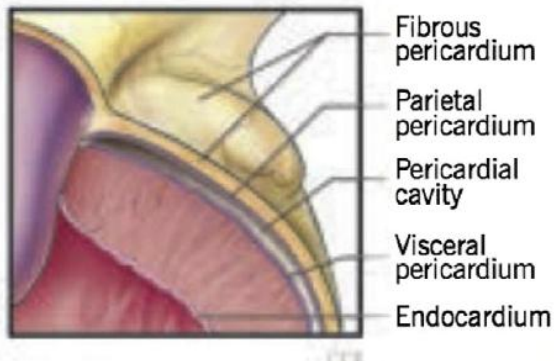
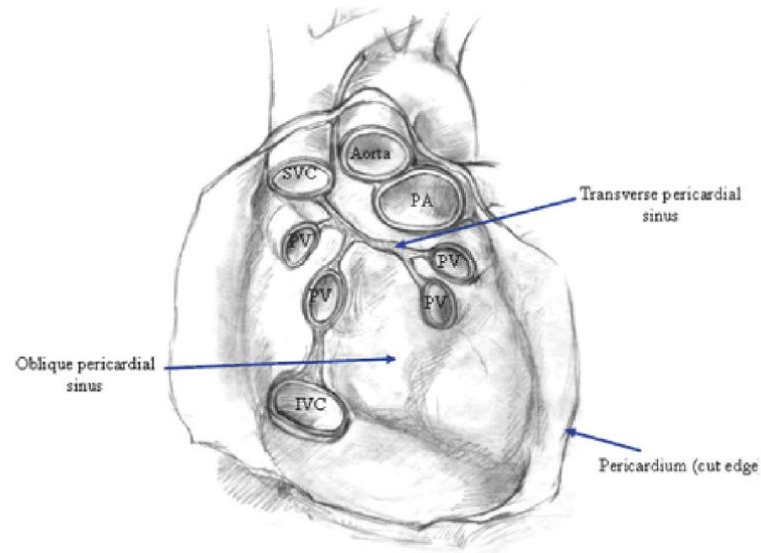
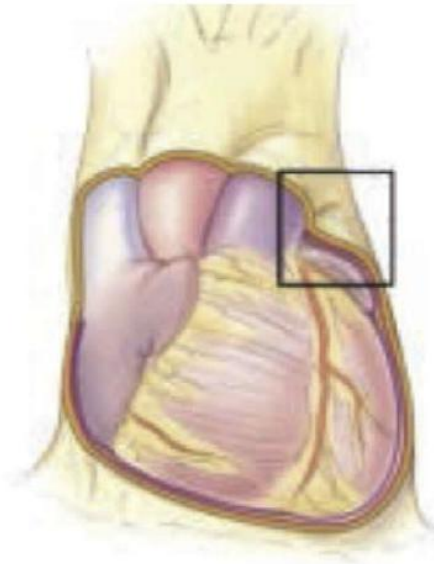


# **SURGICAL MANAGEMENT OF PERICARDIAL DISEASES**

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# SURGICAL ANATOMY AND FUNCTION



The layers of the pericardium

Pericardial space normally contains a small volume of fluid < 50 ml, provides lubrication to the beating heart under normal conditions

The pericardial pressure is negative reflecting the intrathoracic pressure

In cardiac tamponade may reach 20mmHg

# INDICATIONS FOR SURGERY

## **Congenital abnormalities of the pericardium**

Pericardial band with superior vena cava obstruction

Partial pericardial agenesis with cardiac herniation and hemodynamic sequelae

Pericardial coelomic cysts (most common), mostly at the right costophrenic angle  
(asymptomatic, pain, dyspnea, cough, arrhythmia)

## **Acquired pericardial disease**

Pericardial space is affected: pericardial effusion and pericardial tamponade

Pericardium is affected : inflammatory pericarditis, pericardial constriction

# PERICARDIAL EFFUSION/TAMPONADE

Obstructive shock due to compression of the heart chambers by the pericardial fluid

- **Acuity** – as fluid entering the pericardial space exceeds the ability of the pericardium to accommodate or absorb it, pericardial reserve volume (10 – 20ml) is rapidly exceeded and intrapericardial pressure rises abruptly. At this point, pericardial fluid volume can only increase by reducing cardiac chamber volume
- **Chronicity of the process** – the pericardium may compensate for large pericardial effusions (>1l) in chronic inflammatory conditions such as rheumatoid arthritis.
- **Nature of the fluid** – transudative, exudative, hemorrhagic, purulent

# CAUSES OF TAMPONADE

## Common causes:

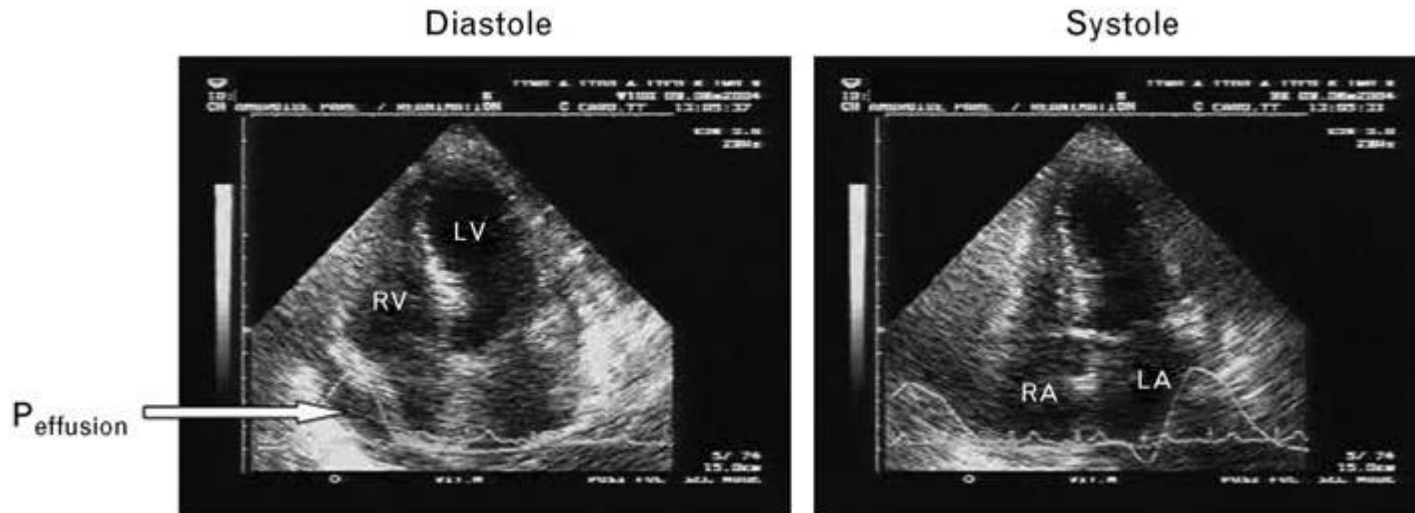
- Pericarditis
- Tuberculosis
- Iatrogenic (invasive procedure-related, post-cardiac surgery)
- Trauma
- Neoplasm/malignancy

## Uncommon causes:

- Collagen vascular diseases (systemic lupus erythematosus, rheumatoid arthritis, scleroderma)
- Radiation induced
- Postmyocardial infarction
- Uraemia
- Aortic dissection
- Bacterial infection
- Pneumopericardium

# PATHOPHYSIOLOGY OF TAMPONADE

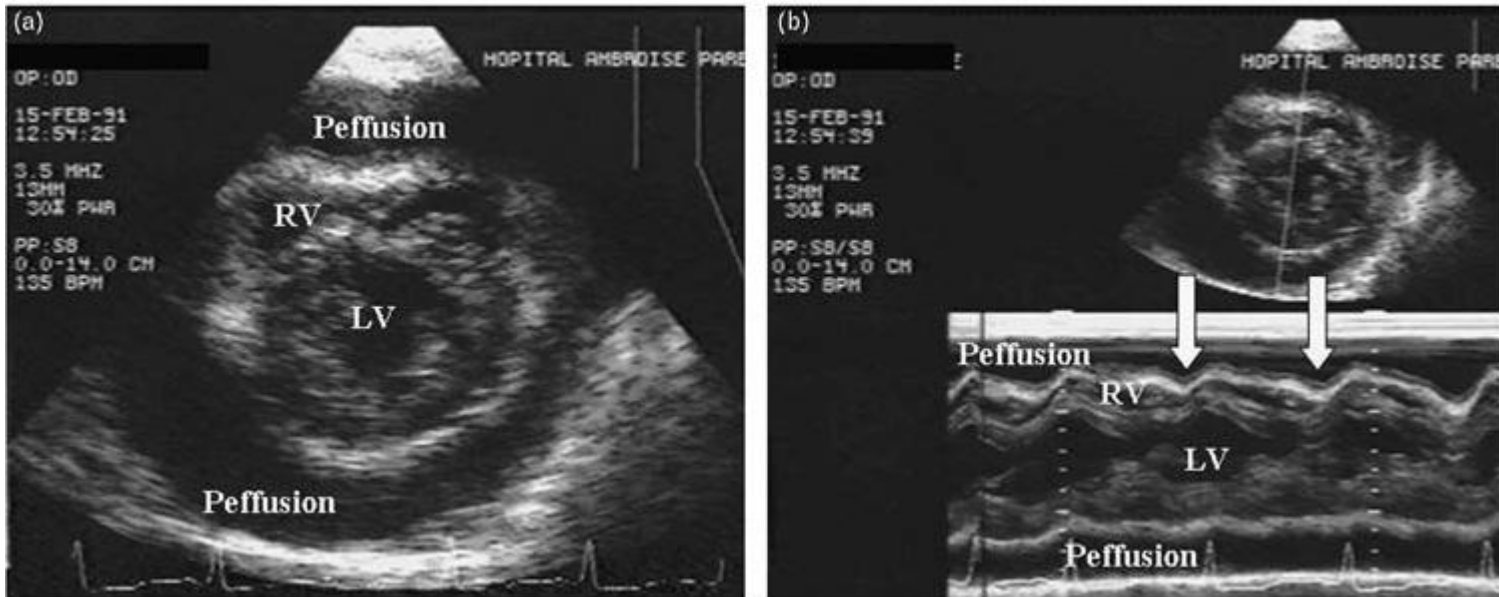
## Right atrioventricular competition - pretamponade



**During diastole:** increase in ventricular volume, leads to huge increase of pericardial pressure resulting in a decrease of atrial transmural pressure and partial collapse of the right atrium

# PATHOPHYSIOLOGY OF TAMPONADE

## Interventricular competition – tamponade



**Early diastole:** external stress affects more easily the right ventricle (thinner wall muscularity), sudden increase in pericardial pressure caused by the increase in ventricular volume overrides the right ventricular free wall, which collapse

# PATHOPHYSIOLOGY OF TAMPONADE



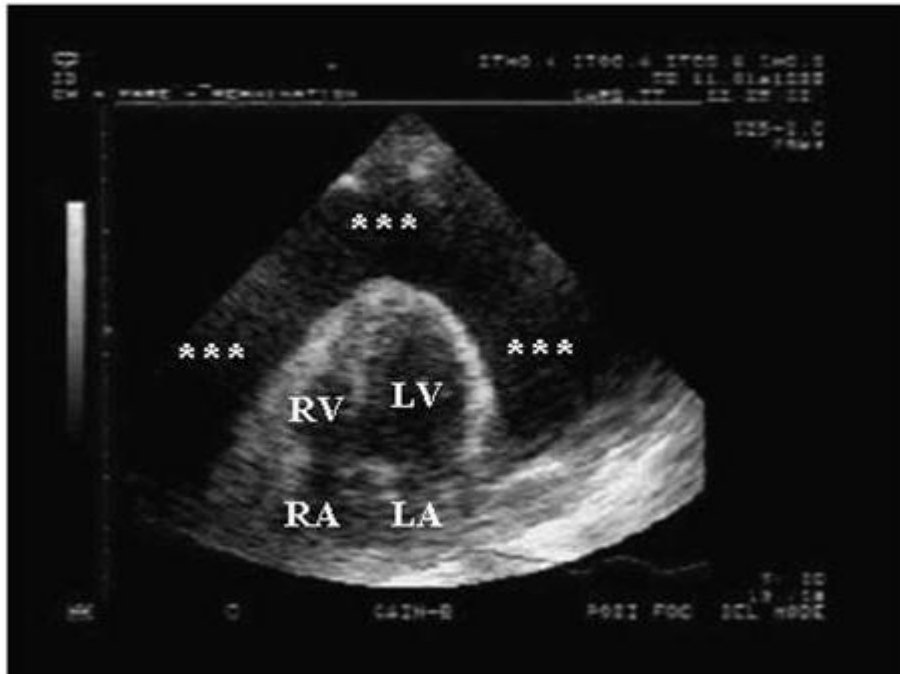
**Inspiration:** RV filling compresses the LV with a shift of the IVS to the left, hampering the pulmonary venous return LV filling and fall in stroke volume, fall in blood pressure

**Expiration:** LV filling after the restoration of the pulmonary venous return, RV is compressed and systemic venous return is interrupted



# PATHOPHYSIOLOGY OF TAMPONADE

## Swinging heart



## Clinical signs

**Beck triad:** hypotension with narrowed pulse pressure

jugular venous distention

muffled heart sounds

**Pulsus paradoxus:** drop of systolic blood pressure

> 10 mmHg during inspiration

**Kussmaul sign:** elevation of jugular vein pressure

during inspiration

# TAMPONADE -TREATMENT

**Volume resuscitation** – treat or delay RV diastolic collapse

**Catecholamines** – vasopressor may be the drug of choice

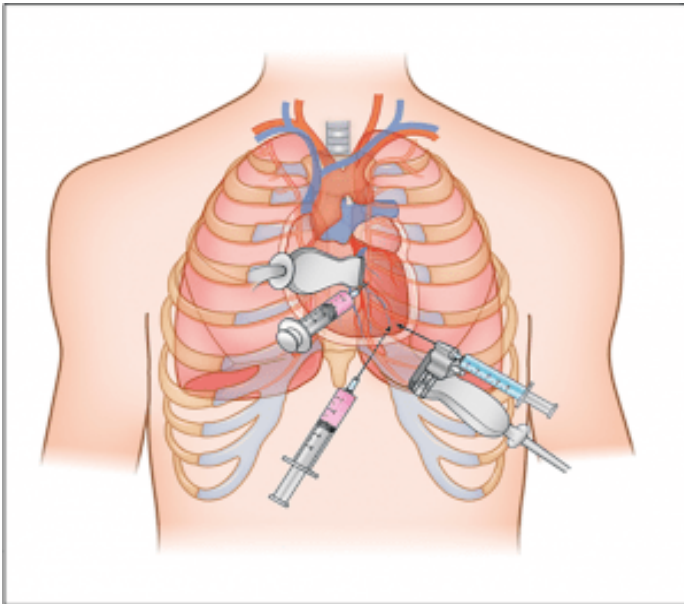
**Pericardial decompression** – Pericardiocentesis

– Surgical pericardiectomy

(pericardial fenestration, video assisted –VATS)

# PERICARDIOCENTESIS

## Three main approaches



**Apical:** 5th-7th intercostal space 1-2 cm lateral to the apex

**Parasternal:** left sternal border 5th intercostal space perpendicular to the skin

**Subxyphoid:** between the xyphisternum and left costal margin, 15-30 degree angle to the left shoulder

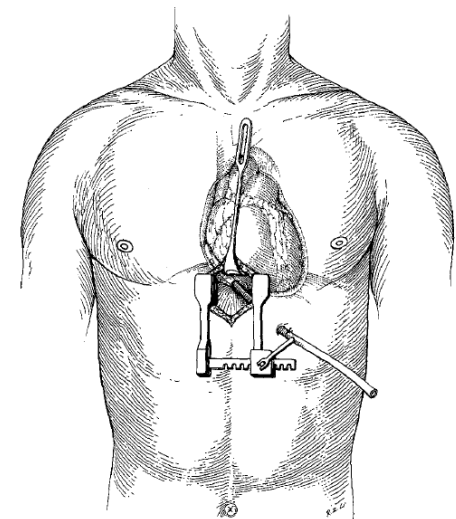
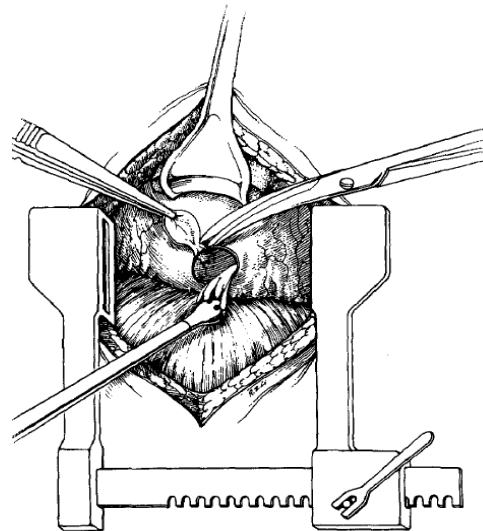
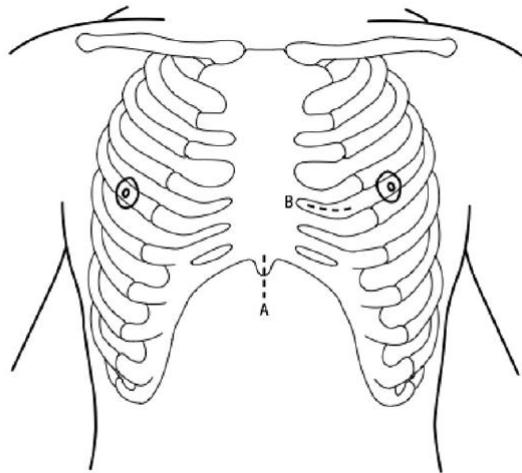
**Fluoroscopy-guided, CT-guided, Echo-guided**

# TRANSTHORACIC/SUBXIPHOID PERICARDIAL FENESTRATION

## Surgical approaches

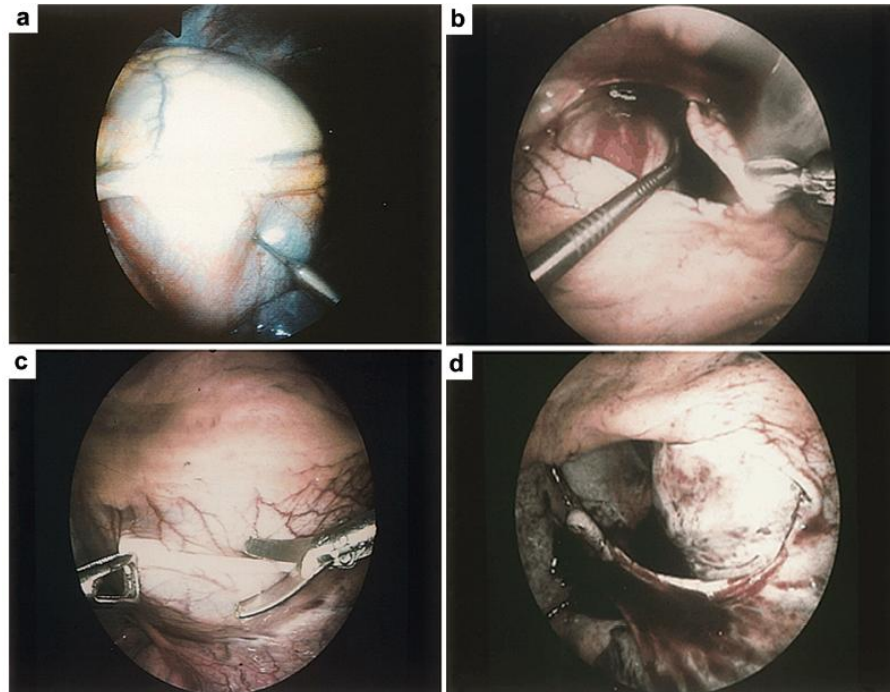
Subxiphoid: short incision (5cm long ) over the xiphoid extending into the midline of the abdomen

Transthoracic: small left anterior thoracotomy (6-8cm long) 5th-6th intercostal space



Subxiphoid pericardial drainage technique

# VIDEO-ASSISTED THORACOSCOPIC PERICARDIAL FENESTRATION



Trocars for the endoscopic camera and various surgical instruments are introduced through 2 or 3 thoracic incisions of < 10mm at the level of 4th and 6th intercostal space

# INFLAMMATORY PERICARDITIS

Potential target for surgical therapy, relatively recent indication

Chronic relapsing pericarditis: no response to treatment

toxic side effects of treatment

high corticosteroid doses with long-term sequelae

MRI- identify the extent and severity of the pericardial inflammation, timing of the surgery

Inflammatory markers guide the timing of the surgery

Surgery best performed when inflammation is at minimum, ie between flares

Principle of the procedure: reduction or elimination of the need of anti-inflammatory medication

Median sternotomy, bilateral thoracotomy, clamshell incision with/without cardiopulmonary bypass

Complete as possible pericardiectomy, except the pericardium posterior to the left atrium in the oblique sinus

Small strip of pericardium remains beneath the phrenic nerves

# CONSTRICTIVE PERICARDITIS

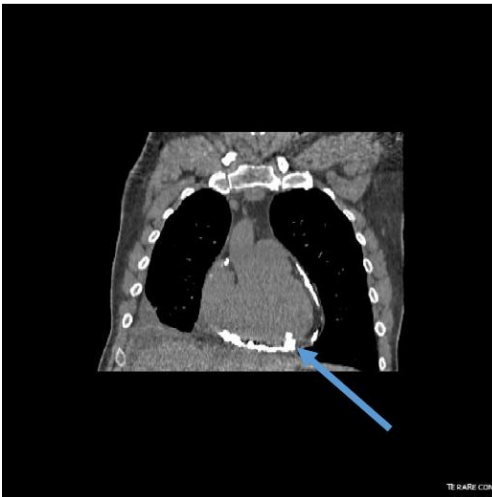
Most common indication for pericardial surgery other than pericardial effusion

Thickening of the pericardium, external pressure on the cardiac chambers causing diastolic dysfunction

Calcification

Gold standard in diagnosis: ECHO, MRI, left and right catheterization

Differentiate from restrictive cardiomyopathy



Pericardial calcification



- median sternotomy, bilateral thoracotomy, clamshell
- with/without cardiopulmonary bypass
- limited anterior phrenic to phrenic pericardiectomy
- complete pericardiectomy

Mortality: around 15%

Complications: bleeding

overdistention leading to heart failure

atrial arrhythmias

vasoplegia

# CONCLUSION

- Acute tamponade is lethal disease, prompt diagnosis and treatment (pericardiocentesis, surgical pericardiectomy) can be life saving
- Clinical symptomatology is not essential for diagnosis, should be combined with imagine methods
- The gold standard for diagnosis is ECHO. Chest CT scan can be used for diagnosis