Pericardial Disease: Anatomic Abnormalities

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Key Points

- Pericardial disease is characterized pathologically by the composition of the pericardial fluid and the cellular components of the inflammatory exudate.
- Infectious and non-infectious causes of pericarditis occur.
- The pericardium may be involved by metastatic or primary neoplasms and cysts.

The important diagnostic features of specimens from biopsy procedures or operative resections of the pericardium are (1) the overall thickness of the pericardium, (2) the presence and type of cellular infiltrates (acute or chronic inflammatory cells, granulomas, or neoplastic cells), (3) morphology of the mesothelial lining cells, (4) infective agents (including appropriate culture and staining procedures), and (5) extracellular deposits (calcium, fibrin, thrombus, and amyloid), either on the surface or within the tissue itself.

Pericardial Fluid

To correctly interpret the morphologic findings, one must know the cytologic, microbiologic, and chemical characteristics of the pericardial fluid that is removed when the tissue sample is obtained. Serous fluid can be found in patients with congestive heart failure, hypoalbuminemia, or irradiation-induced injury. Bloody fluid (hematocrit >10%) can be due to cardiac surgery, penetrating or nonpenetrating injury (including the complications of cardiac catheterization), coagulopathies, overdoses of anticoagulants, complications of chemotherapy [cyclophosphamide], acute myocardial infarction, rupture of the heart or a major vessel, neoplasms, tuberculosis, or chronic renal disease [uremic pericarditis]. Fluid that contains lymph or chyle can result from pericardial neoplasms or obstruction (due to neoplasm, iatrogenic injury, or other causes) of the thoracic duct, pulmonary hilum, or superior vena cava. Pericardial, pleural, and peritoneal chylous effusions also have been reported in patients with pulmonary lymphangiomatosis. Some cases of idiopathic or primary chylopericardium have also been reported. Cholesterol-rich fluid (“gold paint”) is the hallmark of cholesterol pericarditis, which has been reported in patients with myxedema, rheumatoid arthritis, tuberculosis, and other conditions. Purulent pericardial fluid can be caused by bacterial, fungal, or parasitic infections of the pericardium.

Mesothelial Hyperplasia

Mesothelial hyperplasia may be focal or diffuse and is found most frequently in patients with underlying heart disease [i.e., chronic pericarditis or rheumatic heart disease]. The mesothelial cells may form tumor-like masses within the pericardial space. More frequently, mesothelial hyperplasia is diffuse along the parietal or visceral pericardium. Reactive mesothelial cells are multilayered, and nests of mesothelial cells often lie within the pericardial stroma. Again, the cells are remarkably uniform in appearance, with minimal pleomorphism. Mitoses may be seen. Differential special staining of mesothelial cells and carcinoma cells, together with the clinical history, should distinguish mesothelial hyperplasia from metastatic carcinoma involving the pericardium.

Mesothelial hyperplasia may be a complication of treatment with radiotherapy for patients with carcinoma, or it may develop secondary to the pericarditis that sometimes follows the spread of carcinoma to the pericardium. Thus, because of the known coexistence of the two conditions, the diagnosis of metastatic carcinoma involving the pericardium is not excluded by the finding of mesothelial hyperplasia alone.

Pericarditis

Pericarditis can be infectious or noninfectious. The most common causes of bacterial pericarditis are infection with staphylococci, streptococci, pneumococci, or Pseudomonas...
species. Nontuberculous infective pericarditis most often occurs as a complication of cardiothoracic surgery, disseminated infections in patients receiving immunosuppressive or antineoplastic therapy, rupture of the esophagus (as a consequence of a neoplasm) into the pericardial cavity, or infective endocarditis (associated with a septic coronary embolus or the rupture of a ring abscess or a myocardial abscess).

Tuberculous pericarditis continues to be clinically important. Four stages of this disorder have been described:

1. A fibrinous stage, which is associated with a granulomatous reaction [caseating granulomas]
2. A stage of effusion (which can be serous, serosanguineous, or bloody)
3. A stage of pericardial thickening by fibrous tissue and granulomas
4. A stage of cardiac constriction, in which the pericardial space is obliterated by fibrous adhesions

In the fourth stage, the granulomas may disappear completely and be replaced by fibrous tissue, with or without accompanying calcium deposits. A number of parasites have been reported to invade the pericardial cavity. The most commonly encountered is Entamoeba histolytica. Among fungi, Coccidioides, Actinomyces, Histoplasma, and Candida are known causes of pericarditis.

Pericarditis, usually serofibrinous but occasionally bloody, also occurs in association with viral diseases, including infectious mononucleosis, mumps, measles, smallpox, and influenza. Coxsackieviruses are considered the most common cause of viral pericarditis and probably account for the majority of the cases of idiopathic pericarditis.

Pericardial involvement, ranging from fibrinous exudation (Fig. 67.1) to large, bloody effusions, occurs in collagen vascular diseases, including acute rheumatic fever, rheumatoid arthritis, scleroderma, and systemic lupus erythematosus, as well as in chronic renal disease (uremic pericarditis). Bloody effusions also have been reported in patients with Gaucher’s disease.

Fibrous thickening of the pericardium can occur with or without focal or diffuse adhesions (oblitative pericarditis) forming between the visceral and parietal pericardium. Morphologic examination reveals that the fibrous thickening results from the presence of large, coarse bundles of collagen, which often are hyalinized. Very frequently, however, the cause of the scarring is not evident on morphologic examination. Amyloid deposits can be a cause of constrictive or restrictive pericardial and myocardial disease and should be specifically sought in biopsy specimens from patients with these clinical syndromes. Chronic fibrous pericarditis also can result from the healing of hemopericardium in the presence of serosal injury, irradiation, chronic renal disease, rheumatoid arthritis, systemic lupus erythematosus, scleroderma, or infectious agents, particularly tuberculosis. In nearly all these processes, the fibrous thickening can be associated with calcium deposits (fibrocalcific pericarditis). Obliterative and fibrocalcific pericarditis may be associated with granulomatous inflammation (granulomatous pericarditis) [Fig. 67.2]. The granulomas may be caused by infective agents [Mycobacterium tuberculosis, fungi, or parasites], cholesterol, talc or starch (particularly in patients undergoing thoracic surgical procedures), rheumatoid arthritis (in which they bear a resemblance to rheumatoid nodules), and sarcoidosis (Figs. 67.3 and 67.4). Examination of tissue sections by polarized light microscopy can be helpful in the identification of deposits of cholesterol, talc, and starch. Healed granulomas also can undergo considerable degrees of calcification.

Obliterative and fibrocalcific pericarditis may be associated with the clinical syndromes of subacute pericarditis and chronic constrictive pericarditis. The latter condition is more often idiopathic than tuberculous in origin.

Pericardial Tumors

The pericardium is involved much more frequently with metastatic neoplasms than with primary neoplasms, and carcinomatous invasion is more common than sarcomatous
invasion. The most common primary malignant tumor of the pericardium is mesothelioma. The majority of pericardial mesotheliomas diffusely cover the parietal and visceral pericardium, encasing the heart. Solitary or localized pericardial mesotheliomas are distinctly rare. Histologically, localized mesotheliomas are identical to diffuse mesotheliomas and may be of the epithelioid or fibrous type. Microscopically, mesotheliomas are characterized by cellular regularity and histologic variability. They consist of either tubules or solid cords of malignant cells (in a tubular or tubulopapillary pattern) or of spindle-shaped cells with a connective tissue stroma (fibrous pattern). Frequently, both patterns are present in the same tumor. In either histologic pattern, the cells usually are strikingly regular in appearance, and the nuclei most frequently are large, rounded, and vesicular, with prominent nucleoli. Cellular pleomorphism and anaplasia are unusual, and atypical mitoses are rare, although multinucleated cells and occasional mitoses may be seen. Fibrous or mixed fibrous and epithelioid mesotheliomas predominate in the pericardium, as in the pleura.

Mesotheliomas, whether nodular or sheetlike, only superficially invade contiguous structures, including the heart. This is an important differential diagnostic point, in that other primary cardiac sarcomas, most notably, angiosarcomas, can diffusely involve the pericardium but almost invariably have a significant intramyocardial or intracavitary component.

Pericardial mesotheliomas frequently spread to the adjacent pleura and mediastinum and may involve the mediastinal lymph nodes. Occasionally, pericardial mesotheliomas spread through the diaphragm and involve the peritoneum. Distant metastases are extremely unusual.

Pericardial Cysts

Although most pericardial cysts are attached to the parietal pericardium along the border of the right side of the heart, usually at the right costophrenic angle, approximately 25% are present along the border of the left side of the heart. Eight percent project into the posterior or anterior superior mediastinum. The cysts range in diameter from 1 to 15 cm or larger. They commonly appear multilocular externally, however, although the cyst lining is occasionally trabeculated, most cysts are unilocular. They contain clear yellow fluid and occasionally communicate with the pericardial sac. The wall of the cyst is composed mainly of collagen and scattered elastic fibers and is lined by mesothelial cells. Although these mesothelial cells usually form a single layer, foci or hyperplastic mesothelial cells are occasionally encountered. Rarely, foci of calcification and accumulations of lymphocytes and plasma cells are present.

The pericardial cyst and the pericardial diverticulum are microscopically similar, and both probably originate as persistent, blind-ending parietal pericardial recesses.

Pericardial cysts may be detected in patients from childhood to old age, although the majority are discovered during the third or fourth decade of life. Some tumors of the pericardium, such as lipoma, hemangioma, or lymphangioma, may simulate the clinical and radiologic picture of pericardial cysts. Ultrasonic diagnosis and computed tomography may be helpful in the differentiation of pericardial cysts from solid tumors of the pericardium.

Summary

Pericardial disease frequently presents as pericarditis with variable fluid accumulation (effusion). Important diagnostic features relate to the character of the inflammatory cells and nature of the fluid. Pericarditis can result from infectious and noninfectious, inflammatory conditions, and may be accompanied by mesothelial cell hyperplasia. The pericardium may be involved by metastatic or primary neoplasms and cysts.
References


