



# OPEN CONVERSION IN LAPAROSCOPIC CHOLECYSTECTOMY – A SURGICAL TECHNIQUE TO AVOID BILE DUCT INJURIES

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**Abstract:** Introduction: Biliary gallstones are one of the most common benign pathologies. Complications of bile duct injuries, especially in the setting of surgically difficult gall bladders are extremely difficult to treat, sometimes subsequently leading to the stenosis of the bilio-enteric anastomosis, which require either hepatic resections or even transplants. Results: The conversion rate in our case study is 1.51%. In the case of those converted to open abdomen (OA) the mean duration of hospitalization was 7 days. The cause of the conversion to OA was mostly represented by the inability to correctly identify the anatomy of Calot's triangle and obtaining an adequate CVS due to an inflammatory plastron. Conclusions: Laparoscopic cholecystectomy, although a gold standard in the treatment of biliary gallstones, is accompanied by a fairly high rate of bile duct injuries. Conversion in the OA should not be considered a failure but a safer way to treat acute cholecystitis with an intense inflammatory process

## INTRODUCTION

Biliary gallstones are one of the most common benign pathologies. Their reported incidence in the northern hemisphere ranges around the value of approximately 10% of the general population.(1) With the introduction of the first laparoscopic cholecystectomy (LC), performed by Muhe in 1986 and Mouret in 1987, LC became the gold standard treatment for symptomatic gallstone disease.(2,3) The procedure rapidly gained popularity in the United States. The current demographic data available revealed that the number of LC reached approximately 900,000 LC performed annually, only in the United States. The advantages of this method are obvious in comparison to open cholecystectomy, the first being a minimally invasive approach, allowing a much more accurate view of the elements of Calot's triangle requiring a significant decrease in the use of postoperative analgesia, with patients experiencing a more rapid recovery, thus avoiding laparotomy's potential complications and a subsequent decrease for the costs of hospitalization.(4) Despite these advantages, the most significant reported complication in LC, is represented by iatrogenic bile duct injuries (BDI).(2) Complications caused by these inadvertent injuries, especially in the setting of surgically difficult gall bladders are extremely difficult to treat, sometimes subsequently leading to the stenosis of the bilio-enteric anastomosis, which require either hepatic resections or even transplants.(2) One of the “bail-out techniques” usually used, and generally accepted is the conversion to open surgery which according to different studies varies between 1.2% - 6.2%.(5) Although LC is the gold standard, the BDI rate has not substantially improved, bearing a reported frequency of 0.2% - 1.5%. The BDI rate in open approach (OA) surgery is lower, ranging from 0.1% -0.2%.(6) Certain techniques such as critical

view of safety approach (CVS), fundus down cholecystectomy, subtotal cholecystectomy (STC) and intraoperative cholangiography, seek to decrease the frequency BDIs.(7,8)

## AIM

The aim of the present study was to evaluate a consecutive series of 396 LCs, where we have tried to highlight the preoperative and intraoperative risk factors that could predict or decide in favour of the conversion of LC to OA.

## CASE REPORTS

Our study consists of a case series of 6 patients who were converted from an initially planned laparoscopic approach to an open abdomen approach. The patients were selected from a total of 396 consecutive LC performed in a tertiary University Hospital (Cluj-Napoca Municipal Hospital), over a period of two years (01.2020-01.2022). All patients were consented for the risk of OA conversion of any other potential “bail-out techniques” that could be used to treat the initial acute state.

Patient number 1 is a 64-year old female patient, with a personal history of arterial hypertension. She was admitted to the Emergency Department (ER) with right upper quadrant (RUQ) pain, nausea, vomiting, symptoms which have persisted for four days prior to hospital admittance. At the emergent abdominal ultrasound investigation, the gallbladder's wall thickness was of 4 mm in short axis, with two additional hyperechoic large (>1.5 cm in width) gallstones impacted at the level of the gallbladders' neck. The need for conversion to OA was made after 30 minutes, because of an uncontrollable hemorrhage caused by the dissection of the inflammatory adhesences around the gall bladder. After the conversion to an OA, a “fundus first”/“top down”/“anterograde” cholecystectomy

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## CLINICAL ASPECTS

was the conduit of choice for the “bail out technique”. The final pathology report revealed an acute cholecystitis with gallbladder empyema.

Patient number 2, was a 76-year old female, with a history of ischemic cardiomyopathy and arterial hypertension who was admitted to our institution for intermittent RUQ pain and nausea, symptoms which were constant for the for five days, prior to hospitalization. The abdominal contrast-enhanced CT scan revealed a communication between Hartmann’s pouch and the common biliary duct (CBD). The decision of converting to an OA was made based on the inability to correctly identify the anatomy of Calot’s triangle and achieving a CVS, after sixty minutes from the initial trocar insertion. After the conversion to an OA, a “fundus first”/“top down”/“anterograde” cholecystectomy was the conduit of choice for the “bail out technique”. The final pathology report was that of a fistula between Hartmann’s pouch and the CBP associated to an acute cholecystitis.

Patient number 3 was a 48-year old female with a personal history of arterial hypertension, hepatic steatosis and hypercholesterolemia. She presented to the ER with intense RUQ pain baring an onset of 12 days. The abdominal US revealed a gallbladder wall thickness of about 5 mm. The reason lead into an OA conversion was the inability to correctly identify the anatomy of Calot’s triangle and achieving a CVS due to a subhepatic inflammatory plastron. LC was abandoned and conversion to an OA was decided after 45 minutes from trocar insertion. As per the first two cases, after the conversion to an OA, a “fundus first”/“top down”/“anterograde” cholecystectomy was the conduit of choice for the “bail out technique”. The final pathology report revealed an acute gangrenous cholecystitis with gallbladder empyema and subhepatic plastron.

Patient number 4 was a 62-year old male with a history of arterial hypertension and obesity, who presented to ER with severe RUQ pain, nausea, and vomiting, symptoms, escalating in the previous 12 days, prior to hospital admittance. The conversion of the initial LC to OA was made due to the identification of a subhepatic inflammatory plastron which did not facilitate the achievement of the CVS. The duration of the surgery until OA conversion was of 35 minutes. The final pathology diagnostic was that of an acute gangrenous cholecystitis, and subhepatic inflammatory block. After the conversion to an OA, a “subtotal cholecystectomy (SC) was the conduit of choice for the “bail out technique

Patient number 5 was a 90-year old female with a history of arterial hypertension and ischemic cardiomyopathy. She was admitted to the ER with severe RUQ pain and nausea. The gallbladder’s wall thickness measured at abdominal US was 6 mm and the patient had a subhepatic abscess. After the conversion to an OA, a “fundus first”/“top down”/“anterograde” cholecystectomy was the conduit of choice for the “bail out technique” due to a hemorrhage from an aberrant cystic artery. As per the above-mentioned cases, after the conversion to an OA, a “fundus first”/“top down”/“anterograde” cholecystectomy was the conduit of choice for the “bail out technique”. The final pathology report described the presence of gangrenous cholecystitis, gallbladder empyema and subhepatic abscess.

Patient number 6 was a 61-year old male, known with a history of a replaced mechanical aortic valve, under coumarin oral anticoagulant (overdosed prior to hospital admission – INR Of 4.9), old stokes with right hemiplegia and obesity. He was admitted to the ER with severe RUQ pain and nausea, symptoms that had a 7 day-old onset. The patient’s family doctor converted the patient to LMWH on preoperative day 7. After the conversion to an OA, a “subtotal cholecystectomy (SC) was the conduit of choice for the “bail out technique, performed after 30

minutes from trocar insertion.

From the remaining 390 patients, 213 of them had acute cholecystitis confirmed by abdominal US or CT scan and anatomo-pathological results.

The technique used for LC was the same for all the patients. A four port technique is employed in the American position. Open access cholecystectomy is established through a supraumbilical 10 mm port and three 5 mm epigastric, subcostal and right flank ports. Any of the 5 mm ports could have been used to manage the fundus of the gall bladder.

## DISCUSSIONS

The conversion rate in our case study is 1.51%. Out of the six OA conversions, four were “fundus first”/“top down”/“anterograde” approaches and two SC. In the cases where the SC was the conduit of choice, the gallbladder’s transection was made at the level of Hartmann’s pouch, which was later sutured with resorbable multifilament polyglycolic acid sutures. In the cases where we have decided to perform a “fundus first”/“top down”/“anterograde” cholecystectomy, we had no postoperative complications. When it came to the SCs, a biliary leakage 150 ml/24 hours was observed in the postoperative period. In one case there was a spontaneous stop after 5 days of evolution and in the other case, the leakage was due to remained impacted gallstones in duct bile. ERCP with computational extraction was used to resolve this situation.

The length of in-hospital stay for LC was approximately 84 hours. In the case of those converted to OA, the mean duration of hospitalization was 7 days. Most of the patients in our study are females, representing 66%. The age of the converted patients ranged from 48 to 90 years with a mean average of 66 years. The duration of the evolution until hospital discharge was between 4 and 12 days with mean of 7 days. The cause of the conversion to OA was mostly represented by the inability to correctly identify the anatomy of Calot’s triangle and obtaining an adequate CVS due to an inflammatory plastron. In two of the cases, along to the the inflammatory phenomena, an uncontrollable hemorrhage prevented minimal invasive approach. At diagnosis, the imaging reported gall bladder’s wall thickness ranged from 3 to 8 mm. No CBD or other type of biliary duct injuries were noted, neither in LC or OA conversion with either “bail out techniques” used.

After the introduction of LC, this procedure quickly became the gold standard for treating gallstones. Even though at the beginning of the widespread of the LC technique, acute cholecystitis was considered a contraindication of this approach, to this day, this anecdotic reason has been abandoned. The aim of our current case-series was to identify the risk factors that lead to OA conversion. Numerous studies tried to identify both the preoperative and intraoperative risk factors that could predict OA conversion.(4,11,12) Due to the huge number of interventions performed worldwide and the fact that compared to this number of studies are few, it is extremely difficult to identify and harmonize these factors. The most feared complication of LC is represented by bile duct injuries (BDI).(13,14) Despite the fact that surgical teams have reached a significant number of procedures performed, which lead to the accumulation of experience BDIs have not decreased in frequency, ranging from reported values of 0.2-1.5%.(2,9,10) In open cholecystectomy the percentage of BDIs is lower ranging between 0.1-0.2%.(6) Some authors cite another anecdotic reason for this, which could consist in a better haptic feedback offered by the open approach, or betted CBD instrumental exploration.

Heinrich et al reports that every major BDI hides 29 minor every major injury of bile duct there were 29 minor injuries and 300 non-injuries accidents or near misses (figure no.

## CLINICAL ASPECTS

1).(9) Therefore, the real number of bile duct injuries is significantly higher than what was reported.

**Figure no. 1. Heinrich Pyramid**



To avoid the intraoperative risk of BDI, Strasberg et al, established the CVS criteria which are: hepato-cystic triangle is cleared of fat and fibrous tissue; the lower one third of the gallbladder is separated from the liver to expose the cystic plate and two and only two structures should be seen entering the gallbladder. If this desideratum cannot be reached due to the difficult local conditions, we have another anatomical landmark that we should not exceed, this being represented by the imaginary line drawn between the Rouvier cleft and the base of the hepatic segment IV.(15)

In this study we have further tried to identify in the current existing literature the preoperative risk factors that led to the conversion. Gender - in the vast majority of studies, male gender is predominant. This predominance is due to the fact that male patients have the tendency to later address to their physician, after a prolonged onset and natural history of the disease with a more severe inflammatory state. In our case, the female gender is dominant, being represented in 66% of the patients.

Age - several studies report that an age over 65 is a risk factor for conversion. These data are also consistent with our case-series with patients' age varying between 48-90 years, with a mean age of 66 years. The gallbladder's wall thickness of more than 5 mm is a predictive factor for the risk of conversion. This is also true for our case series with the imaging documented thickness of the wall varying between 3 to 8mm.

Acute cholecystitis plays a major role due to the inflammatory reaction that develops around it leading to an acute pericholecystic fibrosis aggravated in the case of concomitant empyema, perforation, and pericholecystic fluid. All 6 patients converted to open abdomen had acute cholecystitis in severe forms from phlegmonous to gangrenous with subhepatic inflammatory plastrons (4 cases) and one with cholecysto-biliary fistula. Stone in the gallbladder neck and biliary fistulas are predictive factors for conversion, this is also confirmed by our case study. Two patients with gallbladder neck stones and one with gallbladder-biliary fistula were converted to OA.

The timespan between the onset of symptoms and the hospital admission time plays an important role. All studies confirm that the optimal interval from the onset of symptoms is 3 days. There is the concept of 3 golden days. In our case, only one patient had a symptom onset of 3 days, all others exceeding this interval, with two of the patients having already 12 days of symptomatic disease.

In our case, we did not consider investigating or reporting comorbidities such as diabetes mellitus, liver cirrhosis, or previous interventions in the upper abdomen (since none of the patients reporting having such concomitant pathologies). The conversion to OA is made after laparoscopic exploration and thorough attempts to release the gallbladder from its inflammatory adhesions. Open conversion should not be regarded as a complication or a failure in LC. It is occasionally

the safer option for the patient when encountering a difficult gallbladder.(1,2)

The main factors that lead to conversion are represented by the local inflammation preventing the correct dissection of the Calot triangle. A study published in the World Journal of Emergency Surgery seeks to establish a severity score for cholecystitis based on laparoscopic exploration (figure no. 2). A score higher than 5 is associated with a conversion rate of 33%.(6,16)

**Figure no. 2. Severity score for cholecystitis based on laparoscopic exploration**

Cholecystitis severity	Score
Appearance	
Adhesions < 50% of GB	1
Adhesions > 50% but GB buried	2
Completely buried GB	3 (max)
Distension/contraction	
Distended GB or contracted shrilled GB	1
Inability to grasp without decompression	1
Stone > 1 cm impacted in Hartmann's pouch	1
Access	
BMI > 30	1
Adhesions from previous surgery limiting surgery	1
Sepsis and complications	
Free bile or pus outside the gallbladder	1
Fistula	1
Total possible	10

In our case study we had patients with an intraoperative score between 5 and 9. The highest score was given to patient 6.

Regarding the safe technique in conversion Strasberg points out that in order to avoid severe biliary vascular injuries concluded that fundus down technique should be strictly avoided for AC cases with severe inflammation. In our case study we performed 4 "fundus first"/"top down"/"anterograde" cholecystectomies after a difficult but correct identification of Calot's triangle elements. In two other cases of difficult cholecystectomy we practice SC. To be a sure gesture, Hartmann's pouch was sectioned at least 1 cm above the imaginary line drawn between the Rouvier cleft and the base of the IV segment.(17,18)

In the case of severe lesions of the bile ducts, complications can be extremely serious leading to severe repetitive cholangitis, liver resections or liver transplantation. Mortality can reach up to 21%, which is extremely serious.(19,20)

## CONCLUSIONS

Laparoscopic cholecystectomy, although a gold standard in the treatment of biliary gallstones, is accompanied by a fairly high rate of bile duct injuries. Conversion in the OA should not be considered a failure but a safer way to treat acute cholecystitis with an intense inflammatory process. Predictive factors for preoperative conversion in our case series found in the literature were also represented by acute cholecystitis with severe inflammatory disease, gallbladder wall thickness determined by US and CT, impacted gallstones in gallbladder neck, pericholecystic abscesses, gallbladder fistula, advanced age and duration between the symptoms and the presentation to the doctor.

In case of conversion, the preferred surgical technique was fundus down cholecystectomy. In difficult cholecystitis with the impossibility of correctly identifying the elements of Calot's triangle, we preferred to perform a subtotal cholecystectomy. These are safe techniques, but small disadvantages could be the extension of the duration of the procedure, an extension of the in-hospital stay interval and a higher complication rate than in the case of LC.

The intraoperative predictive score of the conversion was based on the G10 score. The pathology is vast, making it difficult to make effective preoperative predictability possible. The future lies in multicenter studies that can develop guidelines such as the Tokyo guideline or IRCAD recommendation.

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