

ORIGINAL ARTICLE

The Impact of obesity in patients undergoing laparoscopic cholecystectomy.

Saad Yaqub¹, Tanvir Ahmad², Syeda Samina Ashfaq³, Muhammad Ans⁴

ABSTRACT... Objective: To evaluate the effect of obesity on operative duration and the rate of conversion to open surgery among patients undergoing laparoscopic cholecystectomy. **Study Design:** Analytical Cross-sectional study. **Setting:** Department of Surgery. **Period:** 25 November 2025 to 24 May 2026. **Methods:** Recruitment was concluded after the required sample size of 194 patients had been achieved. A total of 194 patients scheduled for laparoscopic cholecystectomy were included and categorized into two equal groups: obese (n=97) and non-obese (n=97). The sample size was determined using the WHO sample size calculator with a confidence level of 95% and study power of 90%. Patients aged between 18 and 60 years, of either gender, were selected through simple random sampling. Baseline demographic and clinical characteristics including age, sex, body mass index (BMI), ASA classification, associated comorbidities, and history of prior abdominal surgery were documented. All procedures were performed by consultant surgeons having a minimum of three years' post-fellowship experience. The primary outcomes assessed were operative time and frequency of conversion to open cholecystectomy. Statistical analysis was carried out using SPSS version 25. Independent sample t-test and Chi-square test were used for comparison, with $p \leq 0.05$ taken as statistically significant. **Results:** Obese patients demonstrated a longer mean operative time compared to non-obese patients (97.43 ± 35.04 minutes vs. 87.45 ± 35.75 minutes); however, this difference did not reach statistical significance ($p=0.051$). The rate of conversion to open cholecystectomy was significantly greater in the obese group than in the non-obese group (14.4% vs. 3.1%; $p=0.005$). Subgroup analysis further revealed increased conversion rates among obese individuals in several categories, particularly females, younger patients, those with higher ASA grades, and patients with diabetes mellitus or hypertension. **Conclusion:** Obesity appears to increase the likelihood of conversion from laparoscopic to open cholecystectomy and may also contribute to prolonged operative duration. Thorough preoperative evaluation, appropriate patient counseling, and experienced surgical management are important factors in achieving favorable outcomes in obese patients undergoing laparoscopic cholecystectomy.

Key words: Conversion to Open Surgery, Gallstone Disease, Laparoscopic Cholecystectomy, Obesity, Operative Duration.

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INTRODUCTION

Obesity has emerged as a major global health concern, reaching epidemic levels worldwide. Its prevalence is estimated to be approximately 34% in the United States and more than 20% across Europe, while rates exceeding 40% have been reported in certain Middle Eastern populations.^{1,2} In addition to adversely affecting functional capacity and overall quality of life, obesity represents a complex multifactorial condition influenced by interactions among physical activity, energy balance, genetic predisposition, biological mechanisms, environmental influences, and social determinants.^{3,4} A strong association exists between symptomatic gallstone disease and obesity. The development of cholesterol gallstones in obese individuals occurs through multiple mechanisms, mostly due

to metabolic disturbances that promote excessive hepatic cholesterol secretion.^{5,6} Increased cholesterol output from the liver has been linked to enhanced activity of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase, which becomes upregulated in states of hyperinsulinemia commonly associated with obesity.⁷ Consequently, obese patients are at greater risk of developing symptomatic gallstone disease that ultimately requires surgical intervention.⁸

Laparoscopic cholecystectomy (LC) is currently regarded as the standard surgical treatment for symptomatic gallstones because of its advantages, including shorter hospital stay, reduced postoperative pain, and faster recovery.⁹

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Despite the increasing prevalence of obesity, relatively limited literature has comprehensively evaluated the influence of obesity on laparoscopic surgical outcomes.¹⁰ Performing LC in obese patients may present many technical challenges, including difficulty in identifying Calot's triangle, increased intra-abdominal fat, thicker abdominal wall, and problems associated with establishing pneumoperitoneum. Trocar insertion may also become technically demanding due to the increased thickness of the abdominal wall and restricted operative field exposure.¹¹

Enami et al. conducted a study to evaluate outcomes of LC among obese patients and observed significant differences in operative duration between obese and non-obese groups¹². Similarly, another study demonstrated that obese patients had a greater frequency of conversion from laparoscopic to open cholecystectomy compared with non-obese patients (19.2% vs. 4.4%; $p=0.008$).¹³

Although LC remains the preferred treatment modality for symptomatic gallstone disease, obesity continues to be considered an important factor contributing to increased operative complexity, prolonged operative time, and higher conversion rates to open surgery. In Pakistan, obesity is becoming increasingly prevalent; however, locally generated data comparing LC outcomes between obese and non-obese patients remain scarce. Determining the extent to which obesity affects operative duration and conversion rates may help provide evidence relevant to local surgical practice, improve perioperative planning, facilitate informed patient counseling, and support better healthcare resource allocation. Therefore, this study was designed to evaluate the impact of obesity on outcomes of laparoscopic cholecystectomy and to generate context-specific evidence aimed at improving patient safety and surgical outcomes.

METHODS

This analytical cross-sectional study was carried out in the Department of Surgery over a six-month period after obtaining approval from the Institutional Ethical Review Committee and the College of Physicians and Surgeons Pakistan (CPSP), vide Letter No. TUF/IRB/315/24, dated 5th June 2024,

this analytical cross-sectional study was conducted in the Department of Surgery from 25 November 2025 to 24 May 2026. The required sample size was calculated using the WHO sample size calculator for comparison of two means, with a confidence level of 95% and study power of 90%. Based on previously published operative times of 84.3 ± 35.67 minutes in non-obese patients and 99.4 ± 39.17 minutes in obese patients, a total of 194 participants were enrolled, comprising 97 obese and 97 non-obese patients.

Patients between 18 and 60 years of age, of either gender, who were scheduled for laparoscopic cholecystectomy were recruited through simple random sampling. Patients treated conservatively, those undergoing interval cholecystectomy after delayed presentation, and patients requiring cholecystectomy for indications other than acute cholecystitis were excluded from the study. Written informed consent was obtained from all participants prior to inclusion.

Relevant demographic and clinical information including age, sex, height, weight, body mass index (BMI), ASA physical status classification, and prior history of abdominal surgery were documented. Participants were subsequently divided into two groups: Group A (non-obese) and Group B (obese). All laparoscopic cholecystectomies were performed by consultant surgeons possessing at least three years of post-fellowship surgical experience. The primary outcome measures included operative duration and frequency of conversion to open cholecystectomy.

All collected data were entered into a predesigned proforma and analyzed using SPSS version 25. Quantitative variables were presented as mean $\pm$ standard deviation, whereas qualitative variables were expressed as frequencies and percentages. Comparison of continuous variables between groups was performed using the independent samples t-test, while categorical variables were analyzed using the Chi-square test. Potential effect modifiers, including age, gender, ASA status, and associated comorbidities, were addressed through stratification followed by post-stratification analysis. A p-value of ≤ 0.05 was considered statistically

significant.

RESULTS

194 patients undergoing laparoscopic cholecystectomy were included in the study, with 97 patients each in the obese and non-obese groups. The mean age of the study population was comparable between the two groups, and females constituted the majority of patients. Baseline demographic and clinical characteristics, including age, gender distribution, comorbidities, and history of previous abdominal surgery, were largely similar between the groups; however, significant differences were observed in BMI and ASA physical status, with obese patients more frequently classified as ASA III. Obese patients showed a significantly higher rate of conversion to open cholecystectomy compared to non-obese patients, while operative time was longer

in the obese group but did not reach statistical significance.

TABLE-I presents the baseline demographic and clinical characteristics of patients stratified by obesity status. There was no statistically significant difference between obese and non-obese patients regarding gender distribution ($p=0.664$), mean age ($p=0.513$), age groups ($p=0.202$), diabetes mellitus ($p=0.061$), hypertension ($p=0.667$), or previous abdominal surgery ($p=0.313$). As expected, BMI was significantly higher in the obese group ($p<0.001$). ASA physical status differed significantly between the groups, with all non-obese patients classified as ASA I or II, while a substantial proportion of obese patients were categorized as ASA III ($p<0.001$).

TABLE-I

Baseline characteristics of the Patients

Variable		Non-obese	Obese	Total	P-Value
Gender					
Male		44 (45.4%)	41 (42.3%)	85 (43.8%)	0.664
Female		53 (54.6%)	56 (57.7%)	109 (56.2%)	
Age (Years), mean ± SD		38.26±11.70	39.43±13.23	-	0.513
Age Groups, n (%)	18-30 Years	27 (27.8%)	28(28.9%)	55(28.4%)	0.202
	31-45 Years	40 (41.2%)	29(29.9%)	69(35.6%)	
	46-60 Years	30 (30.9%)	40(41.2%)	70(36.1%)	
Height (m), mean ± SD		1.657±0.06	1.65±0.057	-	0.358
Weight (kg), mean ± SD		64.90±6.28	84.35±8.29	-	0.000
BMI		23.640±1.84	30.99±2.27	-	0.000
ASA status					
ASA-I		43 (44.3%)	0 (0.0%)	43 (22.2%)	<0.001
ASA-II		54 (55.7%)	42 (43.3%)	96 (49.5%)	
ASA-III		0 (0.0%)	55 (56.7%)	55 (28.4%)	
Diabetes mellitus					
No		52 (53.6%)	39 (40.2%)	91 (46.9%)	0.061
Yes		45 (46.4%)	58 (59.8%)	103 (53.1%)	
Hypertension					
No		48 (49.5%)	51 (52.6%)	99(51.0%)	0.667
Yes		49 (50.5%)	46 (47.4%)	95 49.0%)	
Previous abdominal surgery					
No		56 (57.7%)	49 (50.5%)	105 (54.1%)	0.313
Yes		41 (42.3%)	48 (49.5%)	89 (45.9%)	

Table-II compares operative outcomes between obese and non-obese patients. The rate of conversion from laparoscopic to open cholecystectomy was significantly higher in obese patients compared to non-obese patients (14.4% vs. 3.1%, $p=0.005$). The mean operative time was longer in the obese group (97.43 ± 35.04 minutes) compared to the non-obese group (87.45 ± 35.75 minutes); however, this difference did not reach statistical significance ($p=0.051$).

Table-III shows stratification analysis of conversion to open cholecystectomy according to obesity status and potential effect modifiers. A significantly higher conversion rate among obese patients was observed in females ($p=0.034$), patients aged 18–30 years ($p=0.021$), ASA II patients ($p=0.004$), diabetic patients ($p=0.024$), hypertensive patients ($p=0.035$), and those without previous abdominal surgery ($p=0.026$). Although higher conversion rates were consistently observed in obese patients across most strata, some associations did not achieve statistical significance, indicating the influence of multiple interacting clinical factors.

DISCUSSION

The present study assessed the influence of obesity on operative outcomes among patients undergoing laparoscopic cholecystectomy, focusing primarily on operative duration and conversion to open surgery. Our results showed that obese patients had a significantly greater rate of conversion to open cholecystectomy compared with non-obese patients. Although the mean operative time was also longer in obese patients, this difference did not achieve statistical significance. Overall, these findings are broadly in line with previously published literature, although some differences exist,

possibly due to variation in patient characteristics, surgeon experience, disease severity, and study methodology.

In our study, the conversion rate was significantly higher in obese patients than in non-obese patients (14.4% vs. 3.1%, $p=0.005$). This finding is consistent with several studies that have recognized obesity as an important factor associated with conversion during laparoscopic cholecystectomy. Ibrahim et al. reported that obese patients were more likely to require conversion because of poor visualization and increased technical difficulty during dissection of Calot's triangle.¹⁴ Similarly, Kama et al. identified obesity as an independent predictor of conversion and attributed this association to excessive intra-abdominal fat, difficult exposure, and impaired recognition of anatomical landmarks.¹⁵ These observations support our findings and further emphasize that obesity may increase the technical complexity of laparoscopic cholecystectomy.

However, not all studies have reported a similar relationship between obesity and conversion. Enami et al. observed comparable conversion rates between obese and non-obese patients and concluded that obesity alone should not be regarded as a contraindication to laparoscopic cholecystectomy.¹⁶ The difference between their findings and those of the present study may be related to differences in patient selection, severity of gallbladder inflammation, comorbid status, and perioperative risk profile. In the present study, obese patients had a higher ASA status, which may have contributed to the increased conversion rate. Higher ASA grades have also been associated with greater operative difficulty in previous studies.¹⁷

TABLE-II

Comparison of conversion to open and mean operative time in both groups

		Group		Total	P-Value
		Non-obese	Obese		
Conversion Open	To No		94(96.9%)	83(85.6%)	0.005
	Yes		3(3.1%)	14(14.4%)	
Operative Time (Minutes)			87.45±35.75	97.43±35.04	0.051
Total			97(100.0%)	97(100.0%)	194(100.0%)

TABLE-III

Stratification Analysis of Conversion to Open Cholecystectomy According to Obesity Status (n = 194)

Variable	Conversion to Open	Non-obese	Obese	P-Value
Gender				
Male	No	42 (95.5)	34 (82.9)	0.061
	Yes	2 (4.5)	7 (17.1)	
Female	No	52 (98.1)	49 (87.5)	0.034
	Yes	1 (1.9)	7 (12.5)	
Age Groups (Years)				
18–30	No	27 (100.0)	23 (82.1)	0.021
	Yes	0 (0.0)	5 (17.9)	
31–45	No	37 (92.5)	23 (79.3)	0.108
	Yes	3 (7.5)	6 (20.7)	
46–60	No	30 (100.0)	37 (92.5)	0.125
	Yes	0 (0.0)	3 (7.5)	
ASA Status				
ASA-II	No	54 (100.0)	36 (85.7)	0.004
	Yes	0 (0.0)	6 (14.3)	
ASA-III	No	—	47 (85.5)	—
	Yes	—	8 (14.5)	
Diabetes mellitus				
No	No	50 (96.2)	34 (87.2)	0.112
	Yes	2 (3.8)	5 (12.8)	
Yes	No	44 (97.8)	49 (84.5)	0.024
	Yes	1 (2.2)	9 (15.5)	
Hypertension				
No	No	47 (97.9)	45 (88.2)	0.060
	Yes	1 (2.1)	6 (11.8)	
Yes	No	47 (95.9)	38 (82.6)	0.035
	Yes	2 (4.1)	8 (17.4)	
Previous abdominal surgery				
No	No	54 (96.4)	41 (83.7)	0.026
	Yes	2 (3.6)	8 (16.3)	
Yes	No	40 (97.6)	42 (87.5)	0.079
	Yes	1 (2.4)	6 (12.5)	

Operative duration was longer among obese patients in our cohort; however, the difference narrowly missed statistical significance. Several previous studies have demonstrated significantly prolonged operative time in obese patients undergoing laparoscopic cholecystectomy. Ammori et al. attributed this increase to technical challenges such as difficult trocar insertion, increased

abdominal wall thickness, limited exposure, and prolonged dissection time.¹⁸ In experienced hands, however, the effect of obesity on operative duration may be reduced, suggesting that surgical expertise plays a major role in overcoming obesity-related technical difficulties. The absence of a statistically significant difference in operative time in the present study may therefore be explained by the fact that

all procedures were performed by experienced consultant surgeons using a standardized operative approach.

Stratified analysis further supported the association between obesity and conversion to open surgery across several clinically relevant subgroups. Obese female patients showed a significantly higher conversion rate compared with non-obese females. Although male gender has traditionally been described as a risk factor for conversion¹⁵, obesity may modify or outweigh gender-related differences in certain populations, particularly where fat distribution, inflammatory severity, and metabolic risk factors vary. This highlights the importance of interpreting risk factors within the context of local patient demographics.

Younger obese patients, particularly those aged 18–30 years, also demonstrated a higher conversion rate compared with their non-obese counterparts. This contrasts with studies that have identified advanced age as a stronger predictor of conversion.¹⁶ One possible explanation is that younger obese patients may present with more severe inflammatory disease or delayed clinical presentation, thereby increasing operative difficulty. Goonawardena et al. similarly emphasized that disease severity may be a more important determinant of conversion than age alone.¹⁵

The observed association between obesity, diabetes mellitus, and increased conversion rates is also supported by existing evidence. Simopoulos et al. reported greater technical difficulty and higher conversion rates among diabetic obese patients, possibly due to chronic inflammation, fibrosis, and tissue friability.¹⁹ Diabetes has also been linked with increased gallbladder wall thickness and adhesions, both of which may complicate laparoscopic dissection.¹⁷ These findings suggest that obesity and metabolic comorbidities may have a cumulative adverse effect on operative difficulty.

An interesting finding in the present study was that obese patients without a history of previous abdominal surgery still had a significantly higher conversion rate. This differs from earlier reports in which previous abdominal surgery was considered a

major predictor of conversion due to adhesions.²⁰ A possible explanation is that obesity itself may create sufficient technical difficulty to require conversion, even in the absence of adhesions from prior surgery. This finding is consistent with systematic reviews and meta-analyses reporting increased technical difficulty and higher conversion rates in obese patients undergoing laparoscopic cholecystectomy, despite comparable overall morbidity and mortality.

The clinical implications of these findings are particularly relevant in resource-limited healthcare settings such as Pakistan. Recognizing obesity as a risk factor for conversion can help surgeons optimize preoperative planning, counsel patients more accurately, anticipate technical challenges, and ensure appropriate readiness for open conversion when required. This approach is consistent with previous recommendations supporting risk stratification to improve patient safety and surgical outcomes.²¹

This study has certain limitations. Its cross-sectional design limits the ability to establish causal relationships. Postoperative outcomes such as wound infection, postoperative pain, length of hospital stay, and overall morbidity were not assessed. In addition, BMI was used as the only measure of obesity, without evaluating visceral fat distribution, which may be more closely related to operative difficulty. Despite these limitations, the study provides useful local comparative data and adds to the existing evidence regarding the effect of obesity on laparoscopic cholecystectomy outcomes.

In comparison with the available literature, our findings suggest that obesity significantly increases the risk of conversion to open cholecystectomy and may also be associated with longer operative time. These results reinforce the need for careful preoperative assessment, detailed patient counseling, and experienced surgical management when performing laparoscopic cholecystectomy in obese patients.

CONCLUSION

Obesity was found to be significantly associated with an increased likelihood of conversion to open

cholecystectomy, with a non-significant tendency toward prolonged operative duration. These results suggest that laparoscopic cholecystectomy in obese patients may involve greater technical complexity, even under the care of experienced surgeons. Identifying obesity preoperatively is therefore important for realistic patient counseling, operative preparedness, and efficient use of surgical resources. Nevertheless, with appropriate patient selection, careful planning, and meticulous operative technique, laparoscopic cholecystectomy remains a safe and effective surgical option for obese patients with symptomatic gallstone disease.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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2	Tanvir Ahmad: Discussion writing.
3	Syeda Samina Ashfaq: Writing.
4	Muhammad Ans: Literature review, data entry.