



## Research

# Determinants of Conversion From Laparoscopic to Open Cholecystectomy: Türkiye Case

## Laparoskopik Kolesistektomiden Açık Kolesistektomiye Geçişin Belirleyicileri: Türkiye Örneği

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### ABSTRACT

**Objective:** The aim of this study was to determine the characteristics of patients who required conversion from laparoscopic to open cholecystectomy. In addition, we compared the health outcomes of laparoscopic and converted cholecystectomy.

**Methods:** This was a retrospective, cross-sectional study. The laparoscopic cholecystectomy procedures performed in hospitals of the Turkish Ministry of Health in 2016 were examined. Chi-square and Mann-Whitney U tests were used to analyze the data.

**Results:** There were 103,387 laparoscopic cholecystectomy. Of these, 102,294 (98.9%) were laparoscopically completed, whereas 1,093 (1.1%) were converted to open cholecystectomy. The majority (75.9%) of the patients were female. The rate of conversion from laparoscopic to open cholecystectomy; in men  $\geq 65$  years of age, patients with chronic renal failure, hypertension, diabetes, malign neoplasm, and cerebrovascular disease were found to be statistically significantly higher than those in the opposing groups. Mortality, complications, intensive care unit treatment rates, and average hospitalization time were found to be statistically significant in cholecystectomy converted to open surgery.

**Conclusion:** Patients who had converted cholecystectomy had more negative health outcomes than those who had completed the procedure laparoscopically. Old age, being male, and having comorbidities and malignancies increase the risk of conversion to open cholecystectomy. These factors can help determine the conversion risk of laparoscopic cholecystectomy to an open procedure.

**Keywords:** Cholecystectomy, conversion, laparoscopic cholecystectomy, risk factors

### ÖZ

**Amaç:** Bu çalışmanın amacı laparoskopik kolesistektomiden açık kolesistektomiye geçilmesi gereken hastaların özelliklerini belirlemektir. Ayrıca laparoskopik ve dönüştürülmüş kolesistektomilerin sağlık sonuçlarının karşılaştırılması amaçlanmıştır.

**Gereç ve Yöntem:** Bu retrospektif, kesitsel bir çalışmadır. 2016 yılında Türkiye Cumhuriyeti Sağlık Bakanlığı hastanelerinde gerçekleştirilen laparoskopik kolesistektomi işlemleri incelenmiştir. Verilerin analizinde ki-kare ve Mann-Whitney U testleri kullanılmıştır.

**Bulgular:** 103.387 laparoskopik kolesistektomi yapılmıştır. Bunların 102.294'ü (98,9) laparoskopik olarak tamamlanmış, 1.093'ü (%1,1) açık kolesistektomiye çevrilmiştir. Hastaların çoğunluğu (%75,9) kadındır. Laparoskopiden açık kolesistektomiye geçiş oranının, kronik böbrek yetmezliği, hipertansiyon, diyabet, malign neoplazm ve serebrovasküler hastalığı olan erkeklerde  $\geq 65$  yaş, karşı gruplara göre istatistiksel olarak anlamlı yüksek olduğu, ölüm, komplikasyon, yoğun bakım ünitesi tedavisi oranları ve ortalama hastanede kalış süresinin istatistiksel olarak anlamlı olduğu tespit edilmiştir.

**Sonuç:** Kolesistektomiye dönüşen hastalar, laparoskopik olarak tamamlayanlara göre daha olumsuz sağlık sonuçlarına sahip olmuştur. İleri yaş, erkek olmak, komorbidite ve malignite varlığı açık kolesistektomiye geçiş riskini artırmaktadır. Bu faktörler, laparoskopik kolesistektominin açık prosedüre dönüşme riskinin belirlenmesine yardımcı olabilir.

**Anahtar Kelimeler:** Kolesistektomi, konversiyon, laparoskopik kolesistektomi, risk faktörleri

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**Cite as:** Aslan H, Çıraklı Ü, Özden S, Çetin E. Determinants of Conversion From Laparoscopic to Open Cholecystectomy: Türkiye Case. Med J Bakirkoy 2024;20:92-96

**Received:** 26.01.2023

**Accepted:** 17.10.2023

## INTRODUCTION

Cholecystectomy is a surgical procedure used in the treatment of gallstone disease. It can be performed openly and laparoscopically. Both open and laparoscopic cholecystectomy are generally safe and effective surgical procedures (1). Laparoscopic cholecystectomy is considered the "gold standard" for treating gallbladder diseases in selected patients (2-6).

Although laparoscopic cholecystectomy is often performed successfully, there is a certain rate of conversion to open cholecystectomy during the operation (7). Bleeding, internal organ injuries, adhesions, anatomical difficulties (8), inflammation, and impacted bile duct stones encountered during the operation (9) can cause the operation to be converted to open cholecystectomy (10). In the literature, it has been reported that the rate of conversion from the laparoscopic cholecystectomy procedure ranges from 3.4% to 11.4% (4,9,11-13). The surgeon's skill and patient characteristics are effective in the conversion of laparoscopic cholecystectomy to open surgery. Old age, male sex, history of upper abdominal surgery, high American Society of Anesthesiologists score, obesity, and acute cholecystitis are reported as patient-related risk factors (4,14).

Identifying patients and conditions that may require conversion to open cholecystectomy can help to select the surgical method to be performed more successfully and to take the necessary prevention measures. Thus, it may be possible to save both treatment costs and provide better quality of care. Therefore, in this study, we aimed to determine the characteristics of patients who required conversion from laparoscopic cholecystectomy to open one. In addition, we aimed to compare the health outcomes (mortality, intensive care, sepsis and hospitalization time) of converted cholecystectomy to open with those completed laparoscopically.

## METHODS

This research is a retrospective, cross-sectional study. In this study, the records of laparoscopic cholecystectomy patients who underwent surgery in the hospitals of the Turkish Ministry of Health between 01.01.2016 and 31.12.2016 were retrospectively examined. Patients who underwent laparoscopic cholecystectomy were examined for the main diagnoses, gender, age, comorbidity, malignancy, length of hospital stay, intensive care use, complications, and sepsis development.

### Statistical Analysis

The data of this research were obtained from the Turkish Ministry of Health. The research protocol was approved by

the İzmir Bakırçay University Non-Invasive Clinical Research Ethics Board (decision no: 564, date: 20.04.2022). The SPSS Statistics 23 package program was used in the analysis. Chi-square and Mann-Whitney U tests were used to analyze the data. In the study, the confidence range was 95% and the significance value was  $p < 0.05\%$ .

## RESULTS

Within one year, 103,387 laparoscopic cholecystectomy were performed. Of these, 102,294 cases (98.9%) were laparoscopically completed, whereas 1,093 (1.1%) were converted to open cholecystectomy. The majority (75.9%) of the patients were female, younger than 65 years of age, and the average age was 50.72 years. The rate of conversion from laparoscopic to open cholecystectomy; in men,  $\geq 65$  years of age, and patients with chronic renal failure, hypertension, diabetes, malign neoplasm, and cerebrovascular disease were found to be significantly higher than those in the opposing groups (Table 1). Patients with heart disease have a higher rate of conversion to open cholecystectomy. However, this difference was not statistically significant ( $p > 0.05$ ).

Table 2 shows the comparison of health outcomes in the procedures of laparoscopically completed cholecystectomy and open cholecystectomy. According to the results of the analysis, mortality, complications, intensive care unit treatment rates, and average hospitalization time were found to be statistically significant in cholecystectomy converted to open surgery. However, the rate of development of sepsis was not statistically significant ( $p < 0.05$ ).

A comparison of mortality rates according to patient characteristics is given in Table 3. Although the share of male patients in the total patient was approximately 1/4, the mortality rate was found to be higher than that of women. It was found that mortality rates were higher in patient groups diagnosed with hypertension, diabetes, and sepsis and in patient groups aged 65 and over who were converted from laparoscopic cholecystectomy to open cholecystectomy compared with their counterparts. In addition, although data did not meet the requirements for chi-square analysis, mortality rates were higher in patients with heart disease, cerebrovascular disease, chronic renal failure, and malignancies.

## DISCUSSION

Conversion of laparoscopic cholecystectomy to open cholecystectomy results in negative health outcomes and additional costs. Therefore, in this study, the rates and causes of conversion of laparoscopic cholecystectomy to open cholecystectomy were investigated. In previous studies, the

**Table 1.** Comparison of patient groups according to type of cholecystectomy

Characteristic		Laparoscopic (n/%)	Converted to open (n/%)	Total (n)	p-value
Sex	Male	24,376/97.9	519/2.1	24,895	<0.001*
	Female	77,918/99.3	574/0.7	78,492	
Age	<65	84,315/99.1	766/0.9	85,081	<0.001*
	≥65	17,979/98.2	327/1.8	18,306	
Chronic renal failure	No	102,152/98.9	1,084/1.1	103,236	<0.001*
	Yes	142/94.0	9/06	151	
Heart disease	No	101,673/98.9	1,082/1.1	102,755	0.092
	Yes	621/98.3	11/1.7	632	
Hypertension	No	96,116/99.0	995/1.0	97,111	<0.001*
	Yes	6,178/98.4	98/1.6	6,276	
Diabetes	No	95,513/99.0	960/1.0	96,473	<0.001*
	Yes	6,781/98.1	133/1.9	6,914	
Malignant neoplasm	No	102,140/99.0	1,079/1.0	103,219	<0.001*
	Yes	154/91.7	14/8.3	168	
Cerebrovascular diseases	No	102,219/98.9	1,090/1.1	103,309	0.016*
	Yes	75/96.2	3/3.8	78	
Total		102,294/98.9	1,093/1.1	103,387	

\*p&lt;0.05

**Table 2.** Health output of patients according to type of cholecystectomy

		Laparoscopic	Converted to open	Total	p-value
Mortality	No	102,231/99.0	1,084/1.0	103,315	<0.001*
	Yes	63/87.5	9/12.5	72	
Complication	No	101,902/99.1	976/0.9	102,878	<0.001*
	Yes	392/77.0	117/23.0	509	
Sepsis	No	102,274/98.9	1,092/1.1	103,366	<0.001
	Yes	20/95.2	1/4.8	21	
Intensive care	No	99,749/99.0	963/1.0	100,712	<0.001*
	Yes	2,545/95.1	130/4.9	2,675	
Hospital length of stay (mean ± SD <sup>a</sup> )		4.20±2.401	7.07±4.153	4.23±2.444	<0.001*
Total		102,294	1,093	103,387	

\*p&lt;0.05, SD: Standard deviation

rates and causes of conversion to open cholecystectomy have varied. This study is considered important because it is the first comprehensive study in Türkiye and evaluates all procedures performed in hospitals affiliated with the Turkish Ministry of Health for a full year.

The rates of conversion of laparoscopic cholecystectomy to open cholecystectomy vary according to the studies. The rates of conversion of laparoscopic cholecystectomy to open cholecystectomy range from 07% to 9.5% (4,8,11,12,15-20). In this study, the conversion rate of laparoscopic cholecystectomy to open cholecystectomy was 1.1%.

Compared with the studies in the literature, except for two studies, it is possible to say that this conversion rate is low.

The conversion rate of laparoscopic cholecystectomy to open cholecystectomy is affected by patient-related factors. In this study, it was found that the conversion rate was higher (three times) in male patients (2.1%) than in women (0.7%). The findings of our study are in accordance with the findings of previous studies (4,9,12,19,20). It has also been confirmed by both systematic reviews and meta-analyses that male sex is a risk factor for conversion to open cholecystectomy (14).

**Table 3.** Comparison of mortality rates according to patients' characteristics

		Mortality No	Mortality Yes	Total	p-value
		(n/%)	(n/%)		
<b>Sex</b>	Male	24,864/99.88	31/0.12	24,895	<0.001*
	Female	78,451/99.95	41/0.05	78,492	
<b>Age</b>	<65	85,063/99.98	18/0.02	85,081	<0.001*
	≥65	18,252/99.71	54/0.29	18,306	
<b>Laparoscopic cholecystectomy</b>		102,231/99.94	63/0.06	102,294	<0.001*
<b>Laparoscopic converted to open</b>		1,084/99.18	9/0.82	1,093	
<b>Malignant neoplasm</b>	No	103,266/99.93	69/0.07	103,335	-
	Yes	49/94.23	3/5.77	52	
<b>Complication</b>	No	102,820/99.94	58/0.06	102,878	<0.001*
	Yes	495/97.25	14/2.75	509	
<b>Sepsis</b>	No	103,305/99.94	61/0.06	103,366	<0.001*
	Yes	10/47.62	11/52.38	21	
<b>Hypertension</b>	No	97,059/99.95	52/0.05	97,111	<0.001*
	Yes	6,256/99.68	20/0.32	6,276	
<b>Diabetes</b>	No	96,415/99.94	58/0.06	96,473	<0.001*
	Yes	6,900/99.80	14/0.20	6914	
<b>Heart disease</b>	No	102,688/99.93	67/0.07	102,755	-
	Yes	627/99.21	5/0.79	632	
<b>Cerebrovascular diseases</b>	No	103,241/99.93	68/0.07	103,309	-
	Yes	74/94.87	4/5.13	78	
<b>Chronic renal failure</b>	No	103,167/99.93	69/0.07	103,236	-
	Yes	148/98.01	3/1.99	151	
<b>Total</b>		103,315/99.93	72/0.07	103,387	-

\*p&lt;0.05

Age is a factor frequently examined in the conversion from laparoscopic cholecystectomy to open cholecystectomy. Previous studies have also found that old age is a risk factor for conversion to open cholecystectomy (4,9,10,12,14,16,19,20). In the study, patient ages were examined as <65 and ≥65. In our study, a statistically significant difference was found in male patients over 65 years of age.

In this study, it was found that the rates of conversion to open cholecystectomy were higher in patients with heart disease, hypertension, diabetes, cerebrovascular disease, and malignant neoplasms and in patients with complications. Lipman et al. (17) reported a higher rate of conversion from laparoscopic cholecystectomy to open surgery in patients with diabetes and heart failure, and other studies (10,21) reported a higher conversion rate in patients with hypertension. In our study, malignancy was detected during or after surgery because of pathology. Out of 168 patients with malignancy identification, 14 (8.3%) converted to open

surgery, and the operations of 154 patients were completed laparoscopically. In another study (21), malignancy was also found to be a risk factor.

The main reason for the preference of the laparoscopic approach in cholecystectomy is the low risk and comfort it provides to patients. For this purpose, health outcomes were examined in patients who converted from laparoscopy to open surgery. Mortality, complications, sepsis, the need for intensive care treatment, and hospital stay were examined as health outcomes. Of the health outcomes examined, all factors except sepsis were found to be significantly higher in patients who converted to open surgery. Similarly, other studies (1,4,11-13) have also found that mortality rate and length of hospital stay (10,12,21) were higher in the operations converted to open surgery than in those completed laparoscopically. Navez et al. (12) found a high complication rate in the converted operations.

There are some limitations to this study. First, the study is a registry survey, and the data are assumed to be correct.

Another limitation is that only the hospital data of the Ministry of Health of Türkiye could be examined during the research period, and the data of the procedures performed in university hospitals and private hospitals could not be obtained.

## CONCLUSION

Although conversion to open surgery is not considered a failure, patients with conversion have more negative health outcomes than those completed laparoscopically. Mortality, the risk of complications, the rate of receiving intensive care treatment, and hospital stay are increasing in patients who have undergone open cholecystectomy.

Although it is inevitable that a certain rate of laparoscopic cholecystectomy will convert to open surgery, it is possible to reduce the conversion rate with a better preoperative evaluation. It is important to determine the risk factors in the preoperative evaluation. Old age, being male, and having comorbidities and malignancies increase the risk of conversion to open cholecystectomy. In these patients, preoperative evaluation should be performed more carefully, and it is useful to prepare the operation considering the possibility of conversion to open surgery.

## ETHICS

**Ethics Committee Approval:** The study was approved by İzmir Bakırçay University University Non-Invasive Clinical Research Ethics Board with its decision dated 20 April 2022 and numbered 564.

**Informed Consent:** Retrospective study.

## Authorship Contributions

Surgical and Medical Practices: E.Ç.A., Concept: H.A., S.Ö., Design: H.A., S.Ö., Data Collection or Processing: Ü.Ç., E.Ç.A., Analysis or Interpretation: Ü.Ç., Literature Search: H.A., Ü.Ç., S.Ö., E.Ç.A., Writing: H.A., Ü.Ç., S.Ö., E.Ç.A.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

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