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# SONOGRAPHIC EVALUATION OF GALL BLADDER WALL THICKNESS IN HEPATITIS B PATIENTS: A CROSS-SECTIONAL STUDY

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**Article Info**



**Abstract**

**Background:**
Hepatitis B virus (HBV) infection is a global health burden with known hepatic complications and potential impacts on the biliary system. Gall bladder wall thickening (GBWT), an indicator of hepatobiliary pathology, has been under-investigated in the context of chronic HBV.

**Objective:**
To assess and compare gall bladder wall thickness between HBV patients and healthy individuals using ultrasonography.

**Methodology:**
A cross-sectional study was conducted at Hayatabad Medical Complex, Peshawar, enrolling 142 participants—71 HBV-positive patients and 71 matched healthy controls. Sonographic assessments were performed using standardized protocols, and GBWT was measured. Additional parameters including liver and spleen dimensions and BMI were recorded. Data were analyzed using descriptive statistics and independent t-tests.

**Results:**
The mean GBWT in HBV patients was 3.98 mm (SD = 0.27), significantly higher than that of controls (3.20 mm, SD = 0.27; $p < 0.05$). No significant difference was observed in gall bladder length. However, HBV patients showed increased liver and spleen dimensions and higher BMI values compared to controls. These findings support the hypothesis that chronic HBV contributes to measurable anatomical changes in hepatobiliary structures.

**Conclusion:**
There is a significant association between chronic HBV infection and increased GBWT. Routine ultrasound evaluation of the gall bladder in HBV patients is recommended for early detection of hepatobiliary complications, facilitating timely intervention and improved disease management.

**Keywords:**
*Hepatitis B, Gall Bladder Wall Thickness, Ultrasonography.*

## 1. Introduction

Hepatitis B virus (HBV) infection remains a significant global health challenge, particularly in Asia and sub-Saharan Africa (1, 2). While HBV primarily affects hepatic tissue, increasing evidence suggests that it may also influence neighboring structures, including the gall bladder (3, 4). Gall bladder wall thickening (GBWT) is a non-specific sonographic finding associated with numerous conditions such as cholecystitis, congestive heart failure, and chronic liver disease (5). However, its occurrence in patients with chronic HBV infection, particularly in the absence of cirrhosis, is less well understood (6).

The gall bladder, intimately connected anatomically and functionally with the liver, may exhibit morphological changes secondary to hepatic inflammation, portal hypertension, or hypoalbuminemia—common consequences of chronic HBV infection (7). Ultrasonography (USG), being a non-invasive, cost-effective, and readily accessible imaging modality, provides real-time visualization of gall bladder anatomy and wall thickness (8).

This study investigates the sonographic features of GBWT in HBV-infected individuals and compares these with healthy controls, aiming to explore whether GBWT can serve as an early marker of hepatobiliary involvement in chronic HBV.

### Methodology

This cross-sectional study was conducted at the Radiology Department of Hayatabad Medical Complex, Peshawar, over a period of six months. The study aimed to evaluate gall bladder wall thickness (GBWT) in patients with chronic Hepatitis B virus (HBV) infection compared to healthy individuals using ultrasonography. A total of 142 participants were included in the study, comprising 71 HBV-positive patients and 71 healthy, HBV-negative controls. Participants were selected using a convenience sampling technique. The inclusion criteria required participants to be aged 18 years or older. HBV patients were selected based on a confirmed diagnosis of chronic infection, while controls were healthy volunteers with no known liver or gall bladder disease. Exclusion criteria included a history of gall bladder disease (such as cholecystitis or gallstones), presence of other chronic liver conditions (e.g., Hepatitis C, cirrhosis), pregnancy, obesity that limited sonographic access, or recent abdominal surgery.

All participants underwent abdominal ultrasonography using a Toshiba Xario 2000 ultrasound machine equipped with a 3.5–5 MHz curvilinear probe. Standard preparation included fasting for at least six hours prior to the examination to ensure adequate gall bladder distension. Each participant was examined in a supine position, and the gall bladder was visualized in longitudinal, transverse, and oblique planes. Gall bladder wall thickness was measured at the most distended anterior wall segment, and a measurement greater than 3 mm was considered abnormal. Additional measurements included gall bladder length, liver and spleen dimensions, and body mass index (BMI), which were also recorded.

Data were entered and analyzed using SPSS software. Descriptive statistics were used to summarize demographic variables and sonographic measurements. Mean values and standard deviations were calculated for continuous variables, and independent t-tests were used to compare the GBWT, liver size, spleen size, and BMI between the HBV group and control group. A p-value of less than 0.05 was considered statistically significant. Ethical approval for the study was obtained from the institutional ethics committee, and written informed consent was secured from all participants before data collection.

### Results

This study included a total of 142 participants, comprising 71 patients with chronic Hepatitis B virus (HBV) infection and 71 healthy controls. The objective was to assess and compare gall bladder wall

thickness (GBWT) and related sonographic parameters between the two groups. The demographic analysis revealed that the mean age of the total study population was 46.66 ± 12.10 years, with a minimum age of 25 and a maximum of 64 years (Table 1).

**Table 1: Overall Age Distribution of Study Participants**

| Statistic | Value |
|---|---|
| Number of Participants | 142 |
| Mean Age (years) | 46.66 |
| Standard Deviation (SD) | 12.10 |
| Minimum Age (years) | 25 |
| Maximum Age (years) | 64 |

Among the 65 male participants, the mean age was 46.58 ± 11.28 years, while the 77 female participants had a slightly higher mean age of 46.73 ± 12.82 years. The distribution of age groups showed that a majority of participants (56.34%) were older than 45 years, indicating a predominance of middle-aged and elderly individuals in the sample (Table 2).

**Table 2: Age Distribution by Gender**

| Gender | n | Mean Age (years) | Standard Deviation (SD) | Minimum Age | Maximum Age |
|---|---|---|---|---|---|
| **Male** | 65 | 46.58 | 11.28 | 26 | 64 |
| **Female** | 77 | 46.73 | 12.82 | 25 | 64 |

The primary outcome of interest, gall bladder wall thickness, was significantly greater in the HBV group compared to the control group. The mean GBWT among HBV patients was 3.98 mm (±0.27), whereas the control group exhibited a mean GBWT of 3.20 mm (±0.27), table 3. The observed difference was statistically significant ($p < 0.001$), suggesting a strong association between HBV infection and increased gall bladder wall thickness. Importantly, the mean GBWT in HBV patients exceeded the clinically accepted upper limit of normal (3 mm), reinforcing the notion that chronic HBV infection contributes to subclinical gall bladder changes, even in the absence of overt biliary symptoms.

**Table 4: Gallbladder Wall Thickness by Hepatitis B Status**

| Hepatitis Status | Obs (n) | Mean GBWT (mm) | Std. Deviation | Min (mm) | Max (mm) |
|---|---|---|---|---|---|
| **Hepatitis B** | 71 | 3.98 | 0.27 | 3.37 | 4.58 |
| **Normal** | 71 | 3.20 | 0.27 | 2.64 | 3.91 |
| **Overall** | 142 | 3.59 | 0.47 | 2.64 | 4.58 |

Gall bladder length was also measured in all participants. The mean gall bladder length among HBV patients was 7.96 cm (±0.86), which was not significantly different from the mean length observed in the control group, 7.98 cm (±0.84). This indicates that gall bladder size, in terms of length, remains relatively unaffected by HBV infection, and the pathological changes are more specific to the wall structure rather than the organ's dimensions.

Further analysis of liver parameters revealed a significant increase in liver size among HBV-infected individuals. The mean liver size in the HBV group was 15.23 cm (±0.55), whereas the control group had a mean liver size of 13.72 cm (±0.52). This difference of approximately 1.51 cm was statistically significant and clinically meaningful, as it suggests the presence of hepatomegaly in HBV patients. Liver width measurements echoed these findings, with HBV patients demonstrating a mean liver width of 6.46 cm (±0.44) compared to 5.80 cm (±0.55) in the control group (Table 5).

**Table 5: Liver Size (LSCM) by Hepatitis Status**

| Hepatitis Status | n | Mean Liver Size (cm) | Std. Dev. | Min (cm) | Max (cm) |
|---|---|---|---|---|---|
| Hepatitis B | 71 | 15.23 | 0.55 | 13.67 | 16.30 |
| Normal | 71 | 13.72 | 0.52 | 12.17 | 15.23 |
| Total | 142 | 14.47 | 0.93 | 12.17 | 16.30 |

Spleen measurements further supported the systemic impact of HBV infection. The mean spleen length in HBV patients was 12.32 cm (±0.77), while the control group had a significantly smaller mean spleen length of 10.95 cm (±0.63). The observed increase in spleen size among HBV patients may reflect the development of portal hypertension, a common complication of chronic liver disease. Similarly, the spleen width was higher in the HBV group, consistent with splenomegaly and further validating the sonographic evidence of systemic hepatosplenic involvement in chronic HBV infection (Table 6).

**Table 6. Comparison of Organ and Physiological Parameters Between Hepatitis B and Normal Groups (Significant Differences)**

| Variable | Hepatitis B (Mean ± SD) | Normal (Mean ± SD) | Mean Difference | 95% CI | p-value |
|---|---|---|---|---|---|
| GBWT (mm) | 3.98 ± 0.27 | 3.20 ± 0.27 | 0.78 | [0.69, 0.87] | <0.001 *** |
| LSCM (cm) | 15.23 ± 0.55 | 13.72 ± 0.52 | 1.51 | [1.33, 1.69] | <0.001 *** |
| LWCM (cm) | 6.46 ± 0.44 | 5.80 ± 0.55 | 0.66 | [0.49, 0.82] | <0.001 *** |
| Spleen Length (cm) | 12.32 ± 0.77 | 10.95 ± 0.63 | 1.37 | [1.14, 1.61] | <0.001 *** |
| Spleen Width (cm) | 6.13 ± 0.44 | 5.39 ± 0.58 | 0.74 | [0.56, 0.91] | <0.001 *** |
| BMI (kg/m²) | 27.17 ± 3.31 | 24.15 ± 2.85 | 3.02 | [1.99, 4.04] | <0.001 *** |

**Legend:**

- ***p < 0.001: Statistically significant difference
- GBWT: Gallbladder Wall Thickness
- LSCM: Liver Size in cm
- LWCM: Liver Width in cm

- BMI: Body Mass Index

In terms of gender-based analysis, both male and female participants showed increased GBWT in the HBV group, with males exhibiting a slightly higher mean thickness (3.64 mm) compared to females (3.55 mm). However, the difference was not statistically significant. Comparable trends were observed in liver and spleen dimensions, where both genders demonstrated increased sizes in the HBV group, without significant inter-gender variability.

The study assessed the Body Mass Index (BMI) of participants, which showed a higher mean BMI in HBV patients compared to controls. This finding may reflect metabolic alterations associated with chronic liver disease and underscores the importance of monitoring nutritional status in HBV-infected individuals.

Results of this study demonstrate a statistically and clinically significant increase in gall bladder wall thickness among HBV patients, along with concomitant enlargement of the liver and spleen (table 7). These findings support the hypothesis that chronic HBV infection exerts measurable effects on hepatobiliary and splenic structures, which can be effectively identified through routine sonographic evaluation.

**Table 7: Group Comparison Summary: Hepatitis B vs. Normal**

| **Variable** | **Hepatitis B (Mean)** | **Normal (Mean)** | **Difference (↑/↓)** | **Interpretation** |
|---|---|---|---|---|
| Liver Size (cm) | 15.23 | 13.72 | ↑ +1.51 cm | Liver size is enlarged in HBV patients. |
| Liver Width (cm) | 6.46 | 5.80 | ↑ +0.66 cm | Liver width is greater in HBV patients. |
| GB Wall Thickness (mm) | 3.98 | 3.20 | ↑ +0.78 mm | Significantly thicker GB wall in HBV ($p < 0.001$). |
| GB Length (cm) | 7.96 | 7.98 | ↓ -0.02 cm | No meaningful difference. |
| Spleen Length (cm) | 12.32 | 10.95 | ↑ +1.37 cm | Suggests splenomegaly in HBV. |
| Spleen Width (cm) | 6.13 | 5.39 | ↑ +0.74 cm | Consistent with splenic enlargement. |
| Height (cm) | 163.51 | 164.12 | ↓ -0.61 cm | Negligible difference. |
| Weight (kg) | 72.32 | 64.82 | ↑ +7.50 kg | HBV patients are heavier on average. |
| BMI | 27.17 | 24.15 | ↑ +3.02 units | Higher BMI in HBV group (possible risk factor). |

**Discussion**

This study demonstrates a significant increase in gall bladder wall thickness (GBWT) among patients with chronic Hepatitis B virus (HBV) infection compared to healthy controls. The observed thickening is likely the result of chronic hepatic inflammation, portal hypertension, and immune-mediated fibrosis, which

alter the vascular and lymphatic dynamics affecting the gall bladder. Our findings support previous studies indicating that GBWT in liver disease reflects systemic processes rather than primary biliary pathology.

Several studies, including those by Yu et al. (2020) and Emara et al. (2023), have emphasized GBWT as a non-invasive marker for complications such as esophageal varices. The mean GBWT of 3.98 mm in our HBV group aligns with thresholds cited in these studies. Advanced imaging techniques like Doppler ultrasound and contrast-enhanced ultrasound (CEUS), though not employed in this study, are useful adjuncts for detailed vascular assessment and could enhance future research (9, 10).

An additional finding was the positive association between elevated BMI and GBWT in HBV patients. This supports existing literature suggesting that metabolic factors like obesity and hepatic steatosis may exacerbate gall bladder changes in liver disease.

Future research should explore longitudinal changes in GBWT in response to antiviral treatment, and incorporate histological and molecular analyses to validate imaging findings. Standardized sonographic criteria are also needed to improve diagnostic consistency.

**Conclusion**

This study found that gall bladder wall thickness is significantly increased in patients with chronic Hepatitis B infection. These sonographic changes likely reflect underlying hepatic inflammation and portal hypertension. Routine ultrasound evaluation of the gall bladder in HBV patients may aid in early detection of hepatobiliary complications and support better clinical management, particularly in low-resource settings.

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