Cardiovascular Infections

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Objectives

Review:
- Anatomy
- Pathophysiology
- Diagnostic Tools
- Treatment
Today’s Topics

- Pericarditis
- Myocarditis
- Endocarditis
Why Does This Matter?

- Potentially High morbidity/mortality, especially if unrecognized
- May mimic STEMI (pericarditis/myocarditis)
- May mimic Heart Failure (myocarditis)
Layers of the Heart wall
PERICARDIUM

Parietal Pericardium
(Fibrous)

Visceral Pericardium
(Serous)

Pericardial Space
(15-50cc fluid)

Diagram depicting the relationship between the pericardium and heart.
Functions of the Pericardium

- Maintains the heart in a relatively fixed position
- Reduces friction between the heart and surrounding organs
- Provides barrier against spread of infection from contiguous organs
- Prevents sudden dilatation of cardiac chambers during acute volume loading
Acute Pericarditis

- Inflammation of the Pericardium
Causes

- **Idiopathic/Viral**: 90%
- Bacterial
- Myocardial Infarction
- TB
- Connective tissue disorders
- Malignancy
- Uremia
- Myxedema
- Radiation
- Aortic Dissection
- Postpericardiotomy
- Drug induced:
  - (Procainamide, Hydralazine, Doxorubicin, Isoniazid, Diphenylhydantoin, Methyldopa, Methysergide)
- Post traumatic
Viral Causes

- Coxsackie virus (most common)
- Echo virus
- HIV
Histology

- Looking at the pericardial tissue under a microscope
Clinical Presentation

Symptoms:

- Retrosternal Chest pain
- Dyspnea
- Fever
- Symptoms of underlying systemic disease, e.g. cough, sputum production
“Classic” Symptoms

- Chest pain worse with laying down
- Pain relieved with sitting up and leaning forward
- Pleuritic pain (worse with deep breathing and coughing)
“Signs” vs. “Symptoms”

- **Signs**: Objective (ie, exam findings [murmur])
- **Symptoms**: Subjective info from the patient (ie, chest pain, SOB, nausea…)
Differential Diagnosis

Life Threatening causes with similar presentations:

- Pulmonary Embolism
- Myocardial Infarction
- Aortic Dissection
- Other bad things...
Exam Findings

- **Friction Rub**
  - Transient (comes and goes)
  - Scratchy/Leathery sound
  - Best heard during expiration with patient sitting upright
  - Can be difficult to hear (especially while transporting)
Diagnostic Studies

- ECG
- Labs (crp, esr)
- CXR
- ECHO (ultrasound)
ECG Findings

- Diffuse ST Segment Elevation
  - especially precordial leads

- PR depression
  - II, aVF

![Image of ECG with concave-up ST elevation and PR segment depression]
Pericarditis
## Theoretical Differences Between MI and Pericarditis

<table>
<thead>
<tr>
<th></th>
<th>Myocardial Ischemia or Infarction</th>
<th>Pericarditis</th>
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<tbody>
<tr>
<td><strong>Character</strong></td>
<td>Pressure-like, heavy, squeezing</td>
<td>Sharp, stabbing, occasionally dull</td>
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<tr>
<td><strong>Change with respiration</strong></td>
<td>No</td>
<td>Worsened with inspiration</td>
</tr>
<tr>
<td><strong>Change with position</strong></td>
<td>No</td>
<td>Worse when supine; improved when sitting up or leaning forward</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Minutes (ischemia); hours</td>
<td>Hours to days</td>
</tr>
<tr>
<td></td>
<td>(infarction)</td>
<td></td>
</tr>
<tr>
<td><strong>Response to nitroglycerin</strong></td>
<td>Improved</td>
<td>No change</td>
</tr>
<tr>
<td><strong>Physical examination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Friction rub</strong></td>
<td>Absent (unless pericarditis is</td>
<td>Present in 85% of patients</td>
</tr>
<tr>
<td></td>
<td>present)</td>
<td></td>
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<tr>
<td><strong>ECG</strong></td>
<td></td>
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<tr>
<td><strong>ST-segment elevation</strong></td>
<td>Localized convex</td>
<td>Widespread concave</td>
</tr>
<tr>
<td><strong>PR-segment depression</strong></td>
<td>Rare</td>
<td>Frequent</td>
</tr>
<tr>
<td><strong>Q waves</strong></td>
<td>May be present</td>
<td>Absent</td>
</tr>
<tr>
<td><strong>T waves</strong></td>
<td>Inverted when ST segments are</td>
<td>Inverted after ST segments have normalized</td>
</tr>
<tr>
<td></td>
<td>still elevated</td>
<td></td>
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</table>
EMS Treatment

- Follow Chest Pain Protocol
- Dane County:
  - 12-lead
  - IV
  - O2
  - Aspirin
  - ? Nitro/morphine
  - ? STEMI alert if unclear
  - ? Call Med Control
Hospital Treatment

- NSAIDs (ibuprofen (motrin), ketorolac (toradol))
- Specific treatment aimed at underlying cause identified
- May need cardiac monitoring, ECHO, cardiology consult
- Usually need close Follow-up
Complications of pericarditis

- Pericardial Effusion (may lead to tamponade)
- Constrictive Pericarditis (CHF-like symptoms)
- Recurrent chest pain
Pericardial Effusion

- Fluid accumulation within the pericardial sac

![Diagram showing normal heart and pericardial effusion](image_url)
Cardiac Tamponade

- Fluid accumulation that leads to restricted ventricular filling
- Rate of pericardial fluid accumulation more important than volume of fluid
Cardiac Tamponade

Compression of the heart due to fluid accumulation within the pericardium

- Sternum
- Heart
- Pericardium
- Fluid within pericardium
Findings

- **Beck’s Triad**
  - Hypotension
  - Distended Neck Veins
  - Muffled/distant heart sounds

- **Pulsus Paradoxus**
  - On auscultation heart beat will be present but radial pulse will not be palpable (on inspiration) because of very low stroke volume at that time due to surrounding pericardial pressure

- **Electrical Alternans**
Electrical alternans = tamponade

- Beat to beat variation in R wave amplitude
- Only 20% of cases
Ultrasound Image of Effusion
Myocarditis
Myocardium

- Muscle layer of the heart
- Muscle cells are called cardiac-myocytes
- Provides squeeze for the heart
Myocarditis

- Inflammation of the myocardium **NOT** due to ischemia
Histology
Causes

- Viral (most common)
  - Coxsackie
  - Echo
  - Influenza
  - EBV

- Bacterial
  - Lyme
  - Mycoplasma

- Chemo-therapy / Radiation

- Rheumatologic
  - Lupus
Clinical Presentation

- Chest pain
- Fever
- Fatigue/Myalgias/Headache/chills
- CHF-like symptoms (If severe)
  - SOB
  - Extremity Swelling
  - Dyspnea on exertion
Clinical Presentation

- Spectrum of disease process
- Mild-to-severe
- Can cause sudden death
- Patients may also present in the subclinical phase, with minimal symptoms
- Can also have pericarditis (myopericarditis)
Findings

- Tachycardia
- Hypotension
- Pericardial rub
- Symptoms of CHF (JVD, edema, crackles, etc)
- Arrhythmia
ECG Findings

- Sinus tachycardia
- QRS / QT prolongation
- Diffuse T-wave inversion
Myocarditis
Diagnosis

- ECG
- ECHO (Ultrasound)
- Labs (cardiac enzymes, reactive markers)
- Biopsy
Treatment

- Admission
- Supportive therapy mainstay of treatment
- Specific treatment aimed at underlying cause identified
Endocarditis
Endocardium

- Inner most layer of the heart
Endocarditis

- Inflammation of the endocardium
- Usually involves the valves of the heart
Anatomy
An inside View of Infective Endocarditis

This cross-section shows vegetations (blood clots & bacteria) on the four heart valves.
Background

- 3-10/100 000/year
- Maximum incidence at the age of 70-80
- More common in women
- *Staphylococcus aureus* is the most common pathogen
Infective Endocarditis (IE)

- Valves
  - Native valve
  - Prosthetic valve (ie, mitral/aortic valve replaced)
- Device-related IE (ICD)
- May be Health-care associated (hospitalized patient)
- Community acquired IE
- Intravenous drug abuse-associated IE
**Risk factors**

- IV drug use (40 times higher incidence)
  - 1/500 incidence among IV drug users
  - Usually involves Right sided valves (tricuspid valve) >50%
  - Usually staph aureus bacteria

- Valve damage/abnormality
  - Hx of Rheumatic Fever
  - Congenital valve malformations
Congenital Bicuspid Aortic Valve

- Normal tricuspid aortic valve
- Position of aortic valve in the heart
- Bicuspid aortic valve
Mechanical Aortic Valve

Mechanical valve

Tissue valve

Artificial valve is sewn in place

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Signs/ Symptoms

- **Fever** - over 90% of patients
- New intra-cardiac **murmur** - about 85% of patients
- Janeway lesions
- Osler Nodes
- Splinter Hemorrhages
- Roth spots (you won’t see this pre-hospitally)
Janeway lesions: flat, pain/ess, red to bluish-red spots on the palms and soles.
Osler’s Nodes: painful, red, raised lesions found on the hands and feet
Splinter hemorrhages

Tiny blood clots that run vertically under the nails
Roth Spot’s

Funduscopic exam findings.....so don’t worry about these
Difficult Diagnosis!!

Start with broad differential

Positive Blood Culture

ECHO
  Transesophageal echocardiogram (TEE) showing vegetations on the valves
Vegetation marked with arrow on valve
Treatment

- Admit
- IV antibiotics
- May need cardiothoracic surgery if severe
- Supportive Treatment
Complications

- Septic Emboli
  - Cerebral (stroke)
  - Septic (pneumonia, abscess)
  - Heart failure
Cardiac Infections can affect all 3 layers of the heart
- Pericarditis, Myocarditis, Endocarditis

- Keep your differential broad
- If you don’t think about it, you won’t be able to diagnose it
- There is a spectrum of disease, may look sick or might look good
- 12-lead is mandatory with any chest pain complaint
Questions?
Thanks

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