

Original Research Article

Continuing Medical (Anatomy) Education Series: Clinical Applications of Human Anatomy; the Surgical Perspectives

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Article History

Received: 17.06.2026

Accepted: 05.08.2026

Published: 07.10.2026

Abstract: Human Anatomy is a core and foundation course in medicine. Its proper understanding is key to the application of clinical medicine in health care. Traditionally, the core sciences of Medicine of which Human Anatomy is one are taught and learnt at the inception of the training. Although, mentions are made of the clinical relevances of the core sciences at this level. The level of appreciation of the clinical applications of the knowledge by the first-and second- year students (Preclinical level) is not that much. By the time these students progress to the clinicals, they tend to be much preoccupied by the clinical details and responsibilities and patient care. Hence, they have little recourse to the core sciences. This gap is what this article set to address by providing the nexuses between Anatomy and Clinical Medicine. This will go a long way to improve the appreciation of the very significant contributions of Anatomy to Clinical Medicine there by making them more competent Physicians. Areas covered include veins, arteries, nerves, surgical incisions, abdominal & pelvic organs, pleural cavities, face & dural venous sinuses.

Keywords: Medical Education, Human Anatomy, Clinical Applications.

INTRODUCTION

World-wide, Human medical education is taught and learnt in two very broad groups with an intermediary group between the two. The first group commonly referred to as preclinical deals with the core biological science of the human body while the second group deals with the health problems that may arise within the human body and their management. The intermediary group deals with understanding the microscopic, structural and functional alterations of the human body in diseases. The preclinical segment consists of Anatomy, Biochemistry and Physiology. Anatomy covers the macroscopic features (gross anatomy), microscopic features (histology), developmental (embryology) and neural tissues (neuroanatomy) of the Human body. The modes of instructions in anatomy education are didactic lectures; cadaveric dissections; light microscopy slides of tissues, structures and organs; and relevant audiovisuals. The didactic lectures ensure the proper understanding and appreciation of the normal forms of the body tissues, structures and organs. This is key to the proper identification and early detection of any derangement in the structural entity of the human body. Whenever, anatomy is taught to students of medicine, dentistry and allied courses (nursing, physiotherapy, pharmacy, human nutrition, public health etc), emphases should be and must be on application to human health. Clinical medicine is all about correct, appropriate and timely application of anatomy, physiology and biochemistry. Thus, it becomes pertinent for early introduction of clinical applications in the course of medical education and training. For a fact, by teaching preclinical students the clinical relevance of a particular organ or structure arouses their interests and stimulate their curiosity. Thus, they become increasingly eager to acquire such knowledge.

The normal pattern is to state the clinical relevance or application at the end of each topic. This paper set out to assemble the clinical applications of human anatomy in a holistic manner.

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Citation: Ajani, R. S. (2026). Continuing Medical (Anatomy) Education Series: Clinical Applications of Human Anatomy; the Surgical Perspectives. *South Asian Res J App Med Sci*, 8(5), 172-189.
<https://doi.org/10.36346/sarjams.2026.v08i05.004>

In this article, the relevant anatomy will just be mentioned very briefly while most of the efforts will be on clinical applications since these constitute the main theme of this article.

BRIEF HISTORY OF ANATOMY

The history of human Medicine and human Anatomy is that of inseparable Siamese twins. Anatomy is both the cornerstone as well as the foundation for standard medical practice and excellent clinical studies. Literature reveals that the first attempt to dissect the human body for the purpose of studying the structure and function was around 500 BC by Alcmaeon of Croton in ancient Greece [1-3]. Hippocrates, circa BC 460-377 opined that the scientific practice of medicine should be premised on natural sciences, diagnosis, therapeutics and prevention. He also emphasised the need for physicians to study anatomy [4]. By means of cadaveric dissection, Herophilus, circa BC 330-280; and Erasistratus circa BC 310-250; were able to elucidate the structure and function of the human body [5].

Galen, circa AD 131-200; consolidated on the then existing knowledge by complimenting it with the gains from patient care and animal dissection. He made a significant in-road into the pathophysiology of diseases. For about 1,300 years, Galen dominated western medicine like a colossus [6]. Sadly, human cadaveric dissection suffered a temporary setback during the Middle Ages. The publication of “Anathomia” in 1316 by Mondino concretized the relevance of anatomy in medical education [7].

The 14th century renaissance brought about the transition from medieval to modern times and several artists were involved in the study of anatomy. However, Leonardo da Vinci circa 1452-1519 was the most outstanding amongst them. With over 750 artistically and scientifically accurate anatomical drawings, he was able to correlate form with function [8]. With the publication of “De Humani Corporis Fabrica” in 1543 by Vesalius, Anatomy became established as the cornerstone of modern medicine [9].

In 1828, Britain had an exponential population growth that led to a very steep rise in the demand for physicians. This invariably led to the demand for cadavers outstripping supply. This disequilibrium in cadaver request and sourcing resulted in dangerous and criminal acts such as kidnapping, drugging and getting drunk with subsequent murder for the purpose of supplies as cadavers; made the British Parliament to enact the Anatomy Act on 1st August 1832. This document brought about the recognition of cadaveric dissection as being key to medical training [10, 11].

In Nigeria, the first medical school was established at the inception of the premier University of Ibadan in 1948.

Over the decades, the number of universities that have been licensed for medical training by the appropriate regulatory government agencies (National Universities Commission & Medical and Dental Council of Nigeria) has continued to be on the increase. This emanates for Nigeria population increase and the external demands for Nigerian trained Doctors.

A recourse to the official Website of the Medical and Dental Council of Nigeria (MDCN) revealed that as at 26 April 2026, sixty-nine Universities have been accredited to run the medical (MBBS) programme. These universities are admixture of Federal Government, State Governments and Private Organization/Individual Establishments. The total approved yearly carrying capacity of all these training Universities for the MBBS programme is currently 8,745.

For the Dentistry programme, 10 Universities have valid MDCN approval with a yearly capacity of 425 [12].

The Council also sets the minimum standards for undergraduate medical and dental education [13]. This MDCN publication contains the course content and also infrastructure and equipment requirements for anatomy education.

1. VASCULAR ACCESS

i). *Saphenous Vein Cut Down*

The great saphenous vein lies anterior to the medial malleolus and also superficial (Fig 1). These features make it very suitable to secure an access for placement of cannula especially in patients that require intravenous fluid or drugs for quite a while. It is also of use in patients with moderate to severe burns, morbid obesity, severe dehydration and thrombosed peripheral veins.

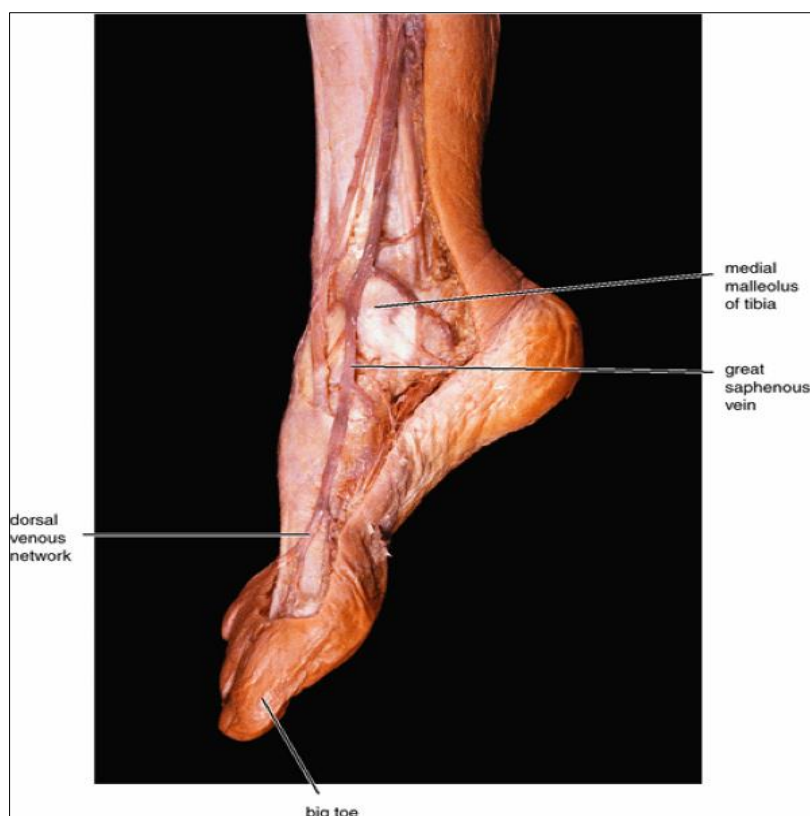


Fig. 1: Medial view of the distal right leg and foot showing the origin and course of the great saphenous vein.
Courtesy Snell © [16]

ii). Femoral Artery Cannulation

The femoral artery lies lateral to the femoral vein in the femoral triangle. Besides being superficial, it is firmly held in position by the deep fascia of the thigh thus making it secured. In patients that require haemodialysis either due to acute renal shut down or chronic renal failure, the femoral artery is the usual site of placement of cannula for the procedure. Also, in Interventional radiological procedures, the femoral artery is the usual site for the introduction of the endoscopic catheter that is used for stenting of occluded coronary artery of the heart or an intracerebral artery of the brain. It is also used for injection of radioactive iodine during angiographic studies.

iii). Median Cubital Vein

This vein lies in the anterior aspect of the elbow linking the cephalic vein (located on the radial side) with the basilic vein that is located on the ulnar side. It is relatively stable as a venous access. Thus, in patients that require intravenous drugs, fluids and blood & its products, it is the most frequent site for venous access.

iv). Vascular Graft

Serious pathology of arteries includes aneurysms and atherosclerosis. Rupture of aneurysm and complete occlusion of a major artery are very sinister as it results in fatal haemorrhage and infarction respectively. Aneurysms usually involve the aorta and the intracerebral arteries while occlusion usually involves the peripheral and coronary arteries. If diagnosed before complication occurs, a vascular bypass is the procedure of choice this may be by endoscopic placement of stents or open surgery. In open surgical operation a reversed segment of superficial vein is used. The long or great saphenous vein is the commonest source of auto graft. The vein starts from the dorsal venous arch located on the dorsum of the foot and courses upwardly anterior to the medial malleolus, passes behind the knee and terminates by emptying into the femoral vein just below the inguinal ligament after piercing the cribriform fascia which is a thickening of the deep fascia of the thigh. The length and location of the great saphenous vein makes it ideal as a source of harvesting graft in vascular surgeries.

2. ARTERIAL PULSE AND BLOOD PRESSURE MEASUREMENT

As part of clinical evaluation and or monitoring of patients, the arterial pulse can be measured at:

- a) Dorsalis pedis artery located subcutaneously on the proximal portion of the dorsal surface of the foot precisely in front of the ankle joint between the tendons of extensor hallucis longus and extensor digitorum longus.
- b) Brachial artery as it lies medial to the bicep tendon and deep to the bicipital aponeurosis in the anterior elbow. This is the commonest site of blood pressure measurement.

- c) The radial artery is palpable at the distal end of the anterior forearm hence it is suitable for pulse measurement.

3. PERIPHERAL NERVE BLOCK

A nerve plexus is a network formation in which fewer numbers of spinal nerves through a process of combination and division ultimately give rise to larger number of specific somatic nerves. Examples include the brachial plexus in the axilla, lumbar plexus and the sacral plexus.

i) Brachial Plexus Block

This is a form of regional anaesthesia in which a local anaesthetic drug is injected into the axillary sheath in order to block the nerves that arise from the cords of the brachial plexus. Thus enabling surgical procedures such as reduction of elbow and wrist joints dislocations; internal fixation of humeral, ulnar and radial fractures. This form of anaesthesia obviates the hazards of general anaesthesia.

ii) Distal Blocks

The spinal cord extends from the base of the skull to the lower border of first lumbar (L1) vertebra or upper border of L2. The tapered end of the spinal cord known as conus medullaris may be higher (T12) or lower (L3). However, in young children, it extends downwards to the upper border of L3 vertebra.

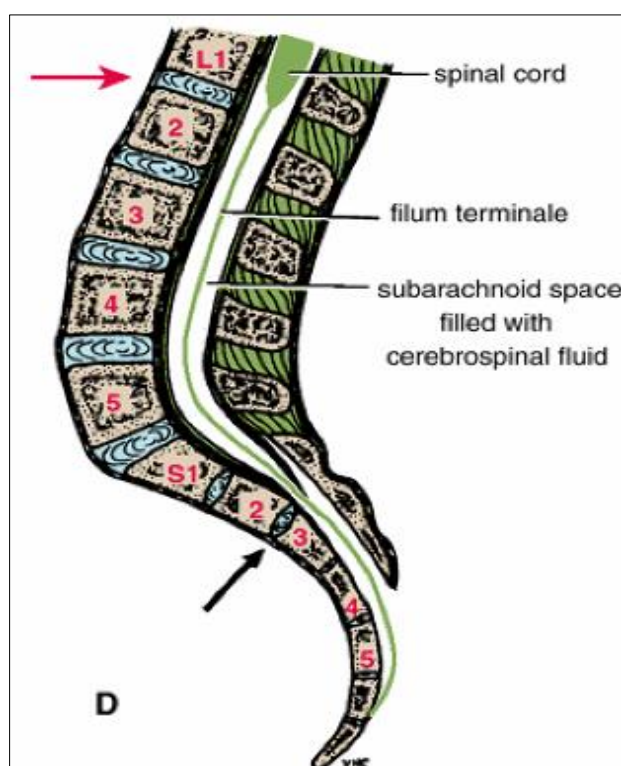


Fig. 2: Distal aspect of the vertebral canal showing the termination of the spinal cord. Courtesy of Moore & Agur© [17]

Thus, the spinal cord occupies two thirds of the vertebral column. The spinal cord has two enlargements-cervical and lumbosacral this gives rise to the brachial plexus and lumbosacral trunk respectively. Loose spinal nerves that arise from the lumbosacral trunk and those from the conus medullaris lying within the lumbar cistern of cerebrospinal fluid are collectively known as cauda equine.

The *filum terminale* arises from the tip of the conus medullaris. It anchors the inferior end of the spinal cord and the spinal meninges to the coccyx (Fig 2).

iv). Lumbar Spinal Puncture

This is a diagnostic bedside procedure for obtaining cerebrospinal fluid (CSF). With the patient lying on the side and the back fully flexed, a needle is inserted into the subarachnoid space usually at any level from 3rd lumbar to the 5th lumbar vertebra as this obviates the probability of injury to the spinal cord (Fig 3).

v). Epidural Block

This is injection of an anaesthetic agent into the extradural (epidural) space. Patient positioning is as described for lumbar puncture. The injected agent temporary paralysis only the spinal nerve roots of the cauda equina after they exit from the dural sac . Anaesthesia is limited to the segment of the body distal to the block (Fig 3).

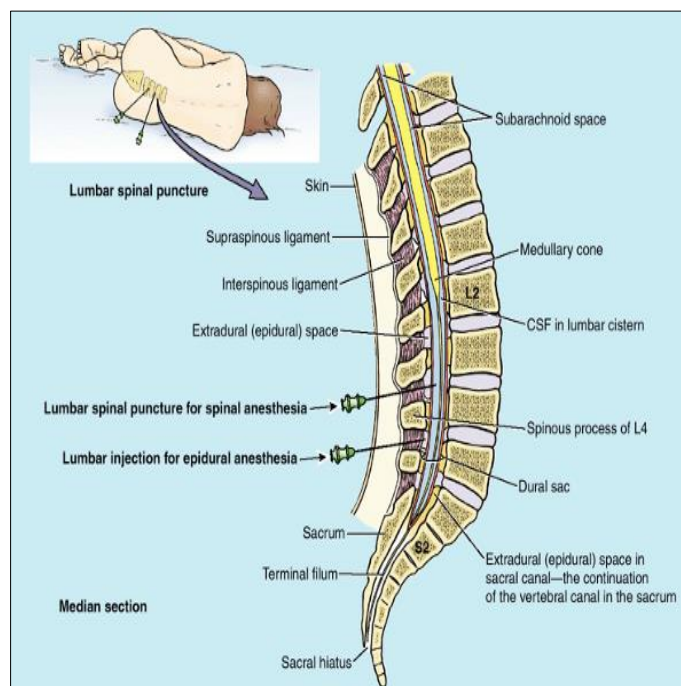


Fig. 3: Illustrations of Lumbar spinal puncture and Epidural Block. Courtesy of Moore & Agur© [17]

vi).Caudal Block

This is effected by injecting anaesthetic agent through the one of the openings (hiatus) of the sacrum into the extradural space in the sacral canal. The agent spreads superiorly and acts on the spinal nerves (caudal analgesia). The distance the agent ascends (and hence the number of nerves affected) depends on the amount injected and on the position assumed by the patient (Fig 4)

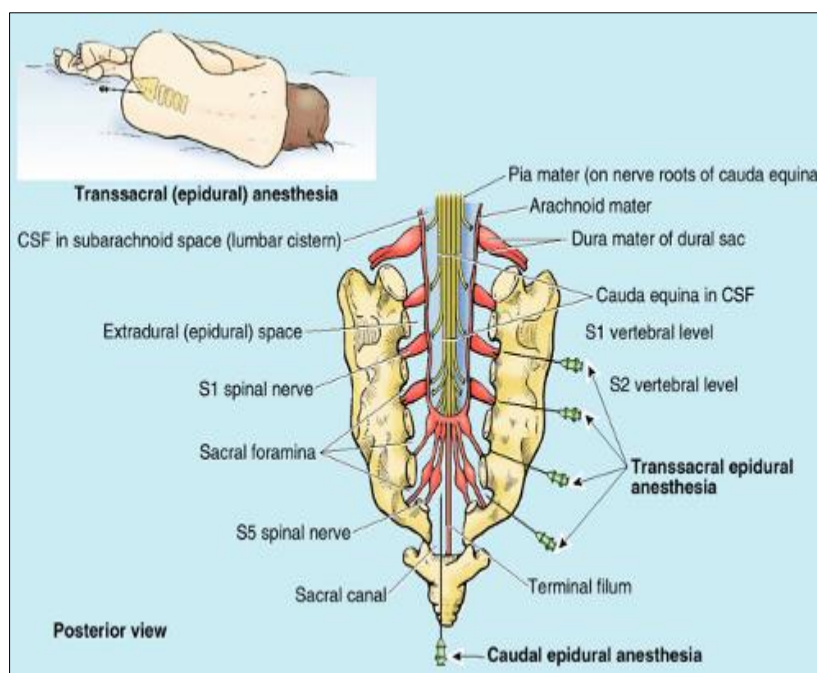


Fig. 4: Illustration for Caudal Block. Courtesy of Moore & Agur© [17]

4. EVALUATION OF LEVEL OF SPINAL CORD LESION

The spinal cord may be compressed by metastatic deposits, primary bone tumours, tuberculosis of the spine and multiple myeloma. Spine injuries be they blunt or penetrating account for a large number of significant limb paralysis. Diagnostic modalities for neurological deficits of spinal cord lesions include plain X-ray of the spine, CT myelography and MRI myelography. Irrespective of the accuracy, sensitivity and specificity of the imaging modality and the image so produced; the exact localisation of the level of blockage or post-traumatic transection of the spinal cord will be determined at neurological examination of the patient. This is where knowledge of the patterns of dermatomes becomes very relevant. By way of definition, a dermatome is the area of the skin that is supplied by a single spinal nerve. Although, a considerable emphasis is laid on the cutaneous (sensory) innervation of the body. Due to the overlapping of the sensory nerves in terms of jurisdictions and also for the fact that one spinal nerve contributes to the formation of several definitive sensory nerve; dermatomal patterns are much more helpful and of relevance in clinical practice (Figures 5-7).

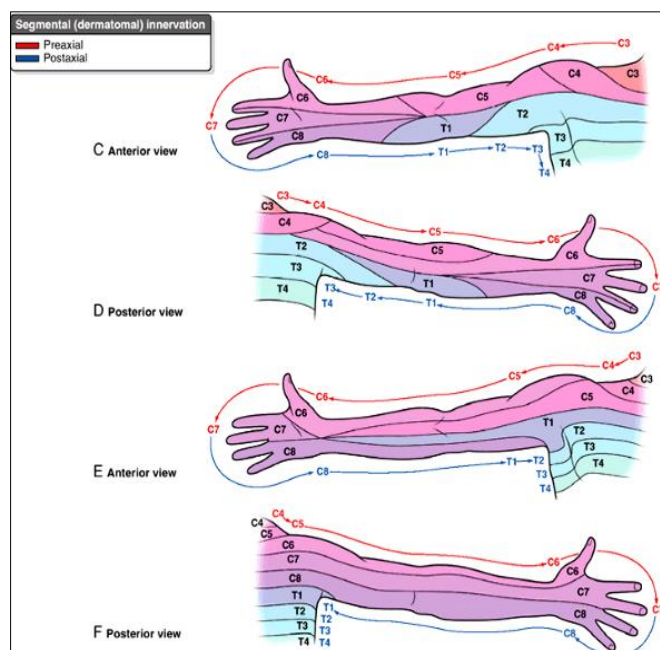


Fig. 5: Dermatome Patterns of the Upper Limb. Courtesy of Moore & Agur© [17]

Key: C6 nerve supplies the thumb and lateral forearm. C7 nerve supplies the middle and ring fingers (or middle three fingers) and the middle of the posterior surface of the limb. C8 nerve supplies the little finger, the medial side of the hand, and the forearm (i.e., the inferior aspect of the abducted limb). T1 nerve supplies the middle of the forearm to the axilla. T2 nerve supplies a small part of the arm and the skin of the axilla.

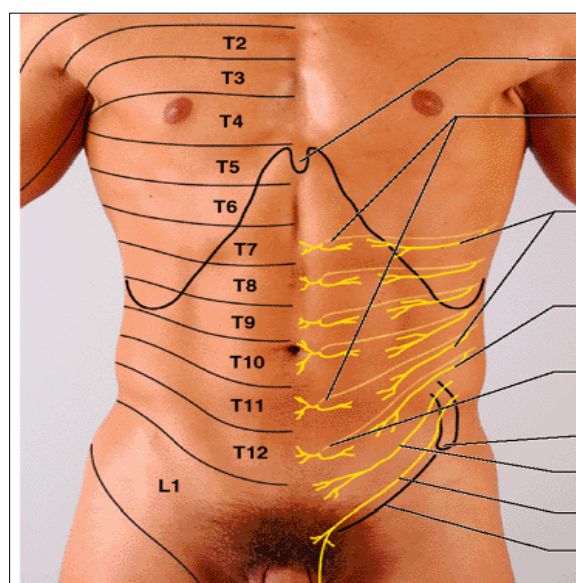


Fig 6: Dermatomal pattern of the trunk Legend: T4 nerve- Nipple, T10 nerve-Umbilicus, T12 nerve Supra pubic and L1 nerve- Groin & Pubis. Courtesy- Moore and Dally © [18]

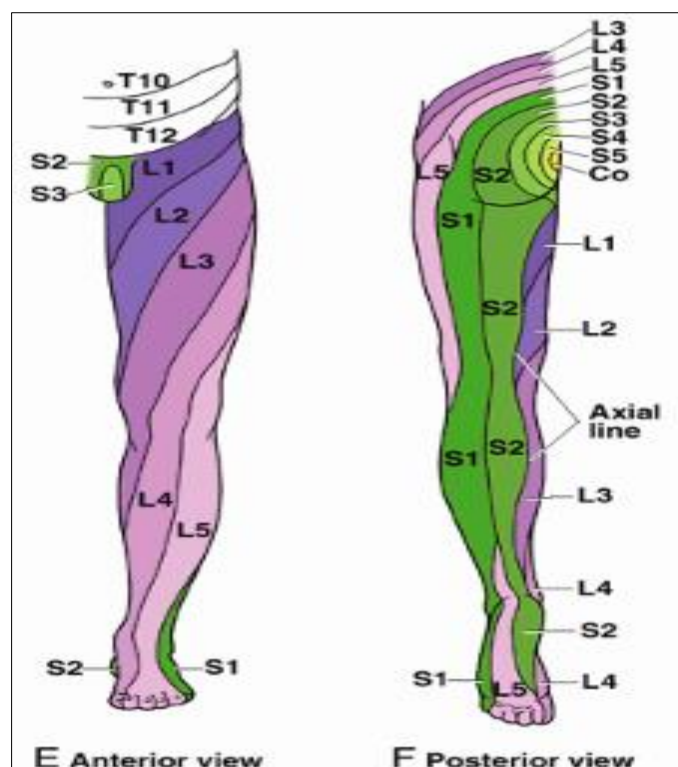


Fig. 7: Dermatome pattern of the lower limb. Courtesy of Moore & Agur© [17]

Legend:- Dermatomes L1 to L5 extend as a series of bands from the posterior midline of the trunk into the limbs, passing laterally and inferiorly around the limb to its anterior and medial aspects, reflecting the medial rotation that occurs developmentally. Dermatomes S1 and S2 pass inferiorly down the posterior aspect of the limb, separating near the ankle to pass to the lateral and medial margins of the foot.

6. SURGICAL INCISIONS

In order to gain access into the body cavities, incisions have to be made on the skin. Placement of surgical incisions is premised on the location of the structure(s)/organ(s). The incision must afford ease of manoeuvring and mobilisation of structures and organs in order to prevent inadvertent (iatrogenic) injuries. Few of such incisions that take advantage of morphology of the anterolateral abdominal wall are subsequently discussed.

The anterolateral abdominal wall is multilayered consisting of subcutaneous fat and fascia, muscles and aponeuroses and peritoneum. However, not all the layers are present in the entire area of the anterolateral abdominal wall. This knowledge is taken advantage off in the placement of the following incisions:-

- i. **Midline Incision-** this passes just through the fascia (linea alba) and peritoneum thus granting a quick access into the abdominal cavity with minimal bleeding. It is suitable for surgical procedures on the liver, biliary tree, pancreas, spleen, stomach, gall bladder, small bowel, colon, kidneys, ureters, urinary bladder, ovaries & uterus.
- ii. **Paramedian Incision-** this is made at the lateral and parallel to the midline passing through the anterior rectus sheath. In succession, it passes through the posterior rectus sheath, fat layers and peritoneum. It can either be on the right side or left side. Right paramedian incision offers easy access to the appendix (ruptured), caecum, right colon, right ovary, right kidney, right lobe of the liver and gall bladder. While left paramedian incision is appropriate for surgical procedures on the left ovary, left (descending) colon, left kidney, spleen and transverse colon.
- iii. **Subcostal Incision-** this is placed vertically along the lower costal margin. It is suitable for procedures on the liver, enlarged spleen and gall bladder.
- iv. **Suprapubic (Pfannenstiel) Incision.** This is a transverse incision placed just above the symphysis pubis. It is the choice for surgical procedures on the uterus, prostate gland and the urinary bladder.
- v. **Lanz Incision-** this is a transverse incision in the right iliac fossa medial to the anterior superior iliac spine of the pelvic bone. It entails the splitting of the external oblique muscle, fascia, fat layers and peritoneum thus making the caecum & appendix visible and subsequent externalization easy. Lanz incision is mostly used for appendectomy [Figs 8 & 9].

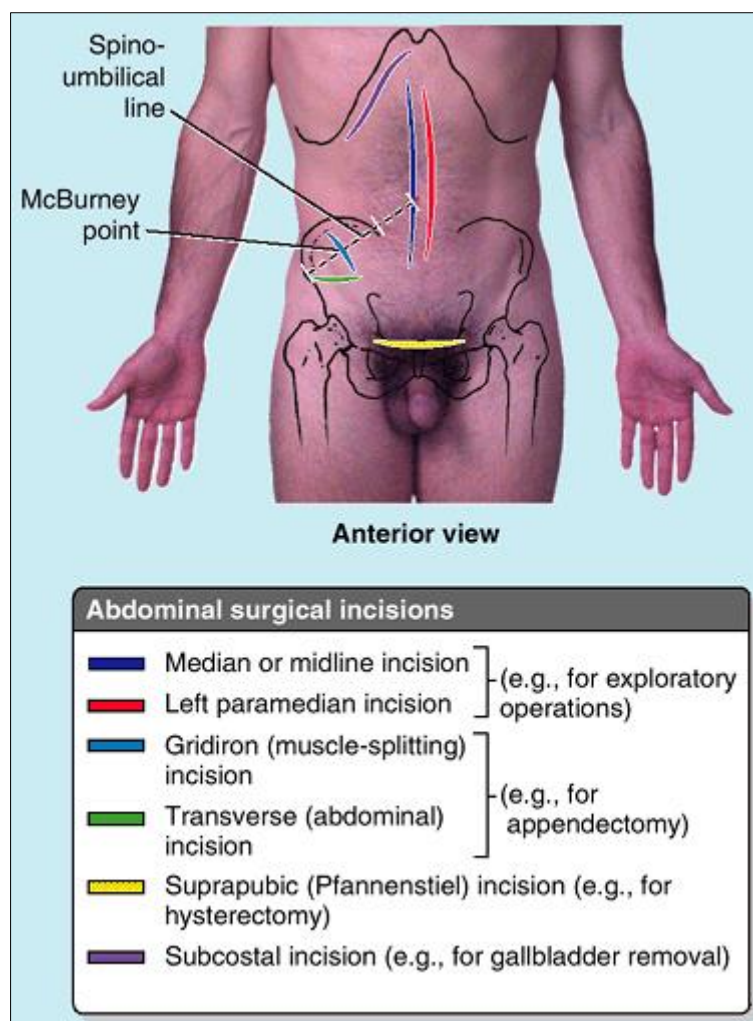


Fig. 8: Surgical incisions on the anterior abdominal wall. *Courtesy of Moore & Agur© [17]*

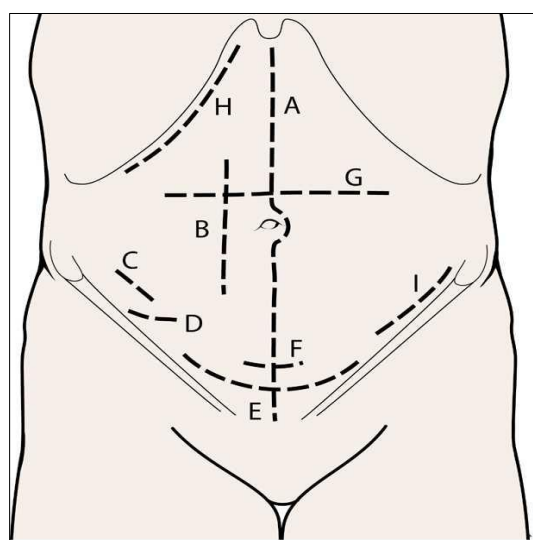


Fig. 9: Illustrations of common abdominal surgical incisions

A = midline; B = paramedian; C = gridiron; D = Lanz; E = Pfannenstiel; F = suprapubic; G = transverse upper abdominal; H = subcostal 'Kocher'; I = oblique iliac muscle-cutting. ©Farquharson *et al.*, [19].

7. The Stomach

This is an intraperitoneal viscus occupying the epigastrium subserving temporary storage for ingested materials and also has specialised cells that secrete an acidic juice. The secretion of the gastric cells and production of hydrochloric

acid are neurally (vagus nerve) and hormonally mediated. The acid secreting cells and gastrin are largely located in the pyloric portion of the stomach. The posterior vagus nerve supplies the pyloric antrum with nerve fibres that are distributed in a manner similar to the foot of a crow (Fig 10). Surgical sectioning of the vagus nerve known as vagotomy is the procedure for reduction of acid and gastrin secretion. When the vagus nerve is sectioned proximal to the hepatic branches, it is known as *truncal vagotomy*. Sectioning of the gastric branches alone is referred to as *selective vagotomy*. While division of only the branches to the antrum is called *highly selective vagotomy*. The first two types compromise gastric emptying hence the need for an ancillary drainage procedure. Whereas, highly selective vagotomy obviates the need for a drainage procured as the integrity of the pyloric sphincter is preserved.

The aetiopathogenesis of chronic peptic ulcer disease has been clearly understood to involve mucosal infestation by the bacteria known as *Helicobacter pylori* and hyperacidity (Fig 11). The secretion of acid by the parietal cells involves active pumping (H^+/K^+ -ATPase) of hydrogen ion and coupling it with chloride ion. This knowledge has been taken advantage off by developing a class of drugs known as proton pump inhibitors. These drugs bind in an irreversible manner to the acid secreting cells of the gastric mucosal there by inhibiting acid secretion. Such drugs include omeprazole, esomeprazole, lansoprazole, pantoprazole, rabeprazole and dexlansoprazole.

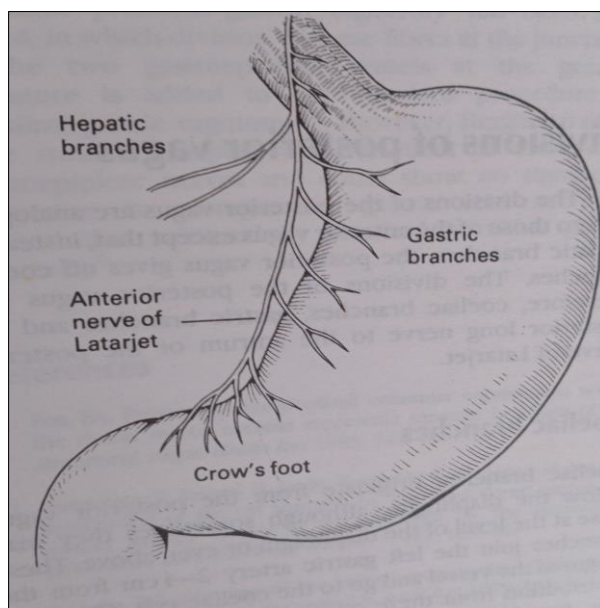


Fig. 10: Stomach, showing distribution of the Vagus nerve. Courtesy- Carter *et al.*, [20].

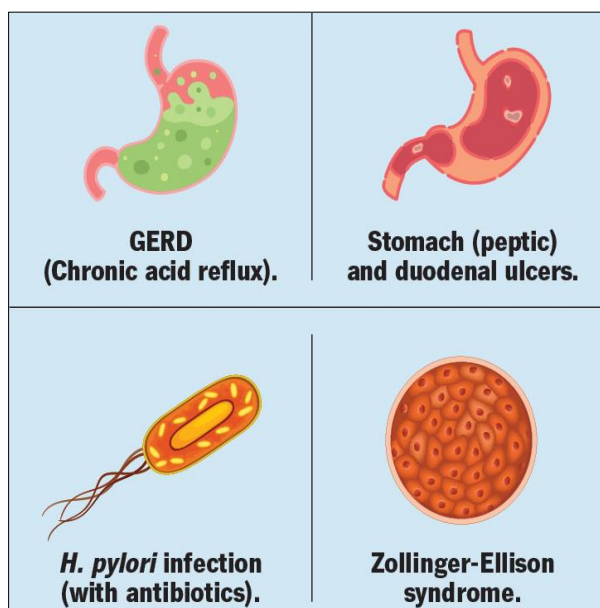


Fig. 11: Peptic acid lesions. Courtesy- Cleveland Clinic [21]

8. The Spleen

The spleen is the largest lymphoid organ involved in the production of lymphocytes, phagocytosis of antigens and destruction of effete red blood cells. It is located in the left hypochondrium lateral to the left 9th to 11th ribs. It is this relationship that makes the spleen the most susceptible internal organ prone to rupture following blunt injury to the abdomen particularly the left lateral side. At the hilum of the spleen, the splenic artery divides into about five non-communicating branches that supply different portions of the spleen thus dividing it into vascular segments. Following posttraumatic rupture or symptomatic enlargement, the spleen is surgically removed through a procedure known as splenectomy. In Caucasians, this procedure may be complicated by severe sepsis known as *Overwhelming post splenectomy septicaemia* (OPSS). This is usually life threatening and requires aggressive management.

From my experience as a General Surgeon and having performed quite a reasonable number of splenectomies in Nigerians (Negroid); the patients usually developed mild febrile illness at about five to seven days post surgery and management is usually symptomatic and no case of OPSS was ever recorded.

Among the Caucasians, in order to reduce the occurrence of OPSS, and in patients with mild to moderate splenic rupture; splenic conserving procedure through endoscopic embolization of the ruptured segment(s) is considered as a safer procedure to splenectomy. This interventional radiological procedure is premised on the anatomy of the arterial supply of the spleen.

9. The Liver

The liver is the largest glandular organ occupying the upper abdomen spanning from the right hypochondriac region through the epigastrium to the left hypochondrium. Anatomically, it is divided into two unequal lobes with the right being about thrice the size of the left. This lobulation does not have any bearing with functionality. The pattern of divisions of the portal vein, right & left hepatic arteries and the right & left hepatic ducts divide the liver into two equal functional lobes and eight segments with each functional lobe having four segments [figs 12 & 13]. Each of these segments have independent and non-communicating portal vein, hepatic artery and hepatic duct.

The liver is the largest site for metastatic deposits from other organs and structures of the body. Other liver pathologies include primary tumours (benign and malignant), abscess and cystic lesions. Knowledge of functional lobulation and segmentations serve as the basis for partial resection of the liver.

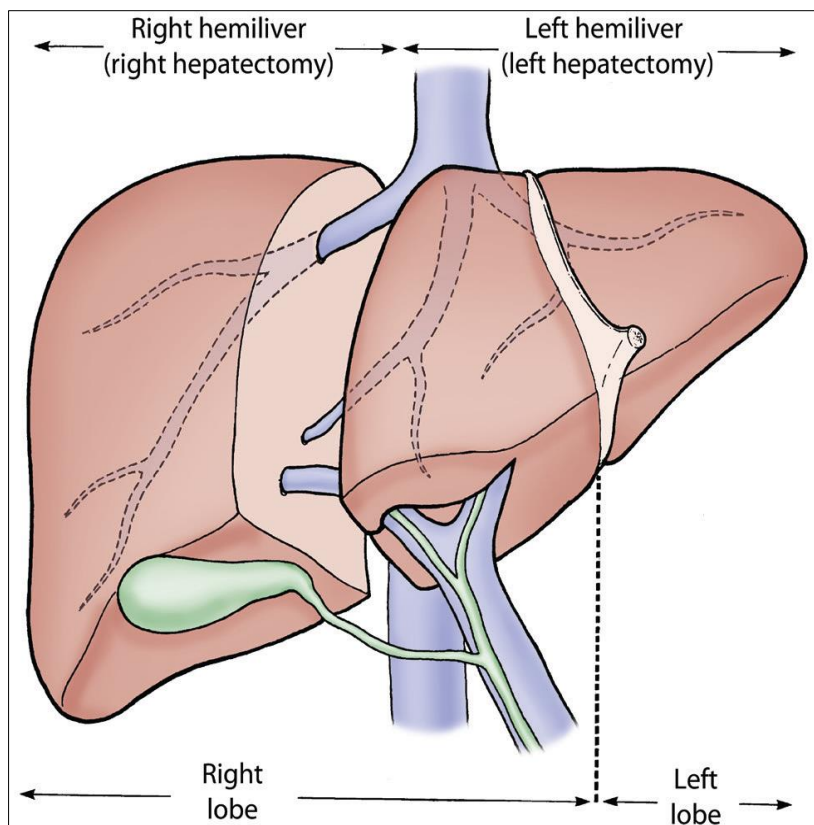


Fig. 12: Functional Lobulation of the Liver. Courtesy: Farquharson [19].

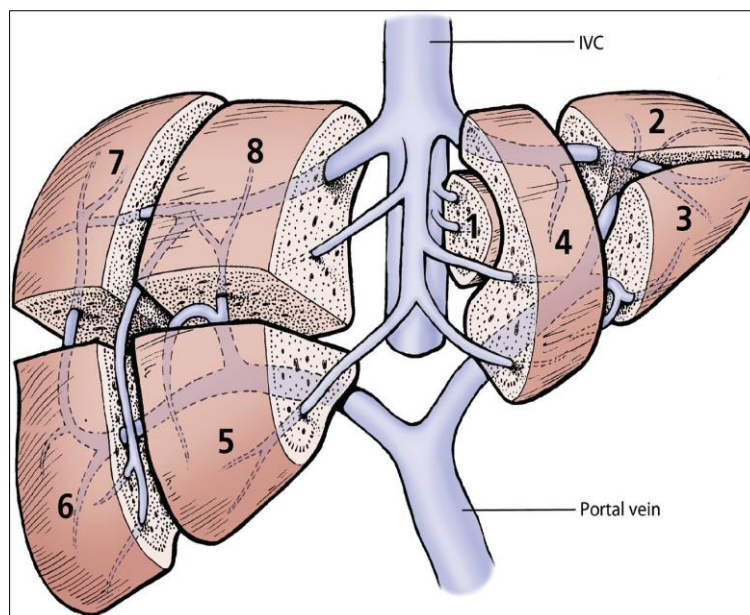


Fig. 13: Division of the Liver into the eight functional segments. Courtesy: Farquharson [19]

10. The Kidney

The kidneys are paired retroperitoneal organs with each located in the lumbar region of the abdominal cavity usually extending vertically from the T12 to L3 vertebral levels. Its medial border is characterised by an indentation known as the hilum. At the hilum, the renal artery divides into two main branches- anterior and posterior. The former gives off four segmental branches and the latter continues as the posterior segmental artery (fig 14). Each of these segmental arteries is an end artery supplying a defined segment of the kidney. Although, in majority of people, there are two kidneys, however in exceptional cases, only one kidney is present [14]. Also, both may not be at optimal functional level. In as much as only one functional kidney is needed for the sustenance of the homeostasis status of the body, the suboptimal functional level of the other kidney will not be obvious. Here lies a major dilemma when a patient has to undergo complete removal of a kidney (nephrectomy). Indications for unilateral nephrectomy include post traumatic rupture of the kidney (Fig 15), renal parenchymal abscess, renal tuberculosis, cystic disease of the kidney, nephroma and renal cancer. In some of these cases, the lesions are well localised and also the rupture is confined to a portion of the kidney. Under these circumstances, consideration of partial nephrectomy becomes a reasonable option. The division of the kidney into five vascular segment is the underlying principle for partial nephrectomy. Operational procedures by which partial nephrectomy is carried out include i) arterial embolization by interventional radiology, ii) laparoscopy and iii) open laparotomy.

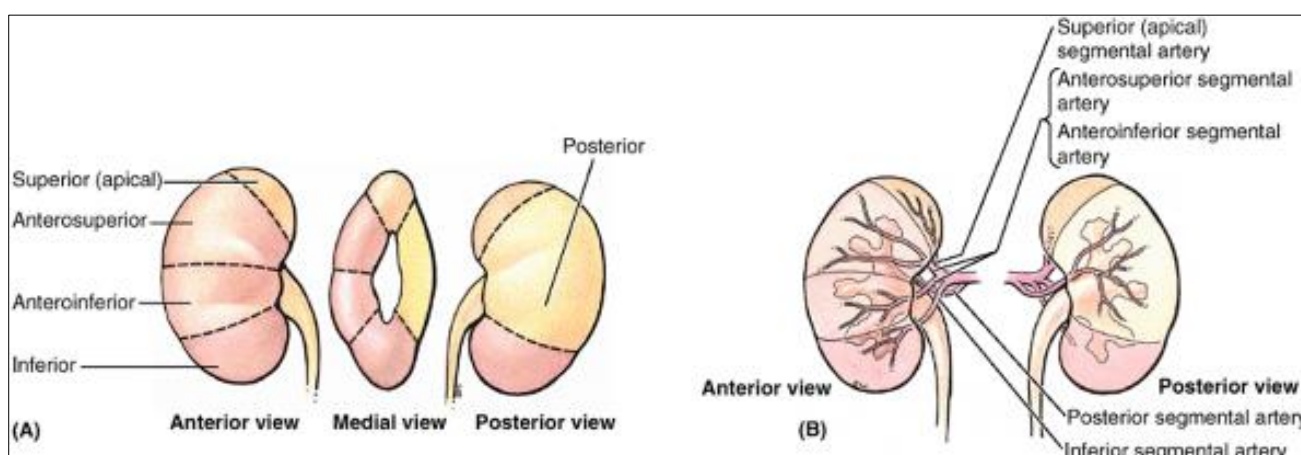


Fig 14: Segmental branching of the Renal Artery and Renal segments. Courtesy of Moore & Agur [17]

A. According to its arterial supply, the kidney has five segments: superior (apical), anterosuperior, anteroinferior, inferior, and posterior. **B.** Only the superior and inferior arteries supply the whole thickness of the kidney. The posterior artery crosses superior to the renal pelvis to reach its segment. **C.** Typically, the renal artery divides into five branches, each supplying a segment of the kidney, as seen in this renal arteriogram. Although the veins of the kidney anastomose freely, segmental arteries are end arteries.

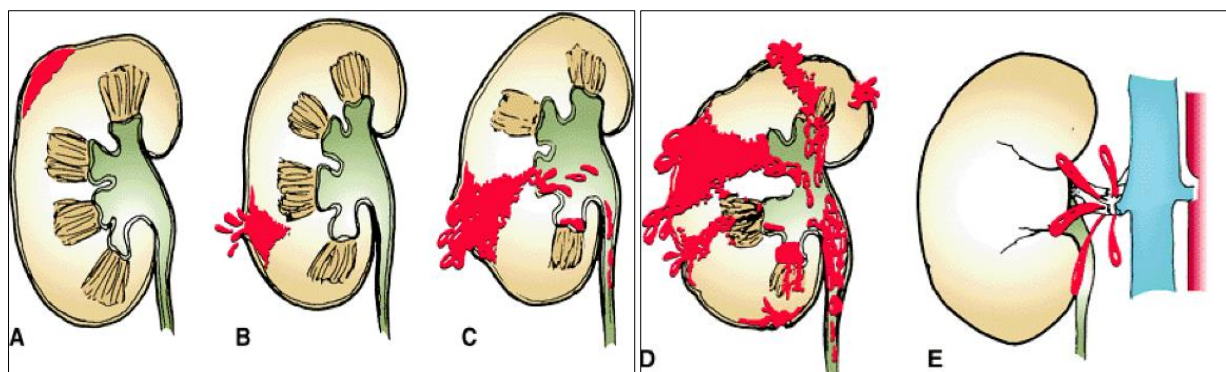


Fig. 15: Classes of Injuries to the kidney. Courtesy Snell [16]

- A. Contusion**, with subcapsular haemorrhage. **B. Cortical laceration**, with extension bleeding into the perirenal fat. **C. Corticomedullary laceration**. There is bleeding into the calyces and hence the urine becomes bloody. Both urine and blood may extravasate into the perirenal and pararenal fat and into the peritoneal cavity. **D. Shattered kidney** with extensive haemorrhage and extravasation of blood and urine into the fat layers. Blood also enters the calyces and appears in the urine. **E. Avulsion Injury**. There is shearing off of the renal pedicle involving the renal vessels and possibly the renal pelvis.

11. The Pleural Cavities

The pleural cavities are two separate spaces within the thorax that house the two lungs. The pleura is a continuous double-layered serous membrane that adherently invests each of the two lungs and lines the internal surface of the thoracic cavity. The portion that invests the lungs is referred to as the *visceral pleura* while the portion lining the thoracic cavity is known as the *parietal pleura* (Fig16). A small quantity of serous fluid is usually secreted into the space between the two layers and this serves as lubricant thus easing movements of the lungs during the phases of respiration. Under abnormal conditions, symptomatic accumulation of substances may occur within the pleural space. Accumulation of air is referred to *pneumothorax*, that of fluid as *pleural effusion*, that of blood as *haemothorax* while that of pus is call *empyema*. Due to accompanying respiratory distress, these collections within the pleural must be evacuated. Evacuation is by a surgical procedure known as *Closed thoracostomy tube drainage* (CTTD). This procedure entails making an opening into the pleural space by deepening the skin incision through the intercostal muscles down to the parietal pleura. The tube is subsequently placed and secured to the skin for continuous drainage of the effluent (Fig 18). The internal surface of a rib has a groove on its inferior aspect. In this groove lies the intercostal vein, artery and vein. Thus, the skin incision has to be close to the superior edge of the rib in the intercostal space of choice. This is to avoid injury to the neurovascular bundle (Fig 17).

12. The Urinary Bladder

The urinary bladder is a highly distensible hollow sub-peritoneal pelvic viscus that serves as a receptacle for urine pending when the urge to micturate is in concordance with the timing. In males, the prostate gland lies inferior to the neck of the bladder. On the superior surface of the bladder, lies loosely a fold of peritoneum (Fig 18). The looseness of the peritoneum affords the unhindered upwards rise of the bladder as it becomes distended with urine thus making it to become accessible per abdomen (Fig 19).

As a male advances in age, the probability of the prostate gland enlarging in size rises steadily and thus obstructing outflow of urine. The most frequent sequela of bladder outlet obstruction is acute urinary retention i.e. Sudden onset of inability to pass urine. This is a medical emergency and is usually remedied by a procedure known as *supra pubic cystostomy*. This procedure entails placement of urinary catheter through a hole made into the bladder. The skin incision is made transversely just beneath the umbilicus and it is deepened down to the bladder wall and it does not pierce the peritoneum (Fig 20). The inserted urinary catheter is anchored to the skin for continuous drainage pending the definitive surgical operation.

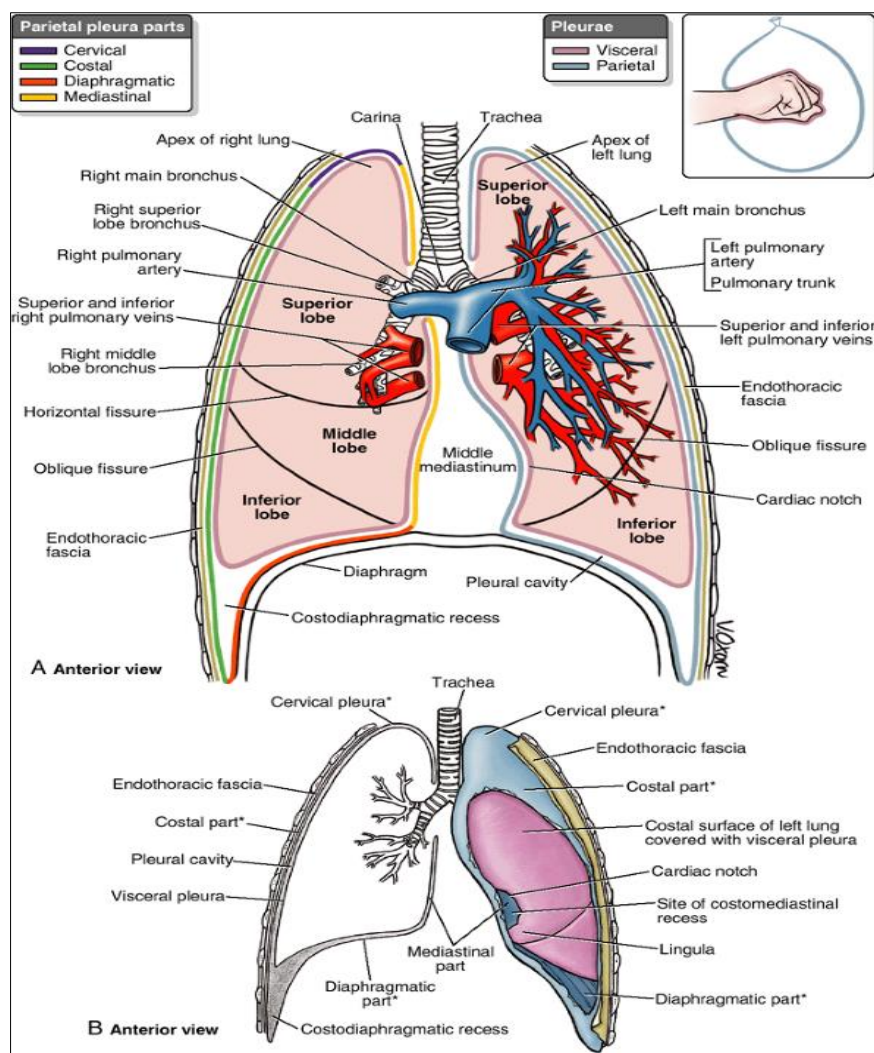


Fig. 16: The Thoracic cavity showing the lungs and the pleurae

A. The lungs and pleural cavity are shown. Inset: A fist invaginating an underinflated balloon demonstrates the relationship of the lung (represented by fist) to the walls of the pleural sac (parietal and visceral layers of pleura). The cavity of the pleural sac (pleural cavity) is comparable to the cavity of the balloon.

B. The parts of the parietal pleura and recesses of the pleural cavities are shown. *Parts of parietal pleura. *Courtesy; Moore and Agur [17].*

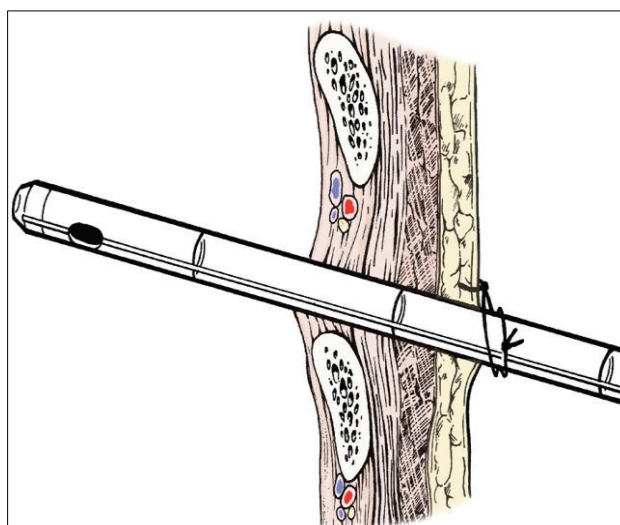


Fig. 17: Chest wall incision placement. Note that the incision is just above the Upper border of the lower rib. [19]

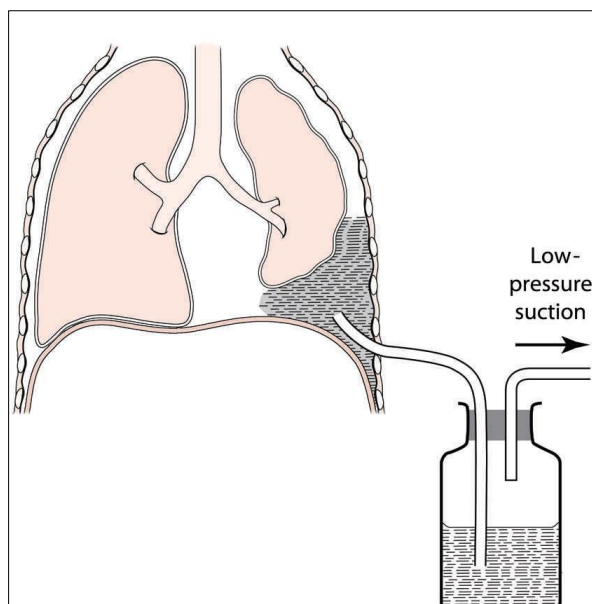


Fig. 18: CTTD with under water seal Courtesy; Farquharson *et al.*, [19].

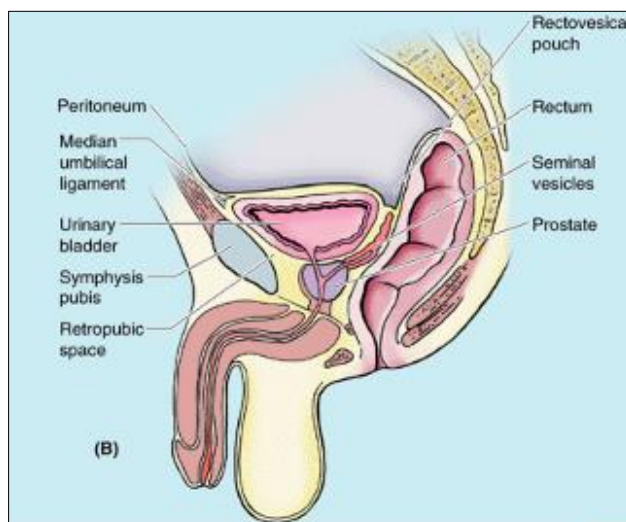


Fig. 19: Sagittal section of the Male Pelvis showing the Urinary bladder. Note its relationship superiorly the peritoneum. Courtesy: Moore & Dalley [18]

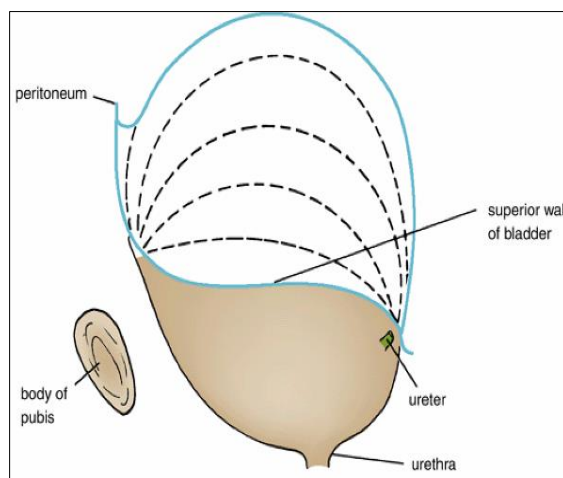


Fig 20: Progressive upward displacement of the peritoneum as the bladder becomes distended due to increasing urine inflow and reduced outflow. Courtesy: Snell [16]

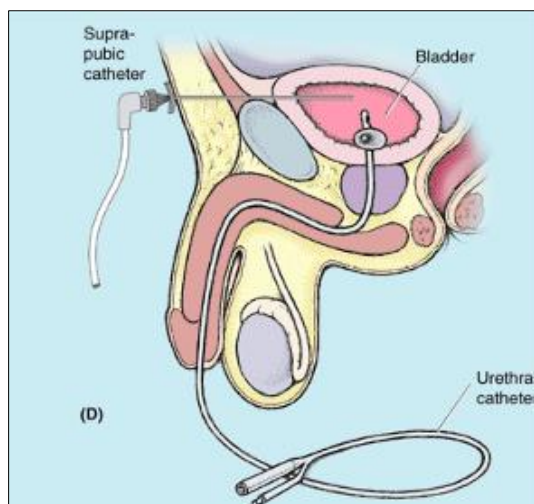


Fig. 20: Supra pubic cystostomy. Note that that does not pass through the peritoneum. Courtesy: Moore & Dalley [18]

13. The Prostate Gland

The prostate is an accessory male reproductive organ that encircles the proximal segment of the urethra and lies inferior to the bladder neck but anterior to the rectum. In adults, its enlargement is a significant cause of morbidity and mortality. The enlargement may be benign or malignant, clinical evaluation may help to differentiate between the two pathologic entities. However, the most objective and reproducible evidence of whether it is benign or malignant is the histology of a sample specimen of the organ. Due to the proximity of the prostate to the rectum; an assessment of the size and the consistency of the gland is made by performing digital rectal examination. When this examination is to be performed, the patient is positioned close to the edge of the examination couch and lying in the lateral position with lower leg in full extension and the upper leg flexed. The Doctor wears a disposable glove and a small quantity of non-irritant gel is applied to the gloved middle finger. With the Doctor standing by the side of the couch, the thumb and the index finger of the other hand are used to part the anal verge (anus). The patient is instructed to bear down and the lubricated middle finger of the examining hand is very gently inserted into the anal canal and is advanced into the rectum. A complete circular motion is performed noting the size and consistency of the prostate. What has just been described is called *digital rectal examination* (DRE) (Fig 21). A sample specimen of the prostate gland is obtained either by trucut biopsy or fine needle aspiration biopsy via DRE (Fig 22).

According to World Cancer Research Fund, prostate cancer is the 4th commonest cancer world-wide and the 2nd most common cancer in men [15]. In 2022, the total number of new prostate cancer case world-wide was 1,467,854 and about 40% of these new cases were from United States of America, China, Japan and Brazil [15]. Globally in 2022, the total number of prostate cancer deaths was 397,430. The top three mortalities were from China, United States of America and Brazil. Nigeria recorded 11,443 prostate cancer deaths in 2022 [15]. This summary statement regarding prostate cancer burden buttresses the crucial role of digital rectal examination as part of clinical evaluation of adult males [21].

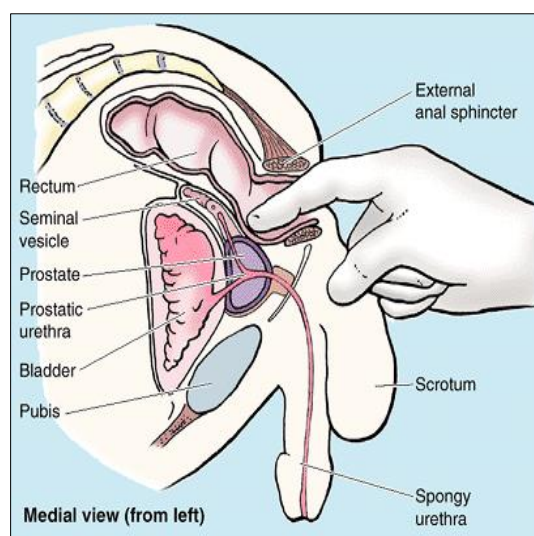


Fig. 21: Prostate gland examination via digital rectal Examination. Courtesy: Moore & Dalley [18]

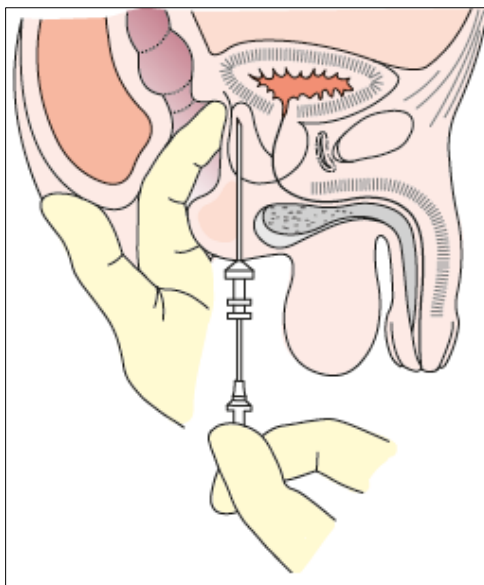


Fig. 22: Prostate biopsy using TruCut biopsy needle. Courtesy: Williams et al., [22]

14. Cavernous Sinus Thrombosis

The cavernous sinus is one of the endothelium-lined spaces between the periosteal and meningeal layers of the dura mater. It is located on either side of the sella turcica. This is the central part of the sphenoid bone (one of the bones of the base of the skull). The cavernous sinus contains some structures which include the internal carotid artery, oculomotor nerve, trochlear nerve and ophthalmic division of the trigeminal nerve. The two cavernous sinuses are interconnected by the intercavernous sinus (Fig 23). The cavernous sinus (CS) communicates directly with the facial vein and indirectly with the superior and inferior ophthalmic veins; the pterygoid venous plexus, basilar plexus and ultimately with the internal vertebral(epidural) venous plexus (Fig 24). The facial vein drains a considerable area of the face. It receives tributaries from other veins before emptying into the internal jugular vein. The facial vein has no valves thus it is a potential route of spread of infection from the “danger zone” of the face (Fig 25) to the cavernous sinuses leading to *cavernous sinus thrombophlebitis*. This is a serious pathology as it can lead to intracranial abscess and ophthalmoplegia (weak eye movements). Thus, it becomes very instructive and pertinent that under no circumstance must a suppurative lesion such as pimples, boil (furuncle) and carbuncle in the danger zone of the face be pressed or squeezed as this will lead to bacterial dissemination to the cavernous sinuses. The danger zone of the face is described as the triangular area from the upper lip to the nasion (nasal bridge) (Fig 25).

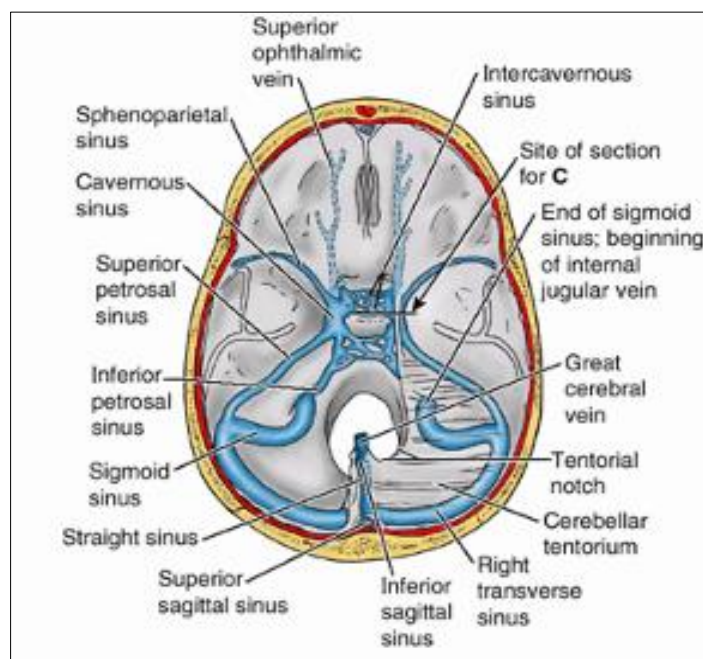


Fig. 23: Dura venous sinuses. Note the cavernous and the intercavernous sinuses. Courtesy: Moore & Dalley [18].

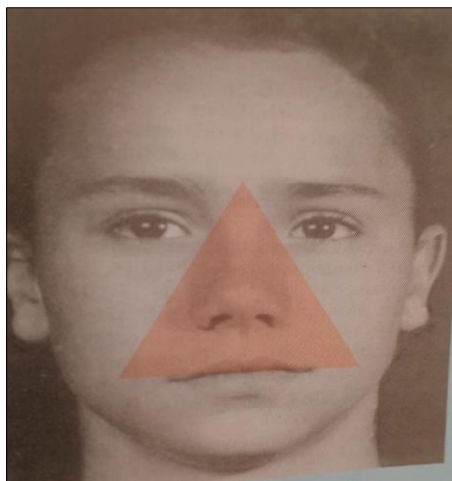


Fig. 25: Danger zone of the face. Courtesy: Moore & Dalley [18]

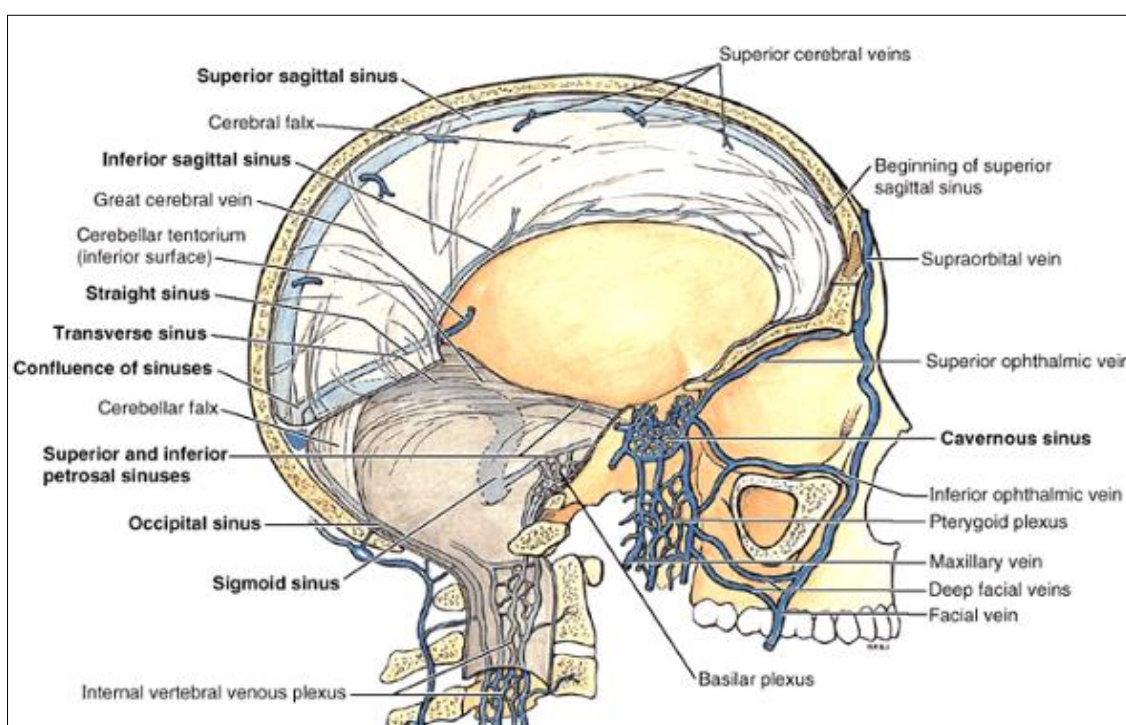


Fig. 24: Dura venous sinuses and their communications. Note those of the cavernous sinuses. Courtesy: Moore & Dalley [18].

CONCLUSION

This article is a compendium of experiences both as an Anatomist and a Clinician- General Surgeon spanning over three and a half decades. The basic aspects of medicine are taught and learnt at the commencement of training while the clinical aspects are the latter and concluding segments. Familiarising the students with the clinical relevance of the basic science component of the medical curriculum as early as possible will stimulate their interest, increase their eagerness and curiosity as to the structures and workings of the human body. Also, it will arouse their curiosity as to the genetic and molecular bases of anomalies, malformations and diseases.

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