# DETECTION AND EARLY DIAGNOSIS OF CARDIOVASCULAR DISEASES

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**Introduction**: Myocarditis is inflammation of the myocardium with necrosis of cardiomyocytes. Myocarditis can be caused by a variety of factors (e.g., infectious diseases, cardiotoxins, drugs, systemic diseases such as sarcoidosis), but is most often idiopathic. Symptoms can be varied and include fatigue, shortness of breath, edema, tachycardia, and sudden death.

Diagnosis is based on symptoms and clinical findings, including abnormal electrocardiogram, cardiac biomarkers, and cardiac imaging in the absence of cardiovascular risk factors. Endomyocardial biopsy confirms the clinical diagnosis of myocarditis. Treatment depends on the cause, but common measures include medications and devices to treat heart failure and arrhythmias, and rarely, surgery (e.g., intra-aortic balloon pump, left ventricular assist device, transplantation). Immunosuppression is used in some types of myocarditis (e.g., hypersensitivity myocarditis, giant cell myocarditis, and myocarditis caused by sarcoidosis).

**Methods and Materials:** Infectious myocarditis in the United States and other developed countries is most commonly of viral etiology ( 1 ). The most common viral causes in the United States are parvovirus B19 and human herpesvirus 6. In low-income countries, infectious myocarditis is most commonly associated with rheumatic carditis, Chagas disease, or HIV infection ( 2 ). Direct myocardial injury due to SARS-CoV-2 infection is rare in patients with COVID-19, with symptoms ranging from mild chest discomfort to fulminant myocarditis, but the risk of myocarditis is 16-fold higher in infected patients than in uninfected patients ( 3 ).

**Research objective.** Noninfectious causes include cardiotoxins, certain drugs, and certain systemic diseases. Drug-induced myocarditis is called hypersensitivity myocarditis. Myocarditis following COVID-19 vaccination with mRNA-based vaccines is rare and less common than COVID-associated myocarditis ( 4 ). It occurs primarily in adolescent and young adult males, usually within a week of vaccination, and is usually mild. Giant cell myocarditis is a rare form of myocarditis with a fulminant course. The etiology is unclear, but it may involve an autoimmune mechanism. Biopsy reveals characteristic multinucleated giant cells. Patients with giant cell myocarditis are in cardiogenic shock and often suffer from persistent ventricular arrhythmias or

complete atrioventricular block. Giant cell myocarditis has a poor prognosis, but it should be excluded in a healthy patient with heart failure or persistent arrhythmias, as immunosuppressive therapy may improve survival.

**Results**: The clinical manifestations of myocarditis are diverse. Patients may have minimal clinical manifestations or fulminant heart failure and fatal arrhythmias. Symptoms depend on both the etiology of myocarditis and the severity of myocardial damage.

Symptoms of heart failure may include fatigue, shortness of breath, and edema. Patients may have signs of fluid overload, such as wheezing, increased jugular venous pressure, and edema.

A third (S3) or fourth (S4) heart sound may be heard on cardiac examination. Patients with ventricular dilatation may have systolic murmurs of mitral regurgitation, as well as tricuspid regurgitation. Patients with pericarditis may present with chest pain typical of pericarditis. Dull or sharp precordial or retrosternal pain may radiate to the neck, trapezius muscles (especially on the left), or shoulders. The pain varies from mild to severe. The pain may be relieved by sitting or leaning forward. Unlike ischemic pain, pericarditis pain is usually aggravated by chest movement, coughing, breathing, or swallowing. A pericardial friction rub may be heard in patients with pericardial effusion.

**Conclusion**: The clinical presentation of myocarditis ranges from subclinical symptoms to fulminant heart failure, persistent arrhythmias, and sudden cardiac death.

Diagnosis is often based on clinical signs and noninvasive tests, including cardiac MRI; endomyocardial biopsy is performed if patients have fulminant heart failure or persistent arrhythmias, or if the results change treatment.

Patients with heart failure and arrhythmias should be treated; immunosuppression is added for sarcoidosis or drug-induced myocarditis and giant cell myocarditis.

Pericarditis is an inflammation of the pericardium, often with fluid accumulation in the pericardial cavity. Pericarditis can occur for a variety of reasons (e.g., infectious diseases, myocardial infarction, trauma, tumors, metabolic disorders), but is most often idiopathic. Symptoms of pericarditis include chest pain or tightness, often worsened by deep breathing. If cardiac tamponade or constrictive pericarditis develops, cardiac output may be significantly reduced. Diagnosis is based on symptoms, auscultatory findings (pericardial friction rub), electrocardiographic changes, and the presence of fluid accumulation in the pericardial cavity on radiographs or echocardiography. Further investigation is required to determine the cause.

Treatment depends on the cause, but usually includes analgesics, anti-inflammatory drugs, colchicine, and occasionally surgery.

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