

myocarditis  
[created by Paul Young 15/10/07]

general

- inflammation of the heart muscle
- commonest feature on myocardial biopsy is infiltration of the myocardium with lymphocytes & fibroblasts accompanied by myocyte necrosis (associated with lymphocytic myocarditis)

- (i) active viral
- (ii) post viral (lymphocytic)
- (iii) hypersensitivity
- (iv) autoimmune
- (v) infectious
- (vi) giant cell myocarditis

aetiology

**TABLE 1. CAUSES OF MYOCARDITIS.\***

INFECTIOUS	IMMUNE-MEDIATED	TOXIC MYOCARDITIS
Bacterial: brucella, <i>Corynebacterium diphtheriae</i> , gonococcus, <i>Haemophilus influenzae</i> , meningococcus, mycobacterium, <i>Mycoplasma pneumoniae</i> , pneumococcus, salmonella, <i>Serratia marcescens</i> , staphylococcus, <i>Streptococcus pneumoniae</i> , <i>Strep. pyogenes</i> , <i>Treponema pallidum</i> , <i>Tropheryma whippelii</i> , and <i>Vibrio cholerae</i> Spirochetal: borrelia and leptospira Fungal: actinomyces, aspergillus, blastomyces, candida, coccidioides, cryptococcus, histoplasma, mucormycoses, nocardia, and sporothrix Protozoal: <i>Toxoplasma gondii</i> and <i>Trypanosoma cruzi</i> Parasitic: ascaris, <i>Echinococcus granulosus</i> , <i>Paragonimus westermani</i> , schistosoma, <i>Taenia solium</i> , <i>Trichinella spiralis</i> , visceral larva migrans, and <i>Wuchereria bancrofti</i> Rickettsial: <i>Coxiella burnetii</i> , <i>Rickettsia rickettsii</i> , and <i>Rick. tsutsugamushi</i> Viral: coxsackievirus, cytomegalovirus, dengue virus, echovirus, encephalomyocarditis, Epstein-Barr virus, hepatitis A virus, hepatitis C virus, herpes simplex virus, herpes zoster, human immunodeficiency virus, influenza A virus, influenza B virus, Junin virus, lymphocytic choriomeningitis, measles virus, mumps virus, parvovirus, poliovirus, rabies virus, respiratory syncytial virus, rubella virus, rubeola, vaccinia virus, varicella-zoster virus, variola virus, and yellow fever virus	Allergens: acetazolamide, amitriptyline, cefaclor, colchicine, furosemide, isoniazid, lidocaine, methyldopa, penicillin, phenylbutazone, phenytoin, reserpine, streptomycin, tetanus toxoid, tetracycline, and thiazides Alloantigens: heart-transplant rejection Autoantigens: Chagas' disease, <i>Chlamydia pneumoniae</i> , Churg-Strauss syndrome, inflammatory bowel disease, giant-cell myocarditis, insulin-dependent diabetes mellitus, Kawasaki's disease, myasthenia gravis, polymyositis, sarcoidosis, scleroderma, systemic lupus erythematosus, thyrotoxicosis, and Wegener's granulomatosis	Drugs: amphetamines, <b>anthracyclines</b> , catecholamines, cocaine, cyclophosphamide, <b>ethanol</b> , fluorouracil, hemetine, interleukin-2, lithium, and trastuzumab Heavy metals: copper, iron, and lead Physical agents: electric shock, hyperpyrexia, and radiation Miscellaneous: arsenic, azides, bee and wasp stings, carbon monoxide, inhalants, phosphorus, scorpion bites, snake bites, and spider bites

\*The most common causes are shown in boldface type. Data are from Liu et al,<sup>9</sup> Anandasabapathy and Frishman,<sup>26</sup> and Caforio and McKenna.<sup>27</sup>

- Coxsackie virus B (an enterovirus) is the most common cause of viral myocarditis
- HIV is generally associated with another infection rather than being causative itself
- Rheumatic fever is an important post-infectious cause
- Systemic diseases such as SLE, polymyositis, scleroderma & sarcoidosis can be complicated by myocarditis
- Infiltrative cardiomyopathies such as haemochromatosis or amyloidosis may have myocarditis as a feature

clinical presentation

- most often presentation is with chest pain, fatigue, dyspnoea & palpitations
- frequently there is prodrome of fever, malaise & arthralgias
  - examination can show fever, tachycardia, S3 & S4, pericardial rub & signs of biventricular failure
- rarely patients present with a fulminant course with severe acute heart failure, pulmonary oedema & cardiogenic shock

investigations

- blood tests may reveal leukocytosis, eosinophilia & an elevated ESR; cardiac biomarkers may be elevated & rheumatological serological markers and HIV testing should be undertaken
  - ECG shows sinus tachycardia and nonspecific ST elevation & T wave changes most often
  - there may be arrhythmias or conduction block
  - echocardiography is essential

- myocardial biopsy is the most definitive diagnostic technique with histopathological diagnosis made on the basis of the Dallas criteria
- biopsy should be strongly considered when results will affect management

clinical course

- patients with heart failure & myocarditis can recover normal LV function; however, a number progress to chronic cardiomyopathy
- paradoxically, patients with fulminant myocarditis have the best long-term prognosis with >90% 1 year and 10 year survival rates

therapy

- intensive care therapies:
  - inotropes and vasopressors may be required
  - in patients with fulminant myocarditis, mechanical ventricular assist devices & IABP should be considered because of the potential for spontaneous resolution & good outcome
  - cardiac transplant is the final option for treating critically ill patients with myocarditis; however, it should only be used as a last resort
- immunosuppressive therapies:
  - clinical trials do not support the routine use of immunosuppressive in patients with lymphocytic myocarditis; however, this treatment should be considered in patients positive biopsy findings who continue to deteriorate despite routine care & in patients with severe heart failure
  - immunosuppressive therapy should be used in patients with myocarditis associated with rheumatological diseases

general heart failure therapies:

- there are no controlled trials in humans that have evaluated standard heart failure medications in patients with myocarditis; however, use of ACE inhibitors in particular is supported by animal models & beta blockers & aldosterone antagonists are also used