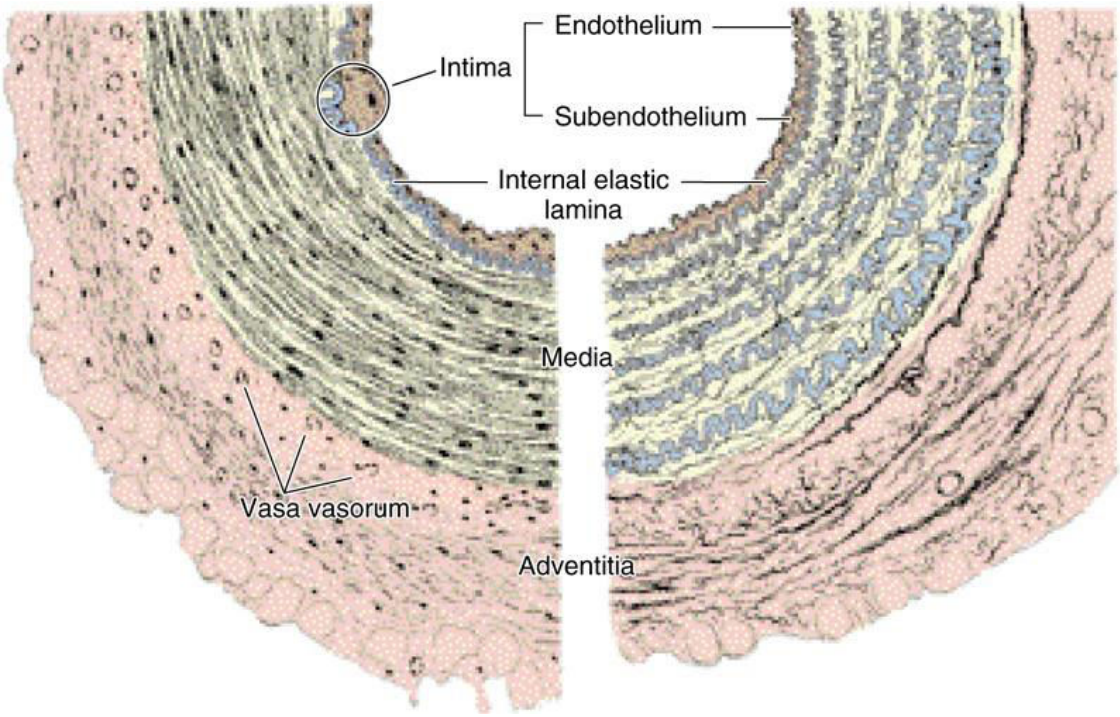
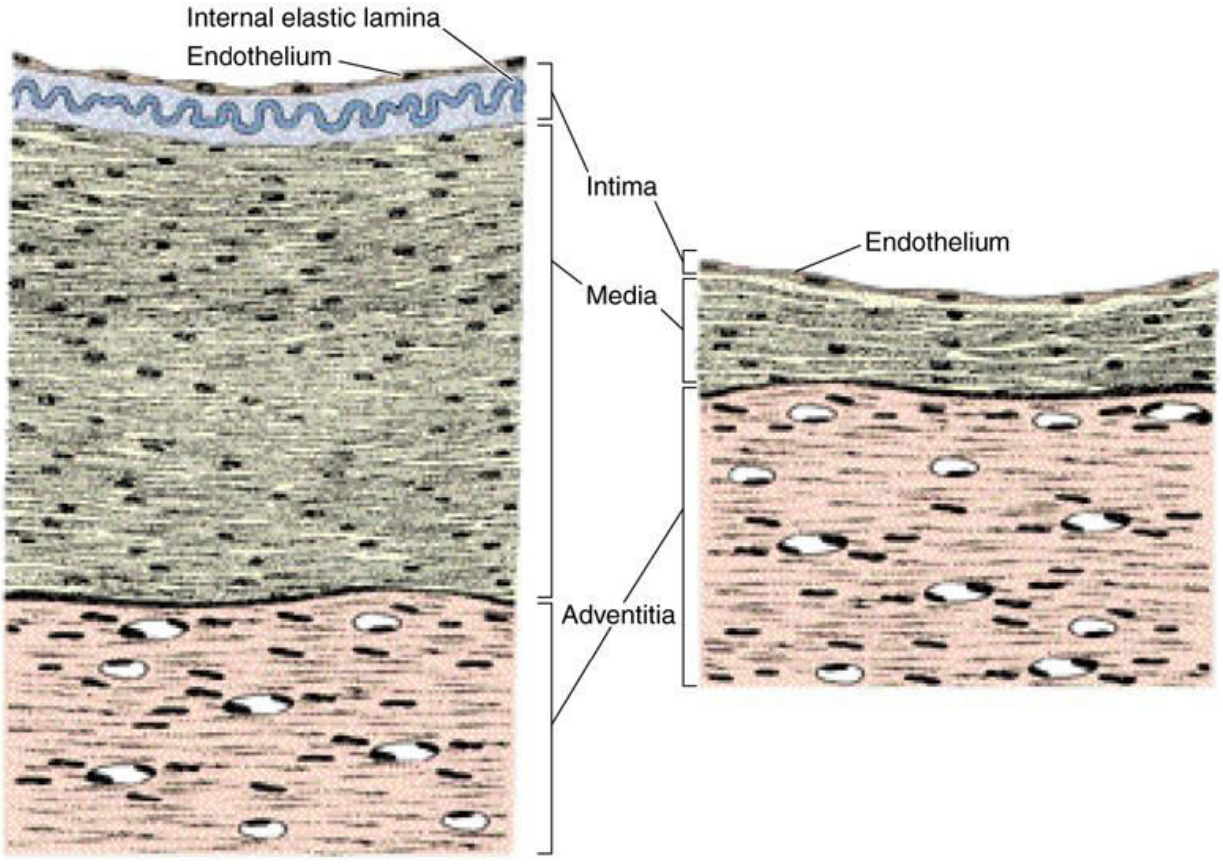
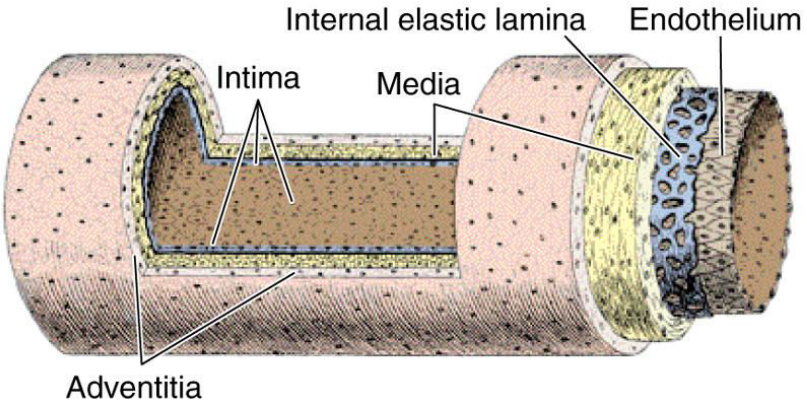
Disturbances in the blood flow

Pathology of the arterial system affects body function through impaired blood flow

Structure of blood vessels







Atherosclerosis

◆ Is a type of hardening of arteries characterized by the formation of fibrofatty lesion in the intimal lining of the large and medium-sized arteries such as aorta and its branches, the coronary arteries and large vessels that supply the brain

◆ Atherosclerosis begins as an insidious process and manifestations of the disease do not become evident for 20-30 years or longer

Mechanism of Atherosclerosis Development

1. **Endothelial cell injury** occurs due to: **Initiating factor for development of atherosclerosis.**

a) immune system

b) Hypertension

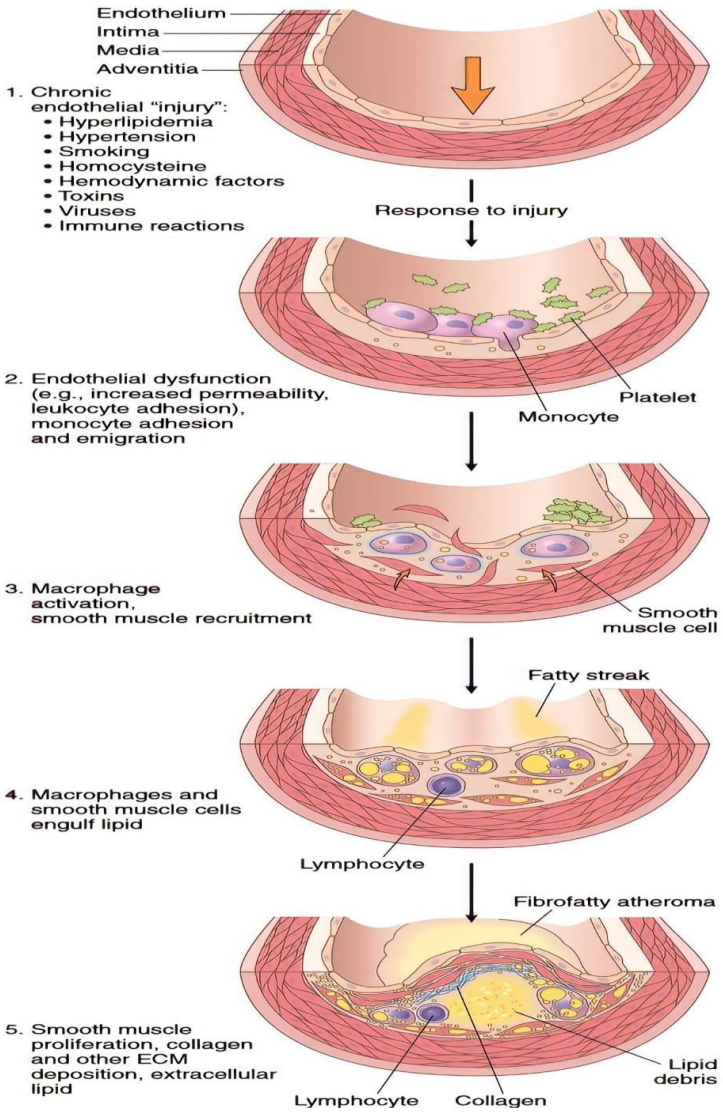
c) High blood cholesterol

d) Product associated with smoking

2. Migration of the inflammatory cells (macrophage) to localize in the intima.

3. Platelets, cholesterol and other blood component are accumulated and stimulate abnormal proliferation of smooth muscle cells and connective tissue with vessel wall.

Mechanism of atherosclerosis development



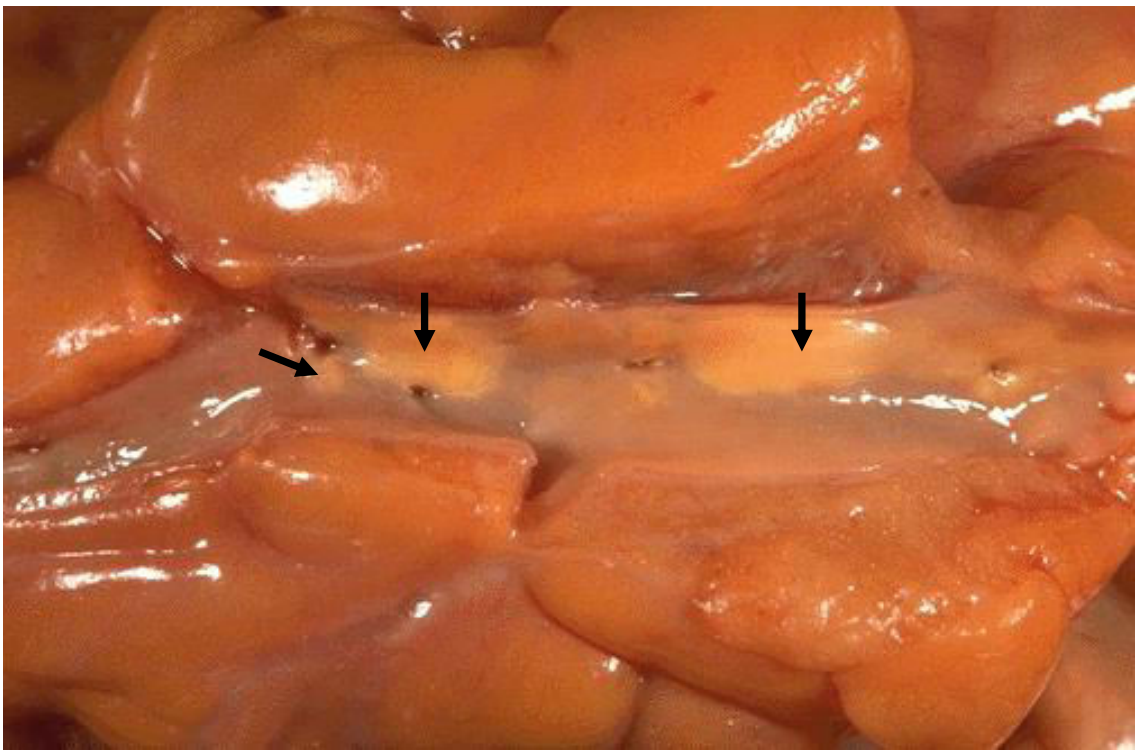
Clinical Manifestations

◆These depend on the vessels involved and the extend of vessel obstruction.

◆**In large vessels**, such as aorta the important complications are those of **thrombus** and **weakness** of the vessel wall.

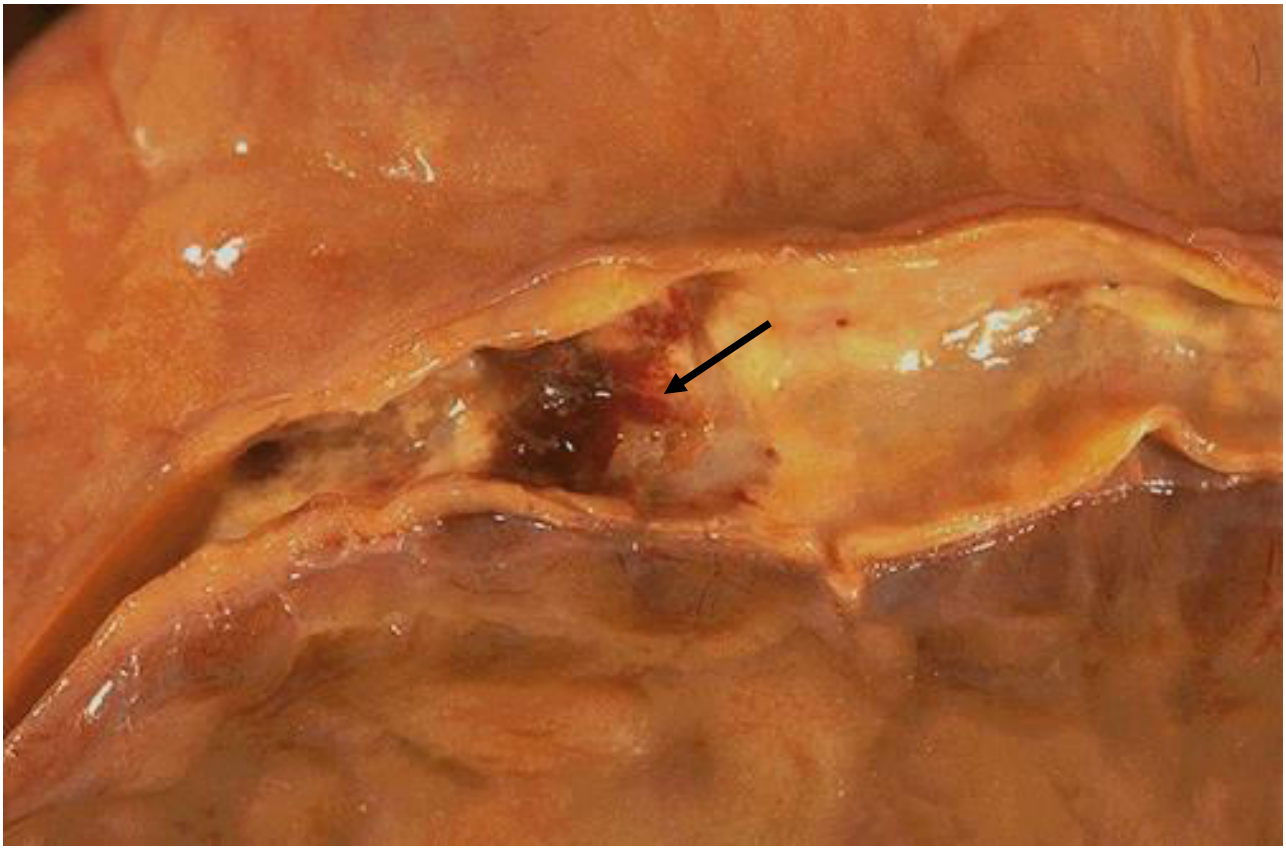
◆ **In medium sized arteries**, such as coronary and cerebral arteries **ischemia** and **infarction** due to vessel occlusion are more common.

Mild degree of coronary atherosclerosis



A coronary artery has been opened longitudinally. The coronary extends from left to right across the middle of the picture and is surrounded by epicardial fat. This coronary shows only mild atherosclerosis, with only an occasional yellow-tan lipid plaques (arrows) and no narrowing.

Coronary atherosclerosis: plaque hemorrhage



This is coronary atherosclerosis with the complication of hemorrhage into atheromatous plaque (arrow). Such hemorrhage acutely may narrow the arterial lumen.

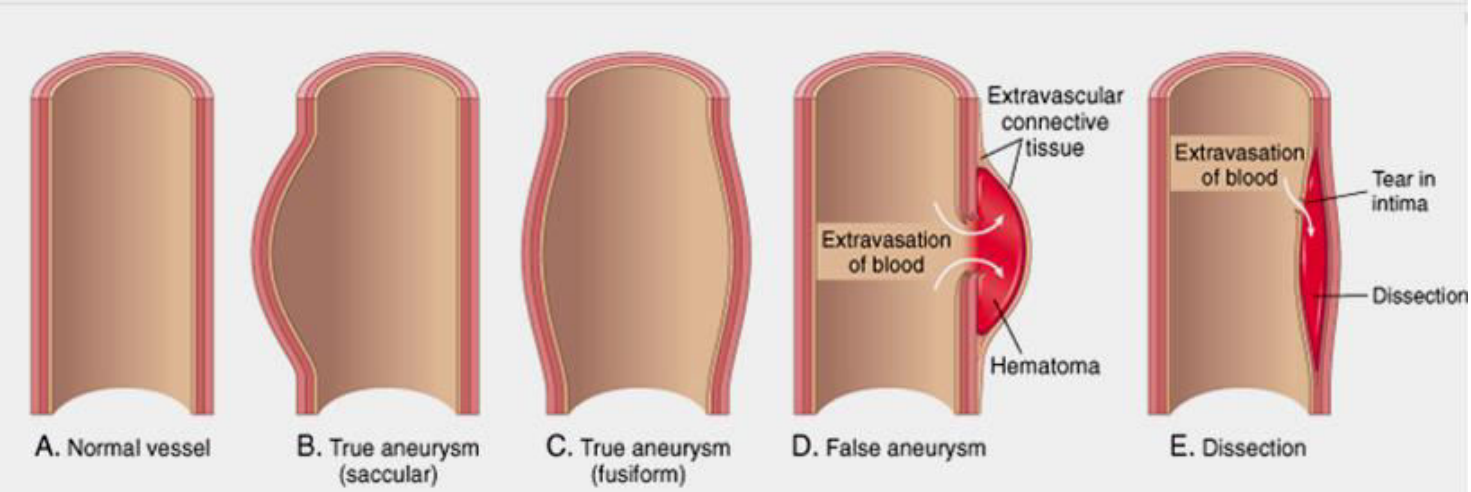
Aneurysm

◆ Is abnormal localized vessel dilation caused by weakness of tunica media of blood vessel's wall.

◆ Causes of arterial wall weakness:

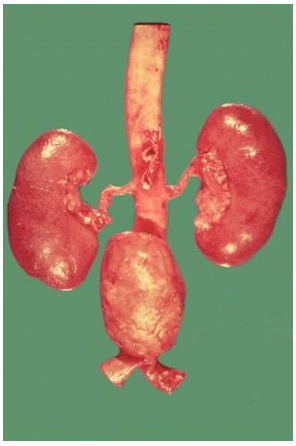
- Congenital defect
- Infections
- Trauma
- Atherosclerosis.

Morphological types of aneurysms



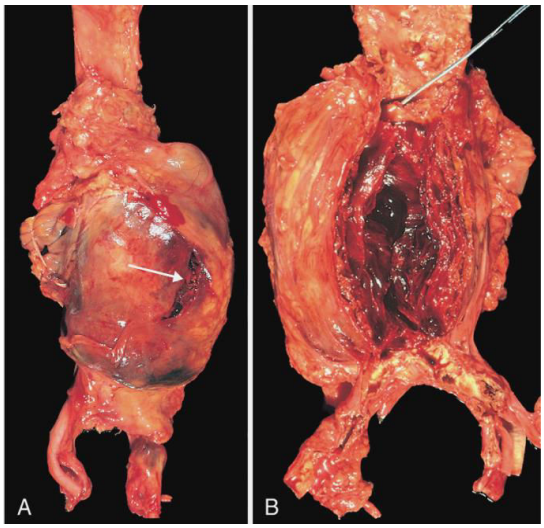
A. Normal vessel. **B**, True aneurysm, saccular type. The wall focally bulges outward and maybe attenuated but is otherwise intact. **C**, True aneurysm, fusiform type. There is circumferential dilation of the vessel, without rupture. **D**, False aneurysm. The wall is ruptured, and there is a collection of blood (hematoma) that is bounded externally by adherent extravascular tissues. **E**, Dissection. Blood has entered (dissected) the wall of the vessel and separated the layers. Although this is shown as occurring through a tear in the lumen, dissections can also occur by rupture of the vessels of the vaso vasorum within the media.

Atherosclerotic aneurysm of the abdominal aorta



A large "bulge" appears just above the aortic bifurcation. Such aneurysms are prone to rupture when they reach about 6 to 7 cm in size. Most such aneurysms are located below the renal arteries so that surgical resection can be performed with placement of a dacron graft.

Abdominal aortic aneurysm



A, External view, gross photograph of a large aortic aneurysm that ruptured (arrow). B, Opened view, with the location of the rupture tract indicated by a probe. The wall of the aneurysm is exceedingly thin, and the lumen is filled by a large quantity of layered but largely unorganized thrombus.

Signs and symptoms

◆Depend on the size and location of aneurysm.

◆Signs of the thoracic aorta aneurysm:

1. Substernal back and neck pain.
2. Dyspnea, cough caused by pressure on the trachea.
3. Hoarseness may result from pressure on the laryngeal nerve.
4. Difficulty in swallowing because of pressure on the esophagus.
5. Odema of the face and neck due to pressure on the superior vena cava.

Aneurysm of cerebral arteries

Berry aneurysms are seen arising where the internal carotid bifurcates into middle and anterior cerebral arteries (arrow).

Ruptured Berry aneurysm with subarachnoid Hge

Blood is present in the subarachnoid space over the cerebellum. in this case, the aneurysm was arising at the tip of the basilar artery.

Diagnosis

- Arteriography
- CT scan
- Ultrasonography
- Magnetic Resonance Imaging (MRI)

Treatment

- Surgically

Hypertension

◆Means elevation in systolic and/ or diastolic blood pressure.

◆Hypertension is commonly divided into:

- Primary (essential) hypertension
- Secondary hypertension.

◆ **Essential hypertension:** is applied to 95% of cases in which no cause for hypertension can be identified.

◆ **Secondary hypertension:** in this type of hypertension the elevation of blood pressure results from some other disorder such as kidney disease.

Essential Hypertension

◆ Is characterized by a chronic elevation in blood pressure that occurs without evidence of other disease.

◆ Risk factors of essential hypertension:

❶ Family history
❷ Race
❸ Lifestyle risk factors (high salt intake, obesity, excess alcohol consumption).
❹ Metabolic disturbances.
❺ Age-related.

◆ Essential is a symptomatic disorder, when symptoms do occur, they are usually related to the long term effect of hypertension on other organ system such as, kidney, heart , eyes and blood vessels.

◆ Hypertension is a major risk factor for atherosclerosis; it predisposes to all major atherosclerotic cardiovascular disorders, including coronary heart disease, heart failure, shock and peripheral artery disease artery disease

In heart

- An increase in blood pressure increase the work load after left ventricle by increasing the pressure against which the heart must pump as it ejects blood into the systemic circulation.

- As the workload of the heart increases it left ventricular wall hypertrophies to compensate for the increased pressure work.

- Left ventricular hypertrophy is a major risk for 1. coronary heart disease, 2. cardiac dysrhythmias, 3. congestive heart failure, 4. sudden death.

Hypertension left ventricular hypertrophy regresses with treatment

- Dementia and cognitive impairment occur more commonly in persons with hypertension.

- Systolic hypertension is a major risk factor for ischemia stroke and intracerebral hemorrhage.

Treatment

- Diuretic
- B- adrenergic blocker
- Angiotensin-converting enzyme inhibitors
- Angiotensin II receptor blockers
- Calcium channel blocking agents

Alteration in cardiac function

- Heart problems that affect people in all age are:

1. Disorders of the pericardium
2. Coronary artery diseases
3. Cardiomyopathies
4. Valvular heart diseases
5. Congenital heart diseases

Disorders of the pericardium

◆ Disorders of the pericardium are:

1. Inflammation of pericardium (pericarditis).
2. Pericardial effusion.

Causes of pericarditis

◆ Infection

◆ Uremia

◆ Rheumatic fever

◆ Myocardial infarction

Signs

◆ Chest pain

◆ ECG

◆ Friction

Pericardial effusion

◆ Means presence of an exudate in the pericardial cavity. It can increase intracardiac pressure, compress the heart and interfere with venous return to the heart.

Causes of pericardial effusion

◆ Inflammation

◆ Kidney diseases

◆ Heart failure

Coronary artery diseases

◆ This type of heart disease is caused by impaired coronary blood flow.

◆ Diseases of coronary vessels can lead to:

Angina, myocardial infarction, heart failure, sudden death.

Angina pectoris

◆ Angina pectoris is a symptomatic paroxysmal pain associated transient myocardial ischemia.

◆ The duration of angina last for 5 minutes

Causes of angina

◆ Coronary atherosclerosis

◆ Spasm of coronary artery (the mechanisms are unknown but it may result from hyperactive sympathetic nervous system)

Diagnosis methods

◆ History

◆ ECG

◆ Exercise stress testing (the presence of chest pain, sever shortness of breath, dysrhythmias, and decrease in blood pressure.

◆ If one or more of these symptoms appear the test is stopped.

◆ Cardiac catheterization.

Treatment

◆ Non-pharmalogical methods

◆Pharmalogical methods which include:

- Relief angina pain
- Vasodilatation
- β blocker
- Anti coagulant

Myocardial infarction

◆Myocardial infarction refers to the ischemic death of myocardial tissue associated with impair blood flow sufficient to produce lethal cell injury.

◆ An infarct may involve the endocardium, myocardium , pericardium or a combination of these.

Signs and symptoms

◆ Severe pain is sometimes described as being suffocating.

◆The pain is usually substernal radiating to the left arm, neck, or jaw.

◆ The pain in myocardial infarction is prolonged (unlike in angina).

◆ Nausea, vomiting

◆ Fever develops within 24 hours and last 3-7 days

◆ The level of myoglobin (an oxygen-carrying protein that is normally present in the cardiac muscle) elevation.

Shock

◆ Is the clinical emergency state caused by circulatory disturbances of acute fall in cardiac out put.

Causes and types

1. Reduction in blood volume (hypovolemic shock), caused by severe hemorrhage extensive vascular exudation, severe vomiting and diarrhea.

2. Acute cardiac shock (cardiogenic shock).

3. Sever infection is associated with bacteremia and septicemia causing septic shock.