



## RESEARCH ARTICLE

**Analysis of Incidence and Risk Factors for Conversion from Laparoscopic to Open Cholecystectomy**Vijay Bharatkumar Dabhi<sup>1</sup>, Shiv Nandan Paswan<sup>2</sup>, Mritunjay Kumar Sinha<sup>3</sup><sup>1</sup>Assistant Professor, Department of General Surgery, Great Eastern Medical School & Hospital, Andhra Pradesh, India<sup>2</sup>Assistant Professor, Department of General Surgery, Great Eastern Medical School & Hospital, Andhra Pradesh, India<sup>3</sup>Assistant Professor, Department of General Surgery, Great Eastern Medical School & Hospital, Andhra Pradesh, India

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**Abstract**

**Background:** Laparoscopic Cholecystectomy is regarded as the best treatment of gallstone diseases. Surgical procedures will at times require a switch in laparoscopic to open cholecystectomy, which will raise the morbidity, hospitalization, and expenditure.

**Aim:** To establish the incidence and risk factors of laparoscopy to open conversion of the gall bladder surgery.

**Methodology:** A one-year observational retrospective study was done in the Department of General Surgery, Great Eastern Medical School & Hospital, Andhra Pradesh, India and involved 120 patients who underwent Laparoscopic Cholecystectomy. Descriptive statistics and logistic regression were used to analyze demographic data, clinical features, lab investigations, imaging, intraoperative data, and conversion rate.

**Results:** Among 120 cases, 18 (15%) cases had to undergo conversion to open surgery. Acuity cholecystitis (33.3%), dense adhesions (27.8%), obesity (22.2%), and prior abdominal surgery (16.7%), were common causes. The relation between leukocytosis and gender (male), age (greater than 50 years) and age was statistically significant ( $p < 0.05$ ).

**Conclusion:** Laparoscopic to open cholecystectomy surgery conversion depends on numerous factors depending on the patient and the disease. Early identification of high-risk patients can potentially allow preoperative planning and prevention of complications.

**Keywords:** Laparoscopic cholecystectomy, Open cholecystectomy, Conversion rate, Gallstones, Risk factors, Acute cholecystitis

**Introduction:**

Gallstones are the most common GI tract disorders since the condition is prevalent in a significant proportion of the adult population and a significant number of surgeries are carried out due to the prevalence of this condition [1]. It is approximated that a significant proportion of cholelithiasis patients need to undergo surgery because of complications that occur as a result of the disorder and they include biliary colic, acute cholecystitis, pancreatitis and obstructive jaundice [2].

The new millennium has seen the introduction of Laparoscopic Cholecystectomy as the new standard of care in the treatment of the gall stones disease, in lieu of the old method of surgery [3]. The benefits of

laparoscopic cholecystectomy include the following: low postoperative pain, reduced surgical trauma, reduced hospital stay, quicker restoration to normality and excellent cosmetic outcome, which renders the technique viable and common. This has seen it be used daily in elective and emergency practice [4].

Nevertheless, although the laparoscopic surgery and instruments have come a long way, laparoscopic to Open Cholecystectomy conversion is a critical consideration during the operation [5]. Conversion is not a sign of surgical failure it is a wise and frequently life saving measure taken to guarantee patient safety when insufficient visualization of

anatomy is possible or in case of complications like uncontrolled bleeding, bile duct injuries, or severe inflammation [6]. Conversion decision is a good surgical judgment made in order to avoid morbidity and to make the best results [7].

In the literature, conversion is reported to occur widely, with a range of 5% to 20%, depending on the patient demographics, severity of the pathology of the gallbladder, the time of surgery, and surgeon experience [8]. A plethora of preoperative and intraoperative risk factors have been identified to be potentially increasing the risk of conversion [9]. These are advanced age, male gender, obesity, acute cholecystitis, thickened gallbladder wall, dense pericholecystic adhesions, anatomical variations and past history of upper abdominal surgery [10]. In addition, general diseases like diabetes mellitus and high levels of inflammatory molecules have also been linked to higher rates of conversion [11].

These risk factors should be well understood in order to enhance surgical outcomes [12]. Early detection of high-risk patients in preoperative units enables the surgeons to preoperatively predict technical challenges, plan their surgeries, provide appropriate patient counselling, and assign skilled surgical teams where they are needed [13]. In addition, the knowledge about these determinants may help to decrease the duration of operations, complications, and overall patient safety.

In this respect, the current research was conducted to examine the incidence and assess the different risk factors relating to conversion of laparoscopic to open cholecystectomy within a tertiary care service in one year [14]. This study will offer valuable contributions to the field of clinical, radiological, and intraoperative parameters, which may help improve decision-making and enhance surgical management approaches toward the patients with gallstone disease.

## Methodology

Conversion to Open Cholecystectomy after Laparoscopic Cholecystectomy is a complex issue that requires a well-organized methodology to assess the occurrence and factors that influence it. The current research was planned in such a way that it would be able to collect data extensively, analyze the results properly, and interpret the clinical and intraoperative results correctly. The study sought to

establish important patient-related and disease-related variables that have an impact on surgical outcomes by using the available hospital records. The research methodology was well designed to be consistent, reduce bias, and improve the validity of the research findings.

## Study Design

The current study is a retrospective study aimed at analyzing the rate of conversion from laparoscopic to open cholecystectomy along with identifying the possible risk factors associated with the process. A retrospective methodology was used for this study because it allows one to review all previously recorded clinical and surgical information.

## Study Area

This study was carried out in the Department of General Surgery, Great Eastern Medical School & Hospital, Andhra Pradesh, India

## Study Duration

The study was conducted within a one-year.

## Study Participants

### Inclusion Criteria

- Patients with a diagnosis of the presence of the gallstone disease through clinical and radiological examination.
- Patients who had laparoscopic cholecystectomy.
- Adult patients (18 years and older).
- Patients who have complete clinical, laboratory, and operative records.

### Exclusion Criteria

- Patients scheduled to undergo primary open cholecystectomy.
- Patients with malignancy of the gallbladder.
- Incomplete or missing medical records of patients.
- Patients who are not suitable to undergo laparoscopic surgery because of severe comorbidity.

## Sample Size

The study included 120 patients who met the inclusion criteria. The sample size was deemed sufficient to evaluate the conversion incidence, and to examine risk factors related to it with a statistically reliable level.

## Procedure

The medical records department and operation theatre registers of the hospital were the sources of relevant patient data. A data collection proforma was employed to provide uniformity and consistency in data extraction.

The following variables were recorded:

- **Demographic parameters:** Age, gender and body mass index (BMI)
- **Clinical manifestation:** The pain in the right upper abdomen, fever, nausea, vomiting, and jaundice.
- **Laboratory tests:** Total hemoglobin, total white blood cell count, liver test, and other similar biochemical markers.
- **Radiological:** It is possible to observe the attributes of ultrasound which involve wall thickening of the gallbladder, gallstones, pericholecystic fluid, and bile duct.
- **Intraoperative observations:** Adhesions, inflammations, distended gall bladder, inability to identify the triangle of Calot, and surgery complications.
- **Operative outcome:** Laparoscopy or an open procedure.

Conversion was considered the intraoperative choice to replace laparoscopic with open cholecystectomy based on technical difficulty, vague anatomy, intraoperative complications, or safety consideration.

The reasons of conversion in particular were also recorded and studied.

All patients' data were kept anonymous to ensure confidentiality, and approval was obtained from the Institutional Ethics Committee for the study

## Statistical Analysis

Data collected were inputted into the Microsoft Excel and analyzed with the help of IBM SPSS Statistics.

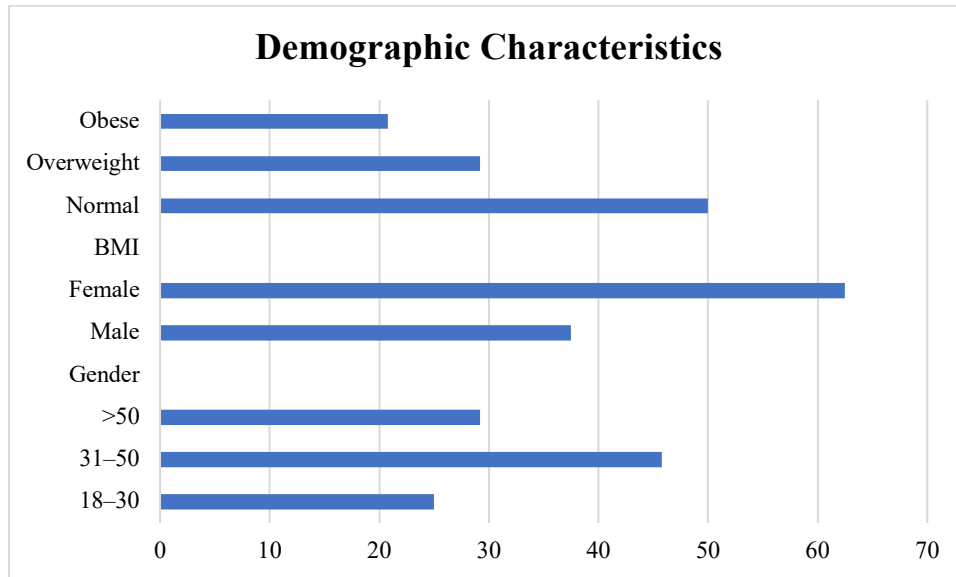
- **Descriptive statistics** were used to summarize data, i.e. mean, standard deviation, frequency, percentage of continuous and categorical variables respectively.
- **Inferential statistics** were employed to determine the correlation between the potential risk factors and conversion rates. Categorical data were analysed using Chi-square test and logistic regression to determine independent predictors of conversion.
- A p-value of less than 0.05 was considered statistically significant.

## Results

The sample size included 120 patients who are undergoing Laparoscopic Cholecystectomy. The data has been displayed based on the demographic variables, symptoms, intraoperative observations, and conversions. Tables and graphs have been used to bring clarity and understanding.

**Table 1: Demographic Characteristics of Study Participants**

Parameter	Frequency (n)	Percentage (%)
<b>Age (years)</b>		
18–30	30	25.0
31–50	55	45.8
>50	35	29.2
<b>Gender</b>		
Male	45	37.5
Female	75	62.5
<b>BMI</b>		
Normal	60	50.0
Overweight	35	29.2
Obese	25	20.8



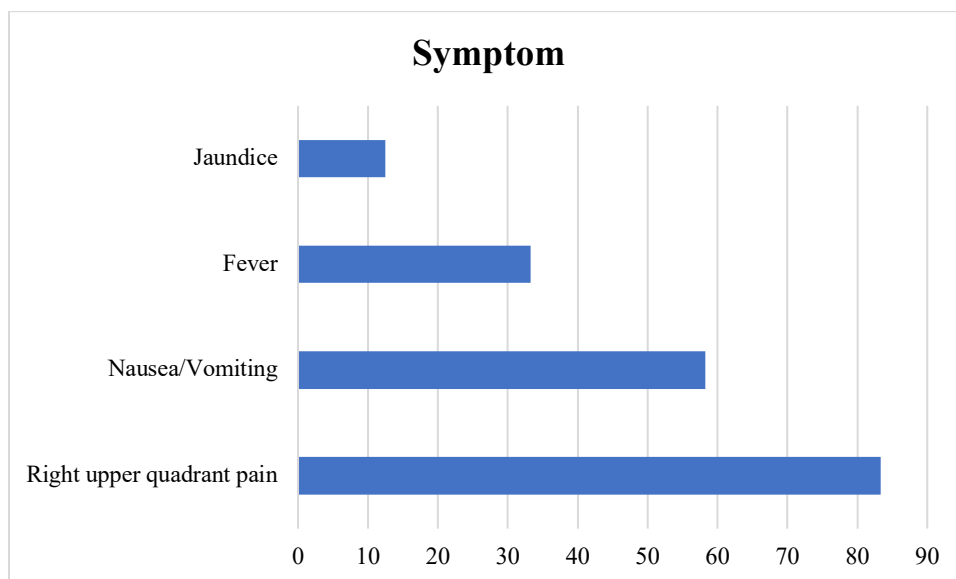
**Figure 1: Graphical Representation of Demographic Characteristics of Study Participants**

Table 1 and Figure 1 constitute the demographic characteristics of the subjects under investigation. The highest number of the patients was from the 31-50 age bracket (45.8%), with those older than 50 years following at 29.2%, while those between the age of 18 and 30 years constituted 25%. It thus suggests that the incidence of gallstone is mostly

common among the middle-aged patients. The number of women (62.5 %) was a little more than that of men (37.5%) due to the rate of prevalence being greater in women. With regard to BMI, most of the patients (50%) were found to be healthy with others being overweight (29.2%) or obese (20.8%).

**Table 2: Clinical Presentation of Patients**

Symptom	Frequency (n)	Percentage (%)
Right upper quadrant pain	100	83.3
Nausea/Vomiting	70	58.3
Fever	40	33.3
Jaundice	15	12.5



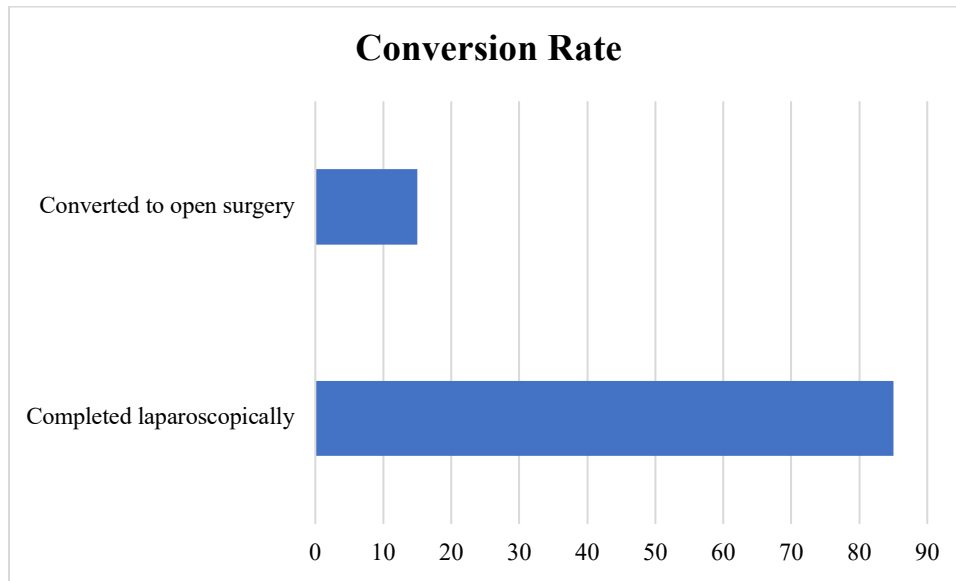
**Figure 2: Graphical Representation of Clinical Presentation of Patients**

Table 2 and figure 2 present the clinical manifestations of the patients. The commonest clinical manifestation is right upper quadrant abdominal pain which is 83.3%. This shows that right upper quadrant abdominal pain is the major clinical manifestation of gallstones disease. Gastrointestinal

complaints were exhibited in the form of nausea and vomiting, which accounted for 58.3% of the total number of patients. Fever was recorded among 33.3% of the patients which shows that inflammation exists in the case, such as acute cholecystitis.

**Table 3: Conversion Rate**

Outcome	Frequency (n)	Percentage (%)
Completed laparoscopically	102	85.0
Converted to open surgery	18	15.0



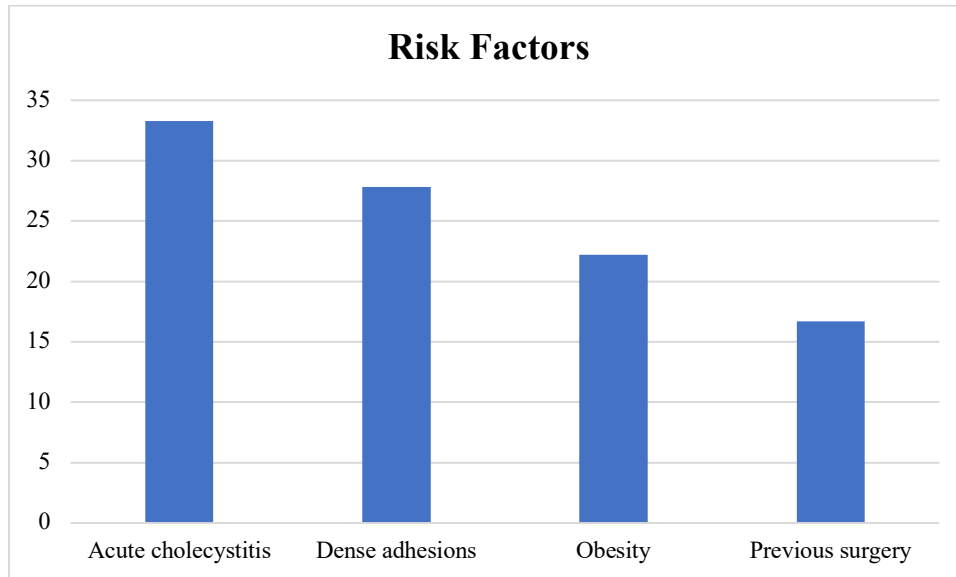
**Figure 3: Graphical Representation of Conversion Rate**

Table 3 and Figure 3 provide the general outcomes of the surgical procedure. Among 120 patients, 102 patients (85%) of the patients had the operation done laparoscopically and 18 patients (15%) had to undergo Open Cholecystectomy. The general

conversion rate indicates not only the viability of Laparoscopic cholecystectomy in the majority of the patients but also shows that there will always be these patients who will need conversion due to intraoperative complications.

**Table 4: Risk Factors for Conversion**

Risk Factor	Frequency (n)	Percentage (%)
Acute cholecystitis	6	33.3
Dense adhesions	5	27.8
Obesity	4	22.2
Previous surgery	3	16.7



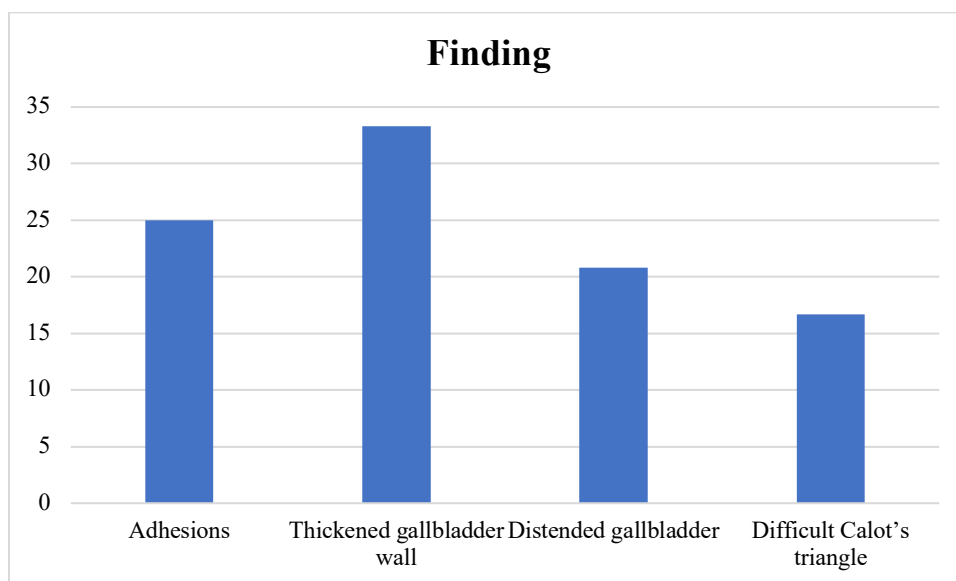
**Figure 4: Graphical Representation of Risk Factors for Conversion**

Table 4 and Figure 4 show the distribution of the risk factors in the patients who needed conversion. The most frequent risk factor was acute cholecystitis (33.3%), underscoring the role of inflammation in challenging surgery. The second most frequent factor (27.8%), which frequently caused obscured anatomy

and risk on dissection, was dense adhesions. Technical challenges were also caused by obesity (22.2%) like poor visualization and poor instrument handling. Also, history of prior abdominal surgery (16.7%) was linked to adhesions and distorted anatomy which made conversion more probable.

**Table 5: Intraoperative Findings**

Finding	Frequency (n)	Percentage (%)
Adhesions	30	25.0
Thickened gallbladder wall	40	33.3
Distended gallbladder	25	20.8
Difficult Calot's triangle	20	16.7



**Figure 5: Graphical Representation of Intraoperative Findings**

Table 5 and Figure 5 summarize the intraoperative observations. The most common finding (33.3%) was a thickened gallbladder wall which was a sign of chronic inflammation. In 25% of cases adhesions existed and in most instances they added to the difficulty of the operation. Handling and visualization were further complicated by gallbladder distension (20.8%). Inability to recognize the triangle of Calot (16.7%) was a critical intraoperative issue, because it exposes the patient to more risk of bile duct injury, and is a frequent cause of an open surgical conversion.

The present study demonstrates that laparoscopic cholecystectomy is a safe and effective procedure, with a high success rate of 85%. Nevertheless, conversion rate was found to be 15% with the main factors being acute cholecystitis, dense adhesions, obesity, and prior abdominal surgery. During the operation, the presence of thickened gallbladder wall and hard anatomical dissection, also added complexity to surgery. These results indicate the need to be careful in preoperative assessment and intraoperative decision-making to guarantee the best patient outcomes.

## Discussion

This present study paper was done to check the incidence and the risk factors that were connected to the conversion between Laparoscopic Cholecystectomy and Open Cholecystectomy. This research offers valuable information on the patient-related and intraoperative factors affecting the outcomes of surgery in a tertiary care facility (Rosen et al., 2002) [15]. In this research, the total conversion rate was identified to be 15% which is within the range of existing literature (5-20%). This suggests that laparoscopic cholecystectomy is a safe and effective procedure, but a considerable number of cases still need conversion as a result of intraoperative difficulties (Simopoulos et al., 2005) [16]. The presented conversion rate indicates the complexity of pathology of the gallbladder and the variability in its presentation. Demographic profile demonstrated that most of the patients were in the age group of 31-50 years with their predominance being female (Skonieczny et al., 2008) [17]. This observation is consistent with the well-known epidemiology of gallstone disease, more prevalent in middle-aged women, as a result of hormonal factors, including estrogen. It is however interesting to note

that the likelihood of conversion was higher in male patients, and this can be explained by the fact that they presented later, the inflammation was more severe, and the disease was more advanced at the time of the surgery (Tang and Cuschieri, 2006) [18]. Age was also of great importance, as patients over 50 years were more likely to convert. This could be attributed to the existence of chronic inflammation, fibrosis and anatomical distortion in the aged that may complicate laparoscopic dissection. The same has been observed in earlier studies where age was found to be a significant predictive factor.

In this study, clinical manifestation was mainly right upper quadrant pain, then nausea, vomiting and fever. The fact that a significant number of patients had a fever indicates that the underlying causes of inflammatory conditions like acute cholecystitis were the most prevalent risk factor of conversion as well. Acute inflammation causes edema, tissue friability and loss of anatomical landmarks, which threatens the possibility of complications in the process of laparoscopic dissection (Tayeb et al., 2005) [19]. Acute cholecystitis (33.3%) was the most important risk factor in conversion among the risk factors that were analyzed. This observation is consistent with a number of studies that have determined acute inflammation as a significant predictor of surgical challenge. Inflammatory process usually leads to distortion of Calots triangle and identification of critical structures becomes difficult, and the chances of bile duct damage are enhanced. The second most prevalent factor related to conversion was dense adhesions (27.8%). Adhesions can grow as a result of recurrent periods of inflammation or prior abdominal operations and can severely obscure the operating area. Adhesions make the process of dissection more challenging and it can take more time to operate, which frequently requires conversion to guarantee patient safety.

Obesity (22.2%) was another important factor contributing to conversion. The fact that obese patients have more adipose tissue may prevent visualization, decrease working space, and complicate handling of instruments. Such technical difficulties can put the safety of laparoscopic surgeries at risk and increase the chances of conversion. Previous abdominal surgery (16.7%) was associated with previous history of abdominal surgery, which led to an increase in conversion rate.

Any previous surgical intervention might cause intra-abdominal adhesions, causing distortion in anatomical structures, thereby making it difficult to perform laparoscopic procedures. It is essential to take a good history before surgery.

These observations were further supported by findings intraoperative. The most common operative observation was a thickened gallbladder wall (33.3) which was a sign of chronic inflammation. Adhesions (25%), gallbladder distension (20.8%), and the inability to locate Calot triangle (16.7) were common as well (Yol et al., 2006) [20]. These are established causes that lead to complexity in surgery and are generally related to conversion. Calot triangle is especially challenging to recognize and this is a very important procedure in laparoscopic cholecystectomy. The inability to visualize this anatomic part clearly predisposes to the risk of bile duct injury as one of the gravest complications of the procedure. In this case, a timely conversion to open surgery is necessary to avoid adverse effects.

The results of this research underline that conversion should not be regarded as a complication or failure but can be considered a strategic intraoperative choice that contributes to patient safety. Conversion at an early stage of challenging cases may help to avoid severe complications and enhance the overall outcome of surgery. Altogether, the research indicates the significance of risk assessment before the operation, patient selection and surgical skills in reducing the conversion rates. Identification of high-risk patients needs to be made through clinical, radiographic, and lab studies to assist in making the best preparations for surgery. Also, alertness while making decisions during the operation process is another crucial element of safe and successful management.

## Conclusion

This study paper concludes that Laparoscopic Cholecystectomy is a safe and effective mode of treatment of gallstone disease with high success rate and good patient outcome. Nevertheless, the conversion of Open Cholecystectomy is a significant and even inevitable intraoperative choice which is noted in 15 percent of cases, in the present study.

The results indicate that conversion depends on a variety of factors related to patients and disease. Acute cholecystitis was identified as the most

important risk factor, then there was dense adhesions, a history of having prior abdominal surgery and obesity. Also, there was a positive relationship between demographic factors including male gender and old age and the probability of conversion. Intraoperative issues, specifically thickened gallbladder wall and inability to locate the triangle of Calot contributed to the further complexity of surgery. Notably, conversion should not be seen as a failure of surgery but a wise choice that will help keep patients safe and avoid severe complications like bile duct injury. The ability to identify the challenging cases early and convert the cases on time may greatly enhance the outcome of the surgery. The study underlines that a careful preoperative assessment, both clinical and laboratory and radiological, is essential in the detection of high-risk patients. A well-thought surgical planning, combined with a well-developed operating methods and intraoperative care, can contribute to the reduction of conversion rates and promote patient safety. In summary, having a thorough insight on the risk factors linked to conversion would help in enhancing decision-making among the surgeons, optimizing the operation and finally managing the patients undergoing laparoscopic cholecystectomy more effectively.

## References

1. Al-Bahlooli, S. H., Al-Malahi, A., Ghallab, N. H., Al-Dain, A. S. A., & Al Sabahi, A. A. (2009). Conversion rate of laparoscopic to open cholecystectomy. *Yemeni journal for medical sciences*, 3(1), 1-8.
2. Anand, A., Pathania, B. S., & Singh, G. (2007). Conversion in laparoscopic cholecystectomy: an evaluation study. *JK Science*, 9(4), 171-4.
3. Bingener-Casey, J., Richards, M. L., Strodel, W. E., Schwesinger, W. H., & Sirinek, K. R. (2002). Reasons for conversion from laparoscopic to open cholecystectomy: a 10-year review. *Journal of gastrointestinal surgery*, 6(6), 800-805.
4. Duca, S., Bălă, O., Al-Hajjar, N., Iancu, C., Puia, I. C., Munteanu, D., & Graur, F. (2003). Laparoscopic cholecystectomy: incidents and complications. A retrospective analysis of 9542 consecutive laparoscopic operations. *Hpb*, 5(3), 152-158.
5. Fraser, S. A., & Sigman, H. (2009). Conversion in laparoscopic cholecystectomy after gastric

- resection: a 15-year review. Canadian journal of surgery, 52(6), 463.
6. Giger, U. F., Michel, J. M., Opitz, I., Inderbitzin, D. T., Kocher, T., Krähenbühl, L., ... & Group, T. S. S. S. (2006). Risk factors for perioperative complications in patients undergoing laparoscopic cholecystectomy: analysis of 22,953 consecutive cases from the Swiss Association of Laparoscopic and Thoracoscopic Surgery database. *Journal of the American College of Surgeons*, 203(5), 723-728.
  7. Ibrahim, S., Hean, T. K., Ho, L. S., Ravintharan, T., Chye, T. N., & Chee, C. H. (2006). Risk factors for conversion to open surgery in patients undergoing laparoscopic cholecystectomy. *World journal of surgery*, 30(9), 1698-1704.
  8. Ishizaki, Y., Miwa, K., Yoshimoto, J., Sugo, H., & Kawasaki, S. (2006). Conversion of elective laparoscopic to open cholecystectomy between 1993 and 2004. *Journal of British Surgery*, 93(8), 987-991.
  9. Lipman, J. M., Claridge, J. A., Haridas, M., Martin, M. D., Yao, D. C., Grimes, K. L., & Malangoni, M. A. (2007). Preoperative findings predict conversion from laparoscopic to open cholecystectomy. *Surgery*, 142(4), 556-565.
  10. Liu, S. I., Siewert, B., Raptopoulos, V., & Hodin, R. A. (2002). Factors associated with conversion to laparotomy in patients undergoing laparoscopic appendectomy. *Journal of the American College of Surgeons*, 194(3), 298-305.
  11. Livingston, E. H., & Rege, R. V. (2004). A nationwide study of conversion from laparoscopic to open cholecystectomy. *The American journal of surgery*, 188(3), 205-211.
  12. Low, S. W., Iyer, S. G., Chang, S. K. Y., Mak, K. S., Lee, V. T. W., & Madhavan, K. (2009). Laparoscopic cholecystectomy for acute cholecystitis: safe implementation of successful strategies to reduce conversion rates. *Surgical endoscopy*, 23(11), 2424-2429.
  13. Pavlidis, T. E., Marakis, G. N., Ballas, K., Symeonidis, N., Psarras, K., Rafailidis, S., ... & Sakantamis, A. K. (2007). Risk factors influencing conversion of laparoscopic to open cholecystectomy. *Journal of Laparoendoscopic & Advanced Surgical Techniques*, 17(4), 414-418.
  14. Rio, P. D., Dell'Abate, P., Soliani, P., Sivelli, R., & Sianesi, M. (2006). Videolaparoscopic cholecystectomy for acute cholecystitis: analyzing conversion risk factors. *Journal of Laparoendoscopic & Advanced Surgical Techniques*, 16(2), 105-107.
  15. Rosen, M., Brody, F., & Ponsky, J. (2002). Predictive factors for conversion of laparoscopic cholecystectomy. *The American journal of surgery*, 184(3), 254-258.
  16. Simopoulos, C., Botaitis, S., Polychronidis, A., Tripsianis, G., & Karayiannakis, A. J. (2005). Risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy. *Surgical Endoscopy and Other Interventional Techniques*, 19(7), 905-909
  17. Skonieczny, B., Pytka, M., Stefaniak, T., Skonieczny, W., Grzybowski, Z., & Śledziński, Z. (2008). Factors influencing frequency of conversion during laparoscopic cholecystectomy. *Age (median and range)*, 57(11), 14-75.
  18. Tang, B., & Cuschieri, A. (2006). Conversions during laparoscopic cholecystectomy: risk factors and effects on patient outcome. *Journal of gastrointestinal surgery*, 10(7), 1081-1091.
  19. Tayeb, M., Raza, S. A., Khan, M. R., & Azami, R. (2005). Conversion from laparoscopic to open cholecystectomy: multivariate analysis of preoperative risk factors. *Journal of postgraduate medicine*, 51(1), 17-20.
  20. Yol, S., Kartal, A., Vatansev, C., Aksoy, F., & Toy, H. (2006). Sex as a factor in conversion from laparoscopic cholecystectomy to open surgery. *JSL: Journal of the Society of Laparoendoscopic Surgeons*, 10(3), 359.