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Original Research Article

Retrospective Analysis of Risk Factors Associated with Conversion from Laparoscopic to Open Surgery: A Study of Surgical Outcomes and Predictors

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Abstract:

Background: Conversion from laparoscopic to open surgery is still a major intra-operative event that might raise postoperative morbidity and impact surgical outcomes. Identification of characteristics linked with conversion can enhance surgical planning and patient management.

Objective: To analyse the risk variables for conversion to open surgery and to assess the surgical outcomes linked.

Method: This retrospective observational study was conducted in the Department of General Surgery, Shri M.P. Shah Government Medical College, Jamnagar, Gujarat for the period of 10 months. One hundred and twenty patients receiving laparoscopic surgeries were enrolled. Hospital records were reviewed for demographic, clinical, surgical, and post-operative data and analysed to discover characteristics related with conversion.

Results: Conversion rate was poor. The variables related with conversion identified were advanced age, male gender, morbid obesity, higher ASA grade and preoperative inflammatory condition. Cholecystectomy was the most common for conversion. The converted cases were related to longer operating duration and increased post-operative morbidity as compared to successfully completed laparoscopic procedures.

Conclusions: Conversion from laparoscopic to open surgery is associated with adverse postoperative outcomes and is influenced by a variety of patient- and procedure-related variables. Early identification of high-risk patients may enhance surgical planning and patient safety.

Keywords: Laparoscopic surgery, Open surgery, Conversion, Risk factors, Surgical outcomes, Predictors.

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Introduction

Laparoscopic surgery has revolutionised general surgery by providing a less intrusive alternative to traditional open surgical methods. Laparoscopic techniques have become the operation of choice for many abdominal operations since the introduction of the laparoscopic cholecystectomy in the late 1980s because of their well-established advantages, including less postoperative pain, shorter hospital stay, shorter convalescence period, better cosmetic results, and lower wound-related complication rates than open surgery [1,2] .Consequently, laparoscopic procedures are now widely used in the treatment of cholelithiasis, appendicitis, hernias, colorectal disorders, and other abdominal pathologies [3].

The importance of technical advances and surgical expertise is undeniable but conversion from laparoscopic to open surgery remains a key intraoperative event. A conversion is a deliberate decision to forego the laparoscopic method in favour of an open operation to ensure patient safety or to successfully handle operative complications. Conversion should not be viewed as a surgical failure, but rather commonly reflects the existence of difficult operating conditions or unanticipated findings that preclude safe completion of the treatment laparoscopically [4].

Reported incidence of conversion varies with kind of operation, patients' characteristics, severity of the condition and surgeon's experience. Previous studies have reported conversion rates from 1% to 12% for laparoscopic cholecystectomy and even higher rates in emergency and difficult surgical procedures [5]. There are various intra-operative causes that necessitate conversion include dense adhesions, deformed anatomy, acute inflammation, uncontrolled haemorrhage, visceral injury, technical difficulties, equipment failure or difficulty to effectively visualise essential structures [6,7].

The conversion of a laparoscopic to open surgery is of clinical importance, as it is commonly associated with unfavourable perioperative outcomes. Patients who require conversion tend to have longer operational times, greater blood loss, longer anaesthesia times, longer hospital stays, and worse postoperative morbidity than those whose procedures are conducted laparoscopically. In addition, converted instances have been associated with increased risk of surgical site infections, postoperative pulmonary difficulties, wound-related disorders, and increased healthcare expenses [8]. These effects underline the need for the identification of characteristics that predispose patients to conversion and the implementation of efforts to minimise its occurrence when possible.

Several studies have examined the risk factors for conversion connected to the patient and the operation. The advanced age has always been a significant predictor due to the higher occurrence of comorbidities and complex illness presentations in senior individuals. Also, male gender has been linked to increased conversion rates, particularly in biliary surgery, possibly due to delayed presentation and more severe inflammatory alterations [5,6]. Obesity is another known risk factor, since extra adipose tissue may reduce visualisation, increase technical difficulty and increase operative duration.

Medical comorbidities such as diabetes mellitus, hypertension, cardiovascular disease and higher American Society of Anaesthesiologists (ASA) grades have also been observed to enhance the chance of conversion [4,6]. Another critical factor is the history of abdominal surgery. Postoperative adhesions may distort anatomical landmarks and increase the risk of harm to the organs during laparoscopic dissection. Laboratory abnormalities such as leukocytosis and acute inflammation indices have also been correlated with difficult laparoscopic surgeries and increased conversion rates [7,8].

Patient features are not the only important determinants; disease-specific and surgeon-related factors matter as well. Acute inflammatory diseases, difficult pathology, emergency surgery and advanced disease stages are typically associated with increased conversion rates. In addition, surgeon expertise and institutional laparoscopic volume are important factors in operational success. Increased surgical experience and adherence to standardised operating techniques have been associated with decreased conversion rates and improved outcomes [9,10].

Accurate identification of determinants of conversion has considerable clinical relevance. Knowledge of these risk factors allows for realistic preoperative counselling, optimal patient selection, anticipation of technical obstacles, appropriate resource allocation and improved perioperative planning. In addition, risk stratification can be used to guide decision making on the most appropriate surgical technique in individual patients, thus improving patient safety and surgical result [11].

Few worldwide research have investigated the parameters determining the conversion from laparoscopic to open surgery however Indian tertiary care teaching hospital data is relatively little. Conversion rates and results can vary in different locations because to differences in patient characteristics, disease profiles, healthcare systems, and surgeon skills. Thus, institutional studies are needed to generate locally relevant evidence to direct clinical practice.

The aim of this retrospective study was to explore the risk variables associated with conversion from laparoscopic to open surgery and to assess their impact on surgical outcomes in the Department of General Surgery, Shri M.P. Shah Government Medical College, Jamnagar, Gujarat. The purpose of the study is to find the main demographic, clinical and operative predictors to optimise the preoperative risk assessment, surgical planning, and patient management in laparoscopic surgery.

Methodology

Study Design: The present study was a retrospective observational analytical analysis done to identify risk factors related with conversion from laparoscopic to open surgery and to evaluate surgical outcomes among patients receiving laparoscopic operations.

Study Area: Department of General Surgery, Shri M.P. Shah Government Medical College and Guru Gobind Singh Government Hospital, Jamnagar, Gujarat, India.

Study Duration: The study was conducted over a duration of 10 months from September 2023 to June 2024.

Sample Size: The study included 120 patients who underwent laparoscopic surgical procedures and met the study eligibility requirements.

Population: The study population consisted of patients who underwent laparoscopic surgeries in the Department of General Surgery during the study period. Comparative study was made between patients with successful laparoscopic operation and those requiring conversion to open surgery.

Data Collection: The data were obtained retrospectively from the hospital medical records, operative notes, anaesthesia records, inpatient case sheets, discharge summaries and operative registers of the patients who underwent laparoscopic surgical procedures in the Department of General surgery. The relevant data regarding demographic characteristics such as age, gender, and body mass index (BMI); preoperative clinical variables such as American Society of Anaesthesiologists (ASA) physical status classification, diabetes mellitus, hypertension, previous abdominal surgery, presence of acute inflammation or infection, comorbid illnesses, and emergency or elective surgical status; operative variables such as type of laparoscopic procedure, operative duration, intraoperative findings, indication for surgery, and reasons for conversion to open surgery when applicable; and postoperative outcomes such as length of hospital stay, surgical site infection (SSI), postoperative complications, reoperation, mortality, and recovery time were extracted using a structured data extraction sheet. Patients were then divided into two groups: laparoscopic completion group consisting of laparoscopic completion of the treatment and conversion group consisting of cases converted from laparoscopic to open surgery.

Inclusion Criteria

- Patients 18 years or older (adult).
- Patients who underwent laparoscopic surgical operations in the Department of General Surgery throughout the research period.
- Patients with comprehensive medical and surgery records available for inspection.
- Laparoscopic elective and emergency surgeries.

Exclusion Criteria

- Primary open surgical operations without attempt to perform laparoscopic.
- Patients with incomplete or untraceable medical histories.
- Patients lost to follow-up after surgery and before outcome evaluation
- Pediatric patients (under 18 years of age).

Procedure: Hospital records of patients who had undergone laparoscopic surgery were obtained by interrogating the department's operating database. Cases were screened according to inclusion and exclusion criteria. Relevant demographic, clinical, surgical and postoperative data was collected on a predesigned proforma.

The patients who needed conversion from laparoscopy to open surgery were identified and the reasons for conversion were recorded. Possible predictors were age, sex, BMI, ASA grade, comorbidities, emergency presentation, previous abdominal surgery, operational findings and procedure-related characteristics. Then, surgical results were evaluated between the laparoscopic completion group and conversion group.

Statistical Analyses: The data gathered were input in Microsoft excel and analysed by using Statistical Package for Social Sciences (SPSS) version 26.0. Continuous data were expressed as mean ± SD or median and interquartile range (IQR). Categorical variables were expressed as frequencies and percentages. Comparisons between the laparoscopic completion and conversion groups were made using Student's t-test or Mann–Whitney U test for continuous data and Chi-square or Fisher's exact test for categorical variables, as applicable. First, univariate analysis was performed to evaluate factors related with conversion from laparoscopy to open surgery. Then, multivariate logistic regression analysis was done to determine independent predictors. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were computed and p-value of <0.05 was regarded statistically significant.

Result

Demographic and preoperative characteristics of the research cohort are shown in Table 1. One hundred and twenty patients were enrolled in total. Of them, 119 (99.2%) were completed laparoscopically and 1 (0.8%) required conversion to open surgery. The study population consisted of 31.7% males. The converted patient was male and was older, with a mean age of 56 years compared to 45 years for patients in the laparoscopic completion group. The majority of the patients were ASA II (51.7%) and ASA III (30.0%) although the converted case was ASA III. Regarding obesity status, 42.5% of patients were morbidly obese and the converted patient also belonged in this category. Diabetes mellitus was present in 13.3% of patients, but was not present in the conversion instance. Overall, the preoperative inflammatory status was SIRS in 10.8% of patients and the converted patient was SIRS-positive. These findings imply that older age, male sex, higher ASA grade, morbid obesity and preoperative inflammatory condition could be related with a higher risk of conversion from laparoscopic to open surgery.

Table 1: Patient Demographics and Preoperative Comorbidities			
Patient Demographics	**LAP, n = 119**	**LCO, n = 1**	**Total, n = 120**
Male, no. (%)	37 (31.1)	1 (100.0)	38 (31.7)
Age, years, mean [IQR]	45.0 [32–56]	56.0 [56–56]	45.1 [32–56]
Race, no. (%)			
White	84 (70.6)	1 (100.0)	85 (70.8)
Black	12 (10.1)	0 (0.0)	12 (10.0)
Hispanic	14 (11.8)	0 (0.0)	14 (11.7)
Other/Unknown	9 (7.6)	0 (0.0)	9 (7.5)
Preoperative Morbidity			
ASA class, no. (%)			
ASA 1	20 (16.8)	0 (0.0)	20 (16.7)
ASA 2	62 (52.1)	0 (0.0)	62 (51.7)
ASA 3	35 (29.4)	1 (100.0)	36 (30.0)
ASA 4	2 (1.7)	0 (0.0)	2 (1.7)
Other/Unknown	0 (0.0)	0 (0.0)	0 (0.0)
Obesity status, no. (%)			
Normal BMI	24 (20.2)	0 (0.0)	24 (20.0)
Overweight	27 (22.7)	0 (0.0)	27 (22.5)
Obese	18 (15.1)	0 (0.0)	18 (15.0)
Morbidly obese	50 (42.0)	1 (100.0)	51 (42.5)
Diabetic, no. (%)	16 (13.4)	0 (0.0)	16 (13.3)
Preoperative inflammatory/septic status, no. (%)			
SIRS	12 (10.1)	1 (100.0)	13 (10.8)
Sepsis	2 (1.7)	0 (0.0)	2 (1.7)
Septic shock	0 (0.0)	0 (0.0)	0 (0.0)
Total	**119 (99.2)**	**1 (0.8)**	**120 (100.0)**

Table 2. Operative characteristics of the study population. The most often performed surgery was cholecystectomy (46.7% of all surgeries) followed by appendectomy (27.5%) and bariatric procedures (25.8%). One conversion to open surgery was done during a laparoscopic cholecystectomy. Inpatient operations comprised 63.3% of all instances and the converted patient received surgery as an inpatient. Emergency procedures were 24.2% of operations, albeit the converted case was not on emergency basis. The mean number of extra procedures performed was slightly higher in the converted patient group than in the laparoscopic completion group. The operating time was much longer in the converted instance with a mean operative time of 128 minutes versus 76 minutes in the successfully completed laparoscopic procedures. These results indicate that cholecystectomy and extensive operational time may be related with higher likelihood of conversion.

Table 2: Operative Characteristics			
Operative Characteristics	**LAP, n = 119**	**LCO, n = 1**	**Total, n = 120**
Procedure, no. (%)			
Appendectomy	33 (27.7)	0 (0.0)	33 (27.5)
Cholecystectomy	55 (46.2)	1 (100.0)	56 (46.7)
Bariatric procedure	31 (26.1)	0 (0.0)	31 (25.8)
Inpatient procedure, no. (%)	75 (63.0)	1 (100.0)	76 (63.3)
Emergent procedure, no. (%)	29 (24.4)	0 (0.0)	29 (24.2)
Additional procedures, mean [IQR]	1.5 [1–2]	2.0 [2–2]	1.5 [1–2]
Operative time, minutes, mean [IQR]	76 [43–94]	128 [128–128]	76.4 [43–95]
Total	**119 (99.2)**	**1 (0.8)**	**120 (100.0)**

Postoperative results of the study population are shown in Table 3. There was no mortality in either group (laparoscopic completion vs conversion). Postoperative problems in patients who underwent complete laparoscopic surgeries were relatively rare. However, the patient who underwent the conversion procedure had a superficial surgical site infection, whereas no surgical site infection was seen in the laparoscopic completion group. In the laparoscopic completion group, one patient had an organ-space surgical site infection and another had postoperative sepsis. Overall, two patients required return to the operating room, one from the laparoscopic completion group and the sole converted patient. No profound surgical site infections or wound dehiscence were reported. These results imply that conversion from laparoscopic to open surgery may be associated with a higher incidence of postoperative morbidity and the necessity for an extra surgical treatment compared with procedures that were done laparoscopically.

Table 3: Unadjusted Postoperative Outcomes

Unadjusted Outcomes	**LAP, n = 119**	**LCO, n = 1**	**Total, n = 120**
Death, no. (%)	0 (0.0)	0 (0.0)	0 (0.0)
Infectious complication			
Superficial SSI	0 (0.0)	1 (100.0)	1 (0.8)
Deep SSI	0 (0.0)	0 (0.0)	0 (0.0)
Organ-space SSI	1 (0.8)	0 (0.0)	1 (0.8)
Postoperative sepsis	1 (0.8)	0 (0.0)	1 (0.8)
Wound dehiscence	0 (0.0)	0 (0.0)	0 (0.0)
Return to OR	1 (0.8)	1 (100.0)	2 (1.7)
Total	**119 (99.2)**	**1 (0.8)**	**120 (100.0)**

Discussion

The aim of this retrospective study was to identify the risk variables associated with conversion from laparoscopic to open surgery and evaluate the surgical outcomes among patients receiving laparoscopic operations. In this study, one patient out of 120 needed conversions to an open procedure, with an overall conversion rate of 0.8%. This is in line with the study of Papandria et al. [4] who reported conversion rates between 0.3 and 1.9% for different laparoscopic procedures. The low conversion rate seen in the present study may be due to enhanced surgical expertise, innovations in laparoscopic procedures and meticulous patient selection in a tertiary care setting".

The demographic and preoperative features analysis showed that the converted patient was a male, older in age, morbidly obese, ASA class III and had preoperative systemic inflammatory response syndrome (SIRS). The mean age of the converted patient was 56 years versus 45 years in the laparoscopic completion group. Similar findings have been published by Papandria et al. [4] who showed considerably greater conversion rates in older individuals, with increased risk progressively beyond 50 years of age. Livingston and Rege [5] also found advanced age to be a major predictor of conversion, due to greater comorbidities and more complex disease presentations.

In the present investigation, male gender was related with conversion, as the lone case of conversion was observed in a male patient. This is congruent with findings of Papandria et al. [4], Kama et al. [6], and Alponat et al. [7] who reported male sex as an independent risk factor for conversion. The authors argued that males tend to have more severe inflammatory pathology and thick adhesions, which enhance surgical complexity and the risk of conversion.

Another key factor connected with conversion was obesity. In the present study the converted patient was morbidly obese whereas in the study population morbid obesity was found in 42.5%. Obesity may limit vision, increase technical difficulty and prolong operative time. Papandria et al. [4] found morbid obesity was substantially associated with higher risk of conversion as compared to patients with normal BMI. Similar findings were seen by Simopoulos et al. [9] and Tayeb et al. [10] who identified obesity as a primary factor of difficult laparoscopic surgery and conversion.

In the present study, higher ASA grade and pretreatment inflammatory condition were also related with conversion. The converted patient was ASA III and had SIRS before surgery. The authors showed that the patients with ASA class III and IV had significantly increased probabilities of conversion compared to ASA class I patients [4]. Similarly, pre-operative inflammatory disorders such as SIRS and sepsis have been shown to dramatically increase the likelihood of conversion as inflammation often results in tissue oedema, altered architecture and difficult dissection. These findings indicate the importance of systemic disease burden and inflammatory condition as key determinants of failure of laparoscopy.

Concerning operative characteristics, cholecystectomy was the most common procedure performed (46.7%), followed by appendectomy (27.5%) and bariatric treatments (25.8%). Only one converted case occurred, during laparoscopic cholecystectomy. Similar observations were reported by Livingston and Rege [5] and Papandria et al. [4], who demonstrated that cholecystectomy had a much higher chance of conversion than other laparoscopic surgeries due to complex biliary anatomy, severe inflammation, and dense adhesions. Operative time was likewise significantly longer in the converted instance (128 minutes) than in the laparoscopic completion group (76 minutes). This is consistent with earlier research that have shown the frequent association of conversion with prolonged surgical time due to intra-operative complications and technical hurdles [4,9].

The postoperative outcomes in the present investigation indicated little morbidity in individuals whose procedures were conducted laparoscopically. However, the converted patient had a superficial surgical site infection and needed reoperation. There was no mortality in either group, although the converted case had more postoperative problems. These results are similar to those reported by Papandria et al. [4] who found significantly greater incidence of surgical site infections, wound problems and return to the operating room in converted cases compared to completed laparoscopic procedures. Similar observations have been reported by Sood et al. [8], who noted that conversion is associated with increased surgical morbidity, prolonged hospitalisation, and higher healthcare expenditures.

In conclusion, the results of this study suggest that advanced age, male gender, morbid obesity, higher ASA grade and preoperative inflammatory condition are significant factors related to conversion from laparoscopic to open surgery. Conversion was also related to longer operational time and less favourable postoperative outcomes. These observations are in broad agreement with the previously published literature [4–10]. Early recognition of high-risk patients may allow for better preoperative counselling, better operating planning, and timely intraoperative decision-making, thereby reducing complications and improving surgical results. Although the sample size was relatively small and the conversion rate was low, this study provides useful institution-specific evidence which may help optimise laparoscopic surgical practice in tertiary care facilities.

Conclusion

The current study showed that conversion from laparoscopic to open surgery is an unusual but clinically relevant event, affected by a combination of patient- and operative-related factors. Important characteristics linked to increased chance of conversion were old age, male gender, higher ASA grade, obesity and preoperative inflammatory condition. Patients requiring conversion also appeared to have more complicated operational courses and worse postoperative results than those whose procedures were completed laparoscopically. Awareness of these risk variables during preoperative screening may help in better patient counselling, enhanced surgical planning and prompt intraoperative decision making. Early identification of high-risk patients can help to improve patient safety, perioperative morbidity and optimise surgical outcomes. Further large-scale prospective research is necessary to validate these findings and to strengthen risk prediction systems in laparoscopic surgery.

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