Original Article

ISSN (O): 2455-5274; ISSN (P): 2617-5207

Anatomical Variation in Extrahepatic Biliary Apparatus

Shambhu Nath Jha[1], **Saif Omar**[2]

[1]Assistant Professor, Department Of Anatomy, Mata Gujri Memorial Medical College, Kishanganj, Bihar, India, [2]Professor & Head, Department Of Anatomy, Mata Gujri Memorial Medical College, Kishanganj, Bihar, India.

Abstract

Background: For several years, the pathology of the biliary system has been the focus of prolonged study. Largely due to their surgical relevance and the simplicity with which they can be treated in cholecystectomies. While interest in extrahepatic bile ducts has been intensified, very rare studies have been performed on the Indian subcontinent. The anatomical differences of the extra-hepatic biliary area were defined in this study, as these variations are important throughout surgical techniques such as laparoscopic cholecystectomy, thus minimising post-operative difficulties. The objective is aim of the research was to observe anatomical differences in the extrahepatic biliary system in Indian cadaveric specimen samples. **Subjects and Methods :** Sample content consisted of 100 human cadavers of any sex that were dissected. Cadaver specimens from the dissection room were examined. Cadaver specimens were obtained from Mata Gujri Memorial Medical College, Kishanganj, Bihar, Department of Anatomy. By the traditional method of dissection, they were studied. **Results:** In the current study, the smallest gall bladder observed was around 25ml, while the largest gall bladder was around 120ml. On average, our study recorded around 50 ml of the gall bladder. Congenital anomalies of the gall bladder included Intrahepatic, Double, Bilobed and separate mesentery. Further, the pathological findings accounted for 20% of total cases and a solitary pathology involving carcinoma was noted. **Conclusion:** Anatomical variants of the extrahepatic biliary system are widespread and are important for surgeons to prevent injury as critical structures through surgical operations and increase surgical results by recognising them.

Keywords: Biliary apparatus, Cystic duct, Extrahepatic, Laparoscopic cholecystectomy

Corresponding Author: Saif Omar, Professor & Head, Department Of Anatomy, Mata Gujri Memorial Medical College, Kishanganj, Bihar, India.
E-mail: drsaifomar@gmail.com

Received: 01 August 2020 **Revised: 09 September 2020** **Accepted: 20 September 2020** **Published: 22 December 2020**

Introduction

For several years, the anatomy of the biliary system has been the focus of prolonged research.[1] In cholecystectomies, primarily because of their surgical significance and the simplicity at which they can be examined. The extrahepatic biliary apparatus consists of a blind end diverticulum formed by hepatic ducts, gall bladder, common bile duct (CBD), and cystic duct.[2] Gall Bladder flask located in contact with the lower surface of the right liver lobe. The length is between 7-10 cm in adults with a potential of up to 50 ml.[3] The bile is extracted by the further hepatic biliary tract from the liver and drained into the second portion of the duodenum. It is notable for its distinctions. Intrahepatic union of right and left hepatic ducts, peripheral, various ways of end of the normal duct; hepatic, cystic and common bile are common variants.[4] Intrahepatic union of right and left hepatic ducts, closure of cystic duct on the left side of the typical bile duct and accessory hepatic ducts are the differences in this study. There are no medical emergencies with typical human anomalies in this area, but after surgeries in this area, it can cause serious complications.[4]

One of the utmost common sites for surgical operations is the extra-hepatic biliary system. In this method, the occurrence of anatomical differences is stated to be as low as 7.3% to as high as 47%. Popular biliary system and gallbladder disorders involve differences in the number and position of the gallbladder.[5] Multiple gallbladders may also have different cystic ducts, or one cystic duct may be shared by two or more. These additional gallbladders can lie below the liver's right or left lobe or inside the gastrohepatic ligament or liver. They may emerge from the hepatic duct, the CBD, or the right or left hepatic duct. In certain examples, however; the gallbladder, cystic duct, or connection of cystic duct and CBD is reached by a different conduit from the liver. These ducts have been known as the ducts of Luschka. These extra ducts should be treated during laparoscopy by ligation, suture, cutting, cauterization, or removal when they are detected.[6]

The purpose of the research was to observe the anatomical differences in Indian cadaveric specimens in the extrahepatic biliary system. This is the first research in our area to address the anatomical differences of the extra-hepatic biliary system, according to our interpretation.

Subjects and Methods

On 100 embalmed adult cadavers of either sex, a retrospective and observational analysis were conducted. The research period in the Department of Anatomy, Mata Gujri Memorial Medical College, Kishanganj, Bihar ranged from 2014-2020. Included in the collection of specimens were those from unclaimed and accepted bodies formally collected by the Department of Anatomy. For the intent of dissection, the corpses were first embalmed inside the lab. The omission of cadavers with decomposed mutilated bodies and others with malignancies.

Dissection and processing:

From the xiphoid process to the pubic symphysis, the anterior abdominal wall was incised and unlocked layer by layer. The peritoneum was unlocked and the viscera was properly removed from the field of view and washed. Each portion was traced proximally and distally from the extrahepatic biliary apparatus. Relevant information was registered. Gallbladder and information, followed by cystic duct and its associated cystic artery, were identified and noted. It tracked the cystic duct to its connection with the popular hepatic duct. They then dissected and delineated the typical bile duct. Cystic duct length and angulations have been observed. Popular bile duct duration and difference, if any, were noted. The common hepatic duct was then traced caudally until its branching and period were noted.

Results

In our study of 100 cases, 70 were male 30 were females.

Table 1: Observation on size of Gall Bladder

Smallest	25ml
Largest	120 ml
Average	50ml

The size of the gall bladder observed among the participants in the sample was represented in the above table. The smallest measured gall bladder was about 25ml, while the largest observed gall bladder was about 120ml. Our analysis reported approximately 50 ml of gall bladder on average.

Congenital anomalies of the gall bladder were recorded in above table 2. The current study recorded one each case of absence of anomaly, Intrahepatic, Double, Bilobed and with separate mesentery.

Table 2: Congenital anomalies of Gall Bladder

Absence	1
Intrahepatic	1
Intrahepatic	1
Bilobed	1
With separate mesentery	1

Table 3: Evidence of Pathologies in Gall Bladder

Pathological findings	20
Cholelithiasis	12
Choledocholithiasis	3
Carcinoma	1
Adhesion & Thickening	4

Our study observed pathologies in the gall bladder. The maximum cases were recorded for Pathological findings, accounting for 20% of total cases. Around 12 cases of Cholelithiasis were also recorded. Further, around 4 and 3 cases of Adhesion & Thickening and Choledocholithiasis, respectively were also noted. A solitary pathology involving carcinoma was noted.

Table 4: Extent of Peritoneal Investment of Gall Bladder

2/3 to 3/4	75
More than 3/4	13
Less than 2/3	12

From the above table, it can be inferred that the maximum extent (75%) of peritoneal investment of gall bladder was recorded in 2/3 to 3/4. This was surveyed by 13% in extra than 3/4. And, lastly, around 12% of cases showed Less than 2/3 of peritoneal investment of gall bladder.

Table 5: Relation of the fundus of gall bladder with anterior margin of the right lobe of the liver

Level of fundus – Supramarginal	15
Level of fundus – Marginal	25
Level of fundus – Inframarginal	60

[Table 5] shows the relation of the fundus of the gall bladder with the anterior margin of the right lobe of the liver. In our study, we observed maximum cases (n=60) showing the level of fundus – Inframarginal. This was followed by Level of fundus – Marginal showing around 25% cases. The least cases of Level of fundus – Supramarginal were recorded at 25%.

Table 6: Showing Length of various ducts in EHBA

	Gender	Averag length (cm)	Range (cm)	Averag diam-eter (cm)	Range (cm)
CHD	Male	3.1	0.9-5.1	4.1	2.9-9.1
CHD	Female	2.8	0.7-5.6	4.5	3.1-7.2
RHD	Male	1.4	0.6-3.1	1.5	0.2-1.9
RHD	Female	1.2	0.5-2.5	1.7	0.2-1.8
LHD	Male	1.5	0.5-3.1	1.4	0.2-2.1
LHD	Female	1.5	0.5-2.5	1.7	0.2-2.6

Of the 100 cadavers studied, the anatomic positions of bile ducts were standard in the collective hepatic duct right and left. We assessed the diameter and length of various ducts in EBHA. As noted in the above table, the average length of hepatic ducts in this research study was shorter when compared to that of the standard range. Whereas, the average diameter of hepatic ducts in this current study was greater when compared to that of the standard range.

Table 7: Showing the incidence of Accessory Hepatic Ducts

AHD Single Type	Male 7	Female 7
AHD Complex Type	Male 3	Female 2

A total of 19% of specimens having additional ducts were noted. Out of which, 14% were AHD Single Type and the remaining 5% were AHD Complex Type.

Table 8: Pattern ofthe junction of the cystic duct with common hepatic duct to form common bile duct

Site	No. of cases in Male	No. of cases in female
Right side of CHD	45	35
Left side of CHD	02	01
Normal angle	32	30
Parallel course	13	05
Anterior/Posterior of CHD	09	08
Anterior junction of CHD	06	05
Posterior junction of CHD	03	03
Anterior spiral	02	01
Posterior spiral	01	01

Normal angle was observed in 62% of the cases. Whereas, eight variations of the hepatocystic junction were observed in our samples. The first variation is represented by the Right side of CHD in 80% of cases. This was followed by a Parallel course, Anterior/Posterior of CHD and Anterior junction of CHD with 18%, 17% and 11% cases each, respectively. The Posterior junction of CHD recorded 6% cases. Whereas, Left side of CHD and the Anterior spiral recorded 3 cases, each. Only two cases of Posterior spiral were recorded in our study.

Discussion

During the 4^{th} week of foetal development, extrahepatic biliary organ arises along with the liver from the hepatic diverticulum of the foregut. In septum transversum, this diverticulum quickly proliferates and splits into 2 elements, respectively pars cystica and pars hepatica. Gallbladder and cystic duct arise from pars hepatica, liver and hepatic ducts and pars cystica.[7] Several scholars have reported that cells proliferate to form typical bile duct at junction of cystic and hepatic duct throughout the formation of pars cystica.[8,9] Failure of this usual pattern of growth contributes to numerous abnormalities. Awareness of anatomical differences in the hepatobiliary arrangement is critical through surgical and endoscopic processes, as a misreading of normal anatomy and anatomical differences leads to the prevalence of main postoperative problems such as biliary injuries. This can happen after cholecystectomy, with laparoscopic cholecystectomy having a higher occurrence. The cystic duct connects the gallbladder to the bile duct and is one of the main structures that during a typical cholecystectomy need careful diagnosis and separation.[10]

In this study, accessory ducts rising from the left lobe of the liver were not reported. Owing to late separation of hepatic antrum into cystic and hepatic diverticula, accessory hepatic duct develops,[11] otherwise the presence of a foetal link between liver and gallbladder.[12] Among Indian samples, Sharmila et al analysed the occurrence of 15 percent in 40 specimens in the South Indian populace.[13] Paul et al disclosed 26.7 percent of 30 specimens in the North Indian population.[14] In contrast, Devi et al. found that 17% of subjects had accessory hepatic ducts, while Khayat et al. reported just 3.33% of subjects.[15,16] Understanding the frequency and location of the accessory hepatic ducts is especially relevant throughout laparoscopic cholecystectomies as the occurrence of bile duct injury is double high as opposed to open cholecystectomies.[17]

Conclusion

The anatomy of the extra-hepatic biliary device is extremely complex and through surgical operations, such as laparoscopic cholecystectomy, liver resection and living organ relocation, any of these differences and abnormalities may be challenging for surgeons. Surgery done in the absence of abnormalities

may lead to serious difficulties, such as duct leakage or liver atrophy. It is therefore important to provide a detailed understanding of the effective diagnosis and identification of such anatomical differences, thus lowering morbidity and mortality rates in hepatobiliary surgery.

References

1. Mchanwell S, Davies DC, Morris J, Parkin I, Whiten S, Atkinson M, et al. A core syllabus in anatomy for medical students-Adding common sense to need to know. Eur J Anat. 2020;11(S1):3–18.
2. Nigam GL, Lalwani R, Babu CSR, Chauhan K. Surgical anatomy of sub-hepatic biliary system. J Anat Soc India. 2014;63(1):48–51. Available from: https://dx.doi.org/10.1016/j.jasi.2014.05.001.
3. Anjankar VP, Panshewdikar PN, Joshi DS, Anjankar AP. A cadaveric study involving variations in external morphology of gall bladder. Int J Med Sci Public Health. 2013;2(2):239–239. Available from: https://dx.doi.org/10.5958/j.2319-5886.2.2.029.
4. Desai J, Bhojak N. Study of Variations in External Morphology of Gall Bladder in Cadavers. BJKines-NJBAS. 2015;7:29–33.
5. Khayat MF, Al-Amoodi MS, Aldaqal SM, Sibiany A. Abnormal anatomical variations of extra-hepatic biliary tract, and their relation to biliary tract injuries and stones formation. Gastroenterology Res. 2014;7(1):12–12. Available from: https://dx.doi.org/10.14740/gr596e.
6. Schnelldorfer T, Sarr MG, Adams DB. What is the Duct of Luschka?—A Systematic Review. J Gastrointest Surg. 2012;16(3):656–662. Available from: https://dx.doi.org/10.1007/s11605-011-1802-5.
7. Roskams T, Desmet V. Embryology of Extra- and Intrahepatic Bile Ducts, the Ductal plate. Anat Rec (Hoboken). 2008;291(6):628–635. Available from: https://doi.org/10.1002/ar.20710.
8. Aristotle S, Jebakani CF. A duplication of the cystic duct-case report. Eur J Anat. 2011;15(3):176–184.
9. Lamah M, Karanjia ND, Dickson GH. Anatomical variations of the extrahepatic biliary tree: Review of the world literature. Clin Anat. 2001;14(3):167–172. Available from: https://dx.doi.org/10.1002/ca.1028.
10. Strasberg SM, Brunt LM. Rationale and Use of the Critical View of Safety in Laparoscopic Cholecystectomy. J Am Coll Surg. 2010;211(1):132–138. Available from: https://dx.doi.org/10.1016/j.jamcollsurg.2010.02.053.
11. BISMUTH H, NAKACHE R, DIAMOND TOM. Management Strategies in Resection for Hilar Cholangiocarcinoma. Ann Surg. 1992;215:31–38. Available from: https://dx.doi.org/10.1097/00000658-199201000-00005.
12. Walia HS, Abraham TK, Baraka A. Gall-bladder interposition: a rare anomaly of the extrahepatic ducts. Int Surg. 1986;71(2):117–138.
13. Sharmila A, Sumathilatha S, Jebakani CF. Anatomical Variations in the Extra Hepatic Biliary Ductal System. J Anat Soc India. 2011;60(1):50–52. Available from: https://dx.doi.org/10.1016/s0003-2778(11)80011-0.
14. Paul S, Jacinth JS, Muniappan V. Variations of the extra hepatic biliary tract: Cadaveric study. J Appl Dent Med Sci. 2013;10(1):46–50.
15. Devi TS, Krishna PH. The Study of Variations of Extra-Hepatic Biliary Apparatus. J Appl Dent Med Sci. 2013;5(5):25–31.
16. Khayat MF, Al-Amoodi MS, Aldaqal SM, Sibiany A. Abnormal anatomical variations of extra-hepatic biliary tract, and their relation to biliary tract injuries and stones formation. Gastroenterology Res. 2014;7(1):12–16. Available from: https://dx.doi.org/10.14740/gr596e.
17. Mariolis-Sapsakos T, Kalles V, Papatheodorou K, Goutas N, Papapanagiotou I, Flessas I. Anatomic Variations of the Right Hepatic Duct: Results and Surgical Implications from a Cadaveric Study. Anat Res Int. 2012;2012:1–5. Available from: https://dx.doi.org/10.1155/2012/838179.

How to cite this article: Jha SN, Omar S. Anatomical Variation in Extrahepatic Biliary Apparatus. Acad. Anat. Int. 2020;6(2):25-28.

DOI: dx.doi.org/10.21276/aanat.2020.6.2.5

Source of Support: Nil, **Conflict of Interest:** None declared.