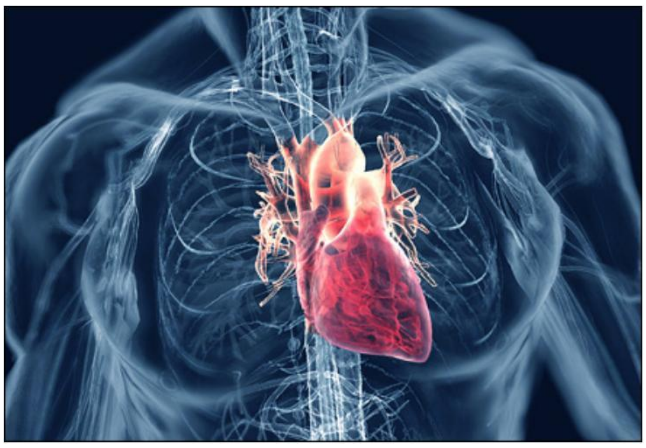
Faculty of Medicine and Allied Medical Sciences (FM&AMS)



Module 3: Cardiovascular System

Student Study Guide

Academic year 2019

Year 1

Contents

Cardiovascular module details

Module details

Course	**MBBS**
Term	**Two**
Year	**One**
Commencement date	**8th July 2019**
Duration of module	**05 weeks**
Pre-requisites	**Successful completion of Module 1 & 2**
Disciplines covered	**Anatomy, Physiology and Biochemistry**
Learning outcomes	**the competent medical practitioner,**
Competencies covered	**I (Skilful), and II (Knowledgeable/ problem solver),**
Module assessment	**End-module assessment**
Assessment methods	**One Correct Answer (MCQs) & Structured Answer Questions (SAQs), Objective structured Practical Examination (OSPE)**
Year 1 coordinator	**Dr Syna Amir**

Cardiovascular module

Introduction

Welcome to the cardiovascular system module. This very exciting module will be very essential to your future work as doctors. The module has been re-designed to make your learning both interesting and productive by including plenty of interactive activities.

During this module, you will be encouraged to learn the structure and function of the cardiovascular system in an integrated manner: this mean what was previously categorized into subjects such as Anatomy, Physiology and Biochemistry, will be learned and assessed together (Horizontal Integration). We will also help you learn the basic sciences in a way that is relevant to their clinical applications (Vertical Integration). By adopting this approach, we are preparing you better for your future work as doctor, where **patients will come to you with problems that are not categorized by discipline name.**

In order to help you learn in an integrated manner, we have updated the learning of basic sciences around a few key health-related situations (real life situations), which you are likely to encounter as first year medical students. You will be expected to think about these scenarios and complete worksheets. You may do this individually or with your colleagues. These worksheets will help you understand the relevance and importance of what you are about to learn within this module. It will also help you focus your attention on what you need to achieve from the lectures, practical and tutorials that have been scheduled during this module.

We hope that you enjoy these next five weeks. There will be other more difficult course ahead, but a good foundation in cardiovascular medicine will be an important of your journey through this integrated organ system-based module.

Aim

The aims of this module is not to teach you to be a cardiologist, or even to teach you all you need to know about cardiovascular science to qualify in medicine. An overall aim of this module is to help you form a cognitive base for understanding pathogenesis of cardiovascular diseases (Cardiovascular diseases module – Third-year) & the practice of cardiovascular medicine (final-year clinical rotation). The module will prepare you for your future work in the medical course that will include learning in relation to the assessment and promotion of cardiovascular health and management of range of cardiovascular disease.

Structure of the Course

To achieve these overall aims, this module comprises seven weeks with a separate theme for almost each week. Therefore, structuring your learning around key areas in cardiovascular health and disease.

Week 1 -2: Structure & functions of the heart: Many aspects of Physiology, and Anatomy will closely relate to this common and life-threatening condition.

Week 3: Cardiac enzymes & lipid metabolism: During this week, the major focus of study shifts to the biochemical aspects of lipids and role of the lipids and cholesterol towards the development of atherosclerosis and other cardiac diseases as a result of it.

Week 4: Heart – Haemodynamics: Learning around this clinical issue will provide a means of contextualizing learning of key aspects of the cardiovascular system, for example the regulation of blood pressure, blood flow to various regions and haemodynamic

Week 5: End-module exam: You will be assessed at the end of the module on the learning around the cardiovascular system.

Module 3: Cardiovascular System

Outcomes of the module:

At the end of this module, first-year medical student should be able to

- Explain the normal structure and function of the cardiovascular system by learning and applying the relevant basic sciences.
- Apply the above knowledge to a few common real-life situations (Hypertension, Myocardial Infarction and Shock) to explain how the anatomy, physiology and biochemistry are altered in the given situation.

In order to achieve the outcomes, the students should be able to

- Explain the normal cardiac cycle by using knowledge of the
    - normal structure of the heart, including its musculature, coverings and surrounding thoracic structures.
    - nerve supply of the health, structure of the conducting system of the heart, the generation of a normal heartbeat and genesis of ECG waves.
    - mechanical events of the heart during a cardiac cycle.
    - cardiac output and the factors that influence it.
    - generation of normal heart sounds as well as murmurs.
- Explain blood pressure and blood flow to various organs by using your knowledge of
    - The normal structure of blood vessels,
    - Haemodynamic of circulation,
    - Factors that regulate blood flow to various organs and blood pressure in health and disease.
- Explain the development and effects of coronary arterial disease by using your knowledge of the
    - Histology of the circulatory system
    - Coronary blood flow and the factors that regulate normal coronary circulation
    - Development and effects of an atherosclerosis.
- Apply the knowledge of the embryology of the heart to the development of congenital heart defects.
- Explain the alteration of normal physiology that occurs in shock, heart failure

Main Content Areas

- Structure of the heart and the arterial system of the heart,
- Embryology of the cardiac system and congenital heart defects,
- Structure and function of the conduction system of the heart and the generation of ECG (Electrocardiography) waves,
- Lipids and cholesterol metabolism as it clinically relate to the cardiovascular system
- Cardiac cycle and cardiac output,
- Blood pressure and blood flow to organs,
- Coronary circulation in health and disease
- Pathophysiology of shock, hypertension and heart failure.

Clinical/ Practical skills

- Measuring blood pressure using sphygmomanometer with correct technique and interpretation of its values and calculation of mean arterial pressure,
- Identification of areas on the chest for auscultation of the heart sounds,
- Placing electrodes and obtaining an electrocardiogram and interpretation of the basic ECG findings,
- Identification of cardiac tissues and blood vessels under the microscope and report those findings in the anatomy practical journals. (you are required to prepare the histology journal in section related to the cardiovascular system. The journal will be assessed during end-module examination).

Real life situations scenarios:

- They must be worked upon during your self-study period.
- They require additional reading and interest for deeper understanding of these topics. Some topics may not have been covered during the module.
- They must be submitted to the medical education department by the end-of the module.

The Cardiovascular Module Team:

Prof. Dr. Zaheer Memon	Anatomy
Dr. Shaukat Memon	Anatomy
Dr Syna Amir	Anatomy/ Year coordinator
Dr. Aftab Abbasi	Anatomy
Dr. Pirha Abbasi	Anatomy
Prof. Dr Navaid Kazi	Physiology
Dr Haji Khan	Physiology
Dr Yar Mohammad Nizamani	Physiology
Dr Abroo Qazi	Physiology
Prof. Dr. Maria Kazi	Biochemistry
Dr Hina Khanzada	Biochemistry
Dr Ruby Shahzad	Biochemistry
Dr. Sheeraz Ansari	Biochemistry
Dr Kabir Dherwani	Medical Education

Content in the guide is submitted by the Basic Medical Science department faculty members. The real-life situations are written by Dr. Kabir Dherwani in collaboration with Basic Medical Science faculty members.

The study guide is compiled and edited by Dr. Kabir Dherwani.

Main Content Area

Main Content Area	Lectures	Practical/ Laboratory	Small Group Discussions	Problem-based Learning	Self-study
Structure and function of the heart: Normal structure of the heart including musculature, coverings, nerve supply, surrounding thoracic structures and surface markings of the heart and great vessels; normal course, relationship and distribution of the arterial system of the heart (pulmonary trunk, aorta, coronary arteries); embryology of the cardiac system and the development of the congenital defects; anatomy of the conduction system of the heart, the generation of a normal heart beat and genesis of ECG waves; mechanical events of the cardiac cycle and the cardiac output, generation of the heart sounds and murmurs;					
Haemodynamics: structure of the blood vessels, haemodynamic of the circulation, normal blood pressure, its regulation and variations in disease and examining the cardiovascular system; regulation of blood flow to various organs; disordered physiology in the development of the hypertension, coronary circulation and factors that regulate coronary circulation; mechanism of atherosclerosis and effects of coronary artery occlusion.					
Lipids and Cholesterol metabolism:					
Total					

Lectures 01 hour (50 minutes approximately)
Practical/ Laboratory 02 hours
Tutorials/ small group discussions (SGD) 02 hours
A – Must know, **B** – Should know, **C** – Nice to know
L – Lecture, **SGD** – Small group discussion, **SS** – Self-study

Real life situation 1 – Myocardial Infarction

You are a first-year medical student. One evening, your friend from the neighbourhood, who is also a first year student, rushes to your home saying that his uncle is ill. He also asks you to come and help. You find that your friend's uncle is complaining of severe chest pain. You also notice that he is **sweating**, and complaints that he **feels nauseated**.

You and your friend are unsure what to do, but from what you have heard, you realize that the patient needs immediate medical attention. You calm the patient and arrange for him to be transported to teaching hospital attached to your medical school. The patient is taken to the **critical care unit**, **receives immediate treatment**, and undergoes a **number of investigations**.

After a few days your friends comes over to thank you and say the **discharge card** indicated that his uncle had a "**myocardial infarction**". He says that he would like to know more about how to look after his father from this point forward and wants to know more about the disease. He asks your help to find out the relevant information.

You are aware about few things related to the "heart attacks", but are also aware that you do are unsure about several aspects. You decide to make a list of what you already know, and the issues that you would like to know about in further detail.

Now you wonder **how you can find out about the necessary information**.

- You are aware that a number of lectures, small group discussions and clinical skills sessions scheduled in your module. You may go through module timetable to see whether they may be useful.
- You realise that this will help you with some of the learning issues at this stage of medical education but you decide to concentrate on selected issues at this stage.
- You can decide to look for other sources of information that may be helpful, at a later stage.

Points to ponder:

1. What is the importance of sweating and feeling nauseated related to the chest pain? You must be able to understand the mechanism behind this phenomenon.
2. Why it is important to clam the patient before transferring him to a place where he can be taken care of?
3. Why this patient require care in the critical care unit and not in the ward?
4. Which investigations would be essential to identify the cause of his chest pain and what do they identify?
5. What is the importance of discharge card once the patient is treated?
6. What do you mean by the term myocardial infarction and how it may be diagnosed and managed?

Theme: Myocardial infarction

Topic: Mediastinum and its contents

Content area:

1. Divisions and content of the mediastinum **(A)**
2. Heart **(A)**
3. Identify and name structures constituting the borders and surfaces of the heart and cardiac apex. **(A)**

Objectives:

- Define the mediastinum and its divisions

Topic: Normal structure of the heart

Content area:

1. Openings of the superior vena cava (SVC) and Inferior vena cava (IVC) into the right atrium, right atrioventricular valve, coronary sinus, crista terminalis, musculi pectinate, interatrial septum, fossa ovalis and limbus, value of the IVC and coronary sinus. **(A)**
2. Openings of the right ventricle, atrioventricular valve and its opening, pulmonary valve and its openings, Trabeculae carneae, chordae tendinae, papillary muscles & the conus arteriosus. **(A)**
3. Opening of the left ventricle and the features of their valves, papillary muscles and the muscular and membranous parts of the interventricular septum. **(A)**
4. Internal features of left atrium and its openings. **(A)**

Objectives:

- Describe the structure of the atria and ventricles.

Topic: Heart Coverings and nerve supply of the heart

Content area:

1. Pericardium **(B)**: fibrous and serous oblique and transverse sinus.
2. Nerve supply **(A)**: sympathetic supply, parasympathetic supply and cardiac plexus.
3. Microscopy of the cardiac muscle. **(A)**

Objectives:

- Describe the pericardium and sinuses formed by it.
- Describe the nerve supply of the heart.
- Describe the histology of the cardiac muscle.

Topic: Surrounding thoracic structures and surface marking of the heart

Content area:

Surface marking

1. Cardiac borders **(B)**
2. Atrioventricular, pulmonary and aortic valves **(C)**
3. Origin of aorta, brachiocephalic trunk, subclavian and common carotid arteries, pulmonary arteries. **(C)**
4. Entrance of superior and inferior vena cava**.(C)**
5. Cardiac borders, great vessels and cardiac chambers. **(A)**

Objective:

- Surface mark the cardiac borders, heart valves, main arteries of the heart and the entrance of superior and inferior vena cava to the heart.
- Interpret the imaging Anatomy of the Heart.

Topic: Great vessels:

Content area:

1. Pulmonary trunk **(A)**
2. Aorta **(A)**
    a. Ascending aorta
    b. Aortic arch
    c. Thoracic aorta and branches
3. Carotid arteries **(A)**
4. Coronary arteries **(A)**
5. Coronary sinus & great cardiac vein **(A)**
6. Common, internal and external **(A)**

Objectives:

- Describe the branches of pulmonary trunk and distribution of left and right pulmonary arteries.
- Describe the arterial supply and venous

Topic: Development of the heart and congenital defects

Content area:

1. Embryology of the heart
    a. Right and left atria
    b. Right and left ventricles
    c. Inter-atrial and Inter-ventricular septa
    d. ASD, VSD, Fallot's tetralogy
    e. Atrioventricular valves
    f. Aortic & Pulmonary valves
    g. PDA, Coarctation of aorta

Objectives:

Describe the development of the heart.

Topic: Heart and conductive tissue

Content area:

1. Properties of heart **(A)**
    a. Automaticity
    b. Rhythmicity
    c. Conductivity
    d. Long refractory period
2. Adult & foetal circulation. **(A)**

Objectives:

- Describe the auto rhythmic cells and contractile cells of heart and mention the components of conductive tissue of the heart.
- Discuss the properties of heart (automaticity, rhythmicity, conductivity, long refractory period).
- Differentiate between an adult and foetal circulation in context of changes that occur in circulation due to congenital heart disease.

Topic: Electrical activity of the heart

Content area

1. Electrical activity of the heart **(A)**
2. Position of the SA node, AV node, AV bundle, bundle branches and their significance**. (A)**
3. Significance of efferent and afferent innervation of the heart. **(A)**

Objectives:

- Describe two types of action potential in the heart muscle.
- Explain the changes in ion permeability responsible for different phases.
- Explain the genesis of pacemaker potential at the SA node
- Describe the effects of vagal and sympathetic stimulations on the pacemaker potential.
- Describe the origin and spread of the electrical impulse from the SA node to the ventricular muscle.
- Explain the role of the conducting system.

Topic: Electrocardiography

Content area:

1. Genesis of ECG wave **(A)**
2. Placing of electrodes and description of normal ECG **(A)**
3. Calculation of **(A)**
    a. Heart rate
    b. P-R interval
    c. Mean electrical axis
4. Diagnostic use of ECG **(A)**
    a. Abnormal spread of excitation
    b. Changes in cardiac size
    c. Damage to heart
    d. Abnormal slow/ rapid/ irregular rhythm

Objectives:

- Define the terms electrocardiogram (ECG) and electrocardiography.
- Describe the electrical events occurring within the heart that are responsible for each wave of electrocardiogram.
- Explain the clinical significance of P-R interval and S-T segment.
- Describe the basis of ECG recording in context of Einthoven's triangle and law.
- List the locations of different ECG leads and draw the shape of ECG waves in each lead.
- Recognize the common abnormalities in the rate and rhythm of the heart (tachycardia, bradycardia, flutter, fibrillations, heart blocks and extra systole).
- Explain the clinical significance of P-R interval and S-T segment. (both prolongation and reduction).

Topic: Mechanical events of the heart

Content area:

1. Cardiac cycle **(A)**
    a. Mechanical events
    b. Intra-atrial, intra-ventricular and aortic pressure changes
    c. Genesis of arterial and venous pulses
2. Jugular venous pressure (JVP)/ Central venous pressure (CVP) **(B)**

Objectives:

- Describe the sequence of events that occur in the heart during the cardiac cycle.
- Illustrate the pressure changes that occur in a single cardiac cycle.
- Relate the genesis of arterial and jugular venous pulses to underlying cardiac events
- Describe the JVP and the value of CVP measurement.

Topic: Heart sounds and murmurs

Content area:

1. Heart sounds **(A)**
2. Functions of the heart valves and murmurs. **(A)**

Objectives:

- Explain the production of the heart sounds and state their significance.
- Describe the function of the heart valves and genesis of the murmurs.
- State the timing of the murmur produced by valvular defects and congenital heart disease.

Topic: Cardiac output and venous return

Content area:

1. Cardiac output – definition **(A)**
2. Factors that regulate cardiac output**. (A)**
3. Principles of measuring cardiac output. **(A)**
4. Effects of selected conditions on Cardiac output **(A)**
5. Venous return **(A)**
6. Factors affecting venous return **(A)**

Objectives:

- Define cardiac output and state its relationship to stroke volume and heart rate.
- List and explain the factors that regulate cardiac output.
- Explain the principles of measuring the cardiac output.
- State the changes in cardiac output in selected conditions.
- Define the central venous pressure and its importance in venous return.
- Mention the factors that affect venous return.

Clinical Skills & Practical skills:

- Identification of the heart tissue and blood vessels under the microscope
    - Difference between veins and arterial vessels by identifying underlying characteristics
- Perform electrocardiography
    - Demonstrate the location of different ECG leads.
    - Perform ECG on a standardized patient.
    - Calculate the heart rate & measure the P-R interval
    - Interpret the ECG for common abnormalities.
- Auscultation of heart sounds and murmurs
    - Recognize the heart sounds and differentiate them from murmurs.
    - Appreciate and recognize the changes in the heart sounds during inhalation and exhalation.

Real life situation 2 – Hypertension

Your aunt is thrilled to hear that you have joined medical college to study medicine. She is excited to know that now she can depend on you to measure her **blood pressure** regularly, and provide necessary advice. You reluctantly tell her that you are only **first-year medical student**, and that you are yet unable to help him. You advise her to continue to **visit her regular doctor**, but promise to start helping her as soon as possible.

You are keen to find out more about the blood pressure, how the **body controls it normally**, and **what causes blood pressure to be high** in some persons. You decide to make a set of notes that will help you understand this condition better. As a first step, you make a list of what you already know about blood pressure and what more you would like to find out in order to understand this condition clearly.

You are aware that you have started a cardiovascular module in your medical education, and eagerly await its commencement. You learn as much as possible about the areas that you have identified above and complete notes as far as possible. You become aware that you can only some areas at this phase of medical study and decide that this is sufficient for now.

You carefully note down areas that you want to learn about later in your medical education

Points to ponder:

1. What do you think about the role of medical student measuring the blood pressure of friend or family member?
2. What are different control systems of the body that keeps the blood pressure in-check? Explain the mechanism?
3. Why it is important for blood pressure to be in normal physiological limits?
4. What happens to your blood pressure during daily household chores and during exercise?
5. What are different pharmacological and non-pharmacological methods to control blood pressure?

You must understand that this module introduces the topic of blood pressure. There are other organ-system modules that are relevant to this topic for complete understanding of how blood pressure is regulated. These modules include: Endocrinology and Urinary system.

Theme: Haemodynamics

Topic: Histology of the arteries and veins

Content area:

1. Classification of arteries and veins
2. Features of 3 types of arteries and veins
    a. Light microscopic **(B)**
    b. Electron microscopic **(C)**

Objectives:

- Describe the structure and function of the arterial and venous system.
- Identify the arterial and venous tissues under the light microscope.

Topic: Haemodynamic

Content area:

1. Haemodynamic – types of blood flow **(A)**
2. Measurement of blood flow **(A)**
3. Factors maintaining volume of blood. **(B)**
4. Wind Kessel Vs resistance vessels (resistance, pressure, volume and flow) **(C)**
5. Circulating time and conditions altering it. **(B)**
6. Local regulation of blood flow **(A)**

Objectives:

- Describe the types of blood flow.
- Describe the relationship between flow, pressure and resistance in the vascular system.
- Compare between Windkessel vessels and resistance vessels.
- Define circulation time and state the conditions altering circulation time
- Explain the auto regulation mechanism of blood flow.

Topic: Blood pressure

Content area:

1. Definition of arterial blood pressure **(A)**
2. Methods of blood pressure measurement. **(B)**
3. Physiological principles of blood pressure measurement. **(A)**
4. Variation of blood pressure (Physiological & pathological) **– (B)**

Objectives

- Define systolic blood pressure, diastolic blood pressure and mean arterial pressure.
- List the methods available to measure the blood pressure.
- Describe the physiological basis of measuring blood pressure using a sphygmomanometer.
- List the physiological and pathological variations in blood pressure.

Topic: Blood pressure regulation – short & long term

Content area:

1. Importance of regulation of blood pressure **(A)**
2. Factors involved **(A)**
    a. Local mechanisms – auto regulation, paracrine secretion
    b. Systemic mechanisms – circulating substances, neural mechanisms,
3. Regulation of blood flow to **(A)**
    a. Brain (Neurology module)
    b. Heart (next page)
    c. Gut (GIT module)
    d. Skeletal muscles (Locomotor)

Objectives:

- Explain the effects of altered blood flow.
- Describe the importance of cardiovascular system and the factors affecting it.

Topic: Capillary and lymphatic circulation

Content area:

1. Capillary circulation **(A)**
    a. Role as exchange vessels
    b. Starling's forces
2. Lymphatic circulation **(A)**
    a. Functions
    b. Role

Objectives:

- Describe the structural features, innervation and blood flow of the capillary system.
- Explain the role of capillaries as exchange vessels.
- Name and give the approximate values of the Starling's forces.
- Explain the state of near equilibrium at the arteriolar and venular end of capillaries.
- Describe the lymph capillary and list the factors that determine the lymph flow.
- List the function of lymphatics
- Describe the role of lymphatic circulation in maintaining normal starling forces across the capillary wall.
- Explain the pathophysiological basis for edema that is increased capillary hydrostatic pressure, hypoalbuminemia, lymphatic obstruction and increased capillary permeability.

Clinical Skills:

- Measurement of blood pressure
    - Identify different parts of the stethoscope & sphygmomanometer
    - Differentiate the auscultatory and palpatory methods of the blood pressure measurement.
    - Demonstrate the correct technique for auscultatory and palpatory methods of blood pressure measurement,
    - Hear the Korotkoff's sound during auscultation.
- Identify for signs of edema using appropriate technique.

Real life situation 3 – Shock

You are first-year medical students at Isra University. On your way to home in the afternoon you, see a group of people calling for help outside the Isra University emergency. When you go to the spot, you see a middle-aged man lying on the road with a stab wound on the left lower aspect of the chest. There is profuse bleeding from the wound.

After a few minutes, he was rused to the nearby emergency departments. The nurse quickly checks his pulse and blood pressure. His blood pressure was **90/60 mmHg** and pulse rate was **120 beats/ minute**. The staff mention the term **"shock"**. They elevate his legs, insert two cannula, and start transfusion of intravenous fluids. The patient is then rushed to the surgical Intensive care unit (ICU).

Now you are interested in finding out what the nursing staff meant by the term "shock" and how it occurs. You know you cardiovascular module is next module. Before the commencement of the module, you decide to list out what you would like to learn about shock and related topics. You then proceed to make some notes about "shock" with the help of reading material in the library.

Points to ponder:

1. What is the clinical meaning of the word shock and what are its clinical characteristics?
2. What does these parameters of blood pressure 90/60 mmHg and pulse of 120 beats/minute indicate?
3. Why the patient was rushed to the surgical ICU?

The understanding of basic medical science subjects can help you with similar topics covered and patients seen during clinical rotations.

Theme: Shock, Hypertension & Heart failure

Topic: Shock

Content area:

1. Shock **(A)**
    a. Definition
    b. Causes of shock with examples

Objectives:

- Define shock
- Describe the four major causes of shock and explain giving examples the pathophysiology of each one.
- Describe the physiological basis of treatment of each type of shock.
- List the factors that make shock refractory.
- Explain the physiological basis of signs and symptoms of different types of shock.
- Explain the short and long-term physiological compensation of shock.

Topic: Heart failure

Content area:

1. Heart failure **(A)**
    a. Definition
    b. Physiological basis of heart failure
    c. Common clinical manifestations
    d. Types – left/ right heart failure (systolic/ diastolic heart failure VS acute/ chronic heart failure
    e. Haemodynamic, neuroendocrine and cellular changes in heart failure.
    f. Treatment principles.

Objectives:

- Define heart failure.
- Explain the physiological basis of the common clinical manifestations of heart failure.
- Describe the different types of heart failure.
- Describe the haemodynamic, neuroendocrine and cellular changes that occur in heart failure.
- Describe the physiological basis of the treatment principles in heart failure.

Topic: Hypertension

Content area:

1. Hypertension **(A)**
    a. Definition
    b. Causes
    c. Pathogenesis
    d. Treatment principles
    e. complications

Objectives:

- Define hypertension.
- List the causes of hypertension.
- Describe the pathogenesis of hypertension.
- Explain the compensatory measures that maintain the blood pressure on rising from supine positions.
- Explain the physiological basis of the treatment principles in hypertension.

Topic: Prevention of Obesity and Hypertension

Content area:

1. Preventive measure for obesity & hypertension
2. Incidence and prevalence
3. Body Mass Index (BMI)
4. Dietary advice

Theme: Metabolism of fatty acids and cholesterol

Topic: Lipids, Fatty acids, Cholesterol & Lipoproteins

Content area:

1. Lipids **(A)**
2. Fatty acids **(A)**
3. Cholesterol **(A)**
4. Lipoproteins **(A)**

Objectives:

- Describe the process of digestion and absorption of lipids and their clinical significance in the cardiovascular system disease.
- Describe the process of synthesis and catabolism of fatty acids and their clinical significance in the CVS diseases.
- Explain the metabolism and functions of cholesterol and its clinical significance in CVS diseases.
- Discuss Lipoproteins and their clinical significance in CVS diseases.

Recommended and additional Reading for the module

Embryology:

Recommended reading

- Webster S & De Wreede R. (2012). **Embryology at a Glance**. John Wiley & Sons.
- Moore, Keith L., *et al*. **The developing human: clinically oriented embryology**. Philadelphia: *Saunders/Elsevier*, 2013 9th edition.

Additional reading

- **Snell's Clinical Embryology for medical students** (Latest Edition)
- Sadler, Thomas W. **Langman's medical embryology**. Wolters Kluwer Health, 2014. 13th edition

Histology:

Recommended reading

- Peckham, M. (2011). **Histology at a Glance (Vol. 50)**. John Wiley & Sons**.**
- Fawcett, D. W., and R. P. Jensh. "**Bloom and Fawcett's Concise Histology** 2nd." *Arnold-Hodder Headline Group*. London (2002): 1-360.

Additional reading:

- Junqueira, C. L., J. Carneiro, and R. O. Kelley. "**Basic histology**." Basic histology (2013) 13th edition.
- Young, Barbara, ed. **Wheater's functional histology: a text and colour atlas**. Elsevier Health Sciences, 2014. 6th edition

Anatomy

Recommended reading

- Faiz O, Blackburn S & Moffat D. (2011). **Anatomy at a Glance** (Vol. 66). John Wiley & Sons.
- Drake, Richard, A. Wayne Vogl, and Adam WM Mitchell. **Gray's anatomy for students**. Elsevier Health Sciences, 2015. 3rd edition.

Physiology

Recommended reading

- Ward, J. P., & Linden, R. W. (2013). **Physiology at a Glance**. John Wiley & Sons.
- Sherwood L, **Human Physiology: From cells to systems** *West Publishing Company*, New York. 7th edition.

Additional reading

- Ganong's **Review of Medical Physiology**. *Lange Medical Publications* McGraw Hill

- Guyton, A.C., **Textbook of Medical Physiology**, Saunders, Philadelphia

Extra Related Reading (refer to case-scenarios)

Pathology

Recommended reading

- Finlayson, C. J., & Newell, B. A. (2009). **Pathology at a Glance**. Wiley-Blackwell.
- Kumar, Vinay, Abul K. Abbas, and Jon C. Aster, eds. **Robbins basic pathology**. *Elsevier Health Sciences*, 2012.

Clinical skills

Recommended reading

- **Macleod's Clinical Examination**. Edited by Douglas *et al*. 2009, 12th edition. Published by Churchill Livingstone, Elsevier. **The Cardiovascular system, pages: 106-151**

Community Medicine

Recommended reading

- Somerville, M., Kumaran, K., & Anderson, R. (2012). **Public health and epidemiology at a glance** (Vol. 72). John Wiley & Sons.
- Iliyas M *et al*, eds. **Public Health and Community Medicine**. *Time publishers*, 2007 7th edition.
- Park, K (2005) **Park's textbook of Preventive and Social Medicine**, 2007. *Bhanot Publication* 29th edition.

Male and female students should refer to the main university library (or ask librarian) for interactive materials available in the form of Compact Discs (CDs).

Note:

- **You are requested to read the latest edition available.**
- **Please read the recommended textbooks as advised in the recommended reading section.**

For an annual academic calendar &

Module 3: Cardiovascular timetable, check the link below:

https://isra.edu.pk/academic-calendar-mbbs-2/

- **Please maintain record of the clinical skills performed during the clinical skills laboratory and get it signed from the relevant faculty member before the end-of the module.**
- **You are also required to maintain the practical journals for basic science disciplines where required. (Histology in Cardiovascular module)**

This study is tentative and will be updated over the course of the year. For any feedback related to the study-guide, please email @: kabirdherwani@gmail.com