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Research Article

# Outcome of Early Cholecystectomy Compared to Percutaneous Drainage of Gallbladder and Delayed Cholecystectomy for Patients with Acute Cholecystitis

*Angelo Di Vittori[1,2*], Fabio Marilungo[1], Vittorio Bartolotta[1], Federica Marinucci[1], Marino Di Furia[1], Fabio D'Emidio[1] and Andrea Gardini[1]*

[1]*Department of General Surgery, "C. e G. Mazzoni" Hospital, Ascoli Piceno, Italy*

[2]*Division of General and Hepatobiliary Surgery, Department of Surgical Sciences, Dentistry, Gynaecology and Pediatrics', University of Verona, Verona, Italy*

## Abstract

**Introduction:** Acute Cholecystitis (AC) presents a significant burden in emergency departments worldwide, with controversies surrounding its optimal management. This study aimed to compare short-term outcomes in patients with AC treated with Emergency Laparoscopic Cholecystectomy (ELC) vs. Percutaneous Transhepatic Cholecystostomy (PTC) followed by Delayed Laparoscopic Cholecystectomy (DLC).

**Methods:** A retrospective study was conducted on 56 consecutive patients with AC admitted between January 2017 and September 2022. Patients were divided into two groups: ELC (n=33) and PC + DLC (n=23). Data on demographics, clinical presentation, treatment pathways, and outcomes were collected and analyzed. **Results:** Patients in the ELC group had less severe disease and an earlier diagnosis compared to the PC + DLC group. PC was successful in all 23 patients without early complications. The PC group exhibited more comorbidities. There were no significant differences in operative time, conversion to open surgery, or intraoperative complications between the two groups. However, the PC group had a higher rate of wound infections and longer hospital stays.

**Conclusion:** PC followed by DLC may be a safer option for frail or elderly patients with AC, allowing for a more controlled procedure and decreased perioperative risks. The use of PC also enables preoperative biliary system imaging, potentially reducing the risk of common bile duct complications.

**Keywords: Acute cholecystitis; Gallbladder; Laparoscopic surgery; Pancreatic surgery**

## Introduction

Acute Cholecystitis (AC) is defined as the distension of the gallbladder, associated with chemical or bacterial inflammation, that results from obstruction of the cystic duct, usually by a gallstone [1]. An increase in the incidence of AC has been reported in recent years [2]. It is one of the most common diseases in the emergency department. The Tokyo guidelines of the Japanese Society of Hepato-Biliary-Pancreatic Surgery include diagnostic criteria, therapeutic strategies, and clinical flowcharts for acute cholangitis and cholecystitis [3].

Based on refinements in laparoscopic technique and increased surgical experience, Laparoscopic Cholecystectomy (LC) has replaced the traditional Open Cholecystectomy (OC), and become a standard therapy of cholecystitis, especially for chronic disease.

In patients with acute cholecystitis, LC is technically feasible and safe within 72 to 96 hours after the onset of symptoms [4]. Within 72 hours after the onset of symptoms and before the development of fibrosis, LC may be a safe procedure because the anatomy is usually clear and the dissection may be guided by edema [4,5]. For patients who are admitted more than 72 hours after the onset of symptoms, however, treatment is controversial, and results are unclear. For the treatment of AC, there has been controversy over the advantages of Emergency LC (ELC) *vs.* delayed surgery after gallbladder drainage, like percutaneous transhepatic gallbladder drainage (PC) [6-8]. In 1980, PC was first introduced by Radder [9]. Because it has the advantages of causing minimal injury, lower complication rate, and being a simple procedure with rapid symptom relief [10], PC has been widely performed as a safer substitute for ELC.

There is an agreement between Tokyo Guidelines (TG) 2018 and World Society of Emergency Surgery (WSES) 2020 guidelines that ELC should be offered to AC patients as first option whenever the risk of surgical intervention deemed acceptable [3,4]. In TG 2018 and WSES guidelines, PC is an alternative option if the surgical treatment is considered high risk and expected to be associated with more unfavourable outcomes compared with PC. However, there is discrepancy in criteria to select ELC or PC and most of recommendations were based on low-quality evidence [11].

The present study was undertaken to compare short-term outcomes in patients admitted for ACC, treated with emergency laparoscopic cholecystectomy or percutaneous transhepatic cholecystostomy followed by delayed laparoscopic cholecystectomy.

## Materials and Methods

### Inclusion criteria and population under study

This is a retrospective study based on a prospectively maintained dataset.

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***Corresponding author:** Angelo Di Vittori, Department of General Surgery, "C. e G. Mazzoni" Hospital, AST 5, Via degli Iris snc, 63100, Ascoli Piceno, Italy, Tel: +39 3924060747

Between January 2017 and September 2022, a total of 198 consecutive patients with ACC were admitted in our surgical unit.

Exclusion criteria were:

- Pediatric patients or 90yrs+ patients
- Patients with acalculous and/or postoperative AC
- AC associated with acute pancreatitis
- AC associated with choledocholithiasis
- Tokyo grade I3
- Patients treated with ELC over 24 hrs after admission
- Patients treated with DLC over 60 days after PC
- Patients treated with PC but non with DLC.

A total of 56 patients were enrolled in the study. Informed consent was administered to all patients. Diagnosis and severity of AC and subsequent treatment pathway were established according to 2013-2018 TG [3,12]. The diagnosis was confirmed by abdominal Ultrasonography (US) in 31(55,3%), by Computed Tomography (CT) in 7 (12.6%) and by both in 18 (32.1%) cases.

The decision to perform PC was at the discretion of the surgery team, mainly as a bridge to surgery in high-risk patients or in those who did not sufficiently improve under medical therapy. All cholecystostomy tubes were performed percutaneously under the guidance of computed tomography by a senior radiologist. In all cases, a Seldinger technique, either by transhepatic or transperitoneal approach, was used for placing a 6 to 8 French catheter. Routine US scan was performed before PC removal in every case. All patients submitted to PC received antimicrobial therapy. Bile samples were taken from all patients for anaerobic and aerobic cultures.

Laparoscopic cholecystectomy was performed by the four-trocar technique, with transection of the cystic duct and artery after reaching the critical view of safety, as described in national and international guidelines [3]. The procedures were performed by surgeons experienced in laparoscopic surgery, defined as performing more than 100 laparoscopic procedures yearly.

In all cases, antimicrobial therapy was administered in association with IV fluids, Proton-Pump Inhibitors (PPIs), and Non-Steroidal Anti-Inflammatory Drugs (NSAISd). The choice of antimicrobial drugs was based on 2016-2020 World Society of Emergency Surgery (WSES) guidelines on acute calculous cholecystitis and the duration of antimicrobial therapy was 4-7 days once the source of infection was controlled [4,13].

Clinical improvement after percutaneous transhepatic cholecystostomy was defined as:

- Resolution of pain or tenderness of the right upper quadrant,
- Body temperature ≤ 37.5°C during a 24-hour period,
- Resolution of leukocytosis.

After the patients were discharged from the hospital, the catheter was monitored twice weekly at the outpatient surgery clinic. Transcatheter cholangiography was performed 2 weeks after the percutaneous transhepatic cholecystostomy. In patients with a patent cystic duct, the catheter was left in place, closed, and secured under wound dressings. All patients had laparoscopic cholecystectomy at less than 8 weeks after discharge from the hospital.

The records of patients were reviewed for baseline characteristics, clinical presentation, and laboratory results during the index admission. Patient characteristics included gender, age, Body Mass Index (BMI), American Society of Anaesthesiologists (ASA) class, AC diagnosis and grade, onset of symptoms >72 h.

Data were recorded for patients requiring PC during their index admission. In patients undergoing PC, events of accidental ejection of the tube, peri-tubal leakage, bleeding, and the need for reinsertion of another tube were recorded. The interval period between the index admission and surgery was evaluated for recurrent episodes of AC and other biliary related complications. Operative reports were reviewed to identify operative time, conversion to an open surgery, and intraoperative complications, mainly bleeding and iatrogenic bile duct injury. Postoperative course was examined for complications within 30 days of surgery. Biliary related complications were classified according to the Strasberg classifi-cation [14].

Recorded outcomes were overall morbidity, intended as any adverse event occurring during the admission and the follow-up, graded according to Clavien–Dindo, major morbidity (any Clavien–Dindo grade > II adverse event) and mortality (death due to any cause) rates.

### Data collection and statistical analysis

All demographic, clinical and outcome data were prospectively collected in a PC dataset. Continuous data were analyzed with the student t test or the Kruskal-Wallis test as appropriate. Categorical data were compared using the chi-square test or Fisher exact test. Continuous data were presented as means (standard deviation), or medians (range/IQR). Categorical data were presented as frequencies. A P value of <0.05 was considered statistically significant. Statistical analysis was performed using SPSS software 21.0 version (IBM Corpo-ration, Armonk, NY).

## Results

Demographics and clinical details of overall patients, according to the treatment group are shown in Table 1. There was no significant difference between the two groups in age, gender, BMI and ASA classification. According to 2018 Tokyo guidelines 3, patients in the ELC group had less severe disease (p 0.014, with an earlier diagnosis (p 0.045). Patients in the PC group had much more comorbidities (p 0.012) as shown in detail in Table 2.

Percutaneous transhepatic cholecystostomy was technically successful in all 23 patients without any early complications. After percutaneous transhepatic cholecystostomy placement, 16 patients (69.6%) had early resolution of cholecystitis symptoms. All of the 23 patients were discharged after complete resolution of symptoms. Two weeks after the placement of the percutaneous transhepatic cholecystostomy catheter, all patients underwent cholangiography; in 4 patients (8.7%) the cystic duct was obstructed, and the cholecystostomy catheter was left open until surgery. Although there were no clinical symptoms, common bile duct stones were observed by cholangiography in 3 patients; these stones were successfully removed by endoscopic retrograde cholangiopancreatography and sphincterotomy before the operation (Table 3).

In all patients, laparoscopic cholecystectomy was performed at an average of 6 weeks (range 4-7) after percutaneous transhepatic cholecystostomy. Surgical approach and conversion rate from

**Table 1:** Overall and treatment group demographics and clinical details.

| | Overall n. 56 patients | ELC n. 33 (58.9%) | PC + DLC n.23 (41.1%) | *p.* |
|---|---|---|---|---|
| **Age (years)** | 69.21 (sd 14.03) | 64.33 (sd 15.07) | 76.22 (sd 8.671) | 0.418 |
| **Gender** | | | | |
| M | n. 30 (53.6%) | n. 17 (56.7%) | n. 13 (43.3%) | 0.789 |
| F | n. 26 (46.3%) | n. 16 (61.5%) | n. 10 (38.5%) | |
| **BMI** | 27.51 (sd 4.44) | 27.30 (sd 4.87) | 27.83 (sd 3.82) | 0.663 |
| **Tokio grade[3]** | | | | |
| 2 | n. 31 (55.4%) | n. 23 (74.2%) | n. 8 (25.8%) | 0.014 |
| 3 | n. 25 (44.6%) | n. 10 (40%) | n 15 (60%) | |
| **Onset** | | | | |
| <72h | n. 24 (42.9%) | n. 18 (75%) | n. 6 (25%) | 0.045 |
| >72h | n. 32 (57.1%) | n. 15 (46.9%) | n. 17 (53.1%) | |
| **ASA** | | | | |
| 1 | n. 4 (7.1%) | n. 4 (100%) | - | 0.264 |
| 2 | n. 22 (39.3%) | n. 14 (63.6%) | n. 8 (36.4%) | |
| 3 | n. 22 (39.3%) | n. 11 (50%) | n. 11 (50%) | |
| 4 | n. 8 (14.3%) | n. 4 (50%) | n. 4 (50%) | |
| **Comorbidity** | | | | |
| 0-2 | n. 34 (60.7%) | n. 26 (76.5%) | n. 8 (23.5%) | 0.012 |
| 2+ | n. 22 (39.3%) | n. 7 (31.8) | n. 15 (68.2%) | |

**Table 2:** Overall and treatment group comorbidities details.

| | Overall n. 56 patients | ELC n. 33 (58.9%) | PC + DLC n.23 (41.1%) | *p.* |
|---|---|---|---|---|
| hypertension | n. 38 (67.9%) | n. 17 (44.7%) | n. 21 (55.3%) | 0.002 |
| CKD | n. 14 (25%) | n. 5 (35.7%) | n. 9 (74.3%) | 0.095 |
| DM | n. 13 (23.2%) | n. 7 (53.8%) | n. 6 (46.2%) | 0.671 |
| CHF | n. 17 (30.4%) | n. 6 (35.3%) | n. 11 (64.7%) | 0.019 |
| Dementia | n. 5 (8.9%) | n. 3 (60%) | n. 2 (40%) | 0.959 |
| Depression | n. 3 (5.4%) | n. 2 (66.7%) | n. 1 (33.3%) | 0.779 |
| Solid tumor | n. 5 (8.9%) | n. 1 (20%) | n. 4 (80%) | 0.147 |
| Metastatic cancer | n. 1 (1.8%) | n. 1 (100%) | n. 0 | 0.4 |
| Potus | n. 10 (17.9%) | n. 4 (40%) | n. 6 (60%) | 0.288 |
| Smoke | n. 21 (37.5%) | n. 7 (33.3%) | n. 14 (66.7%) | 0.003 |

**Table 3:** post-procedural details in PC group.

| | |
|---|---|
| **Recourrence** | |
| Yes | n. 9 (39.9%) |
| No | n. 14 (60.9%) |
| **30d Death** | |
| Yes | n. 0 |
| No | n. 23 |
| **Los** | 14 days (6-45, sd 9.6) |
| **Readmission** | |
| Yes | n. 7 (30.4%) |
| No | n. 16 (69.6%) |
| **Los Read** | 8 days (1-11, sd 3.3) |

laparoscopic to open surgery were not significantly different in patients who were treated with emergency laparoscopic cholecystectomy than cholecystostomy and delayed chole-cystectomy (p= 0.462, p= 0.384). As shown in Table 4, there was no significant difference in operative time (p 0.268) and LOS after surgery (0.467). There was no significant difference in operative complication such as Bile leakage (p 0.498) or bile duct injury (0.400). Differences were shown only in wound-infection rates (p 0.005).

## Discussion

Therapy of AC is a complex multidisciplinary task. A number of factors must be considered to make a therapeutic decision. According to the Tokyo Guidelines 2018 recommendations, we should consider the patient's age, general condition, comorbidities, the beginning of his or her complaints and the severity of the gallbladder inflammation [3].

**Table 4:** post-operative details.

| | ELC n. 33 (58.9%) | PC + DLC n.23 (41.1%) | *p.* |
|---|---|---|---|
| Operation Time | 94 min (34-192, sd 41.9) | 80 min (45-136, sd 23.1) | 0.268 |
| Surgical approach | | | |
| Open | n. 2 (6.1%) | n. 2 (8.7%) | 0.462 |
| Laparoscopic | n. 29 (87.8%) | n. 21 (91.3%) | |
| Convertion to open surgery | n. 2 (6.1%) | - | 0.384 |
| LOS postop | n. 5 (2-27, sd 4.5) | n. 6 (2-17, sd 4) | 0.467 |
| LOS TOT | n. 6 (2-28, sd 4.7) | n. 21 (11-45, sd 8) | 0.001 |
| Compl. Post vlc | n. 5 (15.2%) | n. 11 (47.8%) | 0.018 |
| Bile leakage | n. 3 (9.1%) | n. 1 (4.3%) | 0.498 |
| Bile duct inj. | n. 1 (3%) | - | 0.4 |
| Wound infect. | - | n. 5 (21.7%) | 0.005 |
| other | n. 2 (6%) | n. 4 (17.3%) | 0.215 |

Theoretically, PC is an attractive alternative to cholecystectomy. Unlike cholecystectomy, gallbladder drainage can be performed beside and without need of general anaesthesia. In fact, previous studies have shown the bene-fits of PC in patients defined critically ill or with expected high morbidity and in patients with advanced or com-plicated gallbladder disease, in which an operation poses a great risk [15-17]. This technique may serve as a "bridge to surgery" or as an alternative to the gold standard DLC. Studies comparing PC with ELC have shown conflict-ing results. A Cochrane systematic review including only randomized clinical trials showed no significant difference in morbidity and mortality between the two interventions [18]. Unsurprisingly, patients treated with PC in our cohort presented with more comorbidities and higher severity grade of ACC compared with patients in the No-PC group. "Cooling down" ACC may be a safer option in these patients, allowing to perform the surgery non in emergency, with a dedicated equipe. Percutaneous transhepatic cholecystostomy could make biliary system im-aging before delayed cholecystectomy possible and decrease the risk of retained common bile duct stones or the need for perioperative cholangiography and common bile duct exploration. In elective surgery, furthermore, the use of Fluorescence Imaging (ICG) may lead to avoiding Iatrogenic lesions of the biliary tract [19].

Our single-center experience demonstrated that there were no significant intraoperative or postoperative differences in the two groups. In the PC group there was a higher rate of wound infection and LOS, but there were no significant differences in bleeding, Bile leakage, LOS after surgery.

## Limitations and Future Directions

The retrospective design of our study is its major limitation. The sample size is still relatively small to perform rigorous statistical analysis to answer key clinical questions. In addition, in a suburban hospital like ours, there are multidimensional reasons (clinical, socioeconomic, patient preferences, loss to follow-up etc.,) that could play a role in patients not receiving ELC. Abstracting the exact rea-son from the medical records is not always plausible in a retrospective study design. Indeed, a randomized com-parison of percutaneous drainage versus ELC for high-risk patients is the goal of the multicenter Dutch CHOCO-LATE trial to determine if a survival benefit exists [20].

## Conclusion

The use of or percutaneous transhepatic cholecystostomy followed by delayed laparoscopic cholecystectomy in frail patients or elderly

patients may be a safe and secure option to perform a safe procedure. DLC after PC can be performed laparoscopically in most patients with minimal morbidity.

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