

Factors Affecting Conversion of Laparoscopic to Open Cholecystectomy

Laparoskopik Kolesistektomiden Açık Kolesistektomiye Dönüşü Etkileyen Faktörler

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ABSTRACT

Laparoscopic cholecystectomy (LC) is used the gold standard treatment for gall bladder disease. However, some cases merit converting to open cholecystectomy. Reasons for conversion include acute cholecystitis and advanced age. In this study, we aimed to systematically assess factors that increase the likelihood of conversion.

We assessed age and gender as well as preoperatively noted leukocyte counts (WBC), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and bilirubin, total and direct, levels; and gall bladder wall thickness of patients diagnosed with cholelithiasis. Patients were split into two groups: the open cholecystectomy group and the LC group. We then performed a comparative analysis between these two patient groups.

We determined that these groups showed no significant difference regarding gender ($p = 0,152$). Moreover, the conversion rate was significantly higher in older patients ($p = 0,039$), and increased gall bladder wall thickness and common bile duct diameter also enhanced the conversion rate ($p < 0,001$ and $p = 0,015$). In addition, open cholecystectomy patients had higher ALT and total and direct bilirubin levels than LC patients ($p = 0,014$, $p < 0,001$ and $p < 0,001$, respectively). However, WBC, AST levels, and stone sizes were not significantly different between patient groups ($p = 0,177$, $p = 0,210$ and $p = 0,180$, respectively).

In summary, we found that increased wall thickness and common bile duct diameter led to acute cholecystitis in elderly patients and enhanced the risk of conversion.

Keywords: Laparoscopic cholecystectomy, Conversion, Cholecystitis

ÖZET

Laparoskopik kolesistektomi (LK), safra kesesi hastalıklarında altın standart tedavi yöntemi olarak kullanılmaktadır. Ancak, bazı olgularda konversiyon kolesistektomi uygulanabilmektedir. Akut kolesistit, ileri yaş, koledokolithiaziste konversiyon riski artmaktadır. Çalışmamızda LK esnasında, konversiyon gelişmesine etki eden ve bunu öngörebilen faktörleri ortaya koymayı amaçladık.

Kolelithiazis tanısı olan hastalarda yaş, cinsiyet, preoperatif bakılan lökosit (WBC), aspartate amino transferaz (AST), alanine amino transferaz (ALT), total ve direkt bilirubin değerleri, safra kesesi duvar kalınlığı, intralüminar taş boyutu ve koledok çapı değerlendirildi. Hastalar konversiyon kolesistektomi ve laparoskopik tamamlananlar olarak 2 gruba ayrıldı ve gruplar arası karşılaştırma yapıldı.

Gruplar arasında cinsiyet farklığı görülmezken ($p:0.152$), ileri yaş hastalardaki operasyonlarda konversiyon oranı yüksekti ($p:0,039$). Safra kesesi duvar kalınlığı ve koledok çapı artmış hastalarda konversiyon oranlarının arttığı tespit edildi ($p<0,001$ ve $p:0,015$). Başvuru anında bakılan ALT, total ve direkt bilirubin değerleri de Grup 1'de yüksekti ($p:0,014$, $p<0,001$ ve $p<0,001$). WBC, AST ve intraluminal taş boyutunun, konversiyonu öngörebilmeye etkin olmadığı sonucu görüldü ($p:0,177$, $p:0,210$ ve $p:0,180$).

Duvar kalınlığı ve koledok çapı artmış ileri yaştaki akut kolesistitli hastalarda preoperatif olarak konversiyon riskinin arttığı kanaatindeyiz.

Anahtar Kelimeler: Laparoskopik kolesistektomi, Konversiyon, Kolesistit

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INTRODUCTION AND AIM

In recent decades, laparoscopic cholecystectomy (LC) has emerged as the gold standard to treat gall bladder pathologies such as acute, gangrenous and asymptomatic cholecystitis. Minimizing surgical invasiveness, morbidity and length of hospital stay are key benefits of LC. However, LC still presents with complications, resulting in conversion to open cholecystectomy for some patients.¹ Although previous studies have identified

risk factors for conversion,^{2,3} a systematic algorithm that determines the landscape of conversion has yet to be determined. It is generally accepted, however, that acute cholecystitis, advanced age, choledocholithiasis and previous history of abdominal surgery are factors that increase the risk of conversion.^{2,4-7} In this study, we aimed to reveal factors that affect conversion from LC to open cholecystectomy in patients diagnosed with cholelithiasis.

MATERIALS AND METHODS

After approval of the local ethics committee a retrospective study was designed. The consent was obtained from all patients. Between January 2014 and June 2016, admitted patients diagnosed with cholelithiasis, as per laboratory tests and ultrasonography (USG), undergoing LC were retrospectively analysed. Patient demographics, such as age and gender; Murphy's sign positivity; preoperative leukocyte counts (WBC), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and total and direct bilirubin values; gall bladder wall thickening, as discerned via USG; gall bladder stone size; common bile duct diameter; time between symptoms; and the operation beginning time and duration were all recorded. Patients were split into two groups. Patients who converted to open cholecystectomy were in Group 1, and LC patients were in Group 2. Comparative analyses were then performed. With respect to the period between hospital admittance and when the operation was performed, patients were split into two groups as well: patients operated on within the first 72 h and patients operated on after the first 72 h. Patients were excluded from our study if there was a lack of medical records; if patients had additional illnesses, such as liver or haematological illnesses; and if patients

had undergone open cholecystectomy, and thus not converted. In total, 73 patients were excluded from the study, resulting in a cohort of 410 patients. To note, a Beckman Coulter R Gen-S System® (*Beckman Coulter Diagnostic System Laboratories, Inc., TX, USA*) was used for haematological analyses. Biochemical parameters were measured with a Hitachi R P800 Automatic Analyzer System® (*Hitachi Co., Ltd., Tokyo, Japan*).

Statistical Analysis

Statistical analysis was performed using the SPSS package program for Windows, version 22 (*Chicago, IL, USA*). The normality of the distribution of continuous variables was determined via the Kolmogorov-Smirnov test. Descriptive statistics were reported as mean \pm standard deviation or median and range, where applicable, for continuous variables and case number and percent for categorical variables. The differences between data from the two patient groups were compared via a Student's t-test for mean values and the Mann-Whitney U test for median values. Pearson's chi-squared test was used for categorical variables. The sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV) were compared by ROC curve analysis. $p < 0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

The median age was 48 (18-90), and the female/male ratio was 2.8. Cholecystectomy conversion occurred in 23 (5.6%) patients. Fifty-two (13.7%) patients were positive for Murphy's sign, and complications occurred in 12 patients. Patient demographic specialities are shown in Table 1.

Table 1. Demographic characteristics of the patients

Demographic Characteristics	The number of patients and rate
Age	48 (18-90)
Gender (Female/Male)	302/108
Murphy's sign positivity	52/410
Conversiyon cholecystectomy	23/410
Intraoperative complication rate	12/410
Acute cholecystitis	39/410
Chronic cholecystitis	70/410

Table 2 represents patient complications and conversion to open cholecystectomy. Gender was not significantly different between the two patient groups ($p = 0,152$), but patients with Murphy's sign positivity and gall bladders were at higher risk for conversion ($p < 0,001$). Conversion was observed in 15 of 39 patients with acute cholecystitis and in 5 of 35 patients with chronic cholecystitis ($p < 0,001$ and $p:0,020$). However, patients with acute cholecystitis who were operated on within the first 72 h were at significantly lower risk for conversion ($p = 0,013$).

In addition, older patients (cut-off value of 50.5 as per the ROC curves) were significantly at risk for conversion ($p = 0,039$).

Table 2: Complications

Complication	Number of patients
Bile leakage as a result of bile duct injury **	4 (%1)
Bleeding**	4 (%1)
Incisional hernia	2 (%0.5)
Trocar site infection	1 (%0.3)
Intra abdominal organ injury **	1 (%0.3)

** Complicated cases complete with conversion cholecystectomy

Performed preoperatively via hepatobiliary USG, increased gall bladder wall thickness and common bile duct diameter enhanced the conversion rate ($p < 0,001$ and $p = 0,015$, respectively). At a gall bladder wall thickness cut-off value of 4,5 mm, we observed 78,3% sensitivity, 71,3% specificity, 14,0% PPV and 98,2% NPV, and at a common bile duct diameter cut-off value of 5,5 mm, we observed 69,6% sensitivity, 50,9% specificity, 7,8% PPV and 96,6% NPV.

Upon admission, ALT and total and direct bilirubin values were examined. Via an ALT cut-off value of 27,5, we determined 60,9% sensitivity, 63,0% specificity, 8,9% PPV and 96,4% NPV. For total bilirubin levels at a 0,95 cut-off value, we observed 65,2% sensitivity, 72,6% specificity, 12,4% PPV and 97,2% NPV; direct bilirubin levels with a 0,35 cut-off value resulted in 82,0% sensitivity, 58,9% specificity, 10,2% PPV and 98,3% NPV (Table 3 and Figure 1).

Table 3: Statistical analysis of the data between groups

Parameters	G I n:23	G II n:387	P values	Cut off	Sensitivity	Specificity	PPV	NPV
Age	54 (29-79)	48 (18-90)	0,039	50,5	56,5%	56,6%	7,2 %	95,6 %
ALT	37 (13-410)	22 (6-458)	0,014	27,5	60,9%	63,0%	8,9 %	96,4 %
TB	1,1 (0,4-4,8)	0,8 (0,3-4,7)	<0,001	0,95	65,2%	72,6%	12,4 %	97,2 %
DB	0,5 (0,2-2,7)	0,3 (0,1-6,0)	<0,001	0,35	82,0%	58,9%	10,2 %	98,3 %
Common bile duct diameter (mm)	6 (4-12)	5 (3-6)	0,015	5,5	69,6%	50,9%	7,8 %	96,6 %
Gall bladder wall thickness (mm)	6 (2-15)	3 (2-12)	<0,001	4,5	78,3%	71,3%	14,0 %	98,2 %

*G1: Conversion cholecystectomy; G2: Laparoscopic cholecystectomy; PPV: Positive predictive value; NPV: Negative predictive value
TB: Total bilirubin; DB: Direct bilirubin*

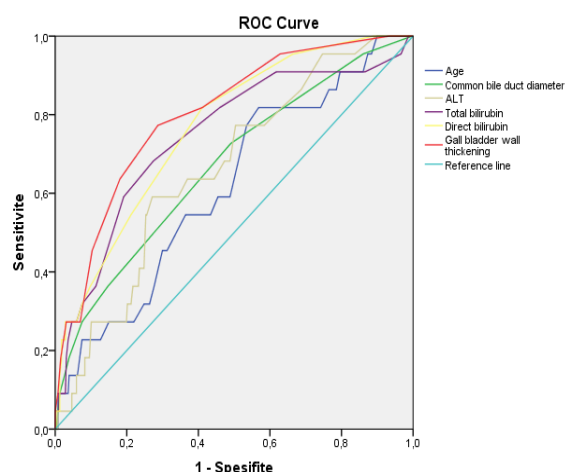


Figure 1. Roc curve curves between groups of parameters

Additionally examined upon admission, WBC, AST and stone size was not statistically significant and did not affect conversion ($p = 0,177$, $p = 0,210$ and $p = 0,180$, respectively).

LC is performed globally and confers advantages such as a lower rate of wound infections, minimal invasiveness, shorter time in the hospital and reduced morbidity.⁷ Thus, LC has become indispensable for gall bladder diseases. In spite of these positive attributes, some cases require conversion to open cholecystectomy. Herein, we determined risk factors for this surgical conversion. We determined that advanced age, acute cholecystitis and increased gall

bladder wall thickness and common bile duct diameter were key factors affecting conversion. In addition, patients with significantly higher bilirubin and ALT levels were also at enhanced risk.

In the literature, conversion rates are in the range of 0,4–13,0%.⁷⁻⁹ In our study, the conversion rate of 5,6% was aligned with this data. The variability in conversion may be due to several reasons. A previous study noted that surgeon expertise affected conversion rate, particularly noting a decrease from 17% to 4% when surgeons had performed at least 100 LC surgeries.¹⁰ In our study, surgeon experience of >1000 LC surgeries affected the conversion rate. To note, acute cholecystitis, previous history of upper abdominal surgery, choledocholithiasis, advanced age and intraoperative complications led to dynamic, fluctuating conversion rates.^{1,2,4,6,11} A previous study reported that the difficulty in gall bladder dissection induced risk of conversion.⁸ In our study, conversion cholecystectomy occurred in 9 of 23 cases (39,1%), in which some of these patients developed intraoperative complications.

USG preoperative assessment of gall bladder wall thickness has been shown to be associated with conversion.^{1,4,6} In our study, a 4,5 mm cut-off value for gall bladder wall thickness was a highly sensitive predictor for conversion. Regarding increased common bile duct diameter in the presence of

choledocholithiasis, previous studies have demonstrated several-fold enhanced risk for conversion.^{1,12} We found in our study that conversion was predicted at a diameter cut-off value of 5,5 mm.^{5,13} Bile duct obstruction is a direct reflection of total and direct bilirubin levels, both of which were also significant predictors of conversion. ALT is an enzyme found mainly in the liver and kidneys, and increased levels in the blood indicate tissue damage, as observed in acute cholecystitis.¹⁴ In our study, conversion was significantly associated with acute cholecystitis and increased ALT levels in the blood.

Contrary to previous studies,^{2,4-6,15,16} our study did not detect a significant difference between men and women concerning

conversion risk. However, our finding of advanced age inducing risk of conversion corroborated previous reports.^{2,4,6,12,17} Lastly, while there are no standard guidelines, performing surgery within 72 h of hospital admittance/onset of symptoms in patients with acute cholecystitis resulted in lower cost, shorter hospital stay, lower morbidity and reduced risk of conversion.^{11,18,19,20} We also made the same observation regarding lower risk of conversion when surgeries were performed within 72 h. In summary, we have highlighted predictive factors in the landscape of LC to open cholecystectomy conversion and noted the importance of performing life-saving surgeries as soon as possible in acute cholecystitis patients.

CONCLUSION

In USG, at the moment of appeal looked wall thickness and the common bile duct diameter increased, ALT, total and direct bilirubin values high, complaints initial period of > 72 hour that in laparoscopic

cholecystectomy operations performed in patients with acute cholecystitis in elderly, conversion cholecystectomy rates is increasing.

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