

Correlation between the histopathological findings of gallbladder samples and clinical outcomes within the framework of a hybrid study

Authors

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Abstract

Background: This study focuses on the histopathological characteristics of benign and potentially malignant lesions of the gallbladder, with a specific emphasis on the efficacy of cholecystectomy as a secondary preventive measure in specific clinical contexts. The aim is to contribute to the development of improved preventive and therapeutic approaches.

Methodology: This research study employed a hybrid approach of retrospective and prospective data analysis on cholecystitis during the year 2023. Various variables were analyzed to explore their associations with clinical outcomes.

Results: The study included 63 patients, with no statistically significant differences in age between male and female patients. Analysis of the length, width, and thickness of the gallbladder wall did not reveal statistically significant differences ($p > 0.05$). Correlation analysis showed weak connections between age and gallbladder characteristics. The average recovery time was 4.46 days, and the duration of hospitalization positively correlated with age ($p < 0.001$). Regression analysis indicated an association between symptoms and age and the duration of hospitalization ($p = 0.015$, $p < 0.001$). Logistic regression demonstrated an accuracy of 61.9%, with high precision in predicting stays longer than 3 days. Chi-square tests confirmed statistically significant differences in histopathological diagnoses related to comorbidities ($p = 0.021$).

Conclusion: Gender-specific approaches in postoperative treatment of patients with gallbladder issues highlight significant differences in patient characteristics, while the analysis of comorbidities reveals a connection between hypertension and pathological changes in the gallbladder.

Keywords: gallbladder; histopathological findings; hybrid study; correlation; clinical outcomes

Introduction

Research on gallbladder diseases focuses on neoplastic lesions, some of which are benign, such as adenomas and papillomas, while others are potentially malignant, such as carcinomas (1). Given the high prevalence of polypoid lesions in the gallbladder and their potential for malignancy, understanding their histopathological and clinical characteristics is crucial (2).

Cholecystectomy, as a standard procedure for treating asymptomatic cholelithiasis, is a consequence of the incidence of gallbladder carcinoma (3). This research aims to further explore the effectiveness of cholecystectomy as a secondary prevention measure in specific clinical contexts (3).

Gallbladder diseases are common in clinical practice, requiring various surgical interventions and biopsies (4). Inflammatory conditions of the gallbladder are often diagnosed through pathological and histological examinations of biopsy samples (4).

Among benign entities, papillomas, adenomas, and adenomyosis of the gallbladder are noteworthy, while carcinomas are the most common malignant tumors (4). In the general population, the reported prevalence of gallbladder polyps is 4–7% (2). Cholelithiasis is widespread and associated with common risk factors such as obesity, hypertriglyceridemia, and fasting glucose levels (5).

This research aims to expand our understanding of these conditions and contribute to the development of better preventive and therapeutic approaches (1). Studies on different types of lesions in the gallbladder not only contribute to our understanding of the histopathological aspects of the disease but also enable more accurate differentiation between benign and malignant entities (4). This study aims to investigate potential connections between histopathological findings and clinical outcomes (4).

The research topic on the correlation between histopathological findings of gallbladder samples and clinical outcomes is of paramount importance given the common occurrence of gallbladder diseases in clinical practice. Understanding the relationship between histological characteristics and clinical outcomes can significantly advance the diagnosis, treatment, and prognosis of patients with similar pathological changes. These studies contribute to a broader understanding of gallbladder diseases, providing a foundation for further guidance in medical interventions and improving patient health. Considering the frequency of gallbladder issues and their potential serious consequences, research on this topic directly enhances the quality of healthcare and can have a significant impact on medical practice.

Objectives of this study include: examining differences in characteristics of patients with gallbladder issues between men and women; analyzing the correlation between age, length, width, and thickness of the gallbladder wall; identifying factors influencing the duration of hospitalization after gallbladder surgery; investigating the association of comorbidities with histopathological diagnoses and the appearance of the gallbladder mucosa; and providing data that can contribute to the development of gender-specific approaches in the postoperative treatment of patients with gallbladder issues.

Methodology

Within the methodology of this research study, a hybrid approach was conducted throughout the year 2023, combining retrospective and prospective data analysis related to cholecystitis. The study commenced on January 1, 2023, and concluded on December 31, 2023, with retrospective observation from August 31, 2022, to January 1, 2023, and prospective observation from September 1, 2023, to December 31, 2023.

A total of 128 patients participated, of whom 65 were excluded due to unnecessary submission of samples for histopathological diagnosis (61 patients) and conversions from laparoscopic to open cholecystectomy (4 patients). Some patients were excluded from the study due to the unnecessary submission of samples for histopathological diagnosis because the macroscopic examination did not indicate the need for additional analysis. This exclusion approach aimed at the efficiency and rational use of resources, considering the clinical picture and macroscopic findings that did not suggest pronounced pathological changes requiring detailed histological analysis. Patients with a conversion from laparoscopic to open cholecystectomy were excluded from the study due to a change in the surgical approach. Conversion to an open approach can result in different clinical and histopathological characteristics compared to a laparoscopic approach. To maintain homogeneity in the sample and avoid introducing additional variants that could affect study results, it was decided to exclude patients with these changes in the surgical approach. Only patients with laparoscopic cholecystectomy (63 patients) were included in the study.

Various variables were monitored, including gender, age, indications for surgery, gallbladder length, gallbladder width, gallbladder wall thickness, gallbladder mucosa findings, preoperative symptoms, duration of hospitalization, histopathological diagnosis, histopathological findings, and comorbidities.

Data analysis involved the application of different statistical methods. Pearson correlation, the Chi-square test, and the ANOVA test were used for relevant variables. All analyses were performed using SPSS software, with a set significance level of 0.05.

This research was conducted in accordance with ethical guidelines and with approval from the institutional ethics committee. Conclusions were drawn from data analysis to contribute to a better understanding of the histopathological characteristics of cholecystitis and provide a foundation for further research and improvement in clinical practice.

Results

The study included 63 patients, ranging in age from 19 to 78 years. The average age was 50.52 ± 13.18 . Out of the total number of patients, 29 (46%) were male and 34 (54%) were female. The median age of male patients was 52, and for female patients, it was 50.

The results indicate that there is no statistically significant difference in age between male and female patients. This conclusion is based on both the equal variance t-test ($t = 0.263$, $df = 61$, $p = 0.794$) and the unequal variance t-test ($t = 0.792$, $df = 60.468$, $p = 0.432$). Both approaches, assuming equal and unequal variances, do not show statistically significant differences in average age between male and female patients.

Data analysis, covering three different parameters, yielded ANOVA test results for the length, width, and thickness of the gallbladder wall that did not show a statistically significant difference among the groups ($F = 0.980$, $p = 0.438$; $F = 0.989$, $p = 0.433$; $F = 0.241$, $p = 0.942$). The average values of these parameters are presented in Table 1.

Table 1. Characteristics of the Gallbladder in Different Types of Comorbidities

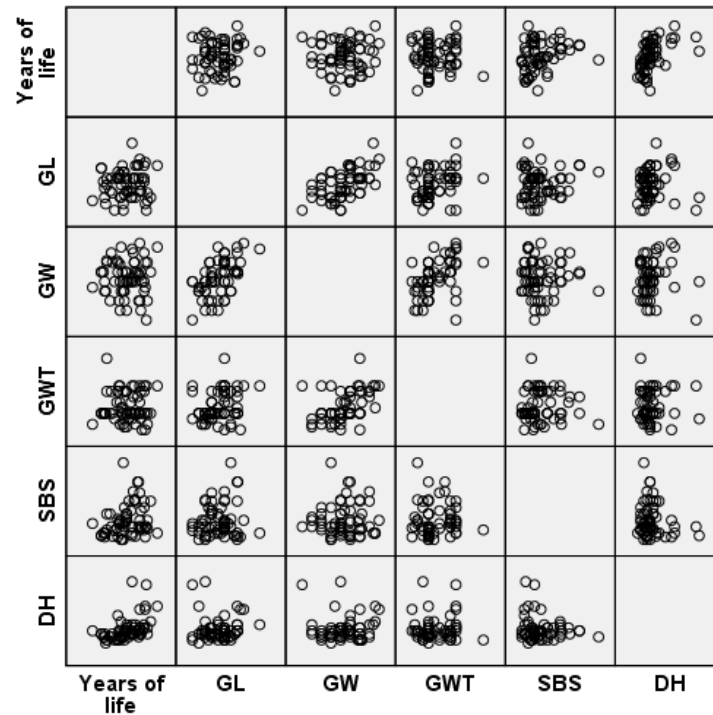
Comorbidity/ Gallbladder dimensions	Gallbladder length Mean±SE	Gallbladder width Mean±SE	Thickness of the gallbladder wall Mean±SE	Bootstrap Bias ± SE	SD ± SE	95% CI Lower - Upper
Without changes	83,42 ± 3,51	32,76 ± 1,52	6,38 ± 0,44	0 ± 0.12	21,62 ± 1,89	76,32 - 90,53
Hypertension	77,26 ± 5,40	31,16 ± 1,81	5,97 ± 0,64	-0.05 ± 1.01	23,52 ± 4,78	65,93 - 88,60
Hyperlipidemia	63,33 ± 3,33	25,00 ± 5,77	5,67 ± 1,76b	-0.01 ± 3.00b	5,77 ± 2,66b	48,99 - 77,68
Obesity	90,00 ± 0.00	40,00 ± 0.00	5,00 ± 0.00c	0 ± 0.00c	/	/
Diabetes mellitus	110,00 ± 0.00	35,00 ± 0.00	8,00 ± 0.00d	0 ± 0.00d	/	/
Hypothyroidism	80,00 ± 0.00	20,00 ± 0.00	5,00 ± 0.00e	0 ± 0.00e	/	/

Based on the results of the MANOVA analysis, we did not find statistically significant differences between male and female patients regarding age, length, width, and thickness of the gallbladder wall. These results suggest that gender does not play a significant role in the variation of these characteristics among patients (Table 2).

Table 2. Multivariate analysis of variance (MANOVA) by gender Top of Form

Variable	Group	Mean	SD	P value
Age	Male	51.00	12.787	0.794
	Female	50.12	13.686	
Gallbladder length	Male	82.83	24.504	0.562
	Female	79.59	19.604	
Gallbladder width	Male	33.76	9.349	0.121
	Female	30.24	8.435	
Thickness of the gallbladder wall	Male	6.57	3.212	0.324
	Female	5.90	2.117	

In the correlation analysis between continuous variables, the following results were obtained: Age exhibited weak and insignificant correlations with the length ($r = 0.096$, $p = 0.454$), width ($r = 0.012$, $p = 0.927$), and thickness of the gallbladder wall ($r = 0.012$, $p = 0.929$), as well as with preoperative symptoms ($r = 0.279$, $p = 0.027$), and the duration of hospitalization ($r = 0.477$, $p < 0.001$). The length of the gallbladder displayed a significant and moderately positive correlation with its width ($r = 0.547$, $p < 0.001$) and weak correlations with other variables. Similarly, the width of the gallbladder exhibited a significant and moderately positive correlation with its length ($r = 0.547$, $p < 0.001$) and weak correlations with other variables. Conversely, the thickness of the gallbladder wall did not show significant correlations with other variables. Preoperative symptoms and the duration of hospitalization demonstrated weak and insignificant correlations ($r = -0.147$, $p = 0.251$). A visual representation of these variables is depicted in Diagram 1.



*DH: duration of hospitalization; *SBS: symptoms before surgery; *GW: gallbladder width; *GWT: gallbladder wall thickness; *GL: gallbladder length

Diagram 1. Relationship visualization: Scatterplot matrix

The average recovery time is 4.46 days. Although comorbidities are present, they do not show a significant correlation with the duration of hospitalization ($p = 0.266$). Through correlation analysis, it has been discovered that there is a significant positive correlation between the duration of hospitalization and age ($r = 0.477$, $p = 0.0001$), as shown in Diagram 2.

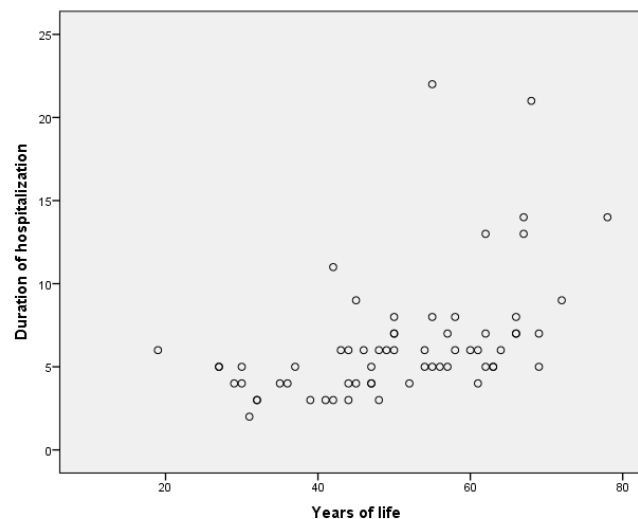


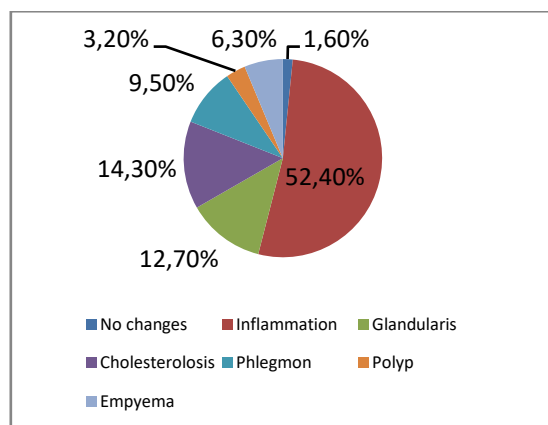
Diagram 2. Relationship between hospitalization duration and age: Scatterplot analysis

Overall, the statistical analysis provided valuable insights into the characteristics of patients with gallbladder issues. Multivariate analysis of variance (MANOVA) revealed significant differences between male and female patients in terms of age, length, width, and thickness of the gallbladder wall. These results underscore the need for gender-specific approaches in postoperative treatment.

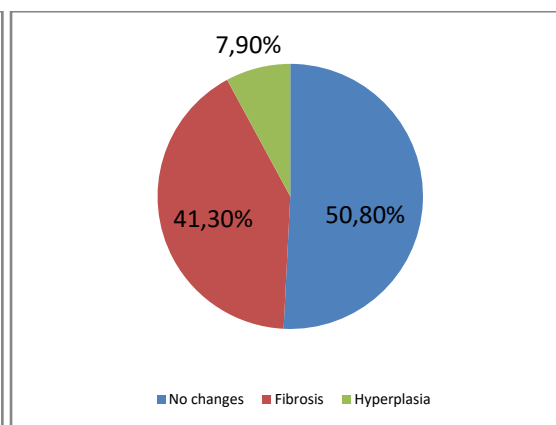
Furthermore, regression analysis indicates key factors influencing the duration of hospitalization after gallbladder surgery. Preoperative symptoms and age are significantly associated with the duration of hospitalization. Understanding these factors can aid in adjusting therapeutic strategies and improving patient outcomes. P-values showed statistical significance for preoperative symptoms ($p = 0.015$) and age ($p < 0.001$), while preoperative symptoms ($p = 0.338$) and the presence of comorbidities ($p = 0.242$) did not exhibit a significant impact on the duration of hospitalization.

Categorical variable analysis for the impact on length of hospital stay was conducted through logistic regression. According to the results, the overall accuracy rate of the model is 61.9%. When examining specific values, the model demonstrated an accuracy of 86.8% in predicting stays longer than 3 days, while the accuracy for stays up to 3 days was 24.0%.

Based on the results of Chi-square tests, it is concluded that there are statistically significant differences regarding histopathological diagnosis and the appearance of the gallbladder mucosa concerning the presence of different comorbidities ($p = 0.021$). Hypertension, as the predominant comorbidity, particularly resulted in a markedly folded mucosa of the gallbladder and a histopathological diagnosis of glandular gallbladder. However, no statistically significant association with comorbidities was found for histopathological findings ($p = 0.146$). Histopathological diagnoses and findings of the gallbladders are depicted in diagrams 1 and 2.



Graph 1. Histopathological diagnoses



Graph 2. Histopathological Funding

Discussion

By analyzing the results of our study, we provide insights into key aspects that contribute to understanding the specific area of research. Let us now consider the significant findings and attempt to assess their impact on practice and research and potentially guide future research efforts. This discussion will help us better understand the contribution of our research in the broader context of the relevance of this field.

Diseases of the gallbladder pose a common clinical challenge with a wide spectrum of histopathological changes. Histopathological findings of gallbladder samples often play a crucial role in accurate diagnosis and the establishment of appropriate treatment. Investigating the correlation between histopathological findings and clinical outcomes has the potential to enhance our understanding of disease progression and predict patient responses to therapy. Such research has broader implications for medical practice, providing a foundation for a personalized approach to the treatment of patients with gallbladder conditions. This study contributes to the overall understanding of pathological processes in the gallbladder, paving the way for the development of more effective diagnostic and therapeutic strategies.

The age of patients undergoing gallbladder surgery and histopathological analysis in the Pigac et al. study (4) ranged from 9 to 94 years, while in our study, patients ranged from 19 to 78 years old. In the same study, the average age of all patients was 54.8, and in our study, it was 50.52.

In our study, we identified 41.30% of fibrotic changes in the gallbladder, showing the same frequency of this pathological change as in the study by Spasovski et al. (6).

Arya Abisatya et al. (7) showed results indicating that comorbidities (hypertension) affect the duration of hospitalization after surgical intervention (>5 days), while we obtained results that do not show a significant correlation with the duration of hospitalization. The average recovery time in our study was 4.46 days, which is approximately the same time period as obtained in the same study, which is 5 days.

Pejić's study (1) emphasizes the presence of chronic cholecystitis, cholesterol polyps, adenomas, and adenocarcinomas, while our research additionally includes fibrosis, hypertrophy, and polypoid cholecystitis. These differences indicate variations in the pathological characteristics of gallbladders between the two studies.

Our study presents histopathological diagnoses of the gallbladder, with cholesterosis accounting for 14.30%, which is a similar prevalence as shown in the study by Contreras et al. (8). Also, the frequency of gallbladder polyps was recorded in 2 (3.20%) subjects, which is the same prevalence as obtained in the study by Dattal et al. (9). In the same study, the prevalence of hyperplasia was 7.40%, much less than in our study, where that percentage is 50.80%. However, Ryong et al. (2) in their study noticed a polyp prevalence of 29.40%, which is much higher than the same prevalence in our study.

It is important to note that in Marcikic's study (4), the incidence of malignant tumors was 1.72%, where adenocarcinoma was present in all 24 cases. These numbers significantly differ from our results, where not a single case of gallbladder cancer was recorded in 63 patients. Differences in the incidence of cancer may be a result of different populations or regional factors.

The strengths of this study lie in its comprehensive approach to analyzing patients with gallbladder issues, contributing to a deeper understanding of this complex area of medical research. First, the wide range of age groups, with patients aged 19 to 78 years, provides a prism of diversity that may be crucial for understanding the characteristics of these

patients at different life stages. The average age of 50.52 years represents a realistic depiction of the age distribution of patients, providing relevant data for medical practice.

Second, the inclusion of different pathological changes in the gallbladder, including fibrosis, hypertrophy, and polypoid cholecystitis, allows for a comprehensive insight into the spectrum of possible pathological conditions affecting this organ. This expanded investigation of pathological characteristics enables a better understanding of variations among patients.

Additionally, histopathological diagnoses, including the frequency of certain pathological entities such as cholesterosis, polyps, and malignant tumors, provide significant information for diagnosis and treatment planning. Differences in the prevalence of these pathological changes compared to previous research highlight the importance of diversity in patient populations and regional characteristics.

Finally, the analysis of comorbidities and their impact on the duration of hospitalization contributes to understanding the relationship between underlying health issues and postoperative outcomes. These strengths make the study valuable for clinical practices, research efforts, and the further development of treatment strategies for patients with gallbladder issues.

The limitations of this study include a limited number of patients and sample specificity, which may reduce the general applicability of the results. Additionally, the lack of long-term outcomes and the absence of comparison with other relevant studies limit the overall interpretation of the results.

Conclusion

The results of this study provide valuable insights into the characteristics of patients with gallbladder issues. While no statistically significant difference in age was found between male and female patients, the multivariate analysis of variance revealed significant differences between genders in terms of age, length, width, and thickness of the gallbladder wall. These findings highlight the need for gender-specific approaches in the postoperative treatment of patients with gallbladder problems. Additionally, regression analysis identified preoperative symptoms and age as key factors influencing the duration of hospitalization after gallbladder surgery.

In conclusion, there are statistically significant differences related to histopathological diagnosis and the appearance of the gallbladder mucosa concerning the presence of various comorbidities. Hypertension stands out as a comorbidity most strongly associated with a markedly folded gallbladder mucosa and a histopathological diagnosis of glandular gallbladder. These findings explore additional aspects of pathological changes, contributing to a holistic understanding of the conditions of patients with gallbladder problems.

This research contributes to the field by providing new insights into specific histopathological characteristics of the gallbladder, thereby contributing to a global understanding of the disease. Clearly defining the correlations between histopathological findings and clinical outcomes lays the foundation for identifying new clinical indicators that can enhance diagnosis and treatment. These results have the potential to influence the global approach to gallbladder disease treatment, contributing to the development of more effective therapeutic modalities worldwide. The contribution of this research expands the horizons of medical practice, providing a basis for enhancing diagnostic and therapeutic guidelines for patients with gallbladder diseases.

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