



A CADAVERIC STUDY ON VARIATIONS OF THE COMMON HEPATIC DUCT

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ABSTRACT Variations in the anatomy of extrahepatic biliary apparatus (EHBA) has been a subject of extended research due to its clinical implications. Cholecystectomy is the commonly performed abdominal surgeries and its safety requires the adequate appreciation of anatomical abnormalities of the extrahepatic biliary tree to decrease the morbidity and mortality of the surgery. Abnormalities of the major ducts and presence of accessory ducts give rise to preoperative difficulties and postoperative complications. **Background & objectives:** To study the normal anatomy of common hepatic duct and its variations. **Methods:** With the aim of the above study, a prospective descriptive study was conducted on 55 specimens with reference to the ducts. Different parameters were used as union of right and left hepatic ducts and common hepatic duct measurements and looked for variations such as accessory hepatic ducts. **Results & discussion:** Extrahepatic union of right and left hepatic ducts seen in 98% cases and intrahepatic union in 2%. Length of common hepatic duct varied from 1.5 to 4.7 cm with an average of 2.9cm. Accessory hepatic ducts were seen in 7 cases (13%) in which 2 joined the common hepatic duct, 1 joined LHD and 3 were to the cystic duct. **Conclusions:** All the findings of the ducts are to enlighten the anatomical knowledge of the anatomists, general and laparoscopic surgeons, oncologists and to the transplant surgeons which are abundantly useful.

KEYWORDS : Right and Left Hepatic Ducts, Common Hepatic duct, Accessory Hepatic ducts

INTRODUCTION

Extra hepatic biliary tract collects the bile from the liver and drains it into the second part of the duodenum. The components of EHBA are right and left hepatic ducts, common hepatic duct (CHD), gall bladder, cystic duct (CD) and common bile duct (CBD). Right and left hepatic ducts carry bile from right and left physiological lobes of liver respectively. They emerge at the porta hepatis anterior to branches of portal vein and hepatic artery. Common hepatic duct (CHD) is formed by the union of right and left hepatic ducts near the right end of porta hepatis. It is 3cm long and is joined on the right side by the cystic duct from the gall bladder to form common bile duct. Cystic duct begins at the neck of gall bladder and joins the common hepatic duct to form CBD. The common variations of extra hepatic biliary tract are intra hepatic union of right and left hepatic ducts, accessory hepatic duct, different mode of termination of common hepatic duct, cystic duct and common bile duct. Anatomical variations of the extrahepatic bile ducts are important during surgical procedures such as laparoscopic cholecystectomy, liver resection (hepatectomy, segmentectomy) and living donor transplantation. The incidence rate of biliary tract injury by laparoscopic cholecystectomy has been found up to three times higher than the open cholecystectomy. The incidence of surgical complications such as iatrogenic bile duct injuries has increased with the gradually increased number of cholecystectomy. Laparoscopic cholecystectomy as the "gold standard" procedure and mini-cholecystectomy as the time saving treatment of cholelithiasis. Variant biliary anatomy is more common in the right lobe and although such variations are not a strict exclusion to transplantation, they often require modifications in the surgical technique. Variations in the anatomy of gallbladder, bile ducts and the arteries that supply them and liver are important to the surgeon because failure to recognize them may lead to inadvertent ductal ligation, biliary leaks, haemobilia, haemorrhage and strictures after laparoscopic or open cholecystectomy and may complicate surgeries, such as liver transplantation. Congenital anomalies of extra hepatic biliary tree such as aberrant or accessory biliary ducts have long been recognized but are rare. Accessory hepatic ducts are normal segmental ducts that join the biliary system outside the liver instead of within it. Most commonly it opens in to common hepatic duct. Recognition of these entities as anomalies and normal variants may avoid diagnostic errors, aid in surgical planning, and prevent inadvertent ductal injury^{1,19}.

MATERIALS AND METHODS

This study on common hepatic duct was undertaken in 55 adult cadavers (51 male and 4 female). The study of the adult cadavers was undertaken in the specimens assigned for dissection of undergraduate students of Government Medical College, Kozhikode for a period of 3 years. Study design : Descriptive study. Study method : Dissection method.

METHODOLOGY

In the present study a total number of 55 human livers with gallbladder and its duct system with related ligaments, duodenum and head of the pancreas were collected from the cadavers. The hepato-duodenal ligament was opened by tracing the bile duct upwards and to secure the

point where the cystic duct and common hepatic duct unites. Cystic duct traced upwards up to the neck of gallbladder. Common hepatic duct was traced upwards to locate the right and left ducts emerging from porta hepatis. All the specimens were numbered and length of CHD was measured from the point of union of RHD and LHD to the point of union of cystic duct with CHD with the help of measuring scale. During the above procedure the mode of formation of the duct system, the course and arrangement of the ducts and the mode of termination were studied. Photographs of all the specimens were taken. This study was limited only to the variations in the hepatic duct pattern in its extra hepatic course.

The study was conducted using following parameters.

Inclusion criteria: Macroscopically healthy and undamaged liver with intact gall bladder and other components of EHBA from cadavers of both sexes were included in the study.

Exclusion criteria: Samples with liver trauma affecting EHBA, burns, hepatobiliary surgery, cholecystectomy, cirrhosis of liver and all pathological livers were excluded.

RESULTS

Extrahepatic union of right and left hepatic ducts were seen in 98% cases and intrahepatic union in 2%. In the present study, 53% of the cases (n=29) the length of common hepatic duct was 3-4 cm, in 38% cases (n=21) the length was below 3 cm (1-3 cm) (Fig 2). In 5 cases the length was >4 cm (9%) (Fig. 1). Length of common hepatic duct varied from 1.5cm to a maximum of 4.7 cm, with an average of 2.9 cm.

Accessory hepatic ducts were seen in 7 cases (13%) in which 3 joined the common hepatic duct (Fig.1), 1 joined LHD (Fig. 3) and 3 were to the cystic duct (Fig. 4,5,6).

Table 1. Length of common hepatic duct

Length of CHD	Number of cases	Percentage
<3 cm	21	38
3-4 cm	29	53
>4 cm	5	9
Total	55	100



Fig. 1: Long CHD (5cm) with accessory hepatic duct (AHD)



Fig. 2: Short CHD (1.5cm)

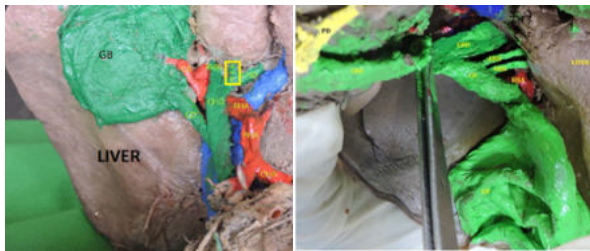


Fig. 3 : Accessory hepatic duct (AHD) to LHD

Fig. 4: Accessory hepatic duct (AHD) to cystic duct (CD)

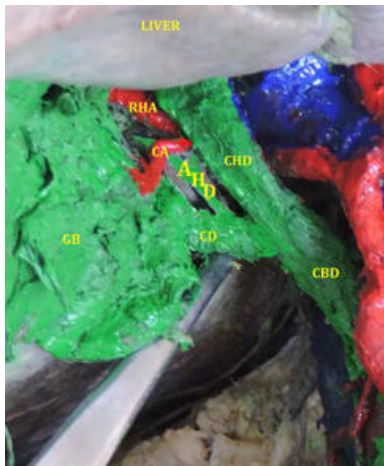


Fig. 5: Accessory hepatic duct (AHD) to CD

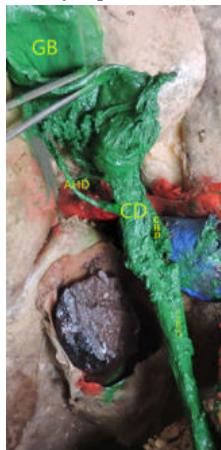


Fig. 6: AHD to CD

DISCUSSION

The findings of intra hepatic union of right and left hepatic ducts in 49 cases (98%) and intrahepatic union in one case (2%) is similar to the findings reported by Eisendrath² in 1920. In his study, extra hepatic union of ducts were seen in 100 cases and there was no case of intra hepatic union.

Ruge.E.³ (1908) demonstrated 34 extra hepatic union & 9 intra hepatic union of ducts and 11 accessory hepatic ducts (26%) in his study on 43 dissected specimens. Compared to his study, the presence of accessory hepatic ducts were few in the present study (13%).

Study by S G Puente⁴ (1944) in 3845 cases also had the same result as the present study where intra hepatic union of ducts were seen in 3768 cases (98%) & extra hepatic union only in 2% cases and no accessory hepatic ducts were demonstrated.

Johnson and Anson⁵ (1952) mentioned that extra hepatic union was the rule in 94% of their cases, which co-incides with the present study findings. Unlike the present study, Anupama⁶ et al (2016) demonstrated intra hepatic union (IHU) of ducts in 54% of cases (n-27) & extra hepatic union (EHU) in 46% cases (n-23) in a total number of 50 cases. The length of common hepatic duct varied from a minimum of 0.7 cm to a maximum of 3.5 cm, with an average of 2.5 cm in their study. Demonstrated only 2 cases of accessory hepatic ducts (4%), in which one right accessory hepatic duct drained in to confluence and to common hepatic duct in another.

Table 2. Comparison of formation of common hepatic duct (CHD)

Author	No of cases	Formation of CHD	
		EHU	IHU
1. Eisendrath ²	100	100	-
2. Ruge ³	43	34	9
3. S G Puente ⁴	3845	3768	77
4. Anupama ⁶	50	23	27
5. Present study	55	54	1

The length of common hepatic duct varied from a minimum of 1.5cm to a maximum of 4.7 cm, with an average of 2.9 cm in the present study is similar to the findings reported by Anupama⁶ et al. In a study by Henry Hollinshead⁷ in 1954 demonstrated the length of common hepatic duct was between 2.5 and 7.5 cms. Eduardo Cachoeira, Antonio Rivas⁸ et al (2012) studied 41 samples from fixated human cadavers and their findings were the length of the common hepatic duct varied between 0.42 cm and 5.1 cm, with an average of 2.2±0.95cm.

Table 3. Comparison of length of the common hepatic duct

Author	Length of CHD(cm)	Average
1. Anupama ⁶ et al	0.7 cm to 3.5 cm	2.5 cm
2. Henry Hollinshead ⁷	2.5 to 7.5 cm	-
3. Eduardo Cachoeira ⁸	0.42 cm to 5.1 cm	2.2 ±0.95
4. Present study	1.5 to 4.7 cm	2.9 cm

Dowdy⁹ in 1962 studied 100 cases which showed accessory hepatic ducts in 15 cases (15%). The findings of 13% accessory hepatic ducts in the present study is similar to his result. Brewer¹⁰ in 1903 studied 57 cases and he could demonstrate accessory hepatic ducts in 5 cases (8.7%). Compared to the present study, the number of accessory hepatic ducts were few in this study.

E.R.Flint¹¹ (1922-23), demonstrated 29 accessory bile ducts (14.5%) in his work on 200 subjects. All were accessory right hepatic ducts, joining the extrahepatic ducts, any where between the point of the junction of right and left hepatic ducts and the point at which the cystic duct opens into the main duct. Present study result is also similar to the findings by E.R.Flint.

In his study in 500 cases, Edward H. Daseler¹² (1947) demonstrated accessory right hepatic duct entering the common bile duct in 1 case, accessory right hepatic duct draining to cystic duct in 3 cases and cystic duct draining directly into the right hepatic duct in 3 cases. He found small hepatic duct from the right or quadrate lobes of liver which drained into common hepatic duct in 2 cases. Cystic, right and left hepatic ducts joined together at a common point of fusion so that no common hepatic duct was formed in 1 case. In the present study, the finding of 3 accessory hepatic ducts entering the cystic duct and 2 ducts joining the common hepatic duct are similar to the findings of Edward

H. Daseler study. No cases of cystic duct draining directly into the right hepatic duct or accessory ducts joining common bile duct were seen in the present study. In the present study, an accessory duct joining left hepatic duct was seen. Rajashekhar Y Dundaraddy¹⁵ et al (2012) could demonstrate only 2 accessory hepatic ducts (5%) in 40 specimens. In her study, T.Sobha devi¹⁴ et al (2013) demonstrated five cases of accessory hepatic ducts (10%) in 50 cadavers, in which 2 accessory hepatic ducts from the right lobe of liver joined the body of gall bladder and in 3 cases accessory hepatic duct from the right lobe of liver drained into common hepatic duct.

Dragica Jurkovicj¹⁵ (2011) reported 2 cases of accessory hepatic ducts in a study using casts in 13 specimens (15%). One of the accessory hepatic duct was draining into the CHD and the other joined the cystic duct. In his study on 50 cadavers, Satarupa Paul¹⁶ et al (2013) found cystic duct in 1 specimen draining to the CHD on the left side and accessory hepatic ducts were seen in 3 cases (6%). In all these specimens the accessory hepatic duct arose from the inferior surface of the right lobe of the liver and drained into neck of the gallbladder. In the present study, no cases of accessory hepatic ducts were seen draining into the gall bladder or cystic duct joining the common hepatic duct.

Seyed Hassan Eftekhari-Vaghefi¹⁷ et al (2014) studied 150 cadavers and reported anatomic variants of biliary tree. In 6 cases (4%) did not have a common hepatic duct. No cases of absence of common hepatic duct were seen in the present series.

In a prospective study in 513 cholangiograms by Kullman E¹⁸ (1996), anatomical aberrations of bile ducts were found in 98 cases that is 8.4%. The aberrant bile ducts opened into cystic duct. This study findings are similar to the present study where 3 cases (6%) of accessory hepatic ducts opening to the cystic duct were seen.

Table 4. Comparison of variations of common hepatic duct

Author	No of cases	No of AHD
1. Ruge.E ³	43	11
2. Puente ⁴	3845	-
3. Anupama ⁶ et al	50	2
4. Dowdy ⁹	100	15
5. Brewer ¹⁰	57	5
6. E.R.Flint ¹¹	200	29
7. Rajashekhar YDundaraddy ¹⁵	40	2
8. T.Sobha devi ¹⁴ et al	50	5
9. Satarupa Paul ¹⁶ et al	50	3
10. Present study	55	7

In a descriptive study done by Bladimir Saldarriaga Tellez¹⁹, the length of the common hepatic duct (CHD) was 2.86 ± 1.14 cm in 33 samples and the accessory hepatic ducts (AHD) were found in three samples (9.1%).

CONCLUSION

Anatomical variations of extrahepatic biliary apparatus are common and their thorough understanding is clinically important for surgeons to avoid iatrogenic injuries during hepatobiliary surgery such as laparoscopic cholecystectomy, liver resection and living donor transplantation. Surgery carried out in ignorance of anomalies can result in major complications such as leakage of ducts or atrophy of liver. Therefore, it is important to have a thorough knowledge in successful detection and recognition of such anatomic variations thereby decreasing morbidity and mortality rates during hepatobiliary surgery.

Abbreviations used:

EHBA : Extrahepatic biliary apparatus
LHD : Left hepatic duct
RHD : Right hepatic duct
CHD : Common hepatic duct
CD : Cystic duct
CBD : Common bile duct
AHD : Accessory hepatic ducts

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