Pathology of the Heart

Heart Failure: It occurs when the heart cannot generate sufficient output to meet the metabolic requirements of peripheral tissues .Inadequate cardiac output always accompanied by increased congestion in the venous circulation, heart failure can affect left side, right side or both sides.

The most common causes of left-sided heart failure are:

1- Ischemic heart diseases (IHD)

2- Systemic hypertension.

3-Mitral or aortic valve disease.

4- Primary diseases of myocardium (ex. Amyloidosis).

Symptoms are related to pulmonary congestion and edema.

The most common causes of right sided heart failure are:

1-pulmonary hypertension

2-congenital heart diseases (left to right shunt).

3-Primary tricuspid valve diseases.

Symptoms are related to peripheral edema and visceral congestion especially **liver** producing **congestive hepatomegaly** which on cut section producing a pattern called **nutmeg** liver in which there is red congested nodules surrounded by pale areas at the periphery of the lobule. In long standing cases the central area become fibrotic lead **to cardiac cirrhosis**.

Other symptoms: -Elevated pressure in portal vein (portal hypertension)

- Congestive splenomegaly.

-Transudate Effusion in pleural, pericardial & peritoneal spaces.

- Peripheral edema in dependent parts and in severe cases generalized massive edema (anasarca).

Congenital Heart Diseases

Are the most common forms of congenital anomalies, that are present at birth, genetic factors play an important role in some cases as in trisomy's 13, 14, 18 and 21 & turner syndrome,

while in others pure environmental factors play an important role such as congenital rubella infection

Left-to-Right Shunts: In which there is abnormal communication permitting blood to flow from left to right cardiac chambers, cyanosis is a late sign. They include:

- Atrial septal defect (ASD).
- Ventricular septal defect (VSD).
- Patent (persistent) ductus arteriosus (PDS).

(The ductus arteriosus is an arterial channel communicating between pulmonary artery and aorta during intrauterine life; it will close shortly after birth)

Right-to-left shunts: In which there is abnormal communication permitting blood to flow from right to left cardiac chambers. Cyanosis is an early sign. They include:

- Tetralogy of Fallot : It is the most common cause of cyanotic congenital heart disease, it includes VSD, aortic root overrides the VSD, right ventricular outflow obstruction (sub pulmonic stenosis) and right ventricular hypertrophy.
- Transposition of the great arteries in which the aorta arises from right ventricle and the pulmonary artery arises from the left ventricle.

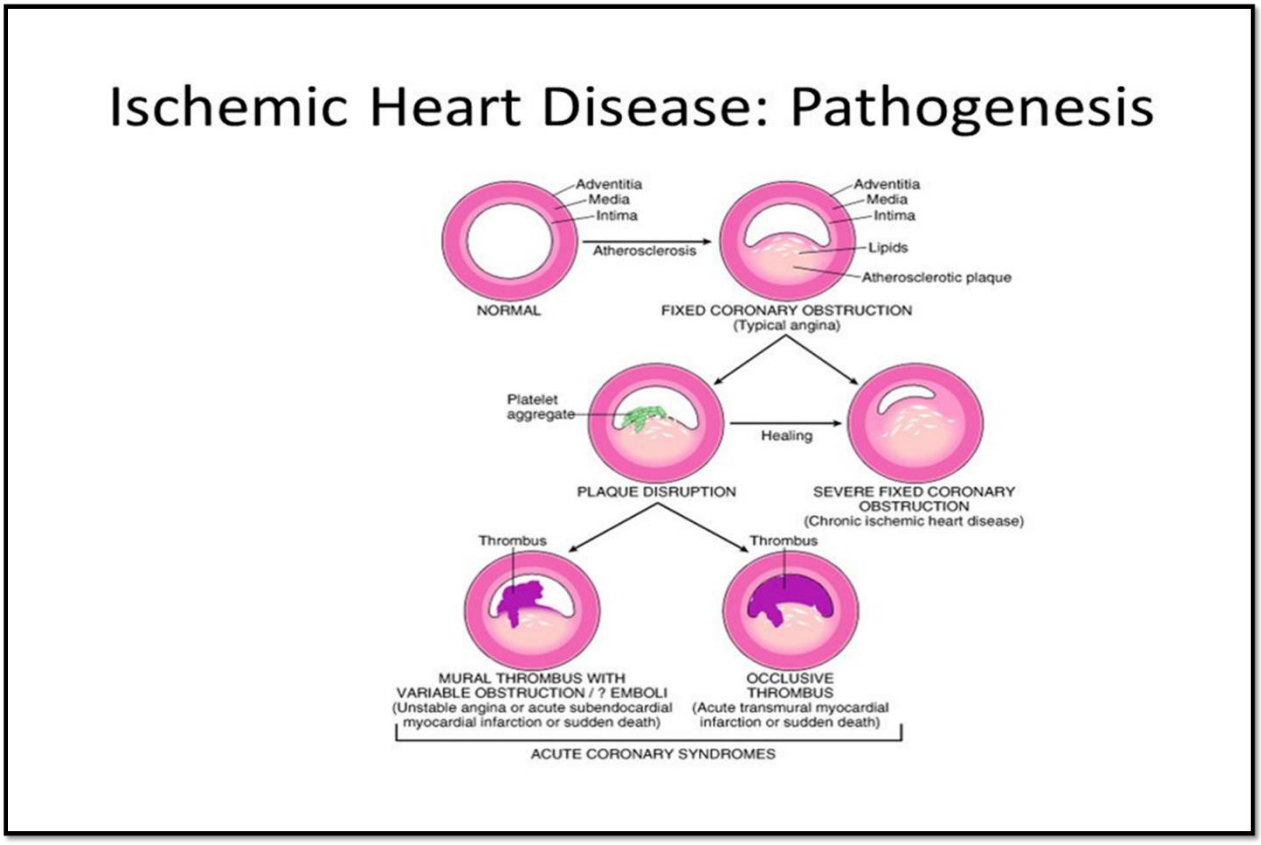
Ischemic Heart Diseases (IHD)

Is a group of closely related syndromes resulting from myocardial ischemia in which there is imbalance between cardiac blood supply and myocardial demand.

There are 4 clinical syndromes: Angina pectoris, acute myocardial infarction (MI), chronic IHD, and sudden cardiac death (SCD).

Pathogenesis: IHD is primarily consequence of inadequate coronary perfusion occurs from:

Preexisting atherosclerotic lesion, and superimposed thrombosis or vasospasm, Lesions occlude more than 70% of the vessel lumen resulting in critical stenosis, that causes symptoms in setting of increased demand and if occluded more than 90% of vascular lumen can lead to inadequate coronary blood flow which causes symptoms even at rest.



Angina pectoris

Is intermittent chest pain caused by transient reversible myocardial ischemia.It is of 3 types:

1 -Typical or stable angina :Episodic chest pain associated with exertion.

2-Prinzmetal variant angina: occurring at rest due to coronary artery spasm.

3 -Unstable angina : Is characterized by increasing frequency of pain with progressively less exertion.

Myocardial infarction (MI)

Is a necrosis of heart muscle resulting from ischemi,most MI are caused by coronary artery thrombosis, in typical MI the following sequence of events take place:

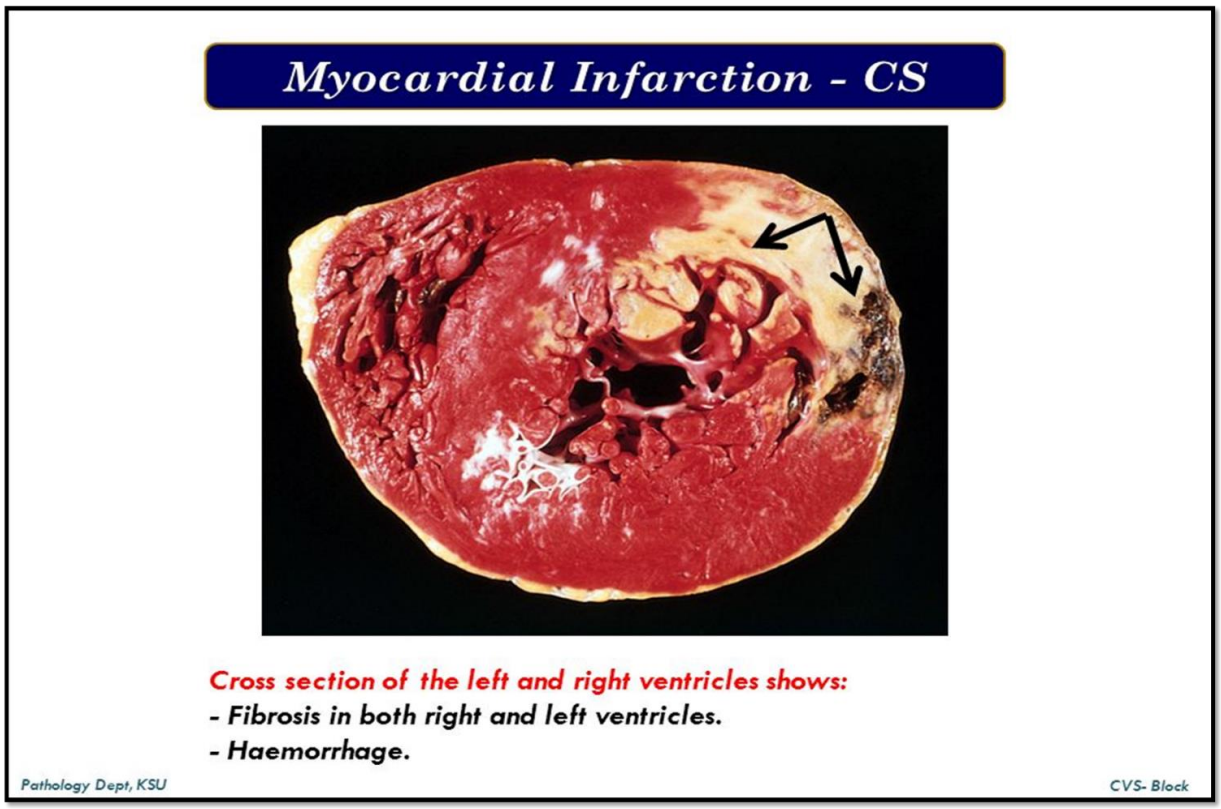
1. An atheromatous plague is suddenly disrupted by hemorrhage or mechanical forces.
2. Platelets adhere, aggregate & activated.
3. Activation of coagulation.
4. Within mints thrombus can evolve to completely occluded the coronary artery lumen.

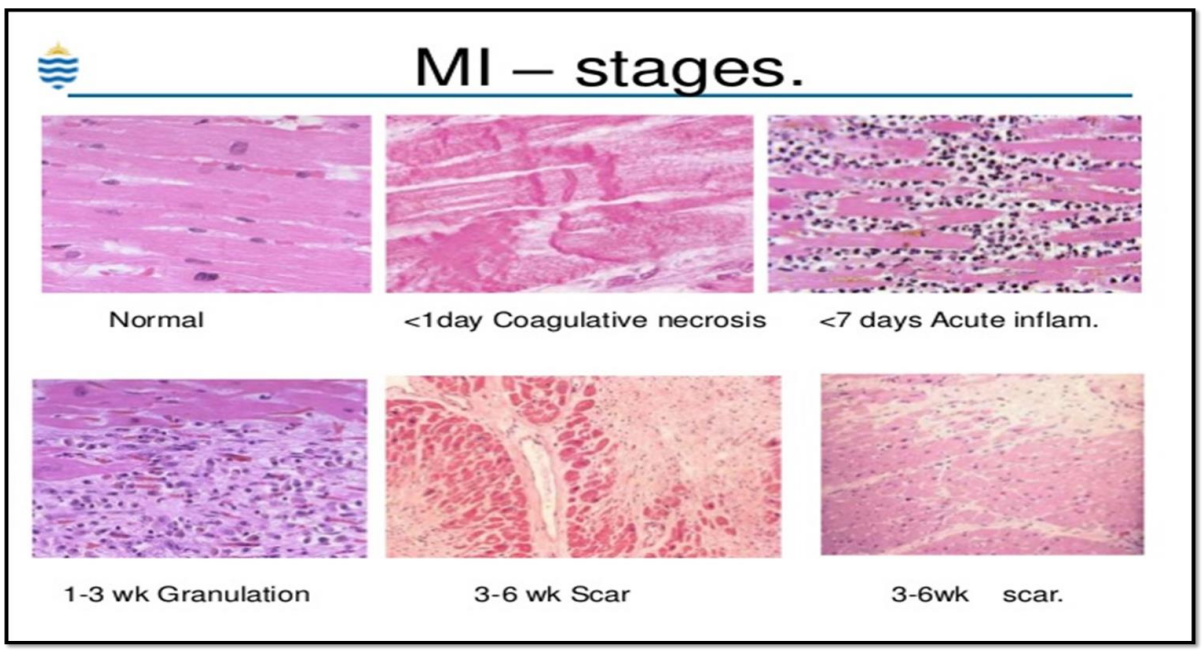
Morphology: Transmural infarction involving more than 50 % of venticular thickness affect at least a portion of left ventricle and/or interventricular septum.

- 15- 30% involve the posterior or posterioseptal wall extend to the right ventricle.

Grossly : Before 12 hours not apparent, 12-24 h, infracted area appears red blue discoloration due to trapped blood, by 10-14 days the infracted area becomes rimmed by hyperemic granulation tissue, after weeks the infracted area replaced by fibrous scar.

Microscopically typical features of coagulative necrosis become detectable within 4-12 hours of infarction.





Complications

1-Arrhythmias.

2-Myocardial rupture :1-5 % of MI.

3-Contractile dysfunction and left-sided heart failure.

4-Pericarditis.

5- Ventricular Aneurysm.

6- Mural thrombus.

7- Chamber dilatation

Valvular Heart Diseases:

Deformed cardiac valves may cause disease by two major mechanisms:

1-Affecting the blood flow through cardiac chambers by either obstruction (stenosis) or regurgitation (incompetence).

2-Abnormal valves are more susceptible to infection and predispose the patient to infective endocarditis

Rheumatic Valvular Disease:

Rheumatic fever is an acute, immunologically mediated, multisystem inflammatory disease that follows an episode of group A streptococcal pharyngitis after interval of a few weeks.

Rheumatic heart disease is the cardiac manifestation of rheumatic fever, it is associated with inflammation of all parts of the heart, but valvular inflammation & scaring produce the most important clinical features .

Pathogenesis:

It is a type of hypersensitivity reaction attributed to Abs directed against group A streptococci, in particular against the M protein of group A streptococci cross-react with normal protein present in the heart (myocardium & cardiac valves), joints and other tissues & cause injury.

Morphology: Inflammatory infiltrate may occur in different tissues including joints, skin and heart, acute rheumatic carditis that is characterized by inflammatory changes in three layers, called pan-carditis.

The most characteristic feature of acute rheumatic carditis is the presence of multiple foci of inflammation within the connective tissue of the heart, called **Aschoff bodies**, which consist histologically of a central focus of fibrinoid necrosis surrounded by a chronic inflammatory cells infiltration include lymphocytes, plasma cells & macrophages

In Chronic rheumatic heart disease: there is organization of inflammation & subsequent scar formation resulting in irreversible deformity of one or more cardiac valves (mitral stenosis or incompetence or aortic stenosis or incompetence)

Myocardial Diseases

Myocarditis: Is a group of inflammatory processes of the myocardium that results in injury to the cardiac myocytes, the major causes of primary Myocarditis are viral, bacterial, immune-mediated reaction like systemic lupus erythematosus or due to drug hypersensitivity reactions.

Morphology: In acute myocarditis the heart appear normal.

In advance stage the myocardium is flabby and mottled with pale & hemorrhagic areas.

Microscopically the myocardium shows edema and interstitial infiltrate by lymphocytes.

Pericardial Diseases

Pericarditis

Primary pericarditis: Viral infection is responsible for most of cases, Bacteria, fungi & parasites may be involved.

Secondary pericarditis: due to Acute MI, cardiac surgery & radiation to the mediastinum.

Uremia is the most common systemic disorder associated with Pericarditis.

Morphology:

In viral or uremic Pericarditis the exudate tend to be fibrinous (Butter and bread appearance)

In bacterial Pericarditis the exudate tend to be fibropurulent (suppurative).

In chronic Pericarditis the appearance varies from delicate adhesions to dense fibrotic scar.

In extreme cases the dense fibrosis encased the heart & preventing it from normal expansion during diastole resulting in (constrictive Pericarditis).

Pericardial effusion:

Is accumulation of fluid in the pericardial space, caused by:

1-Serous effusion caused by congestive heart failure, hypoalbominemia

2-Serosanguinous caused by chest trauma, and malignancy.

3-Chylous caused by mediastinal lymphatic obstruction.

Hemopericardium: is accumulation of pure blood in the pericardial sac caused by :

1-Ruptured aortic aneurysm

2-Ruptured myocardial infarct

3-Penetrating trauma to the chest

If rapidly accumulate in pericardial sac it will cause cardiac temponade and death.