Variation of Cystic Duct Insertion in Relation to the Extrahepatic Ducts and Observed Frequency of Double Lumen Apparent Common Bile Duct

AbeshaAmbaye[1], MueezAbraha[2],Bernard A. Anderson[2], Amanuel T. Tsegay[1]

Anatomy Course and Research Team, Institute of Biomedical Sciences,
College of Health Sciences, Mekelle University
Dep't of Anatomy, College of Medicine and Health Sciences,
University of Gondar, Ethiopia
email -theamanuel18@gmail.com

ABSTRACT

Background: Variations in the pattern of the extra hepatic biliary tract are common and usually encountered during radiological investigations or during operations on the biliary tree. Having a good knowledge of the possible connections of the cystic duct with the common hepatic duct to form the common bile duct is very important; because variation in this area is common.

Objectives: The main aim of this study is to evaluate the frequency of anatomic variations of the cystic duct insertion in relation to the extrahepatic ducts and Observed Frequency of Double Lumen Apparent Common Bile Duct

Methods: Institutional based cross-sectional study design with observational data collection tool was conducted in 25 Ethiopian fixed cadavers and Forensic autopsy specimens obtained from Departments of Human Anatomy at University of Gondar, Mekelle and St. Paul Hospital Millennium Medical College

Result: From the total 25 specimens dissected 9 (36%) had the ACBD and the 16 (64%) of them had CBD with one lumen.

Conclusion: The billiary system formation is very variable, among the variants; the number of the supradoudenal insertion is greater than the infradoudenal insertion. ACBD is more frequent than expected which is 36% of the total data. Further researches should be done on the billiary system formation especially on the occurrence of the ACBD.

Key words- Apparent common bile duct, cystic duct insertion, biliary system

INTRODUCTION

The gall bladder, liver and the biliary ductal system develops from the hepatic endodermal diverticulum of the foregut, at the beginning of the fourth week of development (1). Any arrest or deviation from the normal embryological developmental process may result in some sort of aberration of the gallbladder and the biliary system(2).Because of the development of the liver and biliary system is a complex process failure of the normal development results in various anomalies and patterns of the biliary ductal system. (2, 3).

The cystic duct(CD) drains and attaches the gallbladder to the extra-hepatic bile duct .It passes posterior to the left from the neck of gallbladder and joins the common hepatic duct(CHD) to form the common bile duct(CBD); its point of insertion into the extra-hepatic bile duct marks the division between the CHD and the CBD.The CD usually measures 2–4 cm in length and contains prominent concentric folds known as the spiral valves of Heister and its normal diameter ranges from 1 to 5 mm(4-6).

CD may join the CHD in different ways such as on the right with a right angle intersect, front or behind or wind in front or behind to join on its left. The cystic duct usually enters the extrahepatic bile duct from the right lateral aspect, but may enter from the medial aspect, or from an anterior or posterior position (2, 7, 8, 9). CD may join CHD at any level with respect to the duodenum to form CBD. The importance of recognizing the variable union of CD and CHD has significant importance for surgeons that perform Cholecystectomy, in order to avoid injuries to the CHD or CBD (2, 7, 8).

CD usually runs parallel to the extrahepatic bile duct for a short distance but may also parallel the CHD for a variably long distance even to the ampulla of Vater(9-11). A common sheath can enclosesthe distal parts of CD and CHD and they are move parallel. Which are separated by a common septum. This which we called the ACBD having a double lumen tube, with the single lumen true CBD much shorter and more distal than apparent. Surgeons need to be careful because sometimes during an operation for obstructing biliary stones as

well as for other diseases, the cystic duct (CD) may parallel the common hepatic duct (CHD) intraluminal inside an apparent common bile duct (ACBD) for a variable distance before joining to form a true common bile duct (CBD) (10).

In this variant, the intramural CD and CHD share a common septum of variable length inside the ACBD. In this instance, supra-duodenal ductotomy in an ACBD masquerading as a true CBD may gain entry into an intramural CD and this can cause confusion if the surgeon is unaware of this anatomic variant. Similarly, ligation of the ACBD in the course of cholecysto-enteric biliary bypass, may fail due to the unanticipated obstruction of an unrecognized intramural CHD and CD(11).

The success and safety of laparoscopic, open cholecystectomy and other procedures are depending upon the basic knowledge of normal anatomy and common variants of biliary ductal system. Anatomic variants of the cystic duct are common with an incidence of 18%-23% and these variants have always attracted both the anatomists and surgeons (12-17).

MATERIALS AND METHODS

Institutional based cross-sectional study design with observational data collection tool by using checklist was conducted to assess anatomical variation of the cystic duct insertion in relation to the common hepatic ducts and the frequency of the apparent common bile duct on 25 Ethiopian cadavers and autopsy specimens in University of Gondar, Mekelle university and St. Paul Hospital Millennium Medical College.

Ethical considerations- Ethical clearance was obtained from school of medicine ethical review committee University of Gondar.

Procedure of data collection–After preparing the appropriate materials like blade, forceps, gloves, ruler ,camera and others, the abdomen has been opened, then the area around the liver, gallbladder and duodenum cleared of fat and other tissues then ;-

1. The gallbladder is identified and followed to the CD.

2. The hepatic ducts and common bile duct are well dissected and exposed without disturbing their relationship to show the union.

3. The CD is dissected to its union with the CHD. The morphological course of the CD relative to CHD and ACBD is noted as to its location of union relative to the duodenum (supra duodenal or intra duodenal).

4. The ACBD opened from the CD-CHD junction to the duodenum to identify the level of actual insertion with the CHD intraluminally inside the ACBD in order to determine the length if any of the intramural CD and CHD as well as the length of the true CD.

Data processing and analysis-All collected information was recorded and being entered in to SPSS Version 20.0. Descriptive analysis was done for all variables. The results are presented using Tables, texts, and pictures.

RESULT

General information

A total of 25 cadaver and autopsy specimens with 3 (12%() female and 22 (88%) males were observed to examine the anatomical variation of cystic duct insertion and the frequency of the ACBD occurrence in Gondar, Mekelle universities and St. Paul, Millennium medical collage Ethiopia.

Table.1 Specimen's Basic information

	Variable	FREQUENCY (%)
1	**Sex of the specimen**	
	Male	22(88%)
	Female	3(12%
2	**Place of data collection**	
	Gondar	4(16%)
	Mekelle	19(76%)
	St. Paul	2(8%)
3	**Type of specimen**	
	Cadaver	10(40%)
	Forensic	15(60%)

Basic information about the variations

Variation of the ACBD – from the total specimens 9 (36%) of them shown ACBD with the length ranges from 0.0cm- 4.5 cm and the rest 16 (64%) did not had ACBD rather they had CBD with one lumen or the cystic duct was opened directly to the CBD See Table-2.

ACBD that the ILCD ranges from 0.0 cm- 4.5 cm and ILCHD 0.0 cm- 1.8 cm and one of them has no ILCHD so the ACBD second lumen was opened in direct in to the cystic and RHD directly (fig 1b).

Table-2 frequency of ACBD

Occurrence	Frequency	Percentage (%)
Yes	9	36%
No	16	64%
Total	25	100%

Variation of CD- The CD length ranges from 1.3cm -8 cm, the CHD ranges 0 cm –9 cm but one of the 25 specimens was without CHD instead there was a duct that formed by RHD and CD but the LHD was opened to the CHD (fig. 1a).Fifty percent of the specimens had cystic duct between 2.25cm to 4.05cm with median of 3.5cm.

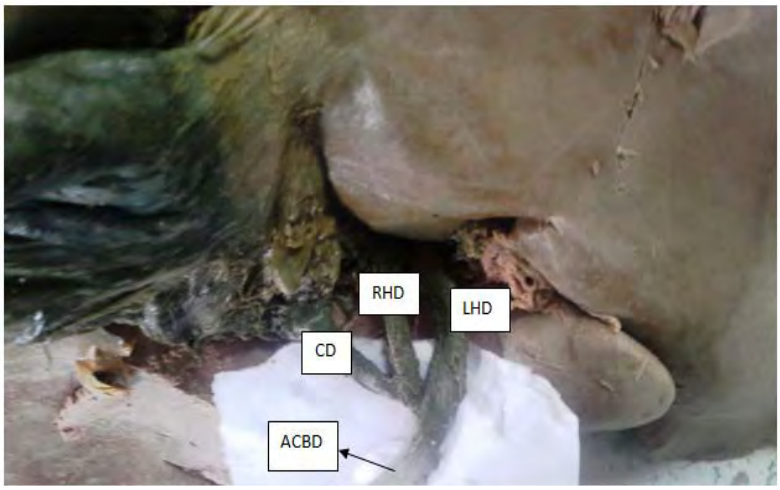

Fig.1a specimen with different variations like the RHD (right hepatic duct) and CD (cystic duct) forming a new duct of the ACBD (Apparent common bile duct).

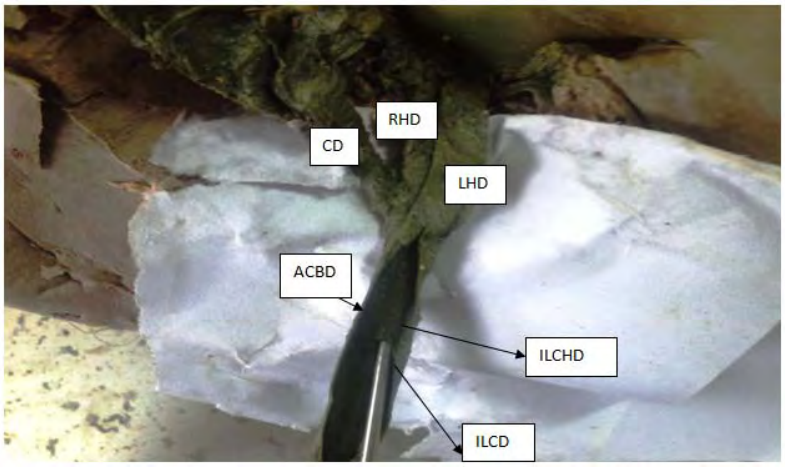

Fig.1b ACBD (Apparent common bile duct) dissected and the duct is opened to expose the lumen.

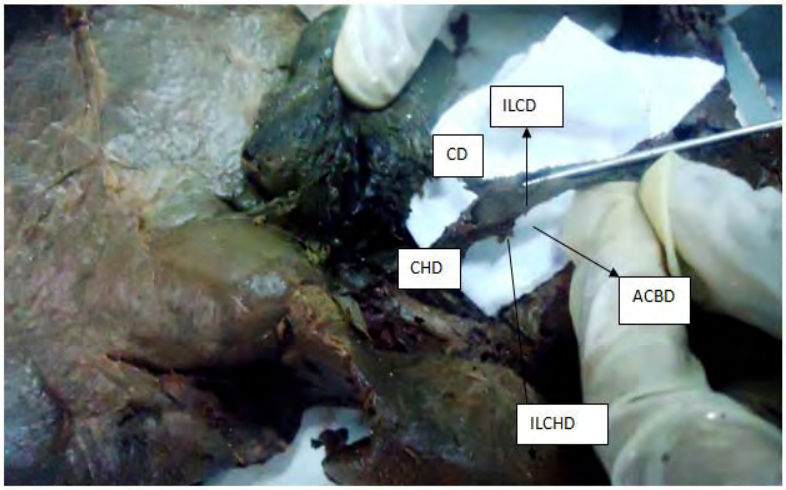

Fig.2 specimen with an ACBD (Apparent common bile duct) but no other variations.

Table. 3 median and range of duct length

Ducts	Median length	Range
Cystic duct	3.5cm	1.3- 8 cm
Common- hepatic duct	3.6 cm	0- 9 cm
Intraluminal cystic duct	0 cm	0.0- 4.5 cm
Intraluminal common- hepatic duct	**0 cm**	**0.0- 1.8 cm**

Variations of CHD- duct length of specimens ranged from 0.0 to 9 cm, the zero represents for the one specimen that doesn't have CHD (fig.1a). Fifty percent of the specimens had common hepatic duct between 2.60 cm and 4.05cm with median of 3.6cm.

The ILCD ranges from 0.0 - 4.5 cm which, 0 is for the normal CBD and 4.5 for ACBD with long ILCD. Fifty percent of the specimens had ILCD between 0.0 cm and 0.65 cm with median of 0.0cm.

The ILCHD length also ranges from 0 to 1.8. Fifty percent of the specimens had ILCHD length between 0 cm and 0.45 cm with median of 0.00 cm.

Table. 4 cystic duct insertion

Insertion	frequency	Percentage (%)
Supradoudenal	11	44%
Infradoudenal	13	52%
Direct to duodenum	1	4%

From the total specimens 11(44%) cystic duct inserted in supradoudenal, 13(52%) of them has infradoudenal insertion and 1(4%) of the specimens inserted direct in to the duodenum.

DISCUSSION

Systematic knowledge of anatomical variations in hepato-biliary system is important during surgical and endoscopic procedures as misinterpretation of normal anatomy and anatomical variations contribute to the occurrence of major postoperative complications like biliary injuries(18).

In the current study the cystic ductswere with the length range from 1.3- 8 cm. Only 48% were with the normal range between 2-4 cm which has a very big difference with the current study so do the CHD which ranges between 0.0 and 9 cm in the current study but 2-4cm in other sites (19).

In a comparative study done in TikurAnbessa, Ethiopia there was no significant difference in the length of the ducts but in the current study there is a significant difference among the duct lengths of the specimens. This might be due to the difference in study design or others (20)

In a study done in Brazil, the length of CHD is between 0.42 and 5 cm which is far beyond the current studies finding which is between 0 and 9cm. This can be genetically, diet or racial differences in addition to that the Brazilian study uses all cadaveric specimens but the current study is mixed with forensic autopsy and cadaveric specimens and can be also because of the number of specimen which is 41 of the Brazil's but only total of 25 with the current study(2).

An unusual variation observed in the current study was a CD connected with the RHD which is similar with the study in Brazil and Iran. In this type of variation the CD and RHD was connected and form common duct then joined LHD to have a CBD(2,20).

In one of the specimens the CD and CHD was directly joined in to the duodenum which has a similar finding with the study done in Iran (21). But there was a difference in the lengths of the CD and CHD.A study done in Uganda also had similar finding with the current study in the insertion of the CD higher which is supradoudenal, lower which is infradoudenal insertions(22).

The CBD is usually a single lumen duct but sometimes due to an embryologic developmental defect it can appear as a double lumen duct. In the frequency of the ACBD the current study is similar with the study in Gondar which preset four cases with the ACBD(20).

CONCLUSION

The biliary system formation is very variable especially in the insertion of cystic duct insertion. Among the variants, the number of the supradoudenal insertion is greater than the infradoudenal insertion. From the total specimens the lengths of the ducts varied and there is a difference with other literatures and text books.The frequency of the ABCD is unexpectedly high. As the finding of this study show the ACBD is not rare it is a frequently appeared variation.

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