

# Conversion of laparoscopic to open cholecystectomy: a literature review

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**Abstract. Background:** Biliary pathologies are major disorders of the digestive tract. Laparoscopic cholecystectomy (LC) is the “gold standard” for the treatment of symptomatic gallstones and is associated with lower morbidity compared to open surgery. In some cases, conversion of LC to open cholecystectomy is unavoidable to prevent injury. However, can result in increased morbidity. Conversion rates depend on several risk factors. The purpose of this work is the knowledge of the features of the conversion and, especially, of the preoperative factors due to the importance of performing better surgical planning. **Methods:** Literature review conducted on Google Scholar, PubMed and Science Direct searching for free full articles using the terms “cholecystectomy”, “laparoscopic cholecystectomy”, “open cholecystectomy”, “conversion to open cholecystectomy” prioritizing the most recent literature and studies with a higher level of evidence. **Results:** Twenty articles, including a meta-analysis about preoperative risk factors for LC conversion (such as male gender, old age, obesity, previous abdominal surgery, diabetes and acute cholecystitis) were selected, after screenings were considered relevant for the purpose of this study and were integrated into this paper. **Conclusions:** The conversion to open cholecystectomy is inevitable in some cases. Knowledge of the risk factors for the conversion of LC helps surgeons to carry out better surgical planning with good judgment to perform better decisions in the face of laparoscopic surgery conditions, avoiding further complications and valuing the patient's life, which is why more studies on the subject should be encouraged.

**Keywords.** Cholecystectomy, laparoscopic cholecystectomy, open cholecystectomy, conversion to open cholecystectomy

## 1. Introduction

Biliary diseases represent important disorders of the digestive tract [1]. Biliary lithiasis is a global disease affecting about 20% of the population with a prevalence of non-symptomatic cases. The pathology causes damages in the gallbladder and the biliary tree, most of the choleliths (85%) are caused by cholesterol in Western countries [2].

Laparoscopic cholecystectomy (LC) has been the reference procedure for symptomatic biliary lithiasis for more than two decades and is considered as a routine surgery in general surgical locations around the world [3,4]. LC is also the first choice treatment for grade I (mild) AC, even though the disease was previously considered a contraindication for the laparoscopic procedure [5].

The first cholecystectomy was performed by Langenbach in 1892. However, the first successful LC

was carried out in 1985 by Eric Muhe and refined by Philip Maure [6].

Laparoscopic cholecystectomy is a safe and cost-efficient surgery associated with less postoperative pain, better recovery and cosmesis and lower morbidity compared to open surgery [3,6,7]. However, the laparoscopic procedure has complications such as gall bladder perforation, bile duct damage and hemorrhage.

About 5-10% of LC require conversion to open surgery [3,6]. The decision to convert can be difficult because results in higher morbidity, extended hospitalization and longer recovery time. Usual indications for conversion include adhesion around the gallbladder and uncontrolled hemorrhage which makes the anatomy of Calot's triangle not defined.

However, the conversion can prevent harms like bile duct injuries and better approach some intraoperative complications [3,4,8]. Conversion

rates depend on several risk factors, such as advanced age, male gender, obesity, previous abdominal surgery, diabetes and acute cholecystitis. [9].

The knowledge of the preoperative risk factors can help the surgeon to better prepare for laparoscopic intra-operative complications and to perform an early decision to convert [6].

Therefore, the aim of this study, based on a literature review, is to investigate by using advanced databases of information and gather the main and current knowledge about the conversion of laparoscopic to open cholecystectomy prioritizing the recent literature and studies with a higher level of evidence emphasizing the risk factors for this conversion.

## 2. Research Methods

This present study performed a literature review using the databases of information Google Scholar, Science Direct and PubMed. The terms used were "cholecystectomy", "laparoscopic cholecystectomy", "open cholecystectomy" and "conversion to open cholecystectomy" giving priority to the most recent articles and studies with a higher level of evidence.

The search was carried out in two stages:

(a) exclusion of repeated titles of the chosen databases;

(b) reading of the abstracts: at this stage, after reading the abstracts, articles that were not related to the purpose of this study were excluded.

Then, after these two screenings, the selected articles were fully read by critically evaluating the scientific information as recommended by Evidence-Based Medicine.

The exclusion criteria were articles that were not available in full or/and paid articles.

## 3. Results

Twenty articles, including a meta-analysis about preoperative risk factors for LC conversion (such as male gender, old age, obesity, previous abdominal surgery, diabetes and acute cholecystitis), were selected by bibliographical research for this literature review [9].

Among the articles selected for full reading, some contradicted information between articles was found. Then, priority was given to the information from the most recent studies with a higher level of evidence.

## 4. Discussion

### 4.1 Laparoscopic Cholecystectomy

Gallbladder disease is intrinsically related to hospital admissions for acute abdomen in adults and is the more usual indication for abdominal surgery in the elderly [10].

Laparoscopic cholecystectomy is a widely used technique for gallbladder pathologies and represents the "gold standard" (treatment of choice) for the treatment of symptomatic gallstones.

LC has become the procedure of choice due to this approach having advantages over open surgery, such as lower morbidity (due to minimal invasiveness of the surgery), less postoperative pain and complications, shorter hospital stays, improved cosmetic results and faster return to work. Almost a huge number of laparoscopic surgeons perform and usually begin their careers with this procedure [2, 11-13].

Despite the advantages of the surgery, there is an increased incidence of iatrogenic lesions of the biliary tract with this technique. The laparoscopic procedure requires more technique than open surgery which has more chance of damaging the common bile duct and surrounding viscera [12,13].

The complications of the laparoscopic surgery in question can be linked to surgery in general, such as complications related to anesthesia or peritoneal access (causing vascular damage), or be specific to LC (such as gallbladder perforation or bile leakage) and both complications may require conversion to open cholecystectomy [6].

However, since the first procedure, as surgeons become more experienced, the duration of laparoscopic cholecystectomy has steadily decreased which has further reduced the incidence of complications, due to a shorter duration of pneumoperitoneum that affects the cardiocirculatory function [12,13].

### 4.2 Conversion to Open Cholecystectomy

Conversion to open surgery is inevitable in some cases, then 5-10% of laparoscopic cholecystectomy still has to be converted in the course of the surgery to prevent damage, treat intraoperative complications such as bile duct injury, better understand incomprehensible anatomical relations or treat associated disease. Conversion usually indicates a hard procedure [3,6].

The conversion should not be seen as a complication or a technical failure, but considered as a better surgical practice for the patient and the surgeon when conversion is indicated aiming at a safe approach and sound surgery. Therefore, the decision should be taken into consideration as a sign of appropriate judgment in the appearance of unusual conditions [3,15,16].

The difficult dissection of Calot's triangle due to factors such as serious inflammation (caused by acute cholecystitis) or dense adhesions (caused by repeated attacks of cholecystitis) represents the most common cause of conversion [14,15].

Despite the improved training of surgeons and better laparoscopic instruments, the conversion rate has remained relatively stable [15]. With the loss of the

benefits of minimally invasive surgery, conversion to open surgery also causes longer hospital stays, more morbidity and increased costs [17].

Conversion to open cholecystectomy is also associated with complications, including death, damage to the bile ducts, bile leak and hemorrhage which may require reoperation or blood transfusion. However, the conversion to open surgery can avoid many complications such as an injury to the biliary tree [14, 18,19].

There are several risk factors that affect the odds of conversion from laparoscopic cholecystectomy to open surgery. Knowing the preoperative factors related to conversion is the key to improving patient safety redefining the treatment strategy and becoming a better surgical planning [9,14].

Therefore, the knowledge of the risk factors for LC conversion helps to predict the difficulty of the procedure and to perform an early decision, which would allow the surgeon to better inform patients about the risk of the conversion, and also help reduce the overall therapy cost [6,11].

Male gender, old age, obesity, previous abdominal surgery, diabetes and acute cholecystitis are risk factors that increase the probability of laparoscopic cholecystectomy conversion [9].

Although the prevalence of gallstone disease is more common in women, males are considered a risk factor for conversion. The reason why men are more likely to convert to open surgery is not certain, but may be related to the distribution of body fat, which makes the laparoscopy more complicated.

Another possible explanation for the men's predisposition to LC conversion is the lower demand for medical advice compared to women, which makes the severity of the disease higher when they are submitted to surgery. Inflammation and dense adhesions were often cited as reasons for the conversion of LC in men [9,14].

It is possible to state that older people, between ages over 60 years, have a longer history of gallstones and a biggest number of cholecystitis attacks, which are related to the fact that ages over 60 are a frequent risk factor for laparoscopic conversion [9].

Obesity is a major risk factor for LC conversion due to various factors such as excess intra-abdominal fat and difficult liver mobilization which is related to the thickness of the abdominal wall, which makes difficult surgical movement [9]. The situation for these patients is aggravated especially by factors such as the surgeon's lack of experience or the fact that the trocar and instruments are too short [1].

Peritoneal adhesions that may exist due to previous abdominal surgery make it difficult to perform gallbladder dissection due to visual blockage of access to the gallbladder and therefore this type of previous treatment represents a risk factor for LC conversion. There is a prevalence of risk factors in

upper abdominal surgery history [1,9].

Diabetes was associated with a major risk of conversion to open cholecystectomy, probably due to the presence of acute inflammation or abdominal wall changes because of microvascular pathologies.

The higher risk of conversion the laparoscopic cholecystectomy in open surgery in diabetics may also be associated with late diagnosis due to the failure to develop symptoms of gallbladder disease early by neuropathy characteristics of obesity.

Acute cholecystitis is a risk factor for LC conversion due to technical difficulty in managing severe inflammatory adhesions around the inflamed gallbladder, making it difficult to dissect the Calot's triangle and identify the local anatomy [9].

However, although AC has been considered a contraindication to LC, early LC is the procedure of choice for grade I (mild) AC, according to the Tokyo Guidelines (Tokyo Guidelines 2013 provided the diagnosis and severity of acute cholecystitis). At the same time, LC is not so recommended by the same guidelines for moderate acute cholecystitis, due to the inflammatory changes [5,20].

## 5. Conclusion

Laparoscopic cholecystectomy is the "gold standard" for the intervention of symptomatic gallstones [13]. This laparoscopic surgery has advantages over open surgery such as reduced postoperative morbidity [12, 13].

However, LC has complications such as gallbladder perforation or bile leakage and these two complications may require conversion to open surgery [6]. Moreover, the most common conversion factor is linked to Calot's triangle dissection [14].

Conversion to open cholecystectomy occurs in 5-10% of cases [3] and is performed with the purpose of preventing injuries, treating intraoperative complications, better understanding confused anatomical relations or treating associated pathologies. Conversion usually indicates a hard surgery [3,6].

The conversion should not be understood as a complication or a technical failure, but rather can be taken into account as good judgment on the part of the surgeon in the face of adverse conditions [3,15].

Conversion causes longer hospital stays, more morbidity, makes costs higher [17] and generates complications including death and bile duct damage which may require reoperation or blood transfusion [14].

Risk factors that increase the likelihood of conversion are: male gender, old age, obesity, previous abdominal surgery, diabetes and acute cholecystitis. [9]

This study aimed to investigate and gather

information on the conversion of laparoscopic cholecystectomy to open surgery through a literature review, in order to prioritize the most current information on the subject and the articles with the highest level of evidence, with an emphasis on the risk factors for this conversion due to the knowledge of the risk factors for LC conversion helps the surgeon to perform a better surgical plan and an early decision to convert the procedure [6, 9].

More studies on the subject should be encouraged, in order to aid surgical judgment and decision-making in the face of LC adverse conditions, avoiding further complications and valuing the patient's life.

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