

Morphology of gall bladder - A cadaveric study

D D Neginhal¹, U K Kulkarni^{2*}

¹Tutor, ²Professor and HOD, Department of Anatomy, Belagavi Institute of Medical Sciences, Belagavi-590001, Karnataka, INDIA.

Email: drdhanu586@gmail.com, drumeshkulkarni@gmail.com

Abstract

Background and aim: Gall bladder is a highly variant organ which presents variations in dimensions, shape and position. Having knowledge of morphological variations of gall bladder becomes important to avoid complications during surgical and radiological interventions. Our study aims to observe the dimensions of gall bladder and also its shape, external morphology and position. **Material and methods:** Fifty adult cadaveric human gall bladders preserved in formalin were studied. The gall bladder was carefully dissected and studied for the maximum length and breadth (transverse diameter) of gall bladder, variations in shape, external morphology and its position. The length and breadth of gall bladder was measured using sliding vernier calipers. Average of three measurement was recorded. The gall bladder was carefully dissected and cleaned to observe the variation in shape, its external morphology and position which was noted down. **Results:** The length and breadth of gall bladder ranged from 5.2cm -8.8cm and 2.0cm- 5.6cm respectively. The mean±SD for length and breadth of gall bladder was 6.76±0.810cm and 3.49±0.75cm respectively. Pear shaped gall bladder was observed in 23 specimens (46%), flask shape in 12 specimens (24%), cylindrical shape in 10 specimens (20%), irregular shape in 03 specimens (06%) and hourglass shape in 02 specimens(04%) . External morphology of gall bladder showed folds at neck and fundus in three specimens each. Hartmann's pouch was seen in one specimen. In two specimens the gall bladder was intrahepatic in position which is of complete type. **Conclusion:** The variations observed in our study will be of great importance to anatomist, surgeons and radiologist.

Key Word: Gall bladder, external morphology, Hartmann's pouch, Intrahepatic.

*Address for Correspondence:

Dr. Umesh K Kulkarni, Professor and HOD, Department of Anatomy Belagavi Institute of Medical Sciences, Belagavi-590001, Karnataka, INDIA.

Email: drumeshkulkarni@gmail.com

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positions. These anatomic variations of gall bladder and biliary tract are important as failure to recognize them can lead to complications like inadvertent ductal ligation, biliary leak and strictures following laparoscopic cholecystectomy and radiological interventions. The present study aims to study the dimensions, variations of shape, external morphology and position of gall bladder which can provide the relevant information to the surgeons and radiologist performing diagnostic and therapeutic interventions at this region.

INTRODUCTION

Gall bladder is a blind ending diverticulum having fundus, body and neck, its capacity is of 30-50ml. It measures between 7-10cm in length and maximum breadth is 3cm. It is obliquely placed in a non-peritoneal fossa on the undersurface of the right lobe of the liver and through the cystic duct drains into the right side of common hepatic duct¹. Gall bladder is highly variant organ, as it presents with variations in dimensions, shape, external morphology in form of folds and abnormal

MATERIAL AND METHODS

The study was conducted at BIMS, Belgaum on fifty adult cadaveric human gall bladder preserved in formalin of unknown sex. Ethical approval was taken from institutional ethical committee prior to commencement of the study. Specimens with any surface anomalies and pathologies were excluded from the study. The gall bladder was carefully dissected and studied for the maximum length and breadth (transverse diameter) of gall bladder, variations in shape, external morphology and its position. The length and breadth of gall bladder was

measured using sliding vernier calipers, average of three measurement was recorded. Range, minimum, maximum and standard deviation was calculated. The gall bladder was carefully dissected and cleaned to observe the variation in shape, its external morphology and position which was noted down.

RESULTS

In present study, the measurements of gall bladder are as shown in table no.1 .The length and breadth of gall bladder ranged from 5.2cm -8.8cm and 2.0cm- 5.6cm respectively .The mean±SD for length and breadth of gall

bladder was 6.76±0.810cm and 3.49±0.75cm respectively. Table no.2 shows the various shapes of gall bladder observed during the study. Pear shaped gall bladder was observed in 23 specimens (46%), flask shape in 12 specimens(24%), cylindrical shape in 10 specimens (20%), irregular shape in 03 specimens (06%) and hourglass shape in 02 specimens(04%) (fig no :1).External morphology of gall bladder showed folds at neck and fundus in three specimens each. Hartmann’s pouch was seen in one specimen. In two specimens the gall bladder was intrahepatic in position which is of complete type (fig no 2- 4).

Table 1: Measurements of gall bladder in the present study

findings	range(cm)	Mean and standard deviation(cm)
Length	5.2-8.8	6.762±0.810
breadth	2.0-5.6	3.492±0.751

Table 2: Various shapes of gall bladder observed in the present study

Shape of gall bladder	Number of specimen	Percentage of specimen
Pear	23	46%
flask	12	24%
cylindrical	10	20%
irregular	03	06%
hourglass	02	04%

Table 3: showing measurements and shape of gall bladder reported by different authors

Author	Number of specimens	length	breadth	shape
Nadeem ³	70	4.5-11.6	2.7-5.2	Pear (82.85%), flask (2.86%), Cylindrical (2.86%), irregular (1.43%), Bilobed (1.43%), others (7.14%)
AV Prakash <i>et al.</i> ⁴	90	7-10	2-5	Pear (82.22%), others (17.78%)
Rajguru <i>et al.</i> ²	60	5-12	2.5-5	Pear (85%), flask (5%), cylindrical (3.33%), Irregular (1.67%), hourglass (3.33%), Retort (1.67%)
RajendraR <i>et al.</i> ⁵	78	4-11	2.5-5	Pear(53.2%),cylindrical (11.4%), hourglass (6.3%) oval (11.4%) others (16.5%)
Desai J <i>et al.</i> ⁶	50	4.5-11	2.8-5	Pear(84%),cylindrical (10%), hour-glass (2%), retort (4%)
Present study	50	5.2-8.8	2.0-5.6	Pear(46%), flask (24%), cylindrical (20%) Irregular (06%), hourglass (04%)

Table 4: Showing external variations in gall bladder reported by different authors

Author	Folded neck	Folded fundus (Phrygian cap)	Hartmann's pouch	Intrahepatic gall bladder
Nadeem ³	-	-	05(7.14%)	-
AV Prakash <i>et al.</i> ⁴	04(4.44%)	05(5.56%)	-	-
Rajguru J <i>et al.</i> ²	03(5%)	03(5%)	-	-
Desai J <i>et al.</i> ⁶	02(4%)	02(4%)	-	-
NaharN <i>et al.</i> ⁹	-	-	04(5.7%)	-
Dundareddy <i>et al.</i> ¹⁰	-	01(2%)	02(4%)	-
Tiwari S ⁷	3(6%)	2(4%)	4(8%)	1(2%)
Present study	03(6%)	03(6%)	01(2%)	02(4%)

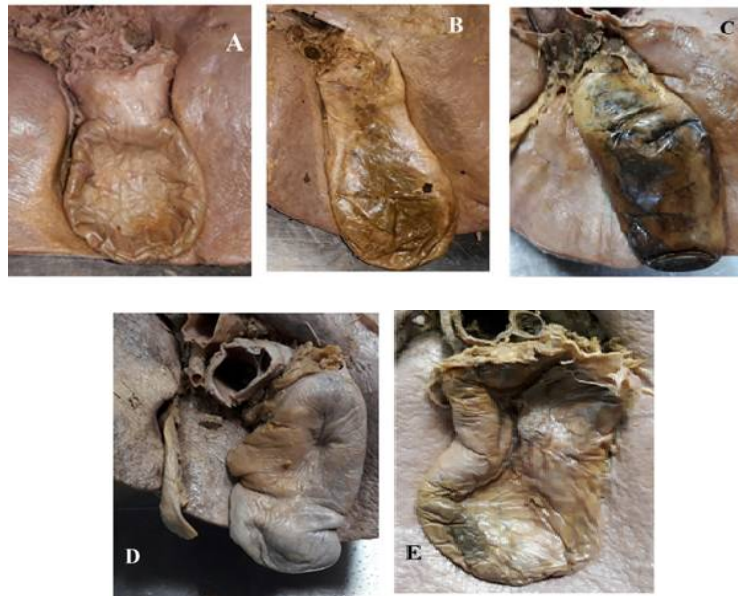


Figure 1: Defferent shapes of gall bladder (A) pear Shaoped (B) Flask Shaped (C) Cylindrical Shapes (D) Irregular Shaped (E) Hourglass Shaped bladder



Figure 2: Gall Bladder showing folds (A) at neck (B) at fundus



Figure 3: Gall bladder with Hartmann's pouch **Figure 4:** intrahepatic gall bladder

DISCUSSION

In third to fourth week of development, hepatic diverticulum of foregut develops into liver, gall bladder and biliary duct system. This diverticulum further grows into septum transversum and divides into two parts for the liver, cranial part as the primordium gives rise to the liver and bile duct. caudal part gives rise to gall bladder and cystic duct .Arrest or deviation from the normal development results into malformation of gall bladder and biliary system². In the present study fifty gall bladder specimens were studied for the morphology. The length

and breadth of gall bladder ranged from 5.2cm-8.8cm and 2.0cm- 5.6cm respectively. Pear shaped gall bladder was the commonest shape observed in our study in 46% of specimens followed by flask shape in 24% of specimens (fig no:1).The findings reported by different authors is summarized in table no.3.The results of present study are similar to that of the previous authors^{2,6}. The gall bladder can become larger or increase in size which is termed as cholecystomegaly. It has been reported in condition like diabetes and also after truncal and selective vagotomy. In Physiological conditions like pregnancy and in obese people the gall bladder enlarges. In condition

like cystic fibrosis, the gall bladder decreases in size⁷. External variations observed in our study were the folds at neck and fundus in 3 specimens each. Hartmann's pouch was seen in one specimen and intrahepatic gall bladder in two specimens (fig no2-4). Variations in the external appearance of gall bladder in the present study is compared with observations reported by previous authors in table no.4^{2,3,4,6,7,9,10}. The most common variation observed is the folded fundus and fold at neck of gall bladder. The folded fundus of gall bladder is referred as Phrygian cap, it is triangular deformity where the fundus is folded on the body, and this partially separates fundus from the body. It is caused by the localized thickening of the gall bladder wall, this variant is asymptomatic and can be diagnosed on x-ray or ultrasound^{11,14}. It is of no clinical significance but can be mistaken for layer of stones or hyperplastic cholecystosis^{8,10}. Hartmann's pouch is seen as a widening at the lateral end of the neck of gall bladder. This can obscure the cystic duct and Calot's triangle, leading to conditions like mucocele and Mirizzi's syndrome¹⁵. Hence, pre-operative diagnosis of presence of Hartmann's pouch should be done to avoid intraoperative and post-operative complications. Intrahepatic gallbladder is one of the abnormal positions of gall bladder. It can present as two types: partial or complete type, when the gall bladder projects out from the liver partly it is of partial type and if completely embedded within the liver parenchyma it is of complete type. This type of presentation, it becomes difficult for the surgeon to operate on gall bladder during laparoscopic cholecystectomy and can also lead to complications. Congenital arrest in the movement of gall bladder from its intrahepatic position in the 2nd month of gestation to its normal superficial location causes this developmental anomaly⁷. Individuals with intrahepatic gall bladder are more prone to cholelithiasis due to incomplete emptying of the gall bladder caused by stasis. It can be diagnosed by ultrasonography or CT scan¹⁶. During laparoscopic cholecystectomy due to anatomical variations, 3.67% of cases showed complication of bleeding and biliary leak from drain in 1.67% of cases. Three patients were reexplored, one for bleeding and other for biliary leak giving rise to morbidity of 01%¹⁴. Hence it is important for the surgeons and radiologist to be aware of such morphological variations of gall bladder for safe execution during any diagnostic and therapeutic interventions.

CONCLUSION

The present study provides information to the anatomist, surgeons and radiologist performing diagnostic and

therapeutic procedures of gall bladder to avoid iatrogenic complications.

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