NON-TRAUMATIC PERICARDIAL EFFUSION / INFECTIOUS PERICARDITIS

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Disease Demographics

- Isolated pericardial effusion is a common finding in clinical practice and may be detected as an incidental finding during echocardiography or other imaging studies. Etiologies are myriad and include infections, cancer, connective tissue diseases, pericardial injury syndromes, metabolic causes, and myocardial, pericardial, and aortic diseases.
- The most common causes pericarditis, cardiac trauma, and iatrogenic myocardial perforation during intravascular procedures.
- Pericarditis is the most common type of pericardial disease worldwide and a relatively common cause of chest pain.
    - Etiologies of pericarditis are infectious (viral, bacterial) or noninfectious (systemic inflammatory diseases, cancer, post-cardiac injury syndromes).
    - Tuberculosis is a major cause of pericarditis in developing countries, but accounts for $\leq 5\%$ of cases in developed countries.
    - Idiopathic, presumed viral, causes of pericarditis account for 80-90% of cases in developed countries.
- Recurrence of pericarditis occurs in 1/3 of patients who present with idiopathic or viral pericarditis. The pathogenesis of recurrence is not well established but may include a new viral infection, reinfection, chronic infection, treatment failures, and autoimmune diseases have all been implicated.

Clinical Presentation

- The classic and most common presentation of pericarditis is chest pain: sharp, pleuritic, improved by sitting up and leaning forward.
- Pericardial friction rub is present in approximately one-third of cases.
- EKG changes are present in 60% of cases and consist of widespread ST-segment elevation or PR depression.
- Specific features at presentation are indicative of poor prognosis and serve as criteria for hospital admission:
    - temperature > 38°C
    - subacute course (onset over the course of more than one week, but less than three months)
    - large effusion (> 20 mm by echocardiographic assessment) or tamponade
    - failure of NSAID therapy.

Evaluation / Diagnostics / Imaging

- Diagnostic criteria for acute pericarditis include at least two of the following: 1) chest pain, 2) pericardial friction rub, 3) EKG changes, or 4) new or worsening pericardial effusion, which is usually mild and present in 60% of cases.
- Additional supportive criteria for pericarditis:
    - elevation of inflammatory markers (CRP, ESR and leukocytosis)

    - evidence of pericardial inflammation by an imaging technique (contrast-enhanced pericardium on CT scan or pericardial edema and pericardial late gadolinium enhancement on cardiac MRI).
- Diagnostic criteria for **recurrent pericarditis** include all of the following: 1) documented first attack of acute pericarditis according to criteria, 2) symptom-free interval of at least 4-6 weeks, and 3) recurrent pain combined with at least one of the following: a) pericardial friction rub, b) EKG changes, c) new or worsening pericardial effusion, or d) elevation in WBC, ESR, or CRP.

Role of Conservative Management and Associated Considerations

- The most common treatment for idiopathic and viral pericarditis in North America and Europe is NSAID therapy.
- Adjunctive management with colchicine is associated with 50% lower recurrence rates.
    - Colchicine has commonly been used for management of recurrent pericarditis, but recent literature supports its use in combination with NSAID therapy for the management of first episodes of acute pericarditis. Specific treatment decisions should include an assessment of the risk/benefit profile (gastrointestinal intolerance, myotoxicity, hepatotoxicity, blood count reduction, and alopecia).
- Corticosteroids are second-line therapy for patients who do not respond, are intolerant of, or have contraindications to NSAIDs and colchicine.
- Duration of anti-inflammatory therapy is individualized. Endpoints include symptom resolution and normalization of inflammatory biomarkers (a typical duration is 1-2 weeks). Tapering, with an overall 4-6 week course of therapy, may be considered to reduce recurrence risk (level B evidence).
- The recommendation for exercise restriction is based only on expert opinion (level C evidence).
- Optimal management of patients with multiple recurrences and patients who are unable to take colchicine or who have failed colchicine therapy is unclear. Medical options include oral azathioprine, IV human immunoglobulin, and anakinra (an interleukin-1 receptor antagonist).

Indications for Operative Intervention

- Pericardiocentesis is indicated for
    - cardiac tamponade
    - Imminent tamponade
    - bacterial pericarditis
    - A neoplastic etiology is suspected.
- Pericardial window may be utilized for
    - management of postoperative pericardial effusions
    - initial management of bacterial pericardial effusions
    - management of symptomatic, recurrent pericardial effusions.
- Pericardiectomy is indicated for

- chronic, permanent constrictive pericarditis
- recurrent pericardial effusions/tamponade
- refractory, recurrent pericarditis that is not responsive to any medical therapy.

Pre-operative Preparation / Impact of Associated Conditions

- Correction of coagulopathy, thrombocytopenia and platelet dysfunction.
- Pre-procedure or pre-operative echocardiography: Tricuspid valve regurgitation (TR) may be an important complicating feature of constrictive pericarditis. Adjunctive tricuspid valve repair may be indicated for patients who have moderate or worse TR at the time of pericardiectomy.
- Pericardiocentesis: Arrange for intra-procedural ultrasound and echocardiography availability.
- Pericardial window and pericardiectomy: Arrange for intraoperative TEE availability. This can be used to assess the effect of the intervention and to monitor cardiac function in patients with limited reserve due to the disease process or otherwise.

Operative Techniques / Intraoperative Considerations

- Techniques for pericardiocentesis:
  - 1) subxiphoid: the safest approach in the emergent situation when ultrasound is not available The needle is inserted into the angle between the xiphoid process and left costal margin at a 45-degree angle relative to the transverse plane; the needle is then directed toward the left shoulder. A sheathed needle is used, and a guide wire and dilator are sequentially employed to introduce a drainage catheter, (typically, a pigtail angiocatheter) into the pericardial space. The drainage catheter is left in place to drain pericardial fluid. The catheter may be placed to gravity drainage with a bag or may be aspirated with a syringe; the latter technique may be more helpful in the immediate, post-procedure period.
  - 2) parasternal: the needle is inserted close to the sternum, usually in the left 5^{th} intercostal space. The cardiac notch of the left lung leaves the pericardium exposed at this site. The needle is advanced into the pericardial effusion utilizing ultrasound guidance.
  - 3) apical: this is the least commonly used approach. The needle is placed 1 cm outside the apex beat in the corresponding left intercostal space. The needle is then directed toward the right shoulder. If the patient can be tilted toward the left lateral position, this allows pericardial fluid to accumulate around the apex of the heart.
- Techniques for pericardial window:
  - 1) subxiphoid approach: this approach can be used for the treatment of postoperative or infectious pericardial effusions. If the patient has had a recent median sternotomy, this procedure can be performed via a small extension of the original incision or sometimes without an additional incision. If the patient has an infectious pericardial effusion, this approach decreases the risk of pleural

empyema. The procedure can be performed utilizing general anesthesia, monitored anesthesia care, or local anesthesia. The rectus abdominis muscle is divided through the linea alba. The xiphoid process is exposed and dissection proceeds beneath it cephalad. The pericardium is incised, the pericardial space is drained, and a Jackson-Pratt drain or small chest tube is placed.
    - 2) transpleural approach (performed thoracoscopically or open via a small thoracotomy incision): this may be a better option for a persistent or recurrent pericardial effusion. A left-sided approach is generally preferred, because most patients have levocardia, and more pericardium is present on the left. General anesthesia is required, and single-lung ventilation is necessary for the thoracoscopic approach. Pericardial drainage includes wide pericardiectomy to prevent reaccumulation of effusion. Care should be taken to protect the phrenic nerve by staying anterior to its course. A chest tube is placed for lung re-expansion and fluid drainage prior to closure.
- Pericardiectomy:
    - is usually performed for management of constrictive pericarditis. Pericardiectomy can also be considered in patients with severe, relapsing pericarditis in whom appropriate medical management has failed.
    - Types of pericardiectomy include: 1) complete, 2) radical, and 3) anterior.
    - Approaches include: 1) median sternotomy, 2) left anterolateral thoracotomy, and 3) bilateral thoracotomy.
    - During pericardiectomy, request minimal paralysis during dissection near nerves; identification of the left phrenic nerve may be difficult.
    - Low threshold for using cardiopulmonary bypass to facilitate dissection in pericardiectomy for constrictive pericarditis.
- Pericardial fluid should be sent for bacterial, viral and fungal cultures to delineate etiology.

Postoperative Management / Complications

- Cardiac puncture with resultant hemopericardium is the primary and most significant complication associated with pericardiocentesis. Many other potential complications are possible and involve anatomic structures in proximity to the site of the procedure (arterial bleeding, injury to the stomach/colon/liver).
- The postoperative course after pericardiectomy is usually uncomplicated. When treating inflammatory pericarditis that has been refractory to medical management, leaving even small amounts of residual pericardium may lead to recurrent symptoms.

Considerations for Special Populations

- Pregnancy: An isolated benign, mild pericardial effusion is common during pregnancy (40% by the 3rd trimester). If pericarditis is diagnosed, nonselective cyclooxygenase inhibitors and aspirin are used during the 1st and 2nd trimesters, but should be withdrawn by 32 weeks gestational age because of the possible effects on ductus arteriosus and renal function. Prednisone can be used throughout pregnancy and during breastfeeding.

Colchicine is generally contraindicated during pregnancy because it is a US FDA pregnancy category C medication.

- Purulent (bacterial) pericarditis: This is a rare disease with a high mortality (20-30%). In addition to culture-directed antibiotic therapy, intrapericardial fibrinolysis may be attempted in the early phase of the disease. If this fails, pericardiectomy is the primary treatment.

Selected Readings

- Imazio M, Gaita F, LeWinter M. Evaluation and treatment of pericarditis: a systematic review. JAMA 2015;314:1498-506.
- Imazio M. Contemporary management of pericardial diseases. Curr Opin Cardiol 2012;27:308-17.
- Imazio M, Adler Y. Management of pericardial effusion. Eur Heart J 2013;34:1186-97.
- Imazio M, Adler Y. Treatment with aspirin, NSAID, corticosteroids, and colchicine in acute and recurrent pericarditis. Heart Fail Rev 2013;18:355-60.
- Loukas M, Walters A, Boon JM, et al. Pericardiocentesis: a clinical anatomy review. Clin Anat 2012:25:872-81.
- Cho YH, Schaff HV. Surgery for pericardial disease. Heart Fail Rev 2013;18:375-87.