GENERAL MEDICINE

Lec.3 Dr.Anas Hammad

Ischemic Heart Diseases

The RA receives deoxygenated blood from the superior and inferior venae cavae and discharges blood to the RV, which in turn pumps it into the pulmonary artery. Blood passes through the pulmonary arterial and alveolar capillary bed, where it is oxygenated, then drains through the pulmonary veins into the LA. Blood then passes into the LV, which pumps it into the Aorta.

Systemic and locally released vasoactive substances influence tone; vasoconstrictors include noradrenaline (norepinephrine), angiotensin II and endothelin-1, whereas adenosine, bradykinin, prostaglandins and nitric oxide are vasodilators. Resistance to blood flow rises with viscosity and is mainly influenced by the haematocrit.

Coronary blood vessels receive sympathetic and parasympathetic innervation. While;

stimulation of a-adrenoceptors causes vasoconstriction and

stimulation of β2-adrenoceptors causes vasodilatation,

the predominant effect of sympathetic stimulation in coronary arteries is vasodilatation.

Parasympathetic stimulation also causes modest dilatation of normal coronary arteries. Because of these homeostatic mechanisms that regulate vessel tone, narrowing or stenosis in a coronary artery does not limit flow, even during exercise, until the cross-sectional area of the vessel is reduced by at least **70%**.

Cardiac output, BP and pulse rate change with respiration as the result of changes in blood flow to the right and left heart.

Investigation of Cardiovascular Disease

Several investigations may be required in the diagnosis of cardiac disease and assessment of its severity. Basic tests, such as electrocardiography, chest X-ray and echocardiography, can be performed in an outpatient clinic or at the bedside, whereas more complex procedures such as cardiac catheterisation, radionuclide imaging, computed tomography (CT) and magnetic resonance imaging (MRI) require specialized facilities.



Cardiac biomarkers

Several biomarkers are available that can be measured in peripheral blood to assess myocardial dysfunction and ischaemia.

✓ Brain natriuretic peptide; (BNP) is a peptide hormone of 32 amino acids with diuretic properties. It is secreted by the LV as a 108-amino acid prohormone, which is cleaved to produce active BNP, and an inactive 76-amino acid N-terminal fragment (NT-proBNP). Circulating levels are elevated in conditions associated with LV systolic dysfunction.

Generally, NT-proBNP is measured in preference to BNP since it has a longer half-life. Measurements of NT-proBNP are indicated for the diagnosis of LV dysfunction and to assess prognosis and response to therapy in patients with heart failure

✓ Cardiac troponin; Troponin I and troponin T are structural cardiac muscle proteins that are released during myocyte damage and necrosis, and represent the cornerstone of the diagnosis of acute myocardial infarction, so that elevated plasma troponin concentrations may be observed in conditions other than acute MI, such as pulmonary embolus, septic shock and pulmonary oedema.

Functional Anatomy and Physiology

The atria are thin-walled structures that act as priming pumps for the ventricles, which provide most of the energy required to maintain the circulation.

The ventricles are thick-walled structures, adapted to circulating blood through large vascular beds under pressure. The LV myocardium is normally around 10 mm thick because it pumps blood at a higher pressure than the RV.

Normally, the heart occupies less than 50% of the transthoracic diameter in the frontal plane, as seen on a chest X-ray.

Coronary circulation

The left main and right coronary arteries arise from the left and right sinuses of the aortic root, distal to the aortic valve (Fig.1). Within **2.5 cm** of its origin, the left main coronary artery divides into the left anterior descending artery (LAD), which runs in the anterior interventricular groove, and the left circumflex artery (CX), which runs posteriorly in the atrioventricular groove.





The LAD gives branches to supply the anterior part of the septum (septal perforators) and the anterior, lateral and apical walls of the LV. The CX gives marginal branches that supply the lateral, posterior and inferior segments of the LV. The right coronary artery (RCA) runs in the right atrioventricular groove, giving branches that supply the RA, RV and inferoposterior aspects of the LV.

The RCA supplies the sinoatrial (SA) node in about 60% of individuals and the AV node in about 90%. Proximal occlusion of the RCA therefore often results in sinus bradycardia and may also cause AV nodal block.

The posterior descending artery runs in the posterior interventricular groove and supplies the inferior part of the interventricular septum. This vessel is a branch of the RCA in approximately 90% of people (dominant right system) and is supplied by the CX in the remainder (dominant left system). The coronary anatomy varies greatly from person to person and there are many normal variants.

The venous system follows the coronary arteries but drains into the coronary sinus in the atrioventricular groove, and then to the RA. An

extensive lymphatic system drains into vessels that travel with the coronary vessels and then into the thoracic duct.

Abrupt occlusion of the RCA, due to coronary thrombosis, <u>results in</u> infarction of the inferior part of the LV and often the RV. Abrupt occlusion of the LAD or CX <u>causes</u> infarction in the corresponding territory of the LV, and occlusion of the left main coronary artery is usually fatal.

The venous system follows the coronary arteries but drains into the coronary sinus in the atrioventricular groove, and then to the RA. An extensive lymphatic system drains into vessels that travel with the coronary vessels and then into the thoracic duct.

Coronary artery disease

Coronary artery disease (CAD) is the most common form of heart disease and the single most important cause of premature death in Europe, the Baltic states, Russia, North and South America, Australia and New Zealand. By 2020, it is estimated that it will be the major cause of death in all regions of the world. However, in Eastern Europe and much of Asia, the rates of CAD are rapidly rising. Disease of the coronary arteries is almost always due to atheroma and its complications, particularly thrombosis (Box-2).

| Clinical problem | Pathology |
|--------------------------|---|
| Stable angina | Ischaemia due to fixed atheromatous stenosis of one or more coronary arteries |
| Unstable angina | Ischaemia caused by dynamic obstruction of a coronary artery due to plaque rupture or erosion with superimposed thrombosis |
| Myocardial Infarction | Myocardial necrosis caused by acute occlusion of a coronary artery due to plaque rupture or erosion with superimposed thrombosis |
| Heart failure | Myocardial dysfunction due to infarction or ischaemia |
| Arrhythmia | Altered conduction due to ischaemia or infarction |
| Sudden death | Ventricular arrhythmia, asystole or massive myocardial infarction |

Box-2: Coronary artery disease: clinical manifestations and pathology.

Stable angina

Angina pectoris is the symptom complex caused by transient myocardial ischaemia and constitutes a clinical syndrome rather than a disease. It may occur whenever there is an imbalance between myocardial oxygen supply and demand.

Coronary atheroma is by far the most common cause of angina, although the symptom may be a manifestation of other forms of heart disease, particularly aortic valve disease and hypertrophic cardiomyopathy

Clinical features

The history is the most important factor in making the diagnosis. Stable angina is characterized by:

- \checkmark central chest pain,
- ✓ discomfort or breathlessness caused by exertion or other forms of stress, and is relieved by rest

Activities precipitating angina;

Common

- Physical exertion
- Cold exposure
- Heavy meals
- Intense emotion

Uncommon

- Lying flat (decubitus angina)
- Vivid dreams (nocturnal angina)

Investigations

- 1- Resting ECG
- 2- Exercise ECG

Management: general measures

The management of angina pectoris involves:

• a careful assessment of the likely extent and severity of arterial disease

• the identification and control of risk factors such as smoking, hypertension and hyperlipidaemia

• the use of measures to control symptoms

• Identification of high-risk patients for treatment to improve life expectancy.

Symptoms alone are a poor guide to the extent of coronary artery disease. An algorithm for the investigation and treatment of patients with stable angina is shown in Figure 2



Fig. 2 A scheme for the investigation and treatment of stable angina on effort. The selection of percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) depends upon patient choice, coronary artery anatomy and extent of coronary artery disease. In general, left main stem and three-vessel coronary artery disease should be treated by CABG surgery.

THANK YOU