

Risk Factors Associated with Conversion of Laparoscopic to Open Cholecystectomy

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Abstract: Background: Gallstones disease is one of the major problem of gastro intestinal tract and surgical removal is usually advised. Surgery is usually laparoscopic but if the dissection is tedious, laparoscopic procedure can be converted into open procedure.

Objective: This study aims to assess the reasons and risk factors for the conversion of laparoscopic cholecystectomy (LC) into open cholecystectomy (OC).

Materials and Methods: A prospective assessment of medical records of patients who underwent laparoscopic cholecystectomy at ward-2, Jinnah Postgraduate Medical Centre from January 2019 to December 2021 was undertaken to identify indications of all laparoscopic cholecystectomies converted to open cholecystectomy and assess operative time and length of hospital stay of these patients.

Results: A total of 984 elective cholecystectomies were performed in which 85.5% (n=841) were females and 14.5% (n=143) were males. Male to female ratio was 1:5.8 with conversion rate 0.40 % (n=04) and 4.36% (n=43) respectively. Laparoscopic cholecystectomy was done in 95.22% (n=937) cases while 4.78% (n=47) patients required conversion to open cholecystectomy with major pre-operative risk factors being acute cholecystitis (p<0.001), history of acute cholecystitis (p=0.012), history of acute pancreatitis (p=0.007), history of previous open surgery (p<0.001) and major per-operative risk factors being severe bleeding (p<0.001), dense adhesions (p=0.755), distorted anatomy (p<0.001), visceral damage (p<0.001) and biliary injury (p<0.001).

Conclusion: We have identified some important risk factors for the conversion of surgical approach for acute cholecystitis. However, the open approach should be done by experienced surgeons when necessary. The overall impact of the study is to identify the patients who are the risk of conversion into open preoperatively so that proper arrangement and counseling should be done.

Keywords: Cholelithiasis, Conversion, Laparoscopic cholecystectomy, Obesity, Surgery, Gallstones disease.

INTRODUCTION

Gallstone disease is one of the most prevalent and costly gastrointestinal tract disorders in the world with prevalence of 10–20% in adults in developed countries [1]. There is a marked geographic variation in gallstone prevalence. About 20 million people in the USA (15% of the population) have gallstones [2]. Prevalence of gall stone disease in Asian population is 3.1 to 6.1% data from Pakistan has found to be scarce, but previous study in southern Sindh area of Pakistan has reported a surgical incidence of 9.03% [3].

Laparoscopic cholecystectomy (LC) has become the gold standard for the surgical treatment of gallbladder disease but conversion to open cholecystectomy is still inevitable in certain cases [4, 5].

Knowledge of the rate and impact of the underlying reasons for conversion could help surgeons during preoperative assessment and improve the informed consent of patients. We decided to review the rate and causes of conversion from laparoscopic to open cholecystectomy. The currently avail-

able literature suggests a wide range of conversion to the open procedure ranges from 5% to 10% nationwide from laparoscopic cholecystectomy (LC) to open cholecystectomy (OC) despite the increase in laparoscopic surgical expertise [6].

Mainly the risk factors for conversion for laparoscopic into open procedures are difficult anatomy, unexpected bleeding, dense adhesions, history of acute cholecystitis or acute pancreatitis, suspicion of bile duct injury, preoperative intervention like ERCP, Comorbid conditions, learning curve.

The aim of our study is to find reasons/ risk factors of conversion for laparoscopic cholecystectomy (LC) into open cholecystectomy (OC). Multiple studies have been carried out on this topic internationally but not much data has been collected in Pakistan so there may be demographic differences. The sample size in previous studies was smaller than our sample size. Most of the studies conducted previously are retrospective studies. Through this research we will find the reasons for conversion of laparoscopic cholecystectomy into open surgery as identifying these patients at risk for conversion remains difficult. This study identifies risk factors that may predict conversion from a laparoscopic to an open procedure which will help in preoperative counseling and seniors' backup.

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MATERIALS & METHODS

A prospective cohort study was conducted at surgical ward 2, Jinnah Postgraduate Medical Center (JPMC), Karachi, Pakistan for a duration of 3 years from January 2019- December 2021. Patients In between age 18 till 80 either gender who visited Surgical ward at Jinnah Post Graduate Medical Centre were included in the Study. Patients included who had a diagnosis of symptomatic cholelithiasis as per operational definition. Patients were excluded who had Obstructive Jaundice (assessed on the basis of LFTs) or with acute gallstone pancreatitis (assessed on biochemistry or CT) or with obstructive jaundice or had radio graphically proven choledocholithiasis.

Patients with after approval from IRB (IRB no.49557) and informed consent from patients all patients fulfilling the inclusion and exclusion criteria within our study period were selected. Patient confidentiality was maintained by obtaining their consent and their names were not included during data entry instead numbers were allotted to them. Demographic profile was recorded including age, gender, and comorbid conditions. The operative time of the procedure and hospital stay was recorded. All the procedures were conducted by a single surgical unit.

The procedure performed was laparoscopic cholecystectomy in patients with symptomatic cholelithiasis and in a few patients it was converted into an open procedure due to pre-operative risk factors such as previous surgeries or intra operative anatomical difficulty or hemorrhage. All the patients received general anesthesia. Intraoperative ondansetron and dexa were given to avoid postoperative nausea and vomiting. Hasson's four-port technique used with umbilical and epigastric port of 10mm, and the rest with 5mm. An umbilical port placement done by open technique in all the cases with a 10mm 00 telescope. Tramadol analgesia was also given. On table, team discussion was also made earlier with the senior surgeon. Before the incision, local bupivacaine was given at the port site.

STATISTICAL ANALYSIS

For statistical analysis SPSS version 22 was used. All quantitative variables were analyzed which includes age, operative time, and hospital stay were presented as mean and standard deviation. All categorical variables like gender, comorbid conditions, and conversion to open cholecystectomy was calculated and presented as frequencies and percentages. P-value<0.05 was considered to be significant. Effect modifiers like age, gender, comorbid conditions, positive viral serology for HBV, HCV, and previous abdominal surgery were addressed through stratification, and post stratification. Chi-square test was applied for conversion, where as indepen-

dent T-test was applied for operative time and hospital stay. P value < 0.05 will be taken as significant. Additionally, body mass index (BMI) was calculated pertinent to WHO standard scale.

RESULTS

Between January 2019 and December 2021, 984 elective cholecystectomies were performed at surgical ward 2 Jinnah Post Graduate Medical Centre. 85.5% (n=841) were females and 14.5% (n=143) were males. Male to female ratio was 1:5.80 and the conversion rate was 8.3% (n=11) and 9.2% (n=71) in females and males respectively. The mean age at presentation was 42.25 years with a standard deviation of ± 12.94 (Table 1).

Body mass index (BMI) of more than 25 was seen in 20 % (n=200) cases. 7.4% (n=73) of cases had comorbid illnesses including Diabetes. 04% (n=39) of patients were positive for viral serology. 5.1% (n=50) of cases had prior abdominal surgeries. In 1.8% (n=18) of cases Ultrasound showed bladder wall thickness of more than 4mm and only 0.5 % (n=5) patients had undergone preoperative ERCP and 1.2% (n=12) % had a history of acute pancreatitis. A diagnosis of cholelithiasis was made in 86.2% (n=332) and acute cholecystitis in 5.1% (n=50) of cases.

Moreover, 0.4% (n=4) had raised total leucocyte count which was associated with cholecystitis (p<0.001). Laparoscopic cholecystectomy was done in 95.2% (n=937) cases while 4.7% (n=47) patients required conversion to open cholecystectomy due to Adhesions 14.9 % (n=07), Severe Bleeding 40.4% (n=19) Anatomic difficulty 25.5% (n=12), and suspected biliary injuries 19.1% (n=09) were the most common intraoperative findings leading to conversion.

The operative time was one hour or less in 81.6% (n=803) of surgeries. 91.5% (n=900) of patients were discharged within second postoperative day and 8.5% (n=83) patients had postoperative pain. The duration of surgeries also showed significant association with less hospital stay (p=0.057); However, no significance was noted between the duration of stay and surgical intent i.e. open or laparoscopic surgery. The results are illustrated in (Table 2).

DISCUSSION

Cholelithiasis and cholecystitis are the most common gall bladder pathologies leading to surgical intervention [7]. Laparoscopic cholecystectomy is now the recommended treatment option for gallstone diseases due to benefits such as shorter hospital stay, reduced morbidity, quick recovery and cost effective in comparison to open cholecystectomy [8, 9]. However, open cholecystectomy is still approached in complicated cases where laparoscopic approach may lead to complications, hence open cholecystectomy is a way to avoid unwanted

ed risks and harm to patients [10]. A total of 937 cases were selected in the study over a period of three years. In our study conversion rate was 2.9%. Our low rate of conversion is mostly attributed to directly supervised training in tertiary

care unit, secondly subtotal cholecystectomy where possible laparoscopically. Conversion rate was found variable in different studies illustrated in (Table 3).

Table 1. Patient Related Demographic Factors (n=984).

Demographic Factors	Groups	Total cases N (%)	Laparoscopic Cholecystectomy n (%)	Converted to Open cases n (%)	p-Value
Age (years)	<50	684(69.5%)	641(65.1%)	43(4.3)	0.94
	>50	300(30.4%)	296(30.08%)	4(0.4%)	
Gender	Male	143(14.5%)	132(13.4%)	11(1.1%)	0.41
	Female	841(85.4%)	770(78.2%)	71(7.1%)	
BMI(Kg/m ²)	18.5-24.9	516(52.4%)	475(48.2%)	41(4.1%)	0.012
	25-29.9	200(20.3%)	181(18.3%)	19(1.9%)	
	30 or above	268(27.2%)	246(25%)	22(2.2%)	

Table 2. Patient and Disease Modifying Risk Factors (n=984).

Risk factors	Groups	Total	No. of cases Laparoscopic n (%)	Open n (%)	p-Value
Diabetes Mellitus	Present	32	18(1.8%)	14(1.4)	0.001
	Absent	952	919(92%)	33(3.3%)	
		984	937(93.3%)	47(4.7%)	
Previous surgery	Yes	26	12(1.2%)	14(1.4%)	0.000
	No	958	925(94%)	33(3.3%)	
		984	937(93.3%)	47(4.7%)	
Diagnosed case of Acute Cholecystitis	Cholecystitis	26	12(1.2)	14(1.4%)	0.000
	Cholelithiasis	958	925(94%)	33(3.3%)	
		984	937(93.3%)	47(4.7%)	
Viral hepatitis	Present	23	22(2.2%)	1(0.1%)	0.845
	Absent	961	915(92%)	46(4.6%)	
		984	937(93.3%)	47(4.7%)	
Gall bladder wall Thickness in US	More than 4mm	23	23(2.3%)	0	*0.026
	Less than 4mm	961	914(91.1%)	47(4.7%)	
		984	937(93.3%)	47(4.7%)	
Preoperative ERCP	Yes	38	38(3.8%)	47(4.7%)	**0.003
	No	946	899(91.2%)	82(8.3%)	
		984	937(93.3%)	129(4.7%)	
BMI Kg/m ²	18.5-24.9	691	664(67.4%)	27(2.7%)	*0.027
	25-29.9	200	187(19.0%)	13(1.3%)	
	30 or above	93	86(8.7%)	7(0.7%)	
		984	937(93.3%)	47(4.7%)	
Past history of Acute Cholecystitis	Yes	29	29(2.9%)	0	*0.012
	No	955	908(92.2%)	47(4.7%)	
		984	937(93.3%)	47(4.7%)	
TLC count	Normal	960	913(92.7%)	47(4.7%)	*0.023
	Elevated	24	24(2.4%)	0	
		984	937(93.3%)	47(4.7%)	
Previous episode of Acute pancreatitis	Yes	33	29(2.9%)	0	*0.012
	No	951	908(92.2%)	47(4.7%)	
		984	937(93.3%)	47(4.7%)	

*Chi square test was applied.

**Fisher exact was applied.

Table 3. Comparison of Conversion Rate of Different Studies with Current Study.

Author	Country of Study	Conversion Rate
Amina et al. [5]	Pakistan	7.78%
Samer et al. [11]	U.S	1.03%
Ekici et al. [12]	Turkey	7.6%
Sutcliffe et al. [13]	U.K	3.4%
Rashid et al. [14]	Pakistan	7.0%

The risk factors responsible for conversion of laparoscopic to open cholecystectomy are mainly classified into preoperative and intraoperative. Preoperative risk factors include age, gender, obesity, diabetes, history of prior abdominal surgery and thickened gall bladder under ultrasound [13, 15]. However, our study produced heterogeneous results about the above mentioned risk factors which is illustrated in Table 2. Diabetes which was mentioned as a factor of conversion show a significant p Value in our study (0.000). Similarly, previous surgery had a p-value of 0.000; however, another study from this region showed similar results on prior abdominal surgeries stating that laparoscopic surgeries are possible if performed at high-volume centers which is also evident in our study [16]. A patient diagnosed with acute cholecystitis was found to be significant in conversion to open cholecystectomy with a p value of 0.000. Similarly, a history of acute cholecystitis also showed the significant value of 0.012. Contrary to that history of previous ERCP and ultrasound suggestive of thick-walled bladder did not change the course of treatment which was described in prior studies [5, 17]. Other risk factors such as presence of positive viral serology for hepatitis B and hepatitis C virus showed insignificant p value of 0.845 and a previous episode of acute pancreatitis had p-value of 0.012. Elevated BMI and increased TLC count showed a significant association with the conversion with a p-value of 0.012.

Our study reported similar findings of previous studies in which laparoscopic surgeries were safer and quicker with less complication than open approach [18], therefore only 0.1% (n=01) of viral hepatitis patient were operated with open approach.

There are intraoperative factors that leads to conversion open cholecystectomy. These factors mainly include dense adhesions, obscure anatomy, uncontrolled bleeding and stones in common bile duct [14, 19]. In this study same causes were observed, 4.78% (n=47) of total surgeries were converted to open cholecystectomy. In 14.89% of cases adhesions were the cause followed by anatomical difficulty in 12% of cases, including severe bleeding in 40.4% (n=19) cases and visceral damage in 19.1% (n=9) cases was found. Another important reason for decreased number of open surgery is conversion of laparoscopic cholecystectomy into subtotal cholecystectomy in 4.78% (n=47) cases.

Operative time and post operation discharge time was also noted in current study. Operative time in laparoscopic is less than open approach [20]. In our study mean time in laparoscopic surgery was 70.94 minutes on average while open surgery was 114 minutes long on average (value = 0.679). Hospital stay was found to be related with the duration of procedure, in cases in which surgeries were of shorter duration, they were discharged within two-day post operatively (value=0.006), this stay is prolonged where conversion into open cholecystectomy is done. There are various post-cholecystectomy complications that may lead to re-exploration. Complications may include bile duct injury, gallstone ileus, suture granuloma, clip migration, post cholecystectomy syndrome and other minor events such as pain, fluid accumulation and esophagitis [21, 22]. In current study only 24.6% (n=95) patients developed postoperative minor complications which were postoperative pain and vomiting in 18.4% (n=71) and 6.2% (n=24) cases respectively.

LIMITATION

All surgeries were not performed by the surgeons of same experience creating a biased.

Secondly, some conversion were not because of per-operative or intraoperative difficulties. It was basically faulty fundamental steps in laparoscopic cholecystectomy that raised the suspension of biliary/organ injuries, leading to conversion.

CONCLUSION

Cholelithiasis and cholecystitis are most common gall bladder benign pathologies which require surgical intervention. Laparoscopic cholecystectomy is the method of treatment however some cases require open approach to prevent complication from laparoscopic procedure. Conversion to open cholecystectomy is associated with numerous preoperative and intraoperative risk factors. Operative time and type of surgery is also associated with overall hospital stay and recovery of patient. Knowledge of these factors may help in arranging the operating schedule, psychological preparation for the procedure, and planning of the duration of convalescence. These factors can help counsel patients undergoing laparoscopic cholecystectomy with regards to the probability of conversion to an open procedure.

AUTHORS' CONTRIBUTION

Hira Moosa: Conceived data, Literature search, and Study design.

Mohammad Naeem and Dileep Kumar: Manuscript writing, proofreading.

Syed Baquer Rivzi: Data analysis, Result interpretation.

Irtiza Ahmed Bhatti: Data collection, Data analysis.

Shabina Jaffer: Data collection.

Shamim Qureshi: Study design, Proofreading.

CONFLICT OF INTEREST

Declared none.

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