ROLE OF SURGERY IN NEONATAL JAUNDICE

THESIS

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of

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INTRODUCTION AND AIM OF THE WORK

Jaundice is a problem during the first few days or weeks of life. This neonatal jaundice may be physiologic, which poses no threat of kernicterus and requires little therapy.

Newborns who are icteric at birth generally have a non physiologic type of jaundice which may be surgically amenable.

Surgically amenable jaundice should be corrected before three months of age and preferably by two months of age, to obviate the otherwise inevitable subsequent problems of cirrhosis, portal hypertension and liver failure.

So the aim of this work is to study the causes, diagnosis and the role which can be played by surgery in correction of neonatal jaundice.

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EMBRYOLOGY AND ANATOMY

Development of the biliary tree :

The human liver develops from three analgen (entoderm, splanchnic mesoderm, and coelomic mesoderm). The first anlage is derived from the entoderm and is the so-called "hepatic diverticulum." From its caudal portion, the extrahepatic bile ducts develop, with the gallbladder and cystic duct branching out as a side arm (Krant and Swenson, 1973).

Recent studies with the electron microscopy have clarified some of the controversial points about the development of the biliary tree.

The liver arises from an area on the ventral aspect of the gut, at the junction between the foregut and the midgut. This area appears first as a pared structure of entoderm, and later as a single pouch known as the hepatic diverticulum. The hepatic diverticulum is hollow and it freely communicates with the gut. A developing transverse furrow divides the hepatic diverticulum into a cephalic and a caudal portion. The cephalic part is termed pars hepatica and it gives rise to the liver and the hepatic and common hepatic ducts. The caudal portion of the hepatic diverticulum is the predecessor of the

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gallbladder and its cystic duct and it is termed the pars cystica. The common bile duct is derived from the antrum which is the common portion of the hepatic diverticulum.

Following the separation between the pars cystica and the pars hepatica, bridges of hepatic elements may still connect between these two structures. The pars cystica develops as a solid outgrowth, and later on it becomes a hollowed gallbladder by resolution of its epithelial contents.

From the pars hepatica cords of hepatic cells grow into the septum transversum. These cords are solid and they consist of two to five cells in thickness. Cords of two cells give rise to hepatic parenchyma, as well as to bile canaliculi. Cords of four to five cells in thickness change their morphology to become ductal cells and they form the bile ducts. The transformation of hepatic to ductal cells is induced by the presence of connective tissue in the septum transversum and in the portal spaces. The bile ducts then become hollow and the lumina become continuous with the lumen of the hepatic duct and hepatic antrum.

The theories that the parenchymal cell of the liver is derived from mesoderm and that the ductal system grows as a hollow system from the hepatic diverticulum have been

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disproved (Goor and Ebert, 1972).

In 1937 Schwegler and Boydon published their detailed studies on the sphincter of Oddi and the ampulla of Vater. The first signs of the sphincter of Oddi occur about the time the embryo reaches a length of approximately 26 mm. Concentric layers of mesenchymal cells make their first appearance at the end of the common bile duct and the pancreatic duct. The cells then differentiate into concentric muscle cells independent of the duodenal musculature. They gradually push into the mucosa in the region of the ampulla, producing the eminence that represents the common duct opening into the duodenum, namely, the papilla of Vater (Nora, 1980).

Gross Anatomy of the Liver:

The liver (hepar), the largest gland in the body, is situated in the cranial and right parts of the abdominal cavity, occupying almost the whole of the right hypochondrium, the greater part of the epigastrium, and not uncommonly extending into the left hypochondrium as far as the mammary line.

The adult liver, in male, weighs from 1.4 to 1.6 kilograms, in the female from 1.2 to 1.4 kilograms. It is relatively much larger in the fetus than in the adult,

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constituting, in the former, about one-eighteenth, and in the later about one thirty-sixth of the entire body weight. Its greatest transverse measurement is from 20 to 22.5 cm. Vertically, near its lateral or right surface, it measures about 15 to 17.5 cm; its greatest dorsoventral diameter from 10 to 12.5 cm is on a level with the cranial end of the right kidney. Opposite the vertebral column this measurement is reduced to about 7.5 cm. Its consistency is that of a soft solid; it is friable, easily lacerated and highly vascular; its colour is a dark reddish brown, and its specific gravity is 1.05.

It is irregularly hemispherical in shape with an extensive, relatively smooth, convex diaphragmatic surface and a more irregular concave visceral surface. The diaphragmatic surface has four parts : ventral, superior, dorsal, and right portions. The human liver has four lobes : a large right lobe, a smaller left lobe, and much smaller caudate and quadrate lobes.

Fissures and Fossae :

The left sagittal fossa (longitudinal fissure) is a deep groove in the visceral surface which extends from the notch on the inferior margin of the liver to the cranial border of the organ. It is not named in the North America but it is worthy of mention because it separates the right

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and left lobes. The porta joins it at right angles and divides it into two parts. The ventral part is the fissure for the ligamentum teres which lodges the umbilical vein in the foetus, and its remains (the ligamentum teres) in the adult; it lies between the quadrate lobe and the left lobe of the liver, and it is often partially bridged over by a prolongation of the hepatic substance, the pons hepatis. The dorsal part, or fossa for the ductus venosus, lies between the left lobe and the caudate lobe; it lodges in the fetus, the ductus venosus, and in the adult a slender fibrous cord, the ligamentum venosum, the obliterated remains of that vessel.

The porta or transverse fissure (porta hepatis) is a short but deep fissure, about 5 cm. long, extending transversely across the visceral surface of the left portion of the right lobe, nearer its dorsal surface than its ventral border. It transmitts the portal vein, the hepatic artery and nerves, and the hepatic duct and lymphatics.

<u>The fossa for the gallbladder (fossa vesicae fellae)</u>: It is a shallow, oblong fossa, placed on the visceral surface of the right lobe, parallel with the left sagittal fossa. It extends from the inferior free margin of the liver, which is notched by it, to the right extremity of the porta.

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The fossa for the inferior vena cava (sulcus venae cava):

It is a short deep depression, occasionally a complete canal in consequence of the substance of the liver surrounding the vena cava. It lies on the posterior surface between the caudate lobe and the bare area of the liver, and is separated from the porta by the caudate process. The orifices of the hepatic veins perforate the floor of this fossa to enter the inferior vena cava.

Lobes : The right lobe is six times as large as the left. It occupies the right hypochondrium, and is separated from the left lobe on its diaphragmatic surface by the falciform ligament, and by the left sagittal fossa on its visceral surface. It is of a somewhat quadrilateral form, its visceral and posterior surface being marked by three fossae the porta and the fossae for the gallbladder and inferior vena cava, which separate left part into two smaller lobes, the quadrate and the caudate lobes.

The quadrate lobe: is situated on the visceral surface of the right lobe, bounded ventrally by the inferior margin of the liver; dorsally by the porta; on the right, by the fossa for the gallbladder; and on the left, by the fossa for the umbilical vein. It is oblong in shape, its dorsoventral diameter being greater than its transverse diameter.

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<u>The caudate lobe</u> : It is situated upon the dorsal surface of the right lobe of the liver, opposite the tenth and eleventh thoracic vertebrae. It is bounded, inferiorly, by the porta; on the right, by the fossa for the inferior vena cava; and on the left, by the fossa for the ductus venosus.

The caudate process is a small elevation of the hepatic substance extending obliquely lateralward, from the lower extremity of the caudate lobe to the visceral surface of the right lobe.

<u>The left lobe</u>: It is smaller and more flattened than the right. It is situated in the epigastric and left hypochondriac regions. Its cranial surface is slightly convex and is molded to the diaphragm; its caudal surface presents the gastric impression and omental tuberosity (Gray, 1973).

<u>Segmental anatomy</u> :

One labor fissure is in line with the fissure of the inferior vena cava above and the fossa of the gallbladder below. This fissure takes an oblique course from left to right to the porta hepatis and divides the liver into two anatomical left and right lobes. The left segmental fissure divides the two left lobes into medial and lateral segments. The right segmental fissure divides

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the right lobe into an anterior and a posterior segment. Knowledge of this anatomy is particularly valuable in planning hepatic surgery.

Functional divisions of the liver :

The functional division into right and left lobes with respect to biliary drainage and vascular supply differs from the anatomically accepted right and left lobes. The line of functional division lies to the right of the attachement of the falciform ligament and follows an irregular line from the inferior vena cava obliquely across the upper surface of the liver to the tip of gallbladder. The functional right and left lobes are supplied by the right and left hepatic ducts and portal venous branches and drained by corresponding hepatic veins (Sherlock,1981).

Ligaments : The liver is connected to the under surface of the diaphragm and to the ventral wall of the abdomen by five ligaments; four of these - the falciform, the coronary and the two lateral - are peritoneal folds; the fifth, the round ligament, is a fibrous cord, the obliterated umbilical vein. The liver is also attached to the lesser curvature of the stomach by the hepatogastric and to the duodenum by the hepatoduodenal ligament.

Structure of the liver :

The substance of the liver or parenchyma is composed

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of lobules, held together by an extremely fine areolar tissue, in which ramify the portal vein, hepatic artery, hepatic veins, lymphatics, and nerves, the whole being invested by a serous and a fibrous coat.

The serous coat (tunica serosa) is derived from the peritoneum, and invests the greater part of the surface of the organ. It is intimately adherent to the fibrous coat.

The fibrous coat (areolar coat) lies beneath the serous investment, and covers the entire surface of the organ. It is difficult of demonstration, except where the serous coat is deficient. At the porta it is continuous with the fibrous capsule of Glisson, and on the surface of the organ with the areolar tissue separating the lobules.

The lobules (lobuli hepatis) form the principal mass of the parenchyma. Their outlines, about 2 mm. in diameter, give a mottled appearance to the surface of the organ. They are roughly hexagonal in shape, with their columns of cells clustered around an intralobular vein, the smallest radicle of the hepatic vein. The adjacent faces of these neighboring hexagonal (or more irregularly polygonal) lobules are fitted together with a minimum of delicate connective tissue. In the pig, the individual lobules have

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