BILIARY RECONSTRUCTION

An Essay

Submitted for the Partial Fulfilment of
The Master Degree in *General Surgery*

By

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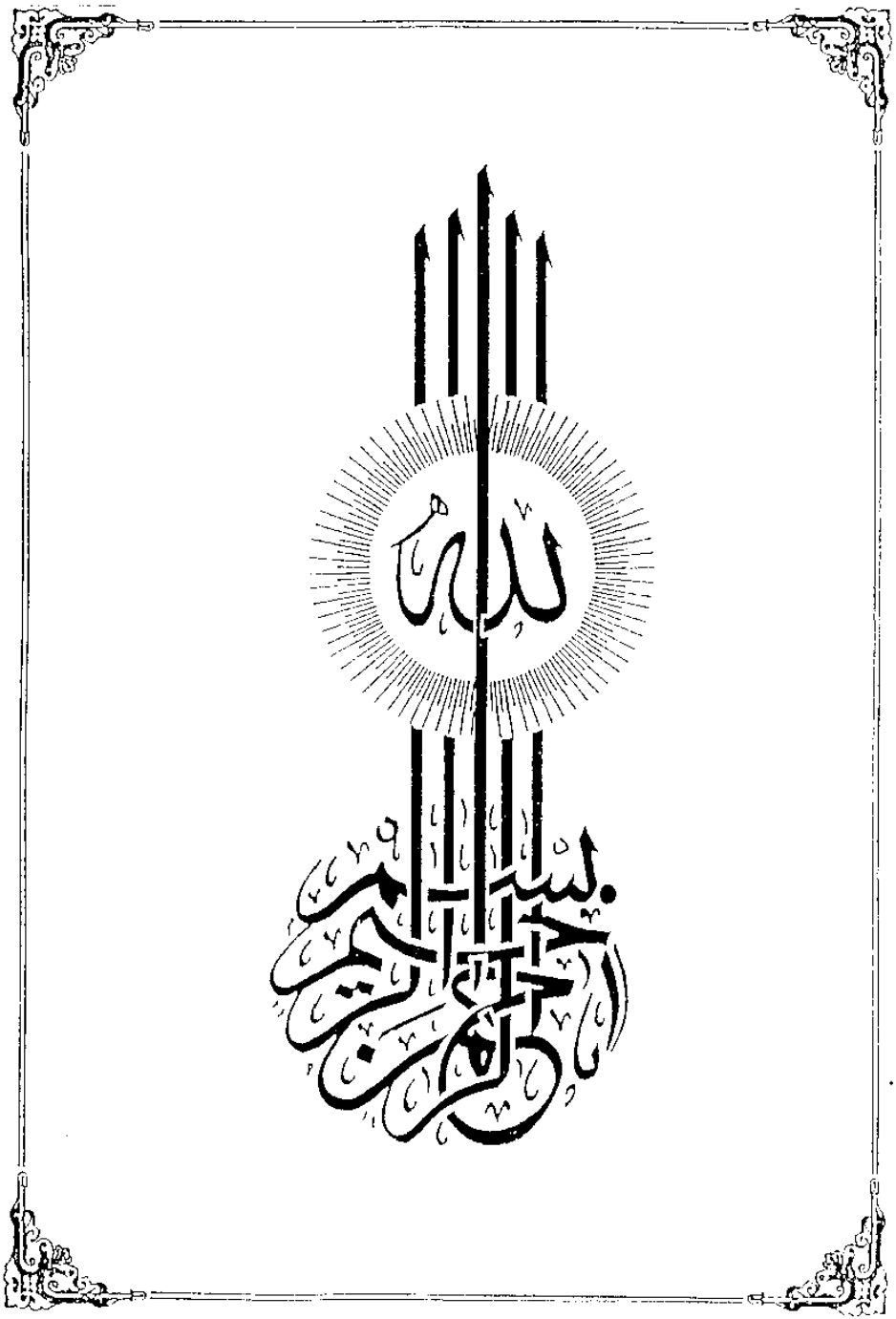
1987

To My Parents



ACKNOWLEDGEMENT

I would like to express my deepest gratitude to Prof. Mohey El Din Sedky, Professor of General Surgery, Faculty of Medicine, Ain Shams University for his kind supervision, constant encouragement, valuable direction and guidance through such a controversal subject.

I must express my very deepest appreciation to Dr. Mohamed Abdel Moneim, Lecturer of General Surgery, Ain Shams University for his skilled, dedicated and kind help.

Also, I appreciate the efforts done by many members of section (6) surgery at El Demerdash Hospital in leading profitable discussion, collecting references, and revision of the work.

Dr. Emad Abd El Aziz Hussien

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INTRODUCTION

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Only one hundred years ago, Langenbuch carried out the first cholecystectomy and shortly afterwards choledochotomy was performed. While the development in anaesthesia, blood transfusion, and antibiotics have made surgical approaches to the abdominal viscera possible and safe, more specific advances and particularly in diagnostic radiology have opened the door to precise and ever-advancing approaches to diseases of the biliary tree.

This essay attempts to bring together the different surgical techniques that are used in biliary tract reconstruction with a critical appraisal of these techniques. It summarizes the current opinion in biliary tract surgery as practiced by contemporary experienced surgeons. No attempts has been made to reconcile conflicting opinions. The reader should find many things to agree with, a good deal to learn and a great deal to debate.

ANATOMY

APPLIED SURGICAL ANATOMY OF THE BILIARY TRACT

Biliary anatomy first become of practical importance to surgeons towards the end of the last century, following the first cholecystectomy by Carl Langenbuch in 1882 *(Glenn & Frafe 1966)*. In 1900 George Emerson Brewer of the Mount Sinai Hospital, noting the "many new and ingenious operative procedures" being carried out on the biliary tract, produced one of the first practical guides to the surgical anatomy of this region. Confronted with this developing surgical challenge, he performed 160 dissections "to educate his tactile sense for recognition of structures which, during operation, are often concealed from view or rendered visible only with difficulty. The modern surgeon, with excellent anaesthesia, muscle relaxation and good lighting at his command, enabling him to use direct vision rather than his sense of touch to demonstrate the biliary anatomy, must surely be grateful.

Following Brewer's work, the first half of this century saw the publication of many studies which amply demonstrated the enormous range of individual variations that so characterizes this region *(Flint, 1923; Friend, 1929; Michels, 1955)*; indeed the well-read surgeon of today can be forgiven if he remains baffled by the complexities reported in the literature. More recently, however, several surgeons have stressed the limited surgical usefulness of much of this data, preferring to emphasize the important major variations *(Benson & Page, 1976; Kune & Sali, 1980)*.

Embryogenesis of the Biliary Tract

Normal Development

In the course of the fourth week of gestation, the embryogenic foregut, at its junction with the midgut, gives rise to the hepatic diverticulum. From the distal end of the diverticulum develops the parenchyma of the liver; the extrahepatic biliary tract and the gall bladder form from the proximal portion. By the start of the fifth week, all the parts of the systems are indicated. During this stage, the future duct system, like the duodenum itself, is a solid cord of cells.

Toward the end of the fifth week, growth of the left side of the duodenum initiates a shift of the attachment of the liver and the two pancreatic diverticula to their final position on the dorsal surface of the duodenum. During the sixth week, the lumina of the ducts become established starting with the common bile duct and progressively extending to the remainder of the system. The gallbladder remains solid until the twelfith week. During the process of recanalization, two or three lumina may appear and eventually coalesce. This pattern of solid stage followed by recanalization parallels the changes in the duodenum, but strangely, no solid stage appears in the pancreatic ducts.

More than one duodenal opening of the common bile duct is not unusual at this stage. The lower one vanishes.

The proximal portion of the hepatic diverticulum, the future common bile duct, becomes absorbed into the expanding duodenum so that the bile and pancreatic ducts enter the wall together. In most individuals, the

dividing septum between the two passages retracts to leave a common ampulla of variable length *(Skandalakis, Gray & Rowe, 1983).*

Anatomical "normality" in the biliary tree

Normality, in the sense of an anatomical pattern which is repeated in the majority of individuals, is a term which cannot be used in relation to the biliary tree *(Benson & Page, 1976).* Variation is such that less than 50%. of individuals exhibit a pattern common in even major details. Any attempt to define the "normal" anatomy of the biliary tree, therefore, would be artificial and misleading, so each major area of the extrahepatic biliary tree and its related vessels will be considered separately, and the more important variational groups described.

Bile ducts at the Liver Hilum

The ducts in the hilum may be encountered either deliberately during partial hepatectomy or when dealing with a tumour or stricture at the porta hepatis, or accidentally in the course of a difficult cholecystectomy. It's important to note that some portion of both the right and left hepatic ducts, and hence their confluence, are always, extrahepatic and, therefore, accessible at the porta *(Kune & Sali, 1980).*In Some cases portions of the major tributaries of the right and left ducts are also outside the liver (Fig. 1-1).

Right Hepatic Duct (RHD)

Just as the bronchial tree has a fairly constant pattern of branches, so have the intrahepatic bile ducts. *Hjortsjo (1951)* and later *Healey and Schroy (1953)* clearly demonstrated that each area of the liver has its own, nameable bile duct, and that the area ducts drain into major segmental ducts.

The functional right lobe (that part of the liver to the right of the lobar fissure marked by gallbladder fossa and inferior vena cava) compromises two segments, anterior and posterior. In 75% of individuals the right anterior and posterior segmental ducts join to form a true right hepatic duct, i.e. a single channel carrying the whole bile output of the functional right lobe; in the remaining 25% there is no true RHD, the segmental ducts emptying into the left hepatic duct (LHD) separately (Fig. 1-1) *(Healey & Schroy, 1953; Balasegarem, 1970; Kune & Sali, 1980).* This important point has bearing on the question of so-called "accessory" bile ducts and will be referred to below.

Among those individuals (75%) in whom a true RHD is present, it is wholly, extrahepatic in but a few. The extra hepatic segment is of variable length, being 1.0 - 2.5 cm long in 80% of cases, but may be up to 6 cm in length *(Johnston & Anson, 1952; Kune & Sali, 1980).*

The RHD is readily approached by dividing the peritoneum and fat overlying it in the porta hepatis. The right hepatic artery usually runs inferior to it, while the right branch of the portal vein lies posterior to these structures.

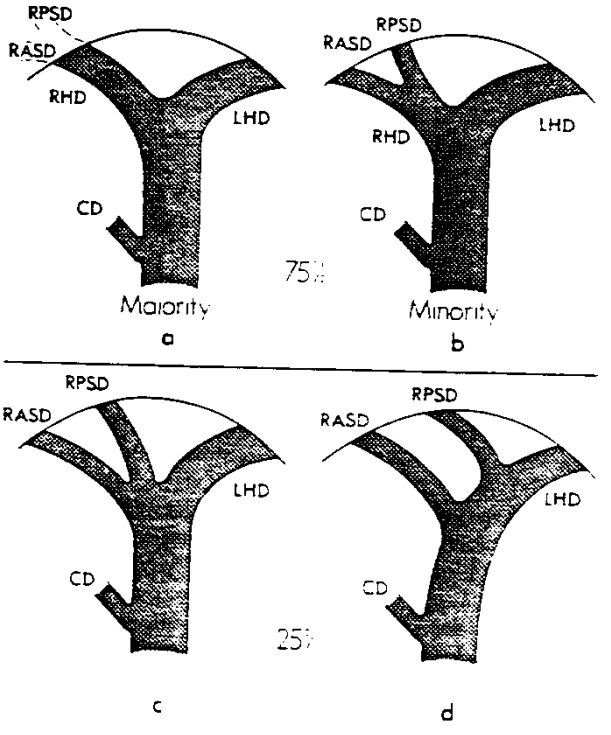

Fig. 1-1: Patterns of formation of hepatic ducts. A true right hepatic duct (RHD) is present in 75% of individuals, usually formed within the liver (a), but sometimes outside (b). In 25% no ture RHD is found, the segmental ducts forming a triple confluence with the LHD (c) or joining it separately (d). In the latter instance, the RASD has in the past been wrongly designated an "accessory duct". RASD = right anterior segmental duct; RPSD = right posterior segmental duct; RHD = right hepatic duct; LHD = left hepatic duct; CD = cystic duct.

"Accessory" Bile Ducts

Flint introduced the term "Accessory bile ducts" in 1923 having found a structure in 15% of individuals which issued from the right lobe of the liver and entered the common hepatic duct (CHD) distal to the termination of the "true" RHD. Since then many other authors have reported such "accessory" ducts, usually in 10-30% of individuals, so that the term has become established in the nomenclature and minds of surgeons.

However, since the first description of the segmental pattern of liver drainage, several authors have shown that "accessory" bile ducts occur in that group (approximately 25% of the population) in whom no true RHD exists- the "extra" or the "true" RHD in these individuals are, in fact, the two major segmental ducts from the right lobe draining separately into LHD (Fig. 1.1c and 1.1d) *(Healey & Schroy, 1953; Hobsley, 1958; Kune, 1970).* Damage to an "accessory" duct will affect the bile drainage of a definite portion of the liver, while inadvertent, unnoticed division will lead a sustained bile leak which may threaten the patient's life*(Kune & Sali, 1980).*

In short, the term "accessory" in this content (defined in Blakiston's Gould Medical Dictionary (1972) as pertaining to "a lesser organ or part which supplements a similar organ or part" is both erroneous and dangerous, and should be dispensed with.

Left Hepatic Duct

This structure is hardly ever seen during routine cholecystectomy, though it can be damaged during this procedure *(Warren et al., 1971).* Unlike the right lobe, the left lobe of the liver is always drained by a single channel.

the true left hepatic duct, and in most cases all its tributaries are intrahepatic *(Healey & Schroy 1953, Kune & Sali, 1980)*. The left hepatic artery usually runs below or behind the LHD, while the left branch of the portal vein may, unlike the right branch, partly spiral around the upper border of its hepatic duct to form an anterior relation of the latter as the two structures pass into the liver substances *(Hobsley, 1958)*.

The confluence of Hepatic Ducts

The point at which the right and left hepatic ducts join is often known to surgeons as "bifurcation". From a functional standpoint, however, the term confluence is more accurate; further; as "bifurcation" suggest two "branches, this term is especially inappropriate and misleading in those 25% of individuals in whom two right segmental ducts open separately into the left hepatic duct (Fig. 1.1c and 1.1d).

The confluence is always accessible in the normal individual, beneath the peritoneum in the porta hepatis; infrequently it is over laid by the right hepatic artery. Sometimes the right and left hepatic ducts have a long extrahepatic course, so that the confluence may lie well down into the free edge of the lesser omentum where it is liable to damage during cholecystectomy.

Common Hepatic Duct (CHD)

This bile duct segment is of enormous surgical importance being involved in two thirds of post-operative strictures *(Warren et al., 1971)*. It is formed by the final confluence of all ducts issuing from the liver and ends