Study of the Portal Circulation in Diabetes Mellitus

Thesis by

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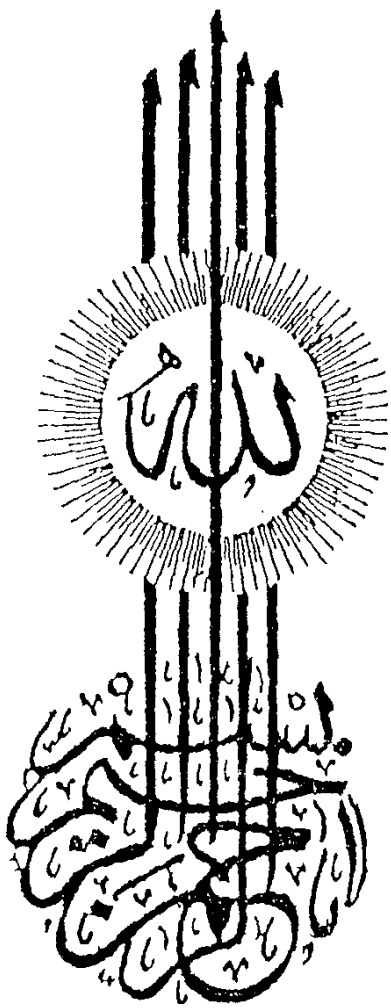

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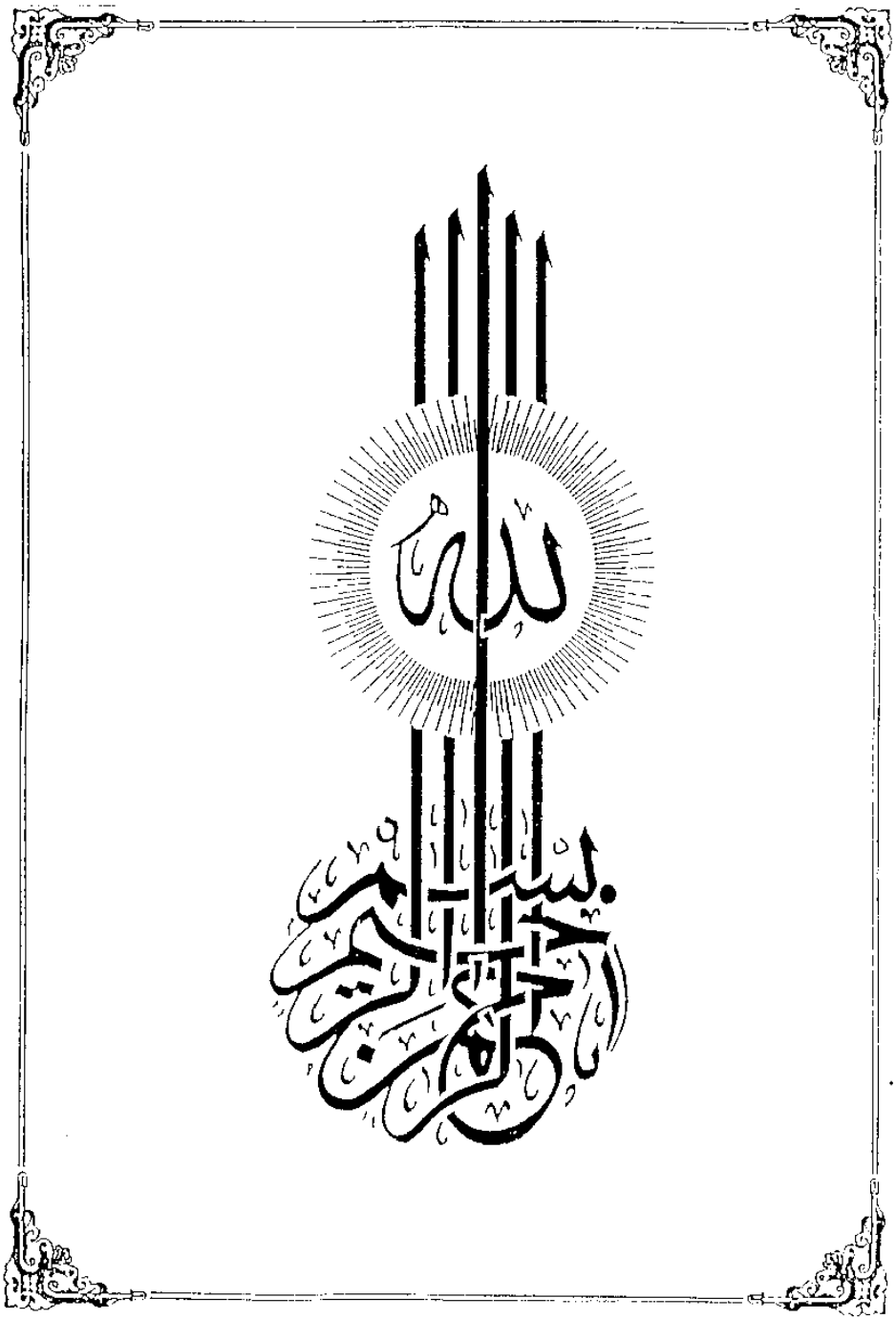

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Introduction

Diabetes Mellitus is a major health problem world wide .

It is a primary disorder of carbohydrate metabolism with multiple aetiogical factors that generally involve absolute or relative insulin defficiency or both .

All causes of diabetes mellitus ultimately leads to hyperglycaemia which is the hall mark of the disease .

The other point included in our study is the portal circulation , it is well known that the portal venous system begins in the capillaries of the intestine and ends in the hepatic sinusoids . The portal vein is formed by the confluence of the superior mesentric vein and splenic vein behind the neck of the pancreas .

Obviously the liver receives about 1500 ml of blood each minute , two thirds of which is provided by the portal vein , moreover hepatic artery provides 40% to 60% of O2 supply to the liver .

On the other hand liver offers little resistance to blood flow and the pressure within the sinusoids is low and since the portal system lack valves , increased resistance to flow at any point increases the pressure in all vessels at the intestinal site of the obstruction .

REVIEW OF LITERATURE

ANATOMY OF PORTAL VENOUS SYSTEM

The portal system includes all the veins draining the abdominal part of the digestive tube, spleen, pancreas, and gall bladder (Williams et al., 1989).

From the viscera the blood is conveyed to the liver by the portal vein. In the liver this vein ramifies like an artery and ends in capillary–like vessels termed sinusoids, from which blood conveys to reach the inferior vena cava via the hepatic veins (Mc Nulty, 1977).

In adult, the portal vein and its tributaries have no valves; in fetal life and for a short postnatal period valves are demonstrable in its tributaries, usually they atrophy but some persist in degenerate form (Williams et al., 1989).

The portal vein is relatively thick–walled vessel which contain more smooth muscle than a comparable systemic vein. It is a bout 8 cm long, and begins at the second lumbar vertebral level as the upward continuation of the superior mesenteric vein, which changes its name to the portal after it has received the splenic vein behind the neck of the pancreas. It lies in front

of the inferior vena cava, passes upward 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. It runs almost vertically upwards in the free edge, where the lesser omentum forms the anterior boundary of the epiploic foramen, laying behind the bile duct and the hepatic artery and reaches the porta hepatis. It is surrounded by the hepatic nerve plexus and accompanied by many lymph vessels and some lymph nodes. In the porta hepatis it is divided into a right and left branches which enter the respective halves of the liver. Below the first part of the duodenum the bile duct and the hepatic artery are curved away from it; the bile duct curves to the right behind the pancreas and the hepatic artery curves to the left infront of the pancreas to the coeliac trunk (Mc Minn, 1990).

The right branch enters the right hepatic lobe but usually first receives the cystic vein or veins. The left branch, longer but of smaller caliber, gives branches to the caudate lobe, and then enters the left lobe of the liver. As it enters the left lobe it is joined by the paraumbilical veins and the ligamentum teres, a remnant of the obliterated left umbilical vein.

The tributaries of the portal vein are: (1) splenic vein, (2) superior mesenteric vein, (3) the coronary vein (left gastric vein), (4) the right gastric vein, (5) the pyloric vein, (6) the cystic vein, and (7) the paraumbilical veins.

1. Splenic Vein

It is formed near the splenic hilum by the convergence of a number of splenic trunks (most commonly three trunks but the number of trunks range from two to six). These trunks emerge in fan–like arrangement from the crescentic hilum to join one another. In a few cases the trunks arise exclusively from either the upper or lower portion of the hilar cleft (Douglas et al., 1950).

The splenic vein traverses the lienorenal ligament and tail of pancreas, and descends to the right, across the posterior abdominal wall inferior to its artery and posterior to the body of pancreas (which it grooves) receiving numerous short rami from the gland. It crosses anterior to the left kidney and its hilar structures or lower pole of the left suprarenal gland, separated from the left sympathetic trunk and left crus of diaphragm by the left renal vessels and from the abdominal aorta by the superior mesenteric artery and left renal vein (Williams et al., 1989).

The splenic vein follows a rather variable course (Doehner et al., 1955). It is not tortuous like the splenic artery. It ends behind the neck of the pancreas, where it joins the superior mesenteric vein at a right angle to form the portal vein. The tributaries of the splenic vein are: (a) short gastric veins, (b) the left gastroepiploic vein, (c) pancreatic veins, and (d) inferior mesenteric vein.

(a) The short gastric veins; four or five in number, drain the fundus and left part of greater curvature of the stomach and pass between the two layers of the gastrosplenic ligament to end in the splenic vein or any one of its large tributaries.

(b) The left gastroepiploic vein arises from the greater curvature of the stomach, where it anastomses freely with the right gastroepiploic vein. It follows the greater curvature from its midpoint, crossing from right to left, ending in or near the begining of the splenic vein.

(c) The pancreatic veins drain the body and the tail of the pancreas. They may be small and many or large and few. The former empty more or less directly into the splenic vein; in the latter case, superior and inferior archades receive these large veins, their ultimate drainage being into the splenic vein.

(d) The inferior mesenteric vein returns blood from the rectum, sigmoid and the descending colon. Its major tributaries are the superior hemorrhoidal vein, and the left colic veins. It begins in the rectum as the superior rectal vein, which has its origin in the rectal plexus and through this plexus it communicates with the middle and inferior rectal veins which drains in the internal iliac vein. The superior rectal vein leaves the lesser pelvis, crosses the left common iliac vessels with the superior rectal artery and is continued upward as the inferior mesenteric vein. This vein lies to the left of the artery and ascends under the cover of the peritoneum and anterior to the left psoas major, it then passes close to the body of the pancreas to terminate in the splenic or superior mesenteric vein. The proximal termination of inferior mesenteric vein is variable, the commonest being in the splenic vein shortly before the junction of this with superior mesenteric vein. Sometimes it ends at the union of splenic and superior mesenteric vein or in the left wall of the superior mesenteric vein itself.

2. Superior Mesenteric Vein

It drains the small intestine, caecum, ascending and transverse parts of the colon. Begining in the right iliac fossa by the union of tributaries from the terminal ileum, caecum,and vermiform appendix, it ascends in the mesentry on the right of

the superior mesenteric artery, passing anterior to the right ureter, inferior vena cava, the horizontal part of the duodenum, and uncinate process of the pancreas, joining the splenic vein behind its neck to form the portal vein. Tributaries, beside those that correspond with the branches of the superior mesenteric artery (namely, the jejunal, ileal, ileocolic, right colic, and middle colic veins), the superior mesenteric vein is joined by right gastroepiploic vein and the pancreaticoduodenal veins. The tributaries of the superior mesenteric vein are: (a) the right gastroepiploic vein, and (b) the pancreaticoduodenal veins (Douglas et al., 1950).

(a) The right gastroepiploic vein receives tributaries from the greater omentum and parts of both anterior and posterior surfaces of the stomach; anastomosing fully with the left gastroepiploic, it turns from left to right along the greater curvature of the stomach between the two layers of the greater omentum. In 83.2% it terminates in the anterior wall of the superior mesenteric vein, most commonly at a distance of about 5 cm below the junction of the latter with the splenic vein (Douglas et al., 1950). (Doehner et al., 1955) stated that the gastrocolic trunk is formed by confluence of the middle colic vein, the gastroepiploic vein and frequently various peritoneal branches, in half of cases they examined. It is a tributary of the

superior mesenteric vein and enters this vein on the right side, slightly below the confluence of the portal and superior mesenteric vein.

(b) The pancreaticoduodenal veins receive tributaries from the head of pancreas and adjacent segment of the duodenum. They accompany their corresponding arteries: the inferior often joins the right gastroepiploic vein; the superior usually ascends to the left behind the bile duct to end in the portal vein.

3. Coronary Vein (left gastric vein)

It drains both gastric surfaces, it runs from right to left along the lesser curvature of the stomach, between the two layers of the lesser omentum, to the oesophageal opening of the stomach, where it receives some oesophageal veins. It then turns downward and passes from left to right, dorsal to the peritoneum of the lesser sac, and enters in the portal system from above (Douglas et al., 1950).

4. Pyloric Vein (right gastric vein)

It is small in size and runs from left to right along the pyloric portion of the lesser curvature of the stomach, between the two layers of the lesser omentum to end in the portal vein (Douglas et al., 1950).

5. Cystic Veins

They are several small vessels that drain the blood from the gallbladder, and accompanying the cystic duct, usually end in the right branch of the portal vein (Douglas et al., 1950).

6. Paraumbilical Veins

They are small several veins around the ligamentum teres of the liver that establish an anastomosis between the veins of the anterior abdominal wall and the portal vein. The most prominent and important from the surgical aspect is a vein that commences at the umbilicus and runs posteriorly and superiorly on the surface of the ligamentum teres between the layers of the falciform ligament to terminate in the left branch of the portal vein (Douglas et al., 1950).