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Role of Gender as a Preoperative Predictor of Difficult Laparoscopic Cholecystectomy

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Abstract

Background: Laparoscopic cholecystectomy (LC) is the standard treatment for symptomatic gallstone disease, though difficult LC continues to pose significant operative challenges. Several patient-related risk factors have been described, yet the role of gender as a predictive factor remains debated. This study aimed to evaluate the association between gender and difficult LC in a Pakistani population.

Methods: A cross-sectional analytical study was conducted in the Department of General Surgery, Federal Government Polyclinic Hospital, Islamabad, over three months. A total of 190 patients undergoing elective LC were enrolled through consecutive sampling. Inclusion criteria were patients of either gender aged 18–90 years, while those with prior biliary drainage procedures, choledocholithiasis, or hepatobiliary

malignancies were excluded. Difficult LC was defined as dissection complicated by adhesions, inflammatory changes, or anatomical distortion. Demographic data, comorbidities, preoperative presentation, intraoperative findings, and postoperative outcomes were documented. Data were analyzed using SPSS version 26.0, with Chi-square test applied for categorical variables and $p<0.05$ taken as statistically significant.

Results: Out of 190 patients, 62 (32.6%) were males and 128 (67.4%) were females. Male patients were significantly older than females (46.2 ± 11.7 vs. 39.5 ± 12.2 years, p=0.000). Hospitalization for acute cholecystitis was more common among males (24.1%) compared to females (12.5%, p=0.041). Difficult LC occurred in 46.7% of males and 26.6% of females (p=0.005). Adhesions were also more frequent in males (27.4% vs. 14.8%, p=0.038). No significant gender differences were noted in conversion to open surgery (3.2% vs. 2.3%, p=0.722) or postoperative complications (9.6% vs. 6.2%, p=0.396).

Conclusion: Male gender is significantly associated with difficult LC, primarily due to higher rates of adhesions and inflammatory changes. While postoperative outcomes did not differ by gender, awareness of this association may enhance surgical preparedness and improve perioperative management strategies.

Keywords: Laparoscopic cholecystectomy; gender; adhesions; gallstones; difficult surgery

Introduction:

Asian countries are said to have an incidence of cholelithiasis of 4% while western countries have a higher incidence reaching 20%. Pakistan has a prevalence ranging from 10-20% showing that the burden of gallstones is high. [1] Women of whom who are aged between 30 to 50 years of age are commonly afflicted in Pakistan. [2]

Laparoscopic cholecystectomy is one of the most commonly performed procedures but it is not without its challenges. Difficult laparoscopic cholecystectomy has been recognised as an entity in the surgical community and its risk factors studied. [3] One study found difficult anatomy, inflammation and adhesions at the operative site and male gender was associated with a difficult cholecystectomy. [4]

Studies have shown that perception of pain varies between the genders and this may result in males prolonging healthcare seeking behavior- this leads to greater inflammation and adhesions formation in men at the time of laparoscopic cholecystectomy making surgery difficult. [5]

A study found that men had more difficult laparoscopic cholecystectomies (50.3% in men vs 29.4% in females) due to adhesions and anatomical alterations and difficulty and they also found that the time for laparoscopic cholecystectomy was significantly longer than for women. 6 Another study found that male gender did not influence difficulty however they also found that operative time was longer in the male (72.48±28.50) than in the female group (65.46±24.83, $p<0.001$) which can be assumed as a proxy for difficult laparoscopic cholecystectomy. 7

Several patient-related factors have been studied in this context, including age, obesity, previous abdominal surgery, comorbidities such as diabetes mellitus and hypertension, history of acute cholecystitis, gallbladder wall thickness, and various ultrasonographic findings. However, the influence of gender as a predictor for difficult LC remains an area of ongoing debate [8].

Some studies suggest that male patients are more likely to experience a difficult procedure, possibly due to delayed presentation, higher incidence of acute cholecystitis, or greater inflammatory response, while others report no significant difference between genders. Understanding the role of gender in predicting intra-operative difficulty is crucial, particularly in resource-limited settings, where accurate anticipation of surgical challenges can optimize operative preparedness and reduce complications [9,10].

In Pakistan, where gallstone disease is a common surgical problem and laparoscopic cholecystectomy is frequently performed, there is limited local evidence addressing the role of gender as a preoperative predictor of surgical difficulty. Establishing such an association could help guide surgeons in risk assessment, operative planning, and early referral to experienced teams when necessary.

Rationale of this research is that there is anecdotal evidence that male gender may be a risk factor for difficult laparoscopic cholecystectomy however there is conflicting data in the literature; this study aims to provide evidence on whether gender is a risk factor for difficult laparoscopic cholecystectomy especially in the local population.

Methodology:

The cross-sectional analytical study was conducted in the Department of General Surgery at Federal Government Polyclinic Hospital. The study was carried out over a duration of three months following approval of the synopsis. Following ethical approval from the Institutional Review Board, informed consent was obtained from all patients. A total of 190 patients undergoing laparoscopic cholecystectomy were enrolled. A non-probability consecutive sampling technique was employed to select the patients. Using the WHO calculator, with an incidence of difficult laparoscopic cholecystectomy of 50.3% in men and 29.4% in women, a 5% level of significance, and 80% power, a sample size of 190 patients was calculated. All patients of either sex aged between 18 and 90 years undergoing elective laparoscopic cholecystectomy were included. Patients were excluded if they refused to undergo the procedure, had previously undergone cholecystostomy tube placement or endoscopic stent placement for biliary drainage, had choledocholithiasis, or had a known diagnosis of hepatobiliary cancer.

Difficult laparoscopic cholecystectomy was defined as the presence of adhesions and inflammatory tissue distorting the normal anatomy, or abnormal anomalous anatomy that precluded the identification of normal structures with ease, thereby making dissection and removal of the gallbladder more challenging than routine.

The surgeries were performed according to standard protocols under supervision of consultant surgeon, it was noted that whether adhesions or anatomical distortion made the procedure difficult. Demographic variables such as age, gender, and body mass index (BMI) were documented for all patients. Co-morbid conditions, including hypertension, diabetes mellitus and hepatitis B or C positivity, were also recorded.

Data were analyzed using SPSS version 26.0. Qualitative variables such as gender, co-morbidities, pre-operative diagnosis, and histopathology were expressed as frequencies and percentages. Quantitative variables, including age and BMI, were described using means and standard deviations. The Chi-square test was applied to determine any statistically significant difference in the frequency of difficult laparoscopic cholecystectomy between genders, with a p-value of <0.05 considered significant. Further

stratification was performed for age, BMI, co-morbidities, pre-operative diagnoses, and histopathological findings, followed by post-stratification Chi-square testing, with statistical significance set at $p < 0.05$.

Results:

A total of 190 patients undergoing elective laparoscopic cholecystectomy were included in the study, of which 62 (32.6%) were males and 128 (67.4%) were females. The mean age of male patients was significantly higher than that of females (46.2 ± 11.7 years vs. 39.5 ± 12.2 years, $p = 0.000$). When stratified by age, patients older than 40 years were more frequently males (58.1%) compared to females (40.6%), and this difference was statistically significant ($p = 0.017$). The mean body mass index (BMI) was comparable between the two groups (25.1 ± 3.8 in males vs. 24.7 ± 3.6 in females, $p = 0.490$). Similarly, no significant difference was found in BMI categories, with 54.8% of males and 49.2% of females having BMI ≥25 kg/m² (Table 1).

With respect to pre-operative characteristics, hypertension was observed in 22.6% of males and 19.5% of females ($p = 0.625$), while diabetes mellitus was present in 14.5% of males and 12.5% of females ($p = 0.149$). The overall presence of any comorbidity was higher in males (33.8%) compared to females (22.6%), though this difference did not reach statistical significance ($p = 0.100$). Hospitalization due to acute cholecystitis, however, was significantly more common in males (24.1%) compared to females (12.5%, $p = 0.041$). A thickened gallbladder wall was noted in 41.9% of males and 28.9% of females, which showed a trend toward significance but did not meet the conventional threshold ($p = 0.074$) (Table 2).

Intra-operative findings demonstrated that difficult laparoscopic cholecystectomy occurred more frequently in males (46.7%) than in females (26.6%), and this association was statistically significant ($p = 0.005$). Adhesions were also more common in males (27.4%) compared to females (14.8%), with a significant difference noted ($p = 0.038$). No significant gender differences were observed in anatomical distortion (17.7% vs. 14.8%, $p = 0.607$), presence of anomalous vessels or ducts (4.8% vs. 3.9%, $p = 0.764$), or the need for conversion to open cholecystectomy (3.2% vs. 2.3%, $p = 0.722$) (Table 3).

Postoperative outcomes were generally favorable in both groups. Overall complications occurred in 9.6% of males and 6.2% of females, with no significant difference between them (p = 0.396). Wound infections were observed in 3.2% of males and 1.6% of females, while bile leak was recorded in 1.6% of both groups. Postoperative ileus was rare, occurring in 1.6% of males and 0.8% of females. None of these postoperative outcomes demonstrated a statistically significant association with gender (Table 4).

Table 1: Distribution of Baseline Demographics

Variable	**Males (n=62)**	**Females (n=128)**	**P-value**
Age of patient			
Mean ± SD	46.2 ± 11.7	39.5 ± 12.2	0.000*
> 40	36 (58.1%)	52 (40.6%)	0.017*
≤ 40	26 (41.9%)	76 (59.4%)	
Body Mass Index (BMI)			
Mean ± SD	25.1 ± 3.8	24.7 ± 3.6	0.490
≥ 25 kg/m²	34 (54.8%)	63 (49.2%)	0.467
< 25 kg/m²	28 (45.2%)	65 (50.8%)	

* Significant at 5% level of significance

Table 2: Distribution of Pre-Operative Characteristics

Characteristics	**Category**	**Males (n=62)**	**Females (n=128)**	**P-value**
Hypertension	Yes	14 (22.6%)	25 (19.5%)	0.625
	No	48 (77.4%)	103 (80.5%)	
Diabetes Mellitus	Yes	9 (14.5%)	16 (12.5%)	0.149
	No	53 (85.5%)	112 (87.5%)	
Any Comorbidity	Yes	21 (33.8%)	29 (22.6%)	0.100
	No	41 (66.2%)	99 (77.4%)	
Hospitalization for Acute Cholecystitis	Yes	15 (24.1%)	16 (12.5%)	0.041*
	No	47 (75.9%)	112 (87.5%)	
Thick Gallbladder Wall	Yes	26 (41.9%)	37 (28.9%)	0.074
	No	36 (58.1%)	91 (71.1%)	

* Significant at 5% level of significance

Table 3: Distribution of Intra-Operative Findings

Variable	Category	Males (n=62)	Females (n=128)	P-value
Difficult LC	Yes	29 (46.7%)	34 (26.6%)	0.005*
	No	33 (53.3%)	94 (73.4%)	
Adhesions	Yes	17 (27.4%)	19 (14.8%)	0.038*
	No	45 (72.6%)	109 (85.2%)	
Anatomical Distortion	Yes	11 (17.7%)	19 (14.8%)	0.607
	No	51 (82.3%)	109 (85.2%)	
Anomalous Vessel/Duct	Yes	3 (4.8%)	5 (3.9%)	0.764
	No	59 (95.2%)	123 (96.1%)	
Conversion to Open	Yes	2 (3.2%)	3 (2.3%)	0.722
	No	60 (96.8%)	125 (97.7%)	

* Significant at 5% level of significance

Table 4: Distribution of Postoperative Outcomes

Variable	Category	Males (n=62)	Females (n=128)	P-value
Any Complication	Yes	6 (9.6%)	8 (6.2%)	0.396
	No	56 (90.4%)	120 (93.8%)	
Wound Infection	Yes	2 (3.2%)	2 (1.6%)	0.561
	No	60 (96.8%)	126 (98.4%)	
Bile Leak	Yes	1 (1.6%)	2 (1.6%)	0.979
	No	61 (98.4%)	126 (98.4%)	
Postoperative Ileus	Yes	1 (1.6%)	1 (0.8%)	0.598
	No	61 (98.4%)	127 (99.2%)	

* Significant at 5% level of significance

Discussion:

The present study investigated the role of gender as a predictive pre-operative factor for difficult laparoscopic cholecystectomy (LC). The findings demonstrated that males experienced a significantly higher frequency of difficult LC compared to females (46.7% vs. 26.6%, p=0.005), with a greater prevalence of adhesions (27.4% vs. 14.8%, p=0.038). These results are in agreement with several international studies suggesting that male gender is associated with increased intraoperative difficulty due to delayed presentation, higher rates of acute cholecystitis, and greater inflammatory changes within the gallbladder.

Our study also found that hospitalization for acute cholecystitis was significantly more frequent among males (24.1%) than females (12.5%, p=0.041), which may explain the higher likelihood of adhesions and distorted anatomy at the time of surgery. Similar findings were reported by Gupta et al., who observed that delayed healthcare-seeking behavior in males often leads to recurrent or severe inflammation, thereby complicating dissection during LC (11). Furthermore, a study from India noted that the male population presented more frequently with acute cholecystitis, which contributed to operative difficulty and longer surgical times (12).

The role of gallbladder wall thickness as a predictor has also been debated. In our study, a thickened gallbladder wall was more prevalent in males, although it did not reach statistical significance. Previous work has consistently shown that increased wall thickness is associated with operative challenges, longer dissection time, and conversion to open procedures (13,14). The trend observed in our results highlights the importance of ultrasonographic parameters in pre-operative risk stratification.

Interestingly, while our study reported a significant difference in intraoperative difficulty, no significant difference was observed in postoperative complication rates between genders. These findings align with

those of Lim et al., who reported that although male patients had more technically demanding operations, complication rates and length of hospital stay remained similar across genders (15). This suggests that once the intraoperative challenges are managed successfully, postoperative recovery does not significantly differ. Contrary to our results, some studies argue that gender is not an independent predictor of LC difficulty. Ibrahim et al. concluded that factors such as BMI, previous abdominal surgery, and presence of acute cholecystitis were stronger determinants than gender alone (16). Similarly, a large-scale review from Europe emphasized that operative difficulty should be considered multifactorial, with male gender being contributory but not definitive (17). These discrepancies may arise from differences in study populations, sample sizes, and definitions of surgical difficulty.

Conversion to open cholecystectomy was not significantly different between genders in our cohort, which is in line with several reports indicating that improved surgical expertise and better instruments have reduced conversion rates in both sexes (18). Nevertheless, other studies continue to report higher conversion rates among males, particularly when combined with acute cholecystitis (19).

Overall, the evidence indicates that male gender is consistently associated with more difficult dissection and longer operative time, but its role as a standalone predictor remains contested. Our findings add to the regional literature by confirming this association in the Pakistani population. From a clinical perspective, awareness of male gender as a risk factor can assist in preoperative planning, allowing allocation of experienced surgeons and anticipation of prolonged procedures.

Future multicenter studies with larger samples are needed to clarify the independent role of gender while accounting for confounding variables such as comorbidities, prior hospitalizations, and ultrasonographic parameters. Moreover, predictive scoring systems that integrate gender with other clinical and imaging factors may provide more robust tools for preoperative assessment.

Conclusion:

This study demonstrates that male gender is significantly associated with difficult laparoscopic cholecystectomy, with higher rates of adhesions and intraoperative challenges compared to females. Although postoperative complications did not differ between genders, the findings suggest that male

patients, particularly those with a history of acute cholecystitis or thickened gallbladder wall, should be considered at higher risk for operative difficulty. Recognizing male gender as a predictive factor can help surgeons anticipate intraoperative challenges, allocate experienced surgical teams, and optimize perioperative planning. Future larger-scale studies are warranted to validate these results and to incorporate gender into comprehensive risk prediction models for laparoscopic cholecystectomy.

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