Pericardial Effusion And Cardiac Tamponade — Symptoms and ECG

Pericardial effusion is the condition of having an abnormal amount of fluid in the pericardial cavity of the heart. The pericardium does not expand. If enough fluid accumulates it will restrict cardiac filling and lead to acute heart failure, this is called cardiac tamponade. Small effusions are usually asymptomatic. Symptoms of a large effusion include Beck’s triad of distended neck veins, low blood pressure and muffled, distant heart sounds. Larger effusions are treated by pericardiocentesis, carefully removing the fluid with a needle.

Epidemiology of Pericardial Effusion

Widespread pericardial effusion

Asymptomatic pericardial effusions have been shown in about 3% of patients at autopsy. The groups at greatest risk of developing pericardial effusion include patients with cancer and patients with HIV and AIDS. Tamponade, requiring a large effusion, is less common.
Etiology of Pericardial Effusion

Effusions and tamponades mainly caused by pericarditis and malignancy

Effusions and tamponade can occur as a result of pericarditis of any type. Malignancy, especially lung and breast cancer, is the most common cause of effusion and tamponade followed by uremia and infectious disease. Effusion is also common after cardiac surgery while an effusion due to a myocardial rupture is rare.

Pathology and Pathophysiology of Pericardial Effusion

The pericardial space normally contains a small volume of serous fluid. Under normal circumstances it cushions the heart and allows for a low friction environment so the heart can move easily. If fluid were to fill the pericardial space rapidly, as in a penetrating chest trauma, as little as 150 ml could lead to tamponade. If fluid were to slowly accumulate, then the pericardial sac could stretch to accommodate about 2 l of fluid without symptoms.

Pericardial effusions can be serous, hemorrhagic or serosanguinous (a pink mixture of serous and hemorrhagic).

As the pericardial effusion continues to grow diastolic filling will be affected. The physiologic response is to increase the heart rate in order to maintain cardiac output. Venous return is also hampered by the gathering fluid, resulting in intravascular buildup in the superior and inferior vena cava and a collapse of the right atrium and ventricle and then left ventricle and a drop in cardiac output. Insufficient cardiac output eventually leads to shock.

Causes of pericardial effusion and cardiac tamponade:
- Neoplasm i.e. breast, lung
- Postmyocardial infarction
- Postpericardiotomy syndrome
- Hypothyroidism
- Viruses like coxsackie group B, influenza, echo
- Bacterial infection
- Connective tissue disease SLE
- Trauma
- Uremia
- Drug induced

Symptoms of Pericardial Effusion

Signals of pericardial effusion

**Symptoms of a cardiac effusion** include the following:

- Chest pain or pressure
- Palpitations
- **Cough**
- Additionally the patient may present symptoms related to the underlying cause of the effusion.

Symptoms of cardiac tamponade

As the effusion grows into a tamponade other symptoms become accumulate:

- **Tachycardia**
- Tachypnea
- **Dyspnea**
- Hypoperfusion leads to cold/clammy extremities

On physical look for **Beck’s Triad:**

- Low blood pressure
- Distended neck veins
- Muffled heart sounds on auscultation

Also look for **pulsus paradoxus**, an abnormally large drop in systolic blood pressure (normal drop is < 10 mm Hg) during inspiration with a lack of palatable radial pulse and Kussmaul’s sign, a paradoxical increase in venous pressure during inspiration.

On x-ray the **pericardial silhouette is enlarged** and takes on a “water-bottle” shape.
Diagnosis of Pericardial Effusion

How to detect pericardial effusions and cardiac tamponades

Small effusions that are found incidentally are usually worked up to determine their etiology. An echocardiogram is used to verify the effusions size. It presents as an anechoic space between the layers of the serous pericardium. This will appear black (remember bone appears white, fluid appears black on ultrasound and echocardiogram).

If the effusion is small and the patient is asymptomatic then the underlying condition is treated and the effusion is monitored. A large effusion may cause the pericardium to “swing” on echo, as the motion of the heart is transmitted through the fluid to the pericardium.

The effusion becomes a cardiac tamponade when sufficient fluid has accumulated in the pericardial space to inhibit proper heart function. Cardiac tamponade is a clinical diagnosis, an enlarged pericardial silhouette on chest x-ray is insufficient to make the diagnosis. If there is a concern for tamponade a patient will be evaluated for Beck’s triad, pulsus paradoxus, echocardiograph and EKG.

On echocardiogram the tamponade will demonstrate the following:

- A large pericardial effusion
- A collapse of the right ventricle during diastole
- Dilation of the inferior vena cava
Compression of the left atrium and ventricle

This will result in poor left heart filling with a drop in cardiac output and venous stasis in the superior and inferior vena cava.

**Image:** "Pericardial effusion with tamponade" by Jer5150. License: [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/)

**Signs of tamponade on ECG** include sinus tachycardia, low-voltage QRS complexes and electrical alternans, consecutive QRS complexes that alternate in height.
Differential Diagnoses of Pericardial Effusion

To be distinguished from effusion and tamponade

- Cardiogenic Shock
- Constrictive Pericarditis
- Pneumothorax
- Pulmonary Embolism

Therapy of Pericardial Effusion

How to treat pericardial effusions and cardiac tamponades

Cardiac effusion will focus on removing the effusion, preventing further effusions and treating the underlying cause. Medical treatment depends on etiology includes

- NSAIDs, first line therapy
- Colchicine
- Antibiotics, if caused by infection

Small effusions are monitored by echocardiography. Larger effusions are removed via pericardiocentesis. If recurrence is a concern a pericardial window may be installed, a permanent catheter that drains the any pericardial fluid into the peritoneal cavity.
Cardiac tamponade is a medical emergency and is treated with oxygen, volume expansion (IV fluids) to increase cardiac output, inotropic drugs (eg, dobutamine) to increase cardiac output, and elevating the legs to improve venous return. Pericardiocentesis should be performed as soon as the patient is stable.

Progression and Prognosis of Pericardial Effusion

Etiology defines prognosis of effusions and tamponades

Prognosis of pericardial effusion depends on the etiology. Treating the underlying cause may be curative. Small effusions are simply monitored. However, untreated cardiac tamponade is rapidly fatal. Long term survival depends on etiology. Tamponade induced by malignancy has the worst long term prognosis.

Review Questions

The answers are below the references.

1. A 55 year old female with progressive dyspnea over last three weeks and a sharp chest pain over last two days. On physical exam she shows jugular vein distention and a drop of 12 mm Hg in systolic blood pressure during inhalation. EKG shows sinus tachycardia with diffuse and nonspecific ST changes. What is the next step in the management of this patient?
   A. Ventilation-Perfusion scan
   B. Bronchoscopy
   C. Paracentesis
   D. Echocardiography

2. Which of the following is NOT part of Beck’s triad:
A. Low blood pressure  
B. Pulsus paradoxus  
C. Muffled heart sounds  
D. Jugular vein distention  

3. Which conditions must be met to classify a patient with pulsus paradoxus?

A. A drop in systolic blood pressure greater than 10 mm Hg during inspiration  
B. An increase in jugular venous pressure with inspiration.  
C. A lack of radial pulse though you can detect beats on cardiac auscultation.  
D. A and C  

References  

Correct answers: 1D, 2D, 3D  

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