Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Pathology and Oncology

Journal homepage: www.ijpo.co.in

Original Research Article

Assessment of histopathological and ultrasonography accuracy in gallbladder pathology

Tanmeet Kaur[1*], Geetika Agarwal[1]

[1]Dept. of Pathology, FH Medical College, Agra, Uttar Pradesh, India

Abstract

Background: The evolution of biliary tract imaging for cholelithiasis and its complications has witnessed profound changes in recent decades. Ultrasonography (USG), serum bilirubin and Histopathology stands out as the methods for detecting cholelithiasis and cholecystitis. Thus, we aimed to assess the histopathological correlation with ultrasonography and serum bilirubin in diagnosis of gallbladder pathology.

Materials and Methods: We conducted a cross-sectional study involving 104 patients who underwent USG abdomen scans and Histopathology assessments. Clinico-demographics were recorded along with the serum bilirubin levels. Data was systematically collected and recorded on a custom-designed data sheet. Statistical analysis was subsequently performed to evaluate the gathered information.

Results: In the study of 104 patients, cholecystitis (23 cases) and Cholelithiasis (81 cases) were prevalent, with cholecystitis mainly seen in ages 31-40 (52.17%) and cholelithiasis in ages 41-50 (45.68%). Females predominated. Symptoms included dyspepsia (26.09%) and epigastric pain (26.09%) for cholecystitis, while Cholelithiasis patients had nausea/vomiting (24.69%) and epigastric pain (24.69%). In patients with cholelithiasis, majority had normal levels (39.51%), followed by abnormal levels of 1.3-2.4 mg/dl - 33.33% and level >2.4 mg/dl- 27.16%. The kappa agreement coefficient analysis between USG and HPA had a value of 0.920 whereas it was 0.895 between serum bilirubin and HPA – signifying almost perfect agreement.

3 cases of cholelithiasis were missed on USG but were found intraoperatively and confirmed on HPE. This indicates nearby correlation of HPE with USG and S. Bilirubin independently for cholecystitis and cholelithiasis respectively. Apart from USG or serum bilirubin alone, USG and serum bilirubin achieved Kappa value of 1.000 highlights a strong consistency between histopathology for both conditions.

Conclusion: USG and serum bilirubin, a combinatorial marker approach, is a versatile tool for quick decision-making and intervention guidance in biliary tract cases.

Keywords: Cholecystitis, Cholelithiasis, Bilirubin, USG, Histopathology.

Received: 16-12-2024; **Accepted:** 31-01-2025; **Available Online**: 15-03-2025

1. Introduction

Up to 9% of all patients admitted to the hospital for abdominal pain are diagnosed with acute cholecystitis and require urgent surgical intervention. However, not all patients present with fever and an elevated white blood cell (WBC) count. Acute biliary pain is one of the commonest symptoms of gallstone disease, presenting typically as abdominal pain in the epigastrium and right upper quadrant within 30 to 60 minutes after meals. The gold standard intervention for identified cholecystitis progression is cholecystectomy, as untreated symptomatic biliary disease progress to complications and mortality risks.[2] Ultrasound is thought to be helpful in making or excluding the diagnosis of cholecystitis.[1] However, discerning acute from chronic cholecystitis proves complicated due to overlapping ultrasound findings. Ultrasonography has a specificity and sensitivity of about 90%.[2] Multiple sonographic indicators for acute cholecystitis have been described: the presence of stones, a sonographic Murphy's sign, a stone wedged in the gallbladder neck, pericholecystic fluid, gallbladder wall thickening, and gall bladder distension. USG abdomen has certain limitations like interference by bowel gas, limited depth resolution and posterior acoustic shadowing in the presence of calculi. Therefore, Ultrasound's ability to predict acute cholecystitis in patients with clinical symptoms appears limited.[5,9] Thus, we aimed to assess the histopathological

*Corresponding author: Tanmeet Kaur
Email: tanya00089@gmail.com

https://doi.org/10.18231/j.ijpo.2025.006

correlation with ultrasonography and serum bilirubin in diagnosis of gallbladder pathology.

2. Materials and Methods

A cross-sectional study was conducted in the Department of Pathology, FH Medical College, Agra from July 2022-July 2023. After getting ethical clearance and informed consent, 104 patients were included in the study. The data included S.bilirubin levels, ultrasonography and histopathology findings.gh

2.1. Inclusion criteria

In this study Patients who diagnosed with cholelithiasis/cholecystitis and Male and female patients between 21 and 70 years who underwent ultrasonography abdomen, S.bilirubin levels and histopathology assessments are included.

2.2. Exclusion criteria

In this study autolysed cholecystectomy specimens and Patients denying consent for lab evaluation or histopathological examination of gall bladder is excluded.

Clinicodemographic profiles were obtained, and serum bilirubin levels were recorded.

2.3. Statistical analysis

The data collected from the study underwent rigorous statistical analysis using SPSS version 26.0 to facilitate a comprehensive evaluation at a significance level set at a p-value ≤ 0.05. The presentation of data involved depicting frequencies for categorical variables. Categorical data were analysed employing the Chi-square statistical test, while continuous data were subjected to Student's t-test. Additionally, the Kappa agreement test was conducted to assess inter-rater agreement between different diagnostic methods.

3. Results

In our study, 104 patients were included, of which 23 had cholecystitis, and 81 had cholelithiasis. Most patients with cholecystitis (52.17%) were aged 31-40 years old, while most patients with cholelithiasis (45.68%) were aged between 41-50 years. Female predominance was noted among both groups. Demographics showed no significant difference among groups. (**Table 1**) The most prevalent clinical symptoms in patients with cholecystitis were dyspepsia (26.09%) and epigastric pain (26.09%). Patients with cholelithiasis had nausea/ vomiting (24.69%) and epigastric pain (24.69%) as the common symptoms. However, no substantial difference was noted among clinical symptoms (p=0.9666). (**Figure 1**)

The majority of the patients with cholecystitis had normal serum total bilirubin (<1.2 mg/dl) (82.61%), followed by those who had abnormal levels (>2.4 mg/dl) (17.39%). In patients with cholelithiasis, majority had normal levels (39.51%), followed by abnormal levels of 1.3-2.4 mg/dl - 33.33% and level >2.4 mg/dl- 27.16%. This difference was significant (p=0.0005*). Direct serum bilirubin levels were abnormal (0.3-1.1 mg/dl) in both groups (78.26%; 82.72%). (**Table 2**)

The kappa agreement coefficient analysis between USG and HPE had a value of 0.920 whereas it was 0.895 between serum bilirubin and HPE – signifying almost perfect agreement.3 cases of cholelithiasis were missed on USG but were found intraoperatively and confirmed on HPE. (**Table 3**). This indicates nearby correlation of HPE with USG and S. Bilirubin independently for cholecystitis and cholelithiasis respectively.

On the other hand, kappa agreement coefficient analysis using the combinational marker approach i.e correlation between combined USG and serum bilirubin with histopathological analysis showed a value of 1.000 (which signifies perfect agreement) – indicating a strong probability to diagnose cholecystitis and cholelithiasis cases. (**Table 4**)

Thus, the correlation of these two diagnostic modalities with HPE are in almost perfect agreement when diagnosing Cholecystitis & Cholelithiasis. This suggests that similar to histopathological findings which are considered gold standard, combination of serum bilirubin levels with USG findings provide a potential marker which was consistent and reliable for diagnosing cholecystitis and cholelithiasis.

4. Discussion

In our study, a total number of 104 patients was enrolled, encompassing 23 cases of cholecystitis and 81 of cholelithiasis. Among the patients afflicted with cholecystitis, a notable majority (52.17%) fell within the age group of 31 to 40 years, while the larger proportion of patients with cholelithiasis (45.68%) was noted in the 41 to 50 years age group. An interesting observation emerged in our study, where a prevailing female preponderance was evident in both these patient subsets with no statistically significant discrepancies across these distinctive groups. Comparable trends have been documented in the scientific literature. Mohan et al.[11] noted a prominent concentration of cases within the 31 to 40 years age range. On the other hand, Mahajan V et al.[12] unveiled a distinct peak in incidences within the 41 to 50 years age bracket, accompanied by a prevailing female dominance. Our investigation concluded that these conditions manifest predominantly in the age range from 31 to 50 years. Further reinforcing this narrative, a parallel study conducted by Kushwah A et al.[13] and other researchers underscore the susceptibility of females to biliary disorders compared to their male counterparts.[14-17] This collective contributes to the heightened female vulnerability to biliary tract diseases.

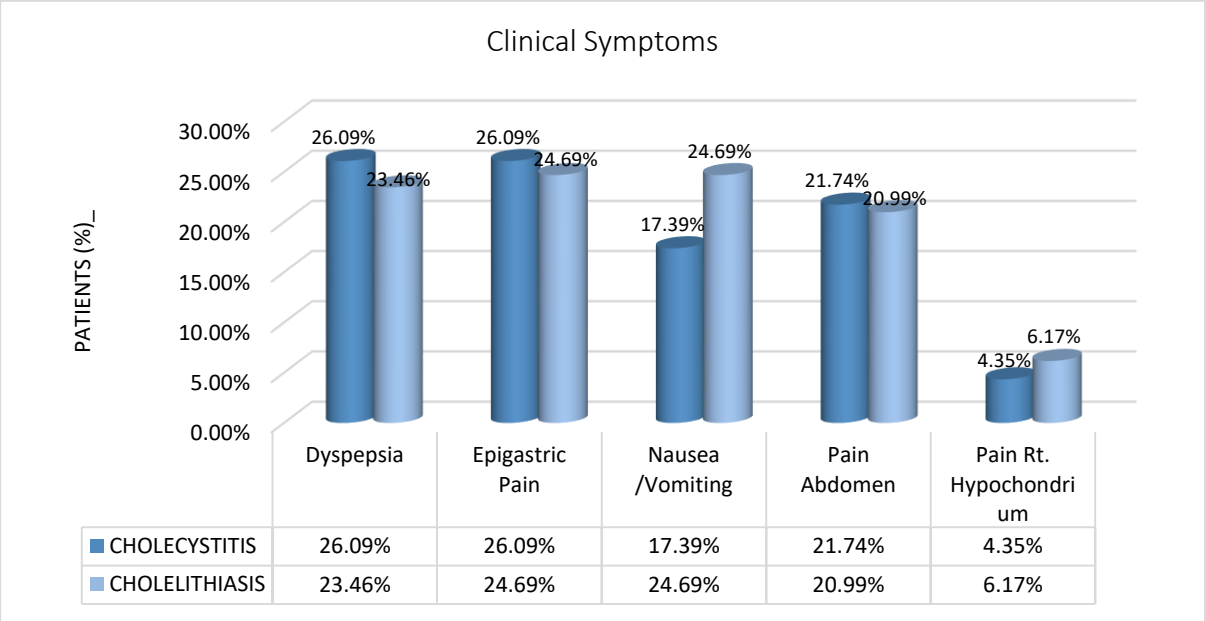

Figure 1: Clinical symptoms of the enrolled patients

Table 1: Clinic demographical profile of the enrolled patients

Clinico- Demographics	**Chilecystitis without Cholelithiasis (n=23)**		**Cholecystitis with cholecithiasis (n=81)**		**P value**
	N	N	N	N	
AGE					
21-30	3	13.04%	16	19.75%	X= 4.588
31-40	12	52.17%	26	32.10%	
41-50	7	30.43%	37	45.68%	P= 0.3322
51-60	1	4.35%	1	1.23%	
61-70	0	0.00%	1	1.23%	
Gender					
Female	16	69.57%	58	71.60%	X= 0.03631
Male	7	30.43%	23	28.40%	P= 0.8489

Table 2: Serum bilirubin level of the enrolled patients

Serum bilirubin (mg/dl)			**Cholecystitis without Cholelithiasis (n=23)**		**Cholecystitis with Cholelithiasis (n=81)**		**P- Value**
			N	%	N	%	
Total	Normal	<1.2	19	82.61%	32	39.51%	X=15.14 p=0.0005*
	Abnormal	1.3-2.4	0	17.39%	27	60.49%	
		>2.4	4		22		
Direct	Normal	<0.3	2	8.70%	2	2.47%	X=1.888 p=0.3890
	Abnormal	0.3-1.1	18	78.26%	67	82.72%	
		1.1-1.9	3	13.04%	12	14.81%	

Table 3: Correlating USG findings with HPE of the enrolled patients

USG Findings	**Histopathological Examination**		**Kappa agreement**
	Cholecystitis without cholelithiasis (n=23)	Cholecystitis with cholelithiasis (n=81)	
Cholecystitis without cholelithiasis	23	03	
Cholecystitis with cholelithiasis	0	78	0.920(0.831-1.000)

Table 4: Correlating S.Bilirubin with HPE of the enrolled patients

Serum bilirubin	Histopathological examination		Kappa agreement
	Cholecystitis without cholelithiasis	Cholecystitis with cholelithiasis	0.895 (0.794-0.995)
Normal	19	32	
Abnormal levels	04	49	

Table 5: Histopathological and USG findings of the enrolled patients

		Histopathological Findings		Kappa Agreement
		Cholecystitis	Cholelithiasis	
USG Findings	Cholecystitis	23	3	0.920 (0.831-1.000)
	Cholelithiasis	0	78	
SR. Bilirubin	Normal	19	32	0.895 (0.794-0.995)
	Abnormal levels	04	49	
USG findings + SR. Bilirubin	Cholecystitis	23	0	1.000 (1.000-1.000)
	Cholelithiasis	0	81	

Within this study, prevailing clinical manifestations among Cholecystitis patient's encompassed dyspepsia (26.09%) and epigastric pain (26.09%), while those with cholelithiasis frequently experienced nausea/vomiting (24.69%) and epigastric pain (24.69%). Nonetheless, no significant discrepancy emerged in clinical symptoms across the groups (p=0.9666). Notably, epigastric pain emerged as the primary shared symptom in both cohorts. Prominent emphasis on the symptom of abdominal pain was noted in the investigations conducted by Chaterjee and Banerjee[18] and Rahman G.[19]

Notably, the presence of jaundice emerged as a noticable feature in 13.87% of cases within the study conducted by Mahajan V et al.,[12] aligning with the corresponding observations conducted by Meyer[20] and Chaterjee and Banerjee.[18]

In the present study, a significant proportion of patients diagnosed with cholecystitis exhibited normal serum bilirubin levels (<1.2 mg/dl) (82.61%), with a smaller group showing elevated levels (>2.4 mg/dl) (17.39%). Among patients diagnosed with cholelithiasis, the majority displayed normal bilirubin levels (39.51%), followed by those with mildly abnormal levels (1.3-2.4 mg/dl) (33.33%). Importantly, this disparity between the two groups was statistically significant (p=0.0005*).

Findings closely parallel the outcomes of a study conducted by Mahajan V et al.,[12] wherein serum bilirubin measurements were available for 631 out of 656 cases, and a considerable majority (85.57%) exhibited bilirubin levels within normal limits. Correspondingly, Pal V et al.[14] also reported a notable prevalence of patients with normal bilirubin levels in their investigation.

In the present study, apart from USG (0.920) and serum bilirubin (0.895) agreement, the combinational marker approach able to achieve Kappa agreement value of 1.000, indicative of perfect agreement, underscores the accuracy between histopathological findings and combinatorial marker USG+ serum bilirubin results in cholecystitis and cholelithiasis cases.

These two diagnostic methodologies demonstrate an almost flawless concordance when identifying these conditions. This noteworthy outcome highlights the dependable and coherent nature of histopathological and combinational marker assessments in diagnosing cholecystitis and cholelithiasis. Biliary tract disorders constitute a frequent clinical challenge, with nearly 30% of cases presenting without overt symptoms. Extensive research has underscored the crucial role of ultrasound scans in evaluating a diverse array of biliary tract conditions.

Malik M et al.[21] uncovered that primary contributors to abdominal pain and epigastric discomfort are cholelithiasis and cholecystitis, efficiently detectable through ultrasound imaging. This diagnostic avenue seamlessly merges precision with promptness in identifying cholelithiasis.

This finds modulation in a parallel study by Bortoff G et al.,[22] which further accentuates the universal embrace of ultrasound as a important imaging modality for the comprehensive assessment of cholelithiasis and cholecystitis. While acknowledging the intrinsic limitations of ultrasound, the establishment of a powerful diagnostic framework of combinatorial marker to curtail the potential for imaging errors, thereby avoiding the adverse consequences that could arise from diagnostic inaccuracies.

5. Source of Funding

None.

6. Conflict of Interest

None.

References

1. Bingener J, Schwesinger WH, Chopra S, Richards ML, Sirinek KR. Does the correlation of acute cholecystitis on ultrasound and at surgery reflect a mirror image?. Am J Surg. 2004;188(6):703–7.
2. Njeze GE. Gallstones. *Niger J Surg*. 2013;19(2):49–55.
3. Schuster KM, Holena DN, Salim A, Savage S, Crandall M. American Association for the Surgery of Trauma emergency general surgery guideline summaries 2018: acute appendicitis, acute cholecystitis, acute diverticulitis, acute pancreatitis, and small bowel obstruction. *Trauma Surg Acute Care Open*. 2019;4(1):e000281.
4. Tiwari A, Rai R. Importance of Routine Histopathological Examination of Gallbladder Specimen in Detecting Incidental Malignancies. *J Lumbini Med*. 2016;4(1):15–9.
5. Cox DR, Fong J, Liew CH, Goh SK, Yeoh M, Fink MA, et al, Emergency presentations of acute biliary pain: changing patterns of management in a tertiary institute. *ANZ J Surg*. 2018;88(12):1337–42.
6. Bingener J, Thomsen KM, McConico A, Hess EP, Habermann EB. Success of elective cholecystectomy treatment plans after emergency department visit. *J Surg Res*. 2015;193(1):95–101.
7. Dimou FM, Adhikari D, Mehta HB, Riall TS. Trends in follow-up of patients presenting to the emergency department with symptomatic cholelithiasis. *J Am Coll Surg*. 2016;222(4):377–84.
8. Bundgaard NS, Bohm A, Hansted AK, Skovsen AP. Early laparoscopic cholecystectomy for acute cholecystitis is safe regardless of timing. *Langenbecks Arch Surg*. 2021;406(7):2367–73.
9. Kalimi R, Gecelter GR, Caplin D, Brickman M, Tronco GT, Love C, et al. Diagnosis of acute cholecystitis: sensitivity of sonography, cholescintigraphy, and combined sonography-cholescintigraphy. *J Am Coll Surg.* 2001;193(6):609–13.
10. Wadhwa V, Jobanputra Y, Garg SK, Patwardhan S, Mehta D, Sanaka MR. Nationwide trends of hospital admissions for acute cholecystitis in the United States. Gastroenterol Rep (Oxf). 2017;5(1):36–42.
11. Mohan H, Punia P, Dhawan S, Ahal S. Morphological spectrum of gallstone disease in 1100 cholecytectomies in north India. *Indian J Surg.* 2005;67(3):140–2.
12. Mahajan V, Jawarkar A, Hiwale B. Clinicopathological profile of cholecystectomy specimens-a retrospective and prospective study. *Trop J Pathol Microbiol*. 2018;4(6):455–65.
13. Kushwah AP, Jamre Y, Baghel PS, Pande S, Kumar S. Role of ultrasonography and computed tomography in gallbladder masses and their correlation with fine-needle aspiration cytology. *Int J Sci Study.* 2018;6(1):85-92.
14. Pal V, Lakhatia H, Gahlaur Y, Ghargav. A. Clinicopathological study of cholecystitis. *Indian J Surg*. 1980;426–31.
15. Mazlum M, Dilek FH, Yener AN, Tokyol C, Aktepe F, Dilek ON. Profile of gallbladder diseases diagnosed at Afyon Kocatepe University: A retrospective study. *Turk Patoloji Derg.* 2011;27(1):23–30.
16. Cucchiaro GI, Watters CR, Rossitch JC, Meyers WC. Deaths from gallstones. Incidence and associated clinical factors. *Ann Surg*. 1989;209(2):149–51.
17. Bekele Z, Tegegn K. Cholecystitis: the Ethiopian experience, a report of 712 operated cases from one of the referral hospitals. *Ethiop Med J*. 2002;40(3):209–16.
18. Chatterjee A, Banerjee P. Evaluation of cholecystitis in young patients-its incidence, etiology and treatment. *Indian J Surg*. 1989;51(7):293–5.
19. Rahman GA. Cholelithiasis and cholecystitis: changing prevalence in an African community. *J Natl Med Assoc*. 2005;97(11):1534–8.
20. Meyer K, Capos N, Mittelpunkt A. Personal experience with 1261 cases of acute and chronic cholecystitis and cholelithiasis. *Surgery*. 1967;61(5): 661–8.
21. Malik MM, Kaur M, Kaur M. Role of ultrasonography in evaluation and diagnosis of Cholelithiasis and Cholecystitis. *Int J Sci Appl Res*. 2020;7(12):1–8.
22. Bortoff GA, Chen MY, Ott DJ, Wolfman NT, Routh WD. Gallbladder stones: imaging and intervention. *Radiographic*s. 2000;20(3):751–66.

Cite this article: Kaur T, Agarwal G. Assessment of histopathological and ultrasonography accuracy in gallbladder pathology. *Indian J Pathol Oncol*. 2025;12(1):29–33.