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Corresponding Author:
Dr. Ratna Prabha.J,
Email: vastushilpi@gmail.com

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MORPHOMETRIC STUDY OF GALL BLADDER

Basanagouda Patil[1], Ratna Prabha.J[2], Sudha Patil[3]

[1]Assistant Professor, Department of Anatomy, Navodaya Medical College Raichur, Karnataka, India.
[2]Professor, Department of Anatomy, Navodaya Medical College Raichur, Karnataka, India.
[3]Professor, Department of Anatomy, Navodaya Medical College Raichur, Karnataka, India.

ABSTRACT

Background: Variations in the morphometry of Gall bladder is quite common. Knowledge of this anatomical variation can prevent iatrogenic injury by surgeon and may help the inexperienced radiologist for proper reporting. **Materials and Methods:** 50 adult cadavers were studied to evaluate the morphometric study of GB. The size and shape were classified with percentage. The length and breadth were measured with tailors tape. **Results:** 50% pear shaped, 12.4% flask shaped, 14% cylinder shaped, 6% hour glass shaped, 6% intra hepatic, 2.0% left GB, 2.0% double GB were studied. The mean length of GB was 6.82 (±1.42), 2.80 (±0.76) was mean breadth of GB, t test was 17.6 and $p<0.01$. **Conclusion:** Present morphometric study of Gall Bladder (GB) will be helpful to surgeon during laparoscopy and cholecystectomy and also help the radiologist for proper reporting the radiology of G.B.

INTRODUCTION

The Gall bladder develops from the hepatic diverticulum, which begins forming during 4th week of embryonic development. Specifically, the hepatic diverticulum splits into a cranial bud (pars hepatica) and caudal bud (pars cystica) with the latter ultimately develops into gall bladder. Initially Gall bladder (GB) is hallow but it becomes filled with endodermal cells before, later on undergoing recanalisation. During early development GB attached to ventral surface of duodenal precursor, and later rotates to be on the dorsal surface due to differential growth. It eventually migrates to final position on the inferior surface of liver.

Hence it is hypothesized that, division of hepatic diverticulum and rotation to be on the dorsal surface may lead to variations of morphometry in the GB. Because rotation of gut was anti-clockwise hence GB size, shape and location is altered, hence the morphometry of GB may be pear shaped, flask shaped, intrahepatic, partially intra hepatic, Phrygian cap etc. Moreover size and shape of GB are important determinants of GB contraction and function. Large GB volume observed in older individuals and in pregnancy. Reduction in GB contractibility leads to biliary stasis and sludge formation tendency leads to GB stones.

The variations in the of GB morpho-metric and positions are frequently noticed during imaging of GB and surgical procedures like laparoscopy and cholecystectomy. These variations of GB are important to surgeon and radiologist. An inexperienced radiologist may report normal GB as pathological GB. Hence an attempt is made to evaluate the morpho-metric study of GB to prevent iatrogenic injury to GB and biliary apparatus.

MATERIALS AND METHODS

50 Gall bladders of both sexes were studied in the cadavers present at dissection theatre of Anatomy department of Navodaya Medical College Raichur, Karnataka – 584103 were studied.

Inclusive Criteria: Non-pathological, non-ruptured GB was selected for study.

Exclusion Criteria: Pathological (cirrhosis of liver), ruptured GB were excluded from study.

Method: Morphological classification was done as per the appearance, position of GB. The length and breadth of GB was measured by Tailors tape by putting the liver in anatomical position.

Duration of Study was April 2024 to May 2026.

Statistical Analysis: Morphological classification was done with percentage. Metrical study was done with t test value. The statistical analysis was carried out in SPSS software. The ratio of Male and female was 3:1.

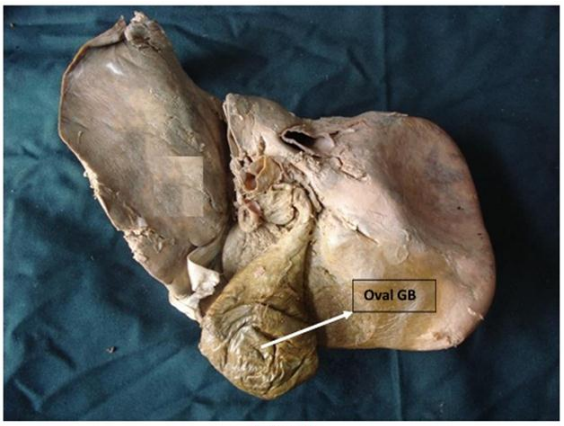


Figure: A

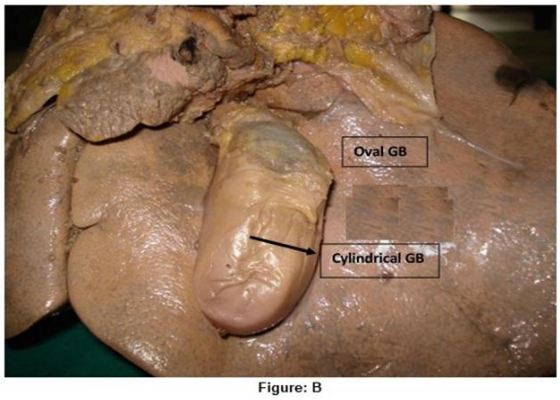
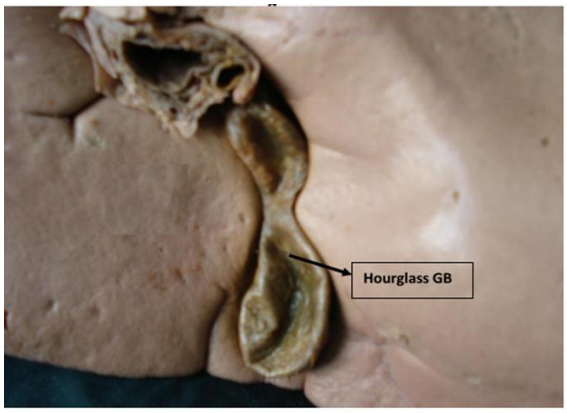


Figure: B



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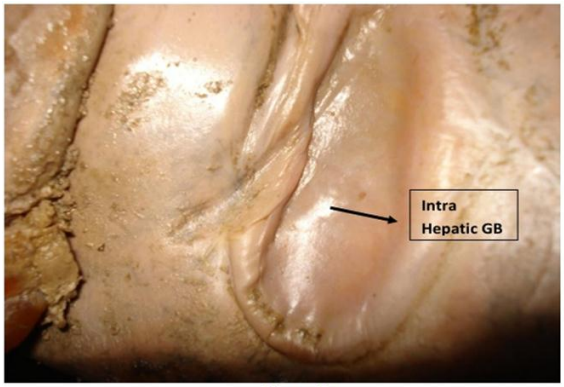

Figure: D

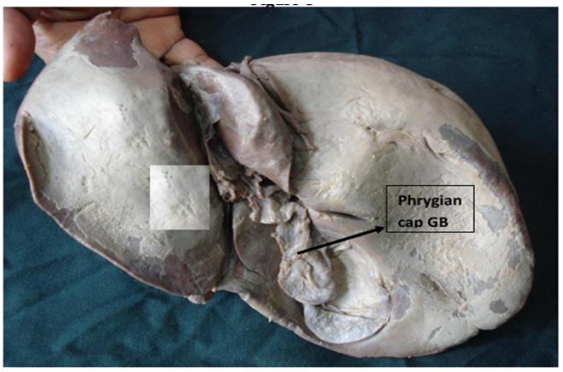

Figure: E

Figure: F

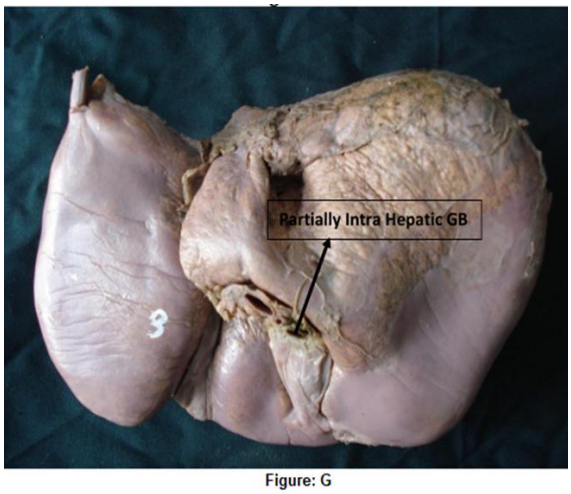

Figure: G

RESULTS

Table-1: Morphological classification of GB

25 (50%) per shaped, 6 (12%) flask shaped, 7 (14%) cylindrical, 3 (6%) hour glass shaped, 2 (4%) partially intra-hepatic, 3 (6%) intra-hepatic, 2 (4%) Phrygian cap, 1 (2.0%) left GB, 1 (2.%) double GB.

Table-2: Present morphological classifications were compared with previous studies. and more or less in agreement with previous studies.

Table-3: Comparison of length and breadth of GB: 6.82 (± 1.40) length of GB, 2.80 (± 0.76) breadth of GB, t test 17.8 and $p<0.001$.

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Table 1: Morphological classification of Gall Bladder **(No. of Cadaveric: 50)**

Detail of Morphology	Incidence	Percentage
Pear shaped	25	50
Flask Shaped	6	12
Cylindrical	7	14
Hour glass shaped	3	6
Partially intra-hepatic	2	4
Intra-hepatic	3	6
Phrygian cap	2	4
Left GB	1	2
Double GB	1	2
Total	50	

Table 2: Comparison of present Morpho-metric study with previous workers

Sl No	Worker and date	Frequency of various shape of GB
1	Raj guru 2012	85% pear shaped, 5% flask shaped, 3.33% cylindrical, 3.33% hour glass bladder, 1.67% retort, 67% Irregular
2	Desai J 2015	84% pear shaped, 10% cylindrical, 2% hour glass shaped , 1.67% retort shaped, 67% Irregular
3	Rajendra.R 2015	53.2% pear shaped, 11.4% cylindrical, 63% hour glass shaped , 11.4% oval, 16.5% Irregular
4	Nadeem 2016	82.8% pear shaped, 2.86% cylindrical, 1.43 bilobed, 7.14% Irregular
5	Tiwari 2018	52% pear shaped, 28% flask shaped, 12% cylindrical, 4% hour glass bladder, 4% Irregular
6	Present study 2026	50% pear shaped, 12% flask shaped, 14% cylindrical, 6% hour glass shaped, 6% Intrahepatic, 2% double GB

Table 3: Comparison of length and Breadth of GB

Length of GB Mean Value (SD±)	Breadth of GB Mean Value (SD±)	t test	p value
6.82 (± 1.40)	2.80 (± 0.76)	17.08	P<0.01

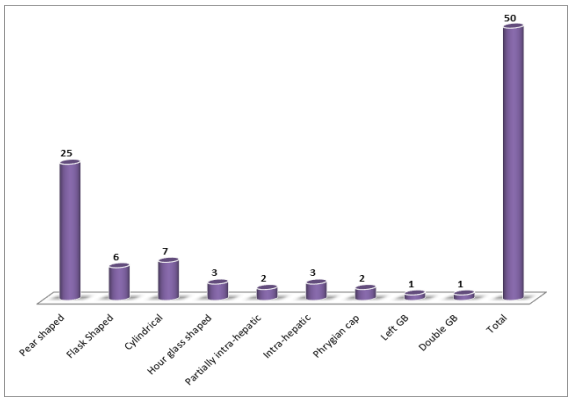

Figure 1: Morphological classification of Gall Bladder

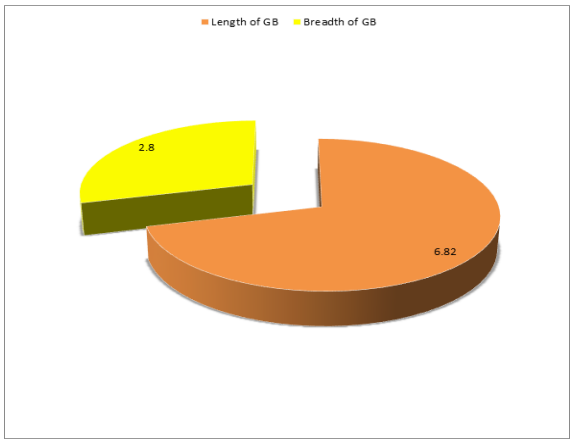

Figure 3: Comparison of length and Breadth of GB

DISCUSSION

Present morpho-metric population (Cadaveric study) out of 48 GB 25 (50%) pear shaped, 6 (12%) flask shaped, 7 (14%) cylindrical, 3 (6%) hour glass shaped, 2 (4%) partially intra-hepatic, 3 (6%) Intra-hepatic, 2 (4%) Phrygian cap, 1 (2.0%) left GB, 1 (2.0%) double GB (Table-1). Mean length of GB 6.82 (± 1.40), 2.80 (±0.76) Mean breadth of GB, t test 17.8 and p<0.01 (p value was highly significant) (Table-3) (Figure A, B, C, D, E, F and G). These findings are more or less in agreement with previous studies.[5,6,7] There is no exact known cause to define these variations but following are the probable reasons. (A) As contraction of GB and secretions of bile are under activation of cholecystokinine and secreting hormones which are released from adreno-axis of pituitary gland, maturations of functional activity of liver depends on adreno-axis of pituitary. Hence role of pituitary may be responsible for these variations.[8] (B) Microscopically, there is no muscularis mucosa in GB rather there is a muscularis lamina consisting of irregular anastomosing bundles of smooth muscles running in longitudinal, circular and oblique directions, moreover concentration of bile solely depends on the ability of epithelium which withdraws water and inorganic ions from the bile. The height of the cells of the epithelium is quite variable to respond to the degree of contraction of bile.[9] Hence indefinite muscular framework might have resulted into variations of shape and size of the GB. (C) The plasticity of hepatic parenchyma is observed in foetal

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life as it does not develop completely until several years after birth but with proliferation of hepatic parenchyma there is an increase in the size and shape of the GB, cystic duct and common bile duct hence there is a mutual or reciprocal relation between GB and functional liver as pars cystica is a spurt of pars hepatica.[10] Hence delay in proliferation or plasticity of hepatic parenchyma might result in Variations of morphometricity of GB. (D). As there is an intimate relation between germ layers, fate or destiny of Anatomy of any gland or organ is difficult to predict, especially in the secondary mesoderm which undergoes such an intimate differentiation that it is hardly possible to follow.[11] Hence it clearly indicates that these variations of the GB resulted in response to the functional need of the body. In the metrical study, length and breadth of GB is highly significant ($p<0.01$) (Table-3).

The present study of length and breadth of GB is in agreement with previous studies.[12,13] This certainly indicates that there was a migration of the different races to India for the sake of survival.[14] Apart from this, genetic signalling requires proper nutrition because each hormone or enzyme is regulated by each gene.[15] Nutritional, ecological or environmental factors also play a contributory role for deciding the morphometricity of any gland. Anthropologists or anatomists still have much to learn about the relative roles of genetic and direct environmental influences on the variations in the size and shape of glands in humans because humans have developed from the interaction between hereditary and environment.

CONCLUSION

These variations and significant values will certainly help the clinician, anatomist, anthropologist and medico-legal expert to differentiate the South Indian findings with other parts of the country and abroad. Above all this study will help the laparoscopic surgeon to take preventive measures before cholecystectomy and the radiologist to differentiate the normal from anomalies. But it requires further study to throw more light upon genetic, embryological and nutritional factors because exact mechanism of contraction of GB, concentration and secretion of bile by GB is yet to be known. As gall bladder is cut and discarded if pathological, hence least attention is paid for this study in research literature.

Limitation of study: Owing to small number of samples and lack of latest technologies, we have limited findings and results.

- This research work was approved by Ethical Committee of Navodaya Medical College Raichur, Karnataka – 584103.
- No Conflict of Interest
- Self Funding

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