LIVER AND BILIARY TRACT

I. INTRODUCTION

The liver is the largest gland in the body. It constitutes a vital organ. The liver is interposed between the gastrointestinal tract and the systemic veins and has a heterocrine function. Thus, it is the first destination of absorbed nutrients and has a major role in the human metabolism.

The liver is the crossroads of the umbilical and systemic circulations in the foetus and of the portal and systemic circulations in the adult.

II. DESCRIPTIVE ANATOMY

A- LIVER

1. Situation

The liver is situated in the supracolic compartment of the abdominal cavity. It lies mainly in the right hypochondrial and epigastric regions and extends to the left hypochondrial region. Much of it is under cover of the lower ribs and diaphragm.

The liver occupies a limited triangular space between, on top, the diaphragm, to the right, the thoracic wall from the fourth intercostal space to the eleventh rib, to the left, the intersection of the mammillary line with the 5th intercostal space.

2. Dimensions

The liver is twenty-eight centimetres long, sixteen centimetres wide and eight centimetres thick. It weighs one thousand five hundred grams and receives a blood flow of one thousand five hundred millilitres per minute.

3. Shape

The liver is red-brown in colour, ovoid in shape with greater right end and lesser left end and has a firm consistency. Its three borders slightly distinguish its three surfaces. The inferior surface contains three H-shaped fissures. The liver contains three lobes.

The anterior border of the liver is sharp. It slopes up from right to left first along the right costal margin and then across the epigastrium. It is marked by two notches, respectively from right to left, made by the ligamentum teres and the fundus of the gall bladder. It separates the diaphragmatic and visceral surfaces of the liver forwards.

The papillary and caudate processes of the caudate lobe mark the inferior-posterior border of the liver and the superior-posterior border contains the reflection of the upper layer of the coronary ligament. The inferior-posterior border separates the diaphragmatic and visceral surfaces backwards when the superior-posterior border separates the posterior and superior parts of the diaphragmatic surfaces.

The diaphragmatic surface of the liver is convex and smooth and is almost totally covered with peritoneum.

Its anterior part is triangular and related to the diaphragm, lungs, pleura and ribs and costal cartilages 6-10 on the right and costal cartilages 6 and 7 on the left with a part behind the

infracostal angle covered by the anterior abdominal wall of the epigastrium; here, the falciform ligament is attached from near the centre down to the notch made by the ligamentum teres in the lower border.

The superior part lies against the diaphragm with above it the pericardium and heart centrally and the pleura and lung on each side, covered by the left triangular ligament to the left and the upper layer of coronary ligament to the right. The cardiac ventricles make a central impression on this surface.

The right part extends from the seventh rib to the eleventh and is related to the following logical sequence of structures; in its lower third to ribs and diaphragm; in its middle third to ribs, pleura and diaphragm; and in its upper third to ribs, pleura, lung and diaphragm. (Figure 1)

The posterior surface or the posterior part of the diaphragmatic surface is globally concave moulding the protrusion of the vertebral column and contains, from right to left, the bare area, a triangular area to the right of the vena cava as its base with sides formed by the upper and lower layers of the coronary ligament, a part of the right suprarenal impression, the groove for the inferior vena cava, the fissure for the ligamentum venosum continuous forwards with the ligamentum teres forming the left limb of the H and the vertical part of the L-shaped liver attachment of the lesser omentum bounding the caudate lobe and process enclosed in the upper recess of the lesser omentum between the left extension of the lower layer of the coronary ligament in front of the vena cava and the right leaf from the falciform ligament and the impressions for the oesophagus and upper part of the stomach as well as possibly the tuber omentale of the pancreas.

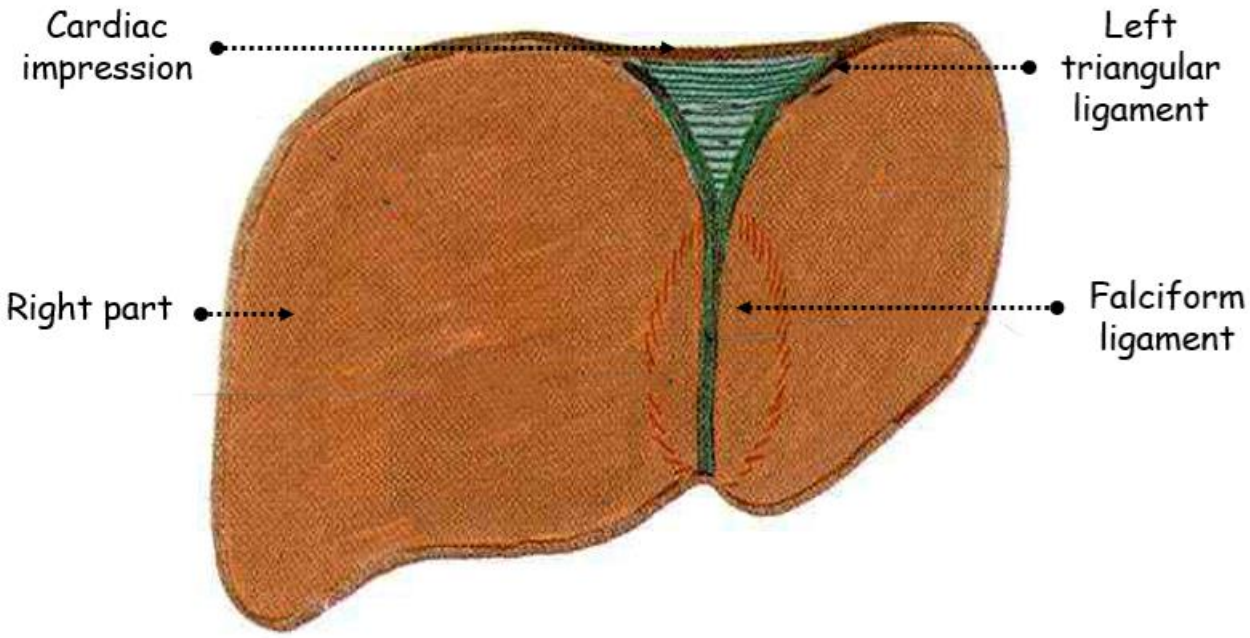

Figure 1: Superior-anterior view of the liver

The inferior surface is the visceral surface of the liver. It looks backwards, downwards and to the left and contains the porta hepatis. On its right side from the top to the bottom, are the impressions for parts of the right kidney and suprarenal gland, second part of the duodenum and right colic flexure. Forwards from the right to the left, are the gall bladder, the quadrate lobe, the fissure for the ligamentum teres and the rest of the gastric impression.

The fissure for the ligamentum venosum constitutes the left limb of the H, it is continuous forwards with the ligamentum teres and ends at the notch made by the ligamentum teres on the sharp anterior border of the liver. The ligamentum venosum is the remnant of ductus venosus. It separates the anatomical right and left lobes.

The impression for the gall bladder forwards and the groove for the inferior vena cava backwards constitute the right limb of the H. The impression for the gall bladder is a shallow fossa at the right end of porta hepatis. It contains the gall bladder with its neck on top and fundus at the bottom. The posterior groove for the vena cava is an important support of the inferior vena cava.

The porta hepatis is the hilum of the liver. It represents the cross-piece of the H and the horizontal part of the L-shaped liver attachment of the lesser omentum.

The porta hepatis is a transverse slit perforated by the right and left hepatic ducts, the right and left branches of the hepatic artery and the portal vein. These elements of the porta hepatis respect the vein-artery-duct order with the ducts in front. The cystic duct lies in loose contact with the right end of the porta. (Figure 2)

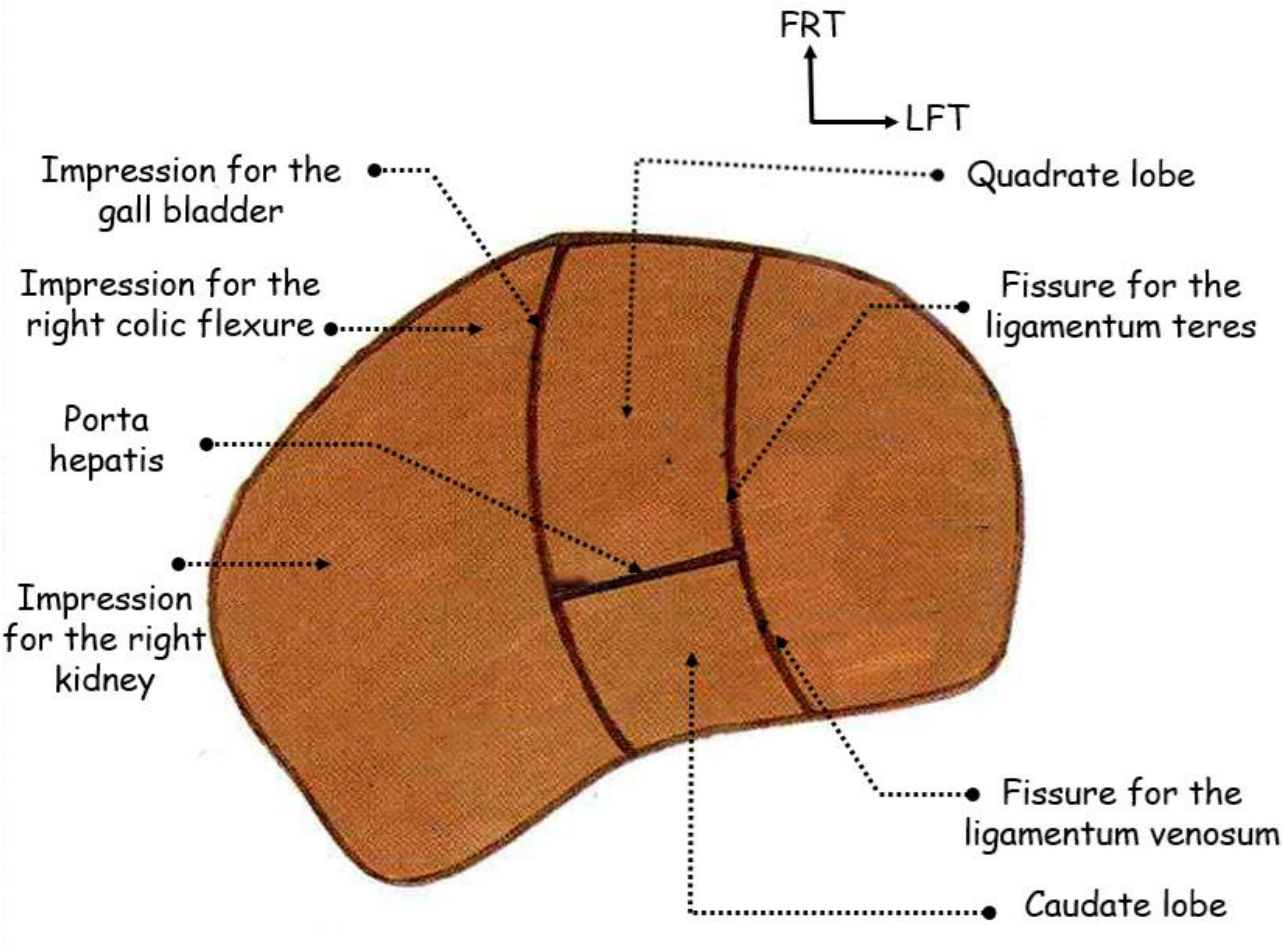

Figure 2: Inferior view of the liver

At the front and above, the falciform ligament divides the anatomical left and right lobes. The right lobe is the largest.

Its inferior surface contains impressions for right colic flexure, right kidney and second portion of duodenum.

The quadrate lobe lies between the gall bladder fossa and the fissure for the ligamentum teres in front of the porta hepatis and behind the anterior border. It covers the pyloric part of stomach,

first portion of duodenum and the prepancreatic part of the transverse colon.

The caudate lobe lies between the inferior vena cava and the fissure for the ligamentum venosum. It is connected to the right lobe to the right of the inferior vena cava by an isthmus of liver substance, the caudate process, as well as to the left lobe to the left of the fissure for the ligamentum venosum by an isthmus of liver substance, the papillary process. The caudate process is the roof of the epiploic foramen.

B- BILIARY TRACT

The biliary tract constitutes the excretory system of the liver that drains the bile secreted by the liver into the duodenum. It is made of a container, the gall bladder drained by the cystic duct, intrahepatic ducts, branches of the right and left hepatic ducts, and extrahepatic ducts, the right and left hepatic ducts, the common hepatic duct and the bile duct. The gall bladder and its cystic duct, the three hepatic ducts and the bile duct constitute the extrahepatic biliary tract.

1. Intrahepatic biliary tract

The bile is manufactured by the liver cells. It is collected in bile canaliculi in the lobules, flows along the portal canals in the bile duct tributaries and so reaches the right and left hepatic ducts.

2. Extrahepatic biliary tract

The extrahepatic biliary tract consists of the three hepatic ducts, right, left and common, the gall bladder, the cystic duct and the bile duct. (Figure 3)

The common hepatic duct results of the union of the right and left hepatic ducts emerging from the porta hepatis near its right margin in a Y-shaped manner to form the common hepatic duct.

It is joined on its right side, usually after about three centimetres, by the cystic duct to form the bile duct one centimetre above the duodenum. The common hepatic duct is four centimetres long with a diameter of four millimetres.

It lies in the free edge of the lesser omentum in front of the right edge of the portal vein and the right hepatic artery and with the hepatic artery on its left. The common hepatic duct is surrounded by several anatomical relations.

The bile duct results of the union of the right side of the common hepatic duct with the cystic duct usually after about three centimetres one centimetre above the duodenum.

It is eight centimetres long and 8 millimetres wide and is classically divided into three thirds.

The supraduodenal part lies in the free edge of the lesser omentum in front of the portal vein and to the right of the hepatic and right gastric arteries, the hepatic plexus and the hepatic lymph nodes forming the anterior boundary of the epiploic foramen.

The retroduodenal third runs behind the first part of the duodenum, the upper edge of the head of the pancreas and the posterior branch of the superior pancreaticoduodenal artery, it slopes down to the right of the portal vein which now lies to the left of the duct with the gastroduodenal artery and the retroduodenal lymph node in front of the inferior vena cava.

The paraduodenal part slopes further to the right in the groove between the back of the head of the pancreas containing the pancreatic duct and the second part of the duodenum, in front of the right renal vein and behind the accessory pancreatic duct and the anterior branch of the superior pancreaticoduodenal artery, it joins the pancreatic duct at an angle of about sixty degrees at the hepatopancreatic ampulla of Vater surrounded by the ampullary sphincter of Oddi; the ampulla opens into the posteromedial wall of the second part of the duodenum at the major duodenal papilla.

The gall bladder stores and concentrates the bile secreted by the liver. It is a pear-shaped blue-grey viscus with a capacity of about fifty millilitres.

The gall bladder is ten centimetres long and five centimetres wide attached to the gall bladder fossa of the inferior surface of the right lobe of liver by fibrous tissue on its superior surface. It is peritonised in its inferior surface and has three distinguished parts.

The fundus of the gall bladder projects a little beyond the sharp lower border of the liver on the commencement of the transverse colon, just to the left of the hepatic flexure and touches the parietal peritoneum of the anterior abdominal wall at the tip of the ninth costal cartilage.

The body passes backwards and upwards towards the right end of the porta hepatis and is in contact with the first part of the duodenum.

The neck of the gall bladder lies at a higher level than the fundus and against the free edge of the lesser omentum fixed to the liver by a ligament containing the cystic artery, is convoluted in the shape of italic S and may show a small diverticulum, Hartmann’s pouch.

The cystic duct is a two to three centimetres long and two to three millimetres thick duct prolonging the neck of the gall bladder. It runs towards the porta to join the common hepatic duct between the two layers of the free edge of the lesser omentum about one centimetre above the duodenum and usually in front of the right hepatic artery and its cystic branch. The cystic duct is subject to anatomical variations.

The biliary tract is subject to many anatomical variations in shape, situation and number.

The gall bladder may be absent, double or septated and intrahepatic or left retrohepatic.

The cystic duct may directly open in the duodenum, runs behind the bile duct or flow into the right hepatic duct.

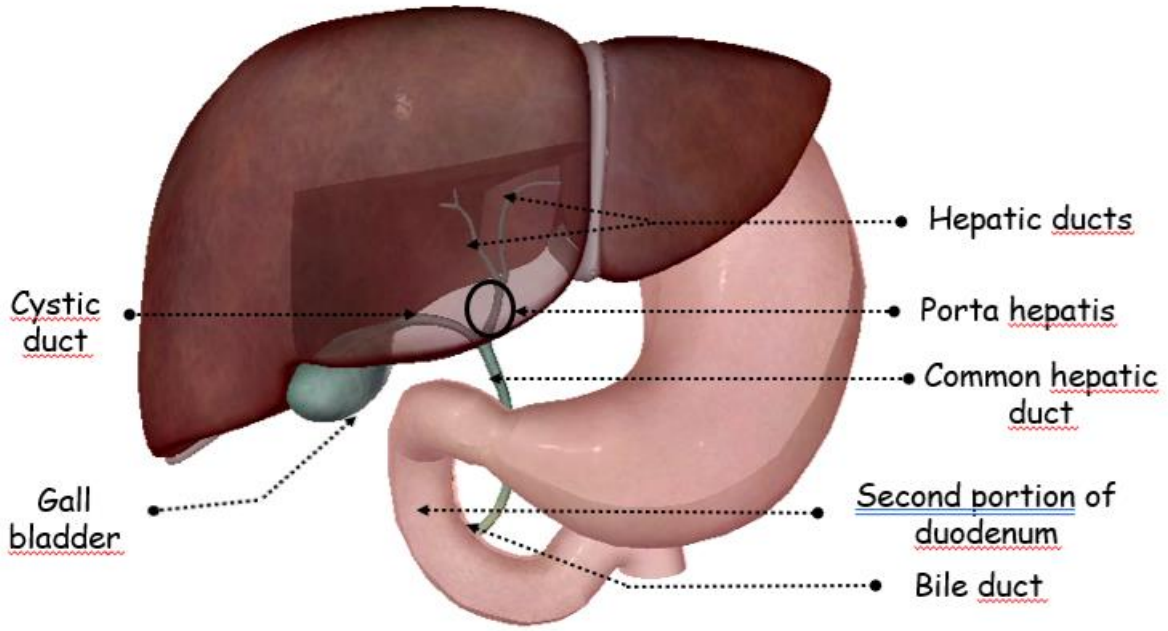

Figure 3: Anterior view of the liver showing the extrahepatic biliary tract

III. STRUCTURE

The liver consists of a large glandular parenchyma covered with a capsule and mostly peritonised.

The serous coat is the peritoneum of the liver.

The Glisson's capsule of the liver is fibrous and continuous at the porta hepatis with the fibrous sheath of the hepatic pedicle.

The parenchyma is arranged into liver lobules scattered into a loose connective stroma built in interlobular septa.

The liver lobule has a pinhead size and hexagonal shape with a central vein and sinusoids and plates or cords of hepatocytes radiating from it to the periphery of the lobule where there may be fine connective tissue septa separating it from adjacent lobules.

At the corners of the lobules small branches of the hepatic artery and portal vein are gathered with bile ductules, forming the portal canals united by anastomosing connexions. They are surrounded by the stroma.

The liver acinus is a diamond-shaped area with central veins at one pair of opposite corners and portal canals at the other pair consisting of parts of two adjacent lobules. The functional implication is that the hepatocytes of the region between the canals are the first to come under the influence of the incoming blood supply, whereas those nearest the central veins are the last to do so. The sinusoids intervening between the cords of hepatocytes allow plasma to leave the sinusoids and enter the perisinusoidal spaces so that exchange of materials can take place

between plasma and liver cells.

Biliary canaliculi are situated between apposing sides of adjacent hepatocytes and drain into the bile ductules of the portal canals, and these in turn unite to form the larger intrahepatic ducts.

The central veins flow into hepatic veins.

The gall bladder contains a small amount of smooth muscle in its wall arranged in three layers, longitudinal, circular and oblique. Its mucous membrane is a lax areolar tissue lined with a simple columnar mucous-secreting epithelium projected into folds. Its posterior surface is covered by a serous coat and its anterior surface by adventitia.

The rest of the biliary tract has the same structure.

The bile duct, hepatic duct and the hepatopancreatic ampulla of Vater are surrounded at their duodenal outlets by sphincters which come from the muscular layer of the duodenal wall.

IV. SUPPORTS

A- CORONARY LIGAMENT

The coronary ligament of the liver attaches the posterior surface to the diaphragm.

Its upper layer is made of the right leaf of the falciform ligament sweeping to the right over the summit of the right dome to pass just in front of the inferior vena cava.

Its lower layer consists of the reduplication of the right leaf of the falciform ligament sweeping downwards to the right to pass in the fissure for the ligamentum venosum and just between the

inferior vena cava and the porta hepatis. The coronary ligament surrounds the bare area of the liver.

B- LESSER OMENTUM

The lesser omentum extends between the liver and the lesser curvature of the stomach usually only seen when the liver is lifted up away from the stomach.

The liver attachment of the lesser omentum is L-shaped to the fissure for the ligamentum venosum and the porta hepatis and is continuous with the lower layer of the coronary ligament to the right of the fissure for the ligamentum venosum.

Between the duodenum and the liver it has a right free margin, where the peritoneum of the greater and lesser sacs become continuous. The right free margin of the lesser omentum constitutes the anterior boundary of the epiploic foramen of Winslow. The epiploic foramen of Winslow is a vertical two centimetres and half high slit like the opening for a coin in a slot machine that can be slightly stretched to admit the tips of two fingers. Its upper boundary is the caudate process of the liver, its lower boundary is the first portion of the duodenum and its posterior boundary is the inferior vena cava covered by the parietal peritoneum of the posterior abdominal wall.

Within the free margin of the lesser omentum, lie the portal vein at the back, the hepatic artery in front and to the left and the bile duct to the front and right of the vein.

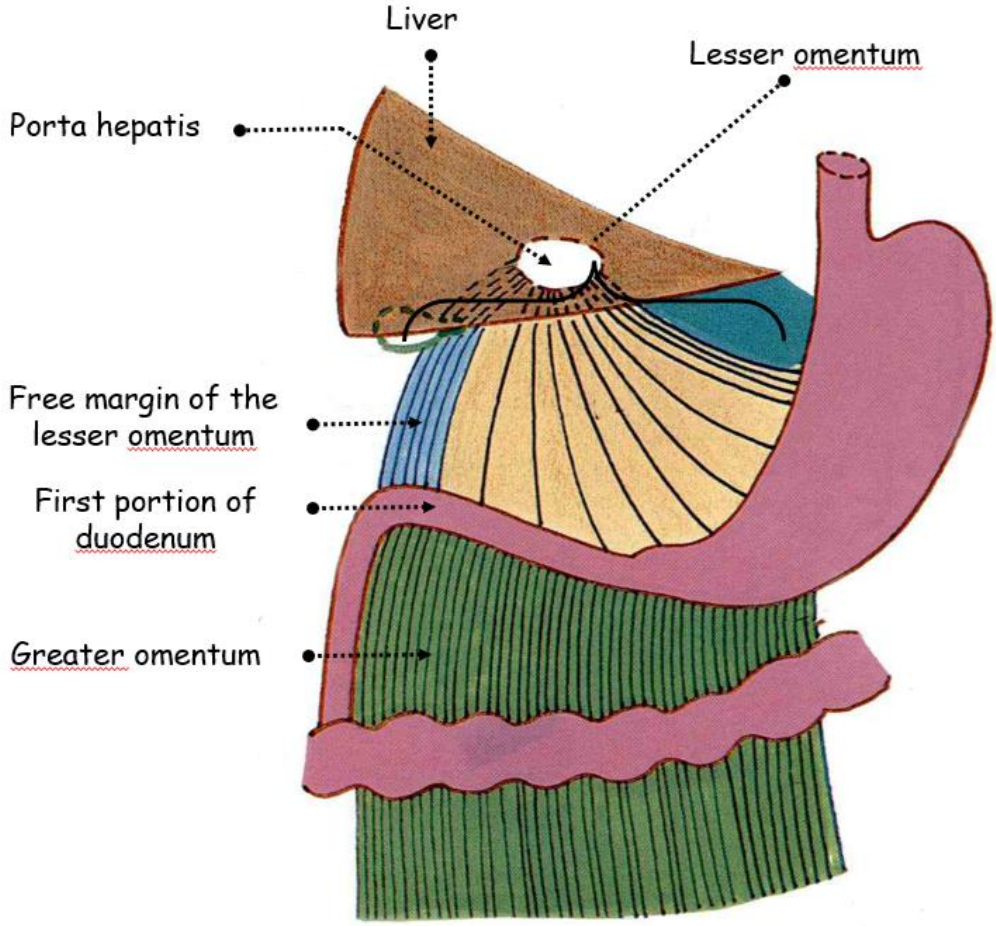

Figure 4: Anterior view of the abdomen

C- FALCIFORM LIGAMENT

The falciform ligament stands as a vertical septum that passes upwards from the umbilicus behind the linea alba towards the xiphisternum forwards and from the ligamentum teres to the diaphragm backwards. In fact, it contains in its posterior and slightly crescentic free margin the ligamentum teres. Having delivered the ligamentum to the liver in its notch, this double-

layered peritoneal fold continues up and to the right of the midline, between the diaphragm and the anterior and superior surfaces of the liver, where the two layers separate. One sweeps to the left along the upper surface of the liver as the left triangular ligament and the other sweeps to the right, reduplicates and forms the upper and lower layers of the coronary ligament. The latters meet at the apex of the bare area and form the right triangular ligament.

The falciform ligament not only separates the right and left lobes but also separates the right and left subhepatic recesses.

D- LIGAMENTUM TERES

The ligamentum teres represents the obliterated remains of the left umbilical vein. It lies in the posterior slightly crescentic free margin of the falciform ligament in the fissure for the ligamentum teres.

E- GLISSON'S CAPSULE

The Glisson's capsule is thin and fibrous. It lines the vessels and the hepatic ducts in the porta hepatis and reflects to line them inside the liver. The capsule is continuous with fine connective tissue septa separating the liver lobules; though in the human liver the septa are poorly developed compared with those in many animals.

V. ANATOMICAL RELATIONS

A- DIAPHRAGMATIC SURFACE

The diaphragmatic surface of the liver is overlied by the diaphragm and thus is in contact through the latter, from the top to the bottom, with the pericardium and heart, right pleura and lung to the right, left pleura and lung to the left, costal cartilages six to ten on the right and costal cartilages six and seven on the left, infracostal angle and the anterior abdominal wall of the epigastrium.

B- POSTERIOR SURFACE

The posterior surface of the liver stands in front of, from the right to the left, right crus of diaphragm, spine and oesophagus.

C- INFERIOR SURFACE

The inferior surface of the liver is in contact with intraperitoneal and retroperitoneal organs that make their impressions on it. Towards the quadrate lobe, the liver is in contact with the pyloric part of the stomach and the first portion of the duodenum. The inferior vena cava has its proper groove to the right of the caudate lobe. Towards the right lobe, the liver is in contact, from the top to the bottom, with the right suprarenal gland, the right kidney, the 2nd portion of duodenum and the right colic flexure. Towards left lobe, it is in contact, from the top to the bottom, with the oesophagus, the stomach and the tuber omentale of the pancreas.

D- ANTERIOR BORDER

The sharp anterior border of the liver is in contact, from the right to the left, with the infracostal angle, the anterior abdominal wall of the epigastrium and the sixth and seventh left costal cartilages.

E- POSTERIOR BORDERS

The superior-posterior and inferior-posterior borders of the liver lie on the diaphragm.

VI. BLOOD SUPPLY; LYMPH DRAINAGE AND NERVE SUPPLY

The liver receives blood from two sources. The arterial blood is furnished by the hepatic artery. Venous blood is carried to the liver by the portal vein and venous return is ensured by three main hepatic veins that flow into the inferior vena cava.

A- ARTERIES

The hepatic artery continues the common hepatic artery curving upwards at the epiploic foramen into the space between the two layers of the lesser omentum. It meets the bile duct and lies on its left side both in front of the portal vein between the duodenum and the porta hepatis surrounded by the peritoneum at the free edge of the lesser omentum. Then, it reaches the porta hepatis and divides. The Y-shaped division of the hepatic artery gives the right and left branches to supply the right and left halves of the liver. Its Y-shaped division gives the right branch of the hepatic artery that normally passes behind the common hepatic duct and in the liver divides into

anterior and posterior segmental branches. The left branch divides into medial and lateral segmental branches. The branches of the hepatic artery accompany the branches of the portal vein.

Sometimes the common hepatic artery arises from the superior mesenteric artery or the aorta instead of the coeliac trunk in which case it usually runs behind the portal vein.

The right and left hepatic branches may themselves arise from the superior mesenteric or left gastric arteries respectively; in this case, they may either replace the normal branches or exist in addition to them and constitute the aberrant hepatic arteries. The commonest is a left hepatic artery arising from the left gastric artery.

The cystic artery, usually a branch of the right hepatic, passes in front of the common hepatic duct then behind the cystic duct in the triangle formed by the liver, common hepatic duct and cystic duct, Calot’s triangle, to reach the neck of the gall bladder and then divides over the surface of the viscus into two branches, anterior superficial and posterior deep on its upper surface towards the gall bladder fossa.

The cystic duct and the bile duct are supplied by the hepatic artery and the posterior branch of the superior pancreaticoduodenal artery.

The cystic artery is also subject to very common anatomical variations. The latters may concern its origin arising from the hepatic, common hepatic, gastroduodenal or superior mesenteric arteries or its course in front of the cystic duct.

B- VEINS

1. Portal vein

The portal vein is the upward continuation of the superior mesenteric vein. It changes its name to portal after it has received the splenic vein at an angle of one hundred degrees behind the neck of the pancreas.

The portal vein lies in front of the inferior vena cava, passes upwards behind the pancreas and the first part of the duodenum and loses contact with the inferior vena cava by entering between the two layers of the lesser omentum with the bile duct to the right behind the pancreas and the hepatic artery to the left in front of the pancreas. It runs almost vertically upwards in the free edge, where the lesser omentum forms the anterior boundary of the epiploic foramen. There, it lies behind the bile duct to the right and the hepatic artery to the left and the hepatic lymph nodes and reaches the porta hepatis.

Once in the porta hepatis, its T-shaped division gives the right and left branches that enter the respective halves of the liver.

The right branch of the portal vein is the largest, it gives the right caudate vein and the anterior and posterior segmental veins, it drains the cystic vein.

The left branch of the portal vein gives the left caudate vein from its horizontal portion and the medial and lateral segmental veins from its umbilical sagittal portion where it receives the vein of the ligamentum teres and where the latter is fixed. At the junction of the two portions, is fixed the ligamentum venosum.

The tributaries of the portal vein are, mainly, the superior mesenteric vein, the splenic vein, the inferior mesenteric vein, the right and left gastric veins at its corresponding borders and the superior pancreaticoduodenal veins. The tributaries of its right branch are the cystic veins, the periumbilical veins through not completely obliterated ligamentum teres. The right periumbilical vein flows into the left branch of the portal vein.

The tributaries of its left branch are, mainly, the vein of the ligamentum teres which is the five centimetres long remnant of the left umbilical vein.

The five site of portosystemic anastomosis considered with the appropriate territories, lower end of the oesophagus, upper end of the anal canal, bare area of the liver, periumbilical region and retroperitoneal areas between the splenic, renal and suprarenal veins or between the colic veins and retroperitoneal veins of Retzius.

The gall bladder is drained by the cystic veins.

2. Hepatic veins

The venous return differs in that it shows a mixing of right and left halves of the liver ensured by three main hepatic veins. The hepatic veins stand high up near the diaphragmatic surface of the liver, they drain into the inferior vena cava.

The middle hepatic vein is large and central, it runs in the plane between right and left halves and flow into the right edge of the inferior vena cava, it receives branches from each half.

Further laterally lie the right and left veins. The entry of these large hepatic veins into the vena cava, already embedded in its deep groove of liver substance, is the main support for the liver rather than the peritoneal ligaments.

Several small accessory hepatic veins enter the vena cava below the main veins, including a separate vein from the caudate lobe.

3. Liver segmentation

The liver segmentation consists of dividing the liver into four sectors based on the hepatic veins' divisions and eight segments based on the division of the portal vein.

The left lateral sector is the left lobe of liver and is drained by the lateral superior and lateral inferior segmental veins.

The left medial sector consists of the caudate lobe and most of the quadrate lobe and is drained by the medial superior and inferior veins.

They are separated by the line of the fissures for the ligamentum venosum and ligamentum teres.

Thus, the line of demarcation of the functional right lobe from the rest of the liver is along the vena caval groove at the back and the gall bladder fossa forwards.

The right anterior and posterior sectors have no visible external marking, but the line of division runs obliquely backwards and medially from the middle of the front of the right lobe towards the vena caval groove. The right anterior sector is drained by the anterior superior and inferior veins and the right posterior sector is drained by the posterior superior and inferior veins.

The right anterior and posterior veins drain into the right hepatic vein and the medial and lateral veins drain into the left hepatic vein. The anterior and medial veins flow into the middle hepatic vein as well.

A system using Roman numerals I-VIII is commonly adopted for segments.

Segment I is the caudate lobe.

Segment II corresponds to the upper posterior part of the left lateral sector.

Segment III is the lower anterior part of the left lateral sector.

Segment IV corresponds to most of the quadrate lobe.

Segment V corresponds to the lower anterior part of right anterior sector.

Segment VI corresponds to the lower anterior part of right posterior sector.

Segment VII corresponds to the upper posterior part of right posterior sector.

Segment VIII corresponds to the upper posterior part of right anterior sector.

Each segment is supplied by a segmental branch of division of portal vein and is independent with an arterial branch of hepatic artery and hepatic duct from right and left hepatic ducts.

The liver segmentation has surgical interest.

C- LYMPH DRAINAGE

The liver is drained by hepatic nodes in the porta hepatis. They receive the lymphatics of the gall bladder. They drain downwards alongside the hepatic artery to retropyloric nodes. The latters drain into the coeliac nodes and to nodes in the posterior mediastinum.

The gall bladder is drained by the cystic node in Calot's triangle at the junction of the common hepatic and the cystic duct. The biliary tract is drained by a node situated at the anterior border of the epiploic foramen.

D- NERVES

The nerves of the liver consist of sympathetic and vagus. The sympathetic supply is ensured by the coeliac ganglia that give rise to nerves running with the vessels in the free edge of the lesser omentum and enter the porta hepatis. The parasympathetic supply of the liver is held by the left vagal trunk along the lesser curve of the stomach via the lesser omentum to the porta hepatis.

VII. SURGICAL APPROACH

A- LIVER

Needle biopsy of the liver is carried out through the right eighth or ninth intercostal space in the midaxillary line; the needle path is below the level of the lung but traverses the costodiaphragmatic recess of the pleura before going through the diaphragm and crossing the peritoneal cavity to enter the liver. The needle must not penetrate more than six centimetres from the skin to avoid entering the inferior vena cava. A misplaced needle could damage the kidney, colon or pancreas, and pneumothorax is another possible complication.

A right hepatic lobectomy involves removing liver tissue along a line from the left of the gall bladder to the right edge of the inferior vena cava, ligating vessels and ducts along the way so that the right lobe and the gall bladder can be removed.

For left lobectomy, the left lobe together with most of the caudate and quadrate lobes are removed. The gall bladder is left intact, and the line of resection at the back is level with the left

edge of the vena cava. In left lobectomy it is important to preserve the right hepatic vein and vice versa. More precise removal of segments can be carried out based on their detailed vascular patterns.

In liver transplantation following removal of the patient's liver, the suprahepatic inferior vena cava of the donor liver is sutured to the patient's but remains clamped, followed by reunion of the portal veins with restoration of circulation so that blood flows out of the lower end of the donor vena cava before joining it to the patient's infrahepatic vena cava. The suprahepatic vena cava is then undamped, and the respective hepatic arteries and bile ducts joined up. Portal blood must flow through the liver to flush out accumulated potassium ions which are a potential cause of cardiac arrest; this is why the superior vena cava is kept clamped until the portal circulation has been restored. The viability of the bile duct is an important factor for a successful transplant; the cut end of the donor duct should bleed when the hepatic circulation is restored.

B- BILIARY TRACT

The fundus of the gall bladder should be easy to see after opening the abdomen through a Kocher's incision below the right costal margin but to display the rest of it and the duct system the adjacent liver, transverse colon and duodenum must be suitably retracted and the peritoneum over the cystic duct and the upper end of the free margin of the lesser omentum incised. The various ducts and vessels are dissected out and all must be positively identified, taking special care not to confuse the cystic duct with the bile duct. For cholecystectomy the cystic duct and artery are ligated and the gall bladder dissected away from the hepatic bed from the neck towards

the fundus. For operative cholangiography the cannula is inserted into the cystic duct and passed down into the bile duct; the spiral valve may cause some obstruction. The upper end of the bile duct can be incised longitudinally, in choledochotomy, for the removal of stones. The lower part of the duct can be exposed by mobilization of the duodenum, Kocher's manoeuvre, incising the peritoneum along the right edge of the second part of the duodenum and turning the duodenum medially so that the posterior surface of the duodenum and head of the pancreas with the duct between them can be palpated and seen. The inferior vena cava, ureter and gonadal vessels must not be damaged when peeling the duodenum forwards.

VIII. CONCLUSION

The liver is the largest gland of the organism annexed to alimentary tube. It is highly peritonised though fixed by vessels. The liver secretes bile and hormones with, mainly, digestive and metabolic effects. It is in contact with several retroperitoneal and intraperitoneal relations. The blood supply of the liver is rich. Nerves mainly provide from the vagi and coeliac ganglia. Lymph drainage is ensured by the celiac nodes. The liver segmentation has a wide clinical use and major surgical interest.