

Virology of the cardiovascular system

Of an importance to know the following:

- This project includes two lectures of the virology considering the cardiovascular system.
- We will talk about this topic briefly, because this medical course isn't enough to cover everything in relation to viral diseases, i.e. the lecture will be very specific.
- We will study the viral carditis and viral hemorrhagic fever, since they are the most common topics in the clinical course.
- No need to refer to slides, this project covers everything.

So let us start talking about our course:

- First what do we mean by carditis? Actually it is inflammation of the heart, and the inflammation of its outer layer or what is called pericardium is pericarditis or sometimes they call it epicarditis, the same thing it doesn't matter. Also we have myocarditis which means inflammation of the myocardium which is the thickest layer in the heart. And you should know that pericarditis and myocarditis are almost always the same disease and so they are called myopericarditis, but pericarditis is much more common than myocarditis.
- Endocarditis, which is inflammation of the endocardium.
- In relation to heart as you know we have the pericardium which is a fibro serous layer, the serous layer divides into visceral and parietal and we have a potential space in between contains fluid of 50ml which gets inflamed, so-called pericarditis.
- Talking about pericarditis includes mentioning a variety of causes as follows :

1-Acute or non-specific, or what is called "idiopathic"

2-Infective, that can be viral, bacterial, and other infections.

3-Immunologic, such as the rheumatic fever, SLE.

4-traumatic, like the myxedema, neoplastic, or uremic. To be more accurate traumatic mainly to the chest wall.

5-Myocardial infarction, which is followed by an autoimmune reaction causes the pericarditis, or what is called "Dressler's syndrome"

6-connective tissue disorder.

-First let's take a look at the infectious pericarditis:

- It divides into acute and chronic, its etiology which varies according to the offending cause which can be viral or bacterial. But what we are concerned in is the viral cause, and the most common virus involved is the enterovirus, actually it is a family of viruses but to be more precise the commonest one of these viruses that cause pericarditis is the coxsackievirus. On the other hand, in relation to the bacterial cause, actually we have a variety of types but mainly we have strep, staph, and Neisseria. In addition we have the T.B which causes pericarditis but in a form of chronic, which in turn is almost always the major cause of infectious pericarditis.

-But the question is how can the microorganism reach the heart?

We have many ways by which the heart can be infected but basically through the blood, or as a direct extension from the closest structure to the heart "lung", i.e. when the lung is infected or its pleura by pneumococci.

Also it can be due to surgery by using contaminated objects, as well as car accidents as if we are talking about the main traumatic cause. But in general the **most** common route of transmission to the heart is the **blood**.

-And you have to know that the pericarditis have phases of adhesion, inflammation, etc.

-Now, let's talk about the major types of acute pericarditis:

1-Acute serous or serofibrous pericarditis.

2-Acute purulent pericarditis.

-In relation to the first one, what do we mean by "serofibrous"? , actually serous is derived from the word "serum" i.e. it contains a fluid that tends to be whitish to yellowish in color, but what makes it yellowish is specific proteins and cells inside it mainly the neutrophils which are associated with the puss, and once these cells and proteins decrease in number the color becomes more transparent, and whenever the proteins become more whenever the color yellow.

1-The serofibrous pericarditis is described as a mild inflammatory reaction associated with focal damage to the adjacent myocardium which occurs in most of cases.

-and the response to such a disease can vary from a small amount of serous fluid with mononuclear cells and fibrinogen to a large neutrophil rich disease with a bloody effusion.

-As we said we can find mild fibrosis and adhesion between visceral and parietal layers of the pericardium, **but** if the immune system was capable and advanced enough to get rid from this adhesion which is supposed to happen, then the patient recovers and becomes normal. But if the patient wasn't protected by a well-developed immune system or advanced enough then he will go into the next manifestation.

-Constrictive pericarditis which is rare is a complication of insufficient immune defense. In this condition the pericardium becomes incompressible and so it affects the pumping mechanism of the heart.

-So in general the acute serofibrinous pericarditis is usually self-limiting and rarely fatal, caused mainly by the coxsackievirus.

2-The acute purulent pericarditis is mainly caused by a group of bacteria in order to differentiate from the first one which is viral. Also it is associated with the so-called purulent.

-The purulent material contains large number of neutrophils in a large number of effusion.

-Also, healing is associated with extensive fibrosis that may extend to constrictive pericarditis.

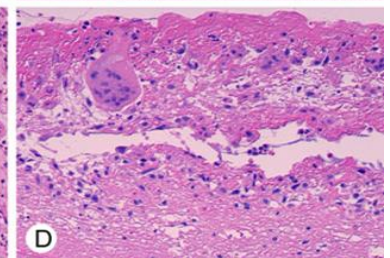
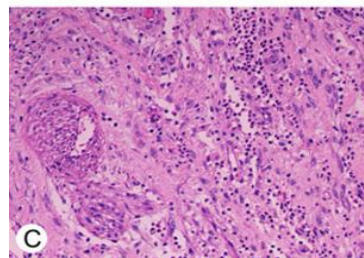
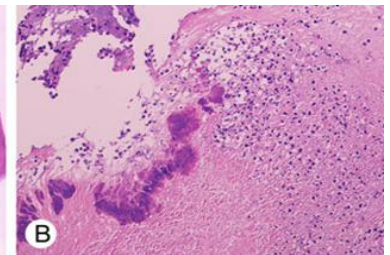
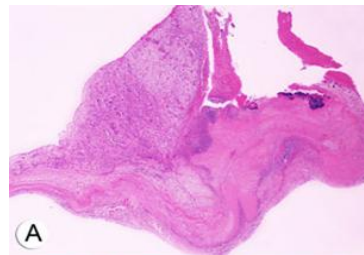
-And it is a must to know that it is associated with a high mortality rate in comparison with the first one.

-Let's move to the chronic pericarditis:

-as we said the major cause is mycobacterium tuberculosis, but there is a possibility for other types of bacteria to cause such a disease if not treated. In addition to this, about 5% of cases associated with pulmonary T.B will develop chronic pericarditis, actually it is rarely to occur in these days because it is diagnosed early and patients can be treated early also before being in a potential to develop such a disease.

-Chronic pericarditis simply is divided into stages, begins with a phase of granulomatous changes associated with large pericardial effusion and the fluid inside exceeds 300ml, which is rich in mononuclear cells, then it is followed by an inflammatory process identified by the presence of a fusion between visceral and parietal pericardium that develops into constrictive pericarditis which leads to circulatory failure ends with shock and death.

- You can refer to slides in order to find out the pathological findings on samples that were previewed in the lecture, add to this the gram-stained cells.



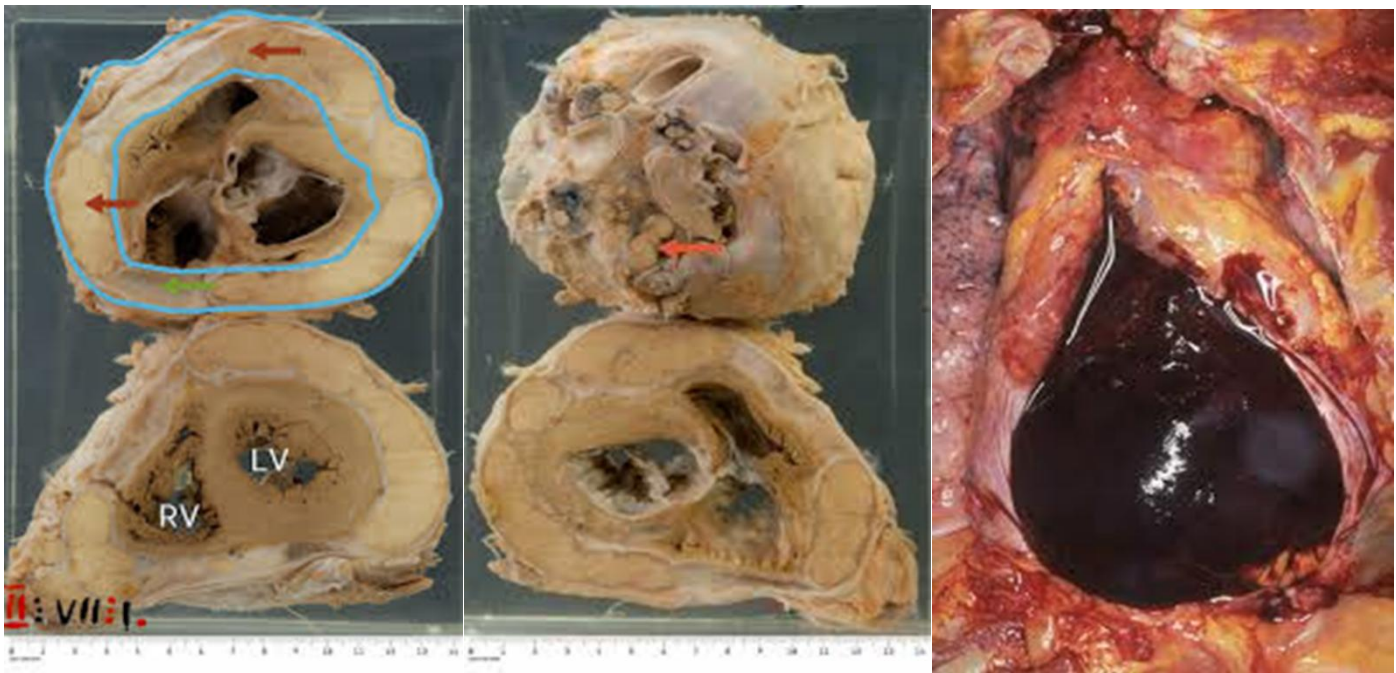
-As you can see on the left, which is serous pericarditis targeted by the red arrows identified by the following:

- 1-Small amount of inflammation.
- 2-Fluid is clearly transparent, and it isn't a puss.

-The one on the right is purulent pericarditis identified by the following:

- 1-The adhesions.
- 2-The puss.

-The slide above that shows a type of purulent pericarditis, is a must to know that there is no significant separation or differentiation between pericarditis and myocarditis, and it is proved by the presence of inflammatory cells inside the myocardium.



-Other diagnostic means for identification:

-Also we can do a CT. scan for the patient and you can notice the presence of thickened pericardium.

-And in relation to T.B you can notice that it is associated with calcification in the last stages of inflammation.

- This is a slide, above on the left that shows the cessation granuloma of the heart targeted by the red arrows. But what do we mean by cessation granuloma? Actually it is a sort of necrosis in the tissues that tends to be like a cheesy material which is pointed by the green arrow in the first slide on the left, and it is usually a site of fibrosis.

-In the last slide, above on the right you can see what is called **hemopericardium**, and is good to know that in this case the blood will not appear directly or sometimes it doesn't appear, because actually it is agglutinated inside. In such disease we can find many causes or infectious causes like staph, strep, and T.B. also it can be due to trauma.

-But in general the main hallmark for cardiac diseases is chest **pain**.

-Symptoms of pericarditis:

A-For the acute serofibrous pericarditis you can find the following;

1-chest pain the main hallmark for cardiac diseases that can be rapid in onset, persistent, and takes hours to days. It gets worse when the patient starts the process of inspiration or going down stairs the so-called recumbence. But when the patient is leaning forward which is really important words in clinical practice, then the patient feels better.

-The pain also can radiate to the upper abdomen or the epigastric part like a sharp, dull, or constricting pain, which means that is variable in different forms. But in certain cases it can be as a **crushing pain** or like putting a heavy object on someone's chest which mimics the pain of M.I, and so we need further investigations in order to differentiate between them. And for many times the pericarditis was diagnosed after canceling the M.I choice.

2-Fever isn't prominent in such a disease, you find the patient sick and suffers from the pericardial friction rub which simply mimics the voice of scratching.

B-The acute purulent pericarditis, as you can see:

1-the same thing we have a chest pain which is little in onset, because the pericardium is moving freely and there is no inflammation inside the pericardium.

2-but it is more associated with fever, chills, or any evidence of other bacterial infections like pneumonia, plural poima, etc.

3-Cardiac tamponade , a pathological process identified by the presence of increased amount of fluids inside the pericardium more than 50ml that affects the filling of the heart , because the heart doesn't have enough space to pump the blood easily with highest efficiency and so due to inappropriate interaction between actine and myosin fibers we will get less powerful contraction . Which in turn can lead to shortness of breath or "dyspnea", agitation, orthopnea, cough and ends with pulmonary edema.

Γ-The chronic pericarditis can be associated with other manifestations of T.B like, the presence of fever, weakness, night sweating for a long period, and chest pain.

-Diagnosis of pericarditis is too easy to do with a great accuracy, which is easily done by certain studies such as ECO mainly the transthoracic eco the best way to do in laboratories. Also the EKG can be used as you know for such diagnosis identified mainly by the presence of S.T elevation.

-**Finally**, how can you treat pericarditis after making sure that the patient doesn't have cancer, gout, uremia, lupus, connective tissue diseases, and he suffers from high fever?

-Actually there is no specific treatment for such diseases but there is what is called supportive treatment by asking the patient for complete rest bed, controlling pain by NSAIDs. But if it was bacterial cause then I have to use pharmacology by giving him antibiotics.

-But how can we reach or take the microorganism?

-by taking blood sample from the patient using a needle , then you send it to culture , but you have to know that you give antibiotics only but only when you have positive results which is unlikely to happen because usually we get negative results . but here we are little bit confused because after concluding that this is an infectious pericarditis we got negative culture , and so there is a possibility that the culture didn't grow, so its you're the choice to choose the best antibiotic that covers staph and strep.

-but if everything was complicated then the last resort for treatment is the surgical intervention.

- in relation to myocarditis, actually it's the same thing for pericarditis.

-I think we completed the first topic related to the pericarditis, now let us move to the next topic.

Ω-The second topic is talking about the viral hemorrhagic fever.

-First, what do we mean by viral hemorrhagic fever? Actually it is a collection of manifestations included in one syndrome caused by several agents. But we are concerned with a distinct viruses as mentioned below.

-We have a group of families , but they share the same form of nucleic acid which is single stranded RNA as well as each one of them is covered by a lipid envelop :

1-Filovirideai, "filo" means thread line or filament in Latin, and it includes Ebola and Marburg viruses.

2-Flavevirideai, and "flave" means yellow in Latin, and it includes yellow fever and dengue fever viruses.

3-Arenavirideai, "arena" means sandy-like virus in Latin, this is due to large number of ribosomes. And it includes Lassa fever virus.

4-Bunyavirideai, "bunya" actually it is a village in guinea, and it includes hanta and rift valley fever viruses.

-Diagnosis of viral hemorrhagic fever:

1-First we have the PCR, we take a blood sample or a tissue biopsy from the patient.

2-ELISA, stands for "enzyme-linked immunosorbent assay. But actually it is used mainly for looking for antibodies not viruses.

3-Viral culture can be used under certain conditions including biological labs with high safety.

-Clinical symptoms of this disease are related to the high infectious dose of the causative agent that ranges between 1-10 viruses which means that these viruses are highly pathogenic.

1-Systemic illness and fever as the name of disease implies.

2-Capillary dysfunction.

3-Prostration.

4-Shock.

5-CNS dysfunction.

6-Also it causes bleeding , due to thrombocytopenia , which is associated with endothelial dysfunction , hemorrhagic rash , epistaxis , hemoptysis, i.e. the patient starts to bleed from many parts of his body including , skin, nose , and also he might have hematemesis.

Δ-Let us start talking about **Ebola** virus which takes the world's attention right now:

-Was discovered in 1976 by a Belgian scientist , when there was an outbreak in west Africa due to a disease caused by Ebola virus , then scientists thought that it is Marburg virus but actually it isn't, it is similar to it .

-Incubation period of this virus ranges between 2-21 days, after that the patient can develop symptoms of the disease:

1-Nausea, vomiting, and abdominal pain.

2-Fever, weakness.

3-Organ failure, like renal failure, also it can lead to encephalopathy and bleeding. but in relation to renal failure it depends on the patient himself ,because some patients don't develop renal failure for a reason or another that's why the death occur in 60% - 80% of cases since we don't know the cause but supposed to be the supportive care.

-Ebola virus is highly infectious , which means it can be transmitted by touching the skin of patient ,or through the blood or any other fluids like sweating , urine , semen , etc. and also when anyone come in contact with primates , like chimpanzees or bats ,since they are the major reservoir of the virus.

-there is no specific treatment for this disease, but we have the choice of supportive treatment. But still they are working on this field to produce a new vaccine called "Zemap", as a monoclonal antibodies that attack the virus directly. Unfortunately by the end of this October about 10,000 patients were infected by this virus half of them died, but all these numbers are underestimated since not all the patents come to the health care clinic. But in general the patients become infected once in their lives, with a possibility for reinfection.

Δ-Now let us move to the next virus which is the yellow fever virus:

-The yellow fever itself was the most important infection in the world ,common in Africa and south America, transmitted mainly by a mosquito .symptoms can range from mild which is the most common case that the travelers face to a sever case associated with hepatitis, bleeding, renal failure, ends with shock and death .

-Mortality rate ranges between 5% - 20%.

-In relation to its vaccine, it is the only one virus that has a vaccine in its family including all other viruses that cause viral hemorrhagic fever.

-Actually its live vaccine is associated with many problems and complications, not commonly used, used mainly for travelers as we said because they are more exposed to such decease.

Subject: Virology of CV5.

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