Management of Pericardial Effusions

Sarah Ikponmwosa, M.D.
Downstate Medical Center
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67 yo female with a PMH of HTN, s/p right mastectomy ’02 and chemotx ‘08
- CC : c/o SOB, weakness, fever/chills x 4-5 days.
- Admitted to the MICU with a ddx of PNA vs CHF exarcebation vs Sepsis
- Vitals : 99.8  161/95  138  28  98% (RA)
- PE :
  - Mild respiratory distress
  - Bilateral wheezes
Case Presentation

- Labs
  - WBC 13.8
  - CHEM wnl
  - Trop neg
- EKG – ST
- CXR – cardiomegaly
- On HOD 1 – worsening respiratory distress in the supine position.
- Pt refused CTA to r/o PE
Hospital Course

- 2D Echo: normal LV fxn, large pericardial effusion 3-3.5 cm with RA collapse consistent with early cardiac tamponade

- CT Surgery consulted

- Failed pericardiocentesis by cardiology

- Taken to the OR for pericardial window
Operative Course

- Prepped, draped and inducted in the supine position
- 500 ml of hemorrhagic fluid evacuated under pressure via sub-xiphoid incision
- V-fib post-op in ICU – successfully resuscitated
- Cytology – reactive mesothelial cell
- Path – reactive mesothelium, acute inflammation
Management of pericardial effusions
2 layers
- a serous visceral layer, which is intimately adherent to the heart and epicardial fat, and
- a fibrous parietal layer

Encloses the greater part of the surface of the heart

Significant portion of the left atrium, however, is not enclosed within the pericardium
Introduction - Anatomy

- Pericardial pressure:
  - –1 to –2 mm Hg on average,
  - –5 mm Hg with normal inspiration

- Pericardial space: 15–50 mL of fluid
  - reserve volume of the pericardium is relatively small
Functions of the pericardium

- Maintaining an optimal cardiac shape
- Promoting cardiac chamber interaction
- Preventing the overfilling of the heart
- Reducing friction between the beating heart and adjacent structures
- Providing a physical barrier to infection and
- Limiting displacement during the cardiac cycle.
Pericardial Effusions

- Definition: Echocardiographic demonstration of pericardial fluid

- Pericardial effusion can develop as a result of:
  - pericarditis
  - uremia
  - cardiac trauma or chamber rupture,
  - malignancy
  - AIDS
  - hypothyroidism
Clinical Presentation

- Symptoms
  - Directly related to the absolute volume and Rapidity of accumulation.
  - slowly developing pericardial effusions can accumulate large volumes of fluid without symptoms up to 1 L
  - Many of these large effusions are discovered incidentally
  - Rapid accumulation - increased intrapericardial pressures and life-threatening hemodynamic compromise
Physical Examination

- Muffled heart sounds (esp. large effusions)
- Left lower lobe lung dullness to percussion of the chest (Ewart sign) as a result of compression of lung parenchyma
- Beck’s triad
Electrocardiography

- reduced voltage and
- electrical alternans, alternating QRS voltage as a result of a swinging motion of the heart that characteristically occurs at a frequency of half the heart rate

Chest Radiography –

- An increase in the cardiac silhouette combined with clear or oligemic lung fields.
- With slowly accumulating fluid, the cardiac silhouette may assume a globular shape that has been likened to a water bottle.
- Radiographic differentiation of pericardial effusion and cardiac enlargement may not be possible.
Echocardiography - fastest and most accurate

- echo-free space between the moving epicardium and the stationary pericardium.
- Two-dimensional echocardiography - demonstrates the full distribution of the effusion and identifies loculated effusion
- Quantification of the volume of effusion by echocardiography is not always precise
- TEE - quantify the anatomic distribution of effusions, especially when loculated, and is superior to transthoracic echocardiography in imaging the thickness of the pericardium.
Cardiac Magnetic Resonance Imaging and Computed Tomography

- Provide highly accurate imaging of pericardial effusions, their anatomic distribution, and the thickness of the pericardium.
- Most accurate methods for delineating the size of effusions, their anatomic distribution, and the thickness of the pericardium.
- Often valuable adjuncts to echocardiography.
Treatment

- Dictated by
  - its size,
  - the presence or absence of hemodynamic compromise from increased intrapericardial pressure

- At the same time it should be recalled that once an effusion reaches a certain magnitude, even small additional amounts of fluid can cause a marked increase in intrapericardial pressure and rapid clinical deterioration; these patients must be monitored closely.

- However, some of these will eventually result in cardiac tamponade. Therefore, elective, closed pericardiocentesis may be recommended in these cases.
Cardiac Tamponade

- Occurs when increased intrapericardial pressure from accumulation of fluid compromises the filling of the heart, thereby impairing cardiac output
- Symptoms and Signs –
  - dyspnea
  - chest discomfort.
  - systemic arterial pressure is typically low, although it may be surprisingly well-preserved on occasion;
  - pulse pressure is usually diminished.
  - typically tachycardiac and tachypneic although bradycardia may ensue in terminal stages.
  - Almost always more comfortable sitting upright.
  - If pericarditis coexists, typical pain and a friction rub may be present.
Cardiac Tamponade

- Essentials of Diagnosis
  - Increased jugular venous pressure
  - Pulsus paradoxus.
  - Echocardiographic evidence of right atrial and ventricular collapse.
  - Equal diastolic pressures in all four cardiac chambers.
Drainage is the cornerstone of therapy

Methods:

- Pericardiocentesis
- Sub-xiphoid pericardiostomy (pericardial window)
- Thoracoscopic pericardiostomy
Pericardiocentesis

- Local anesthesia
- Indicated in acutely unstable patients in tamponade
- Can be done at bedside
- High recurrence rate
- Complications – cardiac injury, pneumothorax
Under echocardiographic guidance
Local anesthesia to left of the xiphoid
An 18-gauge spinal needle attached to a three-way stopcock and syringe
  directed cephalad toward the left shoulder at a 45° angle until fluid is aspirated
  if air is aspirated, the needle is withdrawn and redirected more medially.
  Bloody fluid is inspected for clotting
Pericardiocentesis
Either to diagnose pericardial effusion or to manage tamponade.

For tamponade – prep and drape patient while awake

Complications are rare - bleeding, infection, incisional hernia, anesthetic complications, and cardiac injury have been reported

Recurrence rate is low
Pericardial window
Thoracoscopic pericardiostomy

- safe and effective in the diagnosis and management of pericardial effusion with a unilateral pleural disease
- unsuitable for unstable patients
  - Necessitates single lung ventilation
  - Lateral decubitus positioning
- Need to avoid the phrenic nerve
Thoracoscopic pericardiostomy

- 1.5 cm Incision in Eighth Intercostal Space for Camera Port
- 4.5 cm Incision in Fifth Intercostal Space for Instruments

Assistant behind Patient

Surgeon in Front of Patient
Subxiphoid pericardiostomy in the management of pericardial effusions

- **1:** Heart. 2005 Jun;91(6):785-90

**OBJECTIVE:** To assess the effectiveness of subxiphoid pericardiostomy

- Case series of 368 pts
- Severe 53%, mod 43%, tamponade 25%

**Results**
- Operative complication 0.8%
- Mortality 0.8%
- Pericardial constriction 3%
Questions

1. The etiology of pericardial effusion include all except
   A. Uremia
   B. Pericarditis
   C. Diabetes
   D. malignancy
Question 2

Which of these approaches is not indicated for unstable patients in the management of cardiac tamponade

A. Pericardial window
B. Thoracoscopic pericardiostomy
C. Pericardiocentesis
Recurrent after drainage of pericardial effusion is higher after

A. Thoracoscopic pericardiostomy
B. Pericardiocentesis
C. Pericardial window
To determine if bloody aspirate is pericardial fluid after pericardiocentesis, one should

A. Send specimen to lab for analysis
B. Place on sponge and observe for clotting
C. Obtain blood gas from specimen