

MORPHOMETRY AND MORPHOLOGY OF VARIATIONS OF GALL BLADDER: A CADAVERIC STUDY

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ABSTRACT

Aim: To study variations in dimensions and external morphology of cadaveric gall bladder.

Materials and methods: This study was undertaken on 60 cadaveric liver and gall bladder specimens in the Department of Anatomy at Rajarajeswari Medical College and Hospital. The parameters which were measured are length and breadth at the level of neck, body & fundus of Gall bladder using the measuring tape. The shape and external variations were noted.

Results: Gall bladder had length ranging between 6 and 10cm, breadth at the level of neck, body & fundus ranging between 1 to 2cm, 2 to 3.5cm, 2.5 to 3.5cm respectively. The commonest shape observed in this study was pear shaped.

Conclusion: Variations in morphology of gall bladder are commonly encountered during radiological investigations and in operation theatres. Prior knowledge of morphology and morphometry of gall bladder is of utmost importance to the radiologists & laparoscopic surgeons.

KEY WORDS: Gall bladder, Anatomical variations, Laparoscopic cholecystectomy.

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INTRODUCTION

The gallbladder is a slate-blue, pear-shaped sac, partly sunk in a fossa in the right hepatic lobe's inferior surface. It extends forward from a point near the right end of porta hepatis to the inferior hepatic border. It's upper surface is attached to the liver by connective tissue; elsewhere it is completely covered by peritoneum. It is a blind ending diverticulum attached to the common bile duct by the cystic duct. Gall bladder is 7-10 cm long, 3 cm broad at its

widest part and 30-50 ml in capacity.

It is described as having fundus, body and neck. The neck lies at the medial end close to porta hepatis and sometimes widens to form "Hartmann's Pouch". The body of gall bladder lies in contact with liver surface. The fundus lies at the lateral end of the body and projects past the inferior border of the liver to a variable length. The gall bladder varies in size and shape [1].

Knowledge of normal anatomy & anatomical variations of gall bladder is very important for laparoscopic surgeons, specifically in the context of a cholecystectomy, it has been recognized since long that misinterpretation of normal anatomy as well as the presence of anatomical variations contribute to the occurrence of major postoperative complications especially biliary injuries [2].

The present study will be of great help to laparoscopic surgeons and radiologists to understand the external morphology of gall bladder.

MATERIALS AND METHODS

This study was carried out on 60 liver and gall bladder specimens obtained from 10% formalin-fixed cadavers in the Department of Anatomy, Rajarajeswari Medical College and Hospital, Bangalore after obtaining permission from the Institutional Ethics Committee.

Adult cadavers between the age group 20-60 yrs were included and cadavers with death due to past history of liver disease were excluded from this study.

The parameters studied were the length and breadth at the level of neck, body and fundus of Gall bladder. The maximum length was measured from the porta hepatis to the mid-point of the fundus [figure 1] and breadth was measured at the level of neck, body and fundus using the measuring tape graduated in centimeters. The shape and any variation in external appearance of gall bladder were noted.

Fig. 1: Measuring the length of Gallbladder



Fig. 2: Flask Shaped Gall bladder



Fig. 3: Pear shaped Gallbladder



Fig. 4: Retort shaped Gallbladder



Fig. 5: Hartmann's Pouch

Fig. 6: Irregular shaped Gallbladder.

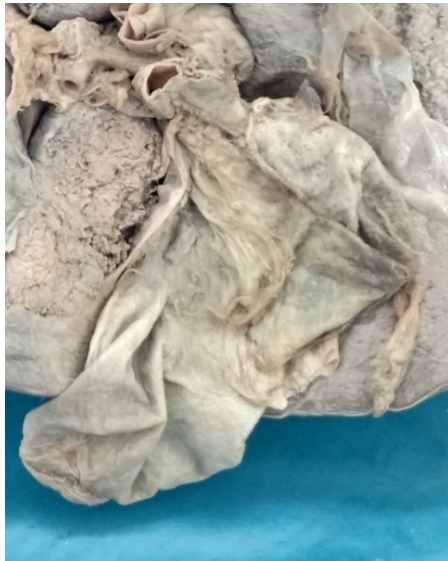
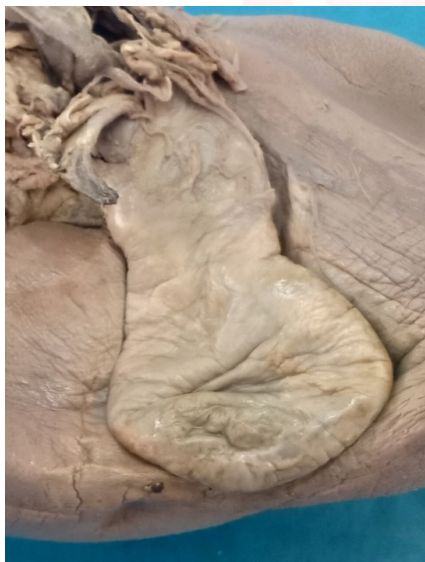


Fig. 7: Hourglass shaped Gallbladder.



fifty two gall bladder specimens. The findings are depicted in Table 2, 3 and 4 respectively.

Table 2: Breadth at the level of Neck of the Gallbladder.

Sl. No.	Breadth at the level of neck	No. of specimens	Percentage
1	<1cm	3	5%
2	1-2cm	54	90%
3	>2cm	3	5%

Table 3: Breadth at the level of Body of the Gallbladder.

Sl. No.	Breadth at the level of body	No. of specimens	Percentage
1	<2cm	6	10%
2	2- 3.5cm	51	85%
3	>3.5cm	3	5%

Table 4: Breadth at the level of Fundus of the Gallbladder.

Sl. No.	Breadth at the level of fundus	No. of specimens	Percentage
1	<2cm	6	10%
2	2.5- 3.5cm	52	86.66%
3	>3.5 cm	2	3.34%

Shapes of gall bladder:

The gall bladders were classified according to their shapes. The shapes observed were pear shape, flask, cylindrical, hourglass, retort or irregular. The commonest shape found was pear shape (76.67%). Their incidences are shown in Table 5.

Table 5: Different shapes of gall bladder.

Sl No.	Shapes of gall bladder	No. of specimens	Percentage
1	Pear	46	76.67%
2	Flask shaped	3	5%
3	Cylindrical	2	3.33%
4	Hourglass	4	6.67%
5	Retort	2	3.33%
7	Irregular	1	1.67%
8	Hartmann’s pouch	2	3.33%

RESULTS

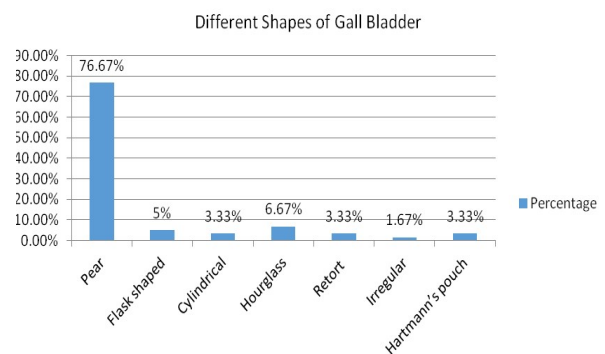
Dimensions of gall bladder

a. Length of gall bladder: In 54 gall bladder specimens (90%), the length was ranging between 6 and 10cm. The smallest gall bladder was 4.5cm in length and the longest had length of 9cm. The findings are depicted in Table 1

Table 1: Length of gall bladder.

Sl. No.	Length in cm	No. Of specimens	Percentage
1	<6cm	4	6.66%
2	6-10cm	54	90%
3	10-12cm	2	3.33%

b. Breadth of gall bladder: Mean breadth of gall bladder at the level of neck is 1 to 2cm in fifty four gall bladder, breadth at the level of body is 2 to 3.5cm in fifty one gall bladder & breadth at the level of fundus is 2.5 to 3.5cm in



External variations of gall bladder:

Hartmann's pouch was observed in 2 out of sixty specimens (figure 5). Folded fundus and neck were not observed in any of the specimens.

DISCUSSION

The liver primordium appears as an outgrowth of the endodermal epithelium at the distal end of the foregut in the middle of the third week. This liver bud consists of rapidly proliferative cells that penetrate mesodermal plate called septum transversum. Hepatic cell continue to penetrate septum so the connection between the hepatic diverticulum and foregut narrows forming the bile duct. Small ventral outgrowth formed by hepatic bud gives rise to the gallbladder and the cystic duct [3]. Malformation of gall bladder and the biliary system may result in deviation and arrest normal embryological developmental process [4].

The gall bladder varies greatly in size and shape. The relaxed gall bladder was approximately 10cm in length & 3.5cm in breadth [5].

The length of gall bladder in the study done by Moore and Dalley [6], Vakili and Pomfret [7], Chari and Shah [8] was found to be 7-10cm.

In the present study the average length of the gall bladder was found to be 6 to 10cm.

The breadth of Gall bladder in present study was measured at the level of neck of gall bladder

was found to be 1 to 2cm in fifty four gall bladder, breadth at the level of body is 2 to 3.5cm in fifty one gall bladder & breadth at the level of fundus is 2.5 to 3.5cm in fifty two gall bladder specimens. This study is unique, since the breadth at the level of neck, body and fundus of gall bladder were measured. We couldn't find any literature with respect to this parameter. .

Gore et al [9] have reported that size of the gallbladder might increase after vagotomy, in diabetes due to autoimmune neuropathy, in pregnancy, in patients with sickle cell disease and in extreme obese people whereas micro-gallbladder was seen in patients with cystic fibrosis. Comparison of length, breadth and shapes of Gall bladder with other studies has been shown in table 6.

Shapes of gall bladder vary tremendously. The most common shape found in the present study was Pear shape which was consistent with many authors such as Rajguru et al [4], Chari & Shah [8]. The hourglass gallbladder presents as a constriction at the junction of middle and lower third of gall bladder, which divides the gall bladder into upper and lower zones. The hourglass shape has been observed in 4 out of 60 specimens (6.67%). These findings are depicted in table 6.

Table 6: Comparison of Length, breadth and shape with observations of other workers.

Sl.No.	Researcher/Year	Length (cm)	Breadth(cm)	Shape
1	Turner, Fulcher, Gore et al. (2000)	10	3.0-5.0	Elliptical
2	Moore and Dalley (2006)	07-10		Pear-shaped
3	Vakili and Pomfret (2008)	07-10	4	Piriform
4	Chari and Shah(2008)	07-10	2.0-5.0	Pear-shaped
5	Rajguru, Khare, Jain et al. (2012)	05-12	2.5-5.0	Pear-shaped
6	Nadeem G (2016)	4.5-11.6	2.5-5.0	Pear-shaped
7	Present Study (2020)	6-10cm	At the level of Neck:1 to 2cm Body:2 to 3.5cm Fundus:2.5 to 3.5cm	Pear-shaped (76.67%)

Rajguru et al studied on 60 gall bladder specimens showed that the average length of gall bladder was 7-10cm (80%), breadth 3-3.5cm(40%), pear shaped gall bladder in 80%, flask shaped in 5%, cylindrical shape in 3%, hourglass shape in 3%, retort shaped in 1.67% & irregular shaped in 1.67% [4].

Nadeem G found average length of gallbladder to be 6-9.5cm and breadth 3.2-4.7cm, pear shaped gallbladder was seen in 82%, cylindrical in 2%, flask shaped in 2.8%, hourglass in 1.43%, irregular shape in 1.43% and Hartmann's pouch was seen in 7% of specimens [10].

Hollinshead [11] and Standring [1] described the

presence of Hartmann's pouch as a clinical entity in which there is widened neck. Futura et al [12] observed higher prevalence of Hartmann's pouch in females than in males. In the present study, Hartmann's pouch was seen in 2 out of sixty specimens (3.33%). Presence of Hartmann's pouch is associated with higher incidence of gall stones. Cholecystectomies are performed most commonly due to the symptomatic gallstones. Recently, the laparoscopic cholecystectomy is considered as the standard procedure, which has led to increase in bile duct injuries [13].

CONCLUSION

Although the occurrence of anatomical variations of gall bladder is rare, it is of utmost importance for laparoscopic surgeons to know the basic anatomical structures and anatomical variations. The number of laparoscopic cholecystectomies performed in India has increased phenomenally in the last few years. This study attempts to discuss the anatomical variations that are of relevance to the performance of a safe cholecystectomy.

Conflicts of Interests: None

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