



# VIRUSES IN MAY

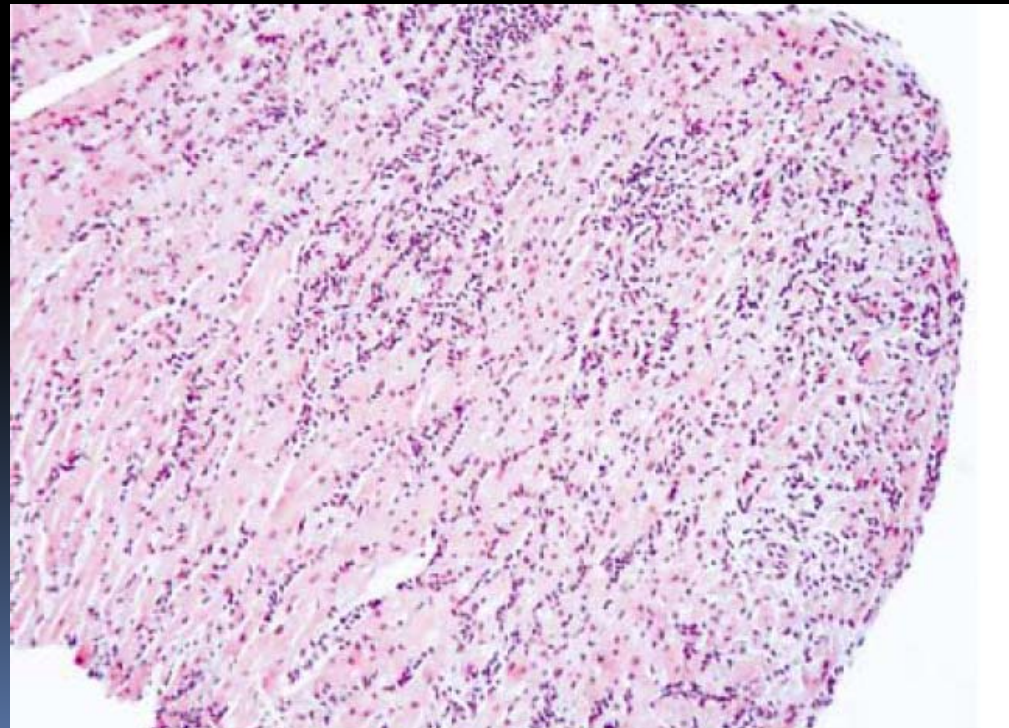
Patrick Groenestein

# VIRAL CARDIOMYOPATHY



# Myocarditis

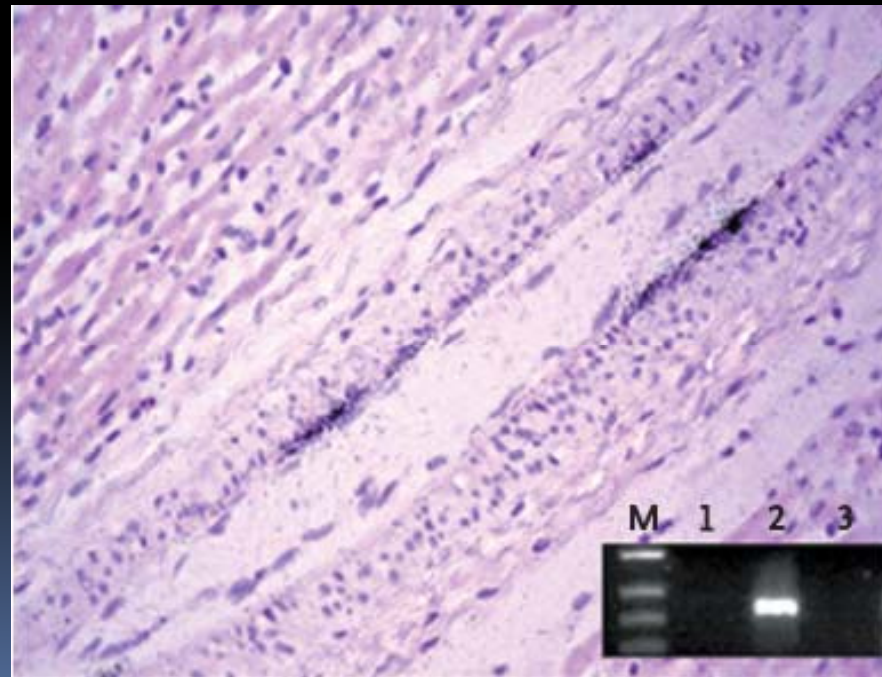
- Myocarditis is an inflammatory condition of myocardial muscle cells with diverse causes.





# Myocarditis

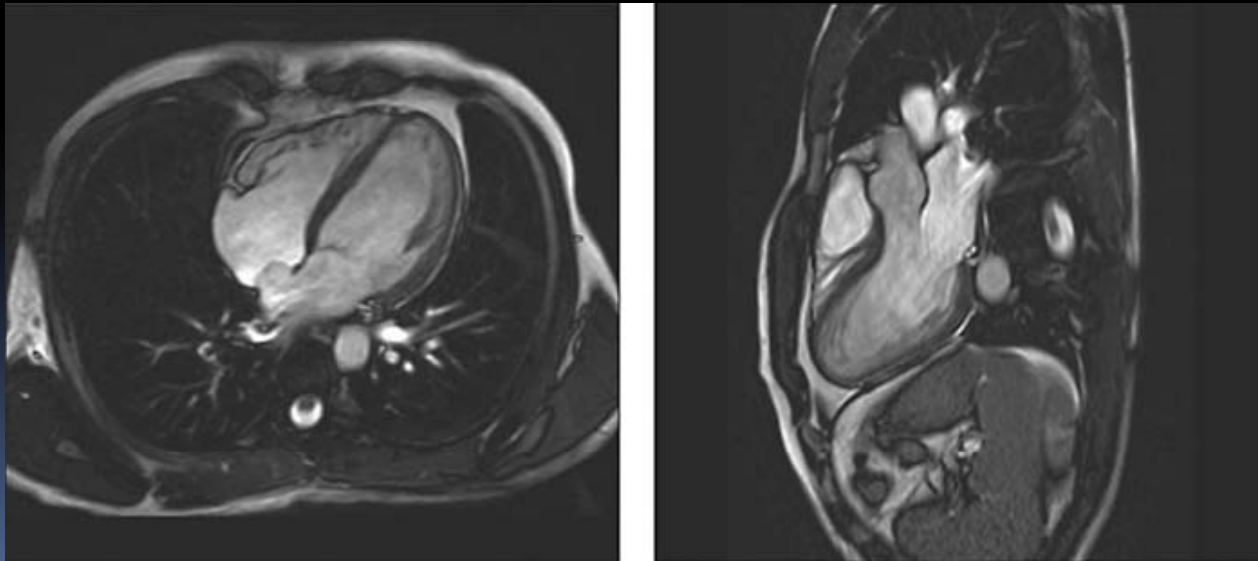
- Wide range of clinical presentation from mild dyspnoea to cardiovascular collapse and death.





# Myocarditis

- Historically, myocarditis referred to any non-valvular heart disease, but now used for inflammatory causes not associated with infarction, injury, or congenital genetic abnormalities.





# Myocarditis: non-viral causes

- Bacterial
  - *C. diphtheriae*, mycobacteria, gonococcus, salmonella, *H. influenzae*, ...
- *Spirochaetes*
- Fungal
  - Aspergillus, mucormycoses, candida
- Parasitic
  - Ascaris, *Trichinella spiralis*, *Taenia spp.*
- Rickettsial



# Myocarditis: non-viral causes

- Immune mediated
  - Allergens
    - Drugs: actazolamide, penicillins, cefachlor, thiazides...
  - Allo-antigens
    - Heart transplant (rejection)
  - Auto-antigens
    - Scleroderma, SLE, Chagas' disease, Churg-Strauss, thyrotoxicosis



# Myocarditis: non-viral causes

- Toxic
  - Drugs
    - Anthracyclines, catecholamines, lithium, cocaine
  - Heavy metals
  - Electric shock, hyperpyrexia, radiation
  - Stings & bites
  - Others
    - Arsenic, phosphorus, CO,



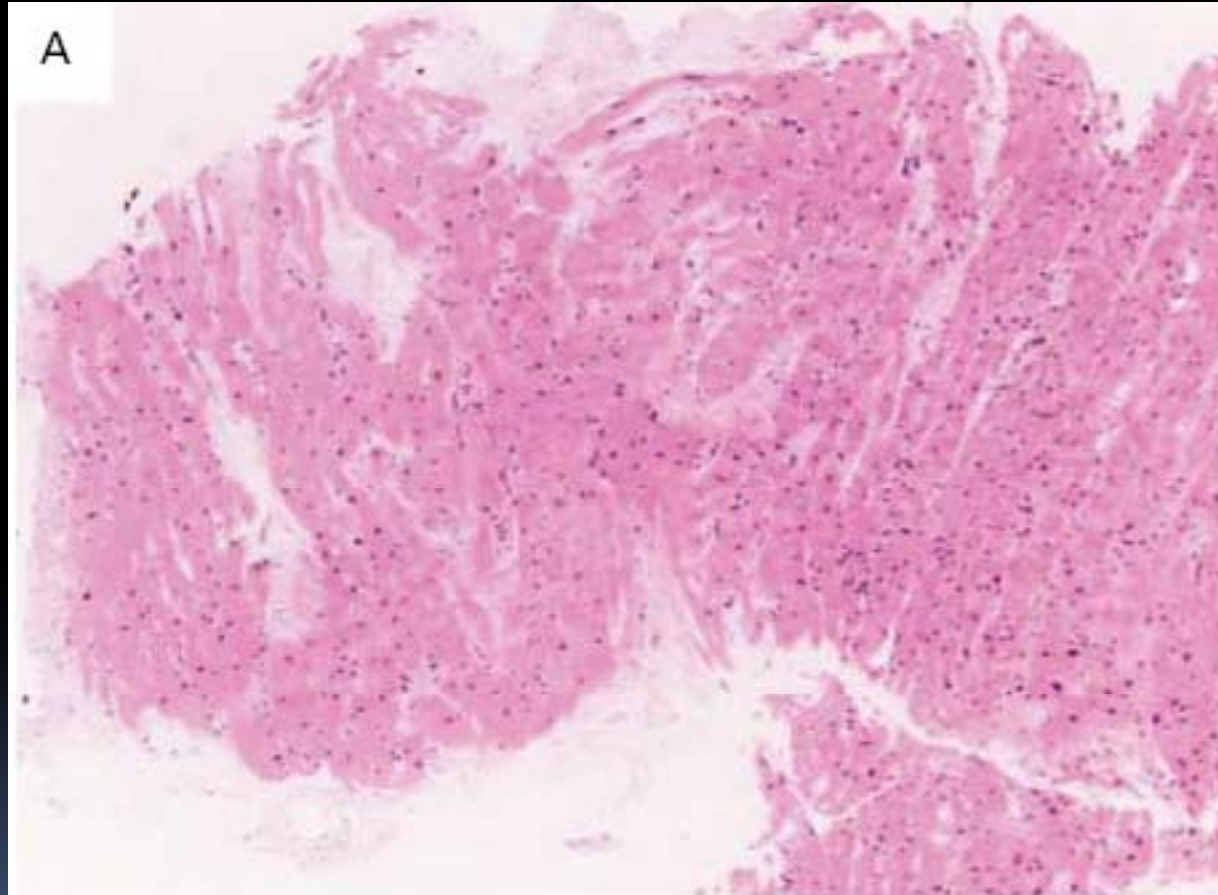
# Viral Myocarditis

- Commonest known cause
  - Most myocarditis is not identified in the community
  - Cause often never established.
- Epidemiology:
  - Sudden death in the young: ~20% attributed to myocarditis on autopsy evidence.
  - Prospective / retrospective autopsy rates of 1-9%
  - Dallas criteria established 1986





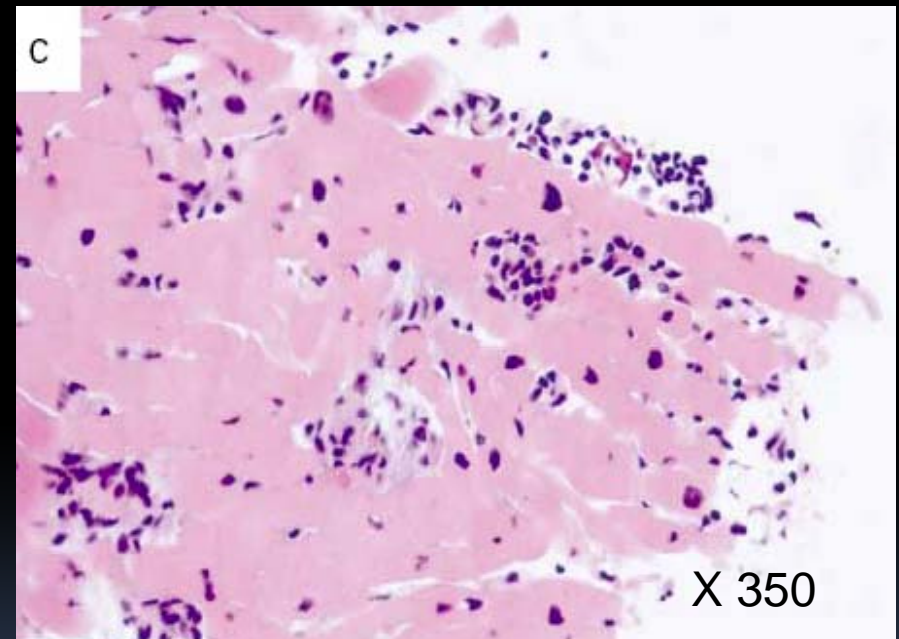
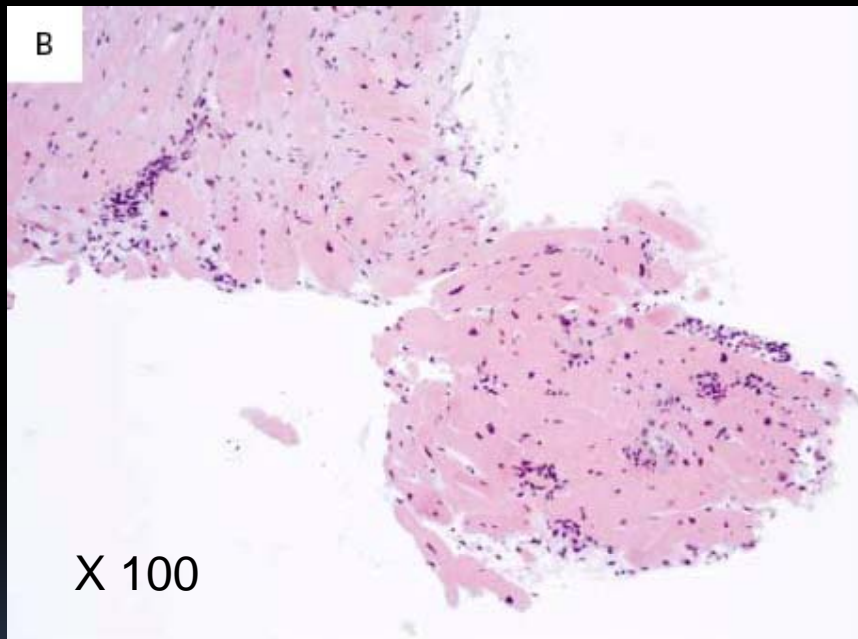
# Dallas criteria: normal



Feldman AM, McNamara D. *Myocarditis* **NEJM** 2000; **343** (19); 1388:

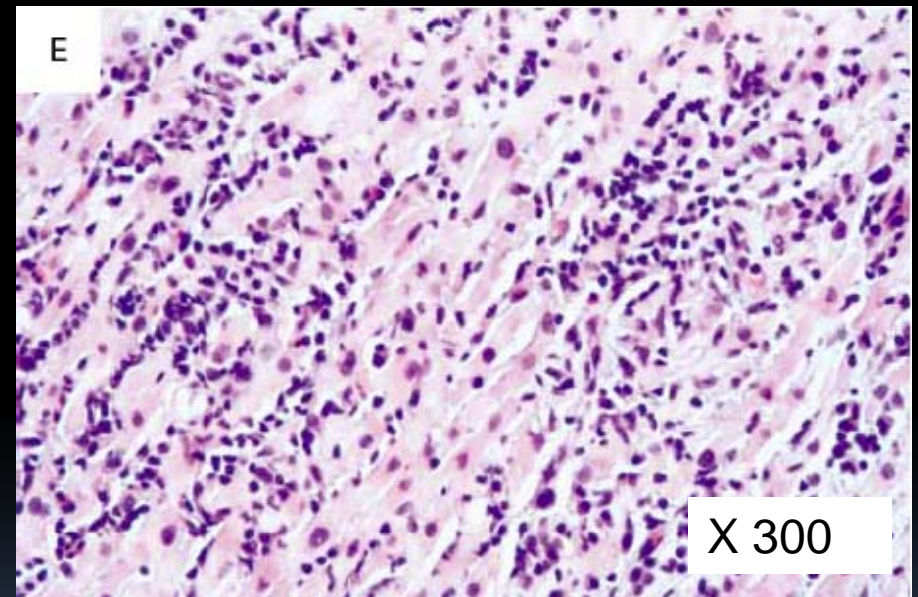
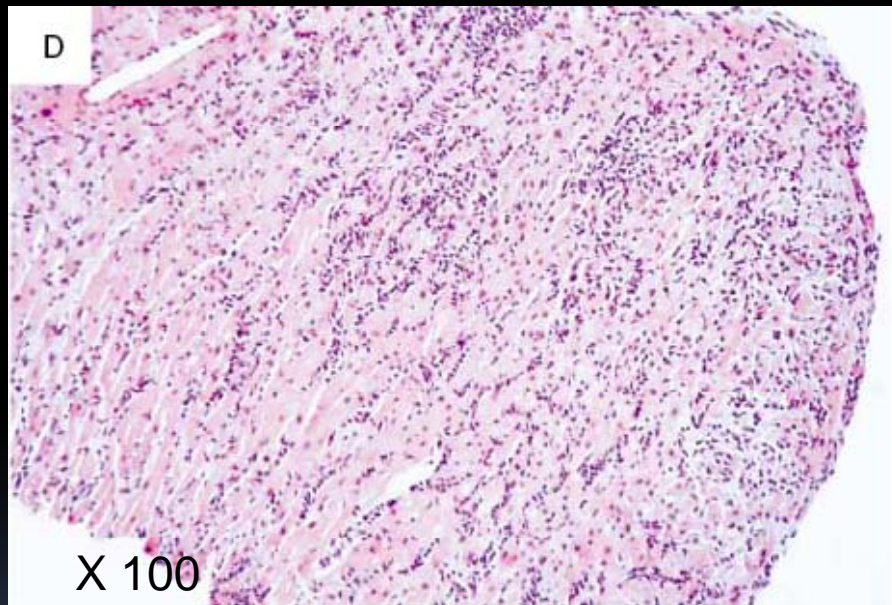


# Dallas criteria: borderline myocarditis





# Dallas criteria: active myocarditis





## Dallas criteria

- Only 10% of those clinically considered to have myocarditis were positive on Dallas criteria
- Myocarditis is often regional, so biopsies can miss the active areas of inflammation



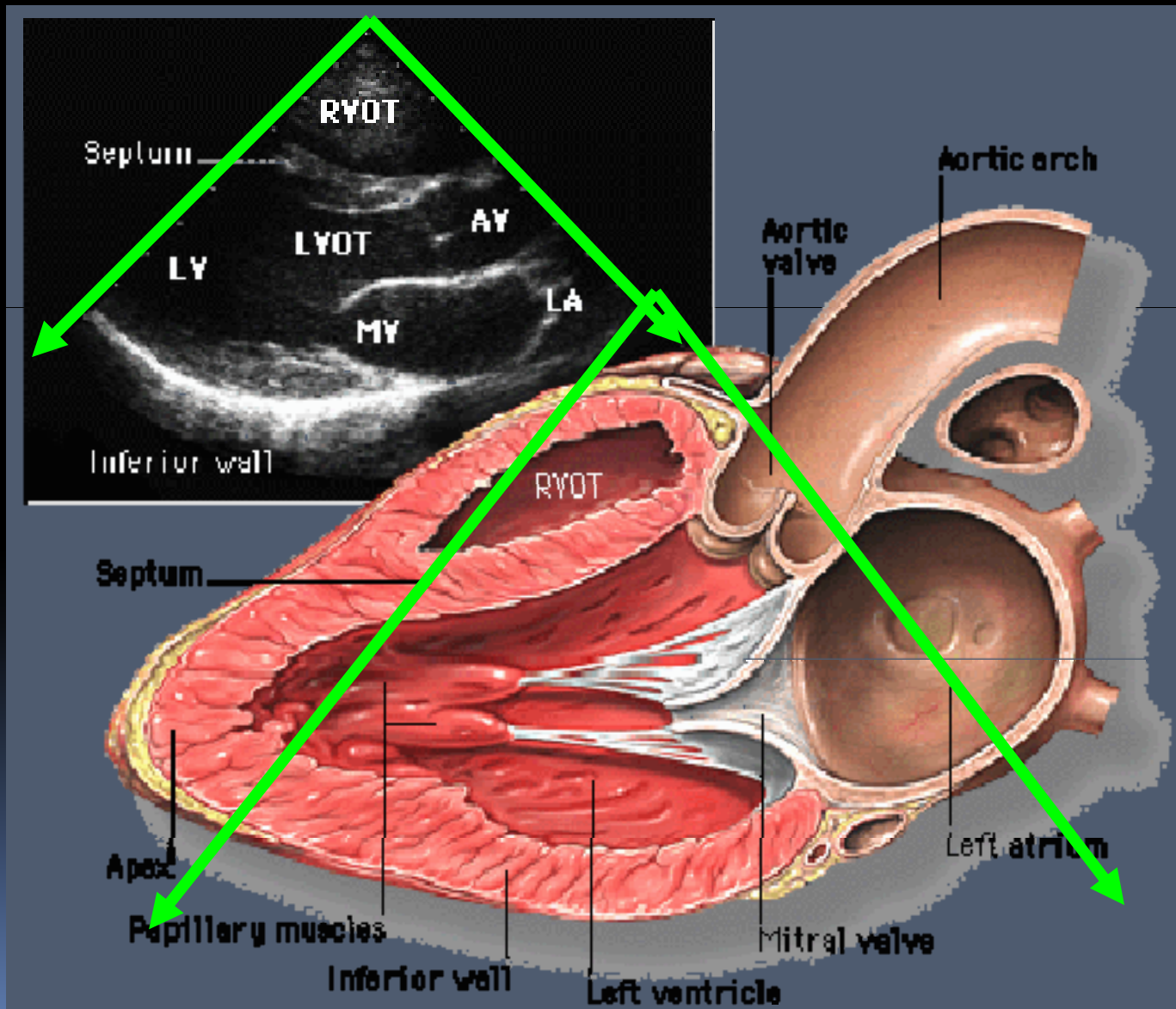


# HIV

- High numbers of asymptomatic persons with HIV have evidence of dilated cardiomyopathy
- Pro-viral DNA not routinely found in myocytes, and other viruses (CMV, EBV HCV) are also present.
  - Unclear whether HIV or its immune suppression are responsible



# Dilated cardiomyopathy





# Normal parasternal long axis



# Dilated cardiomyopathy

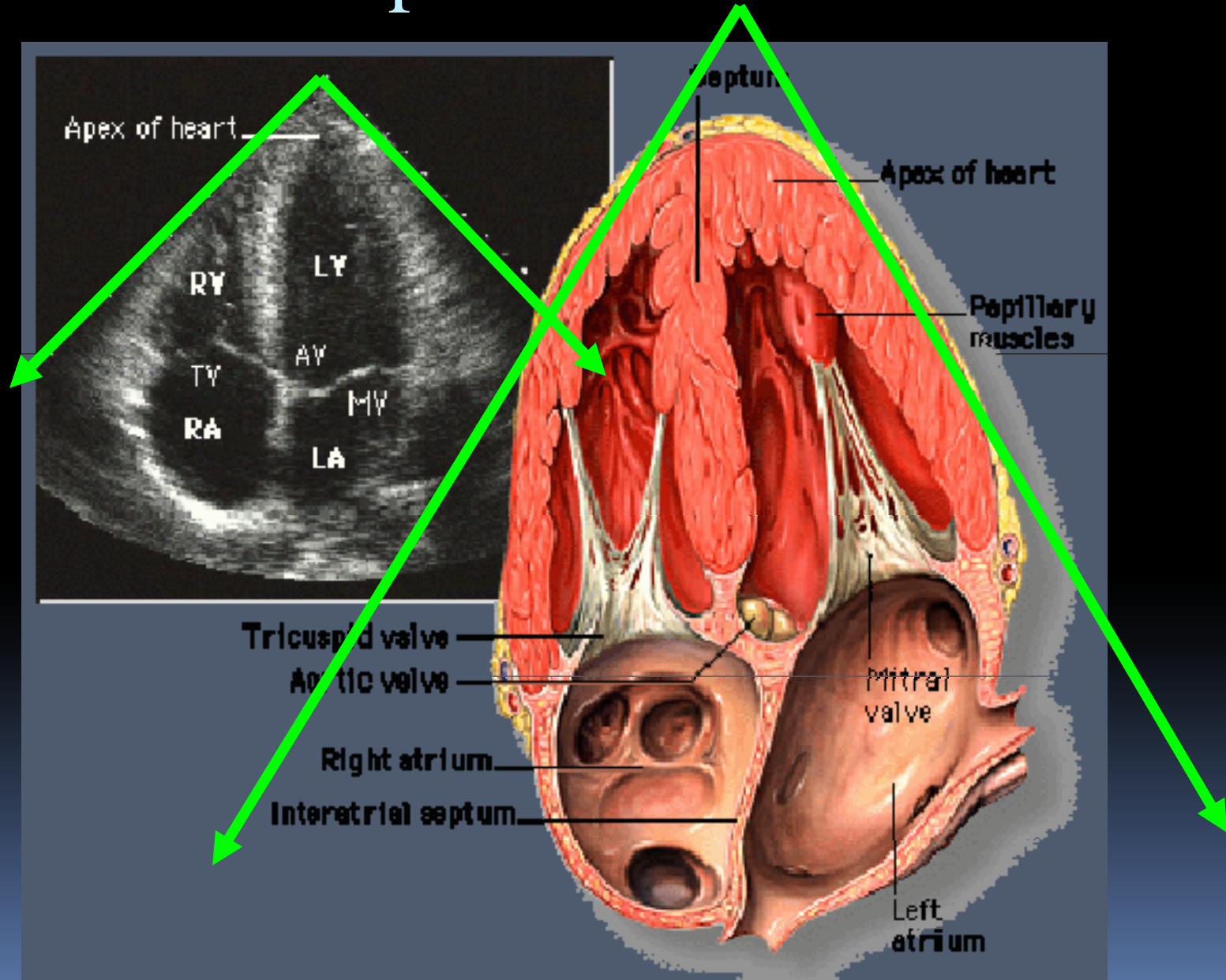




# Dilated cardiomyopathy



# Apical 4-chamber





# Normal A4C



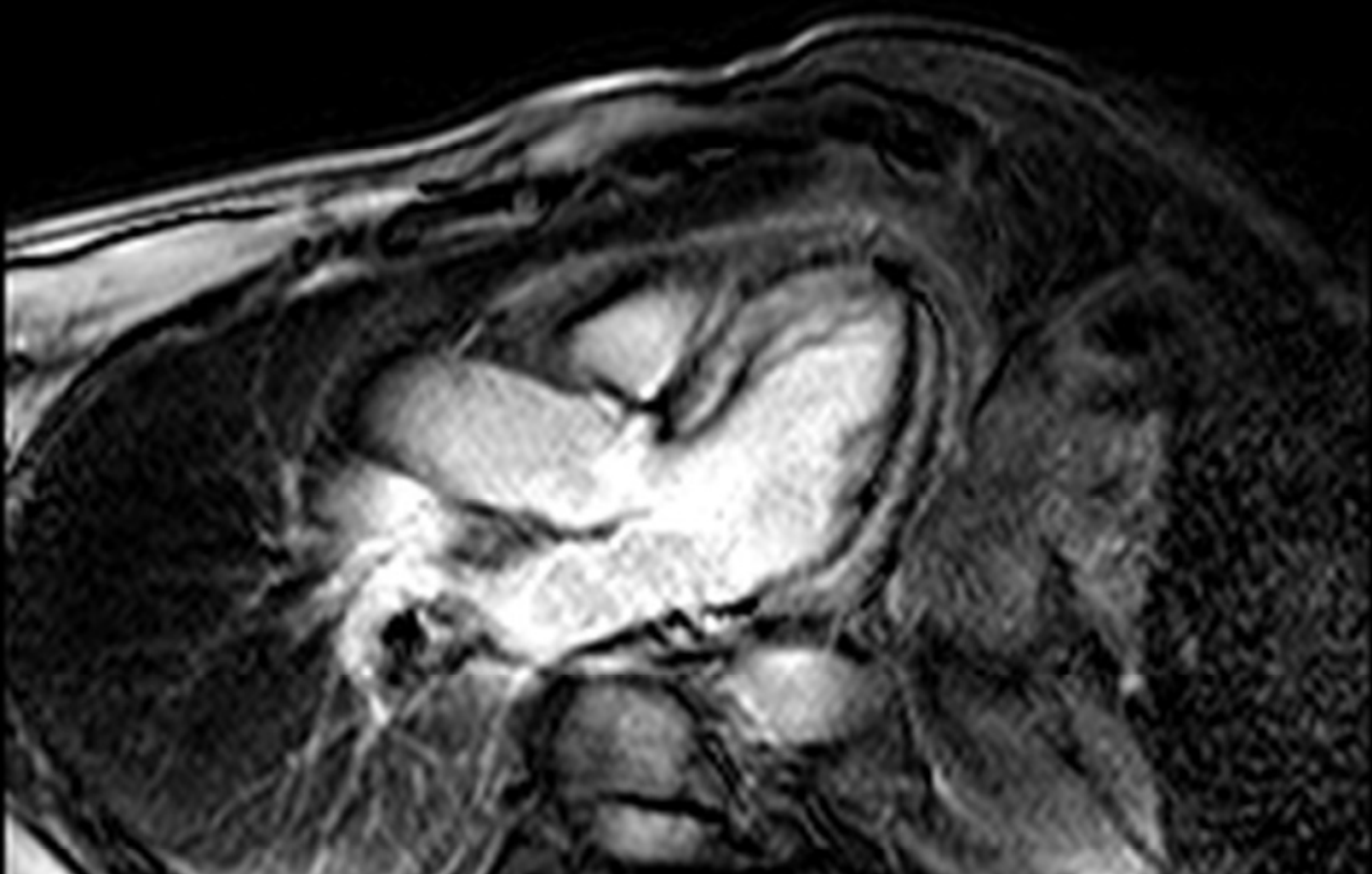
# Dilated cardiomyopathy



# MRI

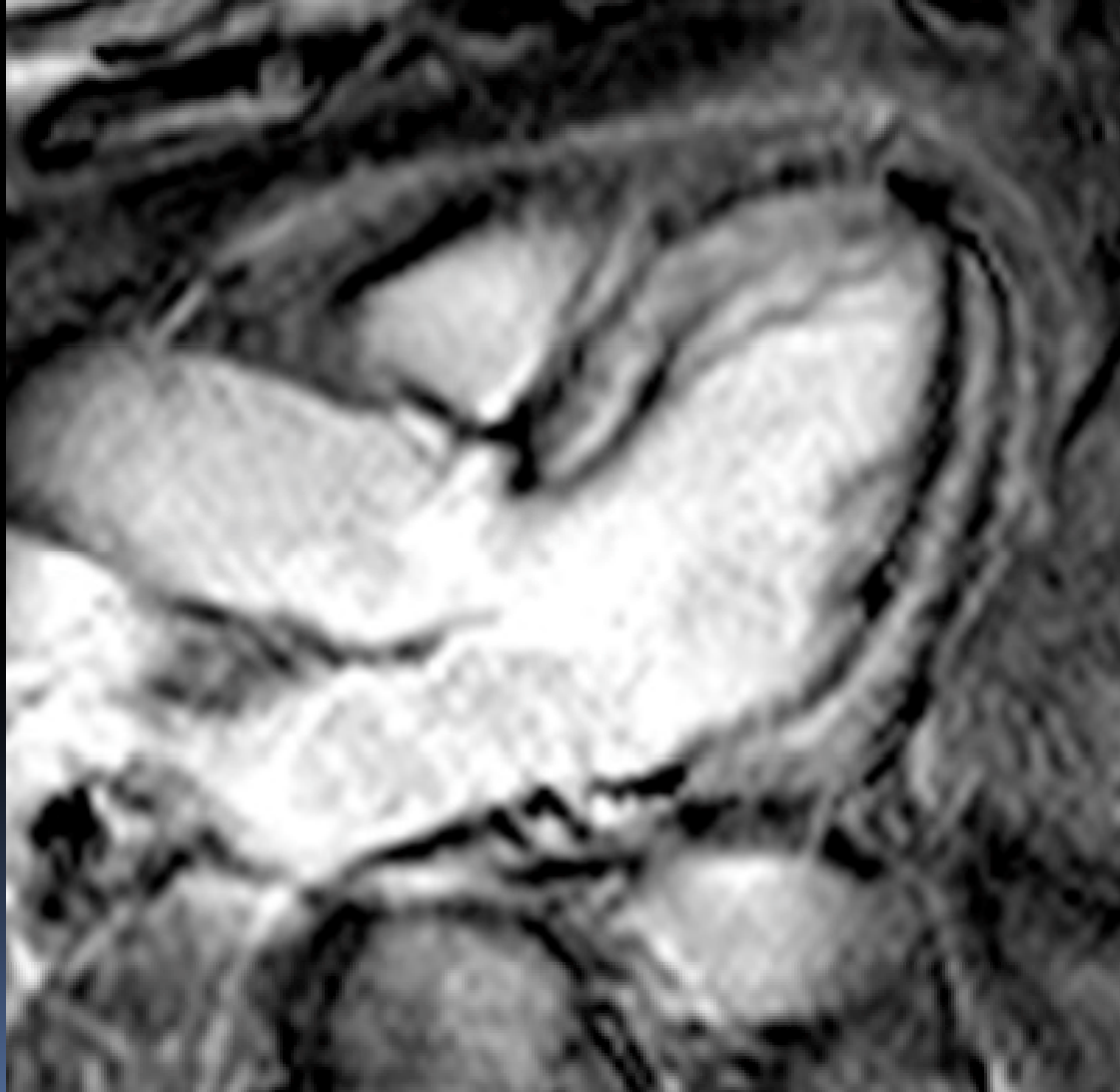


# MRI



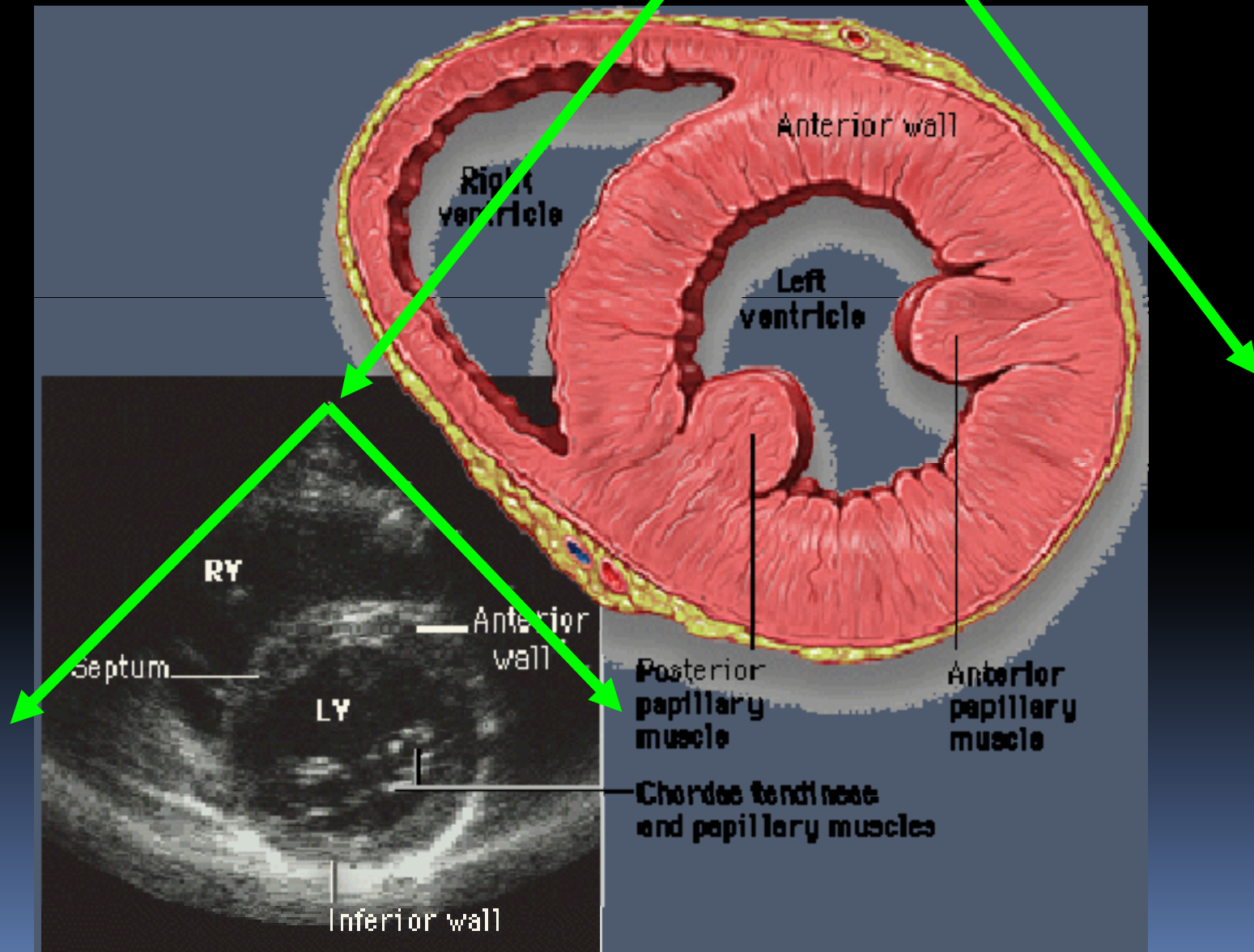


# MRI





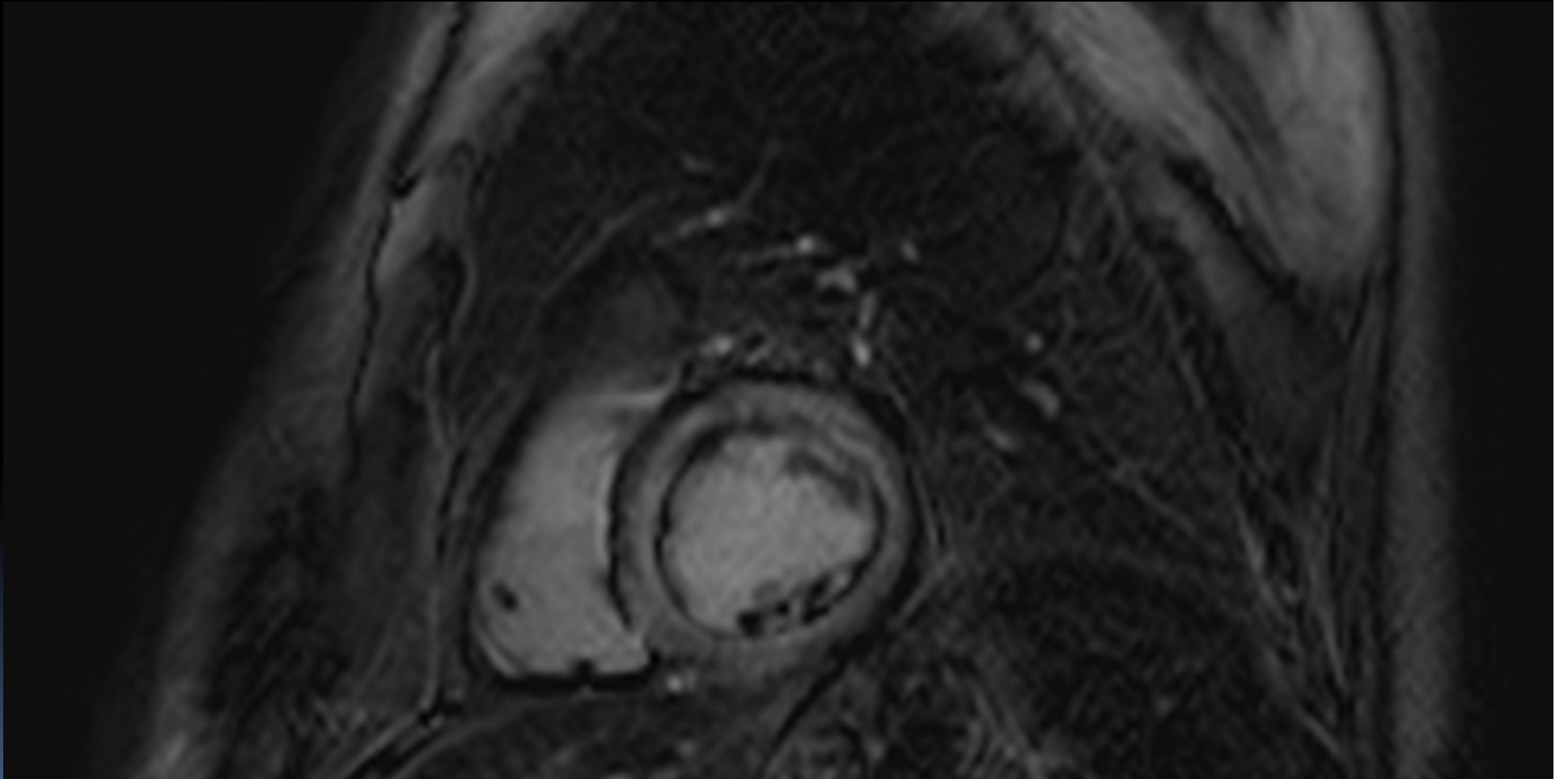
# MRI





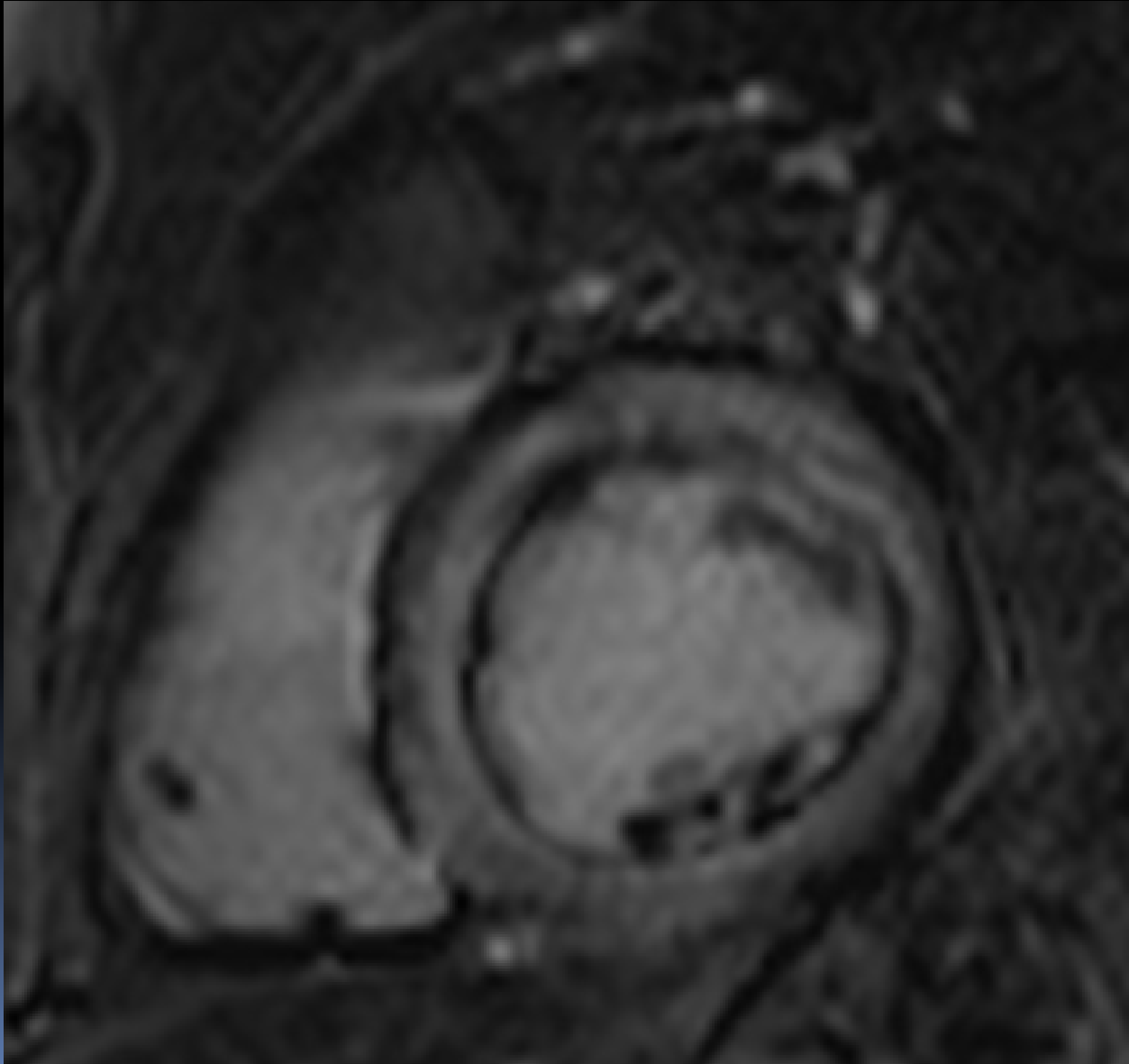


# MRI



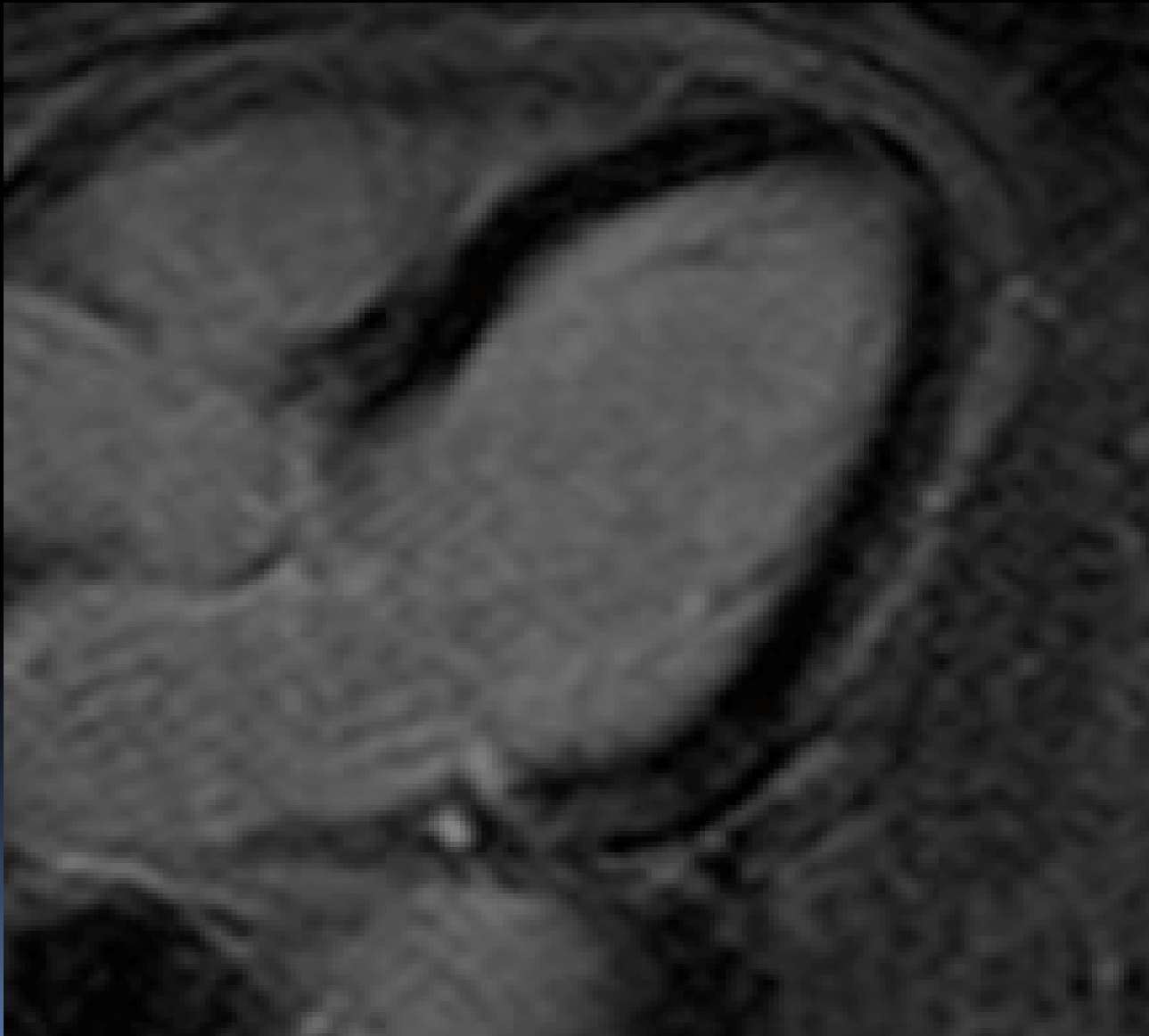


# MRI: myocarditis



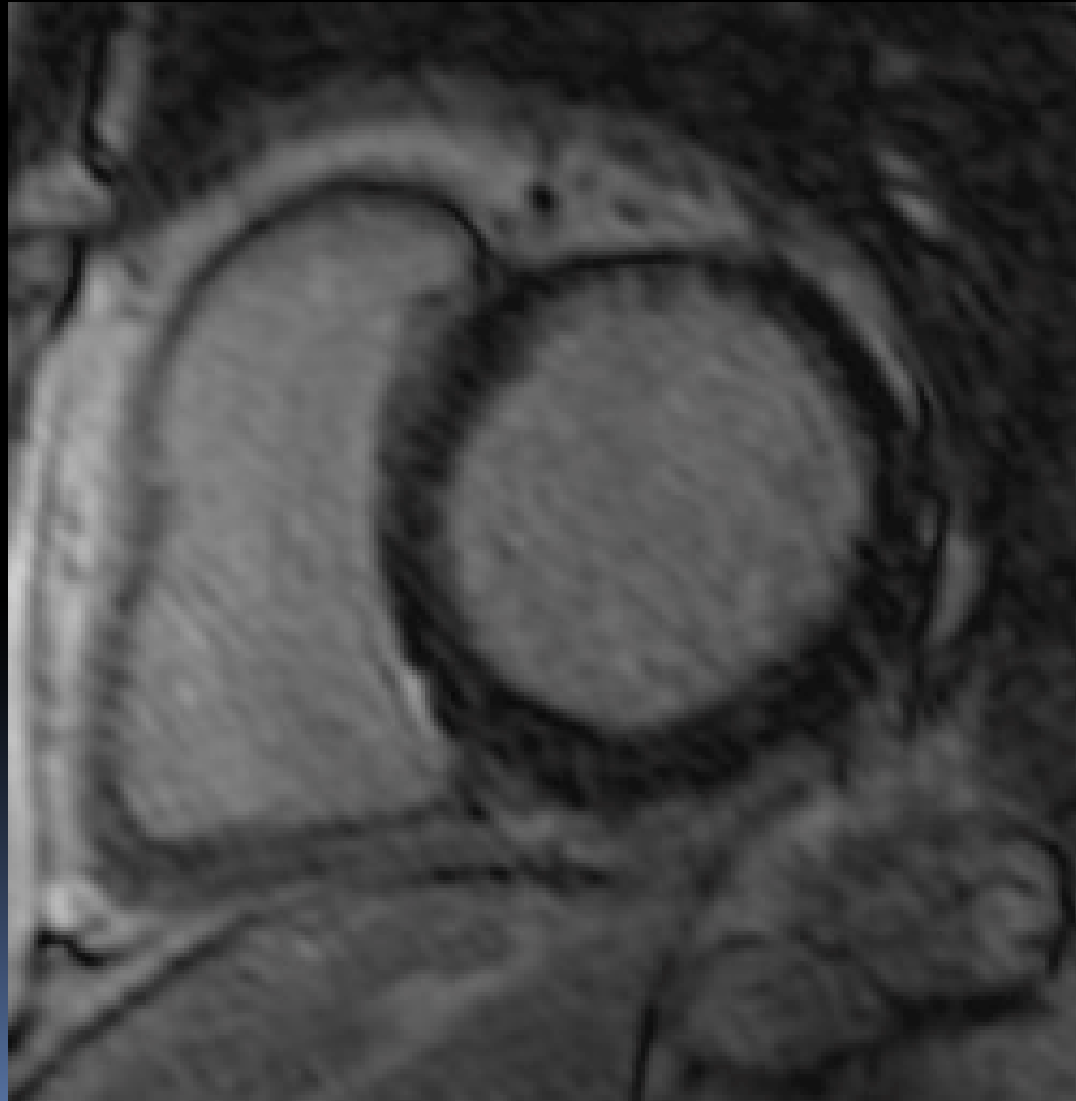


# MRI: normal myocardium



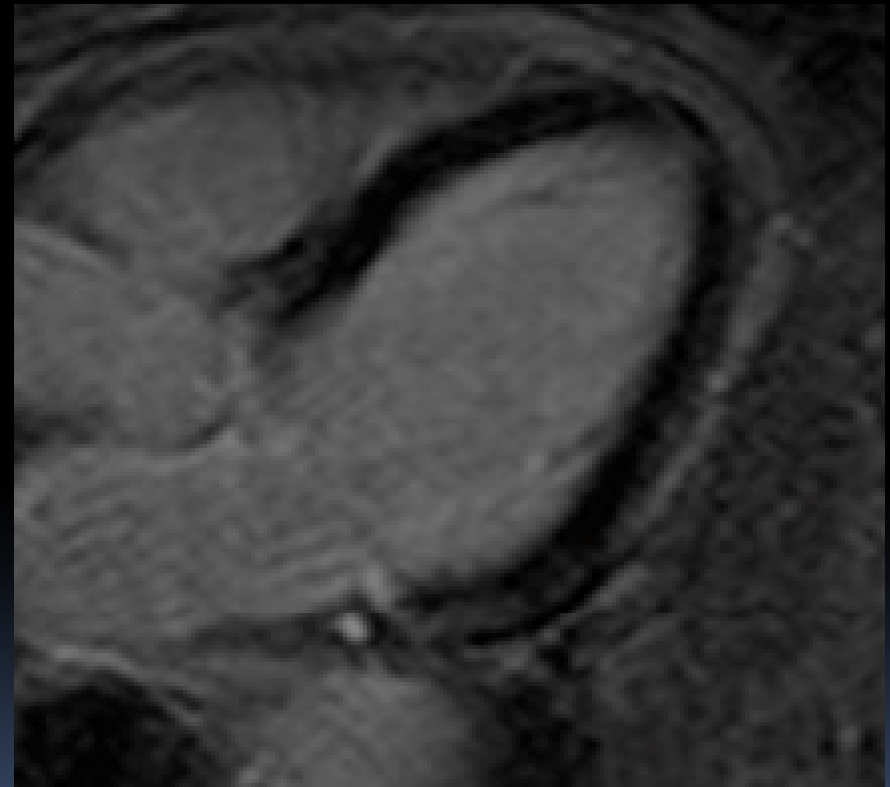
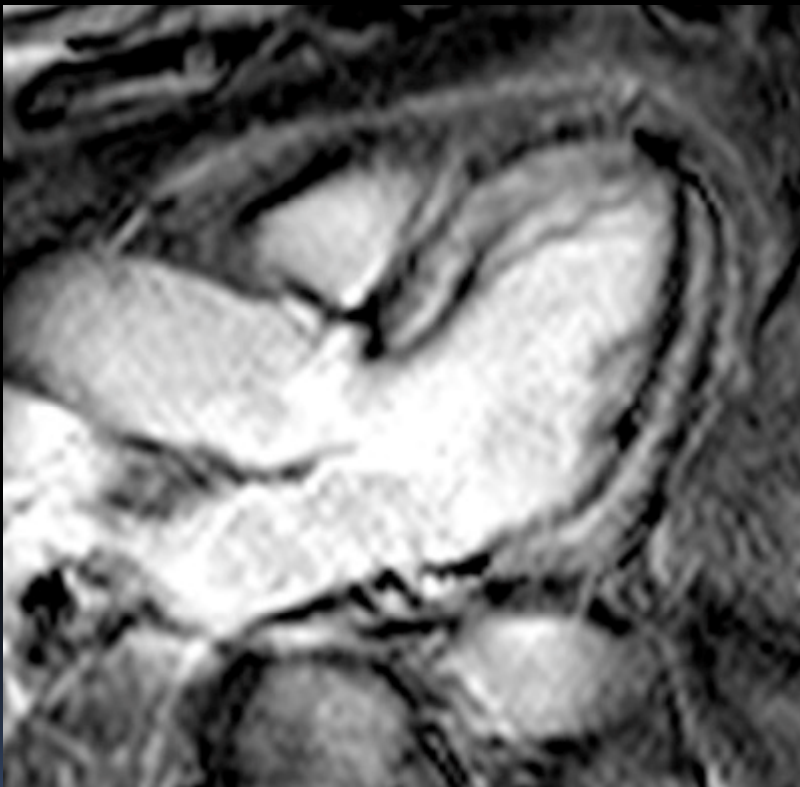


# MRI: normal myocardium





# MRI: normal myocardium



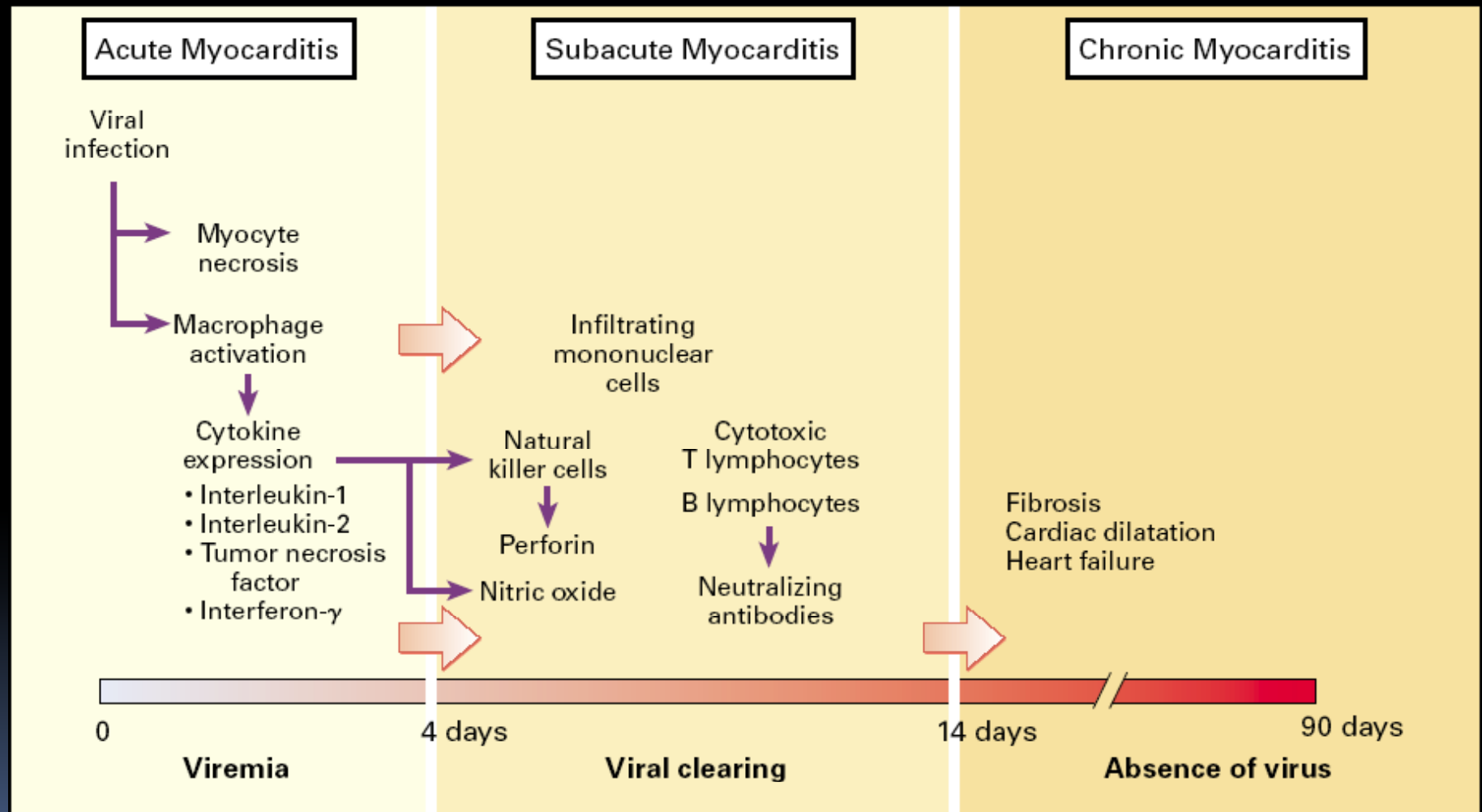


## Acute and chronic disease

- Fulminant myocarditis, and acute myocarditis can be any degree of severity, but fully recover.
- Long term, chronic deterioration with dilated cardiomyopathy associated with ongoing viral infection or immune activation



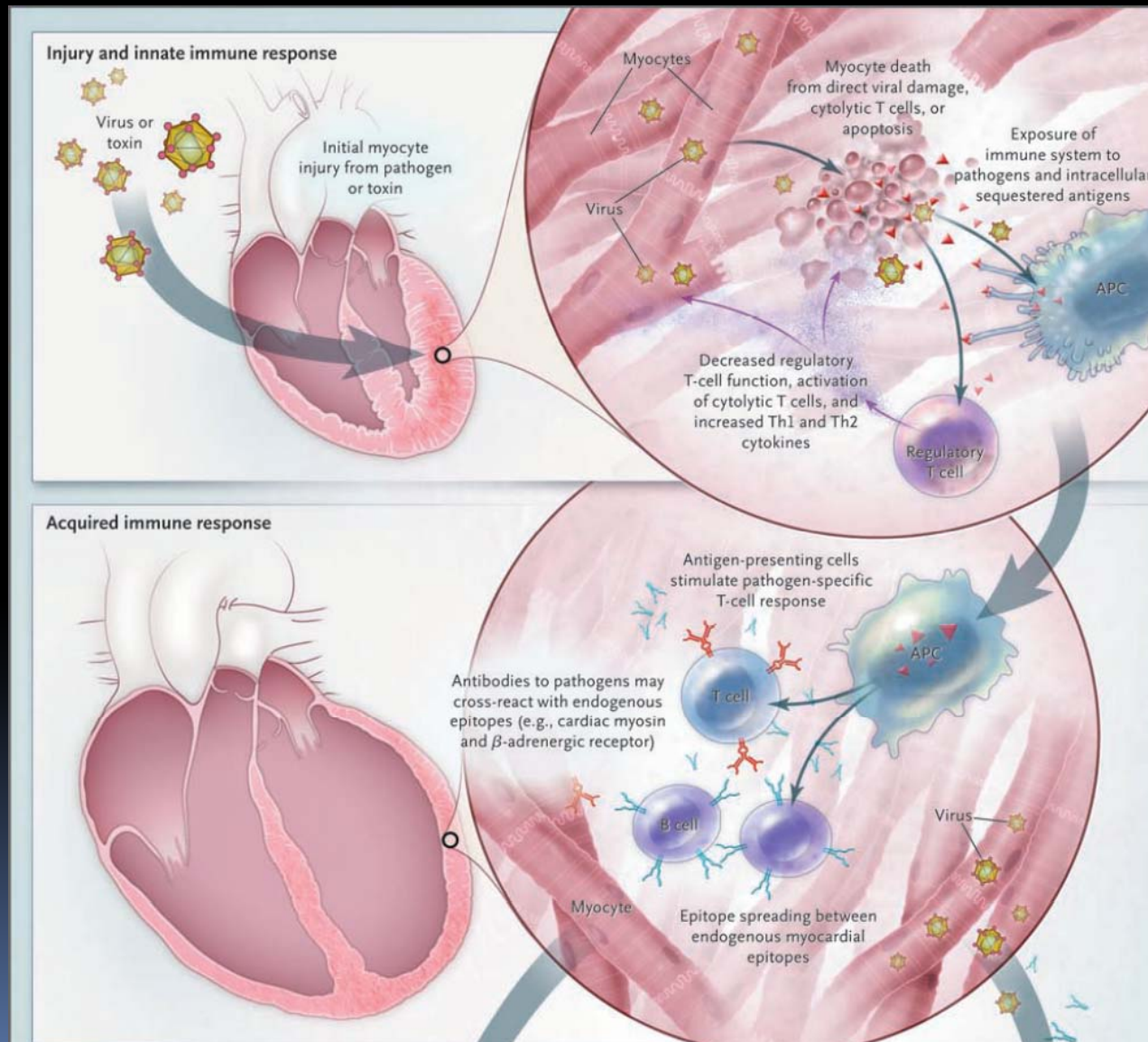
# Acute and chronic disease



**Figure 2.** Time Course of Experimental Viral Myocarditis in Mice.



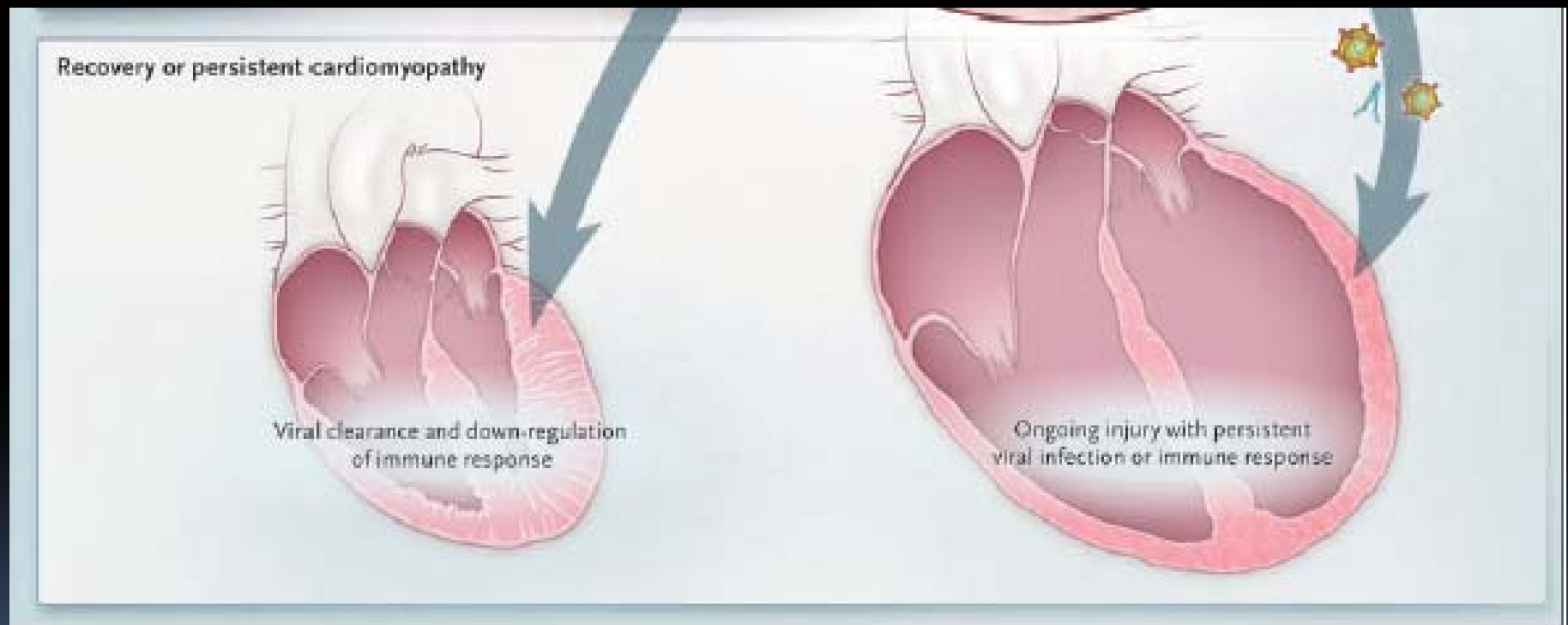
# Acute and chronic disease







# Acute and chronic disease





# Conclusion

- Viral myocarditis is more common than clinical data suggests, as causative agents diagnosed in a minority of cases
- Sequelae range from none to death, through dilated cardiomyopathy, arrhythmia, fibrosis, ongoing viraemia.
- Treatments are supportive, although the immune suppressants may have a role in selected subpopulations.
- Even those infections for which specific treatments exist, improved cardiac outcomes have not been shown.