

The Association of Preoperative Risk Factors for Laparoscopic Conversion to Open Surgery in Elective Cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy is a common operation worldwide, with low mortality (0.01%) and morbidity (2–8%). It has been reported 2.9 to 3.2% of elective laparoscopic cholecystectomies are converted to open surgery. Converted cases are associated with increased complications rates.

Method: Two thousand and seventy-five patients, 82.8% females and 17.2% males who underwent elective laparoscopic cholecystectomy in our hospital, between March 1, 2016, and February 28, 2018, were prospectively collected in a database. Pearson's Chi-squared and Fisher's exact tests were used to determine significance, with $p < 0.05$ deemed statistically significant. We analyzed seven risk factors associated with conversion to open surgery; age, gender, body mass index (BMI), previous abdominal surgeries, the presence of contracted gallbladder, Mirizzi syndrome, or choledocholithiasis. Laparoscopic cholecystectomy was performed using a 3-port technique (73%) and a 4-port technique (27%).

Results: Finding associated "strong" factors to conversion: male patients, >60-years-old, previous upper abdominal surgery, contracted gallbladder, Mirizzi syndrome or choledocholithiasis. The presence of a higher or lower BMI did not influence the rate of conversion. The most impact association were males over 60 years, and males with an earlier upper abdominal surgery.

Conclusion: Laparoscopic cholecystectomy is the gold standard for gallstones and gallbladder disease; however, inflammation, adhesions, and anatomic difficulty continue to challenge the use and safety of this approach in a small number of patients. This study identifies predictors of choice for open cholecystectomy. In view of the raised morbidity and mortality associated with open cholecystectomy, distinguishing these predictors will serve to decrease the rate of conversion and address these factors preoperatively.

Keywords: Cholecystectomy, Conversion, Conversion to open surgery, General, Laparoscopic, Laparoscopy, Risk factors cholecystectomy, Surgery.

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INTRODUCTION

There is a worldwide consensus in recognizing Dr Erich Mühe (Böblingen, Germany), as the first to perform a laparoscopic cholecystectomy on September 12, 1985, at Böblingen County Hospital was head of surgery since 1982.^{1,2} The publication in 1986, followed by the presentation at the Annual Congress of the German Surgical Society (GSS), generated rejection and disapproval on the part of the German Medical Society; as it usually happens before the birth of a new approach and the replacement of an old paradigm.² Phillipe Mouret (Lyon, France) in 1987 and Francois Dubois (Paris, France) in 1988, were known as the pioneers in laparoscopic cholecystectomy. Although Mühe did more than 90 procedures of this type before than Mouret, and 20 months before Dubois.³ However, it recognizes the impetus given by Mouret and Dubois to the video-laparoscopy technique made it quickly position itself worldwide as safe and reliable. Followed by other notable surgeons in the late 1980s, like; Perissat and Reddick, in 1988; Berci and Cuschieri, in 1989, and so on, the beginning of the training of large groups of doctors worldwide.^{4,5}

In 1992 during the 109th Congress of the GSS, 6 years after being disapproved by this same association, Mühe was awarded; in the words of its president Franz Gall: "For one of the greatest and most original achievements of German medicine in recent history." But was until 1999, during the annual convention of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) in San Antonio, Texas, that Mühe was recognized for performing the first laparoscopic cholecystectomy in the world.⁶

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Since the first laparoscopic cholecystectomy, the interest that the procedure awakened in the world's great biotechnology companies allowed the design and accelerated development of biomedical materials, and products in the next decades. Technological innovations, together with the training, and the experience that was accumulating, is how this technique is

nowadays the gold standard for the surgical management of gallbladder pathologies, in cases of emergency and elective surgery, with very few exceptions; mainly gallbladder cancer and advanced Mirizzi syndrome.

The conversion of laparoscopic cholecystectomy to open cholecystectomy has been reported in various ranges (2–10%).⁷ In cases of surgical emergency, the percentage of conversion can rise to 20%. In the literature, risk factors associated with the possibility of conversion have been mentioned, among the most indicated are male gender, obesity, age above 60 years, upper abdominal surgeries, and the presence of a contracted gallbladder or a Mirizzi syndrome, have been associated as factors for higher conversion rate.^{8–10} Those cases associated with emergency situations will not be focused on in the present work. The purpose of this study is to see the relevance of preoperative patient-related characteristics for the conversion of elective laparoscopic cholecystectomy to open surgery, in patients with gallstone disease.

MATERIALS AND METHODS

Our reported case series study was conducted prospective mannerly, at the Department of Hepato-Pancreato-Biliary surgery at our hospital. All patients between March 1, 2016, and February 28, 2018, where 2,075 patients, of whom 1,718 were females and 357 males. All of them were operated initially as elective laparoscopic cholecystectomy, after a complete protocol in the outpatient clinic. Oncologic cases were excluded.

Statistical analysis was performed with SPSS software (version 11.0; SPSS Inc., Chicago, Illinois). Descriptive statistics and odds ratios were calculated to evaluate the relationship between each of the risk factors for conversion to open surgery. Pearson's Chi-squared and Fisher's exact tests were used to determine significance, with $p < 0.05$ deemed statistically significant.

The medical charts were reviewed to record the following data: age, gender, weight, height, comorbidities, previous superior or inferior abdominal surgeries, indication for conversion surgery, complications, bleeding, surgery time. The study was presented and approved by the regional ethics committee.

Operative Technique

With the patient under general anesthesia. The most commonly used technique for abdominal access was the open technique, as described by Hasson¹¹ (a closed technique with the Veress needle was used in only 4.2%). All ports are inserted under direct visualization, with a 12 mm supra or trans umbilical and epigastric ports (first and second ports), and one 5 mm port along the right costal margin (third port); the fourth port was necessary for 27% of patients (560/2,075). Then the anterior and posterior peritoneum was dissected. The critical view of safety is always enforced. The cystic duct and artery, are doubly clipped inferiorly and once superiorly, and then divided. Followed by the separation of the gallbladder to its liver bed, with electrocautery. The gallbladder, once freed, is removed from the abdomen through the epigastric or umbilical port. The use of drainage (69%), and hemostatic agents, used to the surgeon's criteria.

RESULTS

All patients were operated on as an elective laparoscopic cholecystectomy by the Department of Hepato-Pancreato-Biliary

surgery between March 1, 2016, and February 28, 2018, where gathered. A total of 2,075 patients were collected, 82.8% females and 17.2% males (4.8:1), with a mean age of 43.5 years (48.6 in men and 42.3 in women, and total range from 17 to 94 years). The mean BMI was 27.9, with a mean weight of 69.6 kg and 1.58 m of height. The mean surgery time was 79 minutes (190 minutes in converted surgeries compared to 76 minutes in none converted); and a range of 15 to 428 minutes, and mean bleeding of 43 mL (334 mL in converted surgeries compared to 36 mL in none converted), with a range of 5 to 1500 mL.

Encountering a total of 50 patients that were converted to open surgery (2.40%), from whom males had a 4.76% conversion rate and 1.92% in females (17 males and 33 females). The most common cause for conversion to open surgery was an anatomic distortion (46%), followed by choledocholithiasis (18%) and bleeding (12%), among others. We presented four deaths; all of them secondary to abdominal sepsis originated from a pycholecystitis, two of them had a conversion surgery secondary to an anatomic distortion. The overall mortality was 0.19% (4.0% in converted surgeries, compared with 0.09% in none converted).

Age

At the moment of surgery, higher age was presented in male patients (48.6 vs 42.3). From all patients we found a higher conversion rate among the group with 60 or more years, presenting a conversion rate of 4.9% ($p = 0.002$, OD 0.396, CI 95%: 0.21–0.73) compared to 2.0% the group from under than 60 years. This outcome was also encountered when analyzing the age–gender association (1.6 vs 4.0% in females with a $p = 0.003$, and 4.0 vs 7.1% in males, respectively, $p = 0.001$).

Gender

In male patients, a 4.76% of conversion rate was presented, in contrast to 1.92% in female patients, finding statistical significance ($p = 0.002$, OD 0.396, CI 95%: 0.21–0.71).

Body Mass Index

Our population were 33.5% of normally weighted patients (BMI <25), 38.5% of overweight (BMI 25–30), and 28.0% of obese patients (BMI >30). At the moment of surgery, a higher BMI was presented in females compared to male patients (28.1 vs 27.2). From the conversion to open surgeries we presented a slightly lower rate in overweight and obese patients (2.55%), than normal-weight patients (2.77%); none of these presented statistical significance ($p = 0.403$, OD 1.086, CL 95%: 0.50–2.34).

Previous Surgery

Of all the patients, 43.1% had previous abdominal surgery, in whom 86.2% of them were gynecological or obstetrical surgeries, appendectomies were 9.2% and only 4.6% had operations corresponding to the upper half of the abdomen. The conversion rate for patients with previous surgeries was 2.4% (Table 1). Although the presence of surgeries did not show statistical significance, ($p = 0.5457$, OD 0.870, CL 95%: 0.41–1.82) when we divided upper and lower abdominal surgeries, we encounter a 1.9% of conversion rate in lower abdominal surgeries, compared with 15.0% in upper abdominal surgeries ($p < 0.001$, OD 9.196, CI 95%: 2.28–37.04). Employing this, 14.3% in patients with only one upper abdominal surgery, as mentioned before, rose to 33.3% when two or more upper abdominal surgery were reported ($p < 0.001$).

Table 1: Relation between previous surgeries and conversion rate

Surgeries	Females		Males		Total	Females		Males		Conversion				
0 Cx Total	471	72.6%	178	27.4%	649	12	2.5%	6	3.4%	18	2.8%	Superior	Inferior	
2 Cx Total	281	89.5%	33	10.5%	314	8	2.8%	2	6.1%	10	3.2%	3	9	12
Inf	278	92.7%	22	7.3%	300	8	2.9%	0	0.0%	8	2.7%	20	478	498
Sup	3	21.4%	11	78.6%	14	0	0.0%	2	18.2%	2	14.3%	15.0%	1.9%	2.4%
2 Cx Total	120	99.2%	1	0.8%	121	2	1.7%	0	0.0%	2	1.7%	Males	Females	
Inf	114	99.1%	1	0.9%	115	1	0.9%	0	0.0%	1	0.9%	2	1	Upper
Inf + Sup	3	100.0%	0	0.0%	3	0	0.0%	0	0.0%	0	0.0%	11	9	
Sup	3	100.0%	0	0.0%	3	1	33.3%	0			33.3%	18.2%	11.1%	
3 Cx Inf	46	100.0%	0	0.0%	46	0	0.0%	0		0	0.0%	0	9	Lower
4 Cx Inf	14	100.0%	0	0.0%	14	0	0.0%	0		0	0.0%	23	455	
Total	932		212		1,144	22		8		30	2.6%	0.0%	2.0%	

Four different groups were divided by the number of previous surgeries, gender, and type of surgery. Conv, conversion; Inf, inferior abdomen surgery; Sup, superior abdomen surgery; Sx, surgery. Bold values represent the highest percentages by association

Contracted Gallbladder

From the total of our patients, contracted gallbladders were encountered in 1.6% of the patients (36.8% were males and 63.2% females). The conversion rate was 10.5% ($p < 0.020$, OD 4.921, CI 95%: 1.10–21.90), all of them in the female group.

Mirizzi Syndrome

From the total of our patients, Mirizzi syndrome was encountered in 1.8% of the patients (30 females, and 8 males). The overall conversion rate in this group was 42.1% ($p < 0.001$, OD 42.840, CI 95%: 20.69–88.70). Although Mirizzi type I is frequently sub-register in our service, we encounter a 26.9% of conversion rate in this type of Mirizzi syndrome, compare to type II–V with a 75% conversion rate.

Choledocholithiasis

Choledocholithiasis was presented in 21 cases, the need for conversion to open surgery was presented in 13 patients ($p < 0.001$, OD 88.58, CI 95%: 34.64–226.51). From the 13 patients converted, five of them had a history of one or multiple failures by an endoscopic retrograde cholangiopancreatography (ERCP), all of them achieving a successful calculus extraction with open surgery.

DISCUSSION

Laparoscopic cholecystectomy is one of the most common operations in the world, and the everyday challenge for general surgeons usually performed as elective surgery with low mortality (0.01%) and morbidity (2–8%).^{12–14} In most recent studies, it has been reported that 2.9 to 3.2% of elective laparoscopic cholecystectomies are converted to open surgery. Converted cases are associated with a 9-fold increase of trans and postoperative complications (13–18.7%), increased risk of reoperation, infection, higher length of stay, and mortality (2.4%).¹⁵

Since the first laparoscopic cholecystectomy in 1985, a decade was needed to become the gold standard. Despite the advancement of minimally invasive techniques and equipment, there are several situations that a surgeon may find the need to convert it to an open surgery. This is influenced by various factors, from surgeon skill, experience, and comfort with both laparoscopic and open techniques, as well as patients' factors, like anatomy, presented pathology, among others. Identifying high-risk patients

depending on their risk factors preoperatively may lead to a better preoperative workout and study, as well as a surgical strategy.

Some may consider conversion to open surgery as a complication, and some may say that it is a mature judgment for preventing disastrous complications. Whatever the case may be, this always depends on the surgeon's criteria. In our study, the most common occurrence was anatomic distortion. That by doing so, the advantage of palpation and tactile sensation of the surgeon, improves the sense of anatomy.

The prevalence of gallstones disease is three to four times more common in women than in men.¹⁴ However, in our study, the risk of conversion is 2.8 times higher among men. Another important factor present in most of the reported literature is age, using a cutoff of 60 to 70 years. We used 60 years as a cutoff, and it presented statistical significance comparing both groups, when associating gender with age, the presence of more than 60 years increased a 1.5 and two times the risk for conversion. Although, we found a higher conversion rate (6.67%) in elderly patients (>70 years), compared to younger patients (<70 years), as reported in previous studies.¹⁶ This could be explained due to a long progression of the disease, as well as a higher number of inflammation episodes. Comparing gender with previous abdominal surgeries, the conversion rate for males was 8.8%, while in females was 1.9%. This could be associated, that most female abdominal surgeries being gynecological or obstetrical surgeries, which is not associated with many intra-abdominal adhesions in the upper abdomen. When analyzing the patients with previous abdominal surgeries, we found that in patients with lower abdominal surgeries, only 0.8% resulted in a conversion surgery due to the surgical antecedent, in contrast, with 13% of conversion in patients with the story of upper abdominal surgeries. Furthermore, comparing upper abdominal surgeries, the conversion rate in males was 18.2%, against 11.1% in females, making the association of gender with previous upper abdominal surgeries, 3.8 times more likely to be converted to open surgery in males, and 5.7 times in females.

Mirizzi syndrome as reported by Beltran has a prevalence of 5.7%.¹⁷ Although, in our study we presented a prevalence of 1.8% (26 type I; 11 type II–IV; and 1 type V Mirizzi syndrome), probably because most Mirizzi syndrome is shown in emergency scenarios, also taking into consideration that in uncomplicated cases, type I Mirizzi syndrome is usually sub-registered. Compared to, presenting a prevalence of Mirizzi syndrome type II–V, as reported on international literature.¹⁸ In experienced hands Mirizzi syndrome

type I can be resolved laparoscopically, but poorly skilled hands are a common cause of conversion and injury of the extrahepatic bile duct. Mirizzi syndrome type II or higher requires more complicated surgical repair, usually bilioenteric with an open technique, and requires a highly trained surgeon, in this type of intervention. Therefore, presenting a conversion rate of 75% in our study.

Other reasons for conversion can be related, in addition to the experience of the surgeon, with limited access to adequate materials, and equipment at the time of surgery, for example, when it is necessary to perform instrumental exploration of the bile duct with trans-operative radiology, in the presence of choledocholithiasis.

Obesity has been associated with an inadequate trocar placement, abundant fatty tissue around the Calot's triangle, an inability for liver retraction, making it more difficult the realization of a critical safety view. Associating this as a risk factor for conversion to open surgery.¹⁹ By another hand, in our study, we do not find any difference between obese, overweight, and normal-weight patients and conversion. This, when associated with gender, we found that in obese males the conversion rate was increased to 6.12%, although, with no statistical significance ($p = 0.8140$).

CONCLUSION

We concluded that important risk factors for conversion to open surgery were male patients, over 60-years-old, the presence of a previous upper abdominal surgery, a contracted gallbladder, Mirizzi syndrome, or choledocholithiasis. The presence of a higher or lower BMI did not influence the rate of conversion. The most impact association was males over 60 years and males with an earlier upper abdominal surgery. So we recommend in this scenario, the patient be well informed and surgeons prepared to perform conversion to open surgery.

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