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Comparison of outcome of male versus female laparoscopic cholecystectomy: BMI-adjusted prospective observational study

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Abstract. Background. Laparoscopic cholecystectomy has become the choice of treatment for symptomatic cholelithiasis and has replaced open cholecystectomy. Numerous studies and scoring system have been developed over the past 2–3 decades which predict the rate of conversion of laparoscopic to open cholecystectomy. Recently, few scoring systems have been developed which incorporates various intraoperative findings to predict this conversion. No studies are available in literature to assess gender-specific and body weight complications in laparoscopic cholecystectomy. The purpose of this study was to compare the outcome of laparoscopic cholecystectomy between male and female patients in terms of preoperative factors, intraoperative difficulties and rate of conversion to open cholecystectomy and common postoperative complications. **Materials and methods.** This non-randomized, prospective, observational study was conducted at a tertiary care hospital in Northern India from June 2019 to May 2021. Various preoperative data was collected from the patients like age, the American Society of Anesthesiologists (ASA) class, comorbidity, indication for surgery, preoperative ultrasonography findings and any previous surgery. Surgeries in all patients were started with laparoscopic cholecystectomy under general anaesthesia. The outcomes were measured in terms of time taken to complete surgery, whether laparoscopic cholecystectomy was converted to open cholecystectomy, common bile duct/cystic duct injury during surgery, common postoperative complications and average length of hospital stay in days. **Results.** A total of 300 patients were included in the study: 222 females and 78 males. Mean age of presentation in women was (46.45 ± 11.55) years ranging from 21 to 71 years and in men (51.78 ± 11.49) years ranging from 36 years to 76 years. This difference was statistically significant ($p = 0.001$). The other significant preoperative differences between males and females were comorbidity ($p = 0.001$) and previous surgeries ($p = 0.001$). However, the ASA class under which the patients were operated was not significant ($p = 0.998$). The various indications for surgery to include chronic cholecystitis, resolved acute cholecystitis, gallstone-induced pancreatitis and common bile duct stone had no statistical difference between men and women ($p = 0.072$). **Conclusions.** This study concludes that intraoperative difficulties were more often in male patients as compared to females. The average operating time, conversion of laparoscopic to open cholecystectomy and postoperative hospital stay were significantly higher in men than in women.

Keywords: laparoscopic cholecystectomy; cholecystitis; minimally invasive surgery

Introduction

Laparoscopic cholecystectomy (LC) has become the choice of treatment for symptomatic cholelithiasis and has replaced open cholecystectomy (OC) [1, 2]. The advantages of laparoscopic cholecystectomy like minimal invasiveness, less pain, lesser hospital stay, faster recovery has undoubtedly enabled the laparoscopic procedure to emerge as superior technique over the conventional open cholecystectomy [3–9].

Numerous studies and scoring system have been developed over the past 2–3 decades which predicts the rate of conversion of laparoscopic to open cholecystectomy [10–17]. Recently, few scoring systems have been developed which incorporates various intraoperative findings to predict conversion of LC to OC [18]. Of all the factors, male gender has been considered the one in which conversion to open cholecystectomy has been found more. Repeated episodes

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Table 1 — Patient characteristics

Data	Males	Females	P
Age (mean ± SD), years	51.78 ± 11.49	46.45 ± 11.55	0.001
ASA			
Class I	25	79	0.998
Class II	42	119	
Class III	11	24	
Comorbidity			
Diabetes mellitus	8	28	0.001
Hypertension	31	51	
Coronary artery disease	9	19	
Indications for LC			
Chronic cholecystitis	52	174	0.072
Resolved acute cholecystitis	22	31	
Gallstone pancreatitis	3	12	
CBD stones — post-ERCP stone clearance	1	6	
Previous open surgery			
Appendectomy	3	8	0.001
LSCS	0	48	
Others	11	19	

Notes: SD — standard deviation; CBD — common bile duct; ERCP — endoscopic retrograde cholangiopancreatography; LSCS — lower segment caesarean section.

of inflammation, fibrosis and extensive adhesions at Calot's triangle has been postulated as causative factors for this [19]. On the contrary, many studies have failed to support or propose male gender as a risk factor for conversion to OC [11, 14, 20–22].

The purpose of this study was to compare the outcome of laparoscopic cholecystectomy between male and female patients in terms of preoperative factors, intraoperative difficulties and rate of conversion to open cholecystectomy and common postoperative complications.

Materials and methods

This non-randomized, prospective, observational study was conducted at a tertiary care hospital in Northern India from June 2019 to May 2021 in 300 patients: 78 males and 222 females. All the surgeries were performed by two surgeons, with almost same working experience, hence there was not much variation in the expertise available. Various preoperative data was collected from the patients like age, the American Society of Anesthesiologists (ASA) classification, comorbidity, indication for surgery and any preoperative surgery (Table 1).

Table 2. BMI stratification of cases ($p = 0.289$)

BMI	Males	Females
18–20	6	13
20.1–22	13	27
22.1–24	12	37
24.1–26	23	47
26.1–28	19	58
28.1–30	5	40

Body mass index (BMI) was calculated for all patients and was stratified into various groups. Obesity is considered as a contraindication for laparoscopic cholecystectomy as per Cuschieri A. et al. [23] as it was associated with large number of complications. So, any patient with BMI more than 30 was excluded from the study. Hence, our study was BMI-adjusted (Table 2).

Preoperative ultrasonography was done in all cases, wall thickness (total wall thickness, symmetrical/focal wall thickening) and amount of pericholecystic fluid were evaluated. Patients with focal wall thickening were subjected to further investigation and, if diagnosed with gallbladder (GB) carcinoma, were excluded from the study. Those who had acute cholecystitis were initially managed conservatively and then subjected to surgery after 6–8 weeks depending on resolution of symptoms. Repeated ultrasonography was done before the surgery to check for resolution of acute cholecystitis. Various perioperative findings were noted and recorded (Table 3).

Surgery in all patients was started with laparoscopic cholecystectomy under general anaesthesia. The outcomes were measured in terms of time taken to complete surgery, whether laparoscopic cholecystectomy was converted to open cholecystectomy, CBD/cystic duct injury during surgery, common postoperative complications and average length of hospital stay in days (Table 4).

Exclusion criteria:

- gallbladder carcinoma detected during investigation;
- laparoscopic cholecystectomy combined with some other procedures;
- emergency laparoscopic cholecystectomy;
- other confounding factors like gallbladder empyema, gangrenous gallbladder, previous upper abdominal surgery, ASA class 4 or 5;
- BMI more than 30.

Results

The data was analyzed using IBM® SPSS® software version 23.0. All qualitative data was described as frequency and quantitative data as mean and standard deviation. Various parameters were analyzed in males and females for any significant differences using chi-square test. Student's t-test was used to analyze significant differences in the operative time for two genders. P value less than 0.05 was taken as significant.

A total of 300 patients were included in the study, 222 females and 78 males. Mean age of presentation in female patients was (46.45 ± 11.55) years ranging from 21 years to 71 years and in males, (51.78 ± 11.49) years ranging from 36 years to 76 years. This difference was statistically significant ($p = 0.001$). The other significant preoperative differences between men and women were comorbidity ($p = 0.001$) and previous surgeries ($p = 0.001$). However, the ASA class under which the patients were operated was not significant ($p = 0.998$). Various indications for surgery to include chronic cholecystitis, resolved acute cholecystitis, gallstone-induced pancreatitis and CBD stone had no statistical difference between males and females ($p = 0.072$).

Body mass index of all patients was calculated and was divided in various groups. All individuals whose BMI was above 30 were excluded from the study. There was no statistical difference between male and female patients ($p = 0.289$)

Various intraoperative findings were studied and compared between males and females in our study. Gallbladder was contracted in 26 male patients and 49 females. In the rest of patients, it was distended. This finding was statistically insignificant ($p = 0.103$). Ability to hold GB with forceps was difficult in 23 men and 32 women which was statistically significant ($p = 0.003$). Adhesions around gallbladder were vascular in 13 male and 18 female patients, fibrotic — in 18 and 28, respectively, and flimsy in the rest of patients. The difference between men and women was significant ($p = 0.007$). Dissection of Calot's triangle was difficult in 28 male and 38 female patients; in the rest of patients, it was easy which was statistically significant ($p = 0.001$). Intraoperative blood loss was severe in 10 men and 13 women, moderate in 18 and 25, respectively; in others it was minimal. There was significant difference ($p = 0.003$) between male and female patients.

The outcome of laparoscopic cholecystectomy was compared between males and females as per various parameters as shown in Table 4. Average operative time was (78.65 ± 43.60) min in men and (52.93 ± 26.73) min in women; this was statistically significant ($p = 0.001$). There was significant difference ($p = 0.013$) for conversion of LC to open cholecystectomy. Total of 8 men and 7 women were converted from LC to open cholecystectomy. CBD/cystic

Table 3 — Intraoperative findings and operative difficulties

Findings	Males	Females	P
Anatomy of GB			
Distended	52	173	0.103
Contracted	26	49	
Ability to hold GB with forceps			
Easy	55	190	0.003
Difficult	23	32	
Adhesions around GB			
Flimsy	47	176	0.007
Fibrotic	18	28	
Vascular	13	18	
Dissection of Calot's triangle			
Easy	50	184	0.001
Difficult	28	38	
Intraoperative blood loss			
Minimal	50	184	0.003
Moderate	18	25	
Severe	10	13	

Table 4 — Outcomes of LC

Parameters	Males	Females	P
Average operative time (mean \pm SD), min	78.65 \pm 43.60	52.93 \pm 26.73	0.001
Conversion of LC to OC	8	7	0.013
CBD/cystic duct injury	3	3	0.176
Postoperative complications (30 days):	13	24	0.256
— wound infections;	10	12	0.207
— chest infections;	2	6	0.984
— urinary tract infections	1	6	0.765
Average length of hospital stay (mean \pm SD), days	4.833 \pm 4.677	2.784 \pm 2.658	0.001

duct injury or leak was found equally in 3 male and female patients which was statistically insignificant ($p = 0.176$). Postoperative complications were followed for 30 days. The most common complications were wound infections in the form of surgical site, lung and urinary tract infections. There was no statistical difference ($p = 0.176$) between male and female patients. There was significant difference ($p = 0.001$) for average length of hospital stay. An average hospital stay was (4.833 ± 4.677) days for men and (2.784 ± 2.658) days for women.

Discussion

Laparoscopic cholecystectomy is one of the most common laparoscopic procedures and is the treatment of choice for cholelithiasis. Its advantages are less invasiveness, less pain, early ambulation and early return to work. Factors affecting the outcome in terms of conversion to open cholecystectomy has been heavily investigated. Many studies have shown age (> 65 years) as an independent factor for higher complications and higher morbidity [23–28].

Male gender has also been advocated as independent risk factor for higher morbidity in many studies. Various contributing factors like advanced GB diseases, gangrenous cholecystitis and necrotizing cholecystitis were significantly higher in males [27]. Rosen et al. [29] found in their study that male gender was not an independent risk factor for higher morbidity or conversion to open cholecystectomy. However, Kanaan et al. [16] and Simopolous et al. [30] reported that men have increased level of difficulty in dissection and increased rate of conversion to open cholecystectomy. This study compares intraoperative characteristics and difficulties faced and outcome of surgery in terms of various complications, CBD injury/cystic duct leak, length of hospital stay between male and female patients. Various known confounding factors like gangrenous cholecystitis, necrotizing cholecystitis, suspected GB carcinoma were excluded from the study. In this study, we found that men were of significantly higher age compared to women. Most of the patients had ASA class I and II in both comparative groups. An indication for previous surgery was chronic cholecystitis in most patients, and there was no significant difference between male and female group.

In many studies [31, 32], obesity and BMI > 30 has been associated with increased difficulty during surgery and increased postoperative complications. Hence, patients with BMI > 30 were excluded from this study. BMI of all patients were calculated and stratified in 6 groups. There was no statistical difference ($p = 0.289$) between female and male patients.

The outcome of this study was evaluated in terms of average operating time, percentage of patients in which laparoscopic cholecystectomy was converted to open cholecystectomy, CBD and cystic duct injury, postoperative complications and average hospital stay.

The mean operating time was 61 mins that is almost the same compared to other studies [23, 25]. However, average operating time for men was (78.65 ± 43.60) min which was significantly higher ($p = 0.001$) than for women — (52.93 ± 26.73) min. Various intraoperative factors like more difficult dissection around Calot's triangle, more vas-

cular adhesions and more blood loss are important factors responsible for this.

In our center, LC has been offered to all patients requiring cholecystectomy. We believe that conversion to open cholecystectomy is a safe strategy rather than a complication [20, 30]. In our study, the overall rate of conversion to open cholecystectomy is 0.6 % which is less compared to many series [11, 14, 25]. As all the patients in our study had BMI less than 30, completing LC is technically easier compared to the obese individuals [31, 32]. Secondly, all the surgeries were done by two surgeons with almost similar experience and using a standard approach. Conversion of LC to OC was done in 8 male and 7 female patients which was significant ($p = 0.013$). This is similar to other study [27].

Despite intraoperative cholangiogram not being done, the overall rate of CBD injury/cystic duct leak was 2.0 % that is almost similar to other studies which range between 0.7–2.1 % [23, 30, 32]. There was no significant difference between men and women ($p = 0.176$).

Overall, the complication rate in our study is 10.2 % which is higher than in other studies [23, 25, 32], most complications were managed conservatively. In our study, though complications were common in females compared to males, it was statistically insignificant ($p = 0.256$).

Average hospital stay was (4.833 ± 4.677) days for men and (2.784 ± 2.658) days for women. It was significantly higher in male patients ($p = 0.001$) that was probably due to the fact that men were comparatively older than women (0.001). Other factors which probably contributed to longer hospital stay are more frequent comorbid conditions (0.001) and upper abdominal surgeries compared to females (0.001).

Conclusions

This study concludes that intraoperative difficulties were more common in males as compared to females. The average operating time, conversion of laparoscopic to open cholecystectomy and postoperative hospital stay were significantly higher in men than in women. However, the incidence of CBD injury/cystic duct leak and postoperative complications was statistically the same for both genders. Further, it would require more studies to conclude whether male gender is an independent risk factor for difficult laparoscopic cholecystectomy.

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Порівняння результатів лапароскопічної холецистектомії в чоловіків і жінок: проспективне обсерваційне дослідження з поправкою на індекс маси тіла

Резюме. Актуальність. Лапароскопічна холецистектомія стала операцією вибору при лікуванні симптоматичного холелітазу та замінила відкриту холецистектомію. За останні 2–3 десятиліття проведено численні дослідження і впроваджено бальну систему, що дозволяє прогнозувати частоту конверсії лапароскопічної холецистектомії у відкриту. Нещодавно було розроблено кілька бальних систем, що включають оцінку різних інтраопераційних результатів, для прогнозування цієї конверсії. У літературі немає досліджень з оцінки ускладнень лапароскопічної холецистектомії залежно від статі й маси тіла. **Мета:** порівняти результати лапароскопічної холецистектомії в пацієнтів чоловічої та жіночої статі щодо передопераційних факторів, інтраопераційних труднощів, частоти конверсії у відкриту холецистектомію та поширених післяопераційних ускладнень. **Матеріали та методи.** Це нерандомізоване проспективне обсерваційне дослідження проводилося в лікарні третинної медичної допомоги в Північній Індії з червня 2019 року по травень 2021 року. Було зібрано різні передопераційні дані, такі як вік пацієнтів, клас за Американським товариством анестезіологів (ASA), супутні захворювання, показання до хірургічного втручання, результати передопераційної ультрасонографії, будь-яка попередня операція. Втручання в усіх хворих розпочато з лапароскопічної холецистектомії під загальною анестезією. Результати оцінювали з урахуванням часу, необхідного для

завершення операції, конверсії лапароскопічної холецистектомії у відкриту, пошкодження загальної жовчної/міхурової протоки під час втручання, поширених післяопераційних ускладнень і середньої тривалості перебування в лікарні в днях. **Результати.** Усього в дослідження було включено 300 пацієнтів: 222 жінки та 78 чоловіків. Середній вік жінок становив $(46,45 \pm 11,55)$ року, коливаючись у діапазоні від 21 до 71 року, а чоловіків — $(51,78 \pm 11,49)$ року (36–76 років). Ця різниця була статистично значущою ($p = 0,001$). Іншими значущими передопераційними відмінностями між чоловіками та жінками були супутня патологія ($p = 0,001$) та попередні операції ($p = 0,001$). Однак клас ASA, за яким пацієнти були прооперовані, не був значущим ($p = 0,998$). Різні показання до хірургічного втручання, включаючи хронічний холецистит, завершений гострий холецистит, панкреатит, викликаний жовчнокам'яною хворобою, і камінь загальної жовчної протоки, не мали статистичних відмінностей між чоловіками та жінками ($p = 0,072$). **Висновки.** Це дослідження дозволило зробити висновок, що інтраопераційні труднощі частіше спостерігалися в пацієнтів чоловічої статі, ніж у жінок. Середній час операції, частота конверсії лапароскопічної холецистектомії у відкриту та тривалість післяопераційного перебування в стаціонарі були значно вищими в чоловіків, ніж у жінок.

Ключові слова: лапароскопічна холецистектомія; холецистит; малоінвазивна хірургія