INTRODUCTION TO TERMINOLOGY, ANATOMICAL POSITION, PLANES AND DIRECTIONAL TERMS

Learning Objectives

Upon completion of this session, the student will be able to:

1. Describe the anatomical position.
2. Identify the anatomical planes, the imaginary lines used to transect the human body along the sagittal, coronal and axial (transvers) sections. The description of the position of structures or the direction of movements is related to these sections.
3. List the anatomical terms, which enables medical students to communicate with their team-mates, and the medical professionals, both nationally and internationally.

Required Materials

- Cadaver/ Human Skeleton
- Handouts/ Atlases of Human Anatomy.
- Visual and Electronic Media.
- Images.

Instructions

- There are 3 stations of activities in this practical session.
- When you have completed a particular task you should put a tick in the box be-

fore to it. This indicates completion of the task and comprehension of this part of the assignment. The group's supervisor can question you about it and expect a correct answer. Such questions will be used in your continuous assessment.

- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 1.1

ANATOMICAL POSITION

(Figure.1.1.1)

- ☐ Note that it is important for the medical students to have a complete knowledge of the basic anatomical terminology.
- ☐ Note that the perfect use of basic anatomical terminology by medical students assists them to communicate with their team-mates and the medical professionals, both nationally and internationally.
- ☐ Note that without the basic anatomical terminology, it is very difficult for medical students to discuss or proof the problems related to the actions of muscles, abnormal functions of joints, alterations of position of structures, or the exact place of lesions.
- ☐ Demonstrate, in yourself or colleagues, the ***anatomical position*** of the body (Fig.1.1.1): standing erect, facing directly forward, feet pointed forward and slightly apart, and arms hanging down at the sides with palms facing forward. This position is used as a reference to describe locations or motions of various parts of the body.
- ☐ Note that the ***supine position*** of the body is lying flat on the back. While, the ***prone position*** is lying flat with the front of the chest down and the back upwards.

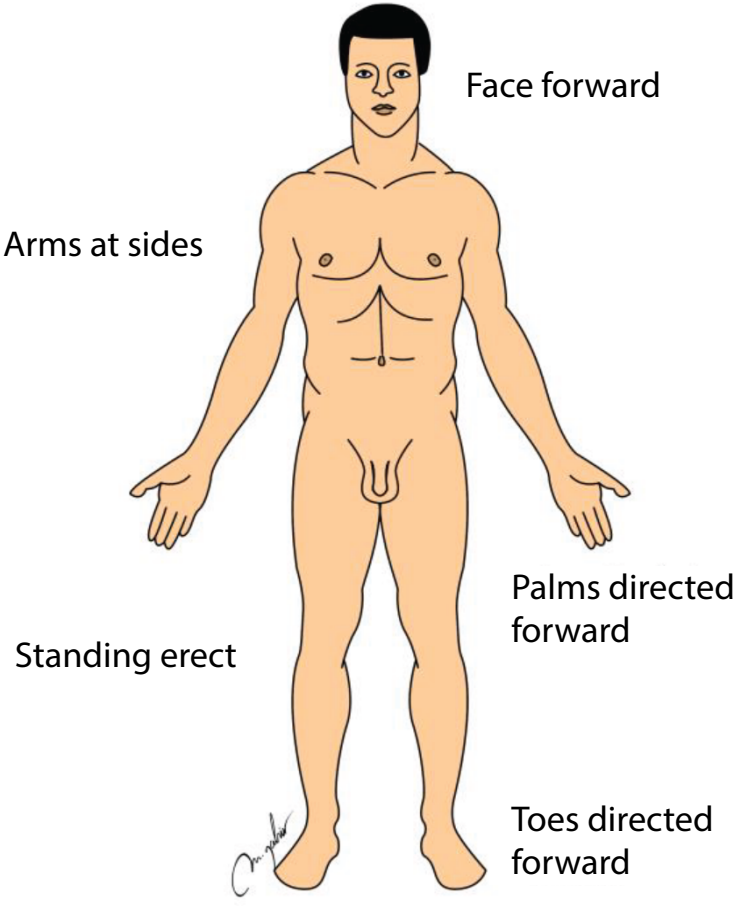

Fig. 1.1.1 Anatomical position of the human body

STATION 1.2

PLANES AND DIRECTIONAL TERMS OF THE HUMAN BODY

(Figure.1.2.1)

Sagittal planes

- ☐ Demonstrate the ***mid-sagittal plane*** (***median plane***); this is a vertical plane transient through the axis of the body, dividing it into right and left halves.
- ☐ Note that the planes located parallel to one side or the other side of the mid-sagittal plane are termed ***para-median (para-sagittal) planes***.
- ☐ Note that if there are two structures: the one located closer to the mid-sagittal plane of the body, is described as ***medial*** to the other. Likewise, the structure that is located farther from the mid-sagittal plane, is described as ***lateral*** to the first.

Coronal Planes

- ☐ Demonstrate the ***coronal plane***; this plane is vertical at the right angle to the mid-sagittal plane.
- ☐ Note that the terms ***anterior*** and ***posterior*** are used to specify the front and back of the body in relation to the coronal plane.

Transverse or Horizontal Planes

- ☐ Demonstrate the ***transverse planes***; these planes are at the right angles to both the mid-sagittal and the coronal planes.
- ☐ Note that the terms ***superior*** and ***inferior*** are used to specify the upper and lower parts of the body in relation to the transverse planes.

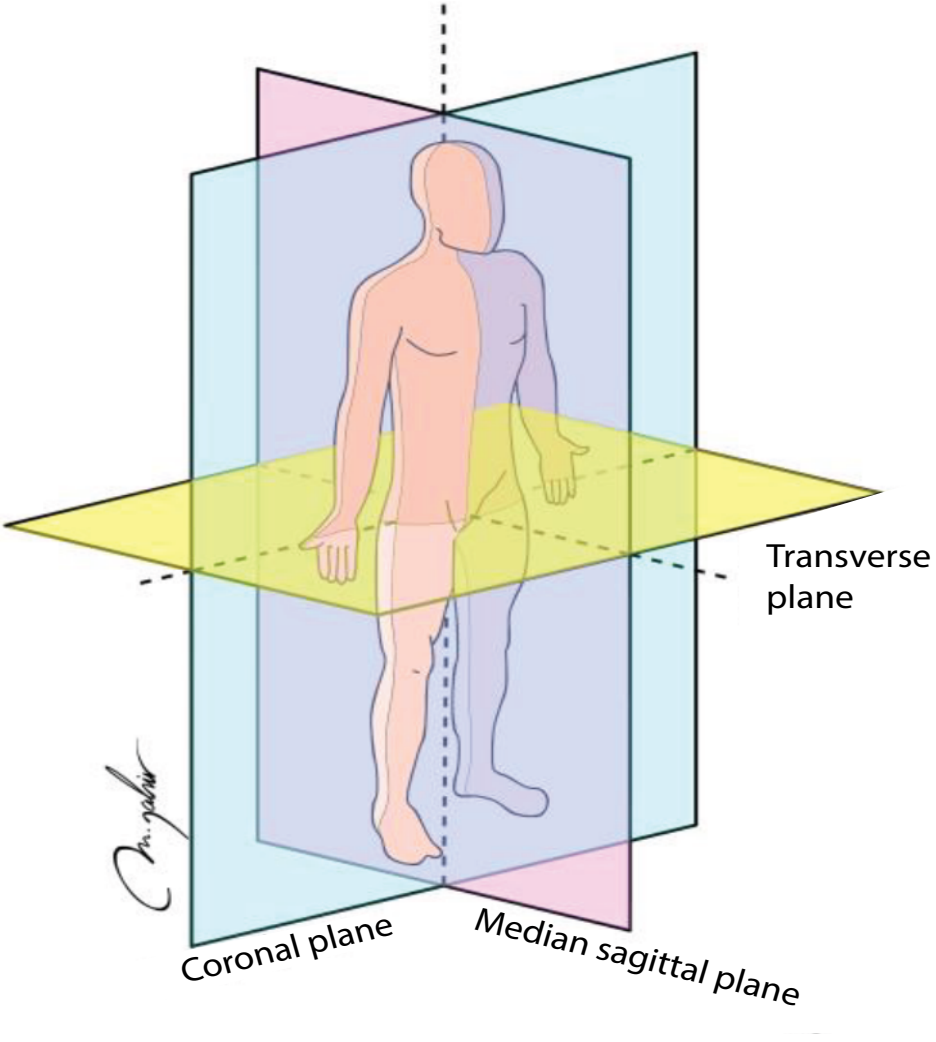

Fig. 1.2.1 Anatomical planes of the human body

STATION 1.3

ANATOMICAL TERMS

(Figure.1.3.1-1.3.6)

- ☐ Note that in the hand the terms ***dorsal*** and ***palmar*** surfaces are used instead of ***posterior*** and ***anterior*** surfaces. Besides in the foot, the terms **dorsal** and **plantar surfaces** are used instead of upper and lower surfaces.
- ☐ Note that the terms ***proximal*** and ***distal*** are used to describe the relative distances from the roots of both the upper and lower limbs; for example, the arm is proximal to the forearm and the hand is distal to the forearm and the thigh is proximal to the leg and the foot is distal to the leg.
- ☐ Note that the terms ***internal*** and ***external*** are used to explain the relative distance of a structure from the center of a cavity; for example, the external iliac artery is distributed outside the pelvis and the internal iliac artery is distributed inside the pelvis.
- ☐ Note that the term ***ipsilateral*** indicates to the same side of the body; for example, the left elbow and left wrist joints are ipsilateral. While, the term ***contralateral*** indicates to opposite sides of the body; for example, the left knee joint and the right ankle joint are contralateral.
- ☐ Note that the site where two or more bones articulate together is known as a ***joint***; there are three types of joints:
  - ☐ ***Fibrous*** joint : have no movement (sutures of the skull).
  - ☐ ***Cartilaginous*** joint : have only slight movement (intervertebral discs).
  - ☐ ***Synovial*** joint : freely movable joint (shoulder joint).
- ☐ Recognize the following terms of the movements : ***please always remember that the baseline of each movement is the anatomical position.***
  - ☐ ***Flexion*** is a movement that decreases the angle between the articulating parts, for example, flexion of the elbow joint makes the anterior

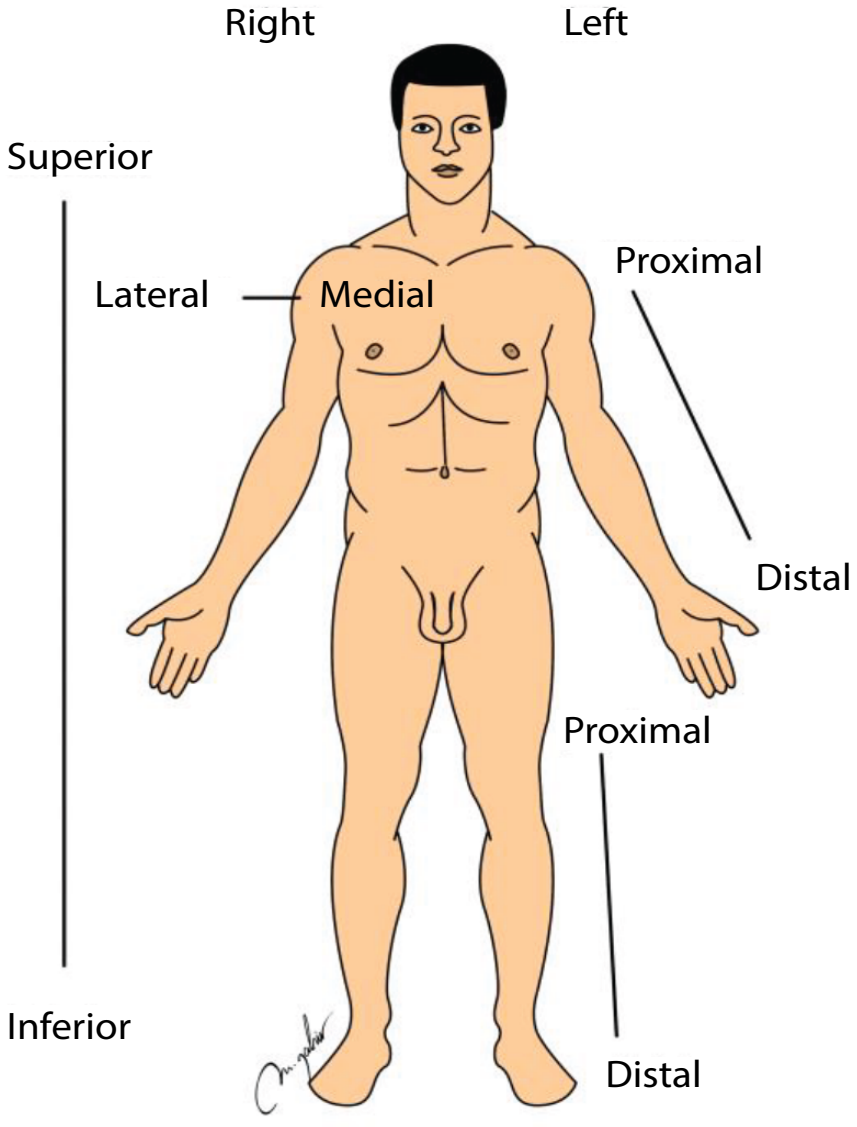

Fig. 1.3.1 Anatomical terms

surface of the forearm to approach the anterior surface of the arm.

- ***Extension*** means straightening the joint.
- ***Lateral flexion*** is a movement of the trunk in the coronal plane.
- ***Abduction*** is a movement of a limb away from the midline of the body.
- ***Adduction*** is a movement of a limb toward the body.
- ***Rotation*** is the movement of a part of the body around its long axis.
- ***Medial rotation*** is the movement that results in the anterior surface of the moving part facing medially.
- ***Lateral rotation*** is the movement that results in the anterior surface of the moving part facing laterally.
- ***Pronation*** of the forearm is a medial rotation of the forearm where the palm of the hand faces posteriorly.
- ***Supination*** of the forearm is a lateral rotation of the forearm from the pronated position where the palm of the hand comes to face anteriorly.
- ***Elevation*** refers to movement in a superior direction, for example, shoulder shrug is an example of elevation of the scapula.
- ***Depression*** refers to movement in an inferior direction, the opposite of elevation.
- ***Dorsiflexion*** of the foot is an upward movement (extension) of the foot. The angle between the dorsal surface of the foot and the leg decreases.
- ***Plantar flexion*** is the flexion of the foot at the ankle joint where plantar surface of the foot turns downward. The angle between the dorsal surface of the foot and the leg increases.
- ***Inversion*** of the foot is a medial rotation of the plantar surface of the foot (the foot turns inward toward the midline of the body).
- ***Eversion*** of the foot is a lateral rotation of the plantar surface of the foot (the foot turns outside).
- ***Protrusion*** and ***Retraction*** are used to describe the anterior and posterior movement of the lower jaw.

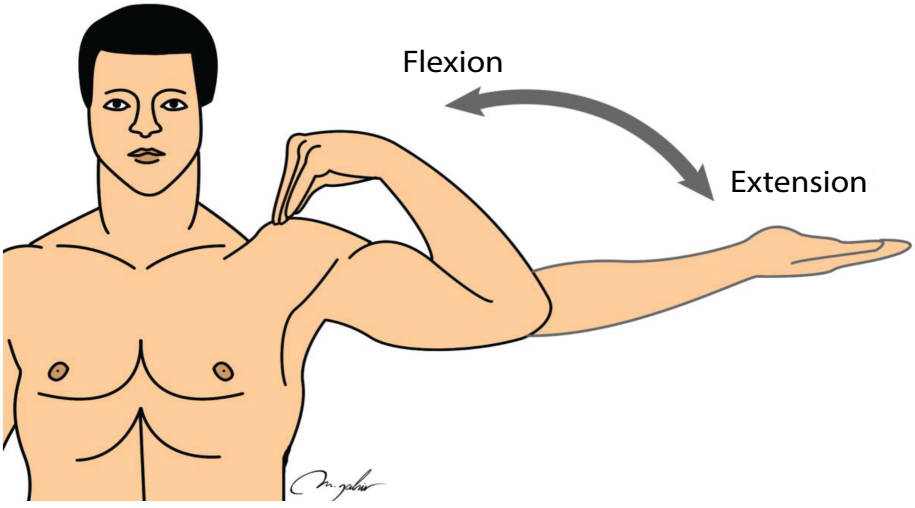

Fig. 1.3.2 Flexion and extension movements of the arm

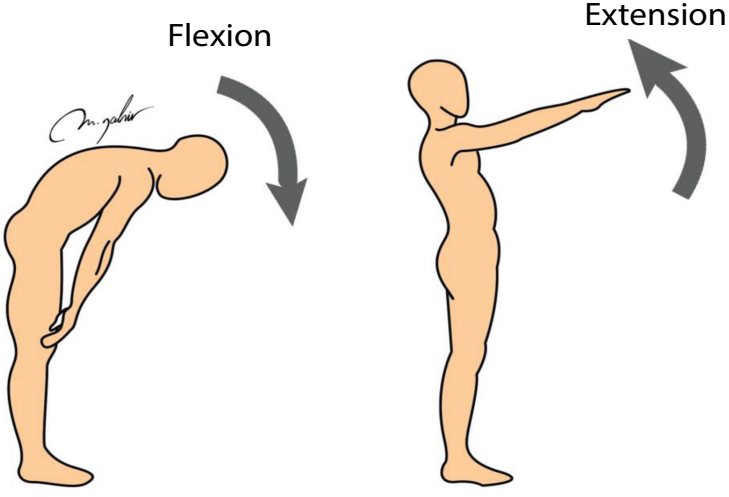

Fig. 1.3.3 Flexion and extension movements of the trunk

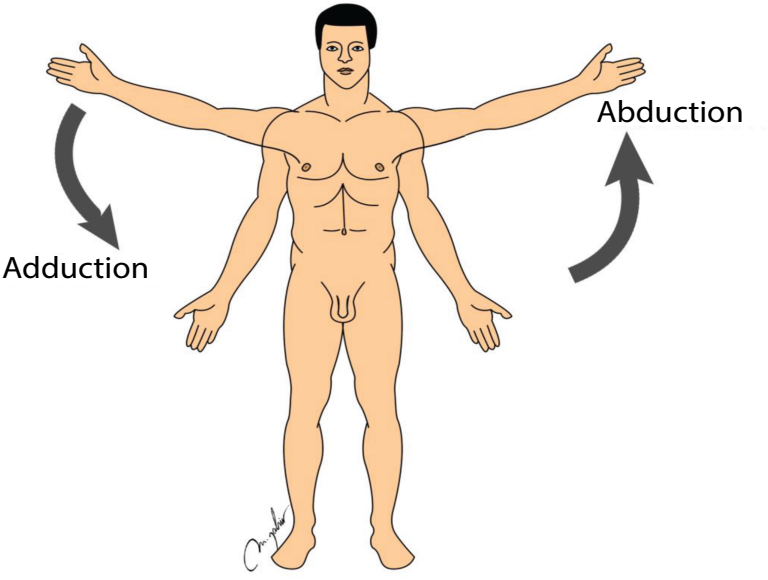

Fig. 1.3.4 Adduction and abduction movements

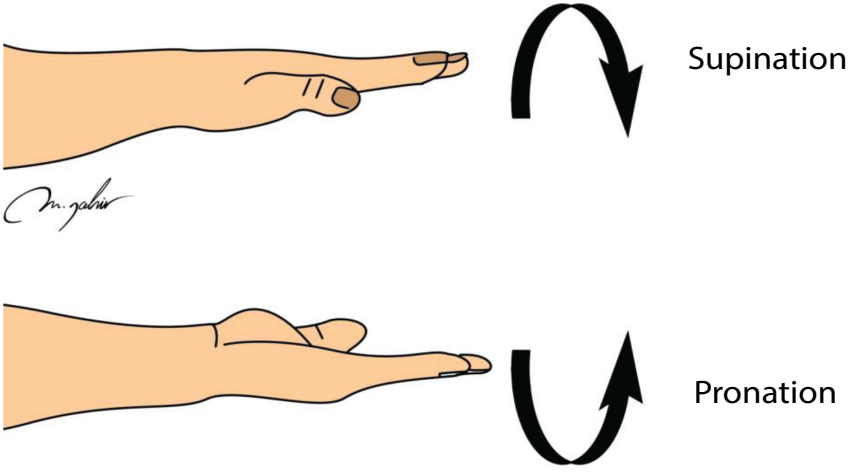

Fig. 1.3.5. Supination and pronation movements

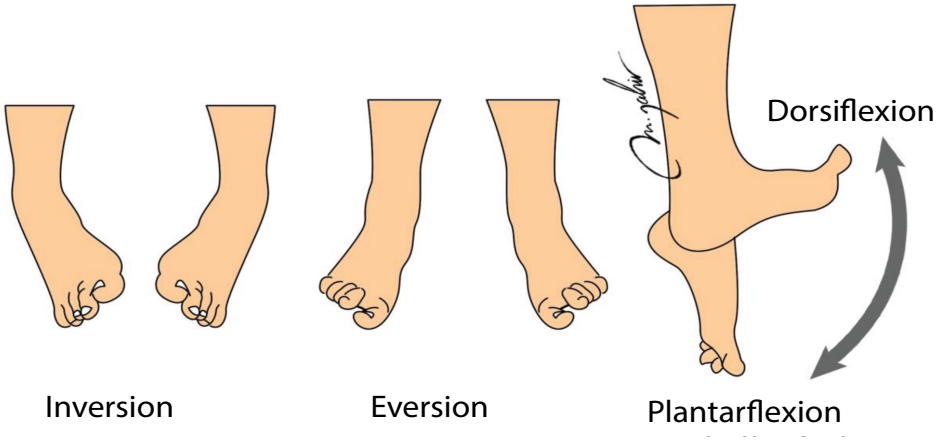

Fig. 1.3.6 Inversion, eversion, dorsiflexion and plantar flexion movements

Questions

1. Describe the anatomical position.
2. Mention the anatomical planes and their related terms.
3. What are the types of joints?
4. Mention the terms related to movement.

MEDIASTINUM

Learning Objectives

Upon completion of this session, the student will be able to:

1. Describe the organization of the mediastinum.
2. Define the boundaries of the superior mediastinum.
3. Identify the contents of the superior mediastinum.
4. Identify and trace the tributaries of the brachiocephalic veins and the superior vena cava.
5. Identify and trace the branches of the arch of the aorta.
6. Identify the thoracic part of the trachea.
7. Define the boundaries and subdivisions of the inferior mediastinum.
8. Identify the contents of the anterior and middle mediastinum.
9. Identify and trace the pulmonary artery and pulmonary veins.
10. Identify the contents of the posterior mediastinum.
11. Identify the thoracic sympathetic trunk.
12. Identify the diaphragm and its major openings
13. Name the main structures in the routine (PA) chest x-ray
14. Identify normal mediastinal structures in PA and Lateral chest x-ray and in CT and MR images.
15. Recognize mediastinal lymphadenopathy in PA chest film.

Required Materials:

- Cadaver/ Thoracic Cage/ Thoracic Cavity.
- Handouts/ Atlases of Human Anatomy.
- Visual and Electronic Media.
- Images.

Instructions:

- There are 4 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it. This indicates completion of the task and comprehension of this part of the assignment. The group's supervisor can question you about it and expect a correct answer. Such questions will be used in your continuous assessment.
- Keep these sheets for future reference and revision.
- Make sure that you answer all the questions at the end of the activities.

STATION 2.1

GENERAL FEATURES OF THE MEDIASTINUM

(Figure. 2.1.1)

☐ Note that the ***mediastinum*** is the region within the chest between the pleural cavities that contain the heart and other thoracic structures.

☐ Identify the boundaries of the mediastinum as following:

- ☐ Superior: thoracic inlet.
- ☐ Inferior: diaphragm.
- ☐ Anterior: sternum and costal cartilages.
- ☐ Posterior: vertebral colu mn (bodies of the thoracic vertebrae).
- ☐ Lateral: parietal pleura (mediastinal pleura).

☐ For purposes of description the **mediastinum** is divided into two parts:

- ☐ Upper portion, above the upper level of the pericardium, which is named as the ***superior mediastinum*****.**
- ☐ Lower portion, which is subdivided into three parts as following:
  - ☐ ***Anterior mediastinum*** in front of the pericardium.

- ☐ ***Middle mediastinum*** containing the pericardium and its contents.
- ☐ ***Posterior mediastinum*** behind the pericardium.

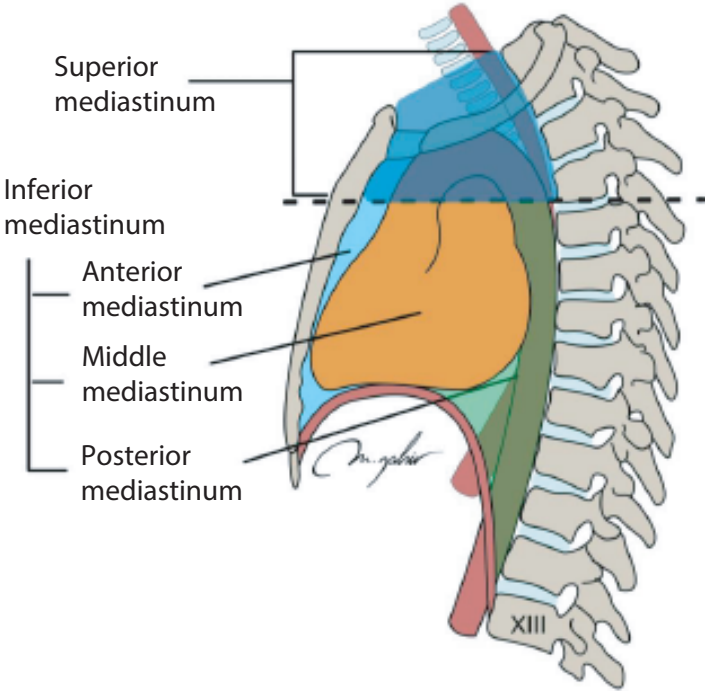

Fig. 2.1.1 Mediastinum

STATION 2.2

SUPERIOR MEDIASTINUM

☐ Identify the boundaries of the ***superior mediastinum*** as following:

- ☐ Superior limit: superior thoracic aperture.
- ☐ Inferior limit: plane from the sternal angle (angle of *Louis*) to the disc between T4-T5.

- Anterior border: manubrium of the sternum.
- Posterior border: vertebral bodies of T1-4.
- Lateral: pleurae of the lungs.

Identify the contents of the superior mediastinum:

- ***Thymus gland*** is the most anterior structure within the superior mediastinum
- Right and left ***brachiocephalic veins*** and superior half of ***superior vena cava***.
- ***Arch of aorta*** and its branches: the ***brachiocephalic trunk***, the ***left common carotid artery*** and the ***left subclavian artery***.
- ***Ligamentum arteriosum*** (remnant of ***ductus arteriosus***) attaches to the aortic arch and the pulmonary trunk.
- ***Right vagus nerve*** runs parallel to the trachea and passes posteriorly to the superior vena cava and the right primary bronchus.
- ***Left vagus nerve*** enters the superior mediastinum between the left common carotid and the left subclavian arteries. It descends anteriorly to the aortic arch, and then passes posterior to the left bronchus. ***Left recurrent laryngeal nerve*** arises from the left vagus nerve as it crosses the aortic arch. It loops under the arch.
- ***Phrenic nerves*** (from the roots of C3, C4 and C5) enter the superior mediastinum lateral to the great vessels. They then descend anteriorly into the middle mediastinum, passing anteriorly to the hilum of the lungs.
- ***Trachea*** bifurcates into the primary bronchi posterior to the ascending aorta at the level of the sternal angle.
- ***Esophagus*** posterior to the trachea.
- ***Sternohyoid*** and ***sternothyroid*** muscles.
- ***Thoracic duct***, which is the major lymphatic vessels in the body, passes through the posterior part of the superior mediastinum. It enters the superior mediastinum from inferior slightly to the left of the midline.

STATION 2.3

INFERIOR MEDIASTINUM

- ☐ Identify the boundaries of the ***anterior mediastinum*** as following:
  - ☐ Anterior: body of the sternum.
  - ☐ Posterior: pericardium.
  - ☐ Lateral: pleurae of the lungs.
- ☐ Identify the contents of the anterior mediastinum:
  - ☐ Thymus.
  - ☐ Superior and inferior ***sternopericardial ligaments***.
  - ☐ Two or three anterior mediastinal lymph nodes.
  - ☐ Mediastinal branches of the internal thoracic vessels.
- ☐ Identify the ***middle mediastinum*** (bounded: pericardial sac)
  - ☐ Identify the contents of the middle mediastinum:
    - ☐ ***Heart*** enclosed in the ***pericardium.***
    - ☐ ***Ascending aorta***, left and right ***coronary arteries*** originate from aortic sinus.
    - ☐ Inferior half of ***superior vena cava*** and the ***inferior vena cava***.
    - ☐ Terminal part of ***azygos vein***.
    - ☐ ***Pulmonary vessels***: pulmonary trunk, right and left pulmonary artery, pulmonary veins.
    - ☐ ***Bifurcation of trachea*** and ***main bronchi***.
    - ☐ ***Phrenic nerves***.
- ☐ Identify the boundaries of the **posterior mediastinum** as following:
  - ☐ Superior: plane from the sternal angle (angle of *Louis*) to the disc between T4-T5.
  - ☐ Inferior: thoracic surface of the diaphragm.

- ☐ Anterior: pericardium.
- ☐ Posterior: bodies of the fifth to the twelfth thoracic vertebra.
- ☐ Lateral: pleurae of the lungs.

☐ Identify the contents of the posterior mediastinum:

- ☐ Thoracic part of the descending aorta.
- ☐ Azygos vein.
- ☐ Hemiazygos vein and the accessory hemiazygos vein.
- ☐ Vagus nerve.
- ☐ Splanchnic nerves.
- ☐ Sympathetic trunk.
- ☐ Esophagus.
- ☐ Thoracic duct.

STATION 2.4

DIAPHRAGM

(Figure. 2.4.1)

☐ Identify the ***diaphragm,*** which is a dome-shaped structure of muscle and fibrous tissue that separates the thoracic cavity from the abdomen, it achieves an important function in respiration.

☐ Note that the diaphragm is formed of a central tendon and a peripheral muscular part.

☐ Identify the right and left crus of the diaphragm.

☐ Identify the diaphragm with its sternal, costal and lumbar parts.

☐ Note that the diaphragm has a series of ***apertures*** to permit the passage of structures between the thorax and abdomen and *vice versa*. Three large openings***: caval***, ***esophageal*** and ***aortic*** are present within the diaphragm.

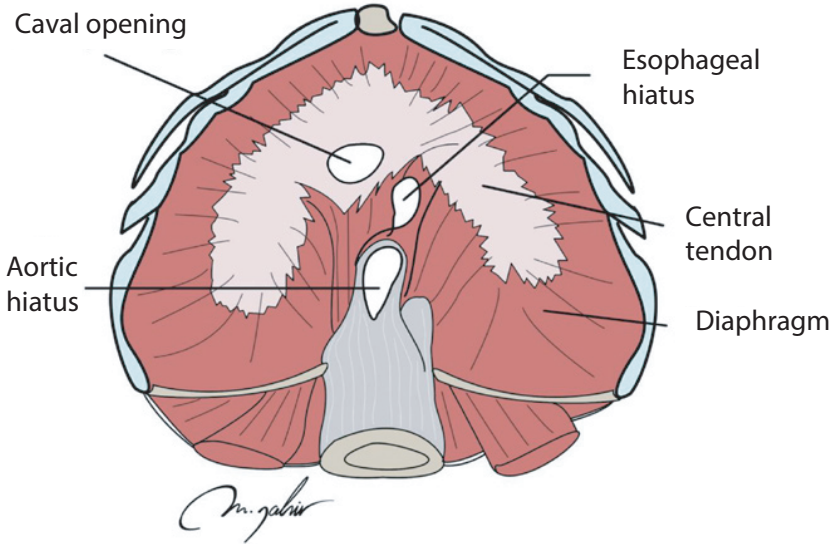

Fig. 2.4.1 Diaphragm

Table 2.4.1. Three large openings of the diaphragm and their level and structures passing

OPENING	LEVEL	STRUCTURES
Caval Opening	T8	• Inferior vena cava • Right phrenic nerve
Esophageal Hiatus	T10	• Esophagus • Anterior and posterior vagal trunks • Small esophageal arteries
Aortic Hiatus	T12	• Aorta • Azygos vein • Thoracic duct • Hemiazygos vein may pass through the aortic hiatus or through the right crus of the diaphragm.

STATION 2.5

IMAGING OF THE MEDIASTINUM

(Figure. 2.5.1 + 2.5.2)

- ☐ Outline the ***borders,*** and identify ***contents***, of the mediastinum.
- ☐ Identify the ***trachea***, ***main bronchi***, ***arch of the aorta***, ***superior vana cava***, ***inferior vana cava***, ***azygos vein*** in PA and lateral chest radiograph.
- ☐ Identify the ***clavicle***, ***scapula***, ***spine***
- ☐ Identify the cupola of the ***diaphragm***.
- ☐ Count the ***ribs*** from above and note the level of the ***right and left cupola***, in deep ***inspiration***.
- ☐ In Fig. 2.5.2 identify the trachea and retrosternal area.

Fig. 2.5.1 PA chest

Fig. 2.5.2 Lateral chest

Questions

1. What is the mediastinum?
2. What are the contents of the superior mediastinum?
3. What are the contents of the anterior mediastinum?
4. What are the contents of the middle mediastinum?
5. What are the contents of the posterior mediastinum?
6. What is the main function of the diaphragm?
7. Mention the openings of the diaphragm and the structures passing through each one.
8. Identify the structures forming the borders of the mediastinum in routine chest radiograph.
9. At which posterior rib is the level of the right cupola in deep inspiration in a routine chest x-ray.

ANATOMY OF THE HEART

Learning Objectives

Upon completion of this session, the student will be able to:

1. Locate the position of the heart.
2. Identify the anatomy of the heart.
3. Identify the structures located in the four chambers of the heart and consider their significance.
4. Compare the anatomical characteristics between the right and left sides of the heart.
5. Describe the sternocostal plans of the valves of the heart and identify their auscultation points.
6. Identify the arterial supply and venous drainage of the heart.
7. Describe the conduction system of the heart.
8. Review the structures forming the borders of the mediastinum and heart in a routine chest x-ray.
9. Diagnose cardiomegaly.
10. Identify the cardiac chambers and great vessels in imaging films, and suggest specific chamber and great vessel enlargements.
11. Identify the heart and mediastinal structures in axial CT images
12. Identify cardiac chambers in long axis and short axis ultrasound images.

Required Materials

- Cadaver/ Thoracic Cage/ Thoracic Cavity/ Heart.
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 7 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it. This indicates completion of the task and comprehension of this part of the assignment. The group's supervisor can question you about it and expect a correct answer. Such questions will be used in your continuous assessment.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 3.1

EXTERNAL FEATURES OF THE HEART

☐ Identify the ***pericardium***, which is a double-walled sac containing the heart and the roots of the great vessels.

☐ Note that the pericardial sac has two layers:

- ☐ ***Fibrous*** layer.
- ☐ ***Serous*** layer.

☐ Recognize the pericardial cavity, which contains pericardial fluid.

☐ Identify the following ***pericardial sinuses*** (that can be used to pass ligature during cardiac surgery):

☐ Oblique sinus: It is located behind the base of the heart. It is laterally bounded by the inferior vena cava and the pulmonary veins and posteriorly bounded by the pericardium.

☐ Transvers sinus: It is located posterior to the pulmonary trunk and the ascending aorta, superior to the left atrium and anterior to the superior vena cava.

☐ Identify the heart in its position in the thoracic cavity.

☐ Note that the wall of the heart consists of three layers, from superficial to deep there are:

- ☐ ***Endocardium***, a thin internal layer (endothelium and subendothelial connective tissue), lining membrane of the heart and also covers heart's valves.
- ☐ ***Myocardium***, a thick middle layer composed of cardiac muscle.
- ☐ ***Epicardium***, a thin external layer (mesothelium) made by the visceral layer of serous pericardium.

☐ Identify the different chambers of the heart:

- ☐ ***Right atrium***.
- ☐ ***Right ventricle***.
- ☐ ***Left ventricle***.
- ☐ ***Left atrium***.

☐ Identify the different ***surfaces*** of the heart as follows:

- ☐ The ***sternocostal*** (anterior) surface is facing anteriorly.
- ☐ The ***diaphragmatic*** (inferior) surface is resting on the diaphragm.
- ☐ ***Posterior*** surface (base of heart).
- ☐ ***Right*** and ***left pulmonary*** surfaces.

☐ Identify the main four ***borders*** of the heart:

- ☐ ***Right*** border: formed by the right atrium.
- ☐ ***Left*** border: formed by the left ventricle (and some of the left atrium).
- ☐ ***Inferior*** border: formed by the left ventricle and right ventricle.
- ☐ ***Superior*** border: formed by the right and left atrium and the great vessels.

☐ Identify the ***apex of heart***, which is the lowermost superficial part of the heart, formed by the inferolateral part of the left ventricle.

☐ Identify the ***base of the heart***, which is located superior and medially. It forms the upper part of the heart, lies just below the second rib, and formed of the left atrium, part of the right atrium, and the proximal portions of the great vessels.

- ☐ Identify the following sulci:
  - ☐ Atrioventricular sulcus (coronary sulcus).
  - ☐ Anterior interventricular sulcus.
  - ☐ Posterior interventricular sulcus.
- ☐ Identify ***interatrial septum*** between the right and left atria.
- ☐ Identify ***interventricular septum*** between right and left ventricles with its muscular and membranous parts. Note that the ***muscular part*** of the interventricular septum is located between the two ventricles while the ***membranous part*** of the interventricular septum is located between the right atrium and left ventricle because of its oblique position.

STATION 3. 2

RIGHT ATRIUM AND RIGHT VENTRICLE

- ☐ Identify the ***right atrium***, which is one of the two blood collection chambers of the heart. It receives deoxygenated venous blood from the superior vena cava, inferior vena cava and the coronary sinus as well as the anterior and the smallest cardiac veins.
- ☐ Locate the following structures of the right atrium:
  - ☐ ***Right auricle***, which is a conical muscular pocket that projects from the outer surface of the right atrium.
  - ☐ ***Pectinate muscles (musculi pectinati)***, which is the rough muscular anterior wall of the right atrium.
  - ☐ ***Sinus venarum*****,** which is the smooth thin posterior part of the right atrium where the veins open.
  - ☐ The smooth and rough parts of the right atrium, which are separated externally by the ***sulcus terminalis*** **(**a shallow vertical groove), and internally by the ***crista terminalis*** (a vertical ridge)**.**
  - ☐ ***Fossa ovalis*****,** which is located in the interatrial septum **(**during fetal de-

velopment of the heart, it is the foramen ovale, which is an opening between the right and left atrium).

- ☐ **Sinoatrial** and ***atrioventricular*** nodes.
- ☐ Openings of the superior and inferior vena cavae and coronary sinus.
- ☐ ***Right atrioventricular orifice***, which is guarded by the ***tricuspid valve***.

☐ Identify the ***right ventricle***, which is the heart chamber that is responsible for pumping oxygen-depleted blood to the lungs.

☐ Locate the following structures of the right ventricle:

- ☐ ***Conus arteriosus*** (infundibulum) smooth wall that leads to the pulmonary trunk.
- ☐ ***Trabeculae carneae*****,** which are irregular muscular elevations in the interior of the right ventricle.
- ☐ ***Supraventricular crest*** that separates the muscular wall of the right ventricle (inflow part) from the conus arteriosus (outflow part).
- ☐ Three ***papillary muscles***: septal, anterior and posterior. They are the thickening of trabeculae and attach to the cusps of tricuspid valve.
- ☐ ***Tendinous cords (chordae tendineae)*** attach to the free edges (ventricular surfaces) of the septal, anterior, and posterior cusps of tricuspid valve.
- ☐ ***Moderator band (septomarginal trabecula)***, which is a muscular band of heart tissue. It extends from the base of the anterior papillary muscle to the ventricular septum.

STATION 3.3

LEFT ATRIUM AND LEFT VENTRICLE

☐ Identify the ***left atrium*** that is one of the four chambers of the heart, located on the left posterior side. Its primary roles are to act as a holding chamber for blood returning from the lungs.

☐ Locate the following structures of the left atrium:

- ☐ Small muscular ***auricle*** containing ***pectinate muscles***.
- ☐ A larger smooth-walled part where the veins open.
- ☐ Four ***pulmonary veins*** (two superior and two inferior) entering its smooth posterior wall.
- ☐ Left atrial wall is slightly thicker than that of the right atrium.
- ☐ An ***interatrial septum*** that slopes posteriorly and to the right.
- ☐ ***Left atrioventricular orifice***, which guarded by the ***mitral valve*** (bicuspid valve).

☐ Identify the ***left ventricle*** that is located in the bottom of the heart. As the heart contracts, blood eventually flow back into the left atrium, and then through the mitral valve, consequently it then enters the left ventricle. From there, blood is pumped out through the aortic valve into the ascending aorta and onward to the rest of the body.

☐ Locate the following structures of the left ventricle:

- ☐ Left ventricular wall are two to three times as thick as those of the right ventricle.
- ☐ Left ventricular wall mostly covered with ***trabeculae carneae*** that are finer and more numerous than those of the right ventricle.
- ☐ Conical cavity that is longer than that of the right ventricle.
- ☐ Anterior and posterior ***papillary muscles*** that are larger than those in the right ventricle.
- ☐ ***Aortic vestibule***, which is the smooth, non-muscular, supero-anterior outflow part, leading to the ***aortic orifice*** and ***aortic valve***.

STATION 3. 4

SURFACE MARKINGS OF THE CARDIAC VALVES

☐ Note that the surface markings of the cardiac valves on the anterior chest wall are typically retrosternal.

- Locate the followings:
  - ***Pulmonary valve***: at the junction of superior and middle thirds of body of sternum and slightly to the left side, near to left third costal cartilage.
  - ***Aortic valve***: it is below and to the right of the pulmonary valve on left side of middle third of sternum, level with the third intercostal space.
  - ***Tricuspid valve***: at the median plane in the inferior third of the sternal body, opposite to the fourth costal cartilage.
  - ***Mitral valve***: overlapping tricuspid area, it is **more superior and to the left of sternal body**.

STATION 3. 5

FIBROUS RINGS OF THE HEART

(Figure 3.5.1)

- Identify the right and left ***fibrous rings*** of heart (***anulus fibrosus cordis***) surround the atrioventricular and arterial orifices.
- Note that the right fibrous ring is named as the ***anulus fibrosus dexter cordis***, and the left is named as the ***anulus fibrosus sinister cordis***.
- Locate the atrioventricular rings, which serve for the attachment of the muscular fibers of the atria and ventricles, also for the attachment of the bicuspid and tricuspid valves.
- Note that the aortic annulus is the fibrous rings surrounding the arterial orifices and serve for the attachment of the great vessels and semilunar valves.
- Identify the fibrous triangles of the heart, which are thickened areas of tissue between the aortic ring and the atrioventricular ring. The right fibrous triangle is between the aortic ring and the right atrioventricular ring. The left fibrous triangle is between the aortic ring and the left atrioventricular ring.

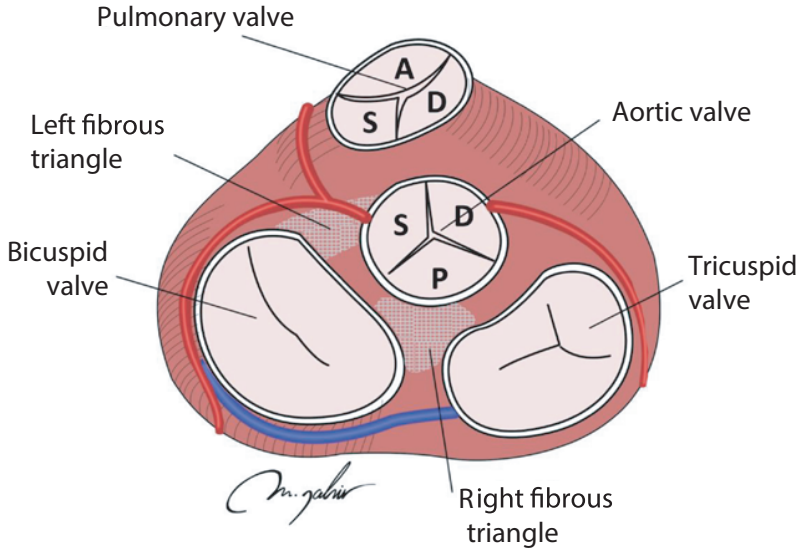

Fig. 3.5.1 Fibrous rings and valves of the heart

STATION 3. 6

BLOOD AND NERVE SUPPLY OF THE HEART

(Figure 3.6.1)

Coronary vessels

☐ Identify the following arteries:

- ☐ ***Right coronary*** artery, and its branches:
  - ☐ ***Posterior interventricular*** artery.
  - ☐ ***Marginal*** artery.
- ☐ ***Left coronary*** artery, and its branches:
  - ☐ ***Anterior interventricular*** artery
  - ☐ ***Circumflex*** artery.

- ☐ Note that the right and left coronary arteries are the branches of ascending aorta.
- ☐ Identify the venous drainage of the heart through veins that accompany the main arteries and their branches as follows:
  - ☐ ***Great cardiac*** vein traveling with the anterior interventricular artery.
  - ☐ ***Middle cardiac*** vein traveling with the posterior interventricular artery.
  - ☐ ***Small cardiac*** vein traveling with the marginal artery.
  - ☐ ***Coronary sinus*** situated posteriorly in the atrioventricular groove.

Conducting system of heart:

- ☐ Note that the conducting system of the heart forms the special innervation of the muscle fibers of the heart.
- ☐ Identify the ***sinoatrial node***, ***atrioventricular node***, ***atrioventricular bundle (bundle of His)*** and *subendocardial plexus (Purkinje fibers)*, which are the main structures of the conducting system of the heart.
- ☐ Note that ***sinoatrial node*** is located near to the opening of superior vena cava in the right atrium.
- ☐ Note that the ***atrioventricular node*** is located at the interatrial septum near to the opening of coronary sinus in the right atrium.
- ☐ The ***atrioventricular bundle*** lies in the membranous part of the interventricular septum in the right ventricle and passes through the **right fibrous triangle**.
- ☐ Note that the atrioventricular bundle is divided into two branches; right and left bundles at the beginning of muscular part of the interventricular septum.
- ☐ The right bundle enters to the ***septomarginal trabecula*** and reaches to the right ventricle wall and forms the ***Purkinje fibers*** and the left bundle reaches to the left ventricle and forms the Purkinje fibers.
- ☐ Note that the sinoatrial node serves as the pacemaker of the heart. The Purkinje fibers are the most rapid conducting component of the heart while the atrioventricular node is the slowest part of the conducting system of the heart.

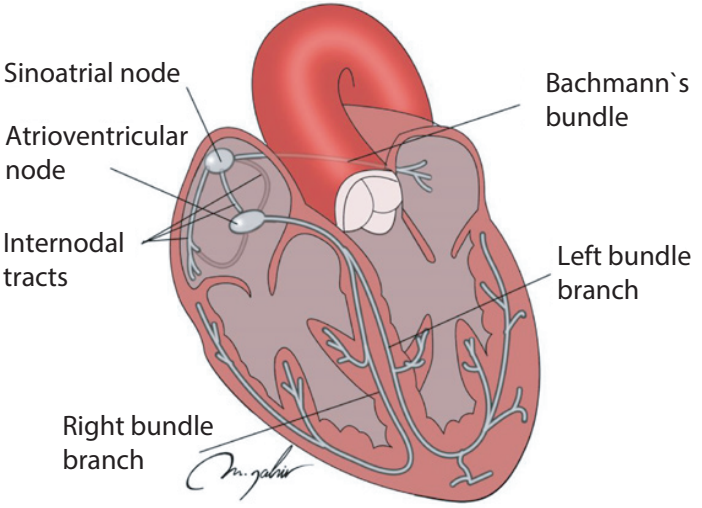

Fig. 3.6.1 The conducting system of heart

Cardiac plexus (plexus cardiacus):

- ☐ Identify the ***cardiac plexus***, which is a plexus of nerves responsible for the innervations of the heart and located at the base of the heart. The cardiac plexus is divided into a superficial part that lies in the concavity of the aortic arch, and a deep part, between the aortic arch and the trachea.
  - ☐ Identify the **superficial part of cardiac plexus**, which is formed by the superior cardiac branch of the left sympathetic trunk and the inferior cervical cardiac branch of the left vagus nerve.
  - ☐ Identify the ***deep part of cardiac plexus***, which is formed by the cardiac nerves derived from the cervical ganglia of the sympathetic trunk, and the cardiac branches of the vagus and recurrent laryngeal nerves.

STATION 3. 7

IMAGING OF THE HEART

(Figure. 3.7.1 - 3.7.4)

- ☐ Review the structures forming the borders of the mediastinum and heart in a routine (PA) chest x-ray (***superior vena cava***, ***right atrium***, ***inferior vena cava***, ***right ventricle***, ***apex***, ***left ventricle***, ***left atrial appendage***, ***pulmonary artery***, ***arch of aorta*** (Figure. 3.7.1).
- ☐ Recognize ***cardiomegaly*** (Figure. 3.7.2).
- ☐ Identify the ***cardiac chambers*** and ***great vessels*** in imaging films, and suggest specific chamber and great vessel enlargements.
- ☐ Identify the heart and mediastinal structures in ***axial CT*** images (Figure. 3.7.3) particularly ascending aorta, superior vena cava, pulmonary vessels, esophagus , bronchi and azygos vein.
- ☐ Identify cardiac chambers in long axis and short axis ***ultrasound*** images (Figure. 3.7.4).

Fig. 3.7.1 Routine (PA) chest x-ray

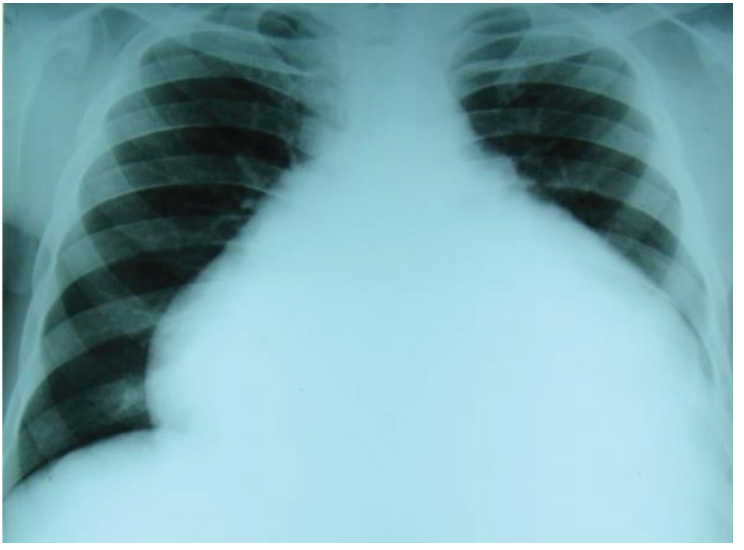

Fig. 3.7.2 Gross cardiomegaly. Calculate cardiothoracic ratio

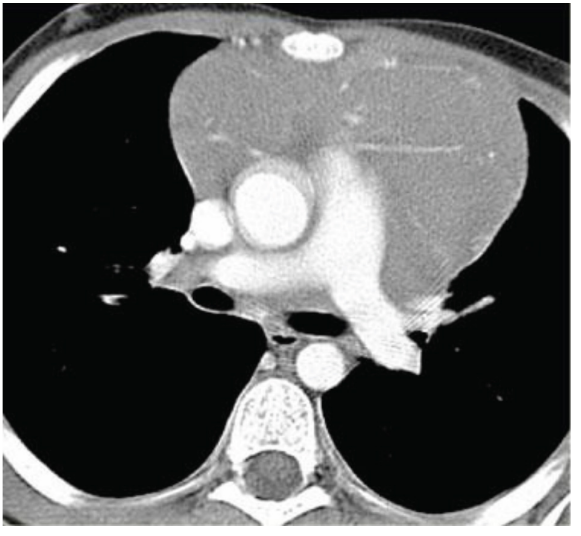

Fig. 3.7.3 Chest CT showing mediastinal structures

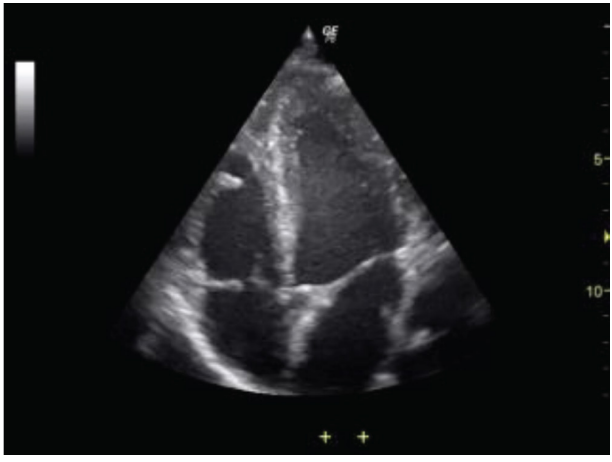

Fig. 3.7.4 Apical 4-chamber view ultrasound of heart

Questions

1. What is the function of the pericardium?
2. What is the clinical use of the pericardial sinuses?
3. Mention the important structures in each heart chamber.
4. What is meaning of the dominant coronary artery?
5. Is the sudden occlusion of a coronary artery, why is the death of heart muscle serious?
6. What is the conducting system of the heart, what are its components and where is the location of each of the components?
7. What is the function of the fibrous skeleton of the heart?
8. Identify mediastinal structures, cardiac chambers and great vessels, in chest x-ray.
9. Diagnose cardiomegaly.
10. Identify mediastinal structures at the level of bifurcation of the trachea in CT chest.
11. Identify the heart chambers and valves as seen in an apical ultrasound view.

LYMPHATIC VESSELS, LYMPH NODES, THYMUS, SPLEEN AND TONSILS

Learning Objectives

Upon completion of this session, the student will be able to:

1. Understand the function of the lymphatic system.
2. Define the terms tissue fluid, lymph, lymphocyte and lymphatic mean.
3. Know how lymph is formed and what is in it.
4. Identify the basic structures and function of a lymph node and the position of the most important lymph nodes in the body.
5. Identify the course by which lymph circulates in the body and is returned to the blood system.
6. Identify the location and function of the spleen, thymus and tonsils.

Required Materials

- Cadaver/ Sagittal section of Neck /Thoracic Cavity/ Abdomen/ Limbs
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions

- There are 3 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it. This indicates completion of the task and comprehension of this part of the assignment. The group's supervisor can question you about it and expect a correct answer. Such questions will be used in your continuous assessment.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 4.1
LYMPHATIC VESSELS

(Figure 4.1.1)

- ☐ Note that the ***lymphatic capillaries*** are blind-ended tubes with thin endothelial walls that located in the spaces between cells.
- ☐ Observe that the ***lymphatic vessels*** grow progressively larger and form 2 lymphatic ducts:
  - ☐ ***Right lymphatic duct***, also called the right thoracic duct, this duct is located near the base of the neck, and goes along the medial border of the anterior scalene muscle at the side of the neck. In most persons it ends at the right subclavian vein. It drains:
    - ☐ Upper right portion of the trunk, (right thoracic cavity, through the ***right bronchomediastinal trunk***),
    - ☐ Right arm (through the ***right subclavian trunk***),
    - ☐ Right side of the head and neck (through the **right jugular trunk**),
    - ☐ In some persons, the lower lobe of the left lung.
  - ☐ ***Thoracic duct***, it originates in the abdomen at the level of L2 from the confluence of the right and left ***lumbar trunks*** and the **intestinal trunk**, forming the ***cisterna chyli***, it traverses the diaphragm at the aortic aperture (at the level T12) and ascends in the superior and posterior mediastinum between the descending thoracic aorta (to its left) and the azygos vein (to its right). The duct curves posteriorly to the left carotid artery and left internal jugular vein at the level of C7 to empty into the junction of the left subclavian vein and left jugular vein. It drains most of the lymph in the body.

STATION 4. 2
LYMPH NODES

- ☐ Note that the ***lymph nodes*** are structures like a bean in shape, are generally spread throughout the lymphatic pathway, providing a filtration mechanism

for the lymph before it returns to the blood stream.

- ☐ Locate the lymph nodes that spread all over the body, with groups found in the neck, chest, underarms, groin, and abdomen.
- ☐ Identify the following groups of lymph nodes:
  - ☐ Lymph nodes of the head and neck
    - ☐ ***Superficial cervical lymph nodes***: including ***occipital***, ***submental*** and ***submandibular***.
    - ☐ ***Deep cervical lymph nodes***: including ***jugulodigastric*** and ***jugulo-omohyoid*** nodes.
  - ☐ Lymph nodes of the thorax
    - ☐ ***Hilar lymph nodes***.
    - ☐ ***Mediastinal lymph nodes***.
  - ☐ Lymph nodes of the upper limb
    - ☐ ***Superficial lymph nodes of the arm***: including ***supratrochlear*** nodes and ***deltoidopectoral*** nodes
    - ☐ ***Deep lymph nodes of the arm***: including the following:
      - ☐ ***Cubita***l lymph node.
      - ☐ ***Brachial*** lymph node.
      - ☐ ***Axillary*** lymph nodes, which are 20-30 individual nodes and subdivided into the following groups:
        - ☐ ***Apical group*** .
        - ☐ ***Central group*** .
        - ☐ ***Anterior (pectoral) group*** .
        - ☐ ***Posterior (subscapular) group*** .
        - ☐ ***Lateral group*** .
        - ☐ ***Infraclavicular (deltopectoral) group*** .
  - ☐ Lymph nodes of the lower limbs
    - ☐ ***Superficial inguinal lymph nodes*** .
    - ☐ ***Deep inguinal lymph nodes*** .
    - ☐ ***Popliteal lymph nodes*** .

STATION 4. 3

THYMUS, SPLEEN AND TONSILS

- ☐ Identify the ***thymus,*** which is a bilobed lymphoid organ located in the superior mediastinum of the thorax and posterior to the sternum.
- ☐ Note that after puberty, the thymus begins to decrease in size; in adults it becomes small and fatty after degeneration.
- ☐ Identify the following relations of the thymus gland:
  - ☐ Inferior: pericardium.
  - ☐ Superior: root of neck.
  - ☐ Anterior: sternum and 1-4 costal cartilage.
  - ☐ Posterior: arch of aorta, brachiocephalic trunk, common carotid arteries, brachiocephalic veins, superior vena cava and trachea.
- ☐ Identify the ***spleen***, the largest lymphatic organ, is a convex lymphoid structure located below the diaphragm and behind the stomach.
- ☐ Locate the spleen within the greater sac of the peritoneum and in the left hypochondrium (one of the regions of the anterior abdominal wall).
- ☐ Check the spleen that has hilum, two surfaces, two borders and two poles.
- ☐ Note the relation of the spleen to the diaphragm, which separates it from the costodiaphragmatic recess.
- ☐ Note that the spleen contacts to the posterior wall of the stomach. It is connected to the greater curvature of the stomach by the ***gastrosplenic ligament*** and to the left kidney by the ***splenorenal ligament.***
- ☐ Identify the splenic vessels:
  - ☐ ***Splenic artery***: supplies the spleen. It branches from the celiac artery, and runs in the upper border of the pancreas.
  - ☐ ***Splenic vein***: drains blood from the spleen, the stomach fundus and part of the pancreas. It is part of the hepatic portal system.

- Note that the ***tonsils*** are aggregates of lymph node tissue situated beneath the epithelial lining of the oral and pharyngeal areas. Identify the following:
  - ***Pharyngeal tonsils*** (adenoids): on the roof of the nasopharynx.
  - ***Tubal tonsil*****:** on the side wall of the nasopharynx.
  - ***Palatine tonsils*****:** on the sides of the oropharynx.
  - ***Lingual tonsils*****:** on the base of the posterior surface of the tongue.
  - Note that these four tonsils of nasopharyngeal and oropharyngeal regions form the **Waldeyer's tonsillar ring**.

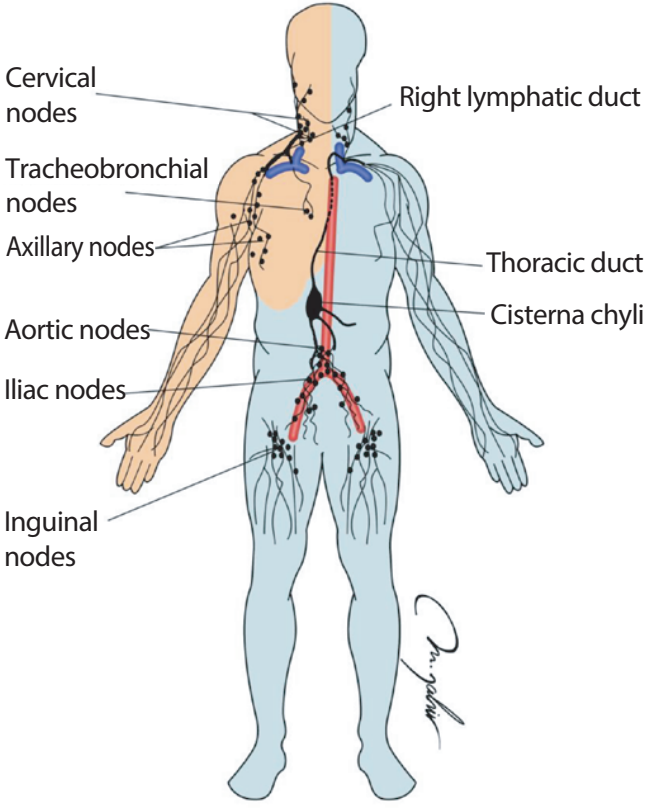

Fig. 4.1.1 Lymphatic vessels and lymph nodes

Questions

1. Describe the structures drain their lymph through the right lymphatic duct.
2. Describe the pass way of the thoracic duct.
3. In which anatomical region does the spleen lie?
4. List the 4 organs that lie in close relation to the spleen.
5. How far forward does the spleen normally project?

UPPER RESPIRATORY TRACT

Learning Objectives

Upon completion of this session, the student will be able to:

1. Describe the nasal cavity, its general anatomy including walls, openings, nasal septum, conchae, and meatuses.
2. Define the innervation and vascular supply of the nose.
3. List the paranasal air sinuses and their openings into the nasal cavity.
4. Identify the basic structures of the pharynx.
5. Identify the cartilages and membranes that form the skeleton of the larynx.
6. Define the actions of the intrinsic muscles of the larynx in abducting, adducting, tensing, and relaxing the vocal folds.
7. Define the innervation and vascular supply of the larynx.
8. Identify the trachea and describe its neurovascular supply.
9. Identify the nose and paranasal sinuses in Lateral skull and Waters x-ray images.
10. Name the various parts of the larynx in x-ray and CT images.
11. Identify the trachea and bronchi in plain x-rays and bronchogram.
12. Describe the bony components of the chest in x-rays and CT images.
13. Identify the lung fields, fissures, lobes and recesses in x-rays.

Required Materials:

- Cadaver/ Dissected Neck/ Sagittal Section of Neck.
- Handouts/ Atlases of Human Anatomy.
- Visual and Electronic Media.
- Images.

Instructions:

- There are 3 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it. This indicates completion of the task and comprehension of this part of the assignment. The group's supervisor can question you about it and expect a correct answer. Such questions will be used in your continuous assessment.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 5. 1

NASAL CAVITY, PARANASAL AIR SINUSES AND PHARYNX

(Figure. 5.1.1)

- ☐ Identify the structures of ***nose*** externally with the ***nasal bone*** and ***cartilages.***
- ☐ Identify the ***cartilages of the nose***, which are: ***great alar cartilages, lesser alar cartilages, lateral nasal cartilages*** and ***septal nasal cartilages***.
- ☐ Note that the nasal cavity has an ***external opening (nostrils)*** in the front of the face and ***posterior nasal apertures (choanae)*** open into the nasopharynx.
- ☐ Note that the most anterior part of the nasal cavity is called ***nasal vestibule*** and the other part of the nasal cavity is called ***nasal cavity proper***.
- ☐ Note that the nasal cavities have a roof, floor and lateral and medial walls as the following:
  - ☐ The ***roof*** of the nasal cavities is curved and narrow. It is formed of the following bones from anterior to posterior: ***nasal***, ***ethmoid***, and ***sphenoid***.
  - ☐ The ***floor*** of the nasal cavities is wider than the roof. The ***palatine processes*** of the ***maxilla*** and the ***horizontal plates*** of the ***palatine bone*** form the floor.

- The ***lateral wall*** of each nasal cavity is formed mainly by the maxilla, and compensated by: the ***perpendicular plate*** of the palatine bone, the ***medial pterygoid plate*** of ***sphenoid***, the ***labyrinth*** of ***ethmoid*** and the ***inferior concha***. Lateral wall has three slopes like projections called the nasal conchae or turbinates, which are ***superior***, ***middle***, and ***inferior conchae***. Below each concha is a recess known as a meatus, superior, middle and inferior meatuses. The superoposterior to the superior concha there is a triangular area named as ***sphenoethmoidal recess***. The anterosuperior part of the middle meatus leads into a funnel-shaped opening, the ***ethmoidal infundibulum*****.**
- The ***medial wall*** of the nasal cavities is formed by the nasal septum, which is formed by; perpendicular plate of ethmoid bone, ***vomer bone***, crest of the maxillary bone, crest of the palatine bone, and septal nasal cartilage.

Note that the nasal cavity is divided into two segments: the ***respiratory*** segment and the ***olfactory*** segment:

- The ***respiratory segment*** includes most of each nasal cavity and is lined by ciliated pseudostratified columnar epithelium (respiratory epithelium). The conchae are situated in this region.
- The ***olfactory segment*** is lined by olfactory epithelium, which contains receptors for the sense of the smell. This segment is located under the mucosa of the roof of each nasal cavity.

Note that the blood supply of the nose arises from branches of both the ***internal*** and ***external carotid*** arteries, including:

- ***Sphenopalatine*** and ***greater palatine*** arteries, branches of the ***maxillary*** artery.
- ***Anterior ethmoidal*** artery and ***posterior ethmoidal*** artery, branches of the ***ophthalmic*** artery.
- ***Septal Branches*** of the ***superior labial*** artery, a branch of the ***facial*** artery.

Note that the general sensory innervation of the nose is by branches of the ***trigeminal*** nerve, including:

- ***Nasociliary*** nerve.

- ***Nasopalatine*** nerve.
- ***Posterior nasal branches*** of ***maxillary*** nerve.

Identify the ***paranasal air sinuses*****,** which are air-filled, extensions of the respiratory part of the nasal cavity into the bones of the skull: ***frontal***, ***ethmoid***, ***sphenoid***, and ***maxilla***.

Note that the paranasal air sinuses are draining into the lateral wall of the nasal cavity, as follows:

- The ***frontal sinus*** drains in the middle meatus via the ***frontonasal duct,*** which opens out at the ***hiatus semilunaris***, which is located between ***ethmoidal bulla*** and ***uncinate process*** of ethmoidal bone.
- The ***sphenoidal sinus***, which drains into the ***sphenoethmoidal recess***.
- The ***ethmoid sinus*****,** which arranged in three groups that are the anterior, middle, and posterior:
  - The ***anterior ethmoid sinus*** drains with the frontal sinus into the middle meatus in the hiatus semilunaris.
  - The ***middle ethmoid sinus*** drains in the middle meatus in the ethmoid bulla.
  - The ***posterior ethmoid sinus*** drains in the superior meatus.
- The ***maxillary sinus*****,** which is the largest and is found in the body of the maxilla. It drains into the middle meatus in the ***semilunar hiatus***.
- Identify the ***nasolacrimal duct*** in the inferior meatus is the opening of the ***lacrimal sac*** of the orbit.
- Locate the ***pharynx***, which is part of the digestive system and also the respiratory system. The pharynx extends from the base of the cranium to the inferior border of the ***cricoid cartilage*** at the level of C6.
- The pharynx is divided into three sections:
- ***Nasopharynx*** (epipharynx) extends from the base of the skull to the level of the ***soft palate*** at C1. Identify the following of the nasopharynx:
  - ***Pharyngeal tonsils***

- ☐ ***Eustachian tubes***, opening of Eustachian tube
- ☐ ***Salpingopharyngeal fold***
- ☐ ***Salpingopalatine fold***
- ☐ ***Pharyngeal isthmus***
- ☐ ***Pharyngeal recess*** (posteriorly carotid canal is present)

☐ ***Oropharynx*** (mesopharynx) extends from the soft palate at the level of C1 to the epiglottis at the level of C3. Identify the following of oropharynx:

- ☐ Palatine tonsil
- ☐ Lingual tonsil
- ☐ Palatoglossal arch
- ☐ Palatopharyngeal arch
- ☐ Oroharyngeal isthmus

☐ ***Laryngopharynx*** (hypopharynx) extends from the ***epiglottis*** at the level of C3 to the inferior border of the cricoid cartilage, where it becomes continuous with ***esophagus*** at the level of the C6.

STATION 5. 2

LARYNX AND TRACHEA

☐ Locate the ***larynx*** within the midline and the anterior aspect of the neck. It is located anterior to the inferior part of the pharynx and superior to the trachea. It is complex organ of voice production.

☐ Note that the larynx is composed of 3 large unpaired cartilages (***cricoid***, ***thyroid*** and ***epiglottis***) and 3 pairs of smaller cartilages (***arytenoids***, ***corniculate*** and ***cuneiform***).

☐ Cricoid cartilage forms a complete ring surrounding the laryngeal air pathway.

☐ There are two sets of paired joints, which aid the movement of the vocal cords in the larynx, the ***cricothyroid*** and ***cricoarytenoid*** joints.

☐ Identify the ligaments of the larynx, which are:

- Extrinsic ligaments:
  - ***Thyrohyoid membrane***.
  - ***Hyoepiglottic ligament***.
  - ***Cricotracheal ligament***.
- Intrinsic ligaments:
  - The ***conus elasticus***: the free superior margin of the conus elasticus is thickened to form the ***vocal ligament***, which forms the ***vocal folds*** (***true vocal cords***).
  - The ***quadrangular membrane***: the free lower inferior margin of this membrane is thickened to form the ***vestibular ligament***, which forms the ***vestibular folds*** (***false vocal cords***).
- Note that the ***laryngeal cavity*** extends from laryngeal inlet, through which it communicates with the laryngopharynx, to the level of the inferior border of the cricoid cartilage through which it communicates with the trachea. It is divided into 3 major regions: the ***vestibule***, the ***ventricle*** and the ***infraglottic*** cavity.
- Observe the ***rima glottidis*** is the opening between the true vocal cords and the arytenoid cartilages.
- Identify the internal laryngeal muscles:
  - ***Cricothyroid*** *muscles:* stretches and tenses the vocal ligaments.
  - ***Thyroarytenoid*** *muscles:* acts to relax the vocal ligament.
  - ***Lateral cricoarytenoid*** *muscles:* major adductors of the vocal folds.
  - ***Posterior cricoarytenoid*** *muscles:* abductors of the vocal folds
  - ***Transverse and oblique arytenoid*** *muscles:* adduct the arytenoid cartilages, closing the posterior portion of rima glottidis. This narrows the laryngeal inlet.
- Identify the ***neurovascular supply*** of the larynx:
  - ***Superior laryngeal*** *nerve, which is the branch of* ***vagus*** *nerve*
  - ***Recurrent laryngeal*** *nerve, branch of the vagus nerve*

- ☐ ***Superior and inferior laryngeal*** arteries
- ☐ ***Superior and inferior laryngeal*** veins
- ☐ Note that the superior laryngeal nerve external branch takes place only in the innervation of cricothyroid muscles.
- ☐ The rest of internal laryngeal muscles are innervated by recurrent laryngeal nerve**.**
- ☐ Note that sensory innervation to the glottis and laryngeal vestibule is by the internal branch of the superior laryngeal nerve and sensory innervation to the subglottis is by the recurrent laryngeal nerve

☐ Identify the ***trachea***, which are the C-shaped rings of hyaline cartilage. The trachea extends from the larynx and branches into the two ***right and left main bronchi***.

☐ Locate the ***carina*****,** which is a ridge of cartilage in the trachea that occurs between the divisions of the two main bronchi. This occurs at the lower end of the trachea (usually at the level of the 4th thoracic vertebra, which is in line with the sternal angle.

☐ Note that the trachea starts at the neck and reaches to the thoracic cavity: it has cervical and thoracic parts.

☐ Identify the ***bronchial tree***, which is formed of:

- ☐ ***Main*** bronchus
- ☐ ***Lobar*** bronchi (two on left and three on right)
- ☐ ***Segmental*** bronchi
- ☐ ***Terminal*** bronchi
- ☐ ***Terminal*** bronchioles
- ☐ ***Respiratory*** bronchioles
- ☐ ***Alveolus***
- ☐ ***Alveolar duct***
- ☐ ***Alveolar sac***

- ☐ Identify the neurovascular supply of the larynx:
  - ☐ Branches from the ***inferior thyroid*** and ***bronchial*** arteries that form anastomotic networks in the tracheal wall.
  - ☐ Veins drain to the inferior thyroid plexus.
  - ☐ Vagus and recurrent laryngeal nerves.

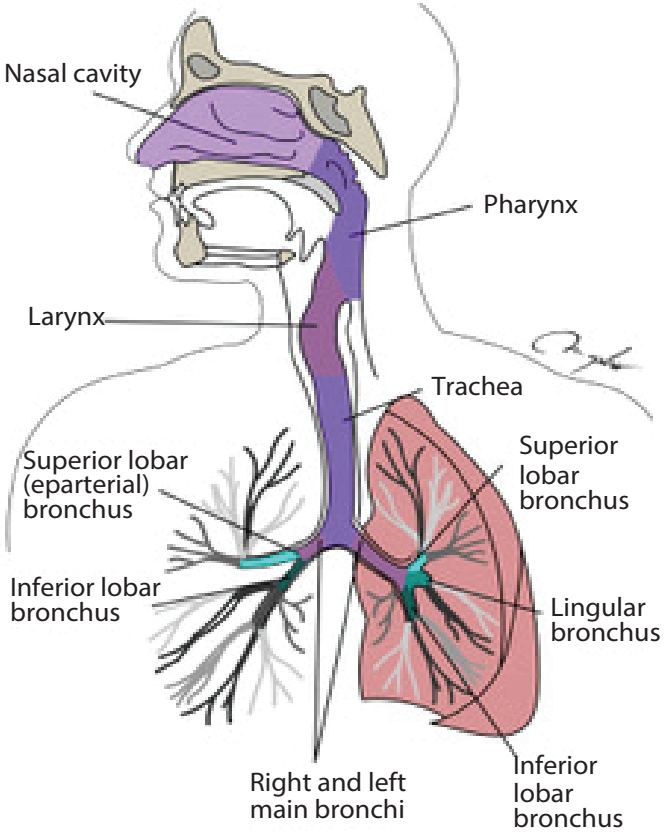

Fig. 5.1.1 Respiratory system

STATION 5. 3

IMAGING OF LARYNX AND TRACHEA

(Figure. 5.3.1-5.3.4)

- ☐ Name the parts of the larynx seen in x-ray and CT images.
- ☐ Identify the trachea and bronchi in plain x-rays and bronchogram.
- ☐ Describe the bony components of the chest in x-rays and CT images.
- ☐ Identify the lung fields, fissures, lobes and recesses in x-rays.
- ☐ Recognize pleural effusion.

Fig. 5.3.1 Lateral view of larynx

Fig. 5.3.2 X-ray contrast bronchogram

Fig. 5.3.3 The lung fields and recesses

Fig. 5.3.4 Obliteration of right costophrenic recess (pleural effusion)

Questions

1. Describe the walls of the nasal cavity.
2. Mention the neurovascular supply of the nasal cavity.
3. Mention the function of the paranasal sinuses.
4. Mention the actions of the laryngeal muscles.
5. Mention the neurovascular supply of the larynx.
6. Identify the thyroid cartilage, cricoid cartilage, vocal folds and epiglottis in a lateral x-ray of the larynx
7. If a person inhales a foreign body into which lung it likely to go? And in which region of it and why?
8. At the bronchial tree, which parts are surrounded by cartilage tissue?
9. Name the airway passages seen in a contrast bronchogram.
10. Name the various zones of the lung fields.
11. Recognize pleural effusion

LOWER RESPIRATORY TRACT

Learning Objectives:

Upon completion of this session, the student will be able to:

1. Identify the structures of the thoracic cage (bones, muscles and neurovascular bundles).
2. Identify and describe the location of the lungs within the thoracic cavity.
3. Identify the hilum of each lung and locate the pulmonary artery, pulmonary veins and the bronchi.
4. Explain a bronchopulmonary segment and discuss its general organization.
5. Name the bronchopulmonary segments and identify their location in indication to the lobes of the lungs.
6. Recognize pneumonic consolidation in chest x-ray.

Required Materials:

- Cadaver/ Thoracic Cage/ Thoracic Cavity/ Lungs
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions:

- There are 2 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it. This indicates completion of the task and comprehension of this part of the assignment. The group's supervisor can question you about it and

expect a correct answer. Such questions will be used in your continuous assessment.

- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 6. 1

THORACIC CAGE AND INTERCOSTAL SPACE

(Figure 6.1.1)

- ☐ Identify the framework of the ***thoracic cage (rib cage)*** which is formed of the followings:
  - ☐ ***Sternum***, formed of:
    - ☐ Manubrium.
    - ☐ Body.
    - ☐ Xiphoid process.
- ☐ ***Twelve pairs of ribs***, each rib consists of a head, neck, and a body. Note the followings:
  - ☐ The upper seven ribs are attached to the sternum by means of costal cartilage, are called ***true ribs***.
  - ☐ The 8th, 9th, and 10th ribs are called ***false ribs***, and join with the costal cartilages of the ribs above.
  - ☐ The 11th and 12th ribs are known as ***floating ribs***, as they do not have connection with the sternum.
  - ☐ Identify the ***subcostal groove,*** which locate along the inferior margin of the superior rib that accommodates the ***intercostal*** nerves and associated major arteries and veins.
  - ☐ Identify the ***angle of the rib***, which is the curvature of the body of a rib posteriorly.

- ☐ ***Twelve thoracic vertebrae***, which form a framework for the ribcage and the torso in order to protect the inner thoracic organs. The body is heart shape and carries the articular facets of the ribs.
- ☐ Identify the ***superior thoracic aperture*** and ***inferior thoracic aperture***:
  - ☐ Note that superior thoracic aperture is formed by superior part of the manubrium of sternum anteriorly, the first ribs laterally and the first thoracic vertebra posteriorly. The superior thoracic aperture is open connects the root of the neck with the thorax.
  - ☐ The inferior thoracic aperture is surrounded by xiphoid process anteriorly, costal arches of the 7-10 ribs laterally and the 12th thoracic vertebra posteriorly. The inferior thoracic aperture is closed by diaphragm.
- ☐ Identify the following joints of the thoracic cage:
  - ☐ ***Joints of heads of ribs*:** first rib and the last three ribs have a single synovial joint with the corresponding vertebrae, while the remaining ribs have two synovial joints: one with the corresponding vertebra and one with the vertebra above.
  - ☐ ***Joints of tubercles of ribs*:** the tubercle of each rib articulates with the transverse process of the corresponding vertebra through a synovial joint.
  - ☐ ***Costochondral joint***: it is the joint between the rib and its costal cartilage. These are ***primary cartilaginous joints*** and no movements are possible here.
  - ☐ **Joints of costal cartilages with sternum (costostrnal Joint) :** the first costal cartilage of both sides attach to the manubrium sterni. At this joint, no movement is possible. The second costal cartilage articulates with the body of sternum and the manubrium sterni by a ***synovial joint*** where movement is possible. The third to seventh costal cartilages articulate with lateral border of the body of sternum at mobile synovial joints.
- ☐ Locate the ***intercostal space*** and identify the following ***intercostal muscles*** of each space:

- ☐ ***External intercostal muscles*** assist in quiet and forced inspiration. They originate on ribs 1-11 and inserted on ribs 2-12. The external intercostals are responsible for the elevation of the ribs and winding them, therefore increasing the transverse dimensions of the thoracic cavity.
- ☐ ***Internal intercostal muscles*** assist in forced expiration. They originate on ribs 2-12 and inserted on ribs 1-11. The internal intercostals are responsible for the depression of the ribs and direct them inward, therefore decreasing the transverse dimensions of the thoracic cavity.
- ☐ ***Innermost intercostal muscle***, the deep layers of the internal intercostal muscles, which are separated from them by a neurovascular bundle. Is comprised of:
  - ☐ ***Transversus thoracis*** **muscle**.
  - ☐ ***Sternocostal*** **muscle.**
  - ☐ ***Subcostalis*** **muscle**.
- ☐ Note that each intercostal space has intercostal ***vein***, ***artery*** and ***nerve*** arranged in order "***VAN***" from above downwards.
- ☐ Identify the followings:
  - ☐ ***Internal thoracic*** artery.
  - ☐ Two small ***anterior intercostal*** arteries.
  - ☐ ***Musculophrenic*** artery.
  - ☐ ***Superior epigastric*** arteries.
  - ☐ ***Posterior intercostal*** artery.
  - ☐ ***Superior intercostal*** artery.
  - ☐ ***Azygos*** vein.
  - ☐ ***Superior*** and ***inferior hemiazygos*** veins.

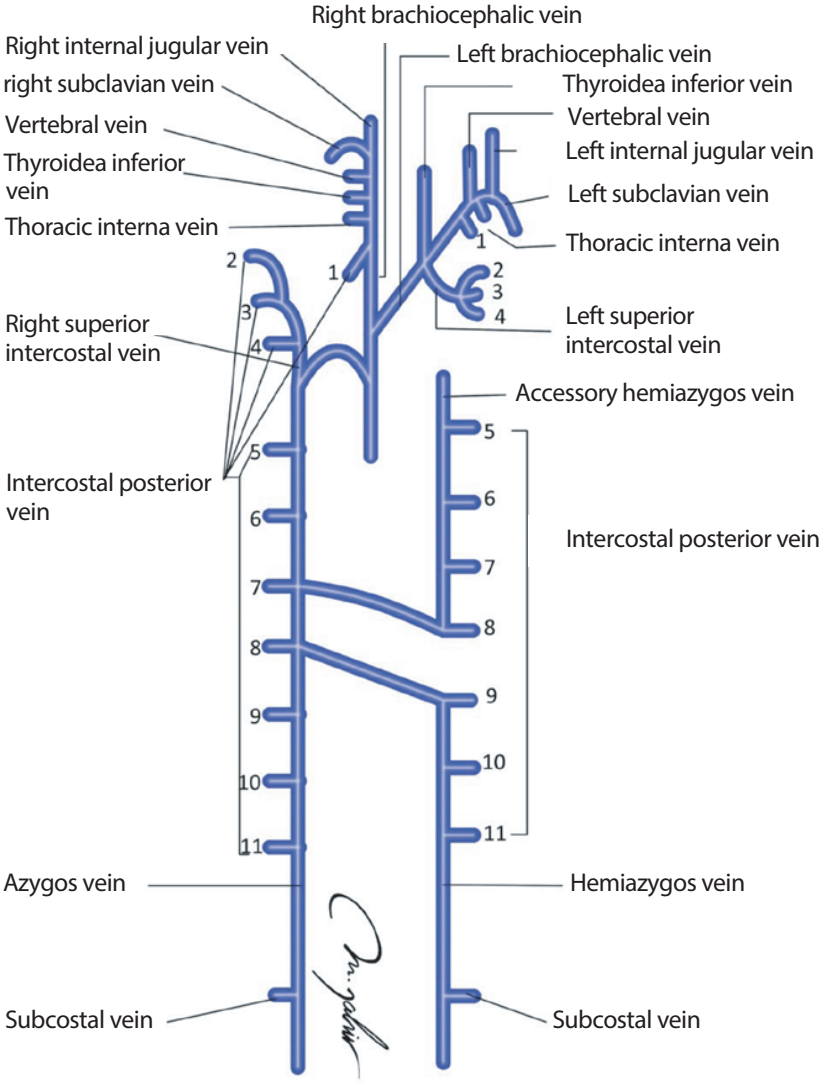

Fig. 6.1.1 Azygos venous system

STATION 6.2

RIGHT LUNG & LEFT LUNG

(Figure 6.2.1)

- ☐ Identify the ***pleura***, which is a serous membrane that folds back onto itself to form a two-layered membrane, as follow.
  - ☐ The outer pleura (***parietal pleura***) lines the pulmonary cavity is attached to the thoracic wall. It is divided in costal part, mediastinal part and diaphragmatic part.
  - ☐ The inner pleura (***visceral pleura***) covers the lungs and adjoining structures, via blood vessels, bronchi and nerves.
  - ☐ The thin space between the two pleural layers is named as the pleural cavity and normally contains a small amount of ***pleural fluid***.
- ☐ Identify the four recesses of the pleural cavity:
  - ☐ ***Costomediastinal recess***: behind the sternum and costal cartilages, where costal pleura is in contact with the mediastinal.
  - ☐ ***Costodiaphragmatic recess***: between the diaphragm and chest wall.
  - ☐ ***Phrenicomediastinal recess***: between the diaphragm and mediastinum.
  - ☐ ***Vertebromediastinal recess***: between the vertebral bodies and mediastinum.
- ☐ Identify the ***lungs*****,** which are the primary organs of respiration. Locate the position of the right and left lungs within the lateral part of the thoracic cavity.
- ☐ Observe the ***right lung***, which is larger in volume than the left lung, with a larger transverse dimension (because of the heart on the left) and a shorter longitudinal dimension (because of the liver on the right).
- ☐ Identify the ***right main bronchus*** that is differs from the left main bronchus, since it is longer, larger caliber and more vertical.
- ☐ Note that the right lung has 2 fissures: the ***oblique and horizontal fissures***.

- ☐ The right lung contains 3 lobes and 10 bronchopulmonary segments:
  - ☐ ***Right upper lobe***
    - ☐ ***Apical*** segment.
    - ☐ ***Posterior*** segment.
    - ☐ ***Anterior*** segment.
  - ☐ **Right middle lobe**
    - ☐ ***Lateral*** segment.
    - ☐ ***Medial*** segment.
  - ☐ ***Right lower lobe***
    - ☐ ***Superior*** segment.
    - ☐ ***Anterior*** segment.
    - ☐ ***Medial*** segment.
    - ☐ ***Lateral*** segment.
    - ☐ ***Posterior*** segment.
- ☐ Observe the ***left lung***, which is smaller in volume than the right lung, with a smaller transverse dimension (because of the heart on the left) and a larger longitudinal dimension (because of the liver on the right).
- ☐ Identify the ***left main bronchus*** that also differs from the right main bronchus, since it is shorter, smaller caliber and more horizontal.
- ☐ Note that left lung has just one fissure: the ***oblique fissure***.
- ☐ Note that the left lung contains 2 lobes and 8 bronchopulmonary segments:
  - ☐ ***Left upper lobe***
    - ☐ ***Apicoposterior*** segment.
    - ☐ ***Anterior*** segment.
    - ☐ ***Superior lingular*** segment.
    - ☐ ***Inferior lingular*** segment.
  - ☐ ***Left lower lobe***
    - ☐ ***Superior*** segment.
    - ☐ ***Anteromedial*** segment.
    - ☐ ***Lateral*** segment.
    - ☐ ***Posterior*** segment.

- [ ] In the specimen provided identify the apex, base, lateral surface, and mediastinal surface of the right and left lungs.
- [ ] Observe the structures that make impressions on the mediastinal surface of each lung as the following illustrations showing:

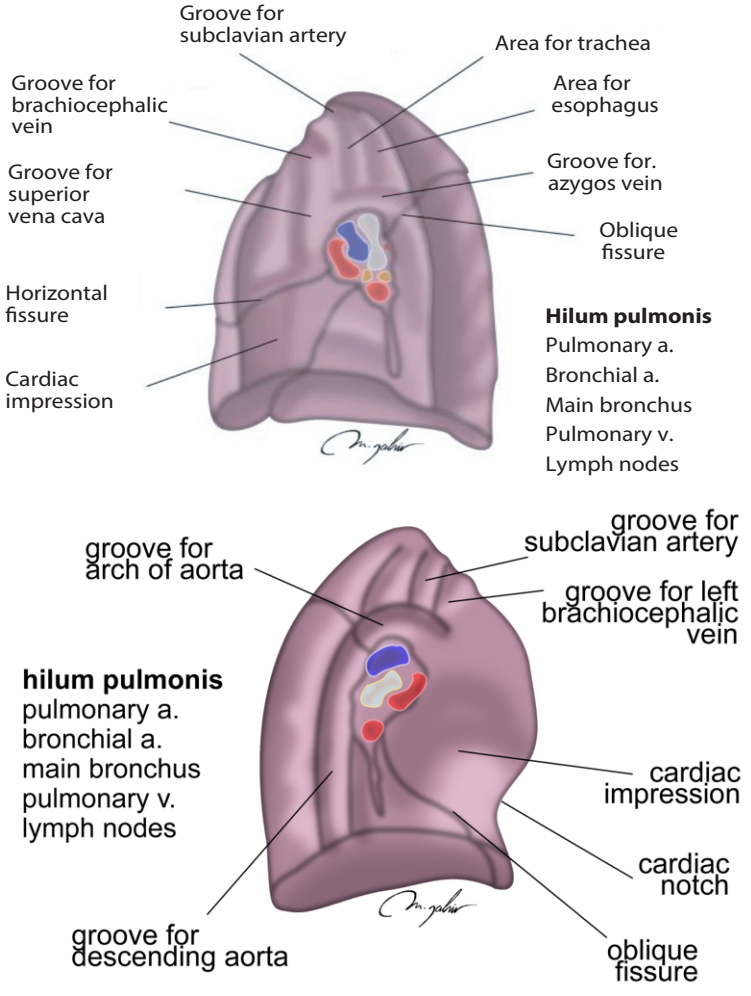

Figure 6.2.1 Mediastinal surface of the right and left lung

STATION 6.3

IMAGING OF LUNGS

(Figure 6.3.1 - 6.3.5)

- ☐ Count the ribs in a PA chest x-ray inf Fig. 6.3.1, and identify a cervical rib in Fig. 6.3.2
- ☐ In a CT (bone window) image, note the appearance of the costovertebral joints in Fig. 6.3.3
- ☐ Observe the location of lobes and fissures in PA and lateral chest (Fig. 6.3.4)
- ☐ Recognize lobar consolidation (Fig. 6.3.5) and note location and orientation of the horizontal fissure.

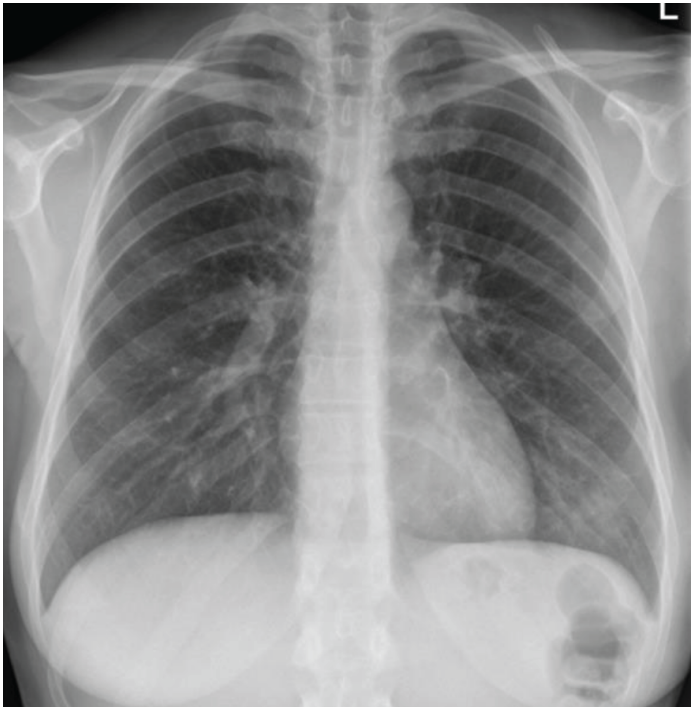

Fig. 6.3.1 Counting the ribs

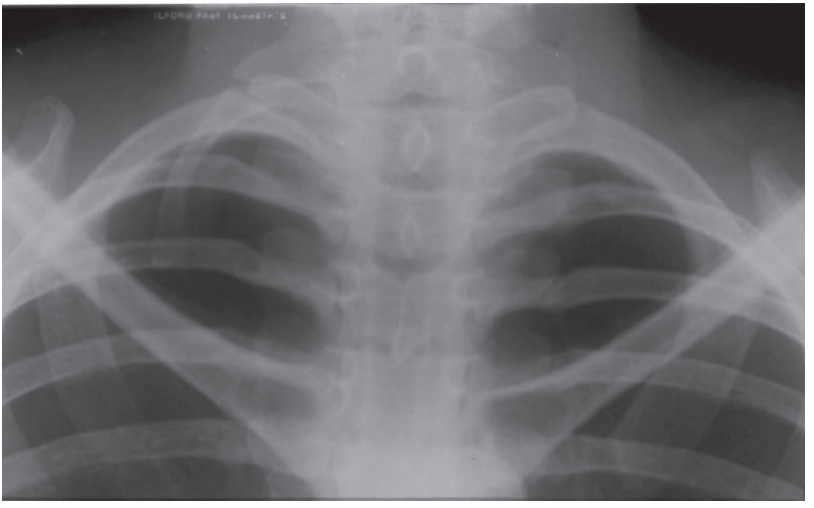

Fig. 6.3.2 Cervical rib

Fig. 6.3.3 Costovertebral joints in CT image

Fig. 6.3.4 Lobes and fissures

Fig. 6.3.5 Pneumonic consolidation of right upper lobe.
Note downward concavity of the horizontal fissure

Questions

1. Describe the anatomy of the ribs.
2. Mention the functions of the intercostal muscles.
3. The lungs have a unique pattern of blood supply, Explain it.
4. What are the structural differences between right and left lungs?
5. What is bronchopulmonary unit?
6. Identify the horizontal fissure in right upper lobe consolidation.