Myocarditis & Pericarditis

TEAM 439
MICROBIOLOGY

VERSION 1

Objectives

- Describe the epidemiology, risk factor for myocarditis.
- Explain the pathogenesis of myopericarditis.
- Differential 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.

Overview

Carditis, or inflammation of the heart, is most conveniently broken down into:

- Pericarditis - Inflammation of the pericardium
- Myocarditis - Inflammation of the heart muscle
- Endocarditis - Inflammation of the endocardium
- Pancarditis - Inflammation of the **whole** heart

Colour index:

Red: Important & Notes.

Grey: Extra info & explanation.

Dark Blue: Original Text

Any future corrections will be in the editing file, so please check it frequently.

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1. Myocarditis

- Myocarditis: an inflammatory disease of the heart muscle.
- Mild & self-limited with few symptoms OR severe with progression to congestive heart failure & dilated cardiac muscle.
- 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, reaches the heart through viremia.
- **Epidemiology:** No accurate estimate of incidence as many cases are mild & brief and diagnosis is not made.

Etiology

Infectious	Viruses	★ **Coxsackievirus B** is the most common cause of myocarditis. • **Other virus** : Coxsackie virus A, Echoviruses, Adenoviruses, Influenza, EBV, Rubella, Varicella, Mumps, Rabies, Hepatitis viruses and HIV.
	Bacterial	• Corynebacterium diphtheriae (Uncommon due to DTP vaccines) Gram +ve, rod shaped, black colonies, virulence factor is diphtheria toxin, treated by antibiotic + antitoxin. It had to complications, myocarditis & neuritis. Remember?!!!!! • Syphilis (Sexually transmitted bacterial infection) • Lyme disease caused by a **Spirochete** called Borrelia Burgdorferi (More common in scandinavian countries & mainly causes joint disease but in secondary stage it causes heart disease and myocarditis) • As a complication of bacterial endocarditis. *Bacterial infection is not common but can progress to myocarditis
	Protozoan	• Trypanosoma cruzi (Chagas disease) • Trichinella • Spiralis • Toxoplasma gondii • Echinococcus
	Others	• Rickettsiae, Fungi, Chlamydia, enteric pathogens, Legionella and Mycobacterium tuberculosis.
Non-Infectious Usually related to immune reactions	Giant cell myocarditis	Due to Thymoma (tumor of thymus), SLE (systemic lupus erythematosus, an autoimmune disease in which the body's immune system mistakenly attacks healthy tissue in many parts of the body.) or Thyrotoxicosis (another term of hyperthyroidism). اذا تبون الصدق وتحريًا للدقة Giant cell myocarditis بالحقيقة idiopathic ولاحد يعرف وش سببها، لكن فيه case reports قليلة وعددها أقل من ٢٠ واغلبها قديمة من التسعينات أصلاً تقول أنها ارتبطت بالـthymoma والخ.
	Systemic Diseases	SLE, Sarcoidosis, Vasculitis (Wegener's disease), Celiac disease
	malignancy	Neoplastic infiltration
	Drugs & Toxins	Ethanol, Cocaine, Massive radiation, Chemotherapeutic agents - Doxorubicin

Myocarditis, contd..

Clinical Presentation

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

General

- Fever
- Headache
- Muscle aches
- Diarrhea
- Sore throat
- Rashes similar to most viral infections.

Heart Related

- ★ **Chest pain**
- ★ **Arrhythmias (Palpitations)**
- **Sweating**
- **Fatigue**
- May present with **congestive heart failure.**

Differential diagnosis

Can look like myocarditis

If the patient is complaining from the above listed symptoms then the diagnosis is one of the following, and further investigations must be done to confirm that.

- Acute Myocarditis
- Vasculitis
- Cardiomyopathy (due to drugs or radiation)

Diagnosis

★ **Elevated Troponin** a protein found in skeletal and cardiac muscle fibers that regulate contraction. The test measures the level of cardiac-specific troponin in the blood to help detect heart injury. Normally, troponin is present in very small quantities in the blood. When there is damage to cardiac muscle cells, troponin is released. Please check the GREAT biochemistry team (biochemical markers) for further clarification.

★ **Elevated CK-MB** Creatine kinase-MB (CK-MB) is a form of an enzyme found primarily in cardiac muscle cells. High levels of CK-MB in the blood indicates damage in cardiac muscle cells. Again, check biochemistry team for more info.

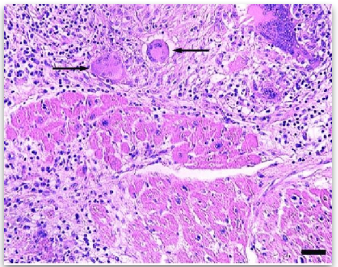
- **Elevated** WBCs, ESR
- ECG (Nonspecific ST-T changes and conduction delays are common).
- **Blood culture** (bacteremia)
- Viral serology and other specific tests for Lyme disease, diphtheria and Chagas disease may be indicated on a case by case basis.
- Chest X-rays : show cardiomegaly (Enlargement of the heart)
- Radiology : MRI and Echocardiogram more specific than x-ray
- Heart muscle biopsy (for some **extreme** cases) Rarely.

Endomyocardial Diagnosis

Pathologic examination is not sensitive

It may reveal lymphocytic inflammatory response with necrosis, and it is very severe.

"Giant cells" may be seen.



Myocarditis, contd..

Management of myocarditis:

1

Supportive therapy, oftenly.

- Restricted physical activity in heart failure.
- Most cases of viral myocarditis are **self limited**, one third of the patients are left with lifelong complications.

2

Treatment

- Specific antimicrobial therapy is indicated when an infecting agent is identified.
- Treatment of heart failure arrhythmia
- Heart transplant (usually related to non-infectious causes)
- Other drugs indicated in special situations like:
  - Anticoagulant
  - NSAID
  - steroid
  - Immunosuppressive immunomodulatory agents

Complications: it's mostly self limited.

- Ranging from mild conduction defects to severe heart failure.
- Patient should be followed regularly every 1-3 months.
- Sudden death may be the presentation of myocarditis in about 10% of cases.

★ Remember that **Coxsackievirus B** is the most common cause of myocarditis, and that the symptoms are not specific **except:** chest pain, arrhythmia, and sweating !!!

2. Acute pericarditis

Pericarditis is an inflammation of the pericardium usually of **infectious** etiology viruses, bacterial,fungal or parasitic.

Myocarditis can be infectious and non-infectious, but pericarditis is USUALLY infectious.

Etiology

Infectious

Viral Pericarditis:

Most common causes:

- ★ **Coxsackievirus A**
- ★ **Coxsackievirus B**
- ★ **Echovirus**

Less common causes:

- Other viruses includes Herpes viruses, Hepatitis B, Mumps, Influenza, Adenovirus, Varicella, HIV.

Bacterial Pericarditis:

الـbacterial pericarditis قليل تصير وإذا صارت فغالبًا جايه بعد الـLung infection.

Usually a **complication of pulmonary infections** e.g. pneumonia, empyema (collection of pus in the pleural cavity) organisms:

- **Strept. pneumoniae** Gram +ve diplococci, alpha hemolytic, catalase -ve, and sensitive to optochin.
- **M. tuberculosis** Prof: MTB commonly causes pericarditis more than myocarditis.
- Mycoplasma pneumoniae Common cause of atypical pneumonia, has no cell wall.
- Staph. aureus Gram +ve cocci in clusters, catalase & coagulase +ve, if MSSA; it is treated with cloxacillin.
- H.influenzae
- K. pneumoniae
- Legionella pneumophila
- Chlamydia pneumoniae
- **HIV** patients may develop pericardial effusions caused by: **M.tuberculosis or M. avium complex.** (immunocompromised)

Disseminated fungal infection:

- *Histoplasma*
- *Coccidioides*

Both are VERY pathogenic fungi, unlike candida which can be normal flora.

Parasitic infections "Rare":

- Disseminated **toxoplasmosis** caused by Toxoplasma
  Usually acquired from animals e.g. cats. Prof: "be careful من البسس"
- Contagious spread of Entamoeba histolytica (common cause of diarrhea)

Non-infectious

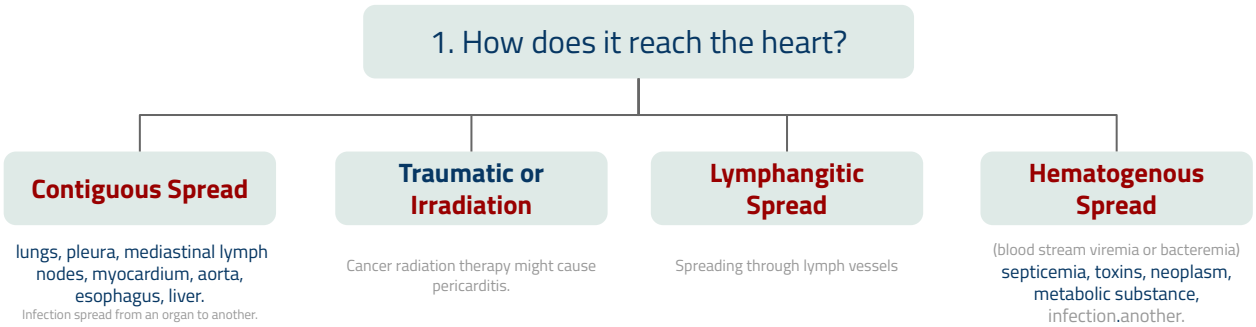
"Less common"

Immune mediated: These rarely progress to pericarditis

- Rheumatic fever
- SLE, systemic lupus erythematosus.
- Miscellaneous due to myocardial infarction
- Malignancy
- Uremia.

Pericarditis, contd..

Pathophysiology:



2. Inflammation provokes **fibrinous exudate** with or without serous effusion
3. Then, the normal transparent and glistening pericardium is turned into a **dull** (pale), **opaque**, and "**sandy" sac** (scrub like texture تسبب خرفشه نقدر نسمعها في صوت القلب)
4. Later on, it can cause pericardial **scarring** with **adhesions** and fibrosis that will affect the smooth movement of heart muscle.

★ Types of Pericarditis

Caseous Pericarditis	Commonly **tuberculous** in origin. • **Caseation most likely indicates TB.** • Originates from the lungs then spreads to the heart.
Serous Pericarditis	• Due to autoimmune diseases and **viral** infections autoimmune e.g. (rheumatoid arthritis, SLE). • Transudative serous fluid (low in protein) تعرفون أنه ال pericardium طبقتين وبينهم fluid. وباختصار لما تحصل viral infection غالبًا بتزيد كمية الfluid هذا ويصير عندنا Serous pericarditis.
Fibrinous Pericarditis	• Due to acute **Myocardial infarction**, uremia, radiation • Fibrinous exudative fluid (high in protein + fibrin)
Purulent/ Suppurative pericarditis	• Due to **bacteria**, fungi or parasites. (Puss always indicates bacteria) • Purulent exudative fluid (high in protein + قيح وصديد)
Hemorrhagic pericarditis	• Usually caused by infection (e.g. TB) or malignancy • Blood mixed with a fibrinous or suppurative effusion

Note that TB can lead to both caseous and hemorrhagic pericarditis

Pericarditis, contd..

Clinical Presentation

differentiate between pericarditis and myocarditis.

Acute Pericarditis:

(More common, signs and symptoms are **more specific** than myocarditis which is usually general):

★ **Sudden** pleuritic chest pain which is **positional** retrosternal (relieved by sitting forward). The pain is usually in the upper abdominal region overlying the stomach and may be sharp, dull, constricting and/or crushing making clinical differentiation from myocardial infarction difficult.

★ On examination: **Pericardial rub** due to sandy sac pericardium **(Diagnostic).**
It is an audible medical sign used in the diagnosis of **pericarditis**. The sound has been described as similar to walking on fresh snow or a leather-on-leather type of sound. Listen here

- ❖ Dyspnea
- ❖ Fever
- ❖ Exaggerated pulses, paradoxus JVP (jugular venous pressure) الضغط يطلع وينزل and tachycardia.
- ❖ As the pericardial pressure increases, palpitations, presyncope or syncope may occur.

Chronic Pericarditis:

- ❖ Tuberculosis pericarditis has insidious onset.

Generally due to M. tuberculosis and the symptoms are those of tuberculosis. E.g. fever, night sweats, weight loss, etc..

- ❖ Incidence of pericarditis in patients with pulmonary TB ranges from 1-8%.
- ❖ Clinical findings: fever, pericardial friction rub, hepatomegaly (liver enlargement).
- ❖ Tuberculin skin test usually positive.
- ❖ Fluid smear for acid fast bacilli (AFB) often negative.

(ZN)-stained smears of pericardial fluid have poor sensitivity for detecting *MTB*, while culture is both slow and insensitive too.

- ❖ Pericardial biopsy is more definitive. Better than AFB

#RespaRecap: here is a case report of a patient who's pericardial fluid AFB smears were negative for MTB. The Xpert MTB/Rif assay, however, detected rifampicin-sensitive TB in the pericardial sample and in the sputum.

Differential Diagnosis

- ❖ Acute myocardial infarction
- ❖ Pulmonary embolism
- ❖ Pneumonia
- ❖ Aortic dissection

Diagnosis

pericardial rub = pericarditis

- ❖ Elevated WBCs (leukocytosis) and ESR is **typical.**

★ **ECG** will show specific changes: **ST elevation, PR depression and T-wave inversion** may occur later. These changes in ECG are more specific for pericarditis.

★ **CT scan show pericardial thickening** due to inflammation >5mm (most diagnostic).

- ❖ Chest x-ray may show enlarged cardiac shadow or calcified pericardium.
- ❖ Blood culture
- ❖ Immunology/ Serology: antinuclear antibody tests and Histoplasmosis complement fixation indicated in endemic area.
- ❖ Tuberculin skin test is usually positive in tuberculosis pericarditis cases.
- ❖ Pericardial fluid or pericardial biopsy specimens for fungi
- ❖ Other routine testing: urea and creatinine.

Pericarditis, contd..

Constrictive Pericarditis, is a sequelae of chronic inflammation of **pericardium.**

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.

Causes of Constrictive Pericarditis

- Idiopathic (unknown)
- Radiotherapy
- Cardiac surgery
- Connective tissue disorders
- Dialysis
- Bacterial infection, viral, fungal.
- TB 30% of patients who are diagnosed with tuberculous pericarditis also develop constrictive pericarditis.

Management of Pericarditis

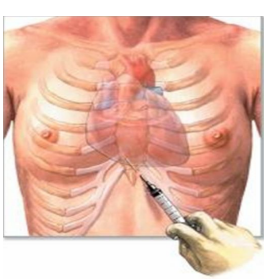
- Management is largely supportive for cases of idiopathic and viral pericarditis including bed rest, NSAIDs and Colchicine.
- Corticosteroid use is controversial and anticoagulants usually contraindicated.
- Specific **antibiotics** must include activity against S. Aureus and respiratory bacteria.
- **Anti virals:** Acyclovir for Herpes simplex or Varicella, Ganciclovir for CMV (cytomegalovirus)
- Symptoms due to viral pericarditis usually subsided within on month.

438: Supportive management of pericarditis depends on its cause. e.g. (uremic pericarditis → dialysis / TB → antituberculous)

Some patients develop **cardiac tamponade** (build up of blood and fluid in the pericardium) that causes restriction in heart pumping and movement. To distinguish it from P.E:

Fluid accumulation:	Pericardial effusion	Cardiac tamponade (So we can say it is the severe form of P.E)
Definition	Accumulation of fluid within the pericardial space, does not necessarily impair the cardiac function	The clinical situation in which the collection of fluid has become severe enough to cause haemodynamic compromise and impairs cardiac functions. (Leads to equal pressure in the pericardial sac and inside the chambers)
Pumping capacity	No change	Greatly reduced (Because adjacent cardiac chambers are compressed and the pumping action of the heart is impaired)
Clinical features	- Nature of apex beat is altered - Soft & distant HS - Fraction rub which gradually diminishes with time - Compression on the left lung cause dull sound on percussion over the region below left scapula	- Jugular vein pressure is usually elevated - Fall in CO - Reduction of systolic blood pressure by about 10 mmHg
investigations	The same group which includes ECG, chest X-ray and echocardiography	
Treatment	No need pericardiocentesis (unless there is a need for fluid analysis for diagnosis)	Needs pericardiocentesis

Pericardiocentesis: therapeutic procedure to remove fluid from the pericardium (to relief Tamponade) in severe cases with pericardial effusion.



Patients who recovered should be observed for recurrence to prevent future build up.

SAQ

SAQ1: A 30 year old came to the ER he has 4 days history of fever, he is feeling unwell .has sore throat today he present to emergency because he start to have chest pain and feeling of regular beats ECG done and there was nonspecific ST and Q wave changes. Elevated Troponin Elevated CK-MB. What is the most likely diagnosis ? what is the most causative organism ? What's your management plan ?

SAQ2: A 60 year old presented with fever. Productive cough.for the last few days.Now he is having chest pain that relieved when sitting forward.On examination: Pericardial rub was heard. What is the diagnose? What can we see on ECG ? X-RAY findings suggested infection of pneumonia. What is the most likely organism ? How can we diagnose it? What is the management ?

SAQ3: A 50-year-old presented with fever and chest pain that relieved when sitting forward, On the investigation ECG show ST elevation, RP depression and T-wave inversion. There was no evidence of infection. What is the most likely diagnosis? What is the most likely cause of this diagnosis? Complication? therapeutic procedure To treat the complication?

SAQ4: List the 5 types of pericarditis and mention thing associated with each one?

SAQ1: 1- Myocarditis 2- Coxsackievirus B 3- supportive care

SAQ2: 1-Pericarditis 2- ECG will show specific changes: ST elevation, PR depression and T-wave inversion may occur later. 3-Strept. Pneumoniae 4-CT scan show pericardial thickening 5- Specific antibiotic

SAQ3: 1-pericarditis 2- uremia or SLE... 3 - cardiac tamponade 4- Pericardiocentesis

MCQs

Q1: A 26-year-old man presents to his primary care physician due to shortness of breath, chest pain, and palpitations. He reports that his symptoms have progressively worsened over the course of a month. His shortness of breath is most apparent with climbing the stairs or low-intensity jogging. His electrocardiogram demonstrates nonspecific cardiac abnormalities, lab results showed elevated cardiac biomarkers, blood culture was negative. The most probable cause of his condition is?			
A- Corynebacterium diphtheriae	B- Syphilis	C- Lyme disease	D- Coxsackievirus B
Q2: Not a sign of pericarditis			
A- Specific ECG changes	B- Leukocytosis and elevated ESR	C- CT will show myocardial thickening	D- X-ray will show calcification and enlarged cardiac shadow
Q3: A 68-year-old male is admitted to your care four days after coronary artery bypass grafting (CABG) for a myocardial infarction (MI). The patient has a history of insulin-controlled diabetes, hypertension, and hyperlipidemia. Of note, the patient states that after the surgery, he had resolution of his chest pain, but he has started experiencing chest pain again. The patient states that the pain is exacerbated by deep breaths but feels better when he leans forward compared to lying down flat. On exam, his vitals are normal, and there are no murmurs heard on auscultation. What is the most likely diagnosis for this patient?			
A- Acute pericarditis	B- Chronic pericarditis	C- Acute myocarditis	D- Chronic myocarditis
Q4: What is true about myocarditis is that			
A- Presents with specific ECG changes.	B- X-ray will show cardiomegaly	C- ST elevation, RP depression and T-wave inversion in ECG	D- Presents as positional chest pain
Q5: Which type of pericarditis is caused by tb			
A- Caseous pericarditis	B- Fibrinous pericarditis	C- Hemorrhagic pericarditis	D- A & C
Q6: A 34-year old HIV-infected man (CD4 cell count = 310 cells/mm3) came to our hospital with a short history of increasing dyspnea and dizziness. He reported chest pain, weight loss, night sweats, but no cough. On initial assessment, he was unwell, diaphoretic, tachycardic (heart rate = 128/min), hypotensive (blood pressure = 100/60 mm of Hg), and severely tachypnoeic (respiratory rate = 40/min). Jugular venous pressure was increased. Chest radiograph demonstrated enlarged cardiac shadow. Smears came negative for AFB. What is the most probable diagnosis?			
A- Acute myocarditis	B- Acute pericarditis	C- Chronic pericarditis	D- I don't know.
Q7: Which one of the following is associated with serous pericarditis?			
A- TB	B- Viruses	C- Bacteria	D- Malignancy

Q1	Q2	Q3	Q4	Q5	Q6	Q7
D	C	A	B	D	C	B

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