# **Original Research Article**

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# Is gender a determinant for the outcome of laparoscopic cholecystectomy?

Akshay Bahadur<sup>1\*</sup>, S. D. Bisht<sup>1</sup>, Yanshul Rathi<sup>1</sup>, Ashish Shukla<sup>1</sup>, Aman Aggarwal<sup>2</sup>

<sup>1</sup>Department of General Surgery, Dr. Hedgewar Arogya Sansthan, Delhi, India

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### \*Correspondence: Dr. Akshay Bahadur,

E-mail: drakshay@live.com

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#### **ABSTRACT**

**Background:** Currently, laparoscopic cholecystectomy is one of the most desirable procedures to treat symptomatic gallstone disease. Yet, various risk factors govern its conversion to open surgery. The impact of male sex as a risk factor for conversion has been a questionable issue. The study aimed to evaluate the role of male sex on outcomes of laparoscopic cholecystectomy.

**Methods:** As per inclusion and exclusion criteria, medical records of all the patients aged 18-70 years who underwent elective LC for a period of 14 months were accessed retrospectively. Data related to patients' demographic details, intra-operative and post-operative findings was recorded and subjected to analysis.

**Results:** Out of 232 selected cases, 17.67% were males and 82.32% were females. Mean age in both gender groups was similar (p=0.139). Body mass index was also found to be similar in both the groups (p=0.232). There was no significant difference (p=0.85) in the mean operative time between men (29.37 $\pm$ 9.29) and women (28.88 $\pm$ 15.66). Conversion to open surgery was seen only in female group (1.57%) but it is not significantly from the male group (p=0.42). No significant difference was observed in both groups regarding unwanted intra-operative events (p=0.231) and post-operative complications (p=0.70) and post- operative stay (p=0.50).

**Conclusions:** This study suggests that male gender may not be considered as an independent risk factor for outcome of laparoscopic cholecystectomy. However, extensive research in future may cast further light on this issue.

Keywords: Gall stone disease, Laparoscopic cholecystectomy, Male sex, Conversion

## INTRODUCTION

In the current era, laparoscopic cholecystectomy (LC) is undoubtedly the gold standard procedure of choice for the management of symptomatic gall stone disease (GSD).<sup>1-4</sup> Since its introduction in 1989, it is being widely used across the globe.<sup>5</sup> As compared to conventional open surgery, LC exhibits superiority in terms of minimal invasiveness, reduced postoperative pain, shorter duration of hospitalization, early recovery, improved cosmetic outcomes and cost-effectiveness.<sup>6</sup>

However, at times it becomes difficult for the surgeon to continue cholecystectomy laparoscopically and conversion into open surgery is unavoidable. Literature suggests that about 1.6%-20% of laparoscopic cholecystectomies get converted to open surgery during operative procedures.<sup>7</sup> In a large proportion of patients, several intraoperative complications influence the conversion of LC to open cholecystectomy (OC). These include uncontrolled bleeding, gall bladder perforation, bile leak, injury of bile duct and viscera, perihepatic collection and rare complications like dense adhesions at the calot's triangle, external biliary fistula, wound sepsis, hematoma, malignancies, etc.<sup>8,9</sup>

<sup>&</sup>lt;sup>2</sup>Dr. B L Kapur Hospital, Delhi, India

Over the past 2 decades, identifying the risk factors accounting for the perioperative complications of LS has been of major interest. Previous studies have reported a considerable association between predisposing risk factors such as age above 65 years, male sex, diabetes mellitus, history of upper abdominal surgery, acute cholecystitis, obesity, high BMI, etc. and outcome of LC including conversion to open. <sup>10,11</sup>

Of late, male sex as a factor for conversion of LC to open surgery has gained utmost recognition. A number of researchers have reported significant association between male sex and higher rates of conversion which may be attributed to increased severity of gall stone disease among them. 9,12-14 On the contrary, data from few studies failed to demonstrate male gender as a risk factor for conversion. 15,16

Although extensive studies exploring the role of gender as a risk factor in LC have already been undertaken in the past, the findings are conflicting. Keeping this in the background, the study aimed to investigate the impact of male gender as an independent risk factor on the outcomes of laparoscopic cholecystectomy.

#### **METHODS**

The medical records of 300 patients between the aged of 18-70 years, who underwent elective LC from September 2018 to November 2019 at a Secondary care District hospital were reviewed retrospectively. Cases operated by one experienced surgeon, who was having experience of more than 1000 LC were included and the surgeon was completely unaware about the plan of study at the time of surgery. All cases of emergency LC, acute cholecystitis, previous upper abdominal surgeries, common bile duct dilatation, obstructive jaundice, empyema of gallbladder, gall bladder malignancy, acute pancreatitis, multiple comorbidities were excluded from the study. Other criteria for exclusion were occurrence of common bile duct stones or mass requiring endoscopic retrograde cholangiopancreatography and stone extraction. Patients that required intraoperative cholangiography/ bile duct exploration were also excluded. Out of 300 cases, 232 cases that satisfied the inclusion and exclusion checklist were included in the study. The study was planned on the basis of null hypothesis that male sex as an isolated risk factor does not impact outcomes of LC. Data gathered from the case notes included age, sex, body mass index (BMI), history of abdominal surgery, surgery time (right from the insertion of the telescopic port to the extraction of gall bladder), duration of post-operative hospitalization, conversion of LC to OC, reason for conversion, bleeding episode, peri-operative and post-operative complications.

Data was expressed as mean±SD and cross tabulated for intergroup comparison. Statistical analysis was performed using SPSS software version 21.0. Student's t test was employed to analyse parametric variables whereas chi square test was applied for non-parametric variables. P value<0.05 was considered significant.

#### RESULTS

Out of 232 cases of elective LC included in the study, 41 (17.67%) were males (group I) and 191 (82.32%) were females (group II). Female:male ratio was found to be 4.65:1. (Table 1) describes the demographic details of both the groups. A similar mean age of male and female patients was observed i.e. 39.59±9.01 and 36.81±11.24 respectively (p=0.139). Both the groups had similar BMI with 23.96±3.65 in men and 24.59±2.92 in women and there was no statistically significant difference (p=0.232). Patients with upper abdominal surgeries were already excluded, and only cases of lower abdominal surgeries were considered. A considerably higher proportion of females (27.22%) were reported with a history of prior abdominal surgery which were either caesarean sections or other gynecological surgeries.

Associated comorbidities were higher in men (26.82%) than women (13.8%). In men and women groups, hypertension was the most commonly encountered comorbidity. When the various demographic characteristics were compared between male and female patients, a significant difference was observed in two variables i.e. history of previous abdominal surgery (p=0.006) and associated co-morbid conditions (p=0.027).

Characteristics	Males (n=41)	Females (n=191)	P value
	N (%)	N (%)	1 value
Age (in years) (Mean±SD)	39.59±9.01	36.81±11.24	0.139
BMI (in kg/m²) (Mean±SD)	23.96±3.65	24.59±2.92	0.232
History of prior abdominal surgery	3 (7.31)	52 (27.22)	0.006*
Associated co-morbidities	11 (26.82)	25 (13.08)	0.027*
Diabetes mellitus	1 (2.43)	5 (2.62)	
Hypertension	6 (14.63)	17 (8.9)	
Diabetes mellitus+hypertension	0	3 (1.57)	
HCV reactive	3 (7.31)	0	
HIV reactive	1 (2.43)	0	

Table 1: Demographic details of patients.

(SD- Standard Deviation, HCV- Hepatitis C Virus, HIV- Human Immunodeficiency Virus; Figures in parenthesis indicate percentage; \* Statistically significant P<0.05)

**Table 2: Surgery outcome summary.** 

Characteristics		Males (n=41) N (%)	Females (n=191) N (%)	P value
Duration of surgery (in minutes)	(Mean±SD)	29.37±9.29	28.88±15.66	0.85
Blood loss (in ml)	(Mean±SD)	22.32±28.31	26.85±46.16	0.545
Condition of gallbladder	Distended	31 (75.6)	166 (87.36)	0.311
	Mucocele	5 (12.19)	16 (8.37)	
	Contracted	2 (4.87)	3 (1.57)	
	Oedematous	1 (2.43)	1 (0.52)	
	Pyocele	2 (4.87)	5 (2.61)	
Gallbladder wall	Thin	17 (41.46)	121 (63.35)	0.033*
	Thick	18 (43.9)	54 (28.27)	
	Inflamed	6 (14.6)	16 (8.37)	
Adhesions noted to adjacent st	ructures	31 (75.6)	117 (61.25)	0.082
Omentum		18 (43.9)	76 (39.8)	
Stomach		5 (12.19)	9 (4.71)	
Omentum and stomach		6 (14.63)	24 (12.56)	
Other organs		2 (4.87)	6 (3.14)	
Conversion to open cholecystectomy		0	3 (1.57)	0.42
Post-operative stay (in days) (M	Mean±SD)	2.54±1.29	2.71±1.53	0.5

(SD- Standard Deviation; Figures in parenthesis indicate percentage; \* Statistically significant P<0.05)

Table 3: Summary of perioperative findings and complications.

Characteristics	Males (n=41)	Females (n=191)	P value	
Characteristics	N (%)	N (%)	r value	
Unwanted intraoperative events	10 (24.39)	65 (34.03)	0.231	
Dense adhesions	5 (12.19)	9 (4.71)		
Bile spillage	2 (4.87)	17 (8.9)		
Bleeding (required some measure to stop it)	3 (7.31)	33 (17.27)		
Stone spillage	0	6 (3.14)		
Postoperative complications	1 (2.43)	3 (1.57)	0.7	
Wound infection	0	2 (1.05)		
Bilious discharge up to 14 days	0	1 (0.52)		
Abdominal distension	1(2.43)	0		

SD- Standard Deviation; Figures in parenthesis indicate percentage; \* Statistically significant P<0.05)

Here, (Table 2) summarizes outcome of surgery. There was no significant difference (p=0.85) in the duration of surgery between the male (29.37±9.29) and the female group (28.88±15.66). Intraoperative data revealed various gall bladder conditions such as distended, mucocele, contracted, oedematous or pyocele. Majority of the male and the female patients had distended gallbladder. No significant difference was observed between the two groups regarding gallbladder condition. In most of the male patients (43.9%), gallbladder wall was thick. On the other hand, a thin-walled gallbladder was observed in a large proportion of women (63.35%).

A significant difference (p=0.033) was seen in between the two groups regarding condition of gall bladder wall. Among the male as well as the female patients, adhesions between the gall bladder and the omentum predominated. However, the two groups did not differ statistically in terms of frequency of gall bladder adhesions with other structures (p=0.082). Conversion of laparoscopic cholecystectomy to open was observed only in three women (1.57%). None of the male patient reported such conversion and the difference between the two groups was also statistically insignificant (p=0.42).

In all the cases of conversion, intense inseparable adherence of gall bladder to other structures like omentum, stomach, large bowel, liver, etc. marked inability to proceed further with laparoscopic procedure. Blood loss during surgery was found slightly higher in female group (22.32±28.31 in males vs 26.85±46.16 in females), but the difference was not significant statistically (p=0.545). The mean post-operative hospital stay in men and women groups was 2.54±1.29 and 2.71±1.53 days respectively and the difference was not statistically significant (p=0.50).

Some unwanted intra-operative events were observed in both the groups such as dense adhesions between gall bladder and adjacent structures, bile spillage, stone spillage and intra-operative bleeding that was controlled either by compression or ligasure vessel sealing. There was no significant difference in the occurrence of these unwanted intra-operative events between the two groups (p=0.231). In male group, occurrence of dense adhesions predominated (12.19%) where as in female group, majority of the patients (17.27%) reported bleeding during surgery (Table 3).

As shown in Table 3, no significant difference was observed regarding post-operative complications in men and women group (p=0.70). Wound infection (1.05%) and bilious discharge up to 14 days (0.52%) was observed in women group whereas a case of abdominal distension (2.43%) was seen in men group. There was no mortality in this study.

#### **DISCUSSION**

LC is a preferred treatment for gall stone disease and has proven to be quite advantageous over open surgery. 17,23 However, some factors like patients advancing age, severe inflammation, history of previous abdominal surgery, obesity, male gender, severe cardiovascular complications during surgery, etc often disease, necessitate conversion of LC to OC. 10,11,18 Several research studies have evidenced that higher surgical difficulties experience in men during LC and increased conversion rates as compared to women. 15-19 Despite the availability of enough evidence, a lot of controversy still governs the role of male gender as an independent risk factor for conversion of LC to open surgery.<sup>20</sup> On these grounds, this single institution study was done to analyse the impact of male sex on outcome of LC to prove whether it is an independent risk factor for conversion or not.

Numerous epidemiological studies across the globe have reported increased incidence of GSD, in women, especially during the fertile years. This can be attributed to raise estrogen levels during pregnancy, use of oral contraception forms or estrogen replacement therapy which lead to hypercholesteremia. In our study, majority of the patients were females (82.32%). Similarly, higher proportion of women patients were observed in studies by Bazoua et al. (72.6%), Al-Mulhim et al. (85.1%), Alqahtani et al (79.8%), Kumar et al. (89.10%), and Zisman et al. (81.15%). 22,23,15-17

In the current study, mean age reported in both male and female groups was below 30 years. Our findings are consistent with a study by Al-Mulhim et al that observed patients with mean age of 32.9 years. Comparatively, in other studies mean age was found to be above 50 years for female patients and above 60 years for male patients.<sup>24-26</sup>

Several studies have identified obesity and BMI>30 kg/m² as an important risk factor for conversion of LC to open. 11.27.28 In our study, the mean BMI in male group was 23.96±3.65 and none of the male patient underwent conversion. In female group, the mean BMI was 24.59±2.92 and all the three patients that underwent conversion had BMI<30 Kg/m². Hence, no association was observed between conversion of LC and obesity. Similarly, studies conducted by Tayeb et al and Manandhar et al did not identify obesity as an independent risk factor predicting conversion. 11,20

Patients of GSD may have many comorbid conditions which might influence surgical outcome of LC as well as increase the risk of its conversion into OC. <sup>22,26</sup> In our study, men had higher incidence of associated comorbidities as compared to women and the difference was also statistically significant (p=0.027). However, in a study by Kumar et al no significant difference was observed between the men and woman groups in terms of comorbid conditions. <sup>22</sup>

Previous upper abdominal surgeries are a risk factor for conversion of LC to open. <sup>14,15,22</sup> This study reported a significant difference between male and female groups in terms of prior abdominal surgeries (p=0.006) and a similar trend was observed in a study by Kumar et al. <sup>22</sup> In contrast, studies by and Genc et al and Coelho al. <sup>9,29</sup> did not show any significant difference in between male and female groups. Since, our research included cases with history of only lower abdominal surgeries; this could not negatively influence the outcome of surgery.

The results of our study revealed that no significant difference was there in duration of surgery between male and female groups (p=0.85). On the contrary, studies by Bazoua et al, Alqahtani et al, Akcakaya et al, Ambe et al, Kanakala et al, Coelho et al. 15,17,18,29 The average operative time was longer in males than females and difference was significant statistically. In this study, post-operative hospital stay was similar for both men and women groups and this finding can be correlated to studies by Bazoua et al, Kumar et al and Coelho et al. 15,22,29 In contrast, some studies reported a longer duration of post-operative stay in male patients. 16,25,26

Thick walled gallbladder has been identified as a risk factor in conversion of LC to open surgery in several studies.30 In this study, gall bladder wall was thickened in majority of the male patients whereas females had mostly thin walled gall bladder and difference was statistically significant (p=0.033). But this variable in men neither increased the overall duration of LC nor resulted in any conversion into open.

Women in this study encountered more unwanted intraoperative events as compared to men but the intergroup difference was statistically insignificant (p=0.231). Intra-operative blood loss was also similar in both the groups (p=0.545) which is in agreement with a

study by Bazoua et al.<sup>15</sup> The incidence of postoperative complications in both male and female groups was very less as compared to other studies.<sup>15,26</sup> Also, the intergroup difference was not significant statistically (p=0.70) which is in agreement to a study by Kumar et al.<sup>22</sup>

In present study, LC in none of the patient in male group was converted into open while, 1.57% of women faced conversion due to dense adhesions between gallbladder and adjacent structures. Nevertheless, the intergroup difference was found to be statistically insignificant (p=0.42). Our findings coincide with some studies that did not observe statistically significant difference between genders in terms of conversion. 15,16,20,22,29 However, many previous researchers have indicated that male gender adversely affects outcomes of LC and results in higher conversion rates in them. 9,14,17,18,23,26 A systematic literature review conducted by Hu et al.<sup>30</sup> also identified male sex as a significant factor for conversion in 17 out of 30 included studies. However, the authors found heterogeneity in the methodological quality of most of the studies. Only one study among them was reported to be of high quality and could be considered for clinical application.<sup>30</sup> The results of our study did not show statistically significant difference between the two sexes with respect to surgical outcome of LC.

#### Limitations

The present study has some limitations. Firstly, the retrospective study design is subjected to bias as the data was obtained from patient records. Secondly, it was a single center study with small sample size which restricts the generalization of our results to population. Despite these weaknesses, all the surgeries were performed by the same experienced surgeon. Thus, surgical outcomes were not compromised.

#### **CONCLUSION**

This study suggests that male gender may not be considered as an independent risk factor for outcome of Laparoscopic cholecystectomy. Apart from the thick-walled gallbladder and associated co-morbidities observed more profoundly in male patients, rest all other findings strongly support that cholecystectomies in men are not as difficult as predicted and perceived by surgeons. However, research with large sample size and at national level are required in future to gain better insights into this issue.

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Institutional Ethics Committee

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