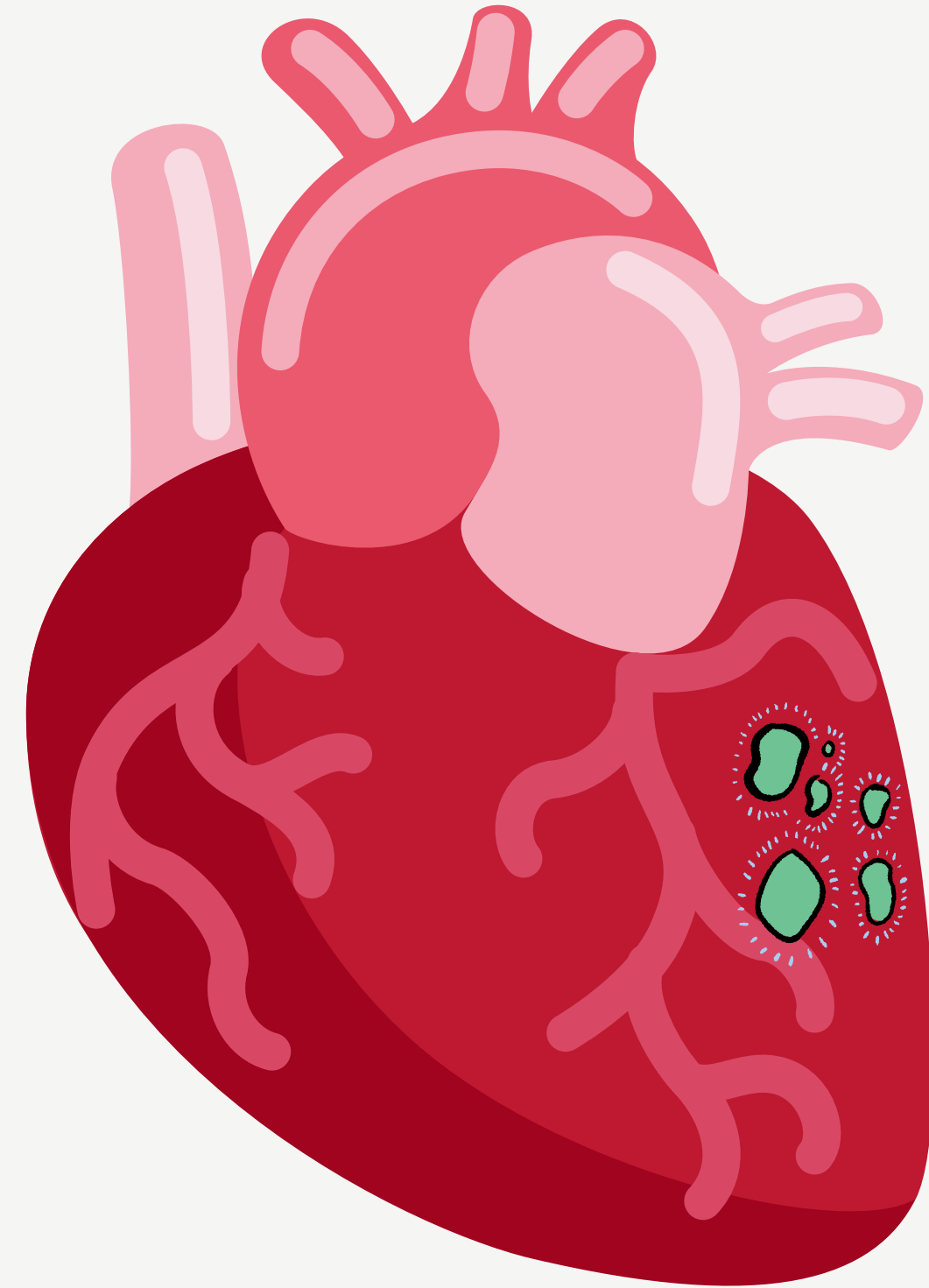
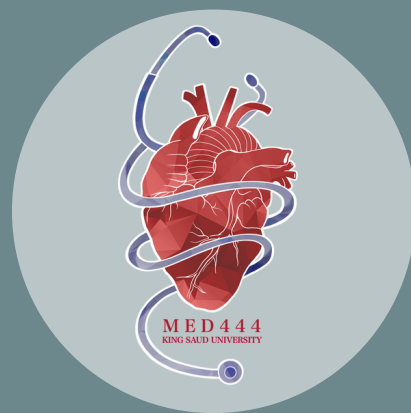


MICROBIOLOGY OF MYOCARDITIS & PERICARDITIS

Lecture no.1

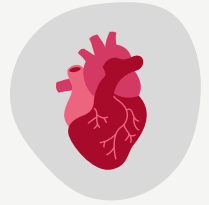


 [Editing File](#)

Color index:

Main text	Girls' slides
Important	Boys' slides
Dr. notes	Extra

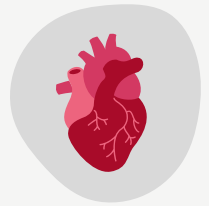
OBJECTIVES



Describe the epidemiology, risk factor for myocarditis.



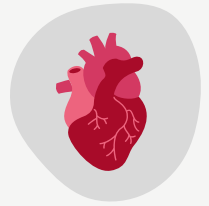
[Helpful Video](#)



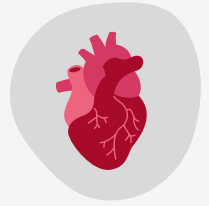
Explain the pathogenesis of myopericarditis.



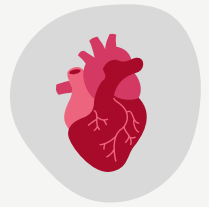
[Helpful Video](#)



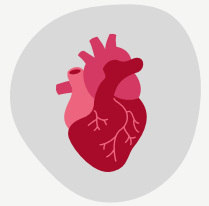
Differentiate between the various types of myocarditis and pericarditis.



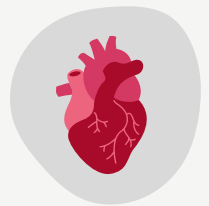
Name various etiological agents causing myocarditis and pericarditis.



Describe the clinical presentation and differential diagnosis of myocarditis and pericarditis.



Discuss the microbiological and non-microbiological methods for diagnosis of myocarditis and pericarditis.



Explain the management, complication and prognosis of patient with myocarditis and/or pericarditis.



MYOCARDITIS



Definition

Inflammatory disease of the heart muscle. The inflammation enlarges and weakens the heart, creates scar tissue that makes the heart work harder to circulate blood and oxygen throughout the body.

Epidemiology

No accurate estimate of incidence as many cases are mild & brief and diagnosis is not made

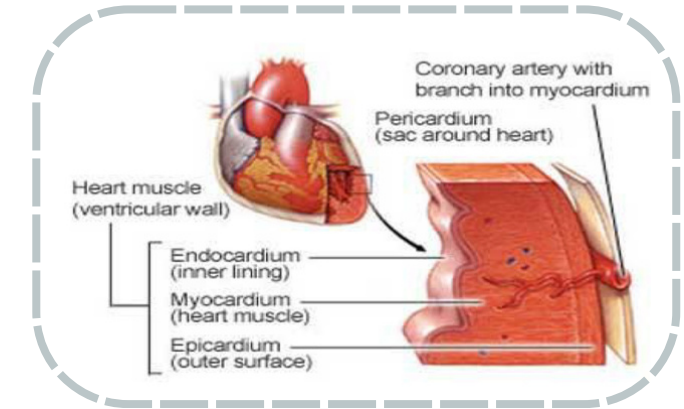
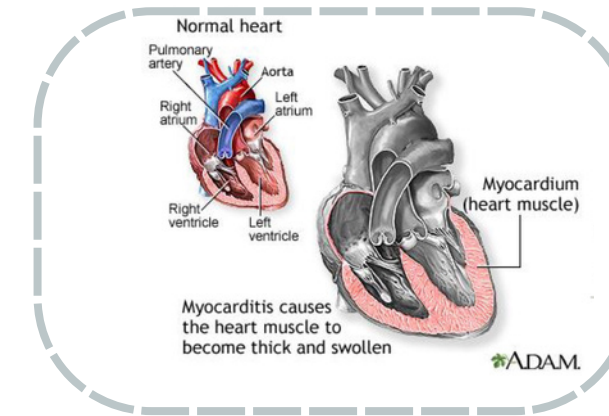
Myocarditis It's **Mild & self-limited usually** -it means you can heal at home- **with few symptoms OR severe with progression to congestive heart failure & dilated cardiac muscle.**

affects all ages.

localized or diffuse

Myocarditis can be due to a variety of **infectious and non infectious** causes eg. toxins, drugs and hypersensitivity immune response.

Viral infection is the most common cause



Extra for good understanding

Pericarditis → Inflammation of the pericardium

Myocarditis → Inflammation of the heart muscle

Endocarditis → Inflammation of the endocardium

Pancarditis → Inflammation of the whole heart



ETIOLOGY OF MYOCARDITIS

Infectious	Viruses	<ul style="list-style-type: none">▶ Enterovirus: (Mainly Coxsackie B & A serotypes) is the most common.▶ Other virus: Adenoviruses, Influenza, EBV, Rubella, Varicella, Mumps, Rabies, Hepatitis viruses, SARS-CoV-2 (causing COVID-19), Parvovirus B19 and HIV. (Note that Myocarditis caused by SARS-Cov-2 while Pericarditis not)
	Bacterial	<ul style="list-style-type: none">▶ Corynebacterium diphtheriae▶ Syphilis▶ Lyme disease caused by a Spirochete called Borrelia Burgdorferi ▶ as a complication of bacterial endocarditis
	Parasites / Protozoan	<ul style="list-style-type: none">▶ Trypanosoma cruzi (Chagas diseases) -affect heart & esophagus-▶ Trichinella spiralis▶ Toxoplasma gondii▶ Echinococcus and others
	Others	<ul style="list-style-type: none">▶ Rickettsiae, Fungi, Chlamydia, Enteric pathogens, Legionella and Mycobacterium tuberculosis.
Non-infectious	Giant cell myocarditis	Due to Thymoma (tumor of thymus), SLE (systemic lupus erythematosus) or Thyrotoxicosis. -Rare and very serious autoimmune disease-
	Systemic Diseases	<ul style="list-style-type: none">▶ SLE▶ Sarcoidosis▶ Vasculitis (Wegener's disease)▶ Celiac disease
	malignancy	Neoplastic infiltration -cancer-
	Drugs & Toxins	<ul style="list-style-type: none">▶ Ethanol & Cocaine▶ Radiation▶ Chemotherapeutic agents - Doxorubicin



MYOCARDITIS CONT...

Highly variable: may occur days to weeks after onset of acute febrile illness or with heart failure without any known antecedent symptoms

CLINICALLY
flu like
symptoms

SIMILAR TO MOST VIRAL INFECTIONS: HEADACHE, FEVER, MUSCLE ACHES, DIARRHEA, SORE THROAT AND RASHES. MOST COMMON

Heart
Related
especially if
it's viral

- ▶ Chest pain
- ▶ **Palpitation (arrhythmia)** More likely in myocarditis
- ▶ Sweating, fatigue and dizziness
- ▶ **Fever** (infection)
- ▶ **May present with congestive heart failure** -In severe cases, when inflammation of the heart occurs, it will result in scarring and the heart will try to exert more effort, resulting in cardiomyopathy and the muscles will enlarge which lead to this symptom-

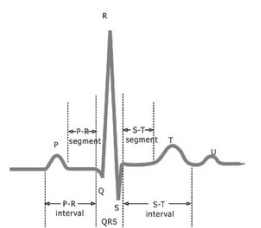
Differential Diagnosis

- ▶ Acute Myocarditis
- ▶ Vasculitis -inflammation in blood vessels-
- ▶ Cardiomyopathy (due to drugs or radiation -causes other than inflammation-)

Diagnosis

- ▶ **Elevated WBCs & ESR**
- ▶ **Elevated Troponin protein & CK-MB enzyme.** -The test measures the level of them in the blood to help in detect heart injury. Normally, they are present in very small quantities in the blood. When there is damage in cardiac muscle cells, they will be released into the blood-
- ▶ **ECG (nonspecific ST-T changes and conduction delays are common)** -the opposite of pericarditis-
- ▶ **Blood culture** -mostly the result will be negative because the main reason is viral infection not bacterial-
- ▶ **Chest X-rays:** show cardiomegaly -in severe cases-
- ▶ **Radiology:** MRI -in severe cases- and Echocardiogram
- ▶ **Heart muscle biopsy (for some extreme cases)**
- ▶ **Specific tests for Lyme disease,** diphtheria and Chagas disease may be indicated on a case by case basis.

in myocarditis and myocardial infarction ->the enzyme elevate in Pericarditis ->the enzyme won't elevate



ECG of normal heart



MYOCARDITIS CONT...

Management

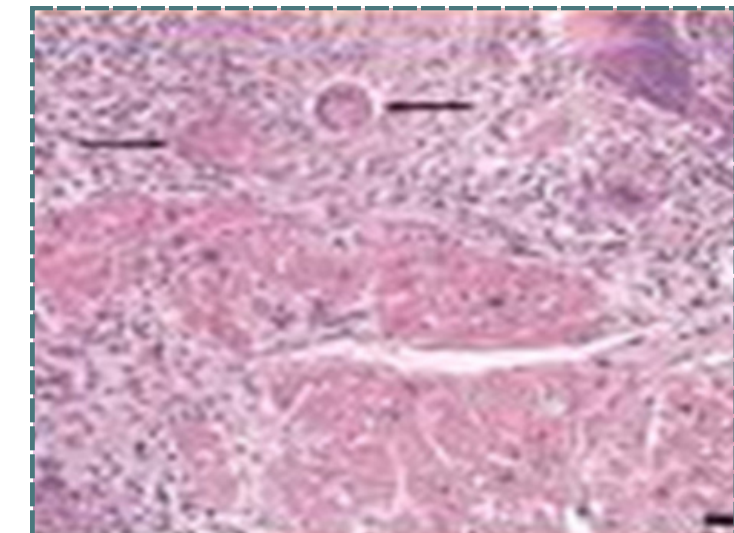
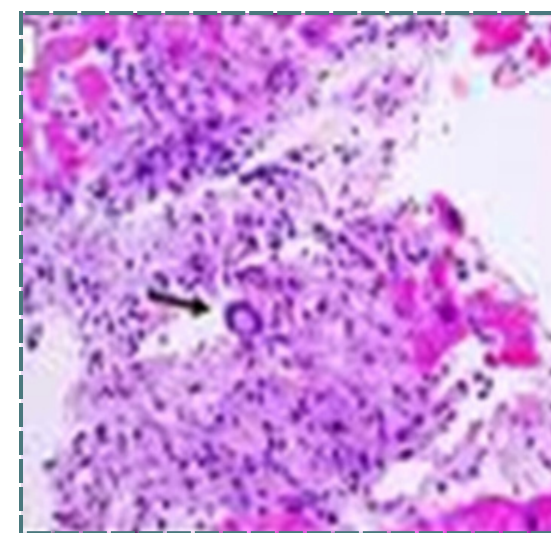
- ▶ Most cases of viral myocarditis are self limited
 - ▶ **Supportive management** -try to treat without the use of drugs- (oftenly): restricted physical activity in heart failure.
 - ▶ Treatment:
 - Specific antimicrobial therapy is indicated when an infecting agent is identified.
 - **Treatment of heart failure arrhythmia**
 - Other drugs indicated in special situations like: Anticoagulant, NSAID -non-steroidal anti-inflammatory Drugs-, Steroid or Immunosuppressive immunomodulatory agents.
 - ▶ **Heart transplant** -in severe cases-
- Patient should be followed regularly every 1-3 months.

Complications

- ▶ One third of the patients are left with lifelong **complications, ranging from mild conduction defects to severe heart failure.**
- Sudden death may be the presentation of myocarditis in about 10% of cases.

Endomyocardial diagnosis

- Pathologic examination is not sensitive.
- It may reveal lymphocytic inflammatory response with necrosis.
- Giant cells may be seen. -in more severe non-infectious cases-





PERICARDITIS

Definition	An inflammation of the pericardium -Sac around the heart- usually of infectious etiology (viruses, bacterial, fungal or parasitic).	
Infectious Causes	Viral pericarditis Same as Myocarditis	<ul style="list-style-type: none">▶ THE MOST COMMON CAUSE: ENTEROVIRUS (COXSACKIE VIRUS A, B, AND ECHOVIRUS SEROTYPES).▶ OTHER VIRUSES: HERPES VIRUSES, HEPATITIS B, MUMPS, INFLUENZA, ADENOVIRUS, VARICELLA AND HIV. (Note that Myocarditis caused by SARS-Cov-2 while Pericarditis not)
	Bacterial Pericarditis	<ul style="list-style-type: none">▶ usually a complication of pulmonary infections (e.g. pneumonia, empyema).▶ Caused by; S.pneumoniae, M.tuberculosis, S.aureus, H.influenzae, K. pneumoniae, Legionella Pneumophila, Mycoplasma pneumoniae & Chlamydia pneumoniae.▶ HIV patients may develop pericardial effusions caused by: M.tuberculosis or M. avium complex.
	Disseminated fungal infection	Caused by: Histoplasma, Coccidioides.
	Parasitic infections	disseminated toxoplasmosis, contagious spread of Entamoeba histolytica are rare causes.
Non-Infectious Causes	<ul style="list-style-type: none">▶ Immune mediated; rheumatic fever & SLE.▶ Miscellaneous: due to myocardial infarction, malignancy and uremia (due to renal failure) .	



PATHOPHYSIOLOGY

How does it reach to the heart?

Contiguous Spread:

lungs, pleura, mediastinal lymph nodes, myocardium, aorta, esophagus, liver.

Spread of infection from adjacent tissue to heart

Traumatic or Irradiation

more likely specific to non infection causes

Lymphangitic spread

Spread Hematogenous:

septicemia, toxins, neoplasm, metabolic

distributed or spread by way of the bloodstream then to pericardium

What can happen if there is inflammation of cardiac sac? fibrous, difficulty with a pulse, scar



Inflammation provokes fibrinous exudate with or without serous effusion (fluid)



The normal transparent and glistening pericardium is turned into a dull, opaque and "sandy" sac



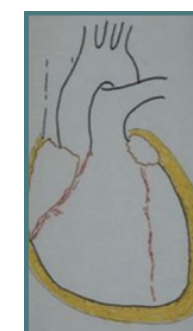
Can cause pericardial scarring with adhesions and fibrosis. (The pericardial will lose its elasticity, and the muscles will not be able to pump blood)



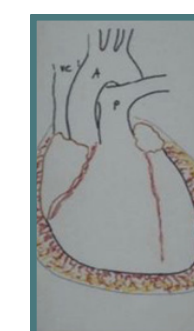
TYPES OF PERICARDITIS

Types of pericarditis	
Caseous pericarditis	commonly tuberculous in origin Hint: Caseous always associated with TB.
Serous pericarditis	due to autoimmune diseases (rheumatoid arthritis, SLE), viral infections – Transudative serous fluid
Fibrinous pericarditis Non-infectious	due to acute MI (myocardial infarction), uremia, radiation – Fibrinous exudative fluid
Purulent/ Suppurative Pericarditis	due to bacteria, fungi or parasites. – Purulent exudative fluid
Haemorrhaging pericarditis	usually caused by infection (e.g. TB) or malignancy – blood mixed with a fibrinous or suppurative effusion

Note: Tuberculosis can lead to both caseous and hemorrhagic pericarditis



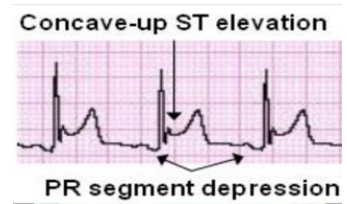

Serous pericarditis



Fibrinous pericarditis



PERICARDITIS CONT...

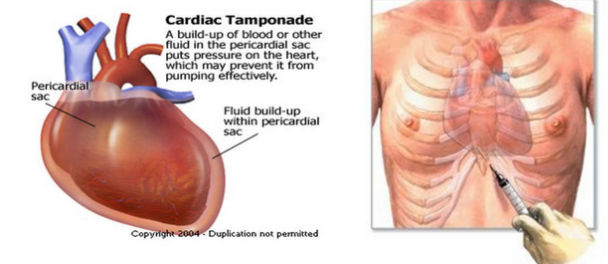
Type	Acute Pericarditis	Chronic Pericarditis
Clinical Presentation	<ul style="list-style-type: none"> • Sudden pleuritic chest pain which is positional retrosternal (relieved by sitting forward). increases with deep inspiration • Dyspnea -shortness of breath- • Fever • On examination: <ol style="list-style-type: none"> 1. Pericardial rub (ones you see it it's pericarditis) (In exam it would be written as Friction rub), exaggerated pulses, paradoxus JVP (jugular venous pressure) and tachycardia. 2. As the pericardial pressure increases, palpitations, presyncope or syncope may occur. 	<ul style="list-style-type: none"> • Tuberculous pericarditis has insidious onset. (meaning: slower to occur→ more chronic) • incidence of pericarditis in patients with pulmonary TB ranges from 1-8% • Clinical findings: fever, pericardial friction rub, hepatomegaly, Weight loss, night sweats. • Fluid smear for acid fast bacilli (AFB) often negative • Pericardial biopsy more definitive, better than pericardial fluid AFB.
Differential Diagnosis	<ul style="list-style-type: none"> • Acute myocardial infarction. 443: but there is no friction rub • Pulmonary embolism. it is hard to differentiate between them • Pneumonia. • Aortic dissection. 	
Investigations <small>pericarditis usually there is no elevation in the cardiac enzymes. That's the difference between Pericarditis and myocarditis.</small>	<ul style="list-style-type: none"> • ECG will show ST elevation, PR depression and T-wave inversion may occur later. • Blood culture -if there is suspicion of TB- & Tuberculin skin test is usually positive in tuberculous pericarditis cases. • Leukocytosis and an elevated ESR are typical. • Chest x-ray may show enlarged cardiac shadow or calcified pericardium and CT scan show pericardial thickening >5mm. • Pericardial fluid or pericardial biopsy specimens. • Immunology/Serology: Antinuclear antibody tests and Histoplasmosis complement fixation indicated in endemic area. • Other routine testing: urea and creatinine. 	 



PERICARDITIS CONT...

Management of Pericarditis

- Management is largely supportive for cases of idiopathic and viral pericarditis including bed rest, NSAIDs and Colchicine. (Most important).
- Corticosteroid use is controversial and anticoagulants usually contraindicated.
- Specific antibiotics must include activity against *S. Aureus* and respiratory bacteria.
- Antiviral: Acyclovir for Herpes simplex or Varicella . Ganciclovir for CMV.
- **Pericardiocentesis:**
 1. Therapeutic procedure to remove fluid from the pericardium (to relief Tamponade) in severe cases with pericardial effusion.
 2. Patients who recovered should be observed for recurrence to prevent future build up.
 3. Symptoms due to viral pericarditis usually subsided within one month.



CONSTRICTIVE PERICARDITIS

Definition

Changes in the pericardial sac (becomes more hard and constrictive) and consistency of fluid يتماسك (serous, purulent..etc) due to ongoing inflammation. In x-ray, it is seen as a calcium shell surrounding the heart.

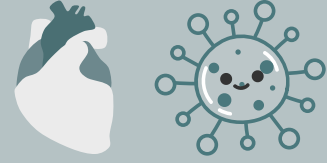
ضاغط على القلب فيصير ما يقدر يضح.

Causes

- Idiopathic (unknown)
- Radiotherapy
- Cardiac surgery
- Connective tissue disorders
- Dialysis
- Bacterial infection, viral, TB, fungal.

Same as pericarditis, because it's a complication of pericarditis.

SUMMARY



Myocarditis

Pericarditis

Prognosis

Mild & Self limiting

Mild & Self limiting in case of acute pericarditis

Cause

- Viruses: Coxsackievirus B or Coxsackie virus A, Echoviruses
- Bacterial: Corynebacterium diphtheriae, Syphilis, Lyme disease.

- 1- Infectious:
 - Viruses: Coxsackievirus B or Coxsackie virus A, Echoviruses.
 - Bacterial: Strept. pneumoniae., M. Tuberculosis
 - Parasitic infections: toxoplasmosis
- 2- Non-infectious: SLE, Uremia

Clinical Presentation

- Chest pain
- Arrhythmias (Palpitations)
- Sweating
- Fatigue
- Congestive heart failure

- 1- Acute:
 - Chest pain which is relieved when sitting forward. (Positional retrosternal)
 - Pericardial rub on examination
- 2- Chronic:
 - Tuberculosis pericarditis has insidious onset.
 - Incidence of pericarditis in patients with pulmonary TB

Management

Supportive therapy

- Supportive for cases of idiopathic and viral pericarditis
- Specific antibiotics must include activity against S. Aureus and Respiratory bacteria.

Other

- Remember that Viral infection is the most common cause, reaches the heart through viremia.
- Coxsackievirus B is the most common viral cause of myocarditis, and that the symptoms are not specific for the heart except: chest pain, arrhythmia, and sweating.

- It reaches the heart by:
 - Contiguous Spread ▸ Traumatic or Irradiation
 - Lymphangitic Spread ▸ Hematogenous Spread.
- Types of Pericarditis:
 - Caseous Pericarditis → TB
 - Serous Pericarditis → viral infection or autoimmune disease
 - Fibrinous Pericarditis → myocardial infarction
 - Purulent/Suppurative pericarditis → bacterial infection
 - Hemorrhagic pericarditis → TB & malignancy
- Some patients develop cardiac tamponade and the therapeutic procedure is Pericardiocentesis

MCQs:



Q1: D

Q2: C

Q3: B

Q1/ Which of the following types of pericarditis could be caused by TB?

A	Caseous pericarditis	B	Fibrinous pericarditis	C	Hemorrhagic pericarditis	D	A+C
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Q2/ Which of the following types of pericarditis is due to autoimmune diseases ?

A	Fibrinous pericarditis	B	Caseous pericarditis	C	Serous pericarditis	D	Suppurative Pericarditis
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Q3/ Most common viral cause for pericarditis and myocarditis?

A	S.pneumoniae	B	Enterovirus	C	Rabies	D	Herpes viruses
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MCQs:



Q4:D

Q5:B

Q6:C

Q4/ What might cause giant cell myocarditis ?

A	Radiation	B	Enterovirus:	C	Sarcoidosis	D	SLE
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Q5/ Which causative organism may lead the HIV patient to develop pericardial effusions ?

A	Enterovirus	B	M.tuberculosis	C	S.aureus	D	K. pneumoniae,
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Q6/ Which of the following is treat of in severe myocarditis ?

A	Antibiotics	B	NSAID	C	Heart transplantation	D	Treatment of heart failure arrhythmia
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SAQs:

Q1/ 30 year old patient presented in the emergency with fever , headache , muscle ache , and started to have chest pain , examination revealed the temperature 39 , irregular heart beat , ECG shows non spesfic changes in ST-T wave segment :



most likely clinical condition ? Myocarditis

Most likely causative organism ? Enterovirus

What other causes ? coronavirus , any other cause from [slide 4](#)
management ? supportive care

Q2/ A 70 years old came to hospital , he has community acquired pneumonia , presented with fever, shortness of breath productive cough and now starting to have chest pain positional in nature , on examination revealed friction rub on auscultation



most likely clinical condition ? acute pericarditis / pericarditis

What do u expect to find on ECG ? T-wave inversion **or** Diffuse ST elevations + PR depression

How do u treat this patient ? it depend on the cause and supportive care **or** NSAIDs, Colchicine, Pericardiocentesis

Most likely causative organism ? S.pneumoniae

Meet The Team :)

Team LEADERS:



Abdulaziz Alanazi



Layal alkhalfah

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