Pericardial Disease

Joseph L. Kummer, MD, FACC
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Disclosures

• No disclosures
• Off-label discussion of use of Colchicine

The Pericardium

• Fibroelastic Sac with two layers (visceral and parietal)
• Potential space between the two layers
  – Usually contains 15-50 mL fluid (ultrafiltrate of plasma)
Clinical Presentations

- Acute Pericarditis
- Pericardial Effusion without symptoms
- Cardiac Tamponade
- Constrictive Pericarditis
- Effusive-Constrictive Pericarditis

Acute Pericarditis

- Most common pericardial disease
- 5% of non-ischemic chest pain in the ER
- Exact incidence and prevalence are not well established
- Etiology usually presumed viral, though most cases never have a confirmed cause

Acute Pericarditis, Etiology

- Idiopathic, Presumed Viral
- Infectious
  - Viral, Bacterial, Fungal, Parasitic
- Autoimmune
  - SLE, RA, MCTD, Scleroderma
  - Wegener's, PAN, Sarcoid, Giant Cell Arteritis, Rheumatic Fever, IBD
  - Post cardiac injury
Acute Pericarditis, Etiology

- Neoplastic
  - Metastatic
  - Primary (Rhabdomyosarcoma, teratoma, angioma)
  - Paraneoplastic
- Cardiac
  - Post-infarct, Dressler's Syndrome
  - Aortic Aneurysm

Acute Pericarditis, Etiology

- Traumatic
  - Blunt, Penetrating
- Metabolic
  - Hypothyroidism, Uremic
- Iatrogenic
  - Post catheterization, pacemaker wires
- Radiation
- Drugs
  - Drug-induced lupus (Hydralazine, Isoniazide)

Acute Pericarditis, High Risk Features

- Fever and leukocytosis
- Evidence of cardiac tamponade
- Large Pericardial Effusion (>20mm)
- Immunosuppressed State
- Anti-coagulation Therapy
- Acute Trauma
- Failure to respond to > 7 days of NSAID Rx
- Elevated Troponin
Acute Pericarditis, Signs and Symptoms

- Chest Pain
- Friction Rub
- EKG Changes
- Pericardial Effusion

Acute Pericarditis, Chest Pain

- Over 95% prevalence
- May be absent in uremic or rheumatologic causes of pericarditis
- Sharp and pleuritic, worse with inspiration and cough
- Worse with lying flat, relief sitting forward

Acute Pericarditis, Friction Rub

- Highly specific when present
- Possibly due to "friction" between the two layers but can be seen with effusions, too
- (Up to) 3 phases:
  - Atrial Systole (not present with a-fib)
  - Ventricular Systole
  - Early Ventricular Filling
Acute Pericarditis, Friction Rub

- Scratchy
  - Diaphragm over the left sternal border
  - Patient leaning forward
- Rubs come and go frequently, so frequent auscultation can be helpful
- Present 35% of the time
- Breath holding distinguishes from pleural or pleuropericardial rub

Acute Pericarditis, EKG

Acute Pericarditis, EKG
Acute Pericarditis, EKG

- Signifies inflammation of the epicardium
- Not as commonly present in uremic pericarditis
- Up to 4 Phases of evolution, though all 4 seen only about 20% of the time

Acute Pericarditis, EKG

- Stage I
  - First hours/days
  - Diffuse ST Elevation, concave up
  - Reciprocal ST Depression aVr and V1
  - PR Depression in limb leads, V5, V6
  - PR Elevation aVr
  - PR changes are highly specific but not sensitive

Acute Pericarditis, EKG

- Stage II
  - Occurs during first week
  - Normalization of ST and PR Changes
- Stage III
  - Diffuse T-wave Inversions
- Stage IV
  - Normalization of the EKG, or some persistence of T-wave changes
Acute Pericarditis, EKG

- Sustained atrial or ventricular arrhythmias are rare with acute pericarditis alone, especially without underlying structural heart disease
- Arrhythmias are nearly 20X more common with concomitant myocarditis

Acute Pericarditis (AP) EKG vs. STEMI

- Morphology: Begins at J-Point, rarely greater than 5 mm. Concave (scoop) rather than convex (dome-shaped) in STEMI
- Distribution: Diffuse with AP, localized to infarct artery with STEMI
- Reciprocal Changes: Usually only aVR and V1 with AP, more diffuse with STEMI

Acute Pericarditis (AP) EKG vs. STEMI

- Concurrent Changes: ST Elevation and T-Wave Inversions not seen simultaneously with AP but often present with STEMI
- Peaked T-Waves: > 10mm precordial leads, > 5mm limb leads not generally seen in AP
- Q-Waves: Only with STEMI
- PR Segment: Changes only with AP
- QT Prolongation: Typically only with STEMI
• Differentiate vs. Early Repolarization (EP)
  - Limb leads usually affected in AP, only involved half of the time with EP
  - PR Changes and Evolution not seen in EP
  - ST Elevation to T-Wave amplitude in V6 > 0.24 strongly favors AP
Acute Pericarditis, Pericardial Effusion

- Only about 5% have a hemodynamically significant effusion
- Moderated size effusions in about 5%
- Small effusions in about half
- 40% have no effusion

Acute Pericarditis, Diagnosis

- Usually a clinical diagnosis based upon history
  - History of a recent “flu-like” illness is common
  - Friction rub confirms diagnosis
  - EKG is usually the most helpful test
  - Other diagnostic tests are indicated but are often normal
Acute Pericarditis, Official Diagnosis

- At least two of the following:
  - Typical Chest Pain of Pericarditis
  - Pericardial Friction Rub
  - Typical EKG changes of Pericarditis
  - New or worsened pericardial effusion

Acute Pericarditis, Testing

- EKG is indicated for everyone
- CXR: Pericardial effusion, R/O other causes of chest pain
- CBC, Troponin, ESR, CRP
- Blood Culture only if febrile
- ACC/AHA/ASE advocate for an echocardiogram for all patients

Acute Pericarditis, Lab Data

- Elevated Troponin
  - Present in 32% of pericarditis patients
  - Suggests myocardial injury (myocarditis)
- Leukocytosis is common
- Inflammatory markers (ESR, CRP)
  - Neither sensitive nor specific
  - May not elevate at all or may elevate only several days after onset
Acute Pericarditis, Optional Lab Data
- TB Testing only when history is suspicious (i.e., immunocompromised patient)
- ANA only when rheumatologic etiology is suspected
- Viral studies are not indicated
  - Low yield and doesn't affect management

Acute Pericarditis, Advanced Imaging
- Echo for all, CT/MRI only in specific scenarios
- Chest (and cardiac) CT
  - Pericardial thickening and/or calcification
  - Effusion size and content (exudate vs purulent)
  - Lung cancer, TB, etc.
- Cardiac MRI can help with the above but usually will not offer more than CT

Acute Pericarditis, Pericardiocentesis
- Therapeutic obviously indicated with cardiac tamponade
- Diagnostic pericardiocentesis
  - Suspected malignant or bacterial etiology
  - Effusion refractory to conventional therapy
Pericardial Effusion

- Etiology
  - Idiopathic (Presumed Viral or Autoimmune)
  - Infectious
    - Viral: Coxsackie, EBV, Adenovirus, Varicella, HIV
    - Bacterial: TB, Staph, Strep, Neisseria, Chlamydia
    - Fungal: Histoplasma, Aspergillus, Candida
    - Parasitic: Echinococcus, Amebic, Toxoplasma
    - Infective Endocarditis with valve abscess
Pericardial Effusion

• Etiology, cont.
  – Autoimmune and Autoinflammatory
    • Systemic Inflammatory - SLE, RA, Sjögren Syndrome, Vasculitis
    • Autoinflammatory – Familial Mediterranean Fever
    • Post-Cardiac Injury
    • Other - Wegener's, Polyarteritis Nodosa, Sarcoidosis, IBD (Crohn's, ulcerative colitis), Whipple's, giant cell arteritis, Behçet's disease, Rheumatic Fever

Pericardial Effusion

• Etiology, cont.
  – Neoplastic
    • Metastatic - Lung, Breast
    • Primary – Rhabdomyosarcoma, Teratoma, Lipoma
    • Paraneoplastic
  – Cardiac
    • Early Infarction Pericarditis
    • Late Post-Cardiac Injury (Dressler's)
    • Myocarditis
    • Dissecting Aortic Aneurysm

Pericardial Effusion

• Etiology, cont.
  – Trauma
    • Blunt
    • Penetrating
    • Iatrogenic – PPM perforation, Cardiac Surgery, CPR
  – Metabolic
    • Hypothyroidism
    • Uremia
    • Ovarian Hyperstimulation
Pericardial Effusion

- Etiology, cont
  - Radiation
  - Medications
    - Procainamide, Isoniazid, or Hydralazine as part of drug-induced lupus
    - Multiple Others (rare)

- Etiology, cont
  - Idiopathic, 29-48%
  - Malignancy, 13-23%
  - Uremia, 6-12%
  - Iatrogenic, 16%
  - Post-Infarct, 8%
  - Infectious, 6-27%
  - Collagen Vascular Disease, 5-12%

Pericardial Effusion, Diagnosis

- Most are asymptomatic, though several patients have symptoms related to the underlying cause

- Physical exam is of very little help except in pericarditis and tamponade
Pericardial Effusion, Diagnosis

- **EKG**
  - Sinus Tachycardia
  - Low Voltage
    - 5mm or less in all limb leads OR
    - 10mm or less in all precordial leads
  - Electrical Alternans
    - Due to rocking motion of heart within pericardial fluid

- **Imaging**
  - CXR
    - Frequently an enlarged cardiac silhouette, though this is not specific
    - Usually need > 200 mL fluid to be seen on CXR
  - CT and MRI rarely used
  - Echo is obviously the mainstay of diagnosis and should be performed in all patients with suspected pericardial disease
Pericardial Effusion

Cardiac Tamponade

- Compression of all intracardiac chambers due to increased pericardial pressure
- Can happen within minutes in trauma, aortic dissection, cardiac free wall rupture, etc.
- Subacute presentations are seen with neoplasia, uremic, idiopathic
  - Much larger volumes can accumulate, as the pericardium has time to stretch and accommodate.
Cardiac Tamponade

- Signs almost always present
  - Sinus Tachycardia
  - Elevated JVP
  - Pulsus Paradoxus

- Echo Findings
  - RA and RV Diastolic Collapse
  - Increased respiratory variation of MV and TV inflow
  - RV and LV reciprocal changes
  - Dilated IVC
Cardiac Tamponade
- Decrease in venous return due to high intracardiac pressures
- Results in decreased LV filling as well as bulging of RV into LV, further reducing cardiac output
- Hypotension, Cardiogenic shock

Cardiac Tamponade, Treatment
- Volume expansion
  - Helps in about half of patients
- Questionable benefit of inotropic support
- Avoid positive pressure ventilation

Cardiac Tamponade, Treatment
- Pericardiocentesis
  - Echo-guided
- Surgical drainage (sub-xiphoid)
  - Pericardial "window" to prevent recurrence
- VATS
Constrictive Pericarditis

- Due to scarring and subsequent loss of elasticity of pericardial sac
- Prevents decreased intrathoracic pressure being transmitted to heart
- Thickened pericardium cannot accommodate increased venous return with inspiration

Constrictive Pericarditis

- Can occur after any pericardial disease
  - Idiopathic/Viral, 42-61%
  - Post Cardiac Surgery, 11-37%
  - Post Radiation, 2-31%
  - Connective Tissue Disorder, 3-7%
  - Post-Infectious, 3-15%

Constrictive Pericarditis

- Risk after initial event
  - Pericarditis: 0.76 per 1000 person-years
  - Connective Tissue: 4.4 per 1000 person-years
  - Neoplastic: 6.3 per 1000 person-years
  - Tuberculous Pericarditis: 32 per 1000 person-yrs
  - Purulent Pericarditis: 53 per 1000 person-years
Constrictive Pericarditis

- **Presentation:**
  - Volume Overload – Edema, Anasarca
  - Decreased Cardiac Output - Dyspnea, Fatigue
  - 2/3 present with CHF, only 5% with tamponade

- **Exam**
  - 97% Elevated JVP
  - Pulsus Paradoxus in less than 20%
  - Kussmaul’s Sign (lack of inspiratory decline in JVP) is actually not common (less than 21%)
  - Pericardial Knock in 47%

- **EKG** non-specific
- **CXR** with pericardial calcification in setting of R Heart Failure is highly suggestive
- **Echo** can show thickened, calcified pericardium
  - Multiple Doppler characteristics
- **CT** and **MRI** can be very helpful
- **Cardiac Catheterization** is usually required to differentiate from restrictive cardiomyopathy, tamponade, cirrhosis, etc.
Constrictive Pericarditis

• Most cases are chronic, though transient, self-resolving episodes are also seen
• Treatment is pericardiectomy
  – 8% operative mortality

Effusive-Constrictive Pericarditis

• Constriction usually obliterates pericardial fluid. When fluid is present, this is called effusive-constrictive pericarditis
  – Tamponade can easily develop
  – Etiology similar to other pericarditis syndromes
  – Disease of visceral pericardium, which is extremely difficult to resect

Pericardium, Miscellaneous

• Congenital Absence
  – Usually seen with other congenital heart disease. Generally benign
• Pericardial Cysts
  – Rare. Often near R atrium. Can cause CHF, particularly R-sided.
• Pericardial Tumor
  – Also rare. Paraganglioma, mesothelioma
Acute Pericarditis, Rx

• When possible, treat underlying cause (TB, malignancy, etc)
• Hospitalize if high risk features or hemodynamic compromise
• In viral or idiopathic disease, no therapy has been proven to reduce sequelae such as constrictive pericarditis or tamponade

Activity Restriction

– Strenuous activity can trigger recurrence
– Non-competitive activities can resume after clinical resolution of symptoms
– Competitive athletics should be avoided for three months after resolution of symptoms

NSAIDS

– Recommended for all patients without contraindication
– Duration and dose individualized based upon symptoms
  • Weekly CRP can be used for guidance
Acute Pericarditis, Rx

- NSAIDS
  - NSAIDS alone sufficient in over 70% of cases
  - ASA, Ibuprofen, Indocin all acceptable
  - Hemorrhagic pericarditis not a true concern
  - Failure to respond to ASA within one week suggests non-viral etiology with higher risk of recurrence, constriction

- After acute MI, ASA preferred. Other NSAIDS may impair scar formation
  - GI Prophylaxis (PPIs) for higher risk patients (Hx GIB, Age > 65, other anticoagulant use)
  - Concomitant use of anti-platelet and anticoagulant agents has never been show to increase risk of pericardial hemorrhage

- Ibuprofen 600-800 TID
- ASA 650-1000 mg TID
- Indocin 50 mg TID

- Taper dose after 1-2 weeks, often need 3-4 weeks of therapy
Acute Pericarditis, Rx

- Colchicine
  - Generally recommended with NSAIDs for initial Rx of pericarditis
  - In conjunction with NSAIDS
    - Improves symptoms
    - Reduces recurrence
    - Generally well tolerated

ICAP Trial
- Randomized, double blind
- Colchicine vs placebo
- 0.5 mg BID if > 70 kg, 0.5 mg QD if ≤ 70 kg
- 3 month duration of therapy
- In conjunction with ASA or Ibuprofen


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<thead>
<tr>
<th>1ICAP Trial</th>
<th>COLCHICINE</th>
<th>PLACEBO</th>
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<tbody>
<tr>
<td>Recurrent Pericarditis</td>
<td>17%</td>
<td>38%</td>
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<tr>
<td>Symptoms at 72 Hours</td>
<td>19%</td>
<td>40%</td>
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<tr>
<td>Hospitalization Rate</td>
<td>5%</td>
<td>14%</td>
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Acute Pericarditis, Rx

• Colchicine
  - Meta-analyses have shown RR of recurrent pericarditis of 0.4
  - Not studied for bacterial or malignant pericarditis
  - GI side effects uncommon at 1.2 mg/day
  - Side effects increase with renal insufficiency
  - Not indicated in US for prevention of recurrent pericarditis: off-label

Acute Pericarditis, Rx

• Colchicine
  - 3 Months therapy for acute pericarditis
  - 6 Months therapy for recurrent pericarditis
  - No need to taper off

Acute Pericarditis, Rx

• Glucocorticoids
  - Primarily for use if NSAIDS +/- Colchicine are ineffective or contraindicated
  - Exclude treatable causes (i.e. TB)
  - Systemic inflammatory disease, pregnancy, CRI
Acute Pericarditis, Rx

- Glucocorticoids
  - Prednisone 0.2-0.5 mg/kg/day
  - High dose (1 mg/kg/day) actually less effective and associated with more side effects
  - Add colchicine whenever able
  - Taper at 2-4 weeks if symptoms and CRP better

- Randomized trials with steroids lacking
- Observational data suggest higher recurrence
- COPE Trial\(^1\) gave steroids if ASA intolerant
  - RR recurrent pericarditis 4.3

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- Prolonged catheter pericardial drainage, surgical pericardiotomy, balloon pericardiotomy
  - Very rarely indicated for acute pericarditis
  - Occasionally for recurrent
Conclusions

- The pericardium is associated with several diseases - spontaneous, iatrogenic, co-morbid
- Pericardial effusion treatment dependent upon symptoms and/or need for diagnosis
- NSAIDS with Colchicine (rather than steroids) for Acute Pericarditis