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

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 will fulminant myocarditis have the best long-term prognosis with >90% 1 year and 10 year survival rates

therapy

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

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

- 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)

aetiology

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

TABLE 1. CAUSES OF MYOCARDITIS.*

INFECTIOUS	IMMUNE-MEDIATED	TOXIC MYOCARDITIS
Bacterial: brucella, *Corynebacterium diphtheriae,* gonococcus, *Haemophilus influenzae,* meningococcus, mycobacterium, *Mycoplasma pneumoniae,* pneumococcus, salmonella, *Serratia marcescens,* staphylococcus, *Streptococcus pneumoniae, Strep. progenes, Treponema pallidum, Tropheryma whippelii,* and *Vibrio cholerae* Spirochetal: borrelia and leptospira Fungal: actinomyces, aspergillus, blastomyces, candida, coccidioides, cryptococcus, histoplasma, mucormycoses, nocardia, and sporothrix Protozoal: *Toxoplasma gondii* and *Trypanosoma cruzi* Parasitic: ascaris, *Echinococcus granulosus, Paragonimus westermani,* schistosoma, *Taenia solium, Trichinella spiralis,* visceral larva migrans, and *Wuchereria bancrofti* Rickettsial: *Coxiella burnetii, Rickeusia rickettsii,* and *Rick. tsutsugamushi* 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,** ***Chlamydia pneumoniae,*** 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, **anthracyclines,** catecholamines, cocaine, cyclophosphamide, **ethanol,** 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.[9] Anandasabapathy and Frishman,[26] and Caforio and McKenna.[27]

- 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
- Rhematic 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