

VARIATIONS IN THE EXTERNAL MORPHOLOGY OF GALL BLADDER

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ABSTRACT

Variations of extrahepatic biliary tract are commonly encountered in surgery. Study was carried out to determine the external morphology of the gall bladder obtained from sixty embalmed cadavers. Differences in dimensions and shape of the gall bladder, apart from other variations such as folded neck and folded fundus (Phrygian cap anomaly) were found. The variations are essentially due to aberration or arrest in normal embryological development. The growing importance of such variations, lie not only from the point of biliary disease but also with respect to the various invasive techniques in the treatment of gall bladder and extrahepatic bile duct disease.

Key words: Gall Bladder, External Variations, Hourglass Gallbladder, Folded Neck, Folded Fundus

INTRODUCTION

Though human beings are thought to be singularly alike in their general anatomical construction, yet when we come to investigate one particular region with more detail, it is surprising how frequently we meet one sort or another type of variation¹. This is so very true in the case of anatomy of the extrahepatic biliary apparatus, that according to some eminent workers, there is no normal anatomy of the extrahepatic biliary tract, instead a common pattern of variations exist and it is the surgeons duty to be familiar with and recognize the normal variations when present². Anomalies of the extrahepatic biliary apparatus can arise from the gall bladder, cystic duct, hepatic ducts and the common bile duct and it is imperative to be familiar with them in order to avoid the disastrous consequences in surgery.

This present study was a part of a larger study of the extrahepatic biliary apparatus in which variations seen in the external morphology of the gall bladder are described.

MATERIALS AND METHODS

This study was carried on sixty gall bladders obtained from 10% formalin fixed cadavers in the Dept of Anatomy, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, after obtaining necessary

permission from the Institutional Ethical Committee. Cadavers with abdominal surgery and crush injury to the abdominal organs were excluded. Data were analyzed using SPSS 17.0 version and Graph Pad Prism software and the result was tested at 5% level of significance.

RESULTS

1. Dimensions of the gall bladder

a. Length of gall bladders was found to be ranging between 5cms to 12cms. In forty-eight (80%) gall bladders the length ranged between 7-10cms. The smallest gall bladder (Fig.1) was 5 cm in length and the largest (Fig.2) was 12cms. The findings are depicted in Table I.

b. The breadth of the gall bladders was observed to be between 2.5cms -5cms. In forty gallbladders (66.67%) the breadth ranged between 3-3.5cms. Mean breadth of Gall Bladder was 3.89 ± 0.57 cm, Positive correlation was found between length and breadth in Gall bladder. ($r=0.344$), ($p=.008$). The findings are depicted in Table I

2. Shapes of the gall bladder.

The gall bladder were either pear shaped, cylindrical shaped, hourglass shaped, retort shaped, irregular or flask shape shaped. Their incidences are depicted in the Table I and shown in (Fig.3-8)

3. External Variations of gall bladder.

Folded fundus and folded neck were the external variations of gall bladder observed in seven (11%) specimens out of sixty. These various entities and their incidences are depicted in Table II and (Fig 9-12).

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TABLE I: MEASUREMENTS AND SHAPES OF GALL BLADDER

LENGTH in cms.	NO.OF SPECIMEN	PERCENTAGE
<7 cm .	2	3.33%
7-10 cm .	48	85 %
10-12 cm .	10	16.6%
BREADTHS in cms		
<3 cm	7	11.67%
3 -4.5 cm .	40	66.67 %
> 4.5 cm	13	21.67 %
SHAPES OF GALL BLADDER		
Pear shape	51	85 %
Flask	3	5%
Cylindrical shape	2	3.33%
Hourglass shape	2	3.33%
Retort	1	1.67%
Irregular	1	1.67%

TABLE III: Length Breadth and Shape of Gall Bladder as per observations of various workers

No.	Researcher /Year	Length	Breadth	Shape
1.	Lee McGregor et al (1986) ⁶	7.5-10cms	-	-
2.	Turner&Fulcher/(2000) ³	10 cms	3-5 cms	Elliptical shaped
3.	Moore& Dalley (2006) ⁷	7-10 cms	-	Pear shaped
4.	Chari &Shah (2008) ⁵	7-10 cms	2-5 cms	Pear shaped
5.	Vakil& Pomfret (2008) ⁸	7-10 cms	4cms	Piriform
6	Standring -(2008) ⁴	7-10cms	-	Flask shaped
	PRESENT STUDY 2008-2010	5-12cms	2.5-5cms	Pear(85%), Flask, (5%), Cylindrical (3.33%), or Hourglass &Retort or Irregular (1.67%)



Fig. 1 - Small Gall Bladder



Fig. 2 - Large Gall Bladder

TABLE II : EXTERNAL VARIATIONS OF THE GALL BLADDER

External variation	Position of folding	No. of specimens	Percentage
Folded Fundus (Phrygian cap)	Anteriorly	1	1.67%
	Posteriorly	2	3.33%
Folded neck	Anteriorly	1	1.67%
	Posteriorly	2	3.33%
Folded Fundus & Neck	Posteriorly	1	1.67%

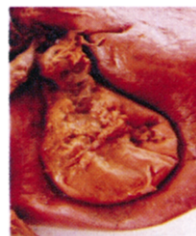


Fig.3 - Pear Shaped

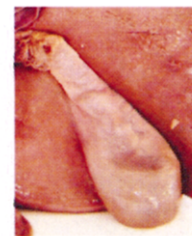


Fig. 4 - Flask Shaped



Fig. 5 - Cylindrical Shaped

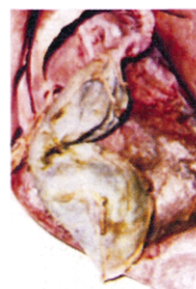


Fig.6 - Retort Shaped



Fig. 7 - Hour Glass Shaped



Fig.8 - Irregular Shaped



Fig. 9 - Folded Neck (Anterior)



Fig. 10 - Floded Neck (Posterior)



Fig. 11 - Folded Fundus (Anterior)



Fig. 12 - Folded Fundus (Posterior) Phrygian Cap

DISCUSSION

The liver, gall bladder and the biliary ductal system develop from the hepatic diverticulum of the foregut, in the beginning of the fourth week of development. This diverticulum rapidly proliferates into the septum transversum and divides into two parts the cranial part is the primodium for the liver and the bile ducts while the caudal part gives rise to the gall bladder and the cystic duct. Initially the extrahepatic biliary apparatus is occluded with epithelial cells, but later on it gets canalized because of subsequent degeneration of these cells. It is quite conceivable that any arrest or deviation from the normal embryological developmental process may result in some sort of malformation of the gallbladder and of the biliary system.

The gall bladder varies greatly in size and shape and it may be impossible sometimes to distinguish between various parts described. The relaxed gall bladder was approximately 10cms long^{3,4} and 3-5 cms in diameter³. The dimensions of the gall bladder as found in this study, in most of the specimens were consistent with those of Chiari and Shah (2008)⁵.

The breadths of the gall bladders in the present study ranged between 2.5-5cms similar to that

found by Chiari and Shah (2008)⁵. The length breadth and the shape of the gall bladder found by various workers are shown in Table III.

Gore et al (2000)⁹ stated that the size might increase after vagotomy, in diabetes because of autoimmune neuropathy, in pregnancy, in patients with sickle cell disease, after cystic duct or common duct obstruction and in extreme obese people whereas micro gallbladder was usually seen in association with cystic fibrosis.

The Pear shape of the gall bladder as found in most of the specimens (85%) in this study were in consonance with the findings of many workers Moore and Dalley (2006)⁷ Chari and Shah (2008)⁵. Cylindrical shape has been observed by Hollingshead (1983)¹⁰. Hourglass gall bladder has been reported by Shafer (2005)¹¹. Boomerang (retort) shaped gall bladder has been described by Meilstrup et al (1991)¹² in a sonographic study.

The gall bladder is relatively constant in its development¹⁰ and the two most significant variations are the folded fundus and variation at the neck of the gall bladder¹⁰. In the present study folding of the neck over the body of the gall bladder was found in four (6.67%) specimens out of which one (1.67%) was anteriorly folded. Meistrup et al (1991)¹² observed that gross bending of the gallbladder could occur posteriorly or anteriorly and lead to bizarre or unusual shapes when visualized by sonography and other imaging techniques. Futura et al (2001)¹³ observed that there was a significantly higher prevalence of kinking of the gallbladder and Hartmann's pouch in the females than in male subjects which could be related to the higher rate of gallstone formation and biliary tract diseases in females.

The folded fundus of the gall bladder, also referred to as the Phrygian cap, was reported in 3%-7.5% of the cases by Lichtenstein & Nicosia (1955)¹⁴. They considered it due to disproportion between the size of the gall bladder and that of the gall bladder bed, but without any pathological significance. Deutsch (1986)¹⁵ found this anomaly in 0.33% and considered it as non-developed form of congenital septum. Gore et al (2000)⁹ found it in 1%-6% of population, and observed a fold or septum between the body and the fundus. In the present study, folded fundus (Phrygian cap) was found in four (6.67%) specimens, which was similar to that of Lichtenstein & Nicosia (1955)¹⁴ and Gore et al (2000)⁹. Presence of a septum was reported by de Csepel et al (2003)¹⁶, Chalkoo (2009)¹⁷ and Talpur et al (2010)¹⁸ in recently. Talpur et al (2010)¹⁸ found this

anomaly in 0.33% of cases.

CONCLUSION

Though the occurrence of bizarre forms of variations of the gallbladder have been well known for many years in form of numerous case reports, however comprehensive study of the morphological variations of the gall bladder and their incidence is relatively scarce. These variations may remain asymptomatic but often lead to complications and therefore have definite clinical bearings. Given the fact that most of interventional procedures are done laparoscopically, and there has been phenomenal increase in the number of laparoscopic cholecystectomies in this present era, knowledge of possible variations in gall bladder anatomy is critical. Comprehensive knowledge and precise understanding of relevant anatomy is the key to correctly performing invasive procedures, therapeutic and diagnostic, related to this important anatomical region.

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