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Morphological And Morphometric Study Of Extrahepatic Biliary Apparatus - A Cadaveric Study

Dr Anuradha [1], Mrs Balwinder Kaur [2], Dr Gaurav Agnihotri[3], Dr Ravikant Sharma[4]

[1]Associate Professor,Department Of Anatomy, Government Medical College, Patiala, Punjab, 147001.

[2]Msc Student 2nd Yr, Government Medical College, Amritsar 143001.

[3]Associate Professor, Department Of Anatomy, Government Medical College, Amritsar, Punjab,143001.

[4]Professor And Head, Department Of Anatomy,Maharishi Markandeshwar University, Kumarhatti, Solan, Himachal Pradesh, 173229

ABSTRACT

Introduction- Extrahepatic Biliary apparatus consists of gall bladder, cystic duct, right and left hepatic ducts, common hepatic duct and common bile duct. Knowledge of anatomy and associated variations related to EHBA is fundamental in the order to avoid error while performing MRCP by radiologist and laparoscopic surgeries like cholecystectomy by surgeons.

Aims and Objectives- To provide detailed morphological and morphometric data of the extrahepatic biliary system. **Material and Method-**A cadaveric study done on 50 adult human cadavers of anatomy department of Government medical college, Amritsar by dissecting extra hepatic biliary apparatus.

Results- Single extrahepatic gall bladder lodged in the fossa for the gall bladder covered with peritoneum, rugae in interior were observed in all specimens. Extrahepatic union of Right and left hepatic duct to form common hepatic duct was noted. In 96% cystic ducts join to common hepatic duct with an acute angle. Length of cystic duct was observed to be varies from 1.5- 4cm, common hepatic duct was 1.5 to 4cm and common bile duct was 6-8cm. Cystic artery arises from hepatic artery was seen inside calot's triangle. Both cystic and hepatic artery passing posterior to common hepatic duct to reach calot's triangle seen in all specimens

Conclusion- Present study is having great clinical, Anatomical and surgical significance. It will further prevent the iatrogenic injuries and complications arise during, and post laparoscopic cholecystectomy.

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1. INTRODUCTION

Extrahepatic biliary apparatus consists of gall bladder, cystic duct, right and left hepatic ducts, common hepatic duct and common bile duct. Right and left hepatic ducts join to form common hepatic duct which join with cystic duct to form common bile duct.[1] Knowledge of normal anatomy and its associated variations of extrahepatic biliary apparatus is fundamental in the order to avoid future error while performing MRCP by radiologist and while performing laparoscopic surgeries like cholecystectomy by surgeons.[2] Finding variations from normal anatomy while performing surgeries lead to iatrogenic bile duct injuries, cystic artery related injuries and these represent a lethal surgical complications. [3]Variations in EHBA reported between 4.7 to 7.3%.[4] common medical disorder related to EHBA include cholelithiasis, cholecystitis, gall bladder atresia, malignant neoplasm of the gall bladder. Anomalies related to morphology of gall bladder include disparities in number, location, volume, shape and attachment. In some cases separate duct from liver may enter gall bladder. Most common type of gall stones are cholesterol. Knowledge of anatomical anomalies should keep in mind while performing cholecystectomy.[3] Proper exposure of calot's triangle and careful identification of structures are key, to avoid injury to extrahepatic biliary apparatus. In Recent advances like living liver transplantation, and to evolve surgical techniques, the prior knowledge of normal anatomy and its anatomorphographic variations is of paramount importance.[2]

2. AIIM AND OBJECTIVES

To Provide detailed morphological and morphometric data of the extrahepatic biliary apparatus.

To recognize the anatomical intricacies for structures in the calot's triangle

3. MATERIAL AND METHODS

The study done on 50 adult human cadaver of known sex from department of anatomy, Government medical college, Amritsar. In cadavers, extrahepatic biliary apparatus was dissected (fig 1) and studied. The study was conducted after taking approval from ethical committee (letter no 37515-16/D 26 dated 24/11/22), of Government medical college, Amritsar. After dissecting the extrahepatic biliary apparatus, the observations were made for each component of extrahepatic biliary apparatus. Instruments used in study for various measurements include scalpel, scissor, stainless steel forceps long toothed, short stainless steel forceps, measuring scale, cotton thread, vernier caliper. Colours were used to highlights different parts of extrahepatic biliary apparatus. Red is used for artery, dark green for gall bladder and cystic duct, light green for common bile duct, blue colour is used for portal vein.

Figure 1: Showing the normal morphology of the extrahepatic biliary apparatus

4. RESULTS

Results of present study were tabulated and statistically analysed and compared with the accessible literature. Single gall bladder was observed in all specimen. It was located on inferior surface of right lobe of liver. The shape of gall bladder was normal in 48 specimens and Phrygian's cap was seen in 2 specimens (fig 2). Fundus and bodies were normal in all gall bladder specimens. The shape of gall bladder was pear shaped in 48 (96%) specimens. In interior of gall bladder rugae were present in 100% of specimens (fig 4). Out of 50 specimens, 7 gall bladders were having gall stones (fig 4). Length of gall bladder varied from 5.8 to 10cm with an average of 7.08cm. Breadth of gall bladder varied from 2.5 to 5cm with an average of 3.08cm. Distance of gall bladder from inferior border of liver varied from 2.7 to 4.6 cm. In present study single cystic duct was observed in 47 (97%) specimens and multiple in 3 (6%) specimens. Length of cystic duct was observed to be varied between 1.5 to 4cm with an average of 2.07cm. In 96% of specimens cystic duct form an acute angle at union with common hepatic duct. In 4% of specimens cystic duct ran parallel with common hepatic duct before union. Length of right hepatic duct varied from 0.4 to 2cm whereas length of left hepatic duct varied from 1.6 to 2.5cm. The length of common hepatic duct ranged from 1.5 to 4cm. length of the common bile duct ranged from 6 to 8cm. In present study boundaries of Calot's triangle were normal in all specimens and one cystic artery found in all specimens (fig 3&5).

Fig 2: Showing Gall bladder with Phrygian cap

Fig 3 : Cystic artery in Calot's triangle (coloured)

Fig 4: Gall bladder interior with gall stones

Fig: 5 : Cystic artery in Calot's triangle

5. DISCUSSION

Numerous studies has been done on extrahepatic biliary apparatus. To provide greater insight, comparison of present study observations was done with previous studies conducted worldwide. Measurements of parameters of gall bladder compared with previous studies. Study done by Mishra P et al [5] on 50 gallbladders found that 82% gall bladders having pear shaped, 2% gall bladder having hour glass shape whereas 14% gall bladders having cylindrical in shape. S Umarani et al [6] observed 95 specimens, founded 76% gall bladder having pear shaped, 12.6% flask shaped, 4.2% cylindrical, 2.1% hour glass, 3.55 % retort shape and 1.4% having irregular shape of gall bladder. Shivanal U et al [7]observed 52% gall bladder with pear shaped, 2% gall bladder having folded fundus and hart's man pouch. Anandhi PG [2]and Das S et al [8] observed 4% and 78.33% gall bladders with stone respectively whereas present study gall stones were observed in 16.27%. Table 1 showing comparison of length and breadth of gall bladder with previous studies.

Table 1 : Comparison of length and breadth of gall bladder

S NO	AUTHORS	LENGTH (cm)	BREADTH (cm)
1	Lee Mc Gregor et al [9]	7.5- 10	-
2	Turner and Fulcher [10]	10	3-5
3	Moore and Dalley [11]	7-10	
4	Chavi and Shah [12]	7-10	2-5
5	Vakili and Pomfret [13]	7-10	4
6	Standring et al [1]	7-10	-
7	Rajguru et al [14]	5-12	2.5-5.0
8	Naadem G et al [15]	4.5- 11.6	2.5-5.0
9	S.Umarani et al [7]	4.2 -11.7	1.7- 4.5
10	Present study	5.8- 10	2.5-5.0

From above table it is evident that present study findings were in consonance with finding of Turner and Fulcher, [10] Chari and Shah[12]and standring et al [1] but present study results were different from other authors.

In present study distance of gall bladder from inferior border of liver varied from 2.7 to 4.6cms. Following table 2 showing comparison of results with previous studies.

Table 2 Comparison of distance of gall bladder from inferior border of liver

S NO	AUTHORS	DISTANCE FROM INFERIOR BORDER OF LIVER
1	Srivastava et al [16]	0.46- 3.93
2	Prakash et al [17]	0.4- 2.5
3	Shivanal U et al [7]	0.5- 4.8
4	Present study	2.7- 4.6

In present study single cystic duct observed in 94% specimens and 6% specimens having more than 2 cystic ducts. Schachner A[18] in his study observed 2% specimens out of 76 specimens with double cystic duct while Sundravadhnam KVK[19] et al observed a single specimen with double cystic duct out of 30 specimens. Parmar P et al[20] observed an accessary cystic duct in 2% out of 50 specimens.

Table 3 Comparison of length of cystic duct with previous studies

S NO	AUTHORS	LENGTH OF CYSTIC DUCT (Cm)
1	Hollinshed [21]	2.5- 7.5
2	Johnston EV[22]	2.9
3	Standring [1]	3-4
4	Anandhi PG [2]	2-4
5	Present study	1.5-4

In present study maximum length of the cystic duct was observed to be varies from 1.5-4cms with an average of 2.72cm which is in consonance with studies done in past by Johnston EV[21], Standring et al[1] and Anandhi PG[2] et al.

In 48 specimens acute union is observed between cystic and common hepatic duct whereas In 2 specimens parallel union observed. Many studies had been conducted previously with focussing on type of union of cystic duct with common hepatic duct shown in table 4.

Table 4 Comparison of type of union between cystic and common hepatic duct

S No	AUTHORS	ACUTE UNION	PARALLEL UNION
1	Johnston EV[22]	51%	31.4%
2	Thomson JM[23]	90%	6%
3	Eisendrath[24]	75%	17%
4	Ruge E[25]	35%	20%
5	Anupama D et al[26]	80%	2%
6	Present study	96%	4%

There is a clinical significance of parallel type of union. In this type both cystic and common hepatic duct are so closely bound together and their separation become difficult. Their adherence causes difficulty to put clamp on cystic duct without injuring common hepatic duct during surgeries. Cystic duct remnant syndrome may occur in parallel type of union which

leads to post cholecystectomy symptoms and complications. This Area becomes site of chronic inflammation and traumatic neuroma.

In present study length of right hepatic duct varies from 0.4 to 2cms. The length of left hepatic duct varies from 1.6 to 2.5cms. In present study common hepatic duct was observed to be formed close to right end of porta hepatis by union of right and left hepatic duct. The length of the common hepatic duct varies from 1.5 to 4cms with average length is 2.79cms. The finding of present study were in consonance with previous studies done by Snell's[27] (4cms), Grey's[1] (3cm) and Hollished[21]. The normal arrangement of structures were found in all specimens. The accessary hepatic duct found in 2% of specimens. Single common bile duct with length 6-8cm noted in all specimen. Previous study done on 76 specimens by Schancher[18] noted absence of CBD in one case while study done by Flint[28] 200 specimens found 14.6% specimens with accessary bile duct. Another study done by Eftekher vagnefi et al[29] on 50 specimens noted absence of common bile duct in 2% of specimens.

Table 5 Showing comparison of common bile duct length with previous studies

S NO	AUTHORS	RANGE (cms)	AVERAGE (cms)
1	Hollinshed[21]	5 -- 15	10
2	Standring et al[1]	6 --8	7.5
3	Snell's[27]	6.5 -- 8.8	8
4	Present study	6 -- 8	8

In present study diameter of the common bile duct range from 5 to 9 mm with an average 7.66mm. Boundaries of Calot's triangle were normal in all specimens with single cystic artery with normal course whereas previous study done by Stemple JF[30] estimated 85% variation in hepatic pedicle, among those 50% variations were of potential hazard during cholecystectomy. Single lymph node was observed in calot's triangle in all specimens.

6. CONCLUSION

This study is of great anatomical, clinical and surgical significance. Knowledge of morphological and morphometric variability of extrahepatic biliary apparatus is very essential for surgeons, radiologists and doctors in general, thus contributory to prevent or decrease hepatobiliary iatrogenesis. It will further decrease the incidence of iatrogenic injuries and complications like biliary leak, neuroma and inflammation after and during cholecystectomy.

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