# Acute calculous cholecystitis with complications in octogenarians: is laparoscopic cholecystectomy the method of choice?

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**Key words**

acute cholecystitis, octogenarians, laparoscopic cholecystectomy, comorbidities

**Original article**

SURGERY SURG ENDOS 2019;1: 11-18

## Abstract

Background. Surgical interventions as treatment modalities of acute cholecystitis in an advanced age group of patients with a wide range of comorbidities remain unclear. The high incidence of surgical and non-surgical complications clearly indicates the need for a protocol to avoid possible complications in octogenarians and to reduce the high incidence of mortality and hospital stay. The aim of the study was to evaluate the safety and efficacy of laparoscopic cholecystectomy (LC) in octogenarians with acute cholecystitis or symptomatic gallbladder disease in comparison to open cholecystectomy (OC).

Methods. A retrospective analysis of 160 octogenarians with calculous gallbladder disease was performed; among them, 135 patients had acute cholecystitis and 25 had symptomatic calculous gallbladder disease. The mean age was 84.84 years, and an ASA score of 3 or 4 was observed in 84.5% of patients (109/130).

Results. Laparoscopic cholecystectomy was performed in 99 cases (61.9%), OC was performed in 31 (19.4%) patients, and 30 patients (18.7%) were treated conservatively with an antibiotic-based treatment. The conversion rate in the LC group was 18.2% (18/99). In the emergency group, hospitalization (5.84 vs. 17.06 days) and morbidity (20.7% vs. 35.2%, p = 0.001) were lower with LC compared to OC, although the operation time was longer (62.19 vs. 56.87 min). Two patients (1.5%) suffered a bile duct injury. Emergency LC had lower mortality compared to OC (5.2% vs. 16.1%). None of the patients died in the elective group.

Conclusion. Laparoscopic cholecystectomy is associated with shorter hospitalization and a lower morbidity and mortality rate when compared to OC. As a result, LC should be the method of choice unless absolute contraindication is present in octogenarians with calculous gallbladder disease.

# Introduction

Laparoscopic cholecystectomy (LC) is a method of choice in the management of calculous gallbladder disease in the general population [1, 2]. The advantages of this minimally invasive procedure over an open surgical procedure are less postoperative pain, earlier mobilization, less pulmonary function impairment, reduced operative stress, and a shorter hospital stay [3]. Octogenarians often present with several comorbidities such as chronic heart failure, diabetes mellitus, impairment of renal function, and chronic obstructive pulmonary disease, and they are considered high-risk surgical candidates. Open questions in managing octogenarians with acute cholecystitis and related complications result in different clinical practices with insufficient clinical results [2, 4]. This study evaluates the safety and efficacy of LC in octogenarians with acute cholecystitis or symptomatic gallbladder disease.

# Methods

## Patients

We retrospectively collected data from patients over 80 with acute cholecystitis or symptomatic gallbladder disease that were hospitalized at our institution between September 2013 and September 2015.

The following patient data were recorded: age, sex, ASA classification score, and comorbidities. Comorbidities were divided into cardiovascular disease (arterial hypertension, ischemic cardiac disease, chronic cardiac failure, peripheral arterial occlusive disease, history of a heart attack or heart surgery, or chronic atrial fibrillation), pulmonary disease (chronic obstructive pulmonary disease, emphysema, asthma, or fibrothorax), and renal disease (all stages of renal failure or treatment on hemodialysis). The duration of symptoms in acute cholecystitis, type of treatment, conversions to open surgery, duration of operation, length of hospital stay, postoperative complications, and mortality were also recorded.

Diagnosis of acute cholecystitis was established with clinical examination, laboratory parameters, and abdominal ultrasound. In the case of uncertain diagnosis, a CT scan was performed. In patients with symptomatic calculous gallbladder disease or a history of biliary colic, a clinical examination, laboratory test, and abdominal ultrasound were performed. An endoscopic ultrasound was performed in the case of suspected choledocholithiasis and, if needed, endoscopic retrograde cholangiopancreatography (ERCP) was performed. The type of treatment was determined by a consultant surgeon or during consultation morning meetings. All patients scheduled for surgery were viewed by an anesthesiologist and an ASA classification score was assessed. If necessary, preoperative investigations and procedures (e.g., spirometry, dialysis, and heart ultrasound) were performed. All patients received standard antibiotic treatment according to the accepted national guidelines.

## Operative technique

Laparoscopic cholecystectomy was performed using a standard four-port technique (one 12 mm umbilical port, one 10 mm epigastric port, and two 5 mm right subcostal ports). Pneumoperitoneum of 12 mmHg was made with a Veress needle or by an open approach according to the surgeon's preference. If necessary, conversion to an open procedure was performed. A drain was placed according to the surgeon's decision. Open cholecystectomy (OC) was performed with a subcostal incision or using previous surgical incisions. Intraoperative cholangiography was performed in uncertain clinical findings or conditions. Removed gallbladders were sent for histopathological evaluation.

## Statistical analysis

Statistical analysis was performed using a chi-square test, Fisher's test for categorical variables, and Student's t-test for the analysis of ordinal variables. Results were considered statistically significant at $p < 0.05$.

# Results

In the 2-year period we treated 160 patients over age 80. Among them, 135 patients had acute cholecystitis and 25 patients had symptomatic gallbladder disease. There were more men than women (90 vs. 70). Mean age was 84.84 years. The prevalence of cardiovascular comorbidities was

76.2%, followed by renal (12.5%) and pulmonary (11.2%) comorbidities. The majority of patients were treated with a surgical procedure (130/160; 81.2%). Most of the patients were ASA 3 (76%), followed by ASA 2 (14.7%), ASA 4 (8.5%), and ASA 1 (0.8%). The results are listed in Table 1.

All patients in the emergency group (135) had an ultrasound of the abdomen during the initial examination. A CT scan was used in only 7.4% of the patients (10/135). Fifteen patients underwent ERCP with endoscopic papillotomy (EPT) (15/135; 11.1%). In three patients ERCP with EPT was the only intervention needed, and 12 had subsequent surgical intervention. The duration of symptoms in the emergency group is listed in Table 2.

Overall in the emergency group, LC was performed in 74 patients (74/135; 54.8%) with conversion to an open procedure in 16 patients (21.6%). No difference between sex (p = 0.774), duration of symptoms (p = 0.624), or ASA score (p = 0.897) was observed between the LC and the conversion group. An open procedure was performed in 31 patients (31/135; 23%). There was no statistically significant difference between sex (p = 0.629), duration of symptoms (p = 0.273), or ASA score (p = 0.407) among different treatment modalities. In the emergency group, we started antibiotic-based conservative treatment in 46 patients (46/135; 34.1%). Failure of conservative treatment resulted in subsequent surgical intervention in 16 patients (16/46; 34.8%). Nine patients (9/16; 56.2%) from the failure group had a successful LC performed, and in two cases (2/11; 18.2%) a conversion to OC was needed. A successful conservative treatment was achieved in 30 patients (30/135; 22.2%). The treatment modalities and results are listed in Table 3.

Operation time in emergency LC was longer (62.19 minutes) compared to OC (56.87 minutes) and shorter compared to the conversion group (96.63 minutes). Hospitalization after LC was 5.84 days, followed by the conversion group and OC (11.3 and 17.06 days, respectively). Postoperative morbidity was lowest in emergency LC (20.7%), followed by the OC and the conversion group (35.2% and 43.8%, respectively). Statistical analysis confirmed a statistical significance between different types of operation and postoperative complications (p = 0.001). The ASA score and postoperative complications showed no correlation (p = 0.08). Types of complications according to the Clavien–Dindo classification are listed in Table 4. There were two patients with bile duct lesions in LC (2.7%). The duration of the symptoms was not related to bile duct lesion (p = 0.213).

Thirty-day mortality was higher in the OC group (five patients; 16.1%) compared to the LC group (three patients; 5.2%). Comparing the conservatively treated emergency group to the surgically treated emergency group, the mortality rates were similar (three patients; 10% vs. 10 patients; 9.5%). There was no significant association between ASA score and 30-day mortality (p = 0.304).

**Table 1.** Patients' demographic data.

| Parameter | Value |
|---|---|
| Total number of patients | 160 |
| Emergency cases (n, %) | 135 (84.4%) |
| Symptomatic disease (n, %) | 25 (15.6%) |
| Sex (n, %) | |
| Male | 90 (56.3%) |
| Female | 70 (43.7%) |
| Age (mean ± SD) | 84.84 ± 3.788 |
| Comorbidities (n, %) | |
| Cardiovascular | 122/160 (76.2%) |
| Pulmonary | 18/160 (11.2%) |
| Renal | 20/160 (12.5%) |
| ASA (n, %) | |
| 1 | 1/130 (0.8%) |
| 2 | 19/130 (14.7%) |
| 3 | 98/130 (76.0%) |
| 4 | 11/130 (8.5%) |

**Table 2.** Duration of symptoms in the emergency group. All values are expressed as the number and percentage of patients.

| Duration | Value |
|---|---|
| 0–24 h | 38/135 (28.2%) |
| 25–48 h | 28/135 (20.8%) |
| 49–72 h | 23/135 (17.0%) |
| 73–96 h | 5/135 (3.7%) |
| > 96 h | 16/135 (11.8%) |
| Unknown | 25/135 (18.5%) |

**Table 3.** Treatment modalities and results. uLC = urgent laparoscopic cholecystectomy, uLCc = urgent laparoscopic cholecystectomy with conversion to open cholecystectomy, uOC = urgent open cholecystectomy, eLC = elective laparoscopic cholecystectomy, eLCc = elective laparoscopic cholecystectomy with a conversion to open cholecystectomy.

| Treatment category | Conservative | uLC | uLCc | uOC | eLC | eLCc |
|---|---|---|---|---|---|---|
| n (%) | 30 (22.2%) | 58 (43.0%) | 16 (12.0%) | 31 (23.0%) | 23 (17.1%) | 2 (1.5%) |
| Surgery duration (minutes) | – | 62.19 | 96.63 | 56.87 | 46.09 | 107.5 |
| Hospital stay (days) | 6.2 | 5.84 | 11.31 | 17.06 | 3 | 13 |
| Postoperative complications n (%) | – | 12 (20.7%) | 7 (43.8%) | 19 (35.2%) | 3 (13%) | 1 (50%) |
| Surgical complications n (%) | – | 3/58 (52%) | 1/16 (6.2%) | 4/31 (12.9%) | 0 (0%) | 0 (0%) |
| Bile duct lesions n (%) | – | 2/74 (2.7%) | – (0%) | 0/31 (0%) | 0/25 | – |
| Overall mortality in acute cholecystitis n (%) | 3 | 10 (10%) | (9.5%) | | | |

**Table 4.** Surgical complications using the Clavien–Dindo score system in the observed cohort group. All values are expressed as the number of patients and their percentages. CD = Clavien–Dindo classification, uLC = urgent laparoscopic cholecystectomy, uLCc = urgent laparoscopic cholecystectomy with conversion to open cholecystectomy, uOC = urgent open cholecystectomy, eLC = elective laparoscopic cholecystectomy, eLCc = elective laparoscopic cholecystectomy with a conversion to open cholecystectomy.

| CD | uLC | uLCc | uOC | eLC | eLCc |
|---|---|---|---|---|---|
| Grade I | 5 (8.5%) | 1 (6.2%) | 1 (3.1%) | 0 (0%) | 0 (0%) |
| Grade II | 5 (8.5%) | 4 (25%) | 13 (40.3%) | 2 (17.4%) | 1 (8.7%) |
| Grade IIIa | 3 (5.1%) | 2 (12.4%) | 6 (18.6%) | 0 (0%) | 0 (0%) |
| Grade IIIb | 3 (5.1%) | 1 (6.2%) | 4 (12.4%) | 0 (0%) | 0 (0%) |
| Grade IVa | 1 (1.7%) | 1 (6.2%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Grade IVb | 2 (3.4%) | 0 (0%) | 5 (15.5%) | 0 (0%) | 0 (0%) |
| Grade V | 2 (3.4%) | 1 (6.2%) | 4 (12.4%) | 0 (0%) | 0 (0%) |

In the elective group, all the patients were treated with LC, with a conversion rate of 8% (2/25). In one patient, conversion to an OC was performed due to Mirizzi syndrome and the second patient was intraoperatively diagnosed with gallbladder cancer. The average hospital stay was 3 days for the LC group and 13 days for the conversion group. Morbidity was lower in the elective LC group (3/23; 13%) compared to emergency LC. There was no statistical significance between the types of operation and postoperative complications in the elective group ($p = 0.300$). None of the patients died in the elective group.

We found a longer operative time in the acute laparoscopic group compared to the elective laparoscopic group (65.02 minutes vs. 46.09 minutes, $p = 0.008$) and a shorter hospital stay in the elective group (3.39 days vs. 5.84 days, $p = 0.037$). No significant difference in postoperative complications ($p = 0.537$) and bile duct lesions ($p = 0.999$) between the acute and the elective laparoscopic group was observed. There was also no statisti-

cally significant difference in the mortality rates (3/58 vs. 0/23; p = 0.588).

# Discussion

Laparoscopic cholecystectomy is accepted in the surgical community as a gold standard for treating calculous gallbladder disease [1, 2]. It is feasible and safe in elective or acute settings. Reduced postoperative pain, early mobilization, lower incidence of surgical site infection, and less pulmonary function impairment result in earlier return to normal daily activities [3]. The literature is mostly inconclusive on whether early cholecystectomy is preferred over delayed cholecystectomy. Most studies have shown that early LC in an acute setting is feasible and safe [5, 6]. In his report, Gutt argues that LC should be offered up to 10 days after the beginning of symptoms [4]. Other studies show that earlier surgery is associated with a shorter hospital stay and fewer complications [7, 8].

Special considerations are needed in patients over 80. Octogenarians frequently have associated cardiac, pulmonary, metabolic, or renal comorbidities. Older patients also tend to have long histories of calculous gallbladder symptoms, which results in chronic inflammation and scarring. Reports from the literature show a higher incidence of severe complication of calculous gallbladder disease in the elderly (11.4–69%) such as gangrenous inflammation, empyema, or xanthogranulomatous inflammation [9]. Compared to a younger population, morbidity (38.3% vs. 17.6%, OR 2.39) and mortality (3.2% vs. 0.4%, OR 5.91) are higher in this group of patients in any type of treatment [10]. Historically, older and/or high-risk patients were treated conservatively or an open cholecystectomy was performed [11, 12]. Despite evidence that LC is associated with lower morbidity and mortality rates, and lower cardiac and respiratory complications compared to OC, still up to 55% of octogenarians with acute cholecystitis are treated with OC [13, 14]. In the last decade, there has been growing momentum in the surgical community for a laparoscopic approach in octogenarians in an acute setting [14–16]. Reports from the literature show that LC is feasible and safe even in high-risk patients with symptomatic calculous gallbladder disease or complicated calculous gallbladder disease [2, 10, 13, 15]. Laparoscopic cholecystectomy is shown to be superior to any other treatment modality, including OC, percutaneous cholecystostomy, or conservative treatment [2]. This was also confirmed by our results. Patients treated with LC had shorter hospitalization compared to the open procedure (5.84 vs. 17.06 days) with lower morbidity (20.7% vs. 35.2%, p = 0.001). Looking specifically at the surgical complications, LC is again superior to OC (3/58 (5.2%) vs. 4/31 (12.9%)).

There are several main concerns with the laparoscopic approach. First, there is a high conversion rate in older and high-risk patients. Reports in the literature show conversion rates between 5 and 27.2% in high-risk patients [9, 10, 17, 18]. The main reason is chronic inflammation, which causes scarring of Calot's triangle [19, 20]. Another reason for conversion is a higher incidence of intraoperative bleeding as well as a higher degree of gallbladder inflammation. In our study, the overall conversion rate was 18.2% (18/99). In the emergency group, conversion to OC was performed in 21.6% of the patients (16/74). The conversion rate is relatively high but comparable to other published results. One of the possible reasons for the high conversion rate in our cohort is that, unless an absolute contraindication was present (septic shock, or severe cardiac or severe pulmonary comorbidity), we always started with a laparoscopy. In unclear circumstances (adhesions, severe inflammation, bleeding, or anatomical difficulties), we converted to an open procedure. The other reason is that the majority of patients were operated on by younger surgeons, who had limited experience in the advanced laparoscopic approach and are more prone to conversion. Conversion to an open procedure is not associated with a substantial increase in morbidity and mortality, and it should always be considered as an alternative [21]. According to the World Society of Emergency Surgery (WSES) guidelines. conversion is recommended in cases of severe inflammation, adhesions, or bleeding in Calot's triangle, or when bile duct injury is suspected [2].

Another concern is bile duct injuries. Initial reports showed a higher incidence of bile duct injury in LC when compared to the open procedure (0.85% vs. 0.30%) in the general population. This was, however, probably associated with the initial development of the laparoscopic technique and a lack of experience. Recently published data suggest that in the general population the incidence of bile duct injury is similar or even lower with LC compared to the open procedure (0.3–0.6%). In

our study we had two (2/130, 1.5%) bile duct lesions. In the first patient, a lesion of the common bile duct was suspected intraoperatively and conversion to an open procedure was performed. Exploration showed that the common bile duct was transected without any defects in its length. End-to-end anastomosis of the bile duct with a T-drain was performed. In the second patient, a bile duct lesion was suspected because of bile drainage on the second postoperative day. Only the distal part of the common bile duct was seen upon ERCP. During an open exploration, a lesion of the common bile duct was found with a 2 cm long defect. A reconstruction with a Roux-en-Y loop was performed. The postoperative period was uneventful in both cases. Patients with bile duct lesions were primarily operated on by an experienced surgeon. In the first case, the surgeon reported severe inflammation and scarring in Calot's triangle with subsequent anatomical misinterpretation of the bile duct. In the second case, the report of LC was uneventful. Our incidence of bile duct lesions is higher compared to the published data. Comparison is difficult, however, because of our small group of patients and because they were markedly old. Data regarding bile duct lesions in octogenarians are lacking in the literature. From the reports available, it seems that bile duct injury occurs more often in markedly old patients. Hazzan and Sang-Ill Lee reported an incidence of 1.5% [16, 22]. Longstanding gallstone disease with chronic inflammation and consequently scarring of Calot's triangle combined with a higher incidence of severe complication of calculous gallbladder disease makes this population more vulnerable to possible bile duct injury.

Most octogenarians have impaired lung or heart functions. At the beginning of the laparoscopic era, there were concerns about the effects of pneumoperitoneum using carbon dioxide and subsequent respiratory functions. However, recent reports conclude that LC has less impact on postoperative lung function and is favored over OC, even for patients with relatively deranged lung function [23]. One of the main reasons for this is probably lower postoperative pain and early mobilization after laparoscopic treatment. Under the defined circumstances, lower intraabdominal working pressure can permit a safe operation that is not time consuming. The approach described is important and can be reflected in cardiovascular and respiratory functions after surgery (i.e., reduced complications). Even though an open approach is more frequently used in patients with chronic heart failure, laparoscopy seems to offer a safe alternative in appropriately selected patients [24].

Higher morbidity and mortality in octogenarians are usually a consequence of aggravated systemic inflammation response and deterioration of comorbidities with low physiological reserve. Machado et al. showed that elderly patients develop an exaggerated inflammatory response after surgery due to their proinflammatory status [25]. The overall mortality rate in our study was 9.5% (10/105) in the emergency group of patients that were treated surgically. This is a relatively high incidence and is probably a consequence of a patient population in worse health with numerous associated comorbidities. This statement is supported by mortality in the conservative group (3/10; 10%) and no mortality in the elective group of patients. The main reason for mortality in our study population was the development of multiple organ failure (6/13; 46.2%) as a consequence of exaggerated inflammatory response with a subsequent cardiorespiratory failure.

As already mentioned, there are several alternatives to operative treatment. One of them is percutaneous cholecystostomy (PC), which is a treatment of choice at some centers for very old patients with comorbidities and acute gallbladder disease. Viste et al. published the results of 104 percutaneous cholecystostomies in high-risk patients with acute cholecystitis [26]. The majority (82.7%) of patients had calculous cholecystitis. The study showed that PC in high-risk patients is feasible, with minimal complication rates and acceptable morbidity and mortality (3.6%). However, PC does not offer a definitive resolution of the problem, and only 30% of the patients had a subsequent cholecystectomy. Up to a quarter of patients were readmitted because cholecystitis recurred or other biliary problems arose [27]. Currently, PC offers a bridging therapy to cholecystectomy in severe cholecystitis in high-risk patients. After relief of symptoms, a cholecystectomy should be offered. The success rate of LC (94.1%) after PC is acceptable, and conversion rates could be lowered by performing LC as early as possible [28, 29], which is also confirmed with our own experience.

The next treatment modality is antibiotic-based conservative treatment. However, this type of treatment is associated with a high recurrence rate, and up to 23% of patients need an emergen-

cy operation because conservative treatment fails [2]. There are several known predictors for failure of conservative treatment. Patients older than 70 with diabetes and a distended gallbladder should be considered for early cholecystectomy [30]. Failure of conservative treatment with subsequent surgical intervention in our study was 34.8% (16/46). This group consisted of patients with an early stage of cholecystitis or patients with severe comorbidities. One of the patients in this group died (5.9%; 1/16) after surgical intervention due to sepsis and multiple organ failure. Close surveillance is needed, and signs of clinical deterioration demand rapid surgical intervention. Antibiotic treatment should be prompt and based on clinical presentation, concomitant diseases, and data on colonization from previous hospitalization.

Data from Trust et al. show that patients benefit from cholecystectomy as a definitive treatment modality [31]. Older patients with biliary pancreatitis that underwent cholecystectomy had better 2-year survival compared to the no-cholecystectomy group. The readmission rate was 44% for biliary complications compared to 4% in the cholecystectomy group. Gallstone pancreatitis was the reason for readmission in 48% of cases, whereas 52% of patients were readmitted for other gallstone-related complications. This study concluded that elderly patients should be offered a cholecystectomy unless there are absolute contraindications for the procedure. The timing of surgery is another important factor of influence.

Finally, we should mention the main drawback of our study. Its retrospective nature without randomization does not offer high-grade quality of evidence. However, our data support the current clinical practice of performing LC in elderly patients with complicated calculous gallbladder disease.

# Conclusions

Our study shows that LC is associated with shorter hospitalization and lower morbidity and mortality rates when compared to OC. This confirms the published data regarding the safety and feasibility of the laparoscopic approach in octogenarians with symptomatic or complicated calculous gallbladder disease. Conversion to an open procedure is mandatory in cases of severe inflammation, adhesions, or bleeding in Calot's triangle to avoid bile duct injuries. Another important conclusion is the need to develop a standardized clinical evaluation and urge a prompt decision in elderly patients with complicated calculous gallbladder disease. Large randomized controlled trials are necessary to establish a proper treatment algorithm in this group of patients.

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