Morphological Parameters of Gallbladder are Correlated with Age

Farjana Mansura¹, Kazi Abdullah Al Mamun², Abdullah Al Faisal³, Mahmuda Khatun ⁴, Halima Akter Suchi⁵

Abstract

Introduction: Gallbladder issues are prevalent globally, particularly in Bangladesh, and become more common with age. Diagnosis involves clinical assessment and confirmation through noninvasive and invasive methods. Understanding gallbladder features is crucial for effective investigation, diagnosis, and management. Objectives: To find out relation between morphological parameters of human gallbladder with age. Materials and Methods: This cross-sectional descriptive study was conducted in the Department of Anatomy in collaboration with the Department of Forensic Medicine, Sylhet MAG Osmani Medical College, Sylhet from January 2014 to December 2014. Fifty human postmortem gallbladders were selected. Dead bodies autopsied within 36 hours of death. Considerable signs of decomposition or decomposed dead body, presence of gross gallbladder disease and any history of poisoning cases were excluded. All the specimens were examined to detect the length, breadth, weight and thickness of the gallbladder; and length and diameter of cystic duct. Results: The study included cadavers ranging in age from 11 to 55 years, with a mean age of 35.02 ± 19.98 years. Of the total, 29 (58.0%) were male, and 21 (42.0%) were female. The length and thickness of the gallbladder increased significantly with age, as did the length and diameter of the cystic duct. But the weight and breadth also change with age, although not significantly. Conclusion: The length and thickness of the gallbladder; the length and diameter of the cystic duct were varied with age; but no variation in weight and breadth.

Keywords: Morphological parameters, gallbladder, age.

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Introduction:
The gallbladder is a flask-shaped, blind-ending diverticulum attached to the common bile duct by the cystic duct. In life, it is grey-blue in colour and usually lies attached to the inferior surface of the right lobe of the liver by connective tissue. In the adult the gallbladder is between 7 and 10 cm long. It usually lies in a shallow fossa in the liver parenchyma covered by peritoneum continued from the liver surface. This attachment can vary widely. At one extreme the gallbladder may be almost completely buried within the liver surface, having no peritoneal covering (intraparenchyma pattern); at the other extreme it may hang from a short mesentery formed by the two layers of peritoneum separated only by connective tissue and a few small vessels (mesenteric pattern)⁴. The gallbladder stores bile up to 5 fold of its capacity and concentrates bile by absorbing water to a maximum 20 fold. Bile is secreted by the liver cells but most of it is normally stored in the gallbladder until needed. The maximum volume that the gallbladder can hold is only 30 to 60 milliliters⁵,⁶. The organ is divided into fundus, body and neck, the latter opening into the cystic duct. In dilated and pathological gall-bladders there is frequently a pouch present on the ventral aspect just proximal to
The most common biliary diseases are cholelithiasis. Liver and biliary diseases are the most common health problems in the United States. Up to 25% of all Bangladeshi people have gallstones. It is estimated that over 20,000,000 people in developed countries have gallstones.

The gall-bladder and ducts are subject to numerous anatomical variations which are best understood by considering their embryological development. A diverticulum grows out from the ventral wall of the duodenum which differentiates into the hepatic ducts and the liver. Another diverticulum from the side of the hepatic duct bud forms the gall-bladder and cystic duct.

Some variations in biliary anatomy are (a) Along cystic duct joining the hepatic duct low down behind the duodenum. (b) Absence of the cystic duct—the gall-bladder opens directly into the common hepatic duct. (c) A double gall-bladder, the result of a rare bifid embryonic diverticulum from the hepatic duct. (d) The right hepatic artery crosses in front of the common hepatic duct; this occurs in 25% of cases.

Liver and biliary diseases are the most common health problem throughout the world as well as in Bangladesh. The most common biliary diseases are cholelithiasis. Gallstones afflict 10% to 20% of adult populations in developed countries. It is estimated that over 20,000,000 persons in the United States have gallstones. Up to 25% of all Bangladeshi people have gallstones. Cholecystitis is associated with cholelithiasis in 95% cases. Gallstone formation is the most common disorder of the biliary tree and it is unusual for the gallbladder to be diseased in the absence of gallstone. The commonest lesion observed is chronic cholecystitis (80%) followed by acute cholecystitis (9.3%) invasive carcinoma (7.3%) carcinoma in situ (0.6%) and dysplasia (0.6%).

A traditional cholecystectomy is most commonly performed from the infundibulum to the fundus as no medical treatment is still available. Now a day’s laparoscopic cholecystectomy replaces the open surgical method. During operation surgeons have to identify the cystic duct and cystic artery properly before ligation. Uncontrolled bleeding from the cystic artery and its branches is a serious problem that may increase the risk of intraoperative lesions to vital vascular and biliary structures. The performance of a safe cholecystectomy depends on thorough knowledge about the normal anatomy and anatomical variations that may contribute to the occurrence of major postoperative complications.

Materials and Methods:
This cross-sectional descriptive study was conducted in the Department of Forensic Medicine in Sylhet M.A.G Osmani Medical College from 1st January 2014 to 31st December 2014 over a period of one year. Fifty dead bodies autopsied within 36 hours of death were included in this study. Bodies with considerable signs of decomposition, any gross gallbladder disease, any injury to the gallbladder or biliary tract area and any history of poisoning were excluded from this study. Data were collected by using pre-designed checklist prepared for the study. The questionnaires were pre-tested and face validated by consulting with experts.

A total 50 human gallbladder were collected from 50 cadavers, whose age limits were from 11-55 years, of both sexes. The specimens were divided into three groups by age according to Khan et al. for the convenience of differentiating the changes if various histomorphological features of the gallbladder in relation to age. Group A consisted with 7 patients of age 11-20 years, Group B with 28 patients of age 21-40 years and Group C with 15 patients of age 41-55 year.

Fifty human gallbladders were collected from the unclaimed dead bodies autopsied in the Department of Forensic Medicine in Sylhet M.A.G Osmani Medical College, Sylhet during the period from January 2014 to December 2014 meeting the inclusion and exclusion criteria. Particulars of dead body was collected from police inquest report and chalan.

Dead body was kept in supine position on the mortuary table. A longitudinal midline incision was made from the tip of the ziphoid process to the upper border of the symphysis pubis encircling the umbilicus. Then a transverse incision was made from the ziphoid process to mid axillary line in both side. Another incision was made from the symphysis pubis to the anterior superior iliac spine along with inguinal line both side. Then skin and superficial fascia were retracted laterally. After cutting the rectus sheath and parietal peritoneum abdomen was opened. Then gallbladder was identified. Then gallbladder along with cystic duct was collected as block dissection with part of the liver and part of common hepatic duct. After removal from the body, unwanted tissues were cleared and gently washed out in normal saline and fixed with 10% formal saline. Then they were brought to the Department of Anatomy, Sylhet M.A.G Osmani Medical College, Sylhet.

Measurement of the parameters of gallbladder and cystic duct:
Bile was removed by cutting one edge of the gallbladder. The interior of the gallbladder was washed and cleaned thoroughly and carefully. The surface of the gallbladder was dried with blotting paper. Then it was weighed by means of an analytical balance (Mega digital scale, made in China: Elsevier Saunders. 2006; 799-802.

References:

Liver and biliary diseases are the most common health persons in the United States have gallstones (Crawford, unusual for the gallbladder to be diseased in the absence of duodenum which differentiates into the hepatic ducts and anatomical variations which are best understood by bladder through its bed directly into tributaries of the right duodenum. (b) Absence of the cystic duct—the duct joining the hepatic duct low down behind the muscle, but there are only scattered muscle fibres

A traditional cholecystectomy is most commonly performed. Cholecystitis is associated with cholelithiasis.

The performance of a safe cholecystectomy. Cholecystitis is associated with cholelithiasis according to Khan et al. 9 for the convenience of collecting by using pre-designed checklist prepared for the December 2014 over a period of one year. Fifty dead body of the gallbladder in relation to age. Group A consisted with 7 patients of age 11-20 years, Group B with 28 patients of age 21-40 years and Group C with 15 patients of age 41-55 years.

Distribution of the cadaver by sex
There were 29 (58.0%) male and 21 (42.0%) female with a ratio of male to female was 1.38:1. Distribution of the cadaver by sex was shown in figure 2.

In this study age Group-A (11-20 years) constituted 7 (14.0%) cases, age Group-B (21-40 years) constituted 28 (56.0%) cases and age Group-C (41-55 years) constituted 15 (30.0%) cases.

Distribution of the cadaver by age

Data were processed manually and analyzed with the help of SPSS (Statistical package for social sciences) Version 21.0. Quantitative data were expressed as mean and standard deviation; and comparison was done by unpaired t test between two groups and ANOVA test among three groups. A probability value (p) of less than 0.05 was considered statistical significant.

Prior to the commencement of the study, approval of the research protocol was obtained from the Ethical Committee of Sylhet M.A.G Osmani medical college, Sylhet.

Observations and Results
A total of 50 human postmortem gallbladders were studied in the present work. All the specimens were examined to detect the morphology of gallbladder, but only 18 specimens examined histologically. The outcome of the study was as follows:

Distribution of age of the cadaver
The age of the cadaver ranged from 11 to 55 years with the mean age of 35.02 (SD ± 19.98) years. Distribution of the cadaver by age group was shown in figure 1.

Morphology of Gallbladder

In this study age Group-A (11-20 years) constituted 7 (14.0%) cases, age Group-B (21-40 years) constituted 28 (56.0%) cases and age Group-C (41-55 years) constituted 15 (30.0%) cases.

Distribution of the cadaver by sex
There were 29 (58.0%) male and 21 (42.0%) female with a ratio of male to female was 1.38:1. Distribution of the cadaver by sex was shown in figure 2.

Figure-2: Distribution of the cadaver by sex (n=50)

Distribution of the parameters of gallbladder by different age group
The mean length of the gallbladder was 7.07 ± 0.55 cm in the age group of 11 to 20 years; 8.00 ± 0.88 cm in the age group of 21 to 40 years and 8.57 ± 1.05 cm in the age group of 41 to 55 years. The difference among the groups was statistically significant (F=6.622; p=0.003).

The mean weight of the gallbladder was 4.58 ± 1.39 gm in the age group of 11 to 20 years; 6.26 ± 2.12 gm in the age group of 21 to 40 years and 6.98 ± 2.51 gm in the age group of 41 to 55 years. The difference among the groups was statistically not significant (F=2.920; p=0.064).

The mean breadth of the gallbladder was 2.90 ± 0.45 cm in the age group of 11 to 20 years; 3.07 ± 0.43 cm in the age group of 21 to 40 years and 3.19 ± 0.44 cm in the age group of 41 to 55 years. The difference among the groups was statistically not significant (F=1.112; p=0.338).

The mean thickness of the gallbladder wall was 1.33 ± 0.16 mm in the age group of 11 to 20 years; 1.61 ± 0.14 mm in the age group of 21 to 40 years and 2.25 ± 0.35 mm in the age group of 41 to 55 years. The difference among the groups was statistically significant (F=52.845; p=0.0001).

Table 1: Distribution of the parameters of cystic duct by different age group

<table>
<thead>
<tr>
<th>Parameters of gallbladder</th>
<th>Total (n=50)</th>
<th>Group-A (n=7)</th>
<th>Group-B (n=28)</th>
<th>Group-C (n=15)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (cm)</td>
<td>8.04±1.00</td>
<td>7.07±0.55</td>
<td>8.00±0.88</td>
<td>8.57±1.05</td>
<td>0.003</td>
</tr>
<tr>
<td>Weight (gm)</td>
<td>6.24±2.25</td>
<td>4.58±1.39</td>
<td>6.26±2.12</td>
<td>6.98±2.51</td>
<td>0.064</td>
</tr>
<tr>
<td>Breadth (cm)</td>
<td>3.08±0.48</td>
<td>2.90±0.45</td>
<td>3.07±0.43</td>
<td>3.19±0.44</td>
<td>0.338</td>
</tr>
</tbody>
</table>
Liver and biliary diseases are the most common health problems in developed countries. It is estimated that over 20,000,000 people suffer from gallbladder disease. The gall-bladder and ducts are subject to numerous diseases due to infection and disorders. The portal vein within the liver is connected to the hepatic artery, which pass to the gall-bladder from its bed in the liver. The cystic duct and cystic artery properly before ligation.

The interior of the gallbladder was washed and cleaned after removal from the body, unwanted tissues were collected as block dissection along with cystic duct. After cutting the superficial fascia, the transverse incision was made from the ziphoid process to the symphysis pubis to the anterior superior iliac spine. The breadth of the gallbladder was measured at its maximum width in the age group of 11 to 55 years.

**Materials and Methods:**
A total of 50 human postmortem gallbladders were studied in this study. Bodies with considerable signs of disease were excluded from the study. The specimens were divided into three groups by age according to Khan et al. for the convenience of sex distribution. The specimens were examined histologically. The outcome of the study was statistically significant (F=52.845; p=0.0001).

In the present study the weight of the gallbladder ranged from 2.0 to 9.88 gm with the mean 6.24 ± 2.25 gm. This result was consistent with the study of Nahar where the mean weight of the gallbladder was 6.37 ± 0.29 gm in male and 6.26 ± 0.03 gm in female in the age group of 10-20 years. The mean weight of the gallbladder was 4.58 ± 1.39 gm in the age group of 11 to 20 years; 6.26 ± 2.12 gm in the age group of 21 to 40 years and 6.98 ± 2.51 gm in the age group of 41 to 55 years. The difference among the groups was statistically not significant (p=0.064). This result was correlated with the study of Nahar, that the mean weight of the gallbladder in male and female was not statistically not significant (p>0.05).

In the current study the breadth of the gallbladder ranged from 2.50 to 4.00 cm with the mean 3.08 ± 0.48 cm. Rahman et al. found that the average breadth of the gall bladder was 2 cm. Vakili and Pomfret reported that the breadth of the gall bladder was 4 cm. Turner et al. reported that the breadth of the gall bladder was 3.5 cm. Chari and Shah found that the breadth of the gall bladder was 2.5 cm. In the present study the breadth of the gallbladder was 2.90 ± 0.45 cm in the age group of 11 to 20 years; 3.07 ± 0.43 cm in the age group of 21 to 40 years and 3.19 ± 0.44 cm in the age group of 41 to 55 years. The difference among the groups was statistically not significant (p=0.338). This result was supported by Nahar, that the mean breadth of the gallbladder of male and female was not statistically significant in any age group (p>0.50).

This study showed that the thickness of the gallbladder wall ranged from 1.10 to 2.90 mm with the mean 1.76 ± 0.40 mm. Majeski, found that the thickness of the adult gallbladder wall was 3 mm. This finding is slightly higher than the present study. This variation is probably due to difference in geographical distribution and racial variation. In the present study the mean thickness of the gallbladder wall was 1.33 ± 0.16 mm in the age group of 11 to 20 years; 1.61 ± 0.14 mm in the age group of 21 to 40 years and 2.25 ± 0.35 mm in the age group of 41 to 55 years. The difference among the groups was statistically significant (p<0.001). Nahar, found that the difference in mean thickness of the gallbladder wall in male between group A and C (p<0.01) and group B and C (p<0.05) were statistically significant which correlated with the present study. Khan et al., found that the thickness of the gallbladder wall ranged from 1.47-0.06 mm in group A (10-20 years), 1.57 ± 0.05 mm in group B (21-40 years) and 1.61 ± 0.04 mm in group C (41-70 years).

In this study the length of the cystic duct ranged from 2.00 to 3.50 cm with the mean 2.80 ± 0.27 cm. In this regards Standing, found the length of the cystic duct was 3.4 cm. Limthanakhom et al. found that the mean length of the cystic duct was 1.42 cm. According to Sinnatamby, the length of the cystic duct is 2.3 cm and according to Moore et al., the length of the cystic duct is 3.4 cm. In this study the mean length of the cystic duct was 2.57 ± 0.31 cm in the age group of 11 to 20 years; 3.07 ± 0.43 cm in the age group of 21 to 40 years and 3.02 ± 0.22 cm in the age group of 41 to 55 years. The difference among the groups was statistically significant (F=11.178; p=0.001).

This study also showed that age Group-A (11-20 years) constituted 7 (14.0%) cases, age Group-B (21-40 years) constituted 28 (56.0%) cases and age Group-C (41-55 years) constituted 15 (30.0%) cases. Similar findings were observed in the study of Nahar et al. In the current study there were 29 (58.0%) male and 21 (42.0%) female with a ratio of male to female was 1.38:1. Nahar also included similar sex distribution of cadavers that 39 (55.7%) male and 31 (44.3%) female cadaver with a ratio of male to female was 1.26:1 in her study.

In this study the length of the gallbladder ranged from 6.5 to 10.5 cm with the mean 8.04 ± 1.00 cm. This result was correlated with several other studies. All these studies, the length of the gall bladder was 7 to 10 cm. Rahman et al. found that the average length of the gall bladder was 6-7 cm. In this study the mean length of the gallbladder was 7.07 ± 0.55 cm in the age group of 11 to 20 years; 8.00 ± 0.88 cm in the age group of 21 to 40 years and 8.57 ± 1.05 cm in the age group of 41 to 55 years. The difference among the groups was statistically significant (p=0.003). Nahar, found that the mean length of the gallbladder in male and female between group A and B (p<0.05) and group A and (p>0.01) were statistically significant.

### Table II: Distribution of the parameters of cystic duct by different age group

<table>
<thead>
<tr>
<th>Parameters of gallbladder</th>
<th>Total (n=7)</th>
<th>Group-A (n=7)</th>
<th>Group-B (n=28)</th>
<th>Group-C (n=15)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness of wall (mm)</td>
<td>1.76±0.40</td>
<td>1.33±0.16</td>
<td>1.61±0.15</td>
<td>2.25±0.35</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

ANOVA test was done

### Discussion:
In this study the age of the cadaver ranged from 11 to 55 years with the mean age of 35.02 ± 19.98 years. In this regards Rahman and Anwar found that age of the cadaver ranged from 20 to 65 years. Difference was may be due to inclusion of younger age in the present study.

This study also showed that age Group-A (11-20 years) constituted 7 (14.0%) cases, age Group-B (21-40 years) constituted 28 (56.0%) cases and age Group-C (41-55 years) constituted 15 (30.0%) cases. Similar findings were observed in the study of Nahar et al. In the current study there were 29 (58.0%) male and 21 (42.0%) female with a ratio of male to female was 1.38:1. Nahar also included similar sex distribution of cadavers that 39 (55.7%) male and 31 (44.3%) female cadaver with a ratio of male to female was 1.26:1 in her study.

In this study the length of the gallbladder ranged from 6.5 to 10.5 cm with the mean 8.04 ± 1.00 cm. This result was correlated with several other studies. All these studies, the length of the gall bladder was 7 to 10 cm. Rahman et al. found that the average length of the gall bladder was 6-7 cm. In this study the mean length of the gallbladder was 7.07 ± 0.55 cm in the age group of 11 to 20 years; 8.00 ± 0.88 cm in the age group of 21 to 40 years and 8.57 ± 1.05 cm in the age group of 41 to 55 years. The difference among the groups was statistically significant (p=0.003). Nahar, found that the mean length of the gallbladder
Liver and biliary diseases are the most common health problem.

The commonest lesion observed is chronic cholecystitis (80%) followed by acute cholecystitis (9.3%). Cholecystitis is associated with cholelithiasis (7). The gall-bladder opens directly into the common hepatic duct.

A traditional cholecystectomy is most commonly performed. The gall-bladder is supplied by the cystic duct; this occurs in 25 per cent of cases.

The gall-bladder opens directly into the common hepatic duct. (b) Absence of the cystic duct—the cystic duct joining the hepatic duct low down behind the duodenum which differentiates into the hepatic ducts and considering their embryological development. A portal vein within the liver was measured from the neck of the gallbladder to the opening of the cystic duct which was 2.57 ± 0.31 cm in the age group of 11 to 20 years; 3.12 ± 0.45 mm in the age group of 21 to 40 years and 3.22 ± 0.27 mm in the age group of 41 to 55 years. The difference among the groups was statistically significant (p=0.001). The difference in mean thickness of the cystic duct in male and female was statistically significant in between group A and C and group B and C (p <0.01) reported in the study of Nahar et al. (9).

Conclusion:
The length and thickness of the gallbladder, the length and diameter of the cystic duct were varied with age; but no variation in weight and breadth.

Conflict of Interests: None.

Acknowledgment:
We would like to honor the memory of Late Prof. Zakia Sultana, Ex-Professor & Head of Anatomy, Sylhet M A G Osmany Medical College, whose encouragement helped us to do this job.

References: