Can we predict the risk of conversion in elective laparoscopic cholecystectomy?

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Can we predict the risk of conversion in elective laparoscopic cholecystectomy?

AIM: *Cholecystectomy is one of the most common operations. Laparoscopic cholecystectomy has become the golden standard. Yet, conversion to open cholecystectomy is necessary in some patients. However, conversion maybe associated with increased complications and operation time.*
MATERIAL AND METHODS: *The files of 1224 patients patients underwent scheduled elective cholecystectomy were reviewed in a retrospective cohort study. The files of patients who underwent open cholecystectomy operations during the same period were also examined. The demographic data, medical history, operation notes and reasons of conversion were evaluated.*
RESULTS: *The total number of patients who were initiated a laparoscopic operation but converted to open cholecystectomy was 28 (2.28%). A total of 89 patients underwent open cholecystectomy including converted cases. In the regression analysis age, adhesions, edema in the gallbladder, bleeding, previous scar tissue were found to be significantly related to conversion, while sex and higher BMI were not.*
CONCLUSION: *Conversion from laparoscopic to open operations may be inevitable at times. Effort must be done to predict the cases which need conversion to reduce potential complications.*

KEY WORDS: Conversion, Complication, Laparoscopic Cholecystectomy, Open Cholecystectomy

Introduction

Gallstones are a common worldwide health problem. Although mostly asymptomatic, gallstones may cause significant complications, such as acute cholecystitis and biliary pancreatitis, in approximately 5% of the cases annually [1]. Laparoscopic cholecystectomy (LC) has been introduced by Mühe in 1985 but was popularized by Mouret and Dubois in 1987 [2]. Since then, LC has been widely popular and the choice for the management of symptomatic gallstone disease [3]. Laparoscopic cholecystectomy offers less operative pain and disability, a shorter hospital stay, and a quicker recovery period: advantages associated with minimal access.

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However, conversion to an open procedure is necessary in 5-10% of patients [4]. Conversion to open cholecystectomy (OC) brings the advantages of an open operation, superior feeling with hands, better vision through an abdominal incision which may be enlarged if necessary, shortening of the duration of surgery by limiting the prolonged and insistent laparoscopic effort for dissection. Even though conversion has some advantages, the cases are mostly difficult to dissect and susceptible to complications. Conversion is reported to be associated with an elevated risk of bile duct injury, bile leakage, bleeding, and death [5]. Predictive models have been introduced for decades to define patients which may necessitate conversion from a laparoscopic to an open procedure. Conversion to OC from LC may be managed successfully in a tertiary care center but, for sure, the selection of these "risky" patients offers the advantage of transfer of patients to a specialized unit before they are operated, to make it certain that there is enough skilled staff for a possibly problematic operation. And also starting open in selected patients may reduce the

operative time and possible complications from a diligent effort to continue dissection under laparoscopy or it may shorten the time taken until a decision to convert has been made. The aim of this study is to evaluate the risk factors for conversion in scheduled elective laparoscopic cholecystectomies.

Materials and Methods

The files of all patients who went under laparoscopic cholecystectomy due to symptomatic or complicated gallstone disease in a tertiary center over a 2-year period were investigated in a retrospective cohort study. All the patients' operations were performed in the surgery department Haseki Training and Research Hospital between April 1, 2016 and April 1, 2018. Inclusion criteria were cholecystectomies performed for symptomatic disease, biliary colic, or after antibiotic treatment of a previous cholecystitis attack. Patients were excluded if they were younger than 18 years old, if they had open cholecystectomy at first intention, if they presented with choledocholithiasis or intensive care unit-associated acalculous cholecystitis, or cholecystectomy was a part of the main operation such as Whipple procedure. Patients who were diagnosed to have acute cholecystitis or acute cholangitis were also beyond the scope of this investigation. Patients with pathologically detected malignancies or gallbladder polyps were excluded from the study, as well. Preoperative data, including patients' demographics, mode of admission (elective or emergency), indications for cholecystectomy, concomitant disease (diabetes mellitus, obesity, hematological disorder, cardiovascular disease, or respiratory disease), and the existence of previous upper abdominal incisions were collected. The conversion rate to OC, the underlying reasons, and postoperative complications were recorded. Statistical analyses were performed using SPSS (Statistical Packages for Social Sciences) 22.0 software. The chi-square test was used for comparisons of categorical variables. Mann-Whitney U test was used for comparison of numerical values when parametric assumptions were unmet. A value of $p<0.05$ was accepted as statistically significant.

Results

During this period a total number of 1224 patients patients went under scheduled elective cholecystectomy. The overall median age was 49 interquartile range (IQR) (39-59). The total number of patients who were initiated a laparoscopic operation but converted from LC to open cholecystectomy was 28 (2.28%). The median age of the converted cases was 56 (IQR 52-71.2), while the cases which were completed laparoscopically had a median age of 49 (IQR 39-59), P=0.012 (Table I). In this study, the main reason to convert to open procedure was unclear anatomy because of the adhesions resulting in difficult dissection of Calot's triangle in 64,5% 1 of the patients, followed by edema in the gallbladder wall 25% (7) cases, a case of excessive bleeding while dissecting the cystic artery that causes difficulty in dissecting 3.5% was counted in the adhesions group, previous scar tissue 3.5% , high body mass index (>40) 3.5% (1), presence of other intra-abdominal pathologic conditions (intra-abdominal enlarged lymph nodes) 3.5% 1 (Table I).

In the binary regression analysis, age, adhesions, edema in the gallbladder, bleeding, previous scar tissue were all found to be significantly related to conversion, P=0.008, P=0.000, P=0.000, P=0.025, P=0.025, whereas sex and higher BMI were not, P=0.197 and P=0.656, respectively.

During the same period a total of 20 cases of gallbladder stones were managed by emergency laparoscopic cholecystectomy. The patients were sent to an open operation if Computed Tomography showed signs of perforation thus, a total of 14 cases underwent open procedure.

Table I - *Demographics of the study population.*

	Converted	Non-converted	Overall	P
Age	56 (IQR 52-71.2)	49 (IQR 39-59)	49 (IQR 39-59)	P=0.012
Hospital stay	2,18±0,51	3,69±1,18		P=0,000
Sex female	75,00%	63,00%	63,00%	
male	25,00%	37,00%	37,00%	

Table II - *Conversion reasons according to gender.*

Gender	Adhesions	Previous scar tissue	Edema	High BMI	Accompanying medical situations
Male	7 (25%)		1(3.5%)		
Female	11 (39.5%)	1 (3.5%)	6 (21.5%)	1 (3.5%)	1 (3.5%)

TABLE III - *Open cholecystectomy indications*

Indications	Patients n.	%
Accompanying hydatic cyst	3	3,4
Accompanying malignancy	13	14,6
Accompanying choledocolithiazis	16	18
Mirizzi syndrome	2	2,2
Traumatic	2	2,2
Perforation (suspected on preoperative screening)	14	15,7
Conversion from LC to OC	28	31,4
Upper gastrointestinal scar and ventral hernia	9	9,9
Liver hemangioma	1	1,3
Emergency laparoscopic conversion	1	1,3

Another seven patients were started open because of major previous upper gastrointestinal system surgery. However in three of the seven emergency laparoscopic operations, the gallbladders were found to have been perforated, even though imaging studies did not suggest perforation. In all cases of perforation the white blood cell count (WBC) was higher than 16000/ml. Only one in these three operations, as well as 1 in in 20, had to be converted to open because of edema and extensive adhesion (Table II).

During the same period a total of 89 open cholecystectomies were performed including the 28 converted cases. The reasons for open cholecystectomies are as follows (Table III).

According to the Tokyo Criteria, patients who present Murphy's sign, any local symptoms such as mass, pain or tenderness in the right hypochondrium, and any systemic symptoms such as fever, leukocytosis or increased C-reactive protein are diagnosed with AC. The classical Murphy symptom is characterized by the abrupt arrest of breathing when a direct palpation is applied onto the gallbladder. Laboratory values may reveal leukocytosis and mildly increased levels of bilirubin, alkaline phosphatase, transaminase and amylase. Ultrasonography is highly important in the diagnosis. Presence of gallstones or gallbladder sludge, gallbladder wall thickening of 4 mm or above, and detection of pericholecystic fluid support the diagnosis of acute cholecystitis. The Tokyo criteria were defined for the diagnosis and determination of the severity of the disease [6].

The patients were checked for elevated liver enzymes and white blood cell count when they were hospitalized. There appeared 24 (2%) cases of elevation of serum bilirubin levels in the postoperative period. Most of the cases 18/24 (75%) resolved by supportive medical therapy in the postoperative period but in 6 (25%) cases endoscopic intervention was applied, proven that there was residual stone in the choledocus by Magnetic Resonance cholangiopancreatography. Open choledocotomy, extraction of the stone and t -tube drainage was applied in 2 of the cases as endoscopic intervention failed to clear the residual stones in the biliary system. In 16 (1,3%) cases there were fluid collection in the subhepatic region shown by the ultrasonography scan in the postoperative period. 12 of the cases the fluid collection disappeared in the postoperative period by medical therapy. 3 cases were sent to drainage with ultrasound guidance and one case was cured by choledocal repair and t-tube drainage.

Discussion

Converted cases are associated with increased numbers of infectious and other postoperative complications [7]. The converted cases have an increased risk of additional procedures with a higher 30-day readmission rate and conversion results in longer postoperative stays, besides morbidity and mortality rates are higher in this group of patients [8]. Many studies have been undertaken to identify the risk factors for selection of patients with a high risk of conversion.

In the present study, the conversion rate was 2,28% (28/1224), the main reason to convert to open procedure was unclear anatomy because of the adhesions resulting in difficult dissection of Calot's triangle in 61%(17) of the patients. Papandria et al. reported laparoscopic conversion to open in cholecystectomies as 1,9% [9]. Lengyel et al. investigated 70 converted cases in 1193 cholecystectomies and identified 56% of conversions as due to inflammatory process and 30% (20) as noninflamatory adhesions. This rate is close to our rate of conversion. Lim et al. reviewed the files of 201 cholecystectomies performed on acute cholecystitis, 56 patients (27.7%) required conversion to open procedure. The most common reason for conversion was inability to display the anatomy, adhesions around the gallbladder and uncontrolled bleeding. Goonawardena et al. studied a patient population of 732 patients, and found out that 47 (6.4%) required conversion [10].

Our conversion rates are on the lower side this may be because we operate on high volumes and, in addition to this, we only recently have adopted the idea of emergency cholecystectomy for the management of acute cholecystitis, as we prefer cooling down to avoid complications of a subacute cholecystectomy, if we are not sure that it has been shorter than 72 hours before the onset of symptoms and we employ per-cutaneous drainage of the gallbladder in selected patients with high surgical risk as recommended [11]. Although laparoscopic cholecystectomy is the gold standard of care for acute cholecystitis, alternative acceptable treatment includes intravenous antibiotics followed by an interval laparoscopic cholecystectomy [12].

Goonawardena et al. identified increased body mass index as an independent risk factor for conversion (as a resume: two clinical variables, previous upper abdominal surgery and obesity defined as body mass index (BMI)

> 30kg/m^2 plus three ultrasound parameters, visible choledocholithiasis, impacted stone at the neck of the gallbladder and gallbladder wall width in millimeters). In accordance with that finding, in a young patient of age 24, the technical difficulties associated with obesity was the reason for conversion, 1/28(3,5%). There are other studies which support this observation. Ibrahim et al. found the patients who needed conversion were significantly heavier than the LC group and identified higher body weight as a risk factor for conversion [13]. Fried et al. in 1994 identified a lower risk for conversion if the patient was female and younger than 65 and non-obese as 1,9% vs the overall rate 5,4%. Rosen et al. evaluated 1347 patients who went under LC, when patients with acute cholecystitis were evaluated only a body mass index >30 kg/m(2) predicted conversion. For patients undergoing elective cholecystectomy, a body mass index >40 kg/m(2) and a wall thickness >0.4 cm (which may point) acute cholecystitis predicted conversion [14].

Although high body mass index has been reported as a risk factor for conversion from earlier periods of laparoscopic intervention, currently laparoscopic gallbladder resection may be the choice of operation in heavier patients favoring the advantages of minimal access surgery.

Male sex was identified as a risk factor for conversion in some large scale studies. The majority of patients who went under conversion comprised of female in our study, 75% vs 25% (Tables I, II). Lipman et al. in a study of 1377 patients over a period of 71 months identified male gender as a risk factor for conversion in addition to properties which may be imputable to acute cholecystitis [15]. Zang et al. in a group of 1265 patients also identified male sex as a risk factor for conversion in addition to gallbladder thickness, which suggests acute cholecystitis, and previous scar tissue [16]. Kama et al. in a series of 1000 patients identified male gender as a risk factor for conversion, as well as , previous abdominal surgery, acute cholecystitis, thickened gallbladder wall on preoperative ultrasonography, and suspicion of common bile duct stones [17]. Yol et al. found that tissue collagen levels both in the submucosal area of the gallbladder wall and in pericholecystic tissue were significantly higher in men than in women which makes the Calot triangle fibrotic and hard to dissect [18]. This may explain the dominance of male gender in conversion but our findings do not confirm the elevated risk for the male gender. One female patient who had a previous history of a gynecological operation during the trocar insertion intestinal damage occurred and thus converted to open.

Operation time, defined as the time interval from skin incision to skin suture, has been taken an objective measurement of difficulty [19]. However in our study the operation time was not taken into account as a sign of difficulty because the operations were carried out by residents at different stages of training which may alone be a factor for a prolonged operation to a reasonable degree. The operations were performed by 19 different surgeons in a wide range, nearly one fifth by one surgeon only and a few others performing 10 percent each. When we made a chi-square analysis there was the difference of individual conversion rate differed significantly, p=0.006. However, there is clear selection bias in decision of choosing the attending surgeon. Patients with higher age or risky health status would be assigned to the most experienced surgeon available.

Many predictive systems take components of acute cholecystitis as a measure in the prediction system about converting. Kama et al. which is one of the few externally validated systems for scoring the risk for conversion has incorporated acute cholecystitis and gallbladder wall thickness which is a component of the acute disease in their system [20]. Likewise, van der Steeg et al. report that acute cholecystitis as well as history of recent acute cholecystitis is predictive in conversion [21]. Lipman et al. also developed a system to predict conversion based on statistically significant factors, namely male sex, low serum albumin, elevated WBC, pericholecystic fluid on ultrasound, diabetes mellitus, and elevated total bilirubin. Alponat et al. developed a formula with four parameters acute cholecystitis, elevated ALP, elevated WBC and thickened gallbladder wall on ultrasound [22]. Golipur et al. in a study of 793 laparoscopically initiated cholecystectomies reports experience, emergency operation, previous history of a laparotomy, choledocholithiasis, fever, inflammation and elevated bilirubin, ALP and as risk factors for conversion [23]. Simonopulos in a series of 1804 patients reported the risk factors as age, history of abdominal surgery and inflammation. We believe our study represents a cohort of patients who have a least rate of acute operations. Thus, adhesions from previous gallbladder infections appear as the most prominent factor in evaluating the risk factor for conversion. As parameters relating the inflammation of gallbladder has been used in various risk predicting systems perhaps the most simple important risk factor is the previous history of acute cholecystitis or a long symptomatic period which may be imputable to recurrent gallbladder inflammation. Many studies have been undertaken to define the risk for an open conversion, however as open cholecystectomy rate decreases the graduating residents finish with limited experience in open cholecystectomy, this is another important factor to be taken into consideration for detection of potentially risky patients [24].

Our study has some limitations; we serve a great population in the historical peninsula in the vicinity of other big hospitals which people are free to choose, therefore, not all complications refer to the same hospital. Also, while treating the acute cases, cooling is preferred if WBC is elevated, or there is increase in serum bilirubin or alkalene phoshatase levels or in gallbladder thickness or choledocholithiasis. There is also potential bias in the operation notes, not all adhesions or edema are stated in the surgery notes unless there is a particular

difficulty in dissecting. The description of difficulty is also highly subjective and depends on the surgeons experience.
Conclusion:We believe that in elective cases our findings are a retrospective confirmation of the well-known risk factors that are a reason to convert. Our study emphasizes the importance of the studied parameters: age, previous surgery, inflammation, adhesions, and coexisting abdominal medical conditions are reasons for an elevated a risk of conversion, moreover, possibly the most important paramater to predict conversion is previous gallbladder infection.

Riassunto

La colecistectomia, una delle operazioni di più frequente esecuzione, è diventata il gold standard nella sua realizzazione per via laparoscopica. Tuttavia in alcuni pazienti è necessaria la conversione a laparotomia, che da parte sua potrebbe comportare maggiori complicazioni e tempi operativi prolungati.
Sono state esaminare retrospettivamente le cartelle cliniche di 1224 pazienti sottoposti a colecistectomia in elezione programmata, ed anche le cartelle di pazienti sottoposti a colecistectomia laparotomica durante lo stesso periodo, valutando i dati demografici, la storia clinica, i dati dell'intervento e le ragioni della conversione.
Il numero dei pazienti il cui intervento è iniziato per via laparoscopica ma poi è stato convertito in colecistectomia laparotomica è stato di 28 (2,28%), su un totale complessivo di 89 pazienti sottoposti a colecistectomia laparotomica. Nell'analisi di regressione, l'età, le aderenze, l'edema nella colecisti, il sanguinamento, il precedente tessuto cicatriziale sono risultati significativamente correlati alla conversione ad intervento laparotomico, mentre non lo erano il sesso e l'indice di massa corporea più elevato.
La conversione da operazioni laparoscopica a laparotomica dunque può essere inevitabile. Occorre fare uno sforzo per prevedere i casi che richiedono una conversione per ridurre potenziali complicazioni.

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