embocs The EM Educator Series

The EM Educator Series: Pericarditis

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Case 1: A 25-year-old male presents with chest pain that worsens when lying down and improves with sitting forward. He just recovered from an upper respiratory infection one week ago.

Case 2: EMS activates a "CODE STEMI" from the field for a 30-year-old female with diffuse ST elevations and chest pain, which is unrelieved by nitroglycerin.

Questions for Learners:

- 1. What are the causes of pericarditis?
- 2. How can pericarditis present?
- 3. What is the differential of ST elevation on the ECG?
- 4. What is the differential for low voltage on the ECG?
- 5. What should be included in the ED evaluation of pericarditis, and what are important considerations?

Suggested Resources:

- Articles
 - o <u>CORE EM</u>
 - o <u>EM@3AM</u>
 - o <u>ECG Pointers</u>
 - o <u>FOAMCAST</u>
 - o <u>EMCRIT ECG</u>
 - o WikEM
- Journal Articles
 - o https://www.ncbi.nlm.nih.gov/pubmed/29173671
 - o https://pubmed.ncbi.nlm.nih.gov/32306444/
 - o https://www.ncbi.nlm.nih.gov/pubmed/26542793

Answers for Learners:

1. What are the causes of pericarditis?

Pericarditis has a wide range of underlying causes, including infectious, autoimmune, neoplastic, metabolic, traumatic, and pharmacologic. In the United states and Europe, pericarditis is most commonly idiopathic and presumed to be viral. Dresser's Syndrome is now considered rare due to reperfusion therapy reducing the incidence of transmural myocardial infarction.

Infectious	Toxic/ Metabolic	Systemic Diseases	Postinjury	Other
Bacterial	Uremia	Rheumatoid Arthritis	Myocardial Infarction	Tumors
Fungal	Medication Related	Sarcoidosis	Trauma	Aortic Dissection
Parasitic		Systemic Lupus Erythematosus (SLE)	Surgery	
Viral		Dermatomyositis	Radiation	
		Amyloidosis		
		Scleroderma		

- Risk factors go hand in hand with the above causes of the disease
 - o Transmural MI
 - Cardiac surgery
 - Neoplasm
 - Recent viral or bacterial Infections
 - Uremia / history of dialysis
- In developing countries, pericarditis due to tuberculosis is common (70% of all cases)
- Prior to widespread availability of antiretroviral therapy, pericardial disease was the most frequent cardiovascular manifestation of the acquired immune deficiency syndrome (AIDS).

2. How can pericarditis present?

Symptoms:

- Chest pain that is the most common presenting symptom (~85% of cases).
- Described as: sharp /pleuritic, improved by leaning forward, worse with lying down, and often radiates towards the left trapezius (pathognomonic for pericarditis).
- May have associated signs and symptoms specific to underlying disorders.
 - Preceding prodrome (fever, chills, myalgias, gastroenteritis) to suggest associated viral prodrome.
 - \circ $\;$ Symptoms related to autoimmune disease or malignancy.

Physical Exam:

- Pericardial friction rub (1/3 of cases)
 - Occurs due to friction caused by sliding the inflamed visceral pericardium against the parietal pericardium (or the parietal pericardium against the pleura).
 - Heard best along lower left sternal border and apex with patient upright and leaning forward.

- Described as a scratchy or squeaky sound (may sound like walking on dry snow).
- Manifestations of Pericardial Effusion (typically mild)
 - Beck's triad (hypotension, muffled heart sounds, distended jugular veins).
 - Pulsus paradoxus (drop in systolic blood pressure > 10 mm Hg during inspiration).

Diagnosis:

- Acute Pericarditis: requires two of four criteria.
 - Characteristic Chest Pain
 - Sharp/pleuritic that is improved by sitting up and leaning forward.
 - Pericardial Friction rub
 - Typical EKG changes: Widespread ST Elevation and/or PR depression
 - New or worsening pericardial effusion
 - Additional Supporting findings include elevated inflammatory markers and evidence of pericardial inflammation on CT or MRI. [3, 4]
- Incessant Pericarditis: Pericarditis lasting for >4-6 weeks, but less than 3 months without remission.
- Recurrent Pericarditis: History of acute pericarditis with a 4-6 week period free of symptoms followed by recurrence of symptoms.
- Chronic Pericarditis: Pericarditis lasting for greater than 3 months.

3. What is the differential of ST elevation on the ECG?

ST Elevation

- Cardiac
 - ST-segment elevation myocardial infarction (STEMI)
 - Post-MI (ventricular aneurysm pattern)
 - Previous MI with recurrent ischemia in same area
 - \circ Wellens' syndrome
 - Coronary artery vasospasm (eg, Prinzmetal's angina)
 - Coronary artery dissection
 - \circ Pericarditis
 - o Myocarditis
 - Aortic dissection in to coronary
 - $\circ~$ Left ventricular aneurysm
 - Left ventricular pseudoaneurysm
 - Early repolarization
 - Left bundle branch block
 - Left ventricular hypertrophy (LVH)

- o Myocardial tumor
- o Myocardial trauma
- RV pacing (appears as Left bundle branch block)
- Brugada syndrome
- o Takotsubo cardiomyopathy
- AVR ST elevation
- Other thoracic
 - Pneumomediastinum
 - Pneumothorax
 - o Pulmonary embolism
- Metabolic
 - Drugs of abuse (eg, cocaine, crack, meth)
 - Cocaine chest pain
 - Hyperkalemia (only leads V1 and V2)
 - Hypothermia ("Osborn J waves")
- Medications
 - $\circ~$ Tricyclic (TCA) toxicity
 - \circ Digoxin

- ECG is a reliable diagnostic tool, but distinguishing pericarditis from acute MI is the first and most important step.
 - Although, classically pericarditis presents with diffuse ST-elevations, localized ST-elevations are possible.
 - In acute pericarditis, ST-depressions should not be present except in leads V1 and aVR.
 - Acute pericarditis is often associated with PR depression.
 - \circ $\;$ STE in leads II and III helps differentiate STEMI from pericarditis.
 - STE II > STE III favors pericarditis.
 - STE III > STE II is highly suspicious for STEMI.
 - Spodick's Sign is seen in approximately 80% of patients with acute pericarditis and is represented by down-sloping of the TP Segment. This is best seen in lead II and the lateral precordial leads.
 - ST elevations are more commonly convex with STEMI, while concave upwards ST elevations are more likely to be pericarditis., There are also often concurrent T wave inversions, reciprocal changes (ST Depressions), Q waves, as well as dynamic changes in STEMI.
 - <u>ST Segment Depression in aVL helps differentiate inferior STEMI from pericarditis and is</u> <u>sensitive and specific for coronary occlusion in inferior MI.</u>
 - The ST Elevation vector in inferior STEMI occurs between 60-120° in leads II and III. This is a difference of 90° to 150° from lead aVL (-30°) and should result in some reciprocal ST-segment depression in lead aVL. Diffuse inflammation of the pericardium in pericarditis results in an ST axis of approximately 45° (apex of the heart). This is a difference of 75° to lead aVL (-30°) and should not result in reciprocal ST-segment depression in lead aVL.
- Only 60% of patients will manifest the classical findings in pericarditis of widespread ST elevation.
- PR depression is most common in the interior (II, III, aVF) and precordial leads (V2-V6).
- Over the course of disease the EKG may evolve significantly.
- Diffuse ST elevation -> normalization of ST and PR segments -> negative T wave deflection -> overall normalization.

4. What is the differential for low voltage on the ECG?

Cardiac

- Post-MI
- Infiltrative cardiomyopathy
- Myocarditis
- Hypothyroidism

Pericardial

- Effusion
- Constrictive pericarditis
- Pneumopericardium

Extracardiac

- COPD (limb leads)
- Pneumomediastinum
- Pneumothorax
- Pleural effusion
- Pulmonary edema
- Peripheral edema
- Obesity



5. What should be included in the ED evaluation of pericarditis, and what are important considerations?

Echocardiogram

- Up to 60% cases will have pericardial effusion.
 - Most effusions are mild (<10mm), but always consider cardiac tamponade.
 - Large effusions (>20mm) are associated with complications / increased mortality.

Although most patients can be safely sent home on empiric anti-inflammatory therapy, certain features are indicative of increased risk for complication and poor prognosis (nonidiopathic causes). The likely need for admission and need for targeted work up and therapy are divided into major and minor "red flags". Hospital admission and search for etiology is necessary or indicated in patients with high risk features, and one feature alone is sufficient to identify a high-risk case. These features have been verified by multivariate analysis. The "minor" red flags are based on clinical expertise and literature review and should also prompt consideration for admission.

- Major Red flags
 - Fever (>100.3°F, 38°C)
 - Subacute onset
 - Large pericardial effusion (>20mm on echocardiography)
 - Cardiac tamponade
 - Failure or lack of response to NSAID after 1 week of treatment.
- Minor red flags (based on expert opinion)
 - Pericarditis associated with myocarditis
 - o Immunosuppression
 - o **Trauma**
 - Current use of anticoagulants