

## Analysis of the Gallbladder Wall Thickness in Patients with Cholecystitis and Cholelithiasis by Ultrasonography: A Hospital Based Case-Control Study

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### Abstract

**Background:** Gallbladder dimensions play a role for determining the structural integrity of the organ, and ultrasonography is a non-invasive method that offers accurate measures of these dimensions. The purpose of the study was to use ultrasonography to estimate the epidemiology by measuring the gallbladder (GB) wall thickness in patients with cholecystitis and cholelithiasis.

**Methods:** This case-control study was conducted in Department of Surgery, GMCH, Bettiah, West Champaran, and Bihar from February 2025 to July 2025. The study comprised patients of either sex aged 15–70 years with cholecystitis and cholelithiasis. In the fasting condition, the thickness of the GB wall was measured. The study comprised 50 samples in total, 36 of which were cases (having a diseased bladder) and 14 of which were controls (having a normal bladder).

**Results:** More than one-third of cases (38.9%) were between 30 and 40 years. The mean age of cases and controls was  $42.22 \pm 12.81$  and  $35.43 \pm 11.85$  years, respectively. More than one-third of both cases (36.1%) and controls (35.7%) were males. The GB wall thickness was significantly ( $P = 0.005$ ) higher among the cases ( $4.06 \pm 2.28$  mm) than that of controls ( $2.22 \pm 0.67$  mm). Full distention of the GB was in more than half of both cases (69.4%) and controls (57.1%). Partial distended was in 11.1% of cases and in 21.4% of controls. Contracted (8.3%) and over distended (2.8%) were only seen among cases. The GB wall thickness of  $\geq 3$  mm was among 66.7% of patients and in 14.3% of controls. The GB wall thickness of  $< 3$  mm was 92% lower in cases compared to controls (odds ratio = 0.08, 95% confidence interval = 0.01–0.43,  $P = 0.001$ ).

**Conclusion:** During ultrasonography, a higher degree of the GB wall thickness was found in patients with cholecystitis and cholelithiasis compared to the control group.

**Keywords:** Carcinoma, Cholecystitis, Cholelithiasis, Epidemiology, Gallbladder Wall Thickness, Ultrasonography.

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### Introduction

Cholelithiasis are hard crystalline deposits that form in the gallbladder due to an imbalance in the chemical and physical composition of bile. Both genetic and environmental factors contribute to the development of this prevalent biliary tract disease globally.[1] Cholelithiasis are regarded as the main cause of acute cholecystitis in 90% of incidents. The main reason for obstructive cholecystitis is the presence of gallstones. Among those with gallstones, about 1% to 3% will develop cholecystitis. Additional factors that can lead to obstructive cholecystitis include primary tumors of

the gallbladder or common bile duct, benign polyps in the gallbladder, parasites, and metastatic tumors affecting the gallbladder.[2] They can develop anywhere in the biliary system, including the gallbladder and common bile duct. These stones are hard, pebble-like formations that primarily consist of cholesterol, with the rest being a mix of other substances and pigments. Cholesterol stones are the most prevalent type. Pigment stones form from an excess of bilirubin in bile, which is a fluid produced by the liver that aids in fat digestion. Bile contains water, cholesterol, bile salts, and various

other substances, including bilirubin these stones are called pigment stones.[3] Diagnostic ultrasound is a non-invasive method that employs high-frequency sound waves to create cross-sectional images of the body's internal structures. It is extensively used across various medical fields and serves as an important diagnostic tool. The preferred technique for identifying cholelithiasis and cholecystitis is ultrasonography. Gallstones are still best detected by ultrasonography because of its many benefits, which include high sensitivity and accuracy (>95%), non-invasiveness, the ability to do an examination at the patient's bedside, cheap cost, absence of ionizing radiation, and the capacity to assess nearby organs [4].

### Materials and Methods

From February 2025 to July 2025, a hospital-based case-control study was carried out at the Department of Surgery, Government Medical College and Hospital in Bettiah, West Champaran, and Bihar. The study comprised patients, regardless of gender, with cholecystitis and cholelithiasis aged 15–70 years (cases).

All patient's cases (36) and controls (14) were advised the night before that did not eat or drink. Control groups (normal gallbladder) were collected

when patients are having other abdominal diseases diagnosed by ultrasonography. The GB wall thickness was measured in fasting. Total 50 cases, 36 cases and 14 controls were included in the study.

The results are presented in frequencies, percentages, and mean  $\pm$  standard deviation. The Chi-square test was used to find the associations of categorical variables between cases and controls. The unpaired t-test was used to compare the GB wall thickness between cases and controls. The odds ratio (OR) with its 95% confidence interval (CI) was calculated. The  $P < 0.05$  was considered statistically significant. All the analysis was carried out using SPSS software 16.0 version (Chicago, Inc., IL, USA).

### Results

More than one-third of cases (38.9%) and 28.6% of controls were between the age group of 30 and 40 years. The average age of cases and controls was  $42.22 \pm 12.81$  and  $35.43 \pm 11.85$  years, respectively. More than half of both cases (63.9%) and controls (64.3%) were females. No significant ( $P > 0.05$ ) difference was observed in age and gender between cases and controls showing comparability of the groups in terms of age and gender [Table 1].

**Table 1: Distribution of demographic profile of patients between cases and controls**

Demographic Profile	Cases (n=36), n(%)	Control (n=14), n(%)	p-value <sup>a</sup>
<b>Age (years)</b>			0.17
<30	4(11.1%)	5(35.7%)	
30-40	14(38.9%)	4(28.6%)	
41-50	10(27.8%)	4(28.6%)	
>50	8(22.2%)	1(7.1%)	
Mean $\pm$ SD	42.22 $\pm$ 12.81	35.43 $\pm$ 11.85	
<b>Gender</b>			0.97
Male	13(36.1%)	5(35.7%)	
Female	23(63.9%)	9(64.3%)	

<sup>a</sup>Chi-square test. SD: Standard deviation

Smoking was in 13.9% in cases and in 14.3% in controls. Alcohol habit was in 11.1% of cases and in 7.1% of controls [Table 2].

**Table 2: Distribution of personal habit between cases and controls**

Personal Habit	Cases (n=36), n(%)	Control (n=14), n(%)	p-value <sup>a</sup>
Smoking	5(13.9%)	2(14.3%)	0.91
Alcohol	4(11.1%)	1(7.1%)	
None	27(75.0%)	11(78.6%)	

<sup>a</sup>Chi-square test

The GB wall thickness was significantly ( $P = 0.005$ ) higher among cases ( $4.06 \pm 2.28$ ) than that of controls ( $2.22 \pm 0.67$ ) [Table 3].

**Table 3: Comparison of the mean gallbladder wall thickness between cases and controls**

Groups	Gallbladder thickness (mm), mean $\pm$ SD
Cases	4.06 $\pm$ 2.28
Controls	2.22 $\pm$ 0.67
P <sup>a</sup>	0.005*

<sup>a</sup>Unpaired t-test, \*Significant, SD: Standard deviation

GB wall thickness  $\geq 3$  mm was among 66.7% of patients and in 14.3% of controls. The GB wall thickness  $< 3$  mm was 92% lower in cases compared to controls (OR = 0.08, 95% CI = 0.01–0.43, P = 0.001) [Table 4].

**Table 4: Comparison of the gallbladder wall thickness between cases and controls**

Gallbladder thickness (mm)	Cases (n=36), n(%)	Control (n=14), n(%)	OR (95%CI), P <sup>a</sup>
$< 3$	12(33.3%)	12(87.7%)	0.08(0.01-0.43), 0.001*
$\geq 3$	24(66.7%)	2(14.3%)	

<sup>a</sup>Chi-square test. \*Significant. OR: Odds ratio, CI: Confidence interval

A full distention of the GB was among more than half in both cases (69.4%) and controls (57.1%). Partial distended was seen in 11.1% of cases and in 21.4% of controls. Contracted distention was observed in 8.3% of cases only [Table 5].

**Table 5: Comparison of distention of the gallbladder between cases and controls**

Distention of gallbladder	Cases (n=36), n(%)	Control (n=14), n(%)	OR (95%CI), P <sup>a</sup>
Contracted	3(8.3%)	0(0.0%)	NA
Full	25(69.4%)	8(57.1%)	
Overdistended	1(2.8%)	0(0.0%)	
Partial distended	4(11.1%)	3(21.4%)	
None	3(8.3%)	3(21.4%)	

<sup>a</sup>Chi-square test. NA: Not applicable (being  $> 1$  0s in controls)

## Discussion

Gall bladder cancer is rare, however it is the fifth most prevalent gastrointestinal cancer and occurs in 1% to 3% of specimens from cholecystectomy.[5] Every year, 2.5 new cases are found for every 100,000 residents. Because GB is typically detected at advanced stages of the disease, the mortality rate is significant. The lack of symptoms is the cause of this.[6]

Countries having a high incidence of GBC include Chile, Poland, India, and Japan. High incidence of GBC is being reported among North Indian women (21.5/100,000) and female native American Indians (14.5/100,000).[7] In the present study, 38.9% of cases and 28.6% of controls were between 30 and 40 years of age. The mean age of cases and controls was  $42.22 \pm 12.81$  and  $35.43 \pm 11.85$  years, respectively. Agrawal et al. reported that most of the patients were of the age group between 30 and 40 years with an average age of 37 years of acute and chronic cholecystitis patients.[8] The percentage of females was higher than males in this study which was in consistent with the study by Agrawal et al. in which 70% of the acute and chronic cholecystitis patients were females.[8] Hasan et al.[9] reported that the youngest patient of this series was 28 years, and the oldest was of 79 years.

Reported that female are more affected than male these ratio are 1:5-1:2. In this study, the GB wall thickness of  $\geq 3$  mm was among 66.7% of patients and in 14.3% of controls. The GB wall thickness of  $< 3$  mm was 92% lower in cases compared to controls (OR = 0.08, 95%CI = 0.01–0.43, P = 0.001). Agrawal et al.[8] observed that the GB wall was  $> 3$  mm in 25.5% of patients with acute calculus cholecystitis and  $> 3$  mm in 24.5% of

patients with chronic calculous cholecystitis. Engel et al.[10] reported that majority of healthy individuals (97%) had the gallbladder wall thickness of  $< 2$  mm. Hasan et al.[9] reported that there was a strong correlation between cholelithiasis and GBC, with gallstones found in nearly 80% of all cases. GBC can be as focal or diffuse asymmetric wall thickening in 20%–30% cases.[11]

According to several authors, the upper limit for the normal GB wall thickness is 3 mm. However, in patients with inappropriate fasting, the parietal thickness can be exceeded this limit. this is because of the organ's smooth muscle contraction.[6] GB contraction is recognized in resulting from long-standing chronic cholecystitis.[12]

In this study, a full distention of the GB was among more than half in both cases (69.4%) and controls (57.1%). Partial distended was seen in 11.1% of cases and in 21.4% of controls. Contracted distention was observed in 8.3% of cases only.

## Conclusion

Patients with cholecystitis and cholelithiasis had thicker GB walls throughout ultrasonography than the control group.

A biopsy for histological analysis should be performed in all situations where the GB wall thickness is 7 mm or more since the patient is more likely to have cancer. This will help to rule out GB cancer and improve the prognosis.

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