LIVER TRANSPLANTATION

ESSAY

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CONTENTS

Chapter		Page
I	Introduction.	1
II	Anatomy.	3
III	Physiology.	17
IV	Principles, Implications, Organization and Ethics.	30
V	Indications for liver transplantation.	37
VI	Selection and Evaluation.	61
VII	Techniques of liver transplantation.	68
VIII	Postoperative care.	86
IX	Complications of liver transplantation.	97
X	Summary.	114
XI	References.	119
	Arabic Summary.	

CHAPTER I

INTRODUCTION

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The first human liver transplant was attempted in 1963 by Starzl and co-workers at the University of Chicago. In the past 10 years improvements in survival following liver transplantation have resulted in the procedure being accepted as a recognized treatment for end-stage liver disease. (Neuberger and Adams, 1989).

Liver transplantation is rapidly emerging as the most effective treatment pathway for a growing number of acute and chronic liver disease states. (Jenkins and Fairchild, 1989). Liver trasplantation services have expanded dramatically in recent years as indications for liver replacement have broadened, contraindications have diminshed, and referrals to transplant centers have increased.(Gordon, et al., 1990).

Liver transplantation in children has progressed to the point where much of the initial skepticism surrounding the value of this extraordinary endeavor has been overcome, and the results clearly justify the widespread use of this procedure in children with limited life expectancy secondary to severe liver disease. Advances in the areas of organ preservation and reduced-size liver transplantation have increased organ availability for children and significantly decreased mortality on transplant waiting lists. (Superina, 1992).

Advances in immunosuppression and surgical technology have inaugurated a renaissance for the field of liver transplantation, furthering its evolution into a suitable treatment option for patients with acute or chronic end-stage liver disease. (Jenkins and Fairchild, 1989). Although the introduction of cyclosporine as a clinical immunosuppressive agent is credited as a major factor in the improved patient survival following liver replacement, both surgical technique and more cautious selection of candidates for surgery have undeniably contributed to recent successes. (Starzl et al., 1991).

Recent progress in organ preservation with the introduction of the University of Wisconsin preservation solution for liver allografts has further extended the limits of liver transplantation, facilitating distant transport of donor organs and reducing the logistical problems that previously frustrated the development of new programs. (Kalayoglu et al., 1988).

Despite the simplification of the transplant process, liver replacement remains a formidable procedure that requires the intense dedication of surgical and medical support staff and a complete institutional commitment to quality care (Jenkins and Fairchild, 1989).

ANATOMY

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The liver lies in the right upper quadrant of the abdomen, beneath the diaphragm and connected to the digestive tract via the portal vein and biliary drainage system (Meyers, 1991).

Embryology :

The liver, gallbladder and bile ducts arise as a ventral bud (hepatic diverticulum) from the most caudal part of the foregut (Fig.1). The hepatic diverticulum extends into the septum transversum and expands the ventral mesentery. The hepatic diverticulum divides into: a large cranial part which gives rise to interlacing cords of liver cells and the intra-epithelial lining of the intrahepatic portion of the biliary apparatus. The liver cells anastomose around pre-existing endothelium-lined spaces which will become the hepatic sinusoids. The fibrous, haemopoietic and Kupffer cells are derived from the mesenchyme of the septum transversum and a small caudal part which expands to form the gallbladder; its stalk becomes the cystic duct. Initially the extrahepatic biliary apparatus is occluded with endodermal cells, but it is later recanalized. The stalk connecting the hepatic and cystic ducts to the duodenum becomes the common bile duct (Decker and du Plessis 1986).

Gross Anatomy :

The liver is a large organ, weighing 1500 gram. It is surrounded by a fibrous capsule called Glisson's capsule and is invested by peritoneum throughout most of its surface. The topographic arrangement of the liver in the right upper quadrant is secured by a number of ligaments (Fig. 2) . The falciform ligament, the remnant of the obliterated umbilical vein, attaches the liver to the anterior abdominal wall. This ligament resists movement of the liver to the right. The right and left coronary ligaments posteriorly attach the liver to the diaphragm, and the right and left triangular ligaments attach the apex of the left lobe to the diaphragm. The gastrohepatic and hepatoduodenal ligaments contain the important structures in the portal triad, i.e, the hepatic artery, portal vein and common bile duct (Reintgen and Sabiston, 1987).

The superior surface is molded to the diaphragm and reaches the fifth rib on the right and the fifth space on the left. The right lateral margin, a favorite site for liver biopsies, lies against the diaphragm and chest wall. The diaphragm separates the liver from the lung and pleura as far as the eighth and tenth ribs, respectively. A needle placed below the tenth rib will reach the liver and avoid the lung and pleura. The inferior border is sharp and, on the right, lies just below the costal margin, from which it runs leftward to the level of the apex beat of the heart. The anterior surface, lying between the superior blunt and inferior sharp margins, lies behind the ribs and cartilages,

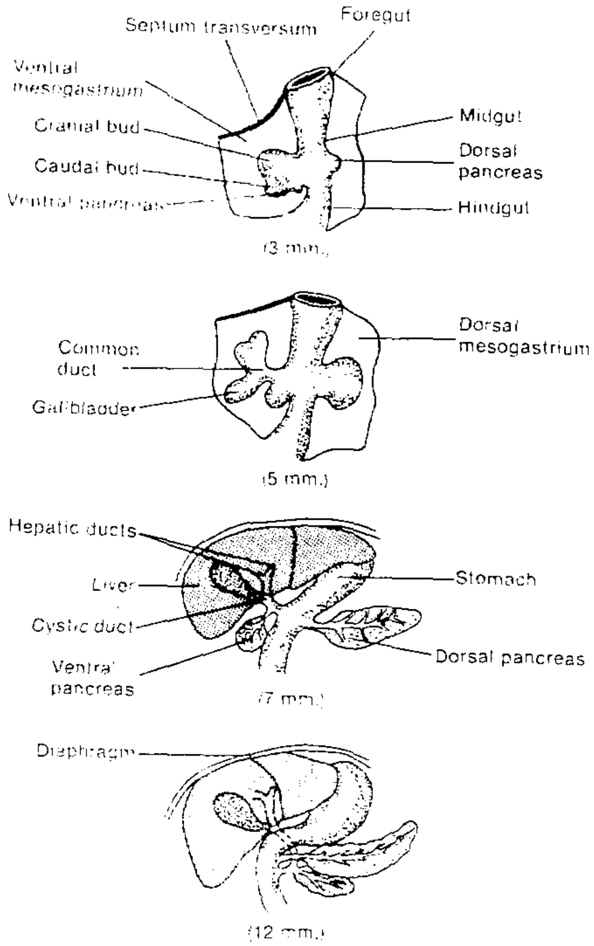

Fig.(1) Embryologic development of the liver.(After Meyers W C , In Textbook of Surgery, Edited by Sabiston D C ,1991).

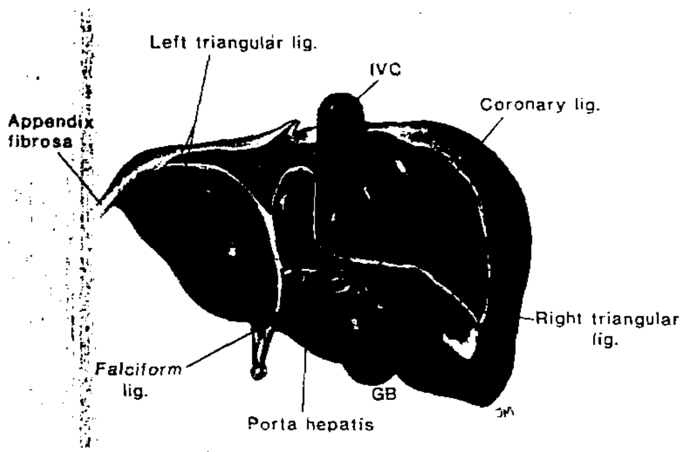

Fig.(2) Ligaments of the liver. (After Rossi R L and Re Mine S G, In Atlas of Abdominal Surgery, Edited by Braasch J W et al.,1991) separated by the diaphragm, pleurae, and lungs. A small portion in the epigastrium lies immediately behind the anterior abdominal wall. The posterior and inferior surfaces merge into each other and are seen by elevating the anterior margin. The inferior concave surface presents a prominent porta hepatis for the passage of the major vessels and bile ducts and is related to structures that impress on the liver. From the right, these are the upper half of the right kidney and suprarenal gland posteriorly, with the hepatic flexure of the colon and the junction of the first and second parts of the duodenum anteriorly. Passing leftward, the liver is in contact with the inferior vena cava and the esophagus and proximal stomach. The posterior surface is largely retroperitoneal and lies in contact with the retrohepatic inferior vena cava and the upper pole of the right kidney and suprarenal gland. This retroperitoneal (bare) area is enclosed by the leaves of the coronary ligaments, and access to this area can only be obtained by division of these ligaments (Ger, 1989).

The liver resembles the lung because of its bilobar anatomy, a dual blood supply with both a venous and arterial source, and an important system of exchange with the outside environments (biliary and bronchial system) (Rappaport, 1982).

However, the liver's parenchymal mass exhibits many vascular and biliary intercommunications between the right and left systems. An example of the importance of these intercommunications is that biliary drainage of one lobe sometimes decompresses effectively the entire liver despite persistent obstruction of the other lobe (Meyers, 1991).

The liver can be divided into the right and left lobes; the right lobe contains 70 percent of the liver mass, and each segment of the left lobe makes up 15 percent (Reintgen and Sabiston, 1987).

Segmental Anatomy :

The distribution of the major branches of the veins, arteries, or bile ducts of the liver do not conform precisely with the topographic anatomy. The relationships between the hepatic veins and portal vein branches determine the lobar anatomy of the liver. The lobar anatomy of the liver is best demonstrated by direct injection of its blood supply with substances such as methylene blue or colored celloidin (Meyers, 1991).

The division of the liver into segments, which are delineated by fissures and the distribution of the vascular and ductal structures, has led to a much more aggressive approach to liver surgery (Fig. 3). The disposition of the fissures and the distribution of the hepatic pedicle (portal triad) allow the liver to be divided into segments, which may be resected singly or in combination (Ger, 1989).

A plane called the portal fissure passes from the left side of the gallbladder fossa to the left side of the inferior vena cava to divide the liver into right and left lobes (Fig. 4). The left lobe consists of a medial segment lying to the right of the falciform ligament and umbilical fissure plus a lateral segment to the left of the falciform ligament. The right lobe consists of an anterior and posterior segment. No visible surface marking designates this segmental separation (Meyers, 1991).

The main portal fissure divides the liver into left and right lobes. The right portal fissure divides the right lobe into anterior and posterior segments. The right hepatic vein courses in this fissure. The left portal fissure divides the left lobe into medial and lateral segments and contains the left hepatic vein. The middle hepatic vein is located in the main portal fissure between the right and left lobes (Rossi and Re Mine. 1991).

Instead of four, there are eight segments : four on the right, three on the left, and one corresponding to the caudate lobe. Segment I corresponds to the caudate lobe. Segments II to IV compose the left lobe, and Segments V to VIII the right. The three main hepatic veins divide the liver into four sectors (Meyers, 1991)

Portal vein :

Venous inflow to the liver is accomplished by the portal