

Variations in the Morphology of Gallbladder: A Cadaveric Study with Emphasis on Surgical Implications

S. Umarani¹, R. Sivaraj², V. Anandhi³, V. Muniyappan⁴

Abstract

Introduction: Gall bladder is flask shaped and usually lies attached to the inferior surface of the right lobe of the liver by connective tissue. It lies in a shallow fossa in the liver parenchyma covered by peritoneum continued from the liver surface. Cholecystectomy is the single most common intra abdominal operative procedure and it is estimated that about 450,000 cholecystectomies were performed annually. Murphy's sign is elicitation of tenderness where the right lateral plane touches the 9th costal cartilage and the fundus of the gall bladder usually felt at this level. Hence the present study aims to find out the variations in the position of fundus of gall bladder. **Methods:** 87 liver specimens were made use for the study. The relationship of the fundus of the gall bladder to the inferior margin of the liver, congenital anomalies and peritoneal relations of the gall bladder was studied. **Results:** The relationship of the fundus of the gall bladder to the inferior margin of the liver had been classified into supramarginal, marginal, inframarginal and their percentages are 28.69%, 20.33% & 33.89% respectively. The folded fundus of the gall bladder was seen in 5 of 57 specimens. Congenital absence of gall bladder was observed in two liver specimens forming 1.75% of 57 specimens. Section of the liver was made to see the presence of intrahepatic gall bladder there was no gall bladder. Bits of liver tissue were sent for histopathological study and the tissue showed biliary cirrhosis. **Conclusion:** The occurrence of congenital anomalies and anatomical variations of gall bladder are not common but can be of clinical importance. 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 diagnosis and treatment of gall bladder.

Keywords: Gall Bladder; Cholecystectomy.

Introduction

Gall bladder is flask shaped and usually lies attached to the inferior surface of the right lobe of the liver by connective tissue. It lies in a shallow fossa of the liver parenchyma and is covered by peritoneum continued from the liver surface. Cholecystectomy is the single most common intra abdominal operative procedure and it is estimated that about 450,000

cholecystectomies were performed annually. Developmental anomalies in extrahepatic biliary apparatus have been emphasized by Rabinovitch et al. It is difficult to assess the percentage of anomalous gallbladders that undergo pathologic changes. It is clear from available literature that considerable percentage of such anomalies produce symptoms in adult life. These anomalies are the site of serious pathologic changes that they become important clinically. Gall bladder develops from a small hollow bud which arises from the duodenum and grows upwards into the septum transversum. This bud divides into two, of which one forms the gallbladder and cystic duct and the other gives rise to the main mass of the glandular substance of liver. Gross in 1936 gave comprehensive details of gall bladder.

The parts of the gall bladder are from below upwards : fundus, Body and Neck. The fundus is the lower expanded free end of the gall bladder which projects below the liver and is directed downwards, forwards and to the right meeting the anterior

Author's Affiliation: ¹Assistant Professor ³Tutor ⁴Professor & Head, Department of Anatomy, Rajah Muthiah Medical College (RMMC) Annamalai University, Chidambaram, Tamil Nadu 608001, India. ²Professor and Head, Department of Pharmacology, Aarupadai Veedu Medical College & Hospital (AVMC), Kirumampakkam, Puducherry 607402, India

Corresponding Author: Umarani S., Assistant Professor, Department of Anatomy, Rajah Muthiah Medical College (RMMC), Annamalai University, Chidambaram, Tamil Nadu 608001, India.
E-mail: hemanth.kommuri@gmail.com

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abdominal wall at an angle of 30°. The neck forms an S shaped curve and extends from the body to the cystic duct. From the neck a small diverticulum known as Hartmann’s pouch sometimes projects downwards and backwards towards the duodenum and the portion of the neck giving attachment to Hartmann’s pouch is sometimes called the “Isthmus of Gall bladder.” Jaba Rajguru in 2012 informed that common pattern of variations exist in extra hepatic biliary apparatus. It is essential to know about the development and normal anatomy of biliary tract to understand the anatomical and embryological anomalies.

The different patterns of variation in the extrahepatic biliary apparatus reported by Boyden, 1926, Gross, 1936, Hollinshead, 1983, Shaher, 2005. The knowledge of these variations will make the laparoscopic procedures easier, though preoperative diagnosis. Murphy’s sign is elicitation of tenderness where the right lateral plane touches the 9th costal cartilage and the fundus of the gall bladder usually felt at this level. Hence the present study aims to find out the variations in the position of fundus of gall bladder.

Aim

To know about the anatomical and morphological variations of the gall bladder.

Materials and Methods

In the present study totally 95 gallbladder

specimens were used and the study was conducted in Rajah Muthiah Medical college and the specimens obtained from formalin fixed cadavers used for undergraduate students study during the period of 6 years. Cadavers with obvious abdominal surgery and crush injury to the abdominal organs were excluded from the study.

The following parameters were studied

- Maximum length of gallbladder
- Maximum transverse diameter,
- Shape of the gallbladder
- Length of gallbladder below the inferior border of the liver.

Length and transverse diameter was measured using metallic measuring tape gradated in centimeters.

Results

The mean length of the gallbladder was 9 cm in the present study. The smallest gallbladder was 4.2 cm in length and 11.7 cm was the maximum length of the gallbladder. In 61% specimens the length of the gall bladder was in between 7-10 cm in length.

The mean transverse diameter of the gallbladder was 3.16 cm in length. The shortest diameter was 1.7 cm in length. In 53% of specimens the range of the transverse diameter was in between 2-4.5 cm in length.

Various shapes of the gallbladders were observed. (Table 1). The most common observation

Table 1: Comparison of length, breadth and shape with previous studies

S. No	Name of the Author	Length of the gall bladder(cm)	Breadth of the gall bladder(cm)
1	Lee McGregor, Decker and Plessis (1986)	7.5-10	-
2	Turner&Fulcher/(2000)	10	3 - 5
3	Moore and Dalley (2006)	7 - 10	-
4	Chari and Shah (2008)	7-10	2.0-5.0
5	Vakili and Pomfret (2008)	7-10	4.0
6	Standring (2008)	7-10	
7	Rajguru, Khare, Jain et al. (2012)	5-12	2.5-5.0
8	Nadeem, G(2016)	4.5-11.6	2.5-5.0
9	In the present study	4.2 - 11.7	1.7- 4.5

Table 2: Shape of the gallbladder

S. No	Shape of the gall bladder	Percentage
1	Pear	76.25
2	Flask	12.6
3	Cylindrical	4.2
4	Hour Glass	2.1
5	Retort	3.55
6	Irregular	1.4

was pear shaped gall bladder and the second common was flask shape. The relationship of the gallbladder to the inferior margin of the liver had been classified into supra marginal, inframarginal & marginal. In the present study the most common type was inframarginal in 43.12% specimens, supra marginal in 36.55% specimens and marginal in 20.33% specimens.

The folded fundus of gallbladder – its appearance in cholecystogram is referred to as “Phrygian Cap”. In the present study 9 specimens showed folded fundus of gallbladder. Congenital absence of gall bladder was observed in one liver forming 1.75 % of 57 specimens. That liver showed multiple accesses. Section of the liver was made to see the presence of intrahepatic gallbladder there was no gallbladder. Bits of liver tissue were sent for histopathological study and it showed biliary cirrhosis.

In the most of the specimens the superior surface of gall bladder was not covered by peritoneum and was situated in the fossa for gall bladder.

Left margin usually plastered to the liver, right margin was free and covered by peritoneum and was separated from the fossa. Whenever it was inframarginal, fundus of the gall bladder was covered by peritoneum. In one liver from neck of the gallbladder peritoneal fold extended from it to the I part of the duodenum.

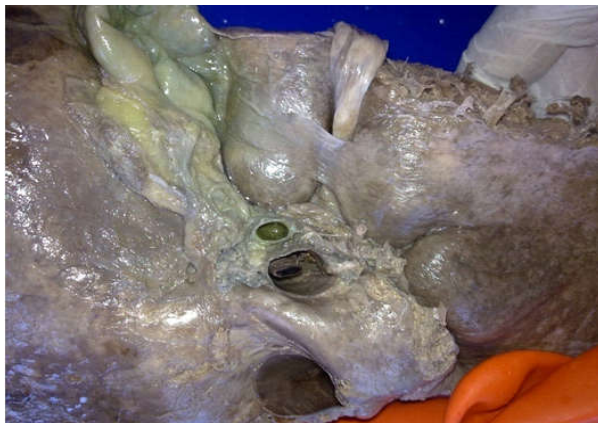


Fig. 1: Folded fundus of gallbladder



Fig. 2: Infra Marginal gallbladder



Fig. 3: Marginal gallbladder



Fig. 4: Supra marginal gallbladder



Fig. 5: Presence of double neck in the gallbladder



Fig. 6: Presence of Hartman's pouch



Fig. 7: Absence of gallbladder



Fig. 8: Inside the liver also there is no gallbladder tissue



Fig. 9: Histopathological Finding – Biliary Cirrhosis Is Seen

Discussion

The relationship of the fundus of the gall bladder to the inferior margin of the liver had been reported by several authors. Lurge (1913) classified the relation of fundus to the edge of the liver into supra marginal, marginal and infra marginal. He reported 33% specimens were supramarginal, 13.9% were marginal and 53% were inframarginal type. In the present study also we observed the most common type was inframarginal in 43.12% specimens and 36.55%, 20.33% were supra marginal and marginal respectively. The measurements of length and breadth were compared with the previous studies in Table. no – 1. The measurement of length and transverse diameter found in present study it similar to that found by Rajendra et al in 2015.

The size of the gallbladder will increase after vagotomy and in diabetes due to autoimmune neuropathy and micro gallbladder with cystic fibrosis was seen in sickle cell disease patients, during pregnancy and extreme obese people. Gore, Fulcher, Taylor et al. (2000).

Pear shaped gallbladder was observed in 76.25% of specimens which coincides with the findings of Rajguru, Khare, Jain et al. (2012), Moore and Dalley (2006) and Chari and Shah (2008). Rajguru, Khare, Jain et al. observed 5% of specimens were flask shaped and 3.33% specimens were cylindrical shaped. In the present study 12.6% specimens showed flask shape and 4.2% specimens were cylindrical. Irregular shaped gallbladder was seen in 1.67% cases by Rajguru, Khare, Jain et al. (2012) reported 1.67% specimens were irregular shaped and in the present study it was 3.15%. Folded fundus of gall bladder was first described by Bartel (1916) who reported 43 cases at autopsy. Boyden (1935) found the same anomaly in 7.5% of the 80 autopsy specimens and in 3.6% of the cholecystograms while Lichtenstein (1937) reported 3% in 212 specimens. Sreekanth et al and J Desai reported 2% and 8% specimens showed folded fundus of the gallbladder, in the present study in 8.47% of specimens observed with folded fundus. Hartmann's pouch was first described by Broca (1938) has been regarded as contrast feature of normal gall bladder (Hollenshead 1971, Gray 1984) but Davis et al considered it to be pathological. Ejick, Veen, Lange et al. (2007) has reported that Hartmann's pouch is a morphological entity and not an anatomical entity Futura et al. reported that there was a higher incidence Hartmann's pouch in females. Nadeem G reported 10% specimens showed hartmann pouch and in the present study it was 6.77% specimens.

The incidence of congenital absence of the gall bladder is certainly low, but it is not known exactly. Latimer, Mendesy and Hage quoted various estimates of 0.065%, 0.3% and 0.075%. Finney and Owen stated that congenital absence of the gall bladder has been said to be about twice as common in women's as in men. In the present study one male cadaver gall bladder was congenitally absent. Mahato NK had been reported septation of the gall bladder may be single or multiple and it will be associated with cholelithiasis and abdominal colic. In the present study we didn't observe any septations in the gall bladder. A double cystic duct is extremely rare. Of the 9 case reports in the English and European literature, it is associated with a double gallbladder over 80% of the time. Shivhare R reported they were three types of variations in the cystic ducts. In the present study we observed the presence of double neck in one specimen.

Conclusion

In the present study we observed the variations in the shape and position of the gall bladder. Anatomical variations of Gallbladder shape and position were taken into the account for Radiological study, Investigative procedures, Surgical interventions, Clinical Implications, Embryological explanations and Comparative anatomy surgeons must be aware of the many possible anatomic anomalies to minimize the risk of complications. These variations generally remain symptoms free but often lead to complications. Finding out of these anatomical variations and make difficult operations easy, to prevent post-operative complications and thus reducing morbidity and mortality. There is tremendous increase in number of laparoscopic Cholecystectomies. So, thorough knowledge in morphology, anatomical variations and congenital anomalies of gallbladder is important.

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