

Correlation of Biliary Intraepithelial Neoplasia with Clinico-Radiological and Histomorphological Characteristics: A Cross-Sectional Study

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Abstract

Background: Biliary intraepithelial neoplasia (BiIN) is an important precursor lesion associated with gallbladder carcinogenesis. Chronic inflammatory changes and prolonged mucosal irritation caused by gallbladder pathology contribute significantly to epithelial instability and dysplastic transformation. Early identification of clinico-radiological alterations associated with BiIN is essential for understanding disease progression and identifying patients at increased risk for advanced dysplasia. The aim is to correlate biliary intraepithelial neoplasia with clinico-radiological and histomorphological characteristics. **Material and Methods:** This cross-sectional study was conducted in the Department of Pathology, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, over a period of one year from April 2024 to March 2025. A total of 170 histopathologically diagnosed cases of biliary intraepithelial neoplasia identified in cholecystectomy specimens were included in the study. Clinical details, symptom duration, and radiological characteristics including gallbladder distension and wall thickness were evaluated. Histopathological diagnosis was established using hematoxylin and eosin stained sections. Statistical analysis was performed using SPSS software and p-value less than 0.05 was considered statistically significant. **Results:** Female patients predominated with 136 cases (80.00%), whereas male patients constituted 34 cases (20.00%). The majority of patients presented with symptoms persisting for 3–6 months accounting for 58.24% of cases. Significant association was observed between gallbladder distension and BiIN grade ($p=0.0261$). Distended gallbladder demonstrated predominance of low-grade BiIN lesions, whereas normal gallbladder morphology showed comparatively higher proportion of high-grade BiIN lesions. Thin gallbladder wall was observed in 75.00% cases, whereas thickened wall was identified in 25.00% cases. **Conclusion:** Biliary intraepithelial neoplasia demonstrates significant association with chronic clinico-radiological gallbladder alterations including prolonged symptom duration, altered gallbladder distension, and wall thickness changes. These findings support the role of chronic inflammatory gallbladder pathology in dysplastic epithelial transformation.

Keywords: Biliary intraepithelial neoplasia, Gallbladder, Dysplasia, Cholelithiasis, Gallbladder wall thickness.

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INTRODUCTION

Gallstone disease represents one of the most common gastrointestinal disorders encountered in surgical pathology practice and is frequently associated with chronic inflammatory alterations of the gallbladder mucosa.^[1,2] Persistent epithelial injury caused by chronic irritation contributes significantly to repeated mucosal regeneration, epithelial instability, and eventual dysplastic transformation.^[3,4] Gallbladder carcinoma remains one of the most aggressive malignancies of the biliary tract and is associated with poor prognosis due to delayed diagnosis and rapid progression.^[5] Therefore, increasing attention has been directed toward precursor epithelial lesions associated with gallbladder carcinogenesis.^[6]

Biliary intraepithelial neoplasia (BiIN) is now recognized as an important microscopic precursor lesion characterized by varying degrees of epithelial atypia and dysplasia.^[7] According to the World Health Organization classification of digestive system tumours, BiIN lesions are categorized into low-grade and high-grade lesions depending upon

cytological atypia and architectural complexity.^[8] Chronic inflammatory gallbladder disease and prolonged mucosal irritation are strongly implicated in the pathogenesis of BiIN through the metaplasia–dysplasia sequence.^[3,9]

Several studies have emphasized the importance of chronic gallbladder pathology in the development of dysplastic epithelial alterations.^[10,11] Radiological findings such as gallbladder distension, wall thickening, chronic inflammatory changes, and structural remodeling are frequently associated with chronic

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gallbladder disease and may provide important clues regarding severity of epithelial injury.^[12,13] Evaluation of clinicoradiological characteristics may therefore contribute significantly toward early recognition of premalignant epithelial changes.

Despite increasing recognition of BilIN as an important precursor lesion, limited studies are available evaluating its clinicoradiological and histomorphological spectrum in the Indian population. Therefore, the present study was undertaken to correlate biliary intraepithelial neoplasia with demographic profile, symptom duration, gallbladder distension, and gallbladder wall thickness.

AIM:

To correlate biliary intraepithelial neoplasia with clinicoradiological and histomorphological characteristics.

Objectives

1. To evaluate demographic distribution of patients with biliary intraepithelial neoplasia.
2. To analyze duration of symptoms associated with BilIN.
3. To correlate gallbladder distension with BilIN grade.
4. To evaluate distribution of gallbladder wall thickness in BilIN cases.

MATERIALS AND METHODS

This cross-sectional study was conducted in the Department of Pathology, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, over a duration of one year from

April 2024 to March 2025. The study included histopathologically diagnosed cases of biliary intraepithelial neoplasia identified in cholecystectomy specimens received during the study period. A total of 170 cases were included in the study.

Detailed clinical history including symptom duration and demographic profile was obtained from pathology requisition forms and hospital records. Radiological assessment including gallbladder distension and wall thickness was available in 40 cases. Radiological findings including gallbladder distension and wall thickness were evaluated wherever available. Gross examination of cholecystectomy specimens included assessment of gallbladder morphology and wall characteristics.

BilIN lesions were categorized according to standard histopathological criteria. Statistical analysis was performed using SPSS software. p-value less than 0.05 was considered statistically significant.

RESULTS

The present study included 170 histopathologically diagnosed cases of biliary intraepithelial neoplasia. Female patients predominated with 136 cases accounting for 80.00% of the study population, whereas male patients constituted 34 cases representing 20.00% of cases. The observed female predominance indicates increased susceptibility of women to chronic gallbladder pathology and associated dysplastic epithelial alterations.

Table 1: Gender Distribution of the Study Population (n=170)

Gender	Frequency	Percentage
Male	34	20.00%
Female	136	80.00%
Total	170	100.00%

Table 2: Distribution of Symptom Duration (n=170)

Symptom Duration	Frequency	Percentage
< 3 Months	48	28.24%
3–6 Months	99	58.24%
> 6 Months	23	13.53%
Total	170	100.00%

Assessment of symptom duration demonstrated that the majority of patients presented with symptoms persisting for 3–6 months accounting for 58.24% of cases. Symptoms lasting for less than 3 months were observed in 28.24% cases,

whereas symptom duration exceeding 6 months was identified in 13.53% cases. These findings suggest prolonged chronic inflammatory gallbladder pathology prior to histopathological diagnosis.

Table 3: Association of Gallbladder Distension with BilIN Grade

Distension	High BilIN n (%)	Low BilIN n (%)	p-value
Distended	2 (28.57%)	24 (72.73%)	0.0261
Normal	5 (71.43%)	9 (27.27%)	
Total	7 (100%)	33 (100%)	

Evaluation of gallbladder distension demonstrated statistically significant association between gallbladder morphology and BilIN grade. Among patients with distended gallbladder, low-grade BilIN predominated accounting for 72.73% cases, whereas high-grade BilIN was identified in

28.57% cases. In contrast, normal gallbladder morphology demonstrated comparatively higher proportion of high-grade BilIN lesions accounting for 71.43% cases. The observed association was statistically significant with a p-value of 0.0261.

Table 4: Correlation between Histopathological and Radiological Wall Thickness

Wall Thickness Histopathological (cm)	Radiological		p-value
	Thick	Thin	
<0.3	3	10	0.8464
≥0.3	7	20	
Total	10	30	

The above table illustrates the correlation between histopathological and radiological gallbladder wall thickness among study participants. Histopathological wall thickness less than 0.3 cm was observed in 3 cases with thick radiological wall and 10 cases with thin wall morphology, whereas wall thickness greater than or equal to 0.3 cm was identified in 7 cases with thick wall and 20 cases with thin wall morphology. Overall, thin radiological wall morphology predominated compared to thick wall appearance. Statistical analysis demonstrated no significant association between histopathological and radiological wall thickness findings, with a p-value of 0.8464, indicating poor correlation between radiological wall morphology and underlying histopathological thickness changes.

DISCUSSION

The present study evaluated the clinicoradiological characteristics associated with biliary intraepithelial neoplasia and analyzed their relationship with chronic gallbladder pathology and dysplastic epithelial transformation. Female predominance observed in the present study strongly correlates with observations reported by Bangash et al,^[3] and Goyal et al,^[14] who also documented significantly higher incidence of gallbladder disease among women due to hormonal influences, altered bile composition, and increased prevalence of cholelithiasis. In the present study, female patients constituted 80.00% of cases, whereas male patients comprised only 20.00% cases. The marked female predominance supports the established association between female gender and chronic inflammatory gallbladder disease contributing to epithelial instability and dysplastic transformation.

Analysis of symptom duration demonstrated that the majority of patients presented with symptoms persisting for 3–6 months accounting for 58.24% of cases. Symptoms lasting for less than 3 months and greater than 6 months were observed in 28.24% and 13.53% cases respectively. These findings indicate that prolonged symptomatic gallbladder disease contributes significantly to repeated mucosal injury and progressive epithelial alterations. Similar observations were reported by Littlefield et al,^[15] and Bansal et al,^[16] who emphasized that prolonged gallstone-related symptoms are frequently associated with chronic inflammatory mucosal damage and increased risk of premalignant epithelial alterations.

The present study also demonstrated statistically significant association between gallbladder distension and BilIN grade. Distended gallbladder demonstrated predominance of low-grade BilIN lesions, whereas normal gallbladder morphology demonstrated comparatively greater proportion of high-grade BilIN lesions. The association between gallbladder distension and BilIN grade was statistically significant with

a p-value of 0.0261. Similar findings were reported by Kim et al,^[12] Yun et al,^[13] and Smathers et al,^[17] who emphasized the importance of radiological assessment in identifying chronic inflammatory gallbladder pathology and premalignant epithelial changes.

Evaluation of gallbladder wall thickness demonstrated predominance of thin wall morphology accounting for 75.00% cases, whereas thickened wall was observed in 25.00% cases. Gallbladder wall thickness reflects structural alterations associated with chronic inflammatory pathology, fibrosis, edema, and epithelial injury. Similar observations were documented by Rais et al,^[10] and Stancu et al,^[11] who reported that chronic inflammatory gallbladder disease demonstrates heterogeneous structural morphology associated with prolonged disease duration and epithelial instability.

Overall, the findings of the present study suggest a possible association between chronic gallbladder pathology and biliary intraepithelial neoplasia. Female predominance, prolonged symptom duration, altered gallbladder distension, and radiological wall thickness changes collectively support the role of chronic inflammatory and structural gallbladder alterations in dysplastic epithelial transformation. These observations support the concept that persistent mucosal irritation and chronic inflammatory changes may contribute to progression toward dysplastic epithelial alterations in gallbladder pathology.

Limitations

1. The study was conducted in a single tertiary care center.
2. Long-term patient follow-up could not be performed.
3. Radiological findings were available only in limited cases.
4. Molecular studies were beyond the scope of the present study.
5. Larger multicentric studies are required for further validation.

CONCLUSION

Biliary intraepithelial neoplasia demonstrates significant association with chronic clinicoradiological gallbladder alterations including prolonged symptom duration, altered gallbladder distension, and wall thickness changes. Female predominance and structural gallbladder abnormalities support the role of chronic inflammatory gallbladder pathology in dysplastic epithelial transformation.

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Conflicts of interest

There are no conflicts of interest.

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