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Original Research Article

Biliary ductal variations and its clinical implications: a cadaveric study

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ABSTRACT

Background: Biliary ductal region being frequently abnormal has been the subject of research since long time for anatomists, surgeons and radiologists as well.
Methods: The present study was carried out in the department of Anatomy at PGIMS, Rohtak on 50 specimens of liver taken unblock with associated structures.
Results: Accessory hepatic and accessory cystic ducts were observed in 4% cases each. 2% cases exhibited abnormal low fusion of cystic duct with common hepatic duct.
Conclusions: These anomalies may add to postoperative complications if ignored. Present study is a step in the direction of creating awareness about these variations among the clinicians.

Keywords: Accessory, Biliary, Hepatic

INTRODUCTION

Extrahepatic biliary tract is comprised of cystic duct, right and left hepatic duct, common hepatic duct and common bile duct. It is known for the transportation of bile from liver to 2nd part of duodenum. Accessory bile ducts are among the well-known variations of this region. These are narrow channels running from the right lobe of the liver in to the anterior surface of the body of the gall bladder usually. In cases, the cystic duct opens into an accessory hepatic duct rather than in to the common hepatic duct.[1]

Persistence of fetal connection between liver and gall bladder or delayed division of hepatic antrum into hepatic and cystic diverticula may lead to accessory ducts.[2] Knowledge of the embryonic development is helpful in understanding the location and pattern of anomalies of the biliary duct system.[3]

These anomalies may add to operative difficulties during cholecystectomy and due to the scarcity of studies of this regional anatomy, the exact incidence of such variations is not known. The present study is a humble attempt to reinforce awareness among clinicians and anatomists regarding ductal variations in order to reduce postoperative morbidity and mortality.[4]

METHODS

The present study was conducted on 50 adult Human cadavers in the department of Anatomy in collaboration with the department of Forensic Medicine and department of Surgery, BD Sharma PGIMS, Rohtak, India during medico-legal autopsies done in the

department of Forensic Medicine after taking informed consent. After a vertical midline incision, the abdomen was exposed layer by layer. Specimens were collected as block dissection of the liver along with its associated structures. Each specimen was thoroughly washed to remove blood clots and after cleaning from surrounding fascia, it was fixed in 10% formalin for 24 hours. Further dissection was done to identify all the structures. Photographs of specimens showing variations were taken and if accessory ducts got noticed, their length and diameter recordings were taken with the help of Vernier caliper.

RESULTS

5 specimens displayed ductal variations. Four specimens out of 50 showed accessory bile ducts: accessory cystic and accessory hepatic duct (2 specimens each). The incidence turned out to be 4% for the same. In one specimen, there was an abnormal low fusion of cystic duct with common hepatic duct (Table 1).

Table 1: Incidence (%) of biliary ductal variations/anomalies.

Anomalies	Frequency	% incidence
Accessory hepatic duct	2	4%
Accessory cystic duct	2	4%
Abnormal low fusion of cystic duct with common hepatic duct	1	2%

One case showed abnormal low fusion of cystic duct with common hepatic duct thereby the common hepatic duct was much longer and common bile duct length was much less. The length, diameter and pathway followed by these accessory ducts as observed in the present study were as follows:

Table 2: Length, diameter and pathways of accessory ducts.

Accessory duct	Length (in cm)	Diameter (in mm)			Pathway
		At origin	Mid-point	Entry point	
Accessory hepatic duct	1.8	1.7	1.79	1.81	In one specimen, out of 50 cases studied, an accessory hepatic duct was observed arising from right lobe of liver which then traversed downward towards left to join common hepatic duct at the union of right and left hepatic ducts (triple confluence)
Accessory hepatic duct	1.03	1.02	1.06	1.12	Besides the above-mentioned specimen, one more specimen showed accessory hepatic duct arising from the right lobe of liver; which followed a downward course towards left to join common bile duct on the right side.
Accessory cystic duct	2.4	0.69	0.73	0.9	In one specimen, an accessory cystic duct was observed to arise from the neck of gall bladder which then traversed downward to join the common hepatic duct.
Accessory cystic duct	2.1	0.4	0.41	0.48	One more specimen showed an accessory cystic duct arising from the neck of gall bladder which ran obliquely to join common hepatic duct on the right side.

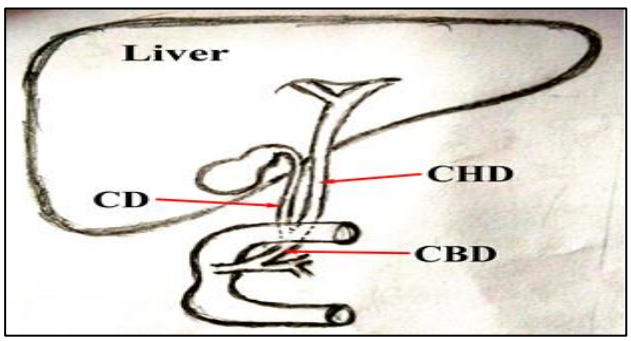

Figure 1: Schematic diagram of cystic duct (CD), common hepatic duct (CHD), common bile duct (CBD).

DISCUSSION

Misinterpretation of normal anatomy and anatomical variations during surgical and endoscopic procedures may contribute to major postoperative complications like biliary injuries thereby implicating that detailed knowledge of anatomical variations in hepato-biliary system is required.

The hepatic diverticulum arises from the ventral side of developing duodenum, during the 4th embryonic week which further divides into cranial (pars hepatica) and caudal parts. The cranial segment develops into liver and intrahepatic ducts, while gall bladder and extrahepatic biliary ducts develop from the caudal segment. The

proximal portions of anastomosing hepatic cell cords form the hepatic ducts. Most of these are absorbed except the more proximal ones which coalesce to form the future common hepatic duct. Incomplete absorption of these multiple primordial extrahepatic ducts is thought to give rise to accessory bile ducts.[1,5]

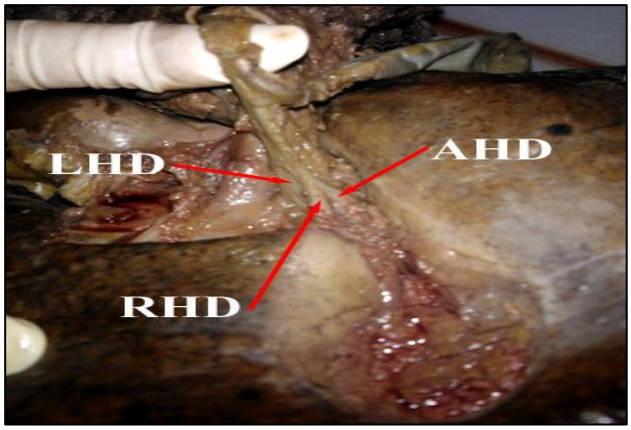

Figure 2: Left hepatic duct (LHD), right hepatic duct (RHD), accessory hepatic duct (AHD).

Hepatic cystic ducts comprise of an anomalous junction between the gall bladder and the hepatic ducts where instead of common bile duct, the cystic duct directly drains the entire biliary tract into duodenum. Cases of hepatic cystic ducts had been reported in the literature by Aristotle et al, Losanoff et al and Adkins et al. No such anomaly was noted in the present study.[6-8]

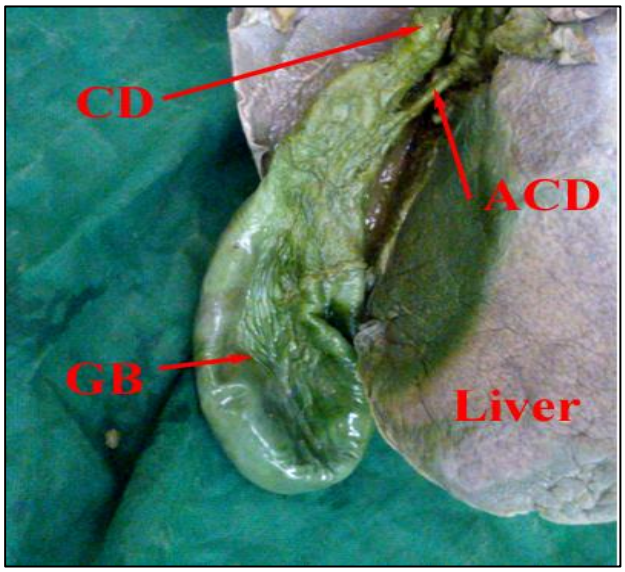

Figure 3: Gallbladder (GB), cystic duct (CD) and accessory cystic duct (ACD).

Accessory hepatic ducts may be present and awareness of its possible presence is of surgical importance. There is a wide variation in its incidence varying from 0.67 to 31% as shown in the table below.

Table 3: Comparison of incidence of accessory hepatic ducts as reported by various authors.

Authors	% of accessory hepatic ducts
Khamiso et al[9]	0.67%
Flint et al[10]	15%
Lichtenstein et al[11]	10%
Johnston et al[12]	31%
Uchiyama et al[13]	2.9%
Shobha devi et al[14]	10%
Taourel et al[15]	9%
Rajguru et al[16]	5%
Delic et al[17]	2.5%
Izuishi et al[18]	16%
Present study	4%

Accessory hepatic ducts were noted in 2 cases (4%) in the present study and this incidence was less as compared to most of the studies cited above. However, it was more than the study of Khamiso, Delic and Uchiyama. This observation was in accordance with the study done by Rajguru et al (5%).

In the present study, 2 out of 50 specimens were showing accessory cystic ducts (4%) which were less in incidence as compared to the finding of Dundaraddy and Mahesh (8%). Failure to recognize such unusual anatomic relationships or vestigial ductal structures like accessory ducts can cause serious injuries to the ducts during operative procedures thereby leading to bile leakage, peritonitis, shock etc and in turn contributes to morbidity and mortality.[19]

In the present study in one of the specimen an accessory hepatic duct was found to open just above the junction of union of right hepatic duct and left hepatic duct amounting to the incidence of 2%. Mariolis-Sapsakos et al categorized this pattern as triple confluence of right anterior and right posterior segments of right hepatic duct with left hepatic duct and reported this in 9.59% cases. Taourel et al, Dohke et al and Mortelem and Ros also reported this observation in 11% cases which was significantly higher than the present study[15,20-22].

Talpur et al reported short cystic ducts (length <1cm) in 2.67% of cases. Nigam et al reported this in 16% cases but no such variation was noted in the present study.[23,24]

Bernard et al reported a case of double common bile duct. Lamah et al reported cases of duct dividing into two channels which opened separately into 2nd part of duodenum. In his review, he had come across 47 cases of double common bile duct. No such findings were observed in the present study.[25-27]

Low fusion of cystic duct with common hepatic duct had been reported in 8% to 11% cases in previous studies which was significantly higher than present study (2%).

Failure to recognize such variation may result into surgical errors.[15.28,29]

To the best of our efforts, we could not find data related to dimensions of accessory biliary ducts, thus the present study is not compared with any other study. This study thus may be a turning stone in providing valuable data in this context

CONCLUSION

The extra-hepatic biliary apparatus being highly variable can cause great problem to surgeons during hepatobiliary surgeries. Lack of recognition of them can cause complications such as leakage or liver atrophy. The focus of present study was on possible occurrence of ductal anomalies and adding to anatomical literature thereby laying down emphasis on accurate appreciation of such anatomic variations.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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