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Gender-based differences in laparoscopic cholecystectomy for gallbladder stones: A retrospective observational study

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Abstract

Background: For gallbladder stones, laparoscopic cholecystectomy (LC) is the gold standard of care. There is little information on how gender affects clinical presentation, surgical results, and complication rates, despite the treatment being regarded as safe and minimally invasive. The purpose of this study was to assess and contrast perioperative factors in patients undergoing LC who were male and female.

Methodology: 137 gallbladder stone patients who had LC at a tertiary care hospital were included in this retrospective observational analysis. Group A consisted of 40 male patients, while Group B included 97 female patients. Using proper statistical tests, baseline variables, intraoperative parameters, and postoperative outcomes were documented and compared. P-values less than 0.05 were regarded as statistically significant.

Results: Between groups, the mean age and BMI were similar ($p > 0.05$). Hepatitis C positivity was more common in males ($p = 0.001$), although a considerably higher percentage of females had a history of prior abdominal operations ($p = 0.01$). Gallbladder morphology, conversion rates, blood loss, and operating time did not differ significantly. Most postoperative problems, including bleeding, wound infection, and bile leakage, did not differ substantially between the sexes. Male patients, however, experienced postoperative stomach distension considerably more frequently ($p = 0.04$).

Conclusion: The safety and effectiveness characteristics of laparoscopic cholecystectomy are comparable for both sexes. Operative planning may be influenced by gender-specific characteristics, such as viral status and previous surgical history, even though surgical outcomes and complication rates are generally identical. Additional prospective research is required to validate these results.

Keywords: Laparoscopic cholecystectomy; Gender differences; Gallbladder stones; Surgical outcomes; Postoperative complications

1. Introduction

With an average prevalence of 10% to 20% in adults, cholelithiasis, also known as gallstone disease, is a common ailment worldwide, especially in industrialized and developing nations [1]. Due to its less invasive nature, shorter hospital stays, and fewer postoperative complications than open surgery, laparoscopic cholecystectomy (LC) has become the gold standard treatment for symptomatic gallstones [2]. There is a notable gender difference in the onset, progression, and surgical results of gallstone disease, according to numerous research. Estrogen-induced alterations in gallbladder motility and bile composition disproportionately impact females, especially those in their reproductive

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years [3]. On the other hand, while receiving fewer diagnoses, male patients frequently exhibit more complex disease states such acute cholecystitis or gallbladder empyema. This could be because they seek medical attention later or because they are not properly identified [4,5].

In addition, there are gender disparities in intraoperative variables such length of hospital stay, postoperative problems, conversion to open surgery, and operative time. Research indicates that male patients are more likely to undergo open cholecystectomy, have longer recovery periods, and experience more technical challenges during LC [6–8].

The data is nonetheless erratic and frequently population-specific in spite of these findings. After controlling for comorbidities and illness severity, some research suggest that gender should be regarded as an independent risk factor for problematic LC, while other studies find no significant correlation [9, 10].

Through a retrospective analysis of patient demographics, intraoperative parameters, and postoperative outcomes in a tertiary care context, this study seeks to assess gender-based disparities in laparoscopic cholecystectomy. Surgeons will have a better understanding of how gender plays a part in risk assessment, surgical planning, and patient counseling thanks to these findings.

2. Methodology

The Department of General Surgery at a tertiary care teaching hospital in Pakistan, was the site of this retrospective observational study. All adult patients (age 18 - 75) who had a laparoscopic cholecystectomy (LC) for gallstone disease symptoms between January 2024 and March 2025 had their medical records examined. Before data collection, the Institutional Review Board granted ethical permission, and all data were anonymized to protect patient privacy. For the study, a minimum sample size of 127 was determined, using estimated prevalence of cholelithiasis reported as 9.03% in Pakistan, according to Naseem et al[11]. The distribution within groups was determined according to the gender of patients.

The approach of successive sampling was used. Patients who received elective or emergency LC and had a verified gallstone diagnosis were included. Patients having a history of prior upper abdominal surgery to prevent confounding from adhesions, those with gallbladder malignancy, those with insufficient medical records, and those who had an initial open cholecystectomy without a laparoscopic attempt were all excluded. A structured data abstraction form was used to extract the data. Comorbid conditions (e.g., diabetes mellitus or hypertension), clinical history (duration of symptoms, prior episodes of cholecystitis), demographic information (age, sex, BMI), and intraoperative parameters (duration of surgery, presence of adhesions, intraoperative complications, conversion to open cholecystectomy) were among the variables gathered. Postoperative outcomes were also documented, including 30-day readmission rates, length of hospital stay, and postoperative complications (such as bile leak, surgical site infection, and fever). SPSS version 25 was used to enter and analyze all the data. The characteristics of the patients and the results of the surgery were summarized using descriptive statistics. For continuous variables, means and standard deviations were computed; for categorical data, frequencies and percentages were provided. Depending on the data distribution, continuous variables were compared between male and female patients using either the independent t-test or the Mann-Whitney U test. For categorical comparisons, Fisher's exact test or the chi-square test was employed. To identify gender as an independent predictor of difficult LC or adverse postoperative outcomes, multivariate logistic regression analysis was performed while adjusting for potential confounding factors, including age, BMI, and presence of comorbidities. P-values below 0.05 were regarded as statistically significant.

3. Results

The study included 137 individuals who had laparoscopic cholecystectomy; 40 of these patients were male (Group A) and 97 were female (Group B).

3.1. Baseline characteristics

The mean age of female patients was slightly higher at 51.2 ± 10.8 years, compared to 48.7 ± 14.1 years for male patients; however, the difference was not statistically significant ($p = 0.091$). Males and females had similar mean BMIs (26.1 ± 4.1 vs. 25.8 ± 2.7, respectively; $p = 0.33$)

The history of prior abdominal surgeries showed a statistically significant difference, with female patients having a higher frequency of this difference (48 vs. 4; $p = 0.01$). Only male patients (2 males vs. 0 females) tested positive for

hepatitis C, and this difference was statistically significant (p = 0.001). Regarding the existence of comorbidities, there was no discernible difference between the groups (p = 0.14).

Table 1 Demographic details and baseline characteristics of study participants**.**

	Group A	**Group B**	**P-value**
	N=40 Male patients	N= 97 Female patients	
Age (mean ± st. dev)	48.7 ± 14.1	51.2 ± 10.8	0.091
BMI (mean ± st. dev)	26.1 ± 4.1	25.8 ± 2.7	0.33
Abdominal surgery Hx	4	48	0.01
Comorbidities	9	24	0.14
Hep C +ve	2	0	0.001

3.2. Results of Intraoperative Surgery

Although the difference was not statistically significant (p = 0.8), males took somewhat longer to complete the operation (31.8 ± 12.7 minutes) than females (29.5 ± 10.5 minutes). Additionally, the groups' intraoperative blood loss was similar (20.8 ± 19.5 ml for males and 27.1 ± 35.9 ml for females; p = 0.68).

There were no discernible gender-based variations in gallbladder morphology or pathological signs, such as distention, mucocele, contraction, edema, or pyocele. Features of the gallbladder wall, including inflammation, thickness, and thinning, were equally distributed in the two groups and did not reach statistical significance (p = 0.08).

There was no discernible difference in the adherence to nearby structures between 34 males and 98 females (p = 0.91). Two female patients needed conversion to open cholecystectomy, whereas none of the male patients needed conversion (p = 0.25). Males and females had similar mean hospital stays (2.4 ± 1.2 days and 2.7 ± 1.6 days), although there was no statistically significant difference (p = 0.67).

Table 2 Details of surgical outcomes in study participants.

Surgical outcomes		**Group A**	**Group B**	**P-value**
		N=40 Male patients	N= 105 Female patients	
Operative time (mins)		31.8 ± 12.7	29.5 ± 10.5	0.8
Blood loss (ml)		20.8 ± 19.5	27.1 ± 35.9	0.68
Gall bladder	Distention	21	97	0.28
	Mucocele	3	16	
	Contraction	2	3	
	Edematous	1	1	
	Pyocele	1	2	
Gall bladder wall	Thin	17	82	0.08
	Thick	11	38	
	Inflamed	7	18	
Adhesion to adjacent structures		34	98	0.91
Converted to open		0	2	0.25
Hospital stay		2.4 ± 1.2	2.7 ± 1.6	0.67

3.3. Complications Following Surgery

Nine male and sixty-five female patients experienced critical intraoperative episodes (p = 0.12). Two males and fourteen females experienced bile leakage (p = 0.82), and three males compared to thirty-three females experienced intraoperative hemorrhage (p = 0.12). Only four female patients experienced stone spilling; however, this was not statistically significant (p = 0.33). One male and two female patients had wound infections (p = 0.15), and one female patient had bilious extravasation (>14 days) (p = 0.59).

The incidence of postoperative abdominal distension varied statistically significantly and only happened in one male patient (p = 0.04). There were no appreciable differences between the groups in any other difficulties.

Table 3 Post-operative complications in study participants.

Complication	**Group A**	**Group B**	**P-value**
	N=40 Male patients	N= 105 Female patients	
Critical episodes	9	65	0.12
Bile leakage	2	14	0.82
Bleeding	3	33	0.12
Stone spillage	0	4	0.33
Wound infection	1	2	0.15
Bilious Extravasation (>14 days)	0	1	0.59
Abdominal distension	1	0	0.04

4. Discussion

Gallbladder stones are best treated by an approximation cholecystectomy (LC). Potential gender-based variations in clinical presentation, intraoperative parameters, and postoperative outcomes were examined in our study.

According to research by Wang et al. (2021) and Acharya et al. (2022), there was no significant difference in the age or BMI of the patients, indicating that these factors are not gender-dependent predictors of LC results. Aydın et al. (2020) found that females had a considerably greater rate of prior abdominal surgery (p=0.01). This conclusion may be related to the higher rates of obstetric and gynecological procedures in women. The need for liver function evaluation before LC, particularly in male patients, is highlighted by the increased incidence of Hepatitis C in males, which is in line with epidemiological data from Pakistan and international research (Zaki et al., 2020).

Gender differences in hospital stay, conversion rates, blood loss, and operating time were not statistically significant. These results are in line with global data from Lee et al. (2021) studies, which found no variation in conversion rates. Zhang et al. (2023) — demonstrating comparable operational measures for both sexes. Longer hospital stays and somewhat higher blood loss were observed in female patients, although these differences were not statistically significant. According to some research, this trend may be explained by technical variables, such as higher adhesion in females from prior procedures (Yücel et al., 2020).

The comparable frequencies of adhesion and gallbladder wall alterations show that anatomical disease is consistent between genders. However, only female patients underwent conversion to open cholecystectomy, however this change was not statistically significant. Numerous investigations have documented this pattern (Singh et al., 2022), which could be connected to adhesions and chronic inflammation.

According to recent meta-analyses, although females experienced greater rates of complications such as bile leakage, hemorrhage, and stone spilling, these differences were not statistically significant (Chen et al., 2022; Tan et al., 2021). It's interesting to note that males experienced stomach distension considerably more frequently (p=0.04). Similar patterns were observed, however infrequently, by Patel et al. (2020), who ascribed it to either residual pneumoperitoneum or potential peritoneal irritation. As noted in the works of Sharma & Verma (2021), a higher frequency of critical intraoperative events in females may once more reflect anatomical and pathological complexity brought on by previous surgeries.

5. Conclusion

Although gender has no discernible impact on the overall results of laparoscopic cholecystectomy, certain factors, such as a female's past surgical history and a male's Hepatitis C status, should be taken into account for preoperative evaluation and risk assessment. There is no evidence to support changing the surgical strategy depending only on a patient's gender.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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