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COMPARISON OF OPEN CHOLECYSTECTOMY AND LAPAROSCOPIC CHOLECYSTECTOMY IN THE TREATMENT OF ACUTE CHOLECYSTITIS: A SYSTEMATIC REVIEW

Muhammad Haider Ali[1*], Mashhood Alam Khan[2], Mashal Khan[3], Hamza Khan Toru[4], Muhammad Waqas[5], Haseeb Ahmad[6], Aisha Farooq[7]

[1*]Resident Surgeon at Hayatabad Medical Complex, Peshawar, Pakistan
haidu.khan00.ha@gmail.com
[2]House officer at Hayatabad Medical Complex, Peshawar, Pakistan
[3]Licensed Practitioner at United Kingdom
[4]Clinical Fellow, Orthopaedics, King's Mill Hospital, Sutton in Ashfield. United Kingdom
[5]Resident Surgeon at Hayatabad Medical Complex, Peshawar, Pakistan
[6]Resident Surgeon at Hayatabad Medical Complex, Peshawar, Pakistan
[7]Resident Doctor at Rehman Medical Institute, Peshawar, Pakistan

***Corresponding Author:** Muhammad Haider Ali
*Resident Surgeon at Hayatabad Medical Complex, Peshawar, Pakistan,
haidu.khan00.ha@gmail.com

Abstract

Background: Acute cholecystitis is considered the most common complication of cholelithiasis. Annually, around 64,000 people require surgical intervention for this frequent surgical disease. The normal medical practice for individuals with acute cholecystitis is to do an early laparoscopic cholecystectomy (LC). The objective of this research is to present compelling data regarding the impact of laparoscopic cholecystectomy on reducing hospitalization duration, postoperative complications, morbidity, and mortality rate, as well as to assess its overall practicality. This objective was accomplished through carrying out a methodical examination of the existing evidence in the study undertaken in this particular area.

Objective: To compare the current evidences of open cholecystectomy Laparoscopic Cholecystectomy (LC) in the management of acute cholecystitis.

Methods: Systematic review was carried out in accordance with the PRISMA standards. Relevant searches were conducted using PubMed, EMBASE, and CINAHL. Eligible quasi-experimental & randomized controlled experiments were conducted utilizing various Mesh terms associated with laparoscopic cholecystectomy as well as open cholecystectomy interventions. Four main outcome parameters (hospital stay, post op complications, morbidity and mortality rate) were assess on short, medium, and long-term effect.

Result: The initial search yielded a total of 65 items. Following the screening process, a total of 10 publications were collected for the study. Multiple studies have consistently shown that laparoscopic cholecystectomy, when compared to open cholecystectomy, results in shorter hospital stays, reduced morbidity, and decreased postoperative problems. The outcome implies that. Laparoscopic

cholecystectomy is a safe procedure for treating acute cholecystitis, with lower mortality rates, shorter hospital stays, and less postoperative problems compared to open cholecystectomy.

Conclusion: The evidence of moderate quality indicates that laparoscopic cholecystectomy provides a safe and effective alternative to open cholecystectomy for patients with acute cholecystitis. It has been shown to reduce hospital stay, morbidity, mortality, and post-operative problems.

Key Words: Open Cholecystectomy, Laparoscopic Cholecystectomy, Acute Cholecystitis

1. INTRODUCTION

Cholecystectomy is widely regarded as one of the most frequently performed surgeries in the United States, with over 1.2 million Cholecystectomies carried out annually.(1) The occurrence of gallstones is estimated to be between 10% and 15% in adults, making it a highly prevalent gastroenterological disorder.(2) Roughly 80% of gallstones do not exhibit symptoms. Gallstones can lead to the blockage of the duct that drains cysts, resulting in the enlargement of the gallbladder and causing severe abdominal pain. Extended blockage leads to inflammation, infection, and perhaps ischemia, a prevalent illness referred to as acute cholecystitis (AC).(3) Acute & long-term cholecystitis can be associated with gallstone disease, however in infancy, cholecystitis unrelated to gallstones might be the most common kind. Persistent acalculous cholecystitis is a specific form of chronic stomach pain that occurs in children.(4) Among individuals under the age of 50, women had a threefold higher likelihood of developing AC compared to men.(5) AC attacks during redo episodes can lead to the development of chronic cholecystitis, characterized by a thickened gallbladder wall, mucosal atrophy, and potential scarring. Laparoscopic cholecystectomy (LC) is an established method for treating AC. Minimally Invasive Surgery (MIS) using the Laparoscopic technique has replaced open cholecystectomy (OC) is the most advanced treatment for AC. This is because it offers comparable effectiveness, reduces complications, and lowers costs.(5, 6) Acute cholecystitis is the most prevalent complication of cholecystolithiasis. Approximately 64,000 patients each year require surgery as part of their inpatient treatment, making it one of the most prevalent surgical conditions. The presentation of the ailment can range from mild to severe, and in some cases, it can be life-threatening. It is more commonly observed in older individuals and those with underlying health concerns. Gallbladder perforation gets a potential consequence that is frequently identified just during surgical intervention. Common clinical manifestations include upper abdominal discomfort, fever, and leukocytosis. (7) Gallstones are a prevalent medical disease in Western countries.

Studies indicate that the adult population has a prevalence rate ranging from 5% to 20%. Additionally, 20% to 40% of patients face a significant risk, ranging from 1% to 4% per year, of developing a symptomatic condition.(8) Acute cholecystitis occurrences make up 3%–10% of all patients experiencing stomach pain. The prevalence of acute cholecystitis in individuals under 50 years old experiencing abdominal pain was quite low, at 6.3%, compared to a higher prevalence of 20.9% in patients aged 50 and above (with an average prevalence of 10%).(9) Hospitalization and surgery are necessary for AC.(10) Early LC is considered the preferred treatment for patients in acute cholecystitis when compared to OC. This is because LC reduces postoperative pain, enables earlier resumption of oral intake, shortens hospital stay, facilitates quicker return to normal activity, and enhances cosmetic results.(12) Nevertheless, a significant proportion of patients (ranging from 2% to 30%) who have laparoscopic cholecystectomy with acute cholecystitis may need to be switched to open cholecystectomy. This conversion is necessary either to better visualize anatomical structures or to prevent or fix any damage to the bile ducts or blood vessels. (13, 14)(10) Lujan JA et al. determined that LC offers a secure and reliable substitute for open cholecystectomy for patients with acute cholecystitis. The approach has a low incidence of problems, which results in a shorter hospitalization term and provides the patient with a more comfortable recovery period compared to open cholecystectomy. Similarly, Tuula Kiviluoto and colleagues determined that LC is technically challenging in patients having acute and gangrenous cholecystitis. However, in the hands of skilled

surgeons, it is a safe and effective treatment. There is no increase in death rate, and the rate of illness appears to be substantially lower than in oral contraceptives. Federico Coccolin et al. demonstrated that the use of LC resulted in a decrease in hospitalization duration, pneumonia incidence, and wound infection rate. A study observed, minimal invasive procedures have been found to result in fewer surgical complications and less immunosuppression compared to open surgery for individuals with acute onset cholecystitis.

An investigation demonstrated that performing laparoscopic cholecystectomy on older individuals with acute cholecystitis is both secure and efficient. Laparoscopic cholecystectomy for elderly people improves their quality of life to the highest extent possible while minimizing the physiological burden and cost. There is currently no substantial information available that compares hospitalization rates, morbidity, duration of hospital stay, surgical trauma, mortality, and clinical outcomes between LC and OC in AC. There have been no published systematic reviews comparing the efficacy of LC versus OC for the treatment of AC. This research aims to provide strong evidence for comparing open cholecystectomy and laparoscopic cholecystectomy and its general feasibility in reducing the hospital stay, morbidity, mortality and clinical outcome. This target achieved through a systematic review of the available evidence in the research work conducted in this field.

2. OBJECTIVE

To assess present evidences on the comparison of open cholecystectomy and laparoscopic cholecystectomy in the treatment of acute cholecystitis.

3. METHODOLOGY

The inclusion criteria to this systematic review encompass all Randomized control trials published in the English language. These studies must specifically compare open cholecystectomy as well as laparoscopic cholecystectomy in the management of acute cholecystitis. There are no restrictions on the publication date or the age, sex, or ethnicity of the subjects. This systematic review includes studies that evaluate the effects of open cholecystectomy compared to laparoscopic cholecystectomy on hospital stay, mortality, morbidity, and clinical outcomes in patients with acute cholecystitis, using the PICO framework (Participant, Intervention, Comparison, and Outcome). The time frame under consideration spans from the earliest recorded data in April 2022. Excluded from consideration are all articles that have not been published, except those written in English. Also excluded are editorials, short interactions, conference papers, and issues related to chronic cholecystectomy.

A comprehensive literature search was conducted utilizing PubMed, CINAHL, Cochrane Library, and EMBASE databases. In addition, Google Scholar was also utilized. The most recent search was conducted in March 2022.

This systematic review includes eligible papers that focused on patients with acute cholecystitis who underwent open cholecystectomy & laparoscopic cholecystectomy procedures. Both randomized controlled trials & quasi-experimental research were included. All comprehensive studies that include non-English texts are omitted. The primary investigators conducted independent searches using the electronic databases PubMed, CINAHL, Cochrane Library, EMBASE, and Google Scholar. An initial search was conducted in PubMed with a combination of the following MeSH terms and search terms: ("acute cholecystitis" [Mesh] OR "acute cholecystolithiasis" [Mesh] OR "cholecystitis") AND ("open cholecystectomy" [Mesh] OR "gall bladder open cholecystectomy") AND ("laparoscopy cholecystectomy" OR "gall bladder removal").

After conducting thorough study, we loaded the data into Endnote X7 with the purpose of eliminating any duplicate entries. The criteria for study selection were limited to the title and abstract of the studies. All studies that met the eligibility criteria were retrieved in full text. The references lists of the retrieved studies or papers were further examined to identify any other studies or articles. At the beginning, a group of (number of authors) autonomous reviewers assessed the titles and abstracts of the research and eliminated those that did not meet the eligibility criteria. If the title and abstracts

proved insufficient to determine the qualifying criteria, the complete text of the papers was examined. The disparities among the three viewers were resolved through a consensus meeting.
Data extraction was carried out by a group of unbiased reviewers, and the retrieved data was compiled into a consistent table format. The data comprised the primary author, year of publication, study methodology, country of origin, sample size, gender distribution, average age of the participants, intervention type (including technique and duration), primary outcomes, time to achieve the results, and any other reported outcomes.

4. RESULTS

An initial search was performed utilizing the databases PubMed, CINAHL, Cochrane Library, as well as EMBASE. These produced 15 research papers, respectively. Another search was performed using Google Scholar, resulting in 30 findings. A total of 65 items have been identified, and after removing duplicates, 40 articles remain. After reviewing the titles and abstracts of the remaining papers, 15 publications were excluded as they did not match the qualifying criteria. Subsequently, ten papers with complete text were evaluated to determine if they met the criteria for inclusion, and all ten of these studies have been included for the qualitative analysis.
The studies included in this systematic review focused on individuals with acute Cholecystitis (Table 1). The diagnosis of Acute Cholecystitis was made by seeing acute soreness in the right upper quadrant and using ultrasonography to confirm the presence of gallstones along with a thickened and swollen gallbladder wall, a positive Murphy's sign, and fluid collections around the gallbladder.
This systematic review aimed to compare the effectiveness of open cholecystectomy as well as laparoscopic cholecystectomy in treating acute cholecystitis. The review included a total of 10 studies, which consisted of 4 prospective controlled trials, 2 randomized controlled trials, 3 comparative studies, and 1 retrospective study. The eligibility criteria remained consistent across all of the investigations. The research reported in table 1 exhibit the trait. Among the 10 studies, a total of 2504 individuals were included. Out of these, 412 patients underwent laparoscopic cholecystectomy whereas 1007 patients underwent open cholecystectomy for the treatment of acute cholecystitis.

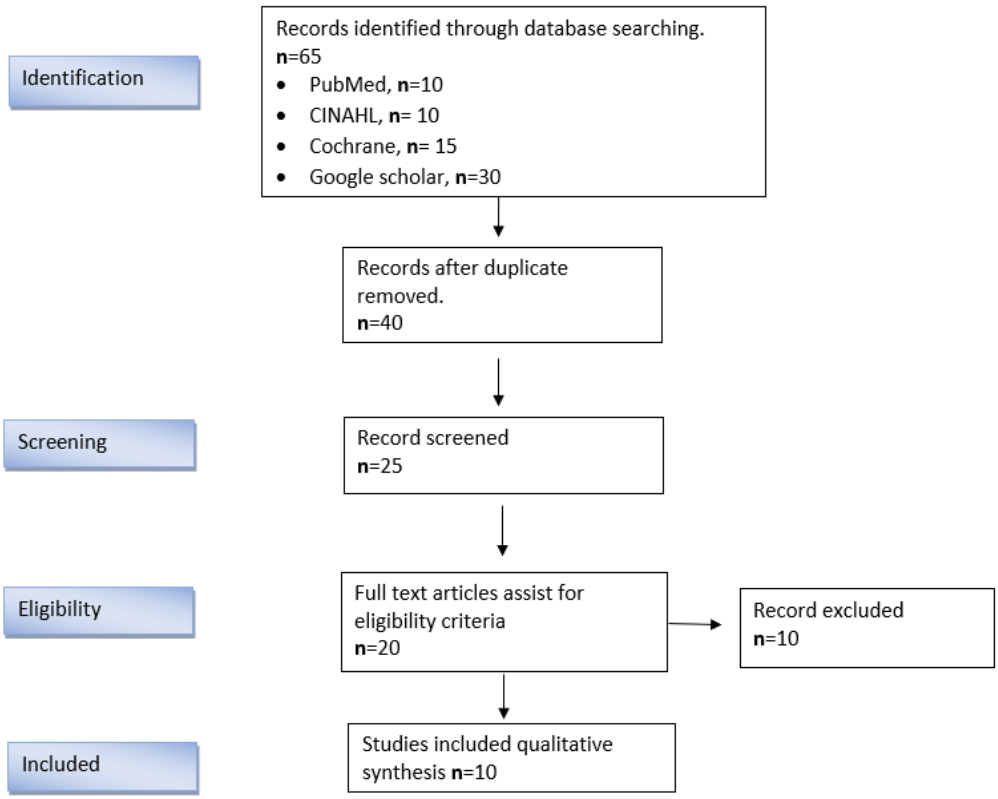

Figure 1 study selection Prisma Flow chart

Table 1 Summary of the included studies

	Study (ref.) year	Number of patients (tot:2504)	Laparoscopic Cholecystectomy (tot:1497)	Open Cholecystectomy (tot: 1007)	Study characteristics
1.	Joao Araujo et al.2014(15)	520 patients	412	108	Randomize control trial
2.	M. Johansson et al,2004(16)	70 patients	35	35	Randomize control trial
3.	Nathan W. Lee et al,2012(17)	226 patients	126	100	Comparative study
4.	Md. Rafiqul Islam2020(18)	950 patients	570	380	Retrospective study
5.	Cássio padilha et al,2008(19)	113 patients	70	43	Comparative study
6.	Z Glavi et al,2000(20)	209 patients	94	115	Comparative study
7.	Fausto Catena et al,2013(21)	144 patients	72	72	Prospective randomize Trial
8.	Y.-J. BOO et al,2006(22)	33 patients	18	15	A prospective randomized study
9.	Pessaux et al,2001(23)	139 patients	50	89	A prospective comparative study
10	Tanweer Karim et al,2015(24)	100 Patients	50	50	A prospective randomized study

4.1 Assessment of risk of bias

There is a possibility of placing too much emphasis on the positive therapeutic outcomes of randomized controlled trials (RCTs), which can lead to a biased interpretation. The risk of bias was thoroughly evaluated in accordance with the standards provided by The Cochrane Collaboration(25). Six specific items were deemed significant and are listed in Table 2. 1) Was the method of allocation genuinely random? 2) Was there proper allocation concealment? 3) Were the groups similar at the beginning of the study? 4) Were the eligibility criteria documented? 5) Was the loss to follow-up specified for each treatment group? 6) Was an intention-to-treat analysis conducted? To evaluate the level of quality of the review, we followed a specific procedure. A study was considered to be of high quality if it had favorable responses to a minimum of six questions. The study was considered to be in fair quality based on a positive response to either five or four questions. If the study received a good response to three or fewer questions, it was classified as low quality. When the studies did not provide enough details to determine the evaluation criteria specified above, an attempt was made to directly get more data from the investigators.

Table 2 Quality assessment of randomized trials

	Study (ref.) year	Randomization	Allocation concealment	Homogeneous baseline characteristic	Eligibility criteria	Loss to follow-up and drop-out described	Intention-to-treat analysis	Study quality
1.	Joao Araujo et al. 2014(15)	Yes	No	Yes	Yes	No	Yes	High
2.	M. Johansson et al, 2004(16)	Yes	Yes	Yes	Yes	Yes	Yes	High
3.	Nathan W. Lee et al, 2012(17)	Yes	No	No	Yes	Yes	Yes	High
4.	Md. Rafiqul Islam 2020(18)	Yes	No	Yes	Yes	No	Yes	High
5.	Cássio padilha et al, 2008(19)	Yes	No	No	Yes	Yes	Yes	High
6.	Z Glavi et al, 2000(20)	No	No	Yes	Yes	No	Yes	High
7.	Fausto Catena et al, 2013(21)	Yes	Yes	Yes	Yes	Yes	Yes	High
8.	Y.-J. BOO et al, 2006(22)	Yes	Yes	Yes	Yes	No	Yes	High
9.	Pessaux et al, 2001(23)	No	No	Yes	Yes	No	Yes	High
10.	Tanweer Karim et al, 2015(24)	Yes	No	No	Yes	No	Yes	High

4.2 Quality of trials

The reviewers exhibited a high level of consensus regarding the eligibility and quality of the research. Table 2 presents the level of research quality of each of the 10 studies that were included. The technique of allocation concealment was deemed sufficient in all three randomized controlled trials

(RCTs) (16, 21, 22). Randomization was conducted at a central site and communicated to treatment providers either through telephone or packed opaque envelopes. The baseline characteristics were comparable among the therapy groups in all seven studies. Every randomized controlled trial (RCT) specified its eligibility criteria for participant inclusion. All randomized controlled trials (RCTs) provided explicit information regarding the number of participants who were no longer available for follow-up in any of the treatment groups. All randomized controlled trials (RCTs) examined the data using an intention-to-treat (ITT) approach, where participants were evaluated according to their original randomization groups. It was not possible to blind the allocation due to the experimental nature of the experiments.

Table 3 Study description

	Study (ref.) year	**Intervention**	**Outcomes Result**		**Conclusion**
1.	Joao Araujo et al. 2014(15)	OC, n =108 and LC, n=412	Mortality, preoperative complications, surgical postoperative complications and medical postoperative complications were lower in LC group.	Hospital stay up to 4 days after surgery in LC group while more than 4 days in OC.	Laparoscopic cholecystectomy is increasingly being used as a treatment for acute cholecystitis, instead of open surgery, due to its advantages.
2.	M. Johansson et al, 2004(16)	OC, n =35 and LC, n=35	Morbidity was decrease in both techniques	Postoperative recovery was rapid after both cholecystectomy types.	Cholecystectomy, which is the surgical removal of the gallbladder for acute cholecystitis, can be done using either laparoscopic or open techniques. There are no significant variations in postoperative result between the two methods. Both procedures provide minimal risk of complications and allow for quick recovery after surgery.
3.	Nathan W. Lee et al, 2012(17)	OC ,n=41 and LC, n=100	Preoperative risk factors: previous abdominal surgery Pericholecystic fluid, gallbladder wall greater than 3 mm.		Administering an oral contraceptive (OC) to patients with preoperative risk factors will reduce the duration of the operation.
4.	Md. Rafiqul Islam 2020(18)	OC, n = 380 and LC, n=570	Patients with comorbidities such as hypertension, diabetes mellitus, and asthma had a decreased incidence of postoperative problems compared to patients without comorbidities.	LC patients required a hospital stay of 2-3 days after surgery, but OC patients needed to stay in the hospital for 5-7 days.	Laparoscopic cholecystectomy shown superior advantages for patients with a lower incidence of postoperative complications, faster resumption of feeding, and a shorter average hospital stay when compared to open cholecystectomy.
5.	Cássio padilha et al, 2008(19)	OC, n =43 and LC, n=70	Patients who underwent laparoscopic cholecystectomy (LC) experienced reduced hospitalization durations.	There were operative complications observed in six patients (14%) following open cholecystectomy (OC) and in nine patients (12%) after laparoscopic cholecystectomy (LC), with no statistically	There was no discernible disparity in the rates of illness and death when comparing open cholecystectomy (OC) with laparoscopic cholecystectomy (LC). The utilization of the laparoscopic technique resulted in a reduced

				significant difference between the two groups.	duration of hospitalization. There was no difference in the duration of the operation between the two methods of access.
6.	Z Glavi et al, 2000(20)	OC, n =115 and LC, n=94	The group underwent laparoscopic cholecystectomy without any fatalities.	The cost of hospitalization was considerably greater in patients who underwent laparoscopic procedures.	Laparoscopic procedures demonstrated superior clinical outcomes and a faster return to normal daily activities.
7.	Fausto Catena et al, 2013(21)	OC, n =72 and LC, n=72	The duration of hospitalization and occurrence of complications were similar in both groups after the operation.	Neither group exhibited any bile duct abnormalities or fatalities.	LC does not contribute to an increase in the morbidity and mortality rate.
8.	Y.J. BOO et al, 2006(22)	OC, n =15 and LC, n=18	The duration of hospitalization was considerably shorter for the LC group compared to the OC group.	There were no instances of postoperative morbidity within the LC group, but two individuals in the OC group experienced postoperative complications.	Patients suffering from acute cholecystitis experience reduced surgical trauma and immunosuppression when a laparoscopic technique is used instead of open surgery.
9.	Pessaux et al, 2001(23)	OC, n =89 and LC, n=50	Group 1 had significantly lower rates of postoperative complications and deaths compared to group 2.	Duration of the surgical procedure, length of hospitalization after surgery,	The safety and efficacy of laparoscopic cholecystectomy for elderly individuals with acute cholecystitis have been demonstrated.
10.	Tanweer Karim et al, 2015(24)	OC, n =50 and LC, n=50	During the study period, the length of laparoscopic cholecystectomy procedures showed a tendency to decrease.	The utilization of injectable analgesics for laparoscopic cholecystectomy is significantly lower compared to open cholecystectomy. y	Surgery that is minimally invasive is superior to open cholecystectomy when it comes to of post-operative pain, analgesic requirement, and early resumption of work.

Discussion

This systematic review presents four key conclusions. The clinical result of laparoscopic versus open cholecystectomy has been thoroughly evaluated in randomized clinical studies. No trial met the criteria for being classified as a low-bias risk trial, meaning that none of the trials had appropriate methodological quality across all four components. Furthermore, laparoscopic cholecystectomy was not associated with a higher incidence of bile duct damage compared to open cholecystectomy. Furthermore, the duration of hospitalization was considerably reduced for laparoscopic cholecystectomy in comparison to open cholecystectomy. Furthermore, the morbidity and mortality rate following laparoscopic cholecystectomy, as well as the time taken to return to work, were dramatically reduced when compared to open cholecystectomy.

The objective of this study was to consolidate current evidence about the comparison between laparoscopic cholecystectomy versus open cholecystectomy in the treatment of acute cholecystitis. The study assessed the outcome measures of hospital stay, mortality, morbidity, and postoperative complications. Out of the 10 research conducted, seven studies demonstrated that a laparoscopic cholecystectomy is a more efficacious treatment for acute cholecystitis. However, two studies determined that both surgical procedures can be utilized for acute cholecystitis, as indicated in Table 3. There is strong evidence from controlled trials showing laparoscopic cholecystectomy is superior

to other therapies in reducing morbidity, mortality, and hospital stay. Out of all the investigations, six of them found that there was a reduction in the duration of hospital stay and the length of the surgical procedure after therapy. Four studies demonstrated a substantial reduction in illness and complications following surgery. We observed no substantial disparity in the duration of the surgical procedure.

Post op complications

A previous study found a significant decrease in post-operative complications in the laparoscopic cholecystectomy group compared to the open cholecystectomy group, despite the presence of strong evidence.(23) The study demonstrated that using the laparoscopic method resulted in a notable reduction in surgical complications during laparoscopic cholecystectomy.(19) Laparoscopic cholecystectomy provides a reliable and secure alternative to open cholecystectomy in patients having acute cholecystitis, with a minimal occurrence of problems after the surgery.(26) A study has shown that minimally invasive procedure is superior than open cholecystectomy when it comes to of post-operative pain, painkiller usage, and early resumption of work. (24)

Hospital stay

The hospitalization duration was decreased in individuals who underwent laparoscopic cholecystectomy for the treatment of acute cholecystitis. The duration of hospitalization was considerably shorter in the LC group compared to the OC group. (22). A study reported that patients who underwent laparoscopic cholecystectomy had a shorter hospital stay compared to individuals who underwent open cholecystectomy. (19). Similarly, Md. Rafiqul Islam demonstrated that LC patients typically required a postoperative hospital stay of 2-3 days, while OC patients typically required a stay of 5-7 days. (18).

Morbidity and Mortality

A study determined that the duration of postoperative complications and deaths was considerably shorter in the group that underwent laparoscopic cholecystectomy compared to the group that underwent open cholecystectomy. (23). A recent randomized controlled trial conducted on high-risk patients with acute cholecystitis compared the outcomes of open cholecystectomy versus laparoscopic cholecystectomy. The study found that laparoscopic cholecystectomy was linked with significantly lower rates of complications and postoperative morbidity. (22) Similarly, a study found that patients who underwent laparoscopic cholecystectomy had better outcomes and a lower mortality rate. (20).

Limitations

- Time duration
- Limited availability of literature research
- Due to the presence of heterogeneity, we refrained from doing a meta-analysis.
- The systematic review is not registered on Prospero or any other registry.

Conclusions

Minimal invasive approach, specifically laparoscopic cholecystectomy, is used to limit the mortality and morbidity associated with post-operative despondency in acute cholecystitis. In addition, laparoscopy decreases the incidence of pneumonia and wound infections. There is a good trend towards longer surgery durations in favor of laparoscopy, but further investigations are required. The approach does not have any effect on the rates of severe hemorrhage and bile leakage. The initial approach for acute onset cholecystitis ought to include attempting laparoscopic removal of the gallbladder.

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