MRI



Hemopericardium



Pericardium

Constrictive  
Pericarditis

# MANAGEMENT

- Oxygen supplementation
- Fluid resuscitation
- Bed rest with leg elevation
- Pericardiocentesis ( if pt is unstable)
- Pharmacotherapy: Aspirin/NSAIDs, Colchicine, Steroids, **Antibiotics**– Vancomycin 1g BD, Ceftriaxone 1-2g BD and Ciprofloxacin 400mg
- **Percutaneous balloon pericardiotomy**
- **Surgical creation of pericardial window**

# PERICARDIOCENTESIS

**SUBXIPHOID**

**PARASTERNAL**

**APICAL**

**APPROACH**



**ULTRASOUND**



**LANDMARKS**

Under the xiphoid process

3rd or 4th ICS to left of sternum  
Probe marker - patient's right shoulder

Probe marker - patient's left

## Management of recurrent cardiac tamponade or pericardial effusion

- **Pericardial sclerosis:**  
Tetracycline, doxycycline, cisplatin, 5-Fluorouracil
- **Pericardio-peritoneal shunt**
- **pericardiectomy**



# Pericardial Effusion

Recommendations	Class	Level
Admission is recommended for high-risk patients with pericardial Effusion <sup>a</sup> .	<b>I</b>	<b>C</b>
A triage of patients with pericardial effusion is recommended as in Figure 3.	<b>I</b>	<b>C</b>

<sup>a</sup>Similar risk criteria as for pericarditis.

Recommendations	Class	Level
It is recommended to target the therapy of pericardial effusion at the aetiology.	<b>I</b>	<b>C</b>
Aspirin/NSAIDs/colchicine and treatment of pericarditis is recommended when pericardial effusion is associated with systemic inflammation.	<b>I</b>	<b>C</b>
Pericardiocentesis, or cardiac surgery, is indicated for cardiac tamponade, or for symptomatic moderate to large pericardial effusions not responsive to medical therapy, and for suspicion of unknown bacterial or neoplastic aetiology.	<b>I</b>	<b>C</b>

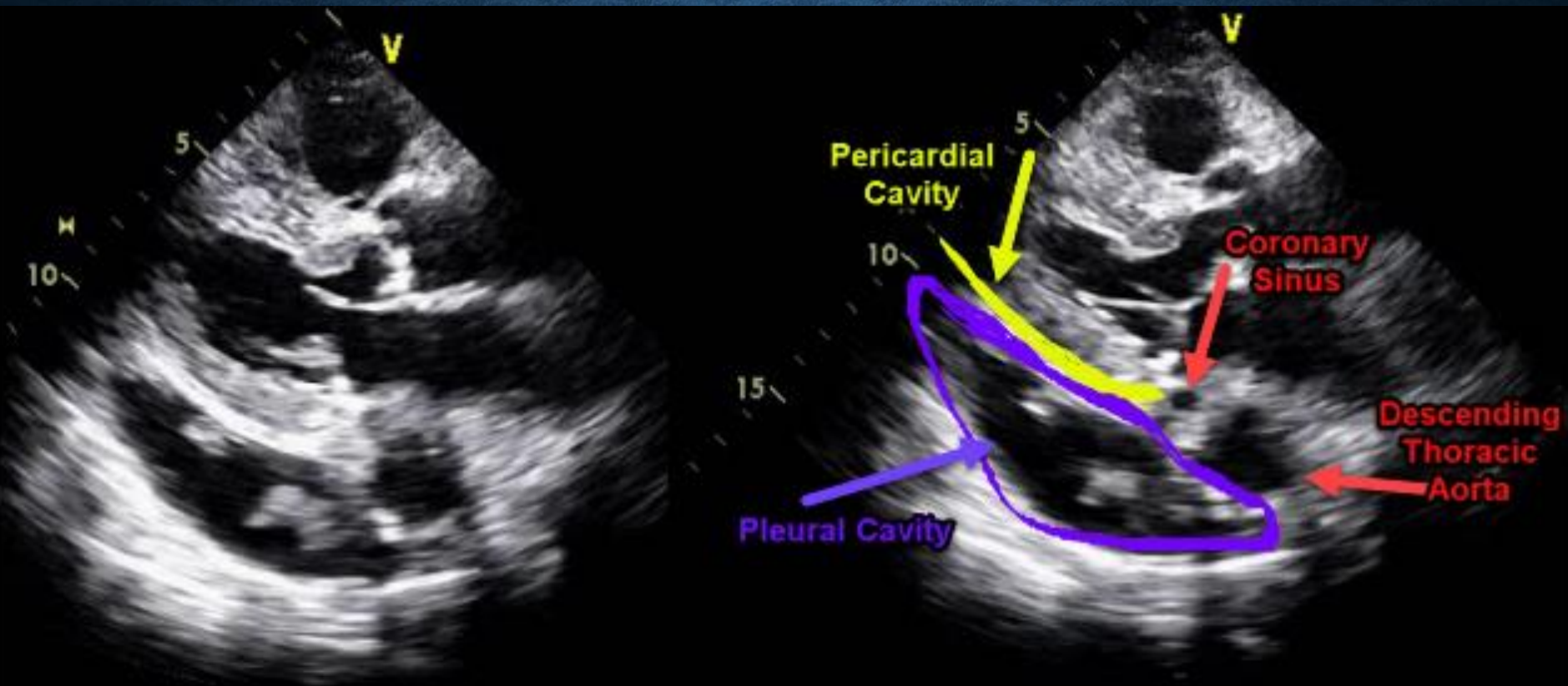
NSAIDs = non-steroid anti-inflammatory drugs.

# WHO NEEDS TAPPING ?

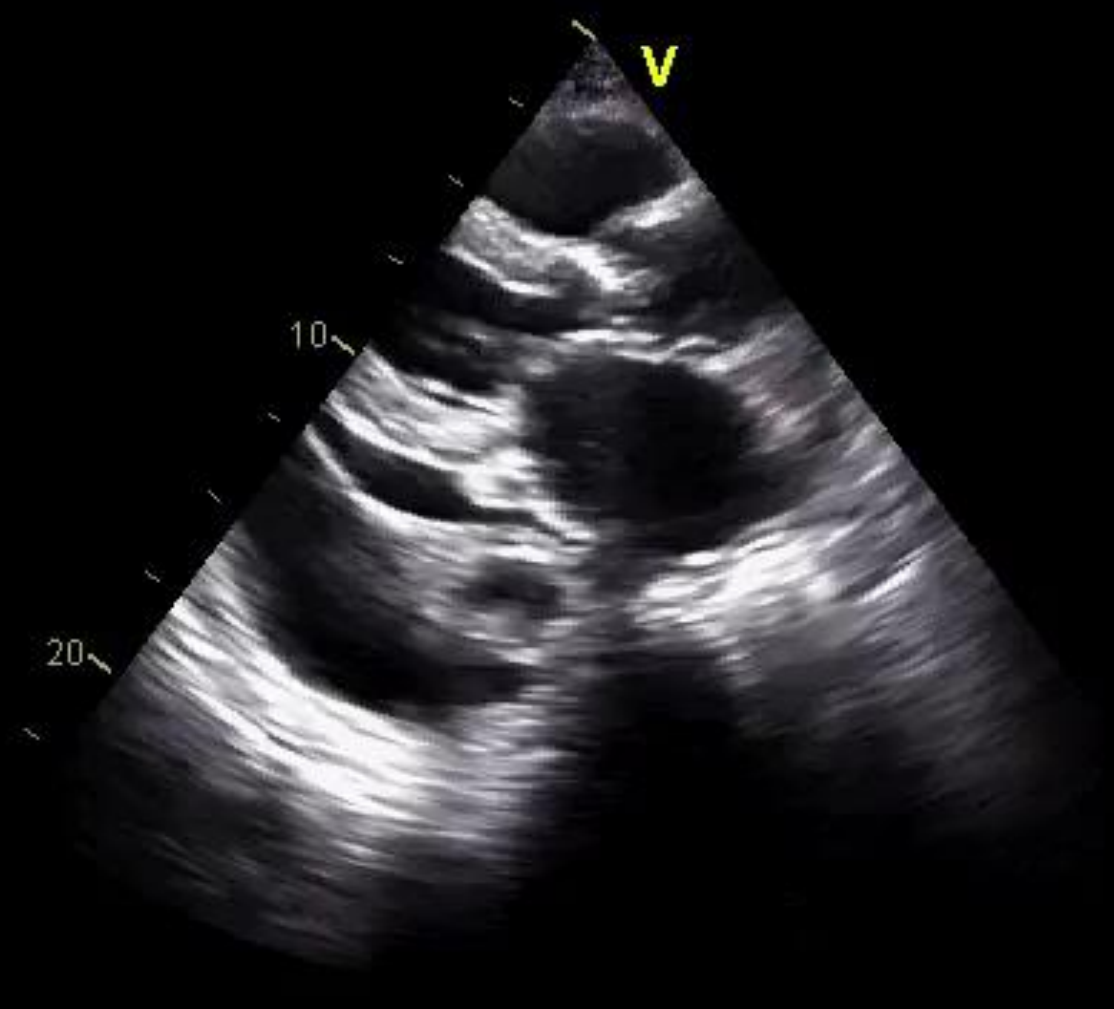


**- BOTH Needs Tapping ??**

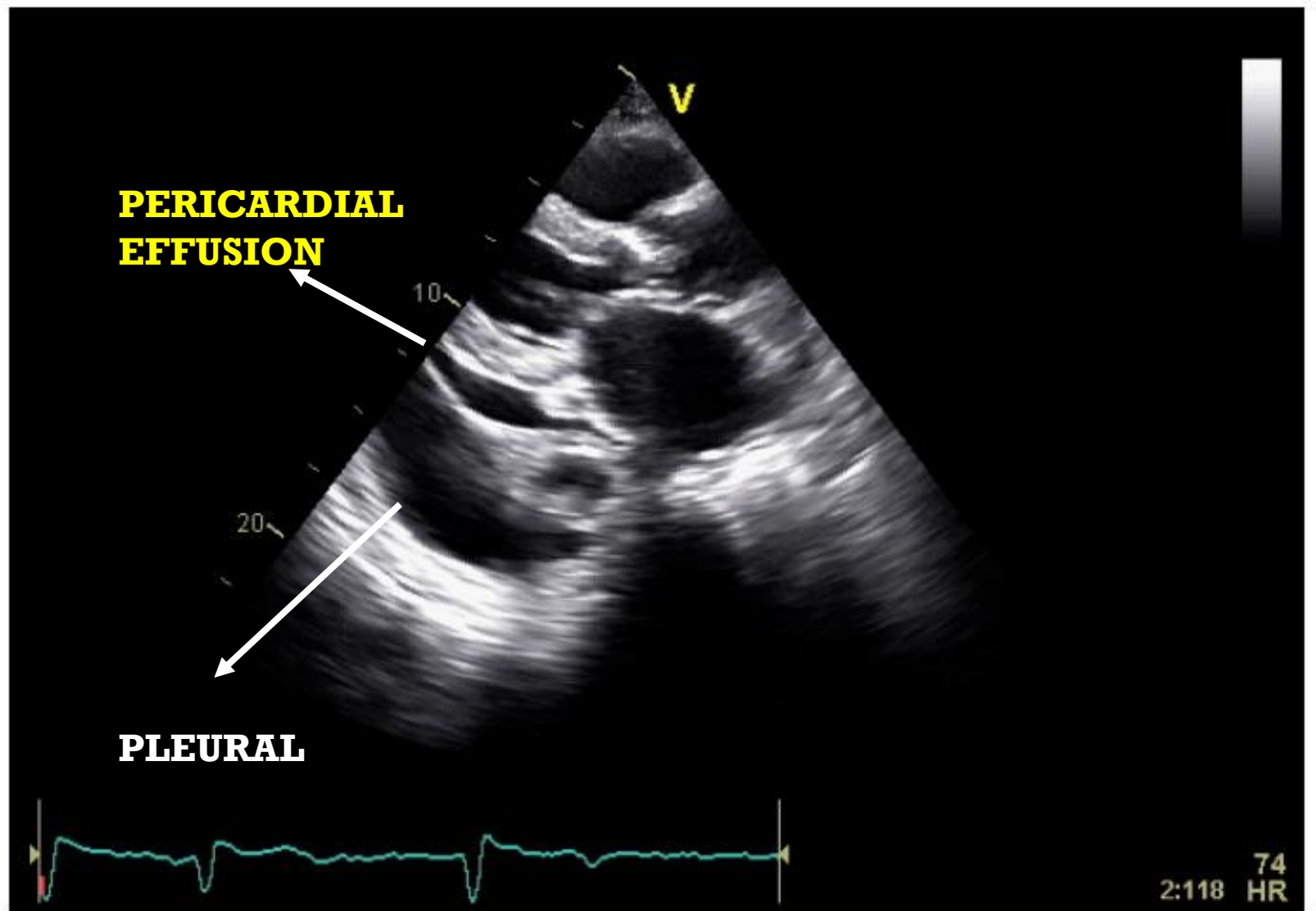
# PERICARDIAL vs PLEURAL EFFUSION



09:50:24

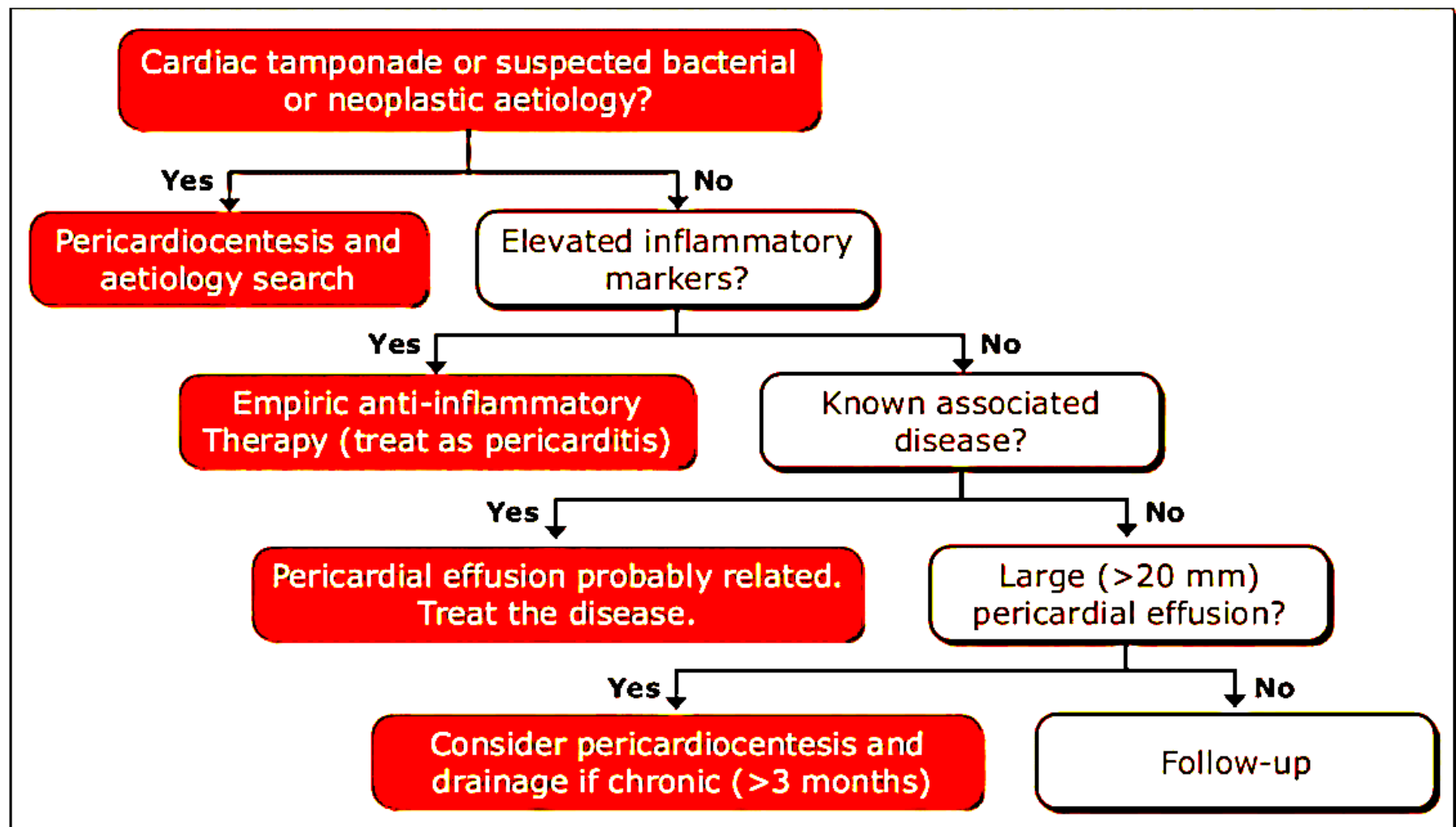


2:118 74 HR



2D transthoracic echocardiogram (TTE) from the parasternal long axis window showing both pericardial and pleural effusions. The pericardial stripe runs anterior to the descending thoracic aorta, allowing differentiation between pericardial fluid and the pleural effusion, which is seen posterior to the aorta.

# A simplified algorithm for pericardial effusion triage and management



- **POST-CARDIAC INJURY  
SYNDROMES  
( PCIS )**

## Post-cardiac injury syndromes

- **PCIS is an umbrella term indicating a group of inflammatory pericardial syndromes including post-myocardial infarction pericarditis, post-pericardiotomy syndrome (PPS), and post-traumatic pericarditis (either iatrogenic or not).**
- **Such syndromes are presumed to have an autoimmune pathogenesis triggered by an initial damage to pericardial and/or pleural tissues.**



## **Diagnostic criteria for post-cardiac injury syndrome (PCIS) including Post-Pericardiotomy Syndrome (PPS)**

1. Fever without alternative causes.
2. Pericarditic or pleuritic chest pain.
3. Pericardial or pleural rubs.
4. Evidence of pericardial effusion.
5. Pleural effusion with elevated CRP.

At least 2 of 5 criteria should be fulfilled.

Recommendations	Class	Level
Anti-inflammatory therapy is recommended in patients with PCIS to hasten symptoms remission and reduce recurrences.	<b>I</b>	<b>B</b>
Aspirin <sup>a</sup> is recommended as first choice for anti-inflammatory therapy of post-myocardial infarction pericarditis and those patients already on antiplatelet therapies.	<b>I</b>	<b>C</b>
Colchicine added to aspirin or NSAIDs should be considered for the therapy of PCIS, as in acute pericarditis.	<b>IIa</b>	<b>B</b>
Colchicine should be considered after cardiac surgery using weight-adjusted doses (i.e. 0.5 mg once for patients ≤70 Kg and 0.5 mg twice daily if patients are >70 kg) and without a loading dose for the prevention of PPS if there are no contraindications and it is tolerated. Preventive administration of colchicine is recommended for 1 month.	<b>IIa</b>	<b>A</b>
Careful follow-up after PCIS should be considered to exclude possible evolution towards constrictive pericarditis with echocardiography every 6-12 months according to clinical features and symptoms.	<b>IIa</b>	<b>C</b>

NSAIDs = non-steroidal anti-inflammatory drugs; PCIS = post-cardiac injury syndromes; PPS = post-pericardiotomy syndrome.

<sup>a</sup>Antiplatelet effects of aspirin have been demonstrated up to doses of 1.5 g/day. There are no data for or against the use of higher doses in this setting.

# Neoplastic Disease

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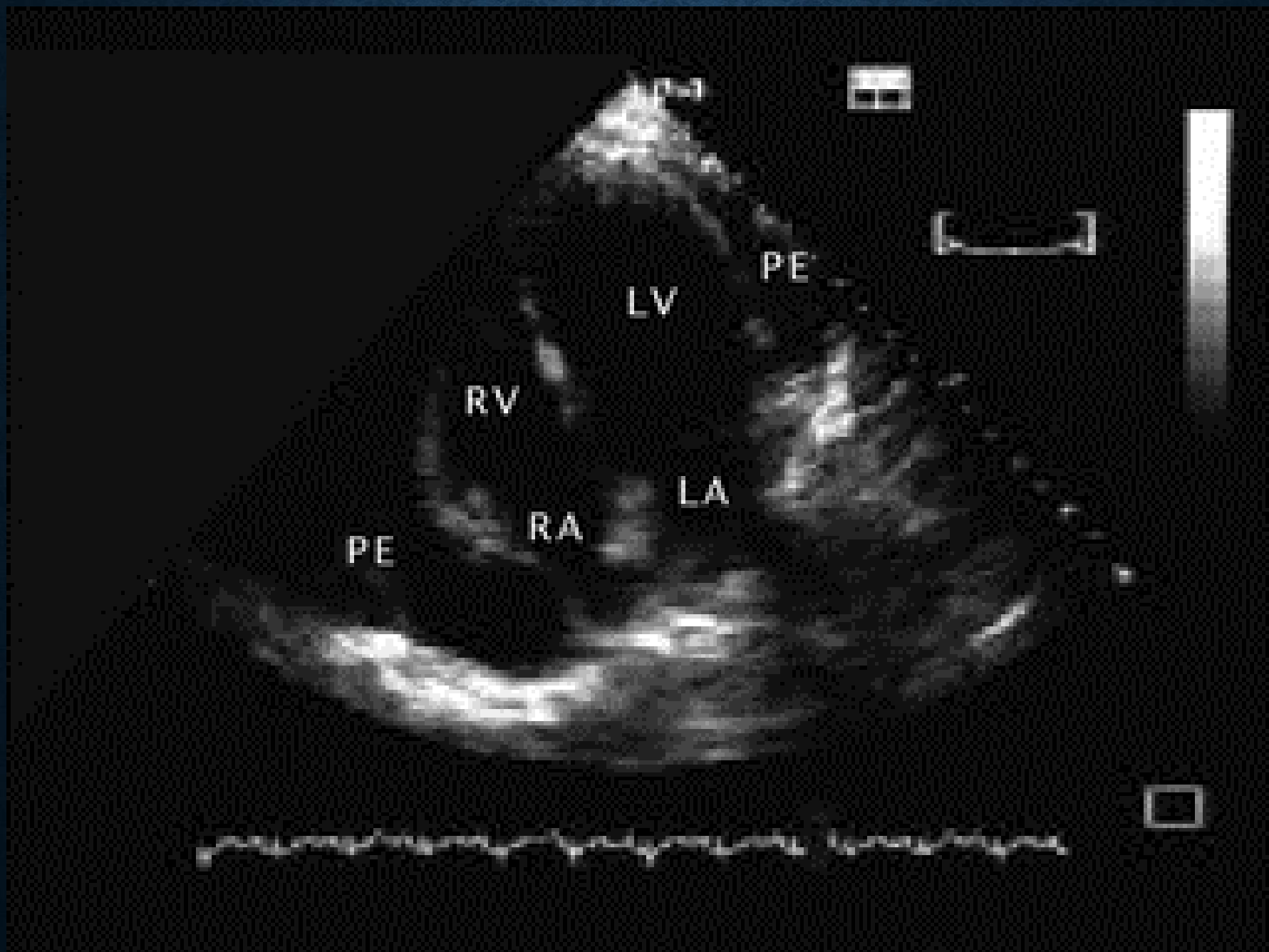
- **The definite diagnosis is based on the confirmation of the malignant infiltration within pericardial fluid (cytology) or tissue (biopsy).**
- **Primary tumours of the pericardium, either benign (lipomas and fibromas) or malignant (mesotheliomas, angiosarcomas, fibrosarcomas) are very rare.**
- **Mesothelioma, the most common malignant tumour, is almost always incurable.**
- **The most common secondary malignant tumours are lung cancer, breast cancer, malignant melanoma, lymphomas, and leukemias.**

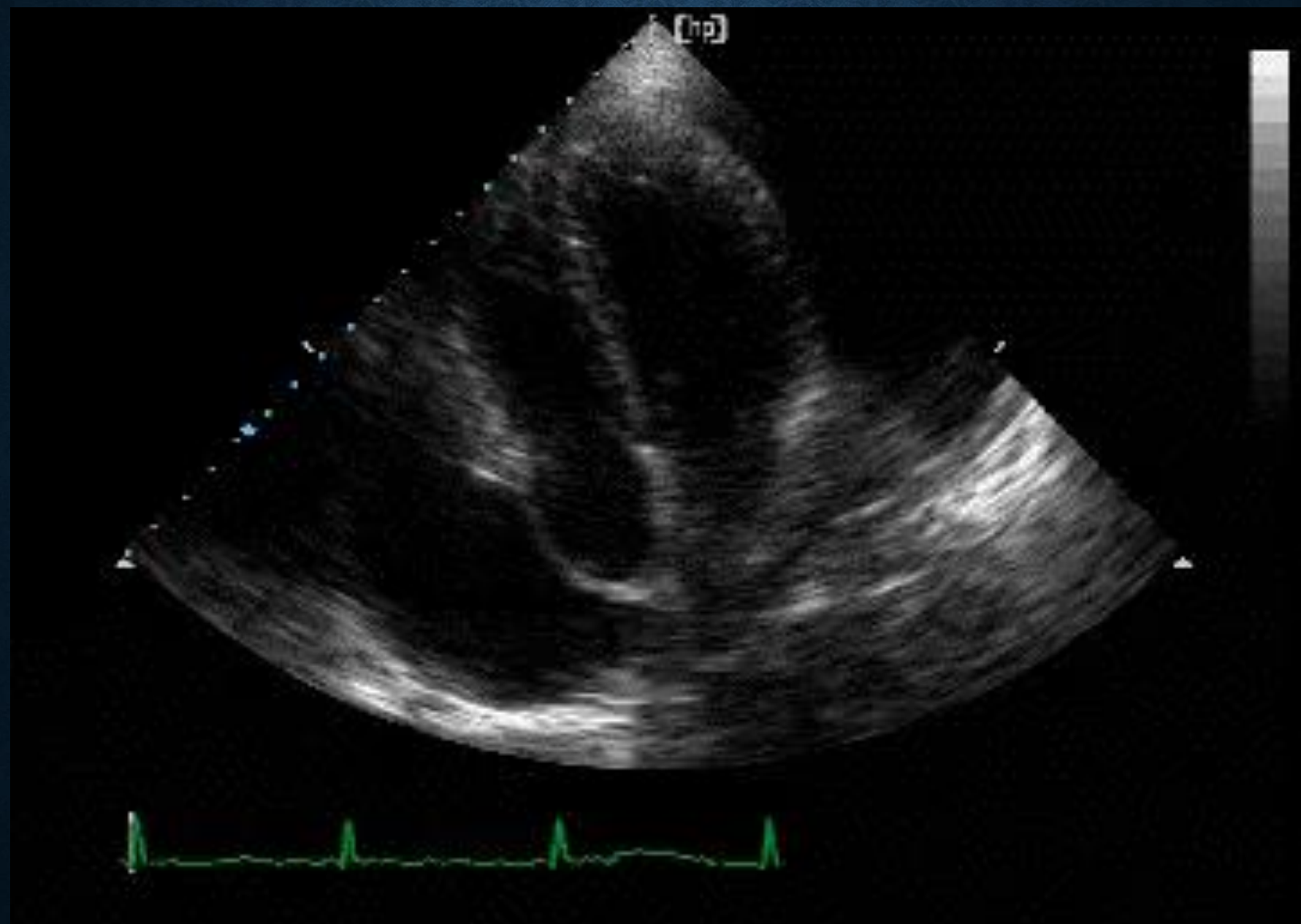
## Pericardial involvement in neoplastic disease (1)

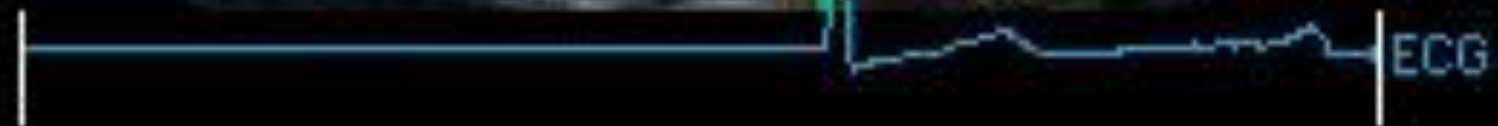
Recommendations	Class	Level
Pericardiocentesis is recommended for cardiac tamponade to relieve symptoms and establish the diagnosis of malignant pericardial effusion.	<b>I</b>	<b>B</b>
Cytological analyses of pericardial fluid are recommended for the confirmation of malignant pericardial disease.	<b>I</b>	<b>B</b>
Pericardial or epicardial biopsy should be considered for the confirmation of malignant pericardial disease.	<b>IIa</b>	<b>B</b>
Tumor marker testing should be considered for distinguishing malignant from benign effusions in pericardial fluid.	<b>IIa</b>	<b>B</b>
Systemic antineoplastic treatment is recommended in confirmed cases of neoplastic aetiology.	<b>I</b>	<b>B</b>
Extended pericardial drainage is recommended in patients with suspected or definite neoplastic pericardial effusion in order to prevent effusion recurrence and provide a way for intrapericardial therapy.	<b>I</b>	<b>B</b>

## Pericardial involvement in neoplastic disease (2)

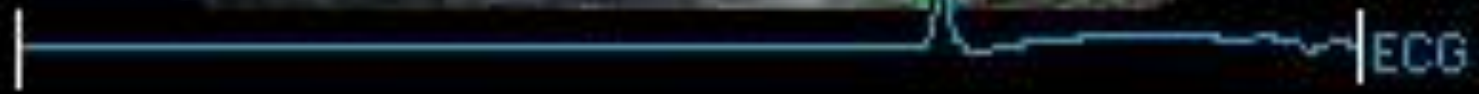
Recommendations	Class	Level
Intrapericardial instillation of cytostatic/sclerosing agents should be considered since it may prevent recurrences in patients with malignant pericardial effusion.	<b>IIa</b>	<b>B</b>
Radiation therapy should be considered to control malignant pericardial effusion in patients with radiosensitive tumours such as lymphomas and leukaemias.	<b>IIa</b>	<b>B</b>
Pericardiotomy should be considered when pericardiocentesis cannot be performed.	<b>IIa</b>	<b>B</b>
Percutaneous balloon pericardiotomy may be considered for the prevention of recurrences of neoplastic pericardial effusions.	<b>IIa</b>	<b>B</b>
Pericardial window creation via left minithoracotomy may be considered in surgical treatment of malignant cardiac tamponade.	<b>IIb</b>	<b>B</b>
Interventional techniques should consider the potentiality of seeding of neoplastic cells, patient prognosis, and the overall quality of life of the patients.	<b>IIa</b>	<b>C</b>







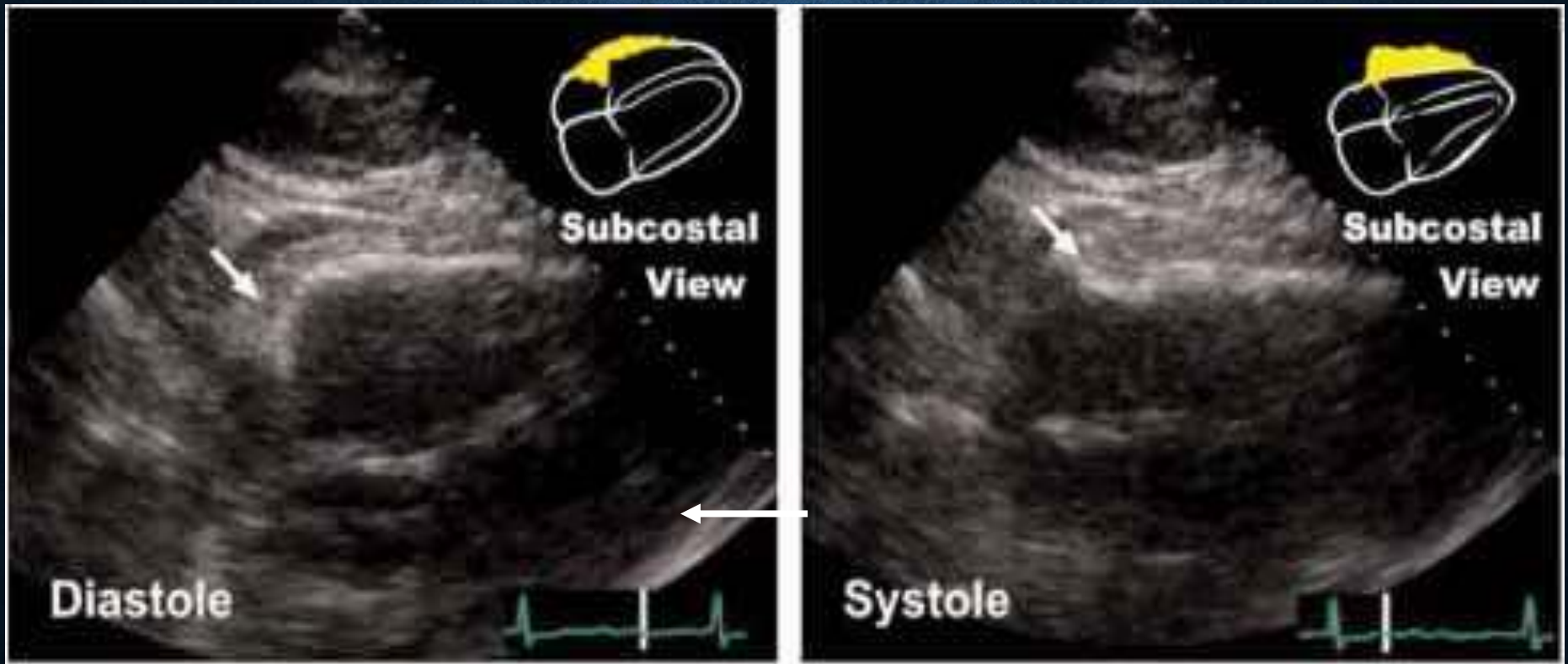




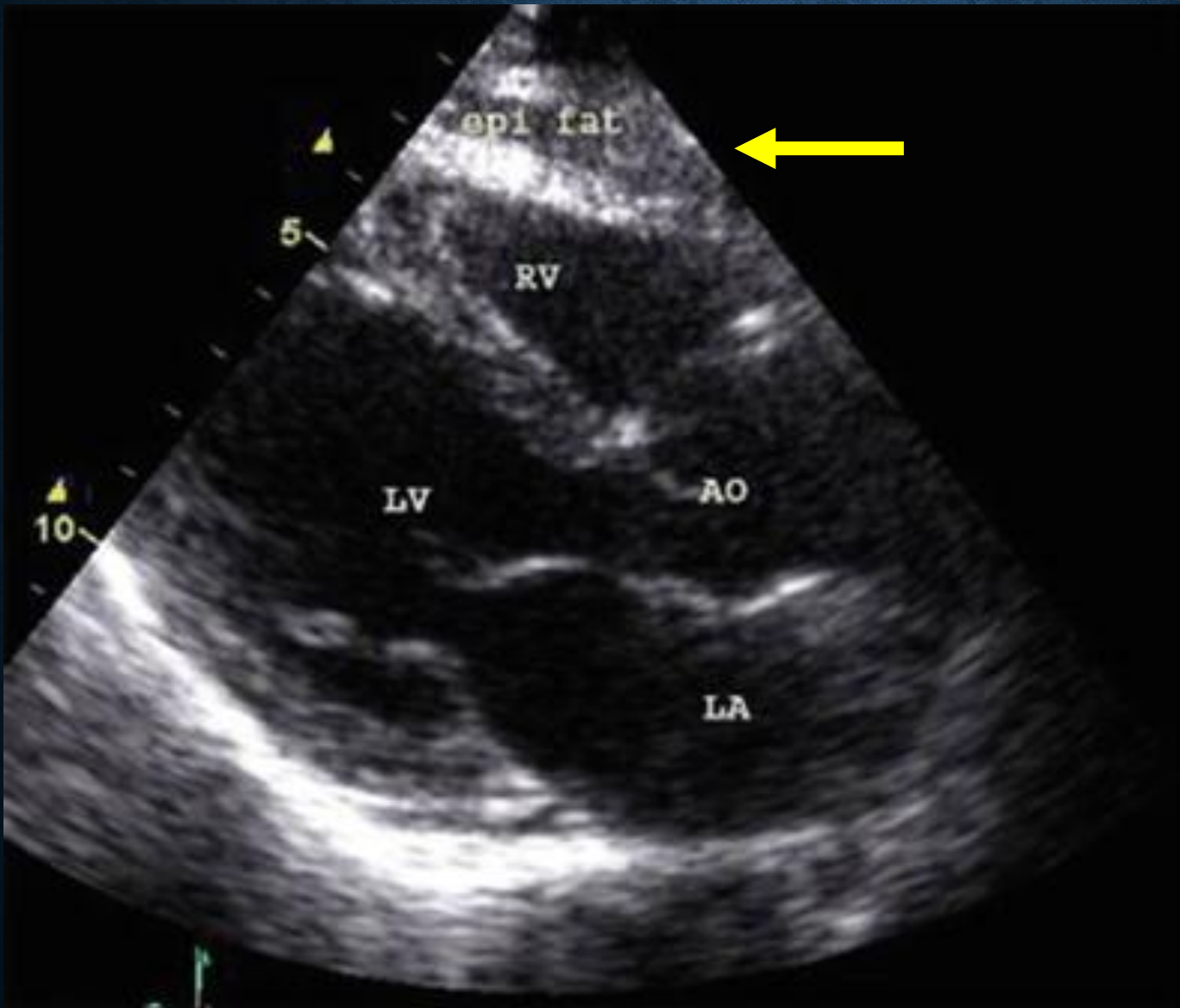
# PERICARDIAL FAT

- Pericardial Fat - commonly seen on 2D Echo
- Accumulation most common in interventricular and AV grooves and RV free wall
- Normal but highly variable finding
- Commonly seen anterior to heart in parasternal long axis and subcostal views
- The best clues as FAT --- its absence posteriorly, Normal motion of pericardium, and low intensity echoes (often seen as faint linear striations) within the pericardial space

# PERICARDIAL FAT PAD

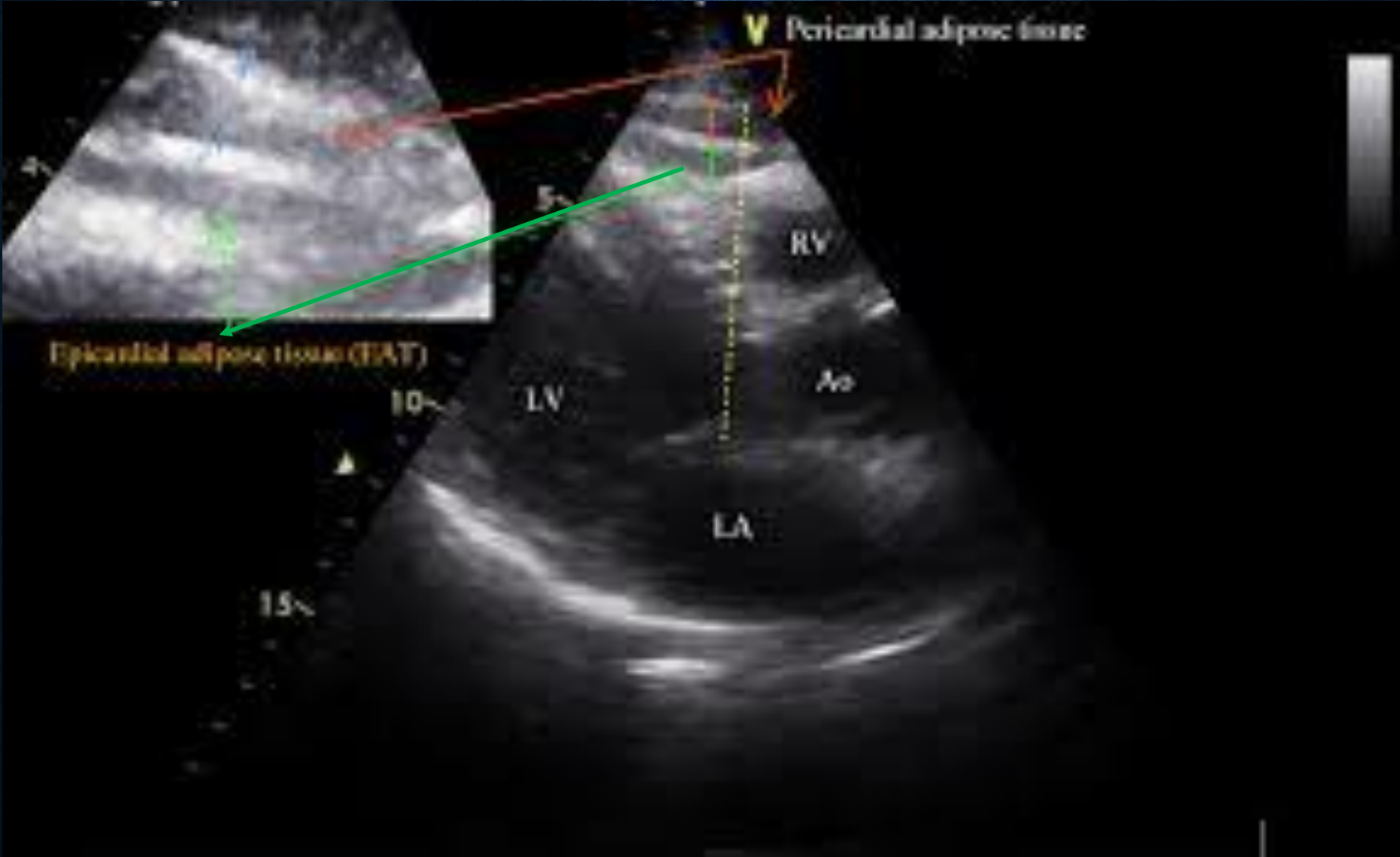


# EPICARDIAL FAT PAD



**Parasternal  
LAX  
view**

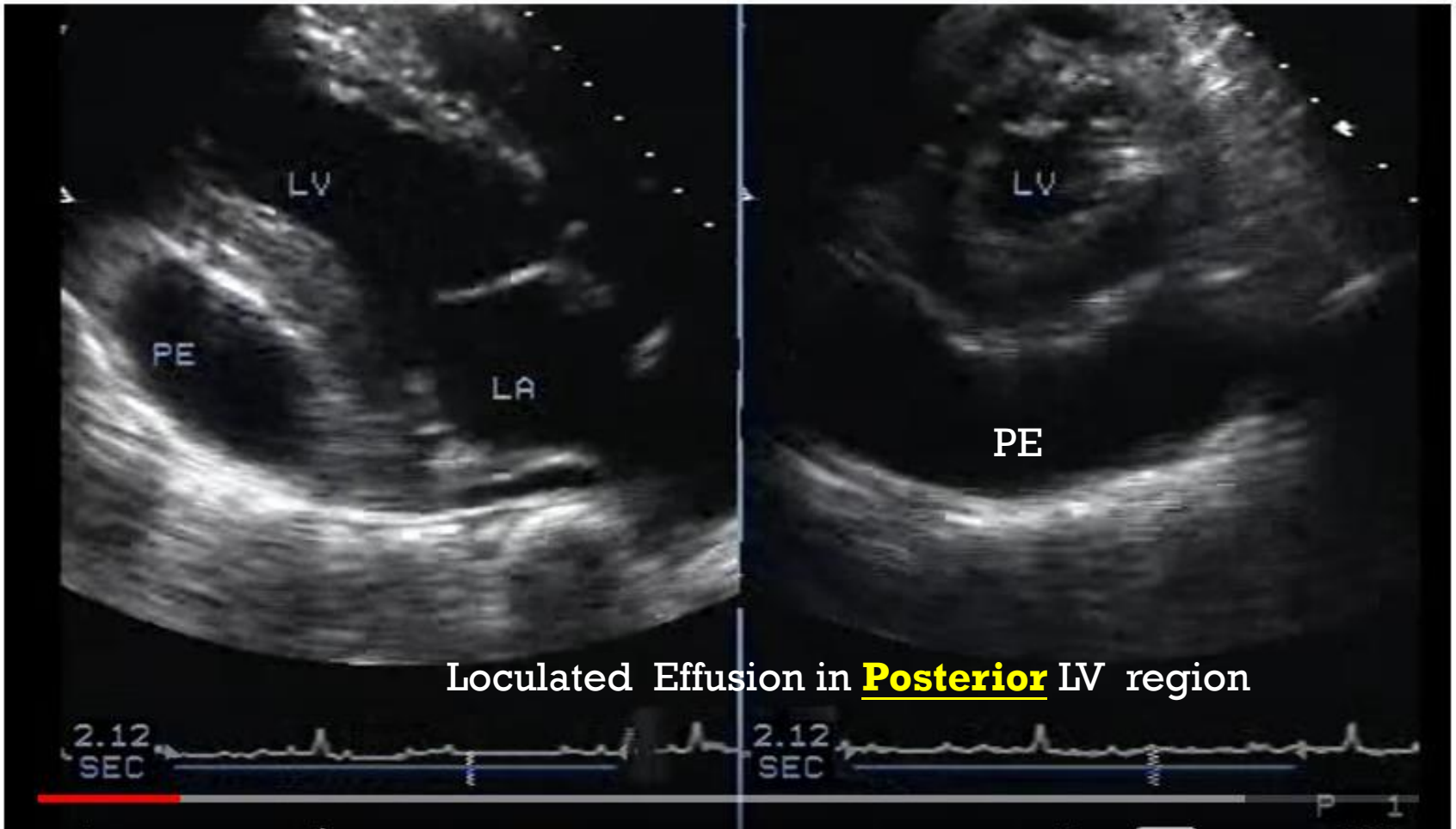
# EPICARDIAL AND PERICARDIAL FAT



# LOCULATED EFFUSION AND OTHER POST OPERATIVE SEQUELAE

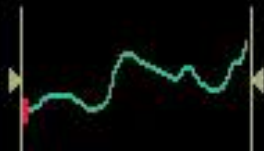
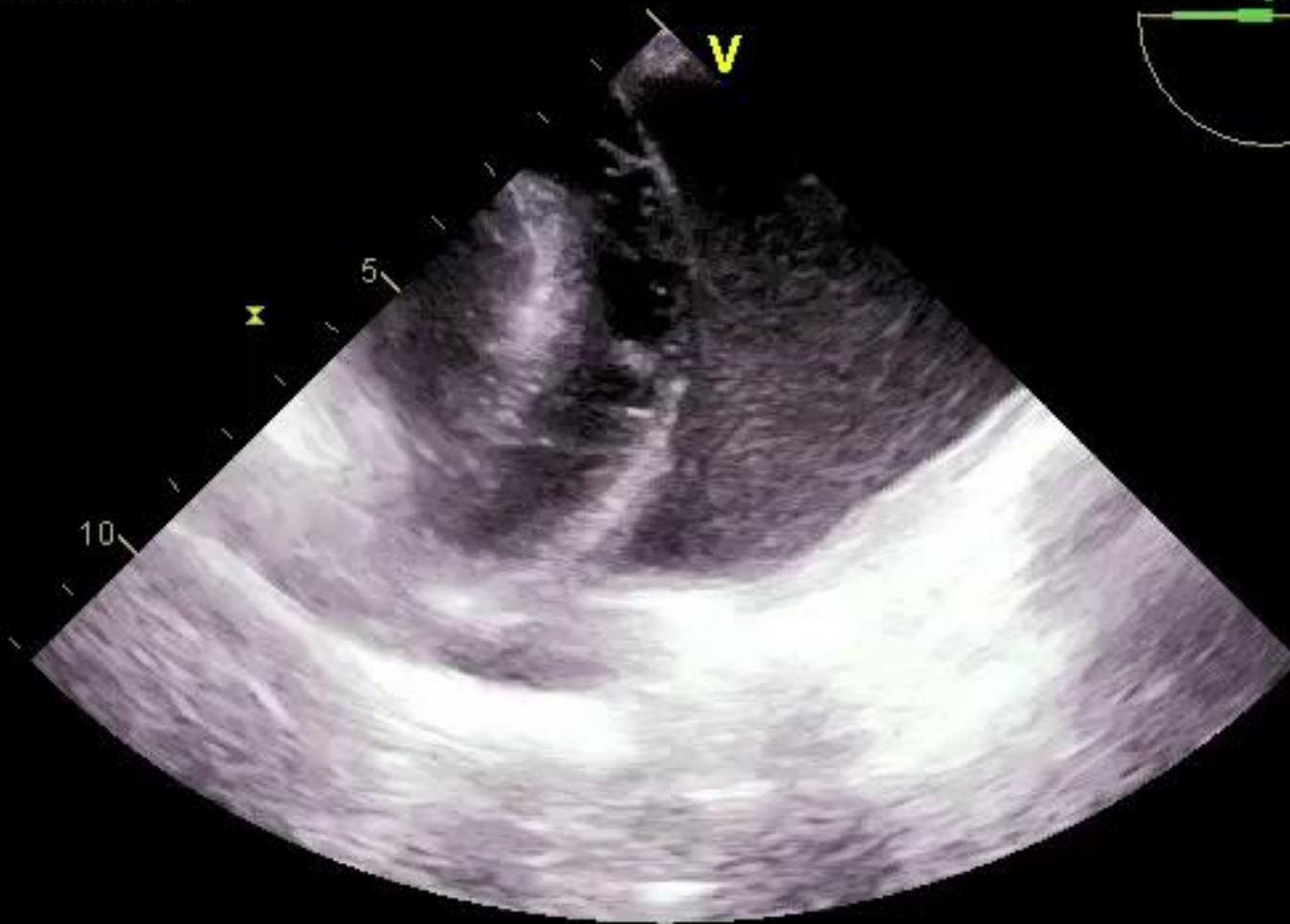
- Pericardial fluid ceases to be circumferential and free flowing and becomes loculated or compartmentalized as a result of some diseases- most commonly post - cardiac surgery or pericardial hemorrhage
- Pericardial stranding, suggestive of fibrous material within the pericardial effusion, is easily seen on echo imaging, often a precursor to loculation of effusion

# LOCULATED PERICARDIAL EFFUSION



# PERICARDIAL STRANDS

07/01/2013 02:38:27 PM



93  
2:61 HR

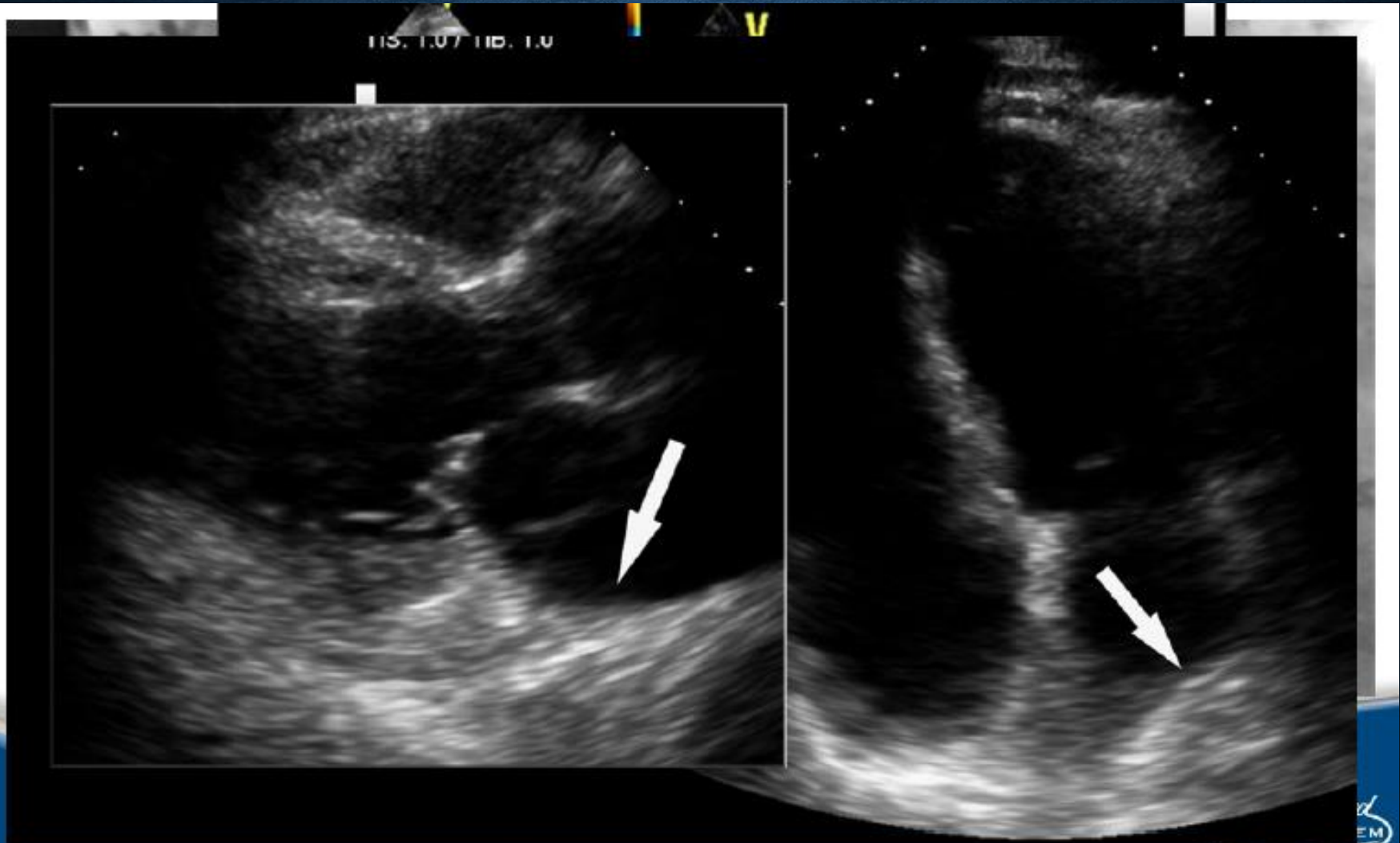


# DRY TAMPONADE

## Tamponade Physiology without Free Fluid in the Pericardium

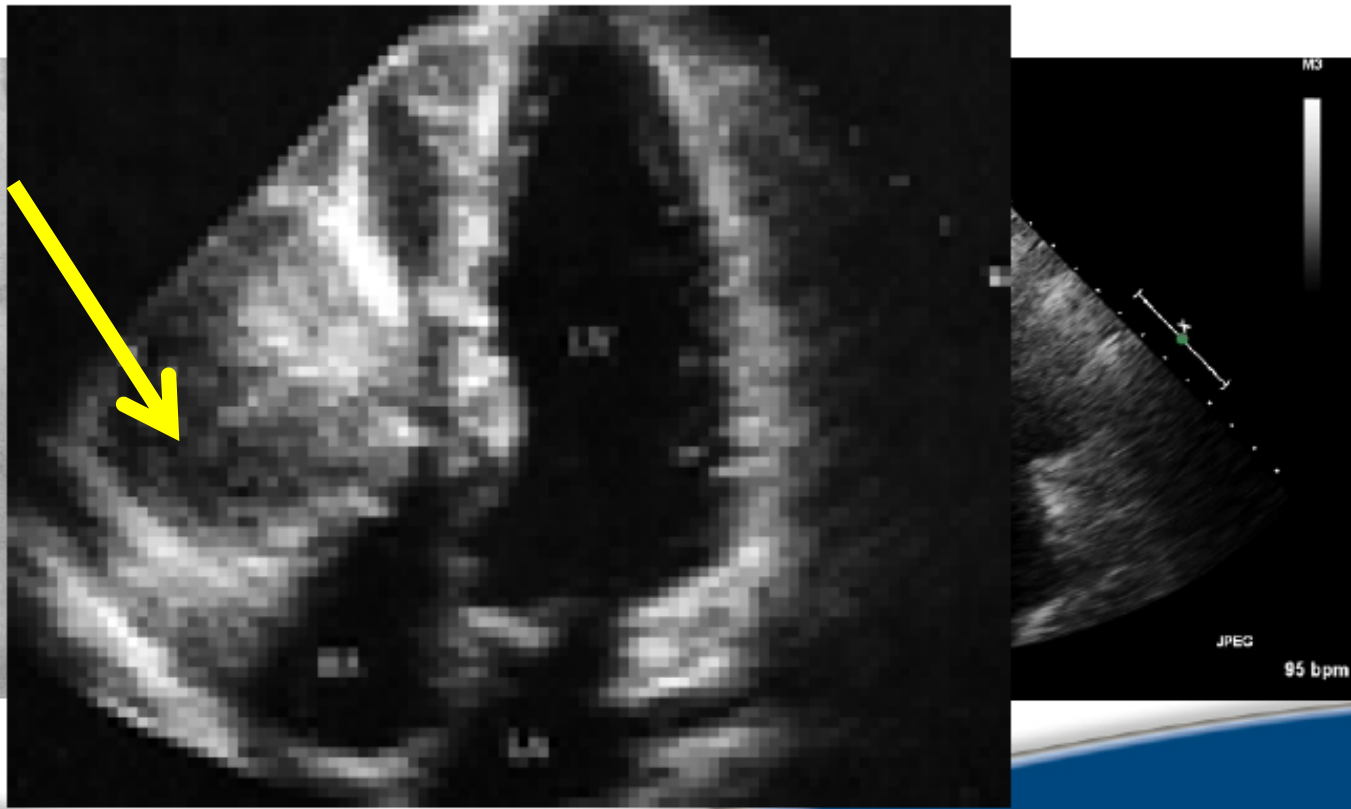
- § Compressing Hematoma
- § Myocardial wall hematoma
- § Dissecting intramyocardial Hematoma

# POST CTO PCI – CVS COLLAPSE COMPRESSIVE LA HEMATOMA MX- PERICARDIAL DRAINAGE

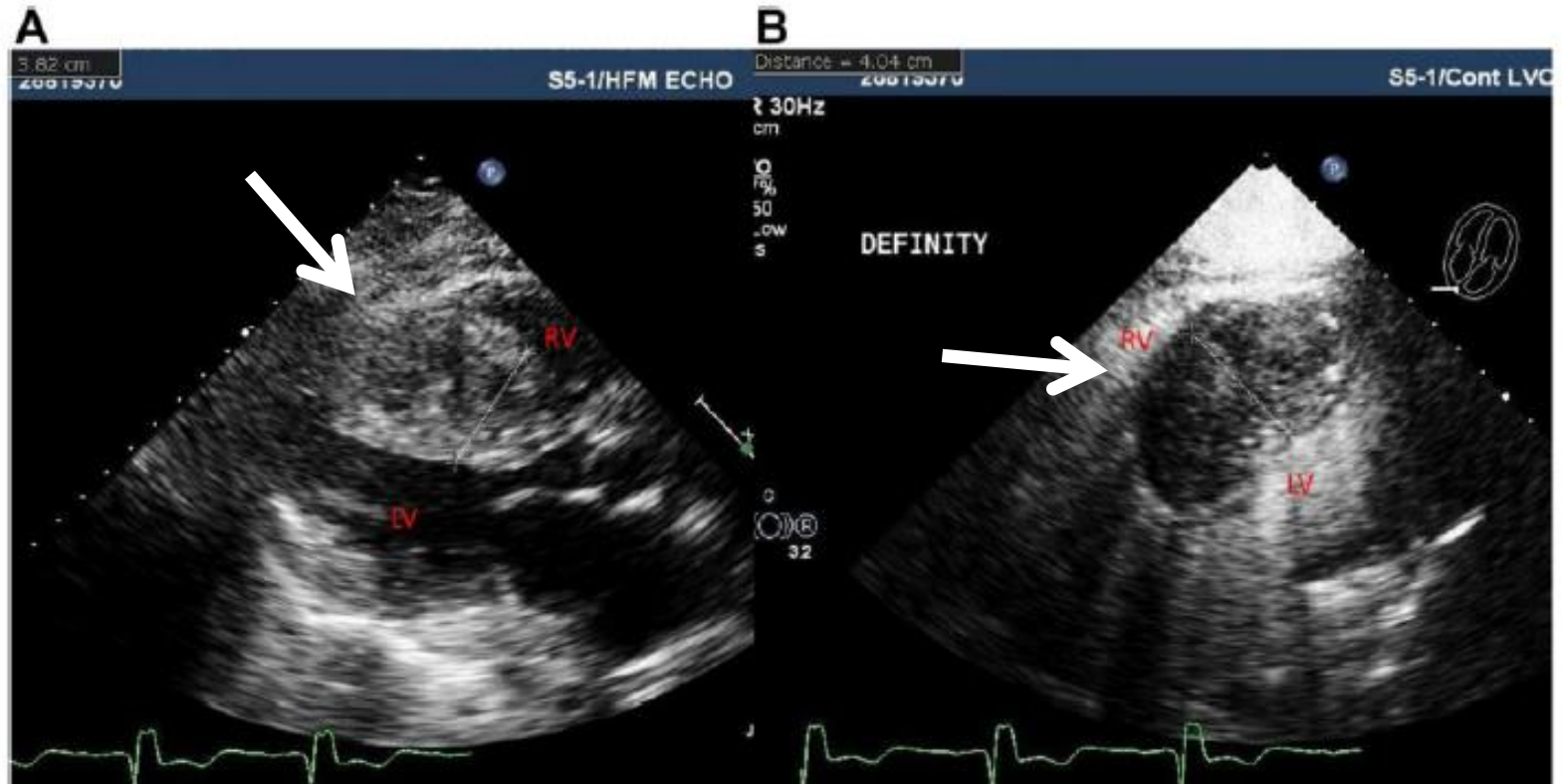


Cardiovascular collapse post chronic total occlusion percutaneous coronary intervention due to a compressive left atrial hematoma managed with percutaneous drainage.  
Volume: 86, Issue: 3, Pages: 407-411, First published: 07 June 2014, DOI: (10.1002/ccd.25571)

# RV Wall Hematoma



# Septal Hematoma



Tiberio M. Frisoli et al. JGIN 2017;10:e91-e92

- **Idiopathic Chronic  
Pericardial Effusion**

# Outcomes of idiopathic chronic large pericardial effusion

Massimo Imazio<sup>1</sup>, George Lazaros<sup>2</sup>, Anna Valenti<sup>3</sup>, Caterina Chiara De Carlini<sup>4</sup>, Stefano Maggiolini<sup>4</sup>, Emanuele Pivetta<sup>5</sup>, Carla Giustetto<sup>1</sup>, Dimitris Tousoulis<sup>2</sup>, Yehuda Adler<sup>6</sup>, Mauro Rinaldi<sup>1</sup>, Antonio Brucato<sup>3,7</sup>

Author affiliations

## Abstract

**Objective** Aim of this paper is to evaluate the outcomes of 'idiopathic' chronic large pericardial effusions without initial evidence of pericarditis.

**Course is usually benign  
Regression in 49% cases  
Cardiac tamponade rate =  
2.2%/ year**

was better in patients treated without interventions (log rank  $p=0.0036$ ).

**Conclusions** The evolution of 'idiopathic' chronic large pericardial effusions is usually benign with reduction of the size of the effusion in the majority of cases, and regression in about 40% of cases. The risk of cardiac tamponade is 2.2%/year and recurrence/complications survival was better in patients treated conservatively without interventions.

• **Thank you very much**







