

## Lecture 3: pericarditis

### Intro:

- Healthy individuals have 15-50 ml of ultrafiltrate of plasma in the pericardial cavity
- pericardium attached to visceral layer
- the heart is attached to:
  - ① phrenopericardial ligament
  - ② Superior Sternopericardial ligament
  - ③ inferiosternopericardial ligament
  - ④ vertebrapericardial ligament

### Acute pericarditis

- General characteristics: it's inflammation of the pericardial sac, myopericarditis or perimyocarditis is used for cases of acute pericarditis

- Causes:
  - ① Idiopathic → mostly post-viral and usually preceded by flu like symptoms or VRTI
  - ② viral: MC: **Coxsackievirus**, echovirus, influenza, HIV, EBV
  - ③ Bacterial: TB
  - ④ Fungal
  - ⑤ post MI: Depends on the time line → (1-4 days: peri-infarction pericarditis / weeks to month → Dressler syndrome)
  - ⑥ post-operative or trauma
  - ⑦ Uremia (Dialysis is not taken for a while)
  - ⑧ Radiation (mostly with obstructive type)
  - ⑨ vascular diseases
  - ⑩ Neoplasm (Hodgkin especially)
  - ⑪ Drug-induced lupus syndrome (Hydralazine or procainamide)

- Clinical features:
  - ① MC: Chest pain (pericardial, mostly retrosternal or on left region, relieved by leaning forward and exacerbated by lying flat, radiates to trapezius)

\* Extra note: absent pain in rheumatoid pericarditis

- ② Fever may be present
- ③ preceding viral symptoms such as non-productive cough
- ④ Friction rub (expiration)

- Diagnosis:
  - ① ECG: ST elevation or PR depression (smiley ST) → it goes into 4 stages
    - ① Stage 1: ST elevation as concave up (AVR and V1 go into depression not elevation)
    - ② Stage 2: in first week ECG back to normal
    - ③ T inversion
    - ④ normal ECG or T wave inversion (chronic pericarditis)
  - ② CXR: non specific, enlarged silhouette
  - ③ ECHO: non specific and normal unless there's pericardial effusion
  - ④ LABS: increased troponin or CKMB (only if myopericarditis), ask for WBC, ESR, CRP

- Treatment:
  - ① Most are self limited and resolve in 2-6 weeks
  - ② treat underlying cause
  - ③ NSAIDs for 1-2 weeks with preferred colchicine for 3 months
  - ④ if step 3 didn't work use Glucocorticoids

§ Use it in: CT disease / uremic / contraindication of NSAID / step 3 not working (but we don't like it bc it's associated with recurrent pericarditis)

\* Note: if associated with post MI pericarditis: Use aspirin (+)

Colchicine:

\* what if we have recurrent pericarditis? happens in 30% of patients, same tx but double the duration (NSAID from 2-4 weeks and colchicine for 6 months) (+) Anti-IL1 (anakinra and rilonacept)

(+) Steroids (+) MTX (+) Azathioprine (+) IV immunoglobulin (+) mycophenolate mofetil

<b>Etiopathetic</b>
In most cases, the majority of patients do not have an identifiable cause of pericardial disease. Frequently, such cases are presumed to have a viral or autoimmune etiology.
<b>Infections</b>
A. Viral - <b>Coxsackievirus</b> , echovirus, adenovirus, EBV, CMV, influenza, varicella, rubella, HIV, hepatitis B, mumps, parvovirus B19, varicella (herpes zoster)
B. Bacterial - <i>Staphylococcus</i> , <i>Streptococcus</i> , <i>Gram-negative</i> , <i>Haemophilus</i> , <i>Neisseria</i> (pneumonia or meningitis), <i>Chlamydia</i> (endocarditis or trachoma), <i>Legionella</i> , <i>Yersinia</i> , <i>Coccidioides</i> , <i>Coccidioides</i> , <i>Coccidioides</i>
C. Fungal - <i>Histoplasma</i> , <i>Aspergillus</i> , <i>Coccidioides</i> , <i>Coccidioides</i> , <i>Coccidioides</i> , <i>Coccidioides</i> , <i>Coccidioides</i>
D. Parasitic - <i>Echinococcus</i> , <i>Amoebae</i> , <i>Toxoplasma</i>
E. Parasitic - <i>Echinococcus</i> , <i>Amoebae</i> , <i>Toxoplasma</i>
F. Infective endocarditis with valve ring abscess
<b>Radiation</b>
<b>Neoplasms</b>
A. Metastatic - Lung or breast cancer, Hodgkin's disease, leukemia, melanoma
B. Primary - <i>Rhabdomyosarcoma</i> , <i>Teratoma</i> , <i>Fibroma</i> , <i>Sarcoma</i> , <i>Spindle</i> , <i>Leiomyoma</i> , <i>Angioma</i>
C. Paraneoplastic
<b>Cardiac</b>
A. Early infarction pericarditis
B. Late infarction pericarditis (Dressler's syndrome), also seen in other settings (eg, post-myocardial infarction and post-cardiac surgery)
C. Myocarditis
D. Dissecting aortic aneurysm
<b>Trauma</b>
A. Blunt
B. Penetrating
C. Iatrogenic - Catheter and pacemaker perforations, cardiopulmonary resuscitation, post-thoracic surgery
<b>Autoimmune</b>
A. Rheumatic disease - Including lupus, rheumatoid arthritis, vasculitis, scleroderma, mixed connective tissue disease
B. Other - Wegener's granulomatosis, polyarteritis nodosa, sarcoidosis, inflammatory bowel disease (Crohn's, ulcerative colitis), Whipple's, giant cell arthritis, Behçet's disease, Churg-Strauss
<b>Drugs</b>
A. Procainamide, hydralazine, or trimethoprim as part of drug-induced lupus
B. Other - <i>Cromolyn</i> sodium, <i>dantrolene</i> , <i>methimazole</i> , <i>methimazole</i> , <i>anticoagulants</i> , <i>thrombolytics</i> , <i>phenytoin</i> , <i>penicillin</i> , <i>phenylbutazone</i> , <i>disulfiram</i>
<b>Metabolic</b>
A. Hyperuricemia - Primarily pericardial effusion
B. Uremia
C. Ovarian hyperstimulation syndrome

#### Diagnostic criteria for acute pericarditis and myopericarditis in the clinical setting

##### Acute pericarditis (at least 2 criteria of 4 should be present)\*:

1. Typical chest pain
2. Pericardial friction rub
3. Suggestive ECG changes (typically widespread ST segment elevation)
4. New or worsening pericardial effusion

##### Myopericarditis:

1. Definite diagnosis of acute pericarditis, PLUS
2. Suggestive symptoms (dyspnea, palpitations, or chest pain) and ECG abnormalities beyond normal variants, not documented previously (ST/T abnormalities, hyperbolic or ventricular tachycardia or frequent ectopy, atrioventricular block), OR focal or diffuse depressed LV function of uncertain age by an imaging study, OR
3. Absence of evidence of any other cause
4. One of the following features: evidence of elevated cardiac enzymes (creatinine kinase-MB fraction, or troponin I or T), OR new onset of focal or diffuse depressed LV function by an imaging study, OR abnormal imaging consistent with myocarditis (MRI with gadolinium, gallium-67 scanning, anti-myosin antibody scanning)

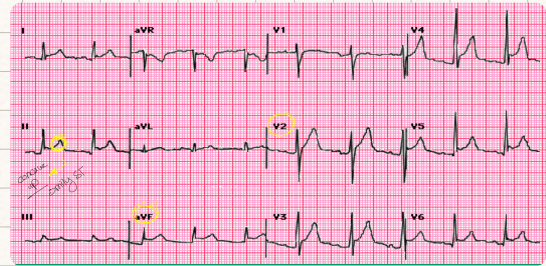
##### Case definitions for myopericarditis include:

- Suspected myopericarditis:** criteria 1 plus 2 and 3
- Probable myopericarditis:** criteria 1, 2, 3, and 4
- Confirmed myopericarditis:** histopathologic evidence of myocarditis by endomyocardial biopsy or on autopsy

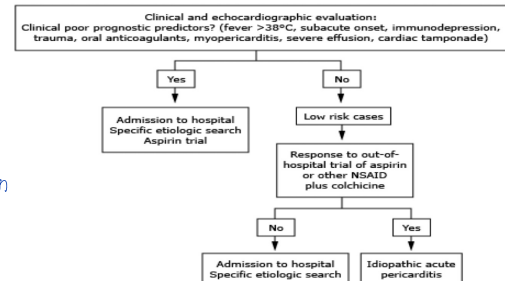
\* Pericardial effusion confirms the clinical diagnosis but its absence does not exclude it.  
† In clinical practice a confirmed diagnosis would require an endomyocardial biopsy that is not warranted in self-limited cases with predominant pericarditis.

### Drug therapy in acute pericarditis

Drug	Dose	Duration of therapy	Tapering
<b>For initial combination treatment of most patients:</b>			
Ibuprofen	400 to 800 mg three times daily	1 to 2 weeks	Decrease the dose weekly
<b>OR</b>			
Indomethacin	50 mg three times daily	1 to 2 weeks	Decrease the dose weekly
<b>PLUS</b>			
Colchicine	0.5 mg two times daily	3 months	Usually not tapered
<b>For initial combination therapy of patients following myocardial infarction:</b>			
Aspirin	81 to 100 mg three times daily	1 to 2 weeks	Decrease the dose weekly
<b>PLUS</b>			
Colchicine	0.5 mg two times daily	3 months	Usually not tapered
<b>For refractory cases or patients with a contraindication to NSAID therapy:</b>			
Prednisone	0.2 to 0.5 mg/kg/day	2 weeks	Slow tapering, see text
<b>PLUS</b>			
Colchicine	0.5 mg two times daily	3 months	Usually not performed



### Initial clinical and echocardiographic evaluation of patients with suspected acute pericarditis



- High risk features for hospital admission:
  - ① Fever > 38
  - ② Subacute onset
  - ③ Large pericardial effusion or tamponade
  - ④ Lack of response to anti-inflammatory therapy after 1 week of treatment
  - ⑤ Myocardial involvement
  - ⑥ immunosuppression
  - ⑦ trauma

### Constrictive pericarditis

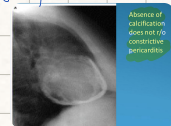
- pathogenesis: Fibrous pericardium → Restrictive rt ventricular filling + restricted CO (note that ventricular filling is ceased at the end (late diastole))

- Causes:
  - ① pericarditis (prolonged)
  - ② Radiation
  - ③ post surgery
  - ④ CT diseases
  - ⑤ Viral infection
  - ⑥ TB

- Clinical features:
  - ① Related to fluid overload: Edema / ascitis / plural effusion
  - ② Related to decreased CO: SOB / Fatigue

- Signs:
  - ① most prominent: JVP distention
  - ② Kussmaul sign (absent V)
  - ③ pulsus paradoxus (decrease in systolic pressure > 10 mmHg in inspiration)
  - ④ Hepatomegaly
  - ⑤ pericardial knock (due to sudden cessation of ventricular filling) → Early diastolic sign
  - ⑥ Edema

- Dx:
  - ① ECG: low QRS voltage, Afib in 20% of patients
  - ② CXR: thickening of pericardium and calcification
  - ③ ECO: thickening of pericardium



- Tx:
  - ① treat underlying cause
  - ② Diuretics
  - ③ pericardiectomy → Try 2-3 months of conservative methods Then do it if
    - (A) NYHA class 2 or 3 with persisting symptoms
    - (B) NYHA class 4
    - (C) cirrhosis, cachexia, markedly reduced CO

### Pericardial effusion/ tamponade

- pathogenesis: (fluid accumulation within pericardial space) / (Rapid increase in pericardial effusion → pericardial pressure is increased → chamber compression)

- Causes:
  - \* Effusion:
    - ① Acute pericarditis
    - ② Malignancy
    - ③ Anticoagulation
  - \* Tamponade:
    - ① Aortic dissection
    - ② vent wall rupture (MI complication)
    - ③ Trauma or post-operative
    - ④ worsening effusion



- Clinical signs : ① Beck's triade : Hypotension, JVD, muffled heart sounds ② pulses paradoxus ③ tachycardia ④ Dullness ⑤ SOB

● Diagnosis : • Effusion : ① CXR: water bottle sign pattern + low voltage ③ ECG : shows

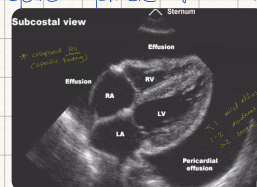


② ECG : alternating pericardial fluid



Temporade : ① CXR: Enlargement of cardiac silhouette ② ECG: alternating pattern ③ ECG (most specific) : collapsed rt chambers/ Dilated IVC without respire- phasic variation/ effusion \* Note : Similar EDP through all chambers.

● Tx : Depends on Hemodynamically stability : ① stable : close monitoring Serial TTE + treat underlying cause ② unstable : aggressive IRT / pericardio- centesis (Subxiphoid) is / Intra- Aortic balloon pump for hypotension / minimize PEEP



Characteristic	Pericardial Pain	Myocardial Ischemic Pain
Quality	Sharp, pleuritic	Pressure, heaviness, tightness, constricting
Location	Left precordial or retrosternal	Retrosternal
Radiation pattern	Left trapezius ridge	Left shoulder, left arm
Duration	Hours or days	1-15 minutes (angina) >20 minutes (unstable angina) Hours (myocardial infarction)
Relation to exercise	Unrelated	Related (stable angina) Unrelated (unstable angina or myocardial infarction)
Relation to position	Relieved by leaning forward Aggravated by assuming a recumbent position	Unrelated
ECG findings	Initial ECG changes that accompany onset of chest pain: ST-segment elevation that is upwardly concave and diffuse (occurs in all leads except aVR and V <sub>1</sub> ) T waves invert after ST-segment elevation resolves and not associated with loss of R-wave voltage or Q waves (occurs several days after onset of chest pain) PR-segment depression present in 80% (occurs in all limb and precordial leads except aVR); reciprocal PR-segment elevation may occur in aVR Q waves absent No left ventricular regional wall motion abnormality	ST-segment elevation is downwardly concave and localized, or ST-segment depression T waves invert while ST-segment elevation is present. May be associated with loss of R-wave voltage or appearance of Q waves PR-segment depression rarely present Q waves may be present Left ventricular regional wall motion abnormality in distribution of coronary artery

**Table 10** Constrictive pericarditis vs. restrictive cardiomyopathy: a brief overview of features for the differential diagnosis (Modified from Imazio et al.<sup>53</sup>)

Diagnostic evaluation	Constrictive pericarditis	Restrictive cardiomyopathy
Physical findings	Kaasman sign, pericardial knock	Apex-tapping murmur; Kaasman sign may be present, S3 (absent)
ECG	Low voltages, non-specific STT changes, atrial fibrillation	Low voltages, pseudo-normalization, possible widening of QRS, left-axis deviation, atrial fibrillation
Chest X-ray	Pericardial calcifications (1/3 of cases)	No pericardial calcifications
Echocardiography	<ul style="list-style-type: none"> <li>• Septal bowing</li> <li>• Pericardial thickening and calcifications</li> <li>• Respiratory variation of the mitral peak E velocity of &gt;25% and variation in the pulmonary venous peak D flow velocity of &gt;25%</li> <li>• Colour M-mode flow propagation velocity (Vp) &gt;45 cm/s</li> <li>• Tissue Doppler peak &lt;45 cm/s</li> </ul>	<ul style="list-style-type: none"> <li>• Small left ventricle with large atria, possible increased wall thickness</li> <li>• E/A ratio &gt;2, short DT</li> <li>• Significant respiratory variations of mitral inflow are absent</li> <li>• Colour M-mode flow propagation velocity (Vp) &lt;45 cm/s</li> <li>• Tissue Doppler peak &lt;45 cm/s</li> </ul>
Cardiac Catheterization	Dip and plateau or square root sign, right ventricular diastolic and left ventricular diastolic pressures usually equal, ventricular interdependence (as assessed by the systolic area index >1.1)	Marked right ventricular systolic hypertension (>50 mmHg) and left ventricular diastolic pressure exceeds right ventricular diastolic pressure (VIEDP >VEDP) at rest or during exercise by 5 mmHg or more (VEDP <13 mmHg)
CT/MR	Pericardial thickness >3-4 mm, pericardial calcifications (CT), ventricular interdependence (real-time cine CMR)	Normal pericardial thickness (<3.0 mm), myocardial involvement by morphology and functional study (CMR)