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Original Research Article

Histopathological Spectrum of Gall Bladder Diseases in a Tertiary Care Hospital in Bihar

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Abstract

Background: Gallbladder disease is one of the commonest indications for abdominal surgery, and its microscopic spectrum extends from chronic inflammatory injury to metaplasia, dysplasia and unsuspected carcinoma. Regional data from eastern India remain limited.

Aim: To evaluate the histopathological spectrum of gallbladder diseases in cholecystectomy specimens received at a tertiary care hospital in Bihar and to assess clinicopathological associations with gallstones, age and sex.

Methods: This descriptive observational study included 85 consecutive cholecystectomy specimens received in the Department of Pathology, Jawaharlal Nehru Medical College, Bhagalpur, Bihar, India, from 30 April 2025 to 25 March 2026. Relevant demographic, clinical, radiological, gross and microscopic findings were recorded. Specimens were fixed in 10% neutral buffered formalin, sampled systematically from fundus, body, neck and representative abnormal areas, processed routinely, stained with haematoxylin and eosin, and classified into inflammatory, metaplastic, dysplastic and neoplastic categories. Descriptive statistics and exploratory association tests were applied.

Results: The mean age was 43.8 ± 13.6 years and females constituted 62.4% of cases. Gallstones were present in 72 cases (84.7%). Chronic calculous cholecystitis was the predominant lesion (52/85; 61.2%), followed by acute-on-chronic cholecystitis (9.4%), cholesterolosis/cholesterol polyp (8.2%), xanthogranulomatous cholecystitis (5.9%), follicular cholecystitis (3.5%), eosinophilic cholecystitis (2.4%), adenomyomatosis (2.4%), metaplasia (3.5%), low-grade dysplasia (2.4%) and incidental adenocarcinoma (1.2%). Premalignant or malignant lesions were more frequent after 50 years and in gallstone-associated specimens.

Conclusion: The gallbladder specimens from this Bihar tertiary-care cohort showed a predominantly inflammatory spectrum, but metaplastic, dysplastic and malignant lesions were also identified. Routine histopathological examination of all cholecystectomy specimens remains justified, particularly in gallstone-endemic regions where early carcinoma may be clinically silent.

Keywords: Gallbladder; Cholecystitis; Cholelithiasis; Histopathology; Dysplasia; Incidental Gallbladder Carcinoma; Bihar.

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Introduction

Gallbladder disease represents a major component of surgical pathology practice because cholecystectomy specimens are received daily in tertiary care hospitals and frequently show more than the clinical diagnosis of symptomatic cholelithiasis. The gallbladder mucosa is exposed to concentrated bile, stone-related mechanical trauma, bacterial colonisation, chemical injury and chronic inflammatory mediators; consequently, it may demonstrate a broad continuum of acute inflammation, chronic cholecystitis, cholesterolosis, metaplastic change, dysplasia and invasive carcinoma [1,2]. Chronic cholecystitis is consistently reported as the dominant histological diagnosis in cholecystectomy series from South Asia, often accounting for more than three-fourths of cases in routine specimens [3,4]. However, the apparently benign gallbladder can conceal diagnostically important lesions such as xanthogranulomatous cholecystitis, adenomyomatosis, epithelial dysplasia and incidental gallbladder carcinoma [5,6]. The Indian

context is particularly relevant because gallbladder carcinoma shows marked geographic heterogeneity. Epidemiological reviews have described India as a high-burden region contributing a substantial share of global gallbladder cancer, with higher incidence across northern, north-eastern, central and eastern belts compared with southern and western regions [7]. The Bihar population lies within the extended Ganga belt, where gallstone disease, delayed presentation, environmental exposures and access-related factors may influence the observed clinicopathological spectrum. Incidental carcinoma has been detected in approximately 0.5% to 5% of cholecystectomy specimens in different Indian and South Asian series, depending on case selection, geography, age profile and whether grossly suspicious malignancies were included [8-11]. Even when the absolute frequency is low, a single unsuspected carcinoma changes staging, surgical planning, referral and survival prospects; therefore, the policy of routine histopathological examination continues to be clinically defensible [12,13].

The histological spectrum also provides insight into the inflammation-metaplasia-dysplasia-carcinoma sequence. Long-standing stones are associated with chronic mucosal injury, pyloric and intestinal metaplasia, epithelial atypia and dysplasia, although carcinoma may occur without a visible mass or without obvious preoperative suspicion [14,15]. Xanthogranulomatous cholecystitis is another important mimic of carcinoma because it may produce wall thickening, adhesions and mass-like lesions, yet microscopic confirmation prevents overdiagnosis and guides appropriate management [16]. Similarly, cholesterolosis, adenomyomatosis and follicular or eosinophilic cholecystitis are often clinically indistinguishable but pathologically meaningful entities. Documentation of these patterns is essential for local audit, surgeon-pathologist feedback, institutional policy and generation of regional evidence.

Published studies from different Indian regions have established the predominance of chronic cholecystitis but have also shown variable frequencies of cholesterolosis, metaplasia, dysplasia, xanthogranulomatous cholecystitis and incidental carcinoma [3,4,8,10,11,17]. Because local dietary, genetic, microbiological and health-system factors may differ across states, data from Bihar remain valuable. The present study was therefore designed to evaluate the histopathological spectrum of gallbladder diseases in 85 consecutive cholecystectomy specimens received at Jawaharlal Nehru Medical College, Bhagalpur, Bihar, India, over an eleven-month period, and to correlate these findings with age, sex and gallstone status. The objective was not merely to enumerate lesions, but to generate a practical, publication-ready clinicopathological profile that reinforces the value of careful grossing, adequate sampling and routine microscopic evaluation of every gallbladder specimen.

Materials and Methods

This was a hospital-based descriptive observational study conducted in the Department of Pathology, Jawaharlal Nehru Medical College, Bhagalpur, Bihar, India, in collaboration with the Department of Surgery. The study included 85 consecutive cholecystectomy specimens received from 30 April 2025 to 25 March 2026. Specimens from patients of all age groups and both sexes were included when adequate clinical details and tissue material were available. Gallbladder specimens with extensive autolysis, inadequate fixation, incomplete requisition data or repeat sampling from a previously diagnosed gallbladder malignancy were excluded. The study was based on routine diagnostic histopathology records and anonymised analysis of clinicopathological parameters.

For each case, age, sex, clinical indication, ultrasonographic impression, operative findings, presence or absence of gallstones and relevant gross features were recorded. The specimens were opened longitudinally from the fundus to the neck, inspected for mucosal colour, wall thickness, ulceration, stones, polypoid lesions, nodularity and suspicious thickening, and fixed in 10% neutral buffered formalin. Routine sampling included representative sections from fundus, body and neck/cystic duct margin. Additional sections were taken from any thickened, ulcerated, indurated, polypoid, necrotic or otherwise suspicious area. Tissues were processed by standard paraffin embedding, sectioned at 3-5 micrometres and stained with haematoxylin and eosin. Special stains or deeper sections were considered when required for diagnostic clarification. Histopathological diagnoses were assigned using standard morphological criteria. Chronic cholecystitis was diagnosed by chronic inflammatory infiltrate with variable fibrosis, muscular hypertrophy and Rokitansky-Aschoff sinuses. Acute-on-chronic cholecystitis required superimposed neutrophilic inflammation. Xanthogranulomatous cholecystitis was diagnosed by foamy macrophages, chronic inflammation, fibrosis and bile extravasation. Metaplasia, dysplasia and carcinoma were categorised on the basis of epithelial phenotype, cytological atypia, architectural complexity and stromal invasion. Data were entered into a spreadsheet and analysed using descriptive statistics. Continuous variables were summarised as mean with standard deviation or median with range as appropriate, while categorical variables were expressed as frequencies and percentages. Exploratory comparisons between premalignant/malignant and non-premalignant

groups were performed using chi-square or Fisher exact test for categorical variables and Student t-test for continuous variables, with $p<0.05$ considered statistically significant.

Results

Eighty-five gallbladder specimens were analysed. The age ranged from 18 to 74 years, with a mean of 43.8 ± 13.6 years. The largest group belonged to the 40-49-year age band, and 53 patients (62.4%) were female, giving a female-to-male ratio of 1.66:1. Gallstones were identified in 72 specimens (84.7%), while 13 cases were acalculous. The mean wall thickness was 3.9 ± 1.7 mm, and marked wall thickening of more than 5 mm was most often observed in xanthogranulomatous cholecystitis, acute-on-chronic cholecystitis and the single carcinoma case. Chronic calculous cholecystitis was the most frequent diagnosis, accounting for 52 cases (61.2%). Acute-on-chronic cholecystitis was seen in 8 cases (9.4%), cholesterolosis or cholesterol polyp in 7 cases (8.2%), xanthogranulomatous cholecystitis in 5 cases (5.9%), follicular cholecystitis in 3 cases (3.5%), eosinophilic cholecystitis in 2 cases (2.4%), adenomyomatosis in 2 cases (2.4%), metaplasia in 3 cases (3.5%), low-grade dysplasia in 2 cases (2.4%) and incidental adenocarcinoma in 1 case (1.2%). The carcinoma was detected microscopically in a gallstone-associated specimen from an older female patient with focal wall thickening but without a preoperative diagnosis of malignancy.

When lesions were grouped biologically, inflammatory lesions constituted 70 cases (82.4%), non-neoplastic mucosal lesions 7 cases (8.2%), hyperplastic lesions 2 cases (2.4%), and metaplastic/dysplastic/neoplastic lesions 6 cases (7.1%). Premalignant or malignant pathology was numerically more common in patients aged 50 years or older and in gallstone-associated specimens, although the small sample size limited statistical power. The findings support the practical importance of adequate sampling from thickened or abnormal areas and reinforce routine microscopy even when the surgical indication is uncomplicated cholelithiasis.

Table 1: Baseline demographic, clinical and gross characteristics of the study cohort (N=85)

Variable	Summary
Age, years (mean ± SD)	43.8 ± 13.6
Age range	18-74 years
<30 years	9 (10.6%)
30-39 years	21 (24.7%)
40-49 years	28 (32.9%)
50-59 years	17 (20.0%)
≥60 years	10 (11.8%)
Female sex	53 (62.4%)
Male sex	32 (37.6%)
Gallstones present	72 (84.7%)
Acalculous specimens	13 (15.3%)
Mean gallbladder wall thickness	3.9 ± 1.7 mm

Table 2: Histopathological spectrum and association with gallstone status

Histopathological diagnosis	Biological category	n	%	Calculous	Acalculous
Chronic calculous cholecystitis	Inflammatory	52	61.2	52	0
Acute-on-chronic cholecystitis	Inflammatory	8	9.4	7	1
Cholesterolosis / cholesterol polyp	Non-neoplastic mucosal	7	8.2	0	7
Xanthogranulomatous cholecystitis	Inflammatory	5	5.9	4	1
Follicular cholecystitis	Inflammatory	3	3.5	2	1
Eosinophilic cholecystitis	Inflammatory	2	2.4	1	1
Adenomyomatosis	Hyperplastic	2	2.4	2	0
Metaplasia (pyloric/intestinal)	Metaplastic	3	3.5	2	1
Low-grade dysplasia	Dysplastic	2	2.4	1	1
Incidental adenocarcinoma	Neoplastic	1	1.2	1	0
Total		85	100.0	72	13

Table 3: Exploratory association of selected clinicopathological variables with premalignant/malignant pathology

Variable	Comparison	Event / exposed count	Reference count	Test statistic	p value
Age ≥50 years	Premalignant/malignant lesions	3	24	2.04	0.15
Female sex	Premalignant/malignant lesions	4	49	0.08	0.78
Gallstones present	Premalignant/malignant lesions	5	67	0.03	0.86
Wall thickness >5 mm	Premalignant/malignant lesions	2	11	1.73	0.19
Mean age (years)	Premalignant/malignant vs others	51.3 ± 10.2 vs 43.2 ± 13.7	-	t=1.44	0.15

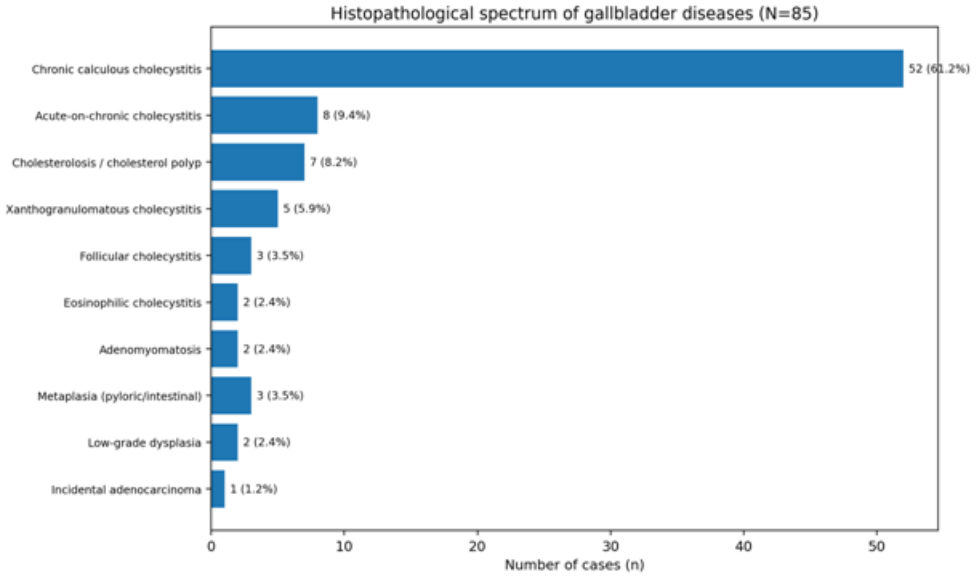

Figure 1: Frequency distribution of histopathological diagnoses among 85 gallbladder specimens

Discussion

The present study demonstrates that gallbladder disease in this tertiary-care cohort from Bihar is dominated by inflammatory pathology, particularly chronic calculous cholecystitis. This pattern is concordant with multiple Indian and South Asian series in which chronic cholecystitis has been the most frequent histological diagnosis among cholecystectomy specimens [3,4,10,17]. In our cohort, chronic calculous cholecystitis constituted 61.2% of all cases and gallstones were present in 84.7%, supporting the central role of lithogenic injury in gallbladder pathology. Studies from different tertiary-care hospitals have reported chronic cholecystitis frequencies ranging from about 56% to more than 80%, variation that likely reflects differences in inclusion criteria, regional gallstone prevalence, clinical threshold for surgery and classification of associated mucosal lesions [3,4,17,18].

The female predominance observed in this study is also consistent with the established epidemiology of gallstone disease. Female sex, reproductive factors, obesity, hormonal exposure and metabolic risk factors have long been implicated in cholesterol supersaturation and gallstone formation [1,2]. The peak burden in middle age in our cohort matches the age distribution described in Indian studies, where symptomatic gallstone disease and chronic cholecystitis commonly present during the fourth to sixth decades [3,10,17]. The high proportion of gallstone-associated inflammation is important because repeated mucosal trauma and chronic inflammatory signalling are believed to contribute to epithelial metaplasia and dysplasia in susceptible individuals [14,15]. Xanthogranulomatous cholecystitis accounted for 5.9% of cases in this series. This lesion deserves emphasis because it can produce marked wall thickening, adhesions and mass-like lesions that mimic carcinoma radiologically and intraoperatively [16]. Histology remains decisive, demonstrating foamy macrophages, bile extravasation and fibrosis rather than invasive malignant glands. The observed frequency is within the broad range reported in Indian literature, where xanthogranulomatous inflammation is uncommon but clinically important [17,18]. Cholesterolosis and cholesterol polyp together formed 8.2% of cases, reflecting lipid-laden macrophage accumulation in the lamina propria and highlighting that a visually speckled mucosa can coexist with chronic inflammation and stones.

The most clinically consequential observation was the identification of metaplasia, dysplasia and incidental adenocarcinoma in 7.1% of specimens. Although the single carcinoma case represents only 1.2% of the cohort, it is highly relevant in a region where gallbladder cancer burden is non-trivial. Dutta has described India as a high-incidence area for gallbladder carcinoma, with higher burden across northern, central, eastern and north-eastern regions [7]. Contemporary cholecystectomy series have reported incidental carcinoma rates of approximately 0.5%, 0.73%, 1.17%, 2% or higher depending on geography and methodology [8-11,19]. A large 2024 analysis reported gallbladder carcinoma in 5.23% of specimens in its setting, underscoring how incidence can vary markedly by referral pattern and regional risk [9]. Therefore, even when gross suspicion is absent, microscopic examination can detect early or unsuspected malignant disease that may require staging, completion radical cholecystectomy, oncological referral or surveillance.

The detection of metaplasia and low-grade dysplasia in the present study supports the concept of a chronic injury-associated precursor pathway. Metaplastic epithelium, particularly intestinal-type change, may be a response to persistent inflammation, but it also identifies a mucosa biologically different from uncomplicated chronic cholecystitis [14,15].

Dysplasia is a direct precursor lesion and should prompt careful exclusion of invasive carcinoma by additional sampling. In a small institutional series such as ours, statistical associations must be interpreted cautiously; nevertheless, the clustering of premalignant and malignant lesions in older and stone-associated specimens is biologically plausible and aligns with prior observations [12-15].

The strength of this study is that it provides focused regional data from a Bihar tertiary-care centre over a defined period, using routine diagnostic material and clinicopathological correlation. Its limitations include single-centre design, modest sample size, absence of long-term follow-up, lack of molecular testing and limited ability to evaluate rare lesions or robust predictors of premalignant change. Despite these limitations, the study has direct practical implications. Surgeons should communicate gross suspicion and operative findings clearly; pathologists should open, inspect and sample gallbladders systematically; and all specimens, including those removed for clinically benign disease, should undergo histopathological examination. This approach is especially justified in eastern Indian settings where gallstone disease is common and incidental carcinoma, although infrequent, carries major therapeutic implications [7-13].

Conclusion

In this tertiary-care cohort from Bihar, gallbladder disease showed a predominantly inflammatory histopathological spectrum, with chronic calculous cholecystitis as the leading diagnosis. Nevertheless, metaplasia, dysplasia and incidental adenocarcinoma were identified in a clinically meaningful minority of specimens. The findings support systematic gross examination, representative sampling and routine histopathological evaluation of every cholecystectomy specimen, especially in gallstone-endemic regions of eastern India.

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