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Comparison between the Laparoscopic and Intraoperative Endoscopic Management of Choledocholithiasis: Systematic Review

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ABSTRACT

Stones in the common bile duct (CBD) are referred to as choledocholithiasis. Nowadays, surgeons have a variety of therapeutic choices from which to address choledocholithiasis patients. This systematic review aims to compare the laparoscopic and intraoperative endoscopic management of CBD stones PubMed, Web of Science, Science Direct, EBSCO, Scopus, and Cochrane library were searched. Study articles were screened by title and abstract using Rayyan QCRI then a full-text assessment was implemented. Eight studies were included, with 3045 patients. The success rates in both interventions were similar; however, only two studies reported that LCBDE had higher success rates than LC-IOEST. Most studies reported more complications in the LC-IOEST except for two investigations. The LC-IOEST was found to reduce the duration of posthospital stay except for one study. We found that LC-IOEST is the most effective option for choledocholithiasis, with higher success rates and a shorter duration of postoperative hospital stay. However, LC-IOEST possessed more complications and seemed to be a safer option.

Keywords: *Environment, Change, Ecosystem, Destruction, Sustainable development gaols (SDGs)*

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INTRODUCTION

Stones in the common bile duct (CBD) are referred to as choledocholithiasis. It is regarded as the most prevalent pathology of the bile ducts in the entire world. According to the research, patients who have gallbladder stones (10%–25%) and those who have cholecystectomy for symptomatic cholelithiasis (approximately 10% of patients) both have CBD stones (including silent CBD stones) (Lee *et al*., 2016; Helton & Ayloo, 2019).

On the other hand, gallbladder stones are present in 95% of individuals with CBD stones (Albalawi *et al*., 2019; Elwy *et al*., 2019; Alhazmi *et al*., 2021). CBD stones can go undetectable for a very long period or perhaps a lifetime, but they may be accompanied by recurring pancreatitis, cholangitis, or upper abdominal pain. They may also have a close connection to the etiology of bile leaks that occur in the immediate aftermath of cholecystectomy. The presence of choledocholithiasis must therefore be confirmed or ruled out during the perioperative period of cholecystectomy (Zgheib *et al*., 2021; Wangchuk & Srichan, 2022).

Today, surgeons have a variety of therapeutic choices from which to address choledocholithiasis patients. In the past, to extract CBDS, common bile duct exploration (CBDE) was carried out by laparotomy (Wu *et al*., 2019; Zhu *et al*., 2020). CBDS can now be accessible and removed laparoscopically, thanks to the development of improved laparoscopic procedures. There have been numerous reports of successful laparoscopic CBDE (LCBDE) procedures using the trans-cystic duct and choledochotomy approaches (Tan *et al*., 2018; Cianci & Restini, 2021; Tanase *et al*., 2022).

Even though the majority of general surgeons are now proficient at laparoscopic cholecystectomy (LC), many lack the knowledge and resources needed to perform LCBDE when confronted with an accompanying CBD stone. They are then only left with two options: converting the case to open CBD exploration (OCBDE) or referring the patient for endoscopic retrograde cholangiopancreatography following surgery (ERCP). Before, during, or after LC, therapeutic ERCP is a crucial adjuvant in the therapy of CBDS. With rare exceptions, it is generally believed that individuals with CBDS and GS should have a cholecystectomy, as well as the CBDS, removed (Guo *et al*., 2022). Otherwise, 20–40% of GS patients with CBDS who receive endoscopic management will need a second procedure for biliary problems (Tsai *et al*., 2018).

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When appropriate, choledocholithiasis diagnosis could be made during the preoperative, intraoperative, or postoperative phases of surgical or other invasive interventions. The purpose of this systematic review is to compare the laparoscopic and intraoperative endoscopic management of CBD stones.

MATERIALS AND METHODS

The established guidelines were followed in implementing this systematic review (Preferred Reporting Items for Systematic Reviews and Meta-Analyses, PRISMA).

Study design

This was a systematic Review.

Study condition

This review investigates the published literature that compares the laparoscopic and intraoperative endoscopic management of CBD stones.

Search strategy

To find the relevant literature, a comprehensive literature search was done in six main databases, including PubMed, Web of Science, Science Direct, EBSCO, Scopus, and Cochrane Library. Our search was restricted to the English language, and it was customized as needed for each database. The following keywords, which were converted into Mesh terms in PubMed, were used to identify the appropriate studies; "common bile duct stones," "CBDS," " cholecystocholedocholithiasis," "choledocholithiasis," "cholecystolithiasis," " laparoscopic," "intraoperative endoscopic," "comparison," and "management." The appropriate keywords were paired with "OR" and "AND" Boolean operators. The search results comprised English, full-text publications, freely available articles, and human trials.

Selection criteria

Inclusion criteria

The subjects were chosen for addition founded on their applicability to the research, which has the following criteria; male or female patients who underwent certain management interventions for CBD stones.

Exclusion criteria

All additional papers, ongoing studies, and reviews of existing studies that did not have one of these themes as their primary goal were excluded.

Data extraction

To find duplicates of the results of the search strategy, we used Rayyan (QCRI) (Ouzzani *et al*., 2016). By limiting the combined search results based on a set of inclusion/exclusion criteria, the researchers assessed the relevance of the titles and abstracts. The reviewers evaluated the entire texts of the papers that met the criteria for inclusion. The authors discussed how to resolve any disagreements. The qualified study was included using a data extraction form that was created. The authors extracted data about the study titles, authors, study year, study design, participant number, the interventions used, success rate, postoperative complications, postoperative hospital stay, and main outcomes.

Strategy for data synthesis

To provide a qualitative summary of the included study components and results, summary tables containing the data gathered from the eligible studies were created. After data extraction for the systematic review, decisions were made on how to best utilize the data from the included study articles. Studies that met the full-text inclusion criteria but did not provide any data that compares the laparoscopic and intraoperative endoscopic management of CBD stones were excluded.

RESULTS AND DISCUSSION

Search results

A total of 390 study articles resulted from the systematic search, and then 44 duplicates were removed. Title and abstract screening were conducted on 346 studies, and 255 studies were excluded. 91 reports were sought for retrieval, and only 10 articles were not retrieved. Finally, 81 studies were screened for full-text assessment; 38 were excluded for wrong study outcomes, 15 for unavailable data on the laparoscopic and intraoperative endoscopic interventions, and 20 for the wrong population type. Eight eligible study articles were included in this systematic review. A summary of the study selection process is presented in **Figure 1.**

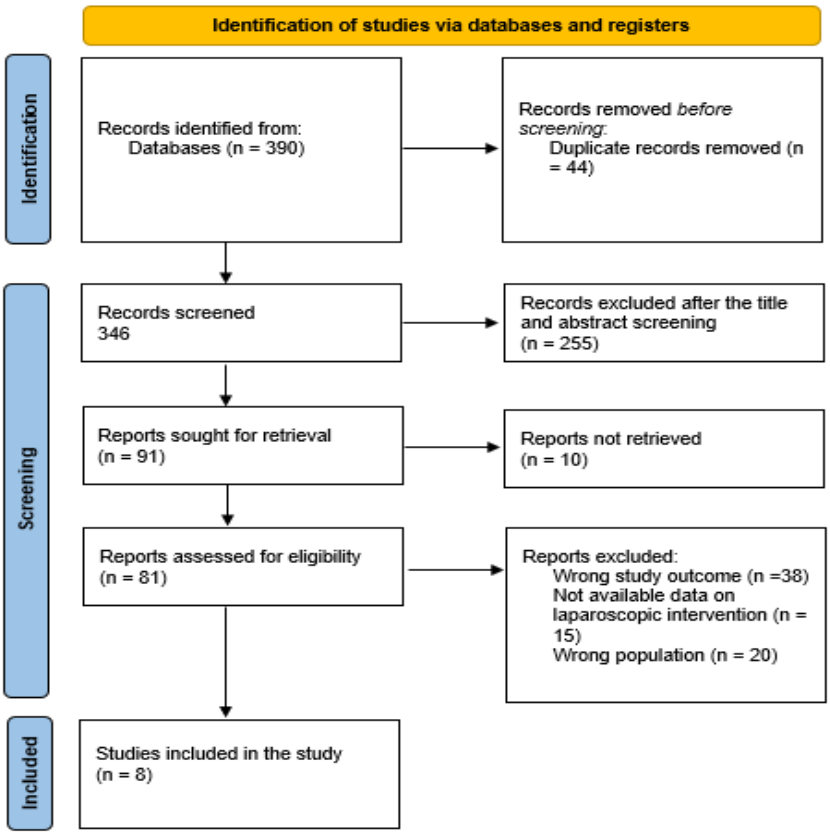

Figure 1. PRISMA flowchart summarizes the study selection process.

Characteristics of the included studies

A total of 8 studies were included in this review, with 3045 patients who underwent laparoscopic and intraoperative endoscopic interventions for choledocholithiasis. Four studies are prospective randomized trials (Hong *et al*., 2006; ElGeidie *et al*., 2011a,b; González *et al*., 2016), three are retrospective cohort studies (Wei *et al*., 2003; Vakayil *et al*., 2020; Zhang *et al*., 2022), and one is randomized control trial (Poh *et al*., 2016). Three studies were conducted in China (Wei *et al*., 2003; Hong *et al*., 2006; Zhang *et al*., 2022), two in Egypt (ElGeidie *et al*., 2011a, b), one in Australia (Poh *et al*., 2016), and one in the USA (Vakayil *et al*., 2020).

The included investigations compared the laparoscopic common bile duct exploration combined (LCBDE) to the laparoscopic cholecystectomy (LC) combined with intraoperative endoscopic sphincterotomy (IOEST). The success rates in both interventions were similar; however, only two studies reported that LCBDE had higher success rates than LC-IOEST (ElGeidie *et al*., 2011b; Zhang *et al*., 2022). Most studies reported more complications in the LC-IOEST except for two investigations (González *et al*., 2016; Zhang *et al*., 2022). The LC-IOEST was found to reduce the duration of posthospital stay, except for one study reported by ElGeidie *et al.* (2011b). Most studies reported that LC-IOEST is the most effective option for choledocholithiasis; however, Wei *et al.* (2003) reported that LCBDE is a safer option.

Table 1. A summary of characteristics of the included study articles.

Study	Study design	Country	Type of intervention	Participants (n)	Mean age	Male	Success rate	Complications	Postoperative hospital stay	Main outcomes
Hong *et al.* (2006)	Prospective randomized trial	China	**LCBDE**	141	NA	NA	89.36	5.55	4.66 ± 3.07	Cholecystocholedocholithiasis can be treated safely, effectively, and with little to no side effects using both LC-IOEST and LC-LCBDE.
			LC-IOEST	93	48	28	91.4	9.41	4.25 ± 3.46	

ElGeidie *et al.*, (2011a)	Prospective randomized trial	Egypt	LC-PES	100	27.5	29	95.3	3	3	In centers that can afford a team approach to the care of choledocholithiasis, LC and intraoperative ERCP is a preferred option. This method is a one-stage therapy that shortens hospital stays and lowers expenditures.
			LC-IOEST	98	31.2	25	97.8	4.5	1.3	
ElGeidie *et al.*, (2011b)	Prospective randomized trial	Egypt	**LCBDE**	115	32.5	86	96	7.1	2.2	Where facilities for endoscopic therapy are easily accessible, they advise using intraoperative ERCP as a preferred alternative for the management of patients with gallbladder stones and CBD stones that have been previously diagnosed.
			LC-IOEST	111	29.2	102	92	9.3	3.1	
Wei *et al.* (2003)	Retrospective cohort study	China	**LCBDE**	45	29-79	17	88	4.4	4	The two groups had similar rates of ductal stone clearance. In addition to being linked to significantly lower hospital costs, LCBDE management looks to be safer. The results imply that LCBDE is a superior treatment for choledocholithiasis.
			LC-IOEST	57	18-75	20	89	8.8	3	
Poh *et al.* (2016)	Randomized control trial	Australia	**LCBDE**	52	53.4	21	69	NA	3	Intraoperative ERCP is more effective than LBDE at reducing the rate of residual stones.
			Intraoperative ERCP	52	53.9	23	87	NA	2	
Zhang *et al.* (2022)	Retrospective cohort study	China	LC+LCBDE+PC	72	57.9±17.6	29 (40.3)	100	12.5	13	Because it shortens hospital stays and prevents postoperative bile leakage, LC+LCBDE+IO-ENBD is both safer and more efficient than LC+LCBD. The antegrade placement of the naso-biliary drainage tube during the IO-ENBD surgery is more practical and efficient since it shortens the hospital stay.
			LC+LCBDE+IO-ENBD	96	55.5±16.0	42 (43.8)	97.9	7.3	10	
González *et al.*, (2016)	Prospective randomized trial	Cuba	**LCBDE**	100	56.3	NA	97.7	4.7	2.1	Shorter hospital stays decreased morbidity, and a better incidence of common bile duct stone clearance are all results of intraoperative ERCP/ES.
			Intraoperative ERCP	99	58.4	NA	97.8	0	1.2	
Vakayil *et al.* (2020)	Retrospective cohort study	USA	**LCBDE**	1185	51.1±19.8	398	90.3	11.5	3	Minimal, comparable rates of morbidity and mortality were reported by intraoperative ERCP and LCBDE. Because it is simpler to reach and takes less time during surgery, intraoperative ERCP may be preferred.
			Intraoperative ERCP	629	51.3±19.9	224	91	11.8	3	

Clinicians are constantly debating which strategy should use when exploring CBD in a clinical environment. Although ERCP or OCBDE are frequently thought of as the typical methods in this subject, several centers all over the world have adopted LCBDE as the first method to remove CBD stones. Laparoscopic surgery generally results in considerable reductions in postoperative pain, wound problems, hospital length of stay, and thromboembolism rates when compared to open surgery. It also promotes a quicker return to regular activities and more cost-effectiveness. Compared to ERCP, laparoscopic techniques have the benefit of doing cholecystectomy and CBD exploration in a single stage. Additionally, it should be emphasized that ERCP is not always effective and involves risks of substantial morbidity and even fatality (Al Samaraee & Bhattacharya, 2019).

We systematically investigated and critically analyzed the published data that compared the LCBDE to LC-IOEST among CBD stones patients, which was made up of 8 studies. The included studies were carried out in various locations throughout the world where regional policies were put into effect. Given that the number/ location/ size of the CBD stones, the size of the CBD or the cystic duct, and other confounding factors and heterogeneity have not been recorded in some of the publications, this fact will surely have an impact on the overall outcome of our investigation. In addition, some of the examined studies did not provide a clear explanation of how patients were chosen for LCBDE.

We found that most studies reported that LC-IOEST is the most effective option for choledocholithiasis, with higher success rates and shorter duration of postoperative hospital stay.

However, LC-IOEST possessed more complications, and Wei *et al.* (2003) reported that LCBDE is a safer option.

The surgical community does not generally favor laparoscopic common bile duct exploration. It is still only performed by skilled and/or motivated laparoscopic surgeons. Results from these randomized trials might not apply to the surgical profession as a whole. Two-stage therapy was the preferable approach in 99% of patients with suspected CBD stones, according to a recent study of more than 16,000 cholecystectomies in Germany, and there was a conversion rate of 43% in patients with tried LCBDE (Spelsberg *et al*., 2009). The results of a UK study of upper gastrointestinal surgeons revealed that, in contrast, 61% of them do laparoscopic CBD exploration, 25% recommend postoperative ERCP, and 13% execute either LCBDE or ERCP when they detect CBD stones (Glaysher *et al*., 2022).

One of the most crucial indicators for assessing the viability and efficiency of surgery is the surgical success rate. According to a prior meta-analysis (Ricci *et al*., 2018), LC-IntraERCP also seemed to be more effective. Comparing the outcomes of these diverse studies may take into consideration various conceptualizations or definitions of surgical success.

The treatment of CBD stones in conjunction with cholecystectomy was also covered in a 2013 Cochrane study (Dasari *et al*., 2013). However, our study's selection criteria and questions were different. In total, 1758 randomly selected participants from 16 randomized clinical trials that met the review's inclusion requirements were included in their analysis. Open surgical clearance and ERCP were compared in eight trials with 737 people; laparoscopic clearance and preoperative ERCP were examined in five trials with 621 participants, and postoperative ERCP was compared in two trials with 166 participants. Since the focus of our analysis is on minimally invasive techniques, we did not include open surgical clearance trials in our study.

Even if pre-op ERCP is a superior strategy to IOES, LCBDE is a better strategy overall. With a similar stone clearance rate, IOES has a 50% greater complication rate. Other factors like hospital stay and recovery time following surgery are comparable. As a result, the evidence suggests that IOES is not a suitable treatment strategy.

CONCLUSION

This systematic review demonstrated that LC-IOEST is the most effective option for choledocholithiasis, with higher success rates and a shorter duration of postoperative hospital stay. However, LC-IOEST possessed more complications and seemed to be a safer option. Further investigations are required to precisely compare these factors between the two groups.

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