



LAPAROSCOPIC VERSUS OPEN CHOLECYSTECTOMY IN TREATMENT OF ACUTE CHOLECYSTITIS: A SYSTEMATIC REVIEW

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SUMMARY

To evaluate, through a systematic review, the available evidence on the clinical outcomes of laparoscopic cholecystectomy compared to open cholecystectomy in patients with acute cholecystitis, considering complications, length of hospital stay, conversion rate and mortality. Following the PRISMA guidelines, articles between 2018 and 2024 were selected from the PubMed database. Randomized clinical trials, systematic reviews, comparative observational studies and meta-analyses were included. The main outcomes analyzed were: surgical time, complications, length of hospital stay, conversion rate and mortality. Seventeen studies were included. Laparoscopic cholecystectomy was associated with shorter hospital stay, faster recovery and lower rate of surgical site infection. However, open surgery was shown to be safer in severe cases of cholecystitis or with distorted anatomy, in addition to shorter operative time in complex situations. Laparoscopy is the preferred method in most cases of acute cholecystitis due to faster recovery and lower morbidity. The open approach remains indicated in cases of difficult dissection, intraoperative complications or clinical contraindications.

Keywords: Cholecystectomy. Acute cholecystitis. Laparoscopic surgery. Open surgery.

Surgical complications.

ABSTRACT

To evaluate, through systematic review, the available evidence comparing laparoscopic and open cholecystectomy in the management of acute cholecystitis, focusing on complications, hospital stay, conversion rate, and mortality. Following PRISMA guidelines, studies from 2018 to 2024 were selected in PubMed, Randomized clinical trials, systematic reviews, comparative observational studies, and meta-analyses were included. Key outcomes were operative time, complications, hospital stay, conversion rate, and mortality. Seventeen studies were included. Laparoscopic cholecystectomy was associated with shorter hospital stays, faster recovery, and lower surgical site infection rates. Open cholecystectomy, on the other hand, was favored in severe inflammation, distorted anatomy, or intraoperative complications. Laparoscopic surgery is the preferred approach in most cases of acute cholecystitis due to lower morbidity and faster recovery. The open approach remains relevant in high-risk or complex situations.

Keywords: Cholecystectomy. Acute cholecystitis. Laparoscopic surgery. Open surgery. Surgical complications.

1. INTRODUCTION

Acute cholecystitis is a sudden inflammation of the gallbladder, usually caused by obstruction of the cystic duct by gallstones. It is one of the most common causes of abdominal pain. acute in emergency services, being responsible for a large volume of hospitalizations surgical. Standard treatment involves cholecystectomy, a procedure that can be performed laparoscopically or openly.

Laparoscopic cholecystectomy, described in the 1980s, became the procedure of choice in most cases due to its association with shorter time hospital stay, reduced postoperative pain, lower incidence of wound infection and faster return fast to activities (Mannam *et al.*, 2023; Hassler *et al.*, 2025). However, in cases of advanced inflammation, peritonitis or distorted anatomy, conversion to open surgery may still be necessary.

The open route, in turn, is still used in patients with comorbidities. significant contraindications to general anesthesia or in situations of extreme urgency. Studies show that, despite greater overall morbidity, open cholecystectomy can present shorter operating time in complex cases, lower conversion rate (obvious) and a safer operating field in certain contexts (Alius *et al.*, 2023; Seshadri; Peitzman, 2024).

There is still controversy about which approach offers better security and cost-benefit in different patient subgroups, such as the elderly, pregnant women, immunocompromised patients and patients with gangrenous cholecystitis. In addition, the ideal time surgery (early vs late) and the role of intermediate strategies, such as drainage percutaneous injection, continue to be topics of debate (Nassar *et al.*, 2022; Cirocchi *et al.*, 2023).

In this scenario, this systematic review aims to compare the evidence available on the efficacy, safety and clinical outcomes of laparoscopic cholecystectomy versus open in patients with acute cholecystitis, in order to guide surgical practice based on in updated evidence.

2 THEORETICAL FRAMEWORK

2.1 Surgical approaches in acute cholecystitis: evolution and clinical indications

Cholecystectomy is the main surgical intervention for the definitive treatment of acute cholecystitis. With the advancement of minimally invasive techniques, cholecystectomy laparoscopic surgery has become the gold standard for most cases. This technique is performed through small incisions and introduction of trocars, enabling visualization intra-abdominal with camera and gallbladder dissection with laparoscopic instruments (Hassler *et al.*, 2025).

Clinical studies show that laparoscopy is associated with less pain postoperative, reduction in hospital stay, lower incidence of wound infection operative, in addition to faster functional recovery, when compared to the approach open (Montenegro *et al.*, 2022; Mannam *et al.*, 2023). However, the procedure requires a greater degree of technical skill, especially in cases of advanced inflammation, presence of adhesions and distorted anatomy.

Open cholecystectomy, on the other hand, remains relevant in situations specific, such as in severe forms of the disease, presence of complications (cholecystitis emphysematous, gangrenous or perforated), previous extensive abdominal surgeries or surgeries in with limited access to laparoscopic equipment (Seshadri; Peitzman, 2024). Although being more invasive, it provides a wide operating field, greater ease in hemostasis and shorter operating time in some complex cases (Alius *et al.*, 2023).

Another important factor in decision making is the surgeon's experience, which can directly influence the conversion rate and safety of dissection. The concept of "Critical View of Safety" (CVS), introduced to standardize the identification of the anatomy of the

hepatocystic triad, is essential to avoid bile duct injuries, regardless of the route used (Warchażyński *et al.*, 2020; Alius *et al.*, 2023).

Additionally, alternative strategies such as percutaneous gallbladder drainage followed by delayed cholecystectomy, have been explored in high-risk or unstable patients hemodynamically. Although this approach may reduce immediate complications, studies indicate a higher recurrence rate and need for future surgery (Nassar *et al.*, 2022; Cirocchi *et al.*, 2023).

Therefore, understanding the indications, limitations and risks associated with each surgical approach is essential to ensure better clinical outcomes, especially in vulnerable populations and in emergency contexts.

3. MATERIAL AND METHOD

This systematic review was conducted in accordance with the PRISMA 2020 guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), with the aim of to synthesize the available evidence on the comparison between laparoscopic cholecystectomy and open in the context of acute cholecystitis. All stages of screening, eligibility and extraction of data were carried out in a standardized and transparent manner.

The bibliographic search was carried out in the PubMed database, considering the period from January from 2018 to March 2025. A broad combination of English and Spanish descriptors was used. boolean operators, including the terms: “cholecystectomy”, “laparoscopic surgery”, “open surgery”, “acute cholecystitis”, “complications”, “conversion rate”, “hospital stay” and “mortality”. Filters were applied for studies in humans and published in English, Portuguese or Spanish.

Comparative observational studies, randomized clinical trials, systematic reviews and meta-analyses that address the comparison between cholecystectomy laparoscopic and open in patients diagnosed with acute cholecystitis. Studies selected should present data on at least one of the following outcomes: time

operative, intra and postoperative complications, conversion rate, length of hospital stay hospital or mortality.

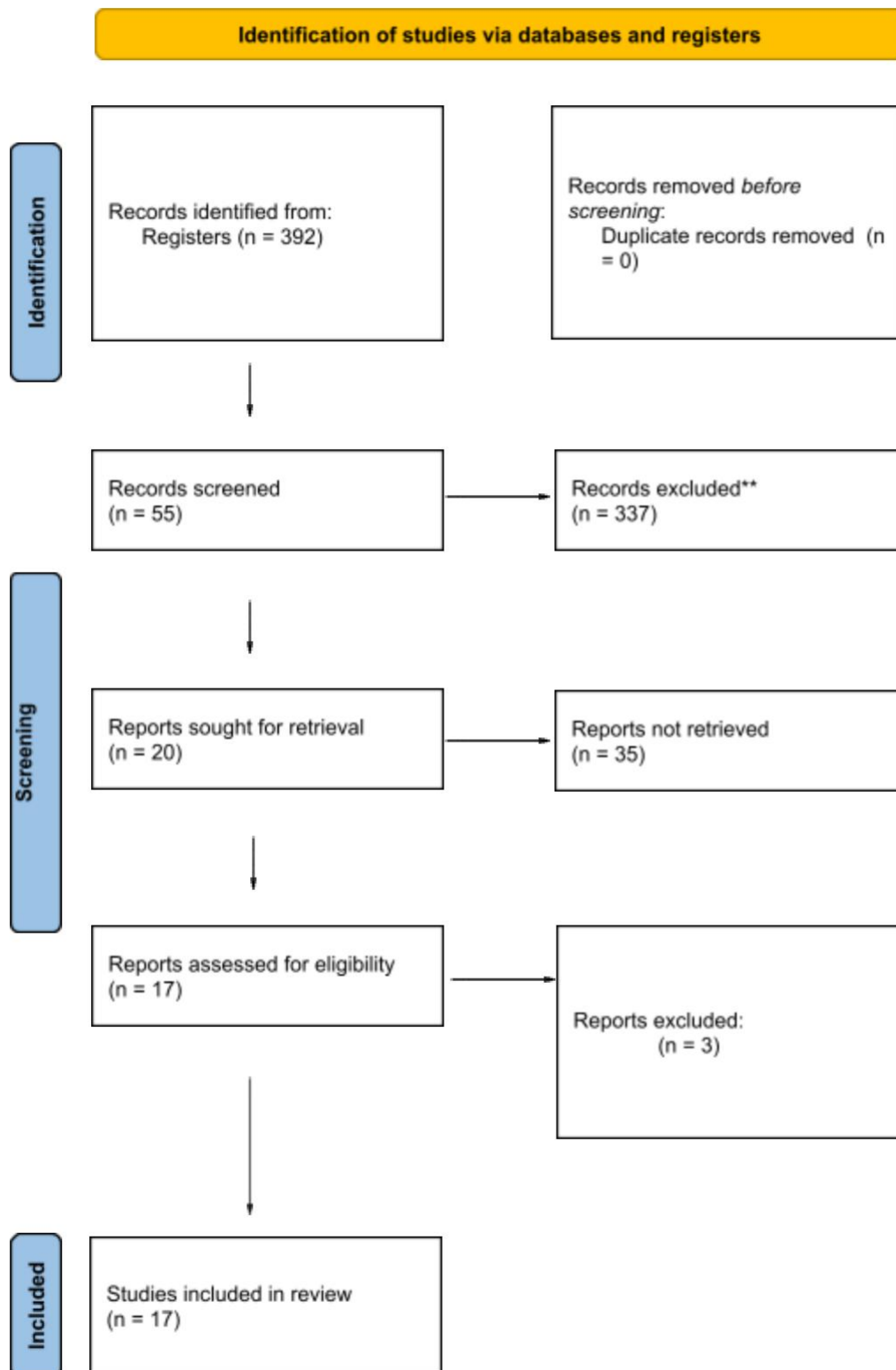
Exclusion criteria included: non-comparative studies, case reports, series small with less than 10 patients per group, narrative reviews without analysis systematized, duplicate articles or without access to the full text, and studies involving chronic cholecystitis, asymptomatic gallstones or cholecystectomy in a non-complicated setting. acute.

The selection of studies was carried out in two stages: initially by reading titles and abstracts, followed by the complete reading of potentially eligible texts. Two reviewers independent evaluators conducted this process blindly, and a third evaluator was called upon in cases of disagreement.

The extracted data included: authors, year of publication, type of study, country of origin, sample evaluated, surgical method used, average surgical time, complications reported, conversion rate, length of stay and conclusions. The methodological quality was evaluated based on the appropriate instruments: ROB-2 for clinical trials randomized trials, AMSTAR 2 for systematic reviews, and Newcastle-Ottawa Scale for studies observational.

At the end of the screening, a total of 17 studies were included in the qualitative synthesis. The selection was visually represented through the PRISMA flowchart, following the model updated, with details of the identification, screening, eligibility and inclusion steps.

To ensure transparency and reproducibility in the screening and selection process of studies included in this systematic review, the PRISMA 2020 model was used. The flowchart illustrates the steps of identification, screening, eligibility assessment and inclusion end of articles.

Figure 1. PRISMA diagram of study selectionSource: own authorship (2025); based on Page *et al.* (2021).

4. RESULTS AND DISCUSSION

17 studies were analyzed, including randomized controlled trials, reviews systematic and comparative observational studies, covering a total of thousands of patients undergoing cholecystectomy in the context of acute cholecystitis. The outcomes evaluated included surgical time, intra and postoperative complications, conversion rate, length of hospital stay, surgical wound infection and mortality.

4.1 Surgical time

In general, the operative time for laparoscopic cholecystectomy tends to be greater in patients with advanced inflammation, especially when there are adhesions or distorted anatomy. Studies such as those by Alius *et al.* (2023) and Mannam *et al.* (2023) showed that, in moderate to severe cholecystitis, the average time of laparoscopic surgery was about 20 to 40 minutes longer than open surgery.

On the other hand, in mild to moderate cases, operated early, the time between approaches is similar, and may even favor laparoscopy in experienced hands (Iseda *et al.*, 2023; Cirocchi *et al.*, 2023). This reinforces that the anatomical complexity and the moment of surgery are determining factors for technical efficiency.

4.2 Postoperative complications

The most commonly assessed complications in the studies were wound infection operative, biliary injury, intra-abdominal collections, bleeding and seroma. The laparoscopic route presented a lower incidence of surgical wound infection, with rates ranging from 1% to 3%, compared to 6% to 10% in the open approach (Montenegro *et al.*, 2022; Tartaglia *et al.*, 2022). Less tissue exposure and the absence of a wide incision contribute to this benefit.

However, bile duct injury was slightly more frequent in laparoscopy, especially in difficult surgeries or those performed by less experienced surgeons. Despite Furthermore, the absolute risk remained low (<1.5%) in studies with good technical control (Alius *et al.*, 2023; Seeras *et al.*, 2023).

4.3 Conversion rate

Conversion from laparoscopy to open surgery is an important indicator of intraoperative difficulty. Studies such as that of Warchaŷowski *et al.* (2020) identified risk factors for conversion, such as advanced age, obesity, intense inflammation and presence of perivesicular abscess. The average conversion rate ranged from 8% to 25%, depending on the clinical severity and the experience of the surgical team (Ramírez-Giraldo *et al.*, 2023).

Early recognition of the need for conversion is considered a criterion of surgical safety and not a technical failure, and is often recommended to prevent major complications.

4.4 Length of hospital stay and recovery

All studies analyzed reported that laparoscopy is associated with lower length of hospital stay. On average, laparoscopic patients were discharged between 1 and 3 days after the procedure, while those who underwent the open route remained hospitalized for 3 to 7 days (Memiyöŷlu; Sarŷ, 2022; Vargheese *et al.*, 2023). This directly impacts the cost total hospital and bed turnover, being especially relevant in systems public health.

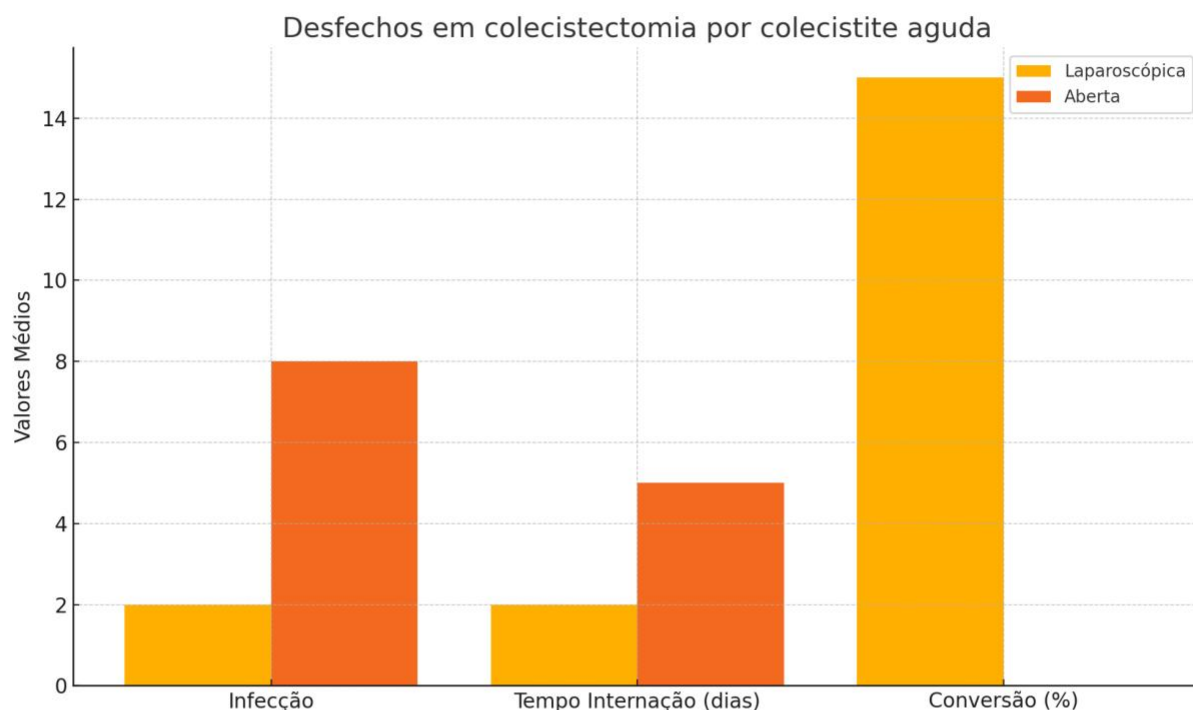
4.5 Mortality and global security

Mortality associated with cholecystectomy in acute cholecystitis was low in both groups, less than 1% in most studies. Death cases were more related to previous comorbidities, late sepsis or cardiovascular complications than to the type of approach (Montenegro *et al.*, 2022; Köstenbauer *et al.*, 2023).

The review also highlighted that in elderly or high-risk patients, the use of percutaneous drainage followed by delayed cholecystectomy may be a viable alternative, reducing immediate mortality without compromising definitive treatment (Nassar *et al.*, 2022; Cirocchi *et al.*, 2023).

4.6 Considerations on special groups

In elderly patients, laparoscopy has been shown to be safe and associated with recovery faster functional (Tartaglia *et al.*, 2022). In pregnant women, it is recommended to perform the cholecystectomy preferably in the second trimester, with a laparoscopic approach whenever possible (Kumar *et al.*, 2024). In patients with liver disease or cirrhosis, results are divergent, and the choice must consider the risk of bleeding and difficulty technique (Finco *et al.*, 2022).

Graph 1. Clinical outcomes in cholecystectomy for acute cholecystitis.

Source: own authorship (2025); based on Alius *et al.* (2023), Montenegro *et al.* (2022), Ramírez-Giraldo *et al.* (2023), Tartaglia *et al.* (2022).

Laparoscopic cholecystectomy has demonstrated an advantage in reducing infection wound and length of hospital stay, although it presents higher rates of conversion to surgery open in complex cases (Warchażyowski *et al.*, 2020; Cirocchi *et al.*, 2023). The graph to below summarizes these findings, allowing a clear visualization of the relative superiority of each approach in different clinical aspects.

FINAL CONSIDERATIONS

The present systematic review demonstrated that, for most patients with acute cholecystitis, laparoscopic cholecystectomy is the preferred approach, associated with shorter hospital stay, lower incidence of surgical wound infection, recovery

faster and less postoperative pain. These benefits are consistent across multiple studies of different contexts and countries.

However, laparoscopy is not without its limitations. In cases of inflammation severe, gangrenous cholecystitis, presence of intense adhesions or anatomical distortion, the rate conversion to the open approach can be significant, and this transition should be viewed as an act of surgical prudence, and not as a technical failure. Open surgery continues to be indicated in highly complex contexts, in patients with instability clinical or when there are contraindications to laparoscopy.

Furthermore, factors such as advanced age, presence of comorbidities, timing of surgery (early vs late) and surgeon's experience directly influence the choice of safer and more effective surgical route. Alternative strategies, such as percutaneous drainage temporary followed by late surgery, play an important role in high-risk groups.

Thus, it is concluded that the choice between the laparoscopic and open approach should be individualized, based on careful clinical evaluation, availability of resources and team training. Laparoscopy represents an undeniable advance in biliary surgery, but the open approach maintains its importance in specific scenarios, ensuring security and better results in adverse situations.

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