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ULTRASONOGRAPHIC PREVALENCE AND CLINICAL CORRELATES OF GALLBLADDER ABNORMALITIES IN ACUTE VIRAL HEPATITIS

Chahat Ali[1], Sawaira Gul[2], Kashif Khan[*3], Shahid Khan[4], Junaid Ali[5], Zia Ul Haq[6]

[1,2]BS Student, Department of Radiology, Iqra National University Swat Campus.
*[*3,4]Lecturer, Department of Radiology, Iqra National University Swat Campus.*
*[*3]Lecturer, Department of Dental Technology, Iqra National University Swat Campus.*
[6]Clinical Radiologist, Saidu Group of teaching hospitals.

[*1]khankashifstar@gmail.com

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Corresponding Author: *
Kashif Khan

Abstract

Background: *Acute viral hepatitis is frequently associated with gallbladder abnormalities that may influence clinical management. This study assessed the prevalence of ultrasonographic gallbladder changes and their association with hepatitis serotypes and jaundice.*

Methods: *A cross-sectional study was conducted at Saidu Group of Teaching Hospitals, Swat, Pakistan, from January 2025 to November 2025. A total of 110 patients with serologically confirmed acute hepatitis A, B, or C were selected through systematic random sampling. Clinical data and abdominal ultrasound findings were recorded. Gallbladder abnormalities included wall thickening, sludge, gallstones, pericholecystic fluid, and cholecystitis. Data were analyzed using SPSS version 27, applying Chi-square tests for associations.*

Results: *The mean age of participants was 35.4 ± 12.7 years, with a nearly equal gender distribution. Hepatitis A was the most common infection (60.9%), followed by hepatitis B (28.2%) and C (10.9%). Jaundice was present in 63.6% of patients. Gallbladder abnormalities were frequent, including gallstones (36.4%), cholecystitis (31.8%), bile duct obstruction (30.9%), wall thickening (20.0%), sludge (19.1%), and pericholecystic fluid (4.5%). Hepatitis A showed a significant association with gallbladder sludge (p=0.041). Jaundice was significantly associated with gallbladder wall thickening (p=0.047), while gallstones were more common in non-jaundiced patients (p=0.025).*

Conclusion: *Gallbladder abnormalities are common in acute viral hepatitis. Hepatitis A is significantly associated with biliary sludge, and jaundice correlates with inflammatory gallbladder wall thickening. Gallstones appear to be incidental findings rather than hepatitis-related. Routine ultrasonography is recommended for comprehensive evaluation.*

INTRODUCTION:

Acute viral hepatitis (AVH) remains a major global public health concern, with a disproportionate burden in developing countries. According to the World Health Organization, viral hepatitis causes approximately 1.3 million deaths annually, predominantly due to hepatitis B virus (HBV) and hepatitis C virus (HCV)[1]. In South Asia, including Pakistan, AVH caused by hepatitis A virus (HAV), HBV, and HCV continues to contribute significantly to morbidity through hepatic and extrahepatic complications[2,3]. Clinically, AVH commonly presents with jaundice, hepatomegaly, elevated transaminases, and right upper quadrant pain, while severe cases may progress to acute liver failure[4].

Due to the close anatomical and functional relationship between the liver and biliary system,

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the gallbladder is frequently involved during acute hepatic inflammation, although these extrahepatic manifestations are often underrecognized clinically[5]. Gallbladder abnormalities associated with AVH include wall thickening, pericholecystic edema, biliary sludge, acalculous cholecystitis, and pericholecystic fluid collection[6,7]. These changes are thought to result from direct viral inflammation, portal venous congestion, and hypoproteinemia-induced edema rather than primary gallstone disease[8]. Consequently, right upper quadrant pain related to gallbladder involvement may mimic acute cholecystitis, leading to diagnostic confusion and potentially unnecessary surgical intervention or delayed medical management[9].

Previous studies have reported gallbladder wall thickening in up to 82.9% of patients with AVH, while acalculous cholecystitis has been observed in 38.7%–57.9% of cases, varying by viral etiology[6,10]. Differentiating hepatitis-related gallbladder changes from primary biliary pathology is therefore essential for appropriate patient care.

In resource-limited settings, ultrasonography remains a key diagnostic tool due to its availability, affordability, and non-invasive nature[11]. Ultrasonographic findings such as gallbladder wall thickening, sludge, pericholecystic fluid, and the "starry-sky" liver pattern are valuable indicators of acute hepatitis, particularly where serological testing is limited[12]. However, the reported prevalence of these abnormalities varies widely (38.7%–85%), and data from Pakistan especially from northern regions remain scarce[7,10,12]. This study aimed to determine the prevalence of gallbladder abnormalities in AVH, assess their association with hepatitis serotypes, and evaluate their correlation with clinical jaundice to enhance diagnostic accuracy and patient management in resource-constrained settings.

MATERIALS AND METHODS

This hospital-based cross-sectional study was conducted at the Saidu Group of Teaching Hospitals, Swat, Pakistan, from January 2025 to November 2025, to determine the ultrasonographic prevalence of gallbladder abnormalities in patients with acute viral hepatitis. Ethical approval was obtained from the Institutional Review Board of Iqra National University (INU-IRB/2023/45). Written informed consent was obtained from all participants before enrollment. A total of 110 patients were selected through systematic random sampling from an initial cohort of 240 eligible cases. Patients aged 5–65 years with serologically confirmed acute hepatitis A, B, or C and an abdominal ultrasound performed within 72 hours of diagnosis were included. Exclusion criteria comprised a history of gallbladder disease or cholecystectomy, chronic liver disease, hepatobiliary malignancy, pregnancy, and recent abdominal trauma or surgery. Data were collected using a structured proforma that recorded demographic characteristics, clinical features including jaundice, hepatitis serology results, and ultrasonographic findings. Jaundice was defined as clinical icterus with a serum total bilirubin level greater than 2 mg/dL. All ultrasonographic examinations were performed after overnight fasting using a Canon Xario 100 ultrasound machine equipped with a 3–6 MHz convex transducer. Examinations were conducted by a single experienced consultant radiologist to ensure consistency. Gallbladder assessment included wall thickness, presence of sludge, gallstones, pericholecystic fluid, sonographic Murphy's sign, and bile duct diameter. A gallbladder wall thickness greater than 3 mm was considered abnormal, while bile duct diameter exceeding 6 mm was regarded as dilated. Sonographic diagnosis of cholecystitis was based on gallbladder wall thickening greater than 3 mm in combination with pericholecystic fluid and/or a positive sonographic Murphy's sign. Data were analyzed using SPSS version 27. Categorical variables were presented as frequencies and percentages, while continuous variables were summarized as mean ± standard deviation. Associations between hepatitis serotypes, presence of jaundice, and gallbladder abnormalities were assessed using the Chi-square test, with statistical significance set at $p < 0.05$.

RESULTS

A study was conducted on 110 cases of acute viral hepatitis. The ratio of males to females in the cohort was nearly equal, 56 (50.9%) males and 54 (49.1%) females. Most of the participants belonged to the 26–46 years age group (n = 66, 60.0%). Jaundice has been observed clinically in 70 (63.6%) patients. The major serotype in this study was hepatitis A (n=67, 60.9%), followed by hepatitis B (n=31, 28.2%), and C (n=12, 10.9%).

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Demographic and baseline clinical characteristics are presented in **Table 1.**

Table 1. Baseline Characteristics and Prevalence of Gallbladder Abnormalities (N=110)

Characteristic/Abnormality		n (%)
Gender	Male	56 (50.9%)
	Female	54 (49.1%)
Age Group	5–25 years	19 (17.3%)
	26–46 years	66 (60.0%)
	>47 years	25 (22.7%)
Clinical jaundice	Present	70 (63.6%)
	Absent	40 (36.4%)
Hepatitis serotype	Hepatitis A (HAV)	67 (60.9%)
	Hepatitis B (HBV)	31 (28.2%)
	Hepatitis C (HCV)	12 (10.9%)
Gallbladder Abnormalities	Gallstones	40 (36.4%)
	Cholecystitis	35 (31.8%)
	Bile Duct Obstruction	34 (30.9%)
	Gallbladder Wall-Thickening	22 (20.0%)
	Gallbladder Sludge	21 (19.1%)
	Pericholecystic Fluid	5 (4.5%)

Association between Hepatitis Serology and Gallbladder Abnormalities: High prevalence of gallbladder abnormalities was found on ultrasonographic examination (**Table 1**). The most prevalent diagnoses were gallstones in 40 cases (36.4%), cholecystitis n=35(31.8%), bile duct obstruction n=34 (30.9%), thickened gallbladder wall (>3mm) in 22 (20.0%) cases, Gallbladder sludge in 21(19.1%) cases and pericholecystic fluid pool in 5(4.5%) of the study population respectively.

Associations between hepatitis serotype (A, B, C) and specific GB abnormalities were evaluated using bivariate analysis **Table 2.** There was a statistically significant correlation between hepatitis serology and the presence of gallbladder sludge ($p = 0.041$). A sludge rate was highest in hepatitis A (19.4%), but the distribution among serotypes showed similar tendencies. There was no significant correlation observed between hepatitis serotype and gallbladder wall thickening ($p = 0.086$), cholecystitis ($p = 0.136$), pericholecystic fluid ($p = 0.156$), or gallstones ($p = 0.199$).

Table 2: Association between Hepatitis Serology and Gallbladder Abnormalities

Gallbladder Abnormality	Hepatitis A (n=67) n (%)	Hepatitis B (n=31) n (%)	Hepatitis C (n=12) n (%)	p-value
Wall Thickening	9 (13.4%)	10 (32.3%)	3 (25.0%)	0.086
Sludge	13 (19.4%)	6 (19.4%)	2 (16.7%)	0.041
Cholecystitis	26 (38.8%)	7 (22.6%)	2 (16.7%)	0.136
Pericholecystic Fluid	1 (1.5%)	3 (9.7%)	1 (8.3%)	0.156
Gallstones	24 (35.8%)	9 (29.0%)	7 (58.3%)	0.199

Clinical jaundice was significantly related to some of the gallbladder pathologies, **Table 3**. Patients with jaundice demonstrated a higher prevalence of gallbladder wall thickening (25.7% vs 10.0%, $p = 0.047$) and gallstones (28.6% vs 50.0%, $p = 0.025$) as compared to those without jaundice. The relationship between jaundice and cholecystitis ($p = 0.164$) or gallbladder sludge ($p = 0.854$) was not statistically significant.

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Table 3: Association between Clinical Jaundice and Gallbladder Abnormalities

Gallbladder Abnormality	Jaundice Present (n=70) n (%)	Jaundice Absent (n=40) n (%)	p-value
Wall Thickening	18 (25.7%)	4 (10.0%)	0.047
Gallstones	20 (28.6%)	20 (50.0%)	0.025
Cholecystitis	19 (27.1%)	16 (40.0%)	0.164
Sludge	13 (18.6%)	8 (20.0%)	0.854

Discussion

This study showed that gallbladder sonographic abnormalities in patients with acute viral hepatitis, gallstones (36.4%), cholecystitis (31.8%), and bile duct obstruction (30.9%) were the most common anomalies detected. 20.0% of patients had gallbladder wall thickening, 19.1% had sludge, and 4.5% had pericholecystic fluid. The 20.0% prevalence of gallbladder wall thickening observed in our study was less than that (70.1%) found by Ahn et al. (2015) among hepatitis A patients in South Korea[14], and the 82.9% recorded by Arooj et al. (2021) among Pakistani pediatric population[2] but comparable to the 34.2% of Israel et al. (2019). These variations likely reflect differences in disease severity, timing of ultrasound examination, and patient populations. Our cholecystitis prevalence (31.8%) closely resembles the 34.5% found in the study by Radunovic et al. (2013) in another cohort, indicating that it is a general problem affecting various populations. The 19.1% prevalence of sludge seen in adults exceeds the figure of 9.8% reported by Israel et al. (2019). This may be suggestive of more advanced disease or prolonged symptom duration in our patients. We found a significant association between hepatitis serology and gallbladder sludge ($p = 0.041$), with Hepatitis A being predominant. Nevertheless, there were no clear relationships between serotype and other gallbladder abnormalities. In contrast to Radunovic et al. (2013), who investigated a higher occurrence of cholecystitis in patients with hepatitis B. Afridi et al. reported that gallbladder wall thickness is associated with liver enzymes (AST, $r = 0.3591$, $p < 0.001$) but not viral serotype[13], pointing to gallbladder changes as a reflection of the stage of hepatic injury rather than individual viruses causing it. A key finding is the significant association between jaundice and both gallbladder wall thickening (25.7% vs. 10.0%, $p = 0.047$) and gallstones (50.0% vs. 28.6%, $p = 0.025$). This corresponds with the findings of Israel et al. (2019), who found a significant correlation between the ultrasonographic findings and peak levels of bilirubin ($p = 0.021$), and Ahn et al. (2015) reported that bilirubin was associated with wall thickening. These results are consistent with the hypothesis that gallbladder alterations are associated with cholestasis and hepatic damage. Proposed mechanisms include hypoalbuminemia causing interstitial edema, cholestatic injury leading to biliary stasis, and systemic inflammation resulting in vascular congestion.

The clinical significance of these findings is underscored by Ahn et al. (2015), who reported that gallbladder wall thickening is associated with longer hospitalization and delayed normalization of liver tests. This suggests that gallbladder abnormalities may serve as markers of disease severity and prognosis.

CONCLUSION

Gallbladder diseases are not infrequent in acute viral hepatitis, gallstones, cholecystitis, and obstruction of bile ducts, being found in about one-third of the cases. Hepatitis A and gallbladder sludge are significantly related, whereas jaundice correlates with gallbladder wall thickening and gallstones. Our observations underscore the importance of routine ultrasonography in detecting gallbladder involvement by acute viral hepatitis and its role in management. Additional prospective studies with long-term follow-up and biochemical matching are required in order to determine the mechanisms and clinical relevance of these correlations.

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