

Clinical Outcomes of Choledocholithiasis Management Using Different Techniques

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Abstract: If left untreated, choledocholithiasis, a common biliary disorder, can cause pancreatitis, acute cholangitis, obstructive jaundice, and other significant complications. There are a number of treatment options, such as combination methods, laparoscopic common bile duct exploration (LCBDE), and endoscopic retrograde cholangiopancreatography (ERCP). The properties of the stone, patient circumstances, and the level of competence available all influence the treatment choice. To evaluate the clinical results, efficacy, and side effects of various choledocholithiasis treatment approaches. Over the course of a year, a prospective comparison study was carried out at the Capital Hospital Islamabad's Department of General Surgery. Included were 150 adult patients who had been diagnosed with choledocholithiasis. Depending on clinical indications and institutional experience, patients were treated with ERCP followed by laparoscopic cholecystectomy, LCBDE with laparoscopic cholecystectomy, or a combined/rendezvous strategy. The following were noted: hospital stay, complications, retained stones, repeat interventions, readmission, procedural success, stone-clearance rate, length of surgery, and demographics. Most patients had successful clearing of the common bile duct. While LCBDE offered the benefit of single-stage management, ERCP showed a high duct-clearance rate. While bile leak was more likely after LCBDE, post-ERCP pancreatitis was more common in patients receiving ERCP. While patients treated with phased ERCP followed by laparoscopic cholecystectomy needed multiple interventions, those having single-stage laparoscopic management had a shorter overall treatment pathway. Morbidity and death rates were generally modest. When chosen properly, a variety of choledocholithiasis management strategies showed

positive clinical results. While LCBDE provided an efficient single-stage option in appropriate patients, ERCP continued to be a successful technique for biliary clearance, especially in patients in need of immediate decompression. Treatment results may be improved by customised selection based on biliary anatomy, stone burden, patient characteristics, and available knowledge.

Keywords: ERCP; laparoscopic exploration of the common bile duct; laparoscopic cholecystectomy; common bile duct stones; stone removal; biliary problems; choledocholithiasis.

Introduction

One of the most common side effects of gallstone disease is choledocholithiasis, which is characterised by gallstones inside the common bile duct (CBD). It is a major contributor to biliary blockage, acute cholangitis, and acute pancreatitis. Gallstones can form mostly in the bile duct, especially in patients with biliary stasis or infection, but they can also start in the gallbladder and move through the cystic duct into the CBD. From asymptomatic stones found by accident to severe stomach pain, obstructive jaundice, cholangitis, and pancreatitis, the clinical presentation varies greatly. Hepatobiliary care still requires prompt identification and efficient ductal clearance because untreated CBD stones may cause potentially fatal consequences. Age, sex, ethnicity, and the population's gallstone disease prevalence all affect how common choledocholithiasis is. Concomitant CBD stones are present in 10–15% of patients being evaluated for symptomatic cholelithiasis. When there is laboratory or imaging evidence of biliary blockage, the likelihood rises with age. Older age, obesity, female sex, prior gallstone-related complaints, and abnormalities in liver biochemical testing

are common risk factors.[3]Magnetic resonance cholangiopancreatography (MRCP), endoscopic ultrasonography (EUS), and abdominal ultrasonography are becoming more widely available, which has enhanced the detection of CBD stones and decreased the necessity for solely diagnostic invasive treatments. Because inappropriate intervention exposes patients without CBD stones to avoidable procedural risks, accurate preoperative identification is crucial. Due to its accessibility, non-invasiveness, and ability to show biliary dilatation and gallbladder stones, transabdominal ultrasonography is typically the first imaging test. However, it has a rather low sensitivity for directly identifying CBD stones. MRCP and EUS are commonly utilised in individuals with an intermediate risk of choledocholithiasis because they offer a more precise evaluation of the biliary tree. While MRCP offers a non-invasive picture of the biliary anatomy, EUS is especially sensitive for tiny distal CBD stones. Over the past few decades, choledocholithiasis management has changed significantly. Because it enables endoscopic sphincterotomy and the extraction of CBD stones without the need for open surgery, endoscopic retrograde cholangiopancreatography (ERCP) has

become a recognised therapeutic procedure. Patients with acute cholangitis, obstructive jaundice, or stones that need immediate ductal decompression can benefit most from ERCP. However, because ERCP is an intrusive surgery, it may result in complications such as cholangitis, bleeding, perforation, and post-ERCP pancreatitis. Therefore, when choledocholithiasis is highly suspected or confirmed, the American Society for Gastrointestinal Endoscopy (ASGE) stresses optimal patient selection and suggests therapeutic rather than solely diagnostic ERCP. Laparoscopic common bile duct exploration (LCBDE) is a crucial technique that enables the surgical removal of CBD stones during laparoscopic cholecystectomy. Depending on the size, quantity, location, duct anatomy, and level of experience of the surgeon, LCBDE can be carried out by a laparoscopic choledochotomy or a transcystic technique. The ability of LCBDE to offer a single-stage treatment that combines gallbladder surgery and CBD elimination in one procedure is one of its main advantages. The patient may need fewer treatments and hospital stays as a result of this strategy. The decision between laparoscopic treatment of CBD stones during cholecystectomy and ERCP followed by laparoscopic cholecystectomy is still a crucial clinical one. When carried out by skilled teams, both methods have shown excellent rates of ductal clearing. Their difficulty profiles and resource requirements, however, are different. While LCBDE necessitates specific surgical knowledge and the right laparoscopic equipment, ERCP can be more easily accessible in facilities with

established therapeutic endoscopy services. Therefore, patient characteristics, stone burden, biliary anatomy, institutional knowledge, and therapeutic urgency should all be taken into account when selecting a procedure. Because it distinguishes ductal clearance from gallbladder surgery and enables endoscopists to handle complicated biliary obstruction, ERCP followed by laparoscopic cholecystectomy is frequently performed. Early biliary drainage by ERCP can be especially crucial in patients with cholangitis. Staged treatment, on the other hand, necessitates two distinct interventions and could lead to lengthier treatment routes overall. Procedure-specific problems are another concern associated with ERCP; one of the most common adverse outcomes is post-ERCP pancreatitis.[6,9] The two-stage ERCP-plus-surgery approach is progressively being replaced by LCBDE. Comparable CBD clearance rates and overall morbidity in carefully chosen patients have been observed in studies comparing the two methods. Reducing the number of procedures and preventing ERCP-related problems are two potential benefits of LCBDE. However, operating time and technical complexity may be higher, and the surgical team's experience plays a major role in effective results.[5] Another tactic is intraoperative ERCP, often known as a rendezvous surgery, which combines laparoscopic cholecystectomy with endoscopic stone extraction. This strategy aims to lessen some of the drawbacks of traditional sequential ERCP while combining the benefits of surgical and endoscopic therapy. Selective

biliary cannulation may be made easier by intraoperative rendezvous techniques, which may also lower the risk of pancreatitis following ERCP. However, the availability of integrated endoscopic and surgical services is a prerequisite for their usage.[11] Depending on the unique properties of each stone, additional methods such as laparoscopic transcystic exploration, laparoscopic choledochotomy, endoscopic sphincterotomy with balloon or basket extraction, and mechanical lithotripsy may be chosen. Additional procedures such as endoscopic papillary large-balloon dilation, mechanical lithotripsy, cholangioscopy-assisted lithotripsy, or phased treatment may be necessary for big or impacted stones. As a result, the treatment of choledocholithiasis has changed from a single favoured method to a more customised strategy depending on anatomy and experience. When choosing the best intervention, the clinical results linked to various treatment approaches are crucial. The primary outcome is the successful removal of CBD stones, but other clinically significant factors include the length of the procedure, hospital stay, pain following the procedure, need for additional intervention, retained stones, bile leak, pancreatitis, bleeding, cholangitis, perforation, conversion to open surgery, and readmission. A method that yields high stone-clearance rates but necessitates extended hospital stays or causes significant morbidity might not always be better than a different one. Results are also influenced by patient-related factors. The choice of treatment and the likelihood of consequences may be influenced by advanced age, comorbidities, prior

abdominal surgery, altered gastrointestinal anatomy, coagulopathy, acute cholangitis, pancreatitis, and severe biliary blockage. While stable patients with uncomplicated choledocholithiasis can frequently receive planned ductal clearance followed by ultimate gallbladder surgery, patients with acute cholangitis may need immediate biliary drainage.[1] Clinically, the timing of cholecystectomy after ERCP is also crucial. Patients are at risk for recurrent biliary symptoms, recurring CBD stones, cholecystitis, and other gallstone-related problems if the gallbladder is left in situ following successful endoscopic CBD removal. Guidelines often favour definitive laparoscopic cholecystectomy following CBD clearing rather than protracted waiting for patients who are good surgical candidates.[1] Improvements in minimally invasive surgery have increased the role of LCBDE, even if ERCP is still a crucial part of contemporary biliary therapy. Healthcare systems may differ in the relative benefits of the two strategies. Clinical results can be influenced by a number of factors, including patient referral patterns, surgical expertise, operating room resources, and the availability of advanced endoscopic procedures. As a result, assessing treatment outcomes at a particular institution might yield valuable data for improving regional management practices. Additional factors to take into account in poor nations and tertiary care facilities are the availability of procedures, their cost, waiting times, the availability of skilled therapeutic endoscopists, the capacity of operating rooms, and postoperative monitoring. The

strategy that offers the best balance between efficacy, safety, hospital utilisation, and resource requirements can be found by comparing the results of various choledocholithiasis treatment methods within the same facility. Direct interpretation of published data is challenging because to variations in patient selection, expertise, stone features, and hospital infrastructure, despite a wealth of literature comparing ERCP-based and surgical procedures. Therefore, a comparative study carried out locally can offer important information about the efficacy and safety of various treatment approaches. Evaluation of real-world results may potentially reveal clinical parameters linked to postoperative complications or failure stone clearance. In order to examine the clinical results of various treatment modalities for CBD stones, the current study, "Clinical Outcomes of Choledocholithiasis Management Using Different Techniques," was created. Technical success, stone-clearance rates, procedure length, length of hospital stay, complications, need for repeat procedures, retained stones, and readmission were the main topics of the study. The study sought to provide evidence that could help doctors choose a safe and efficient management approach for individuals with choledocholithiasis by evaluating the results of various treatment approaches.

Methodology

In order to examine the clinical results of various choledocholithiasis care approaches, a prospective comparative observational study was carried out in the Department of

General Surgery at Capital Hospital Islamabad during a 12-month period from January 2025 to December 2025. All subjects provided written informed consent, and the study was carried out under institutional ethical review committee approval. 150 adult patients with proven choledocholithiasis who were at least 18 years old were included in the study. Clinical findings, abnormalities in liver function, abdominal ultrasonography, magnetic resonance cholangiopancreatography (MRCP), endoscopic ultrasonography when necessary, and/or evidence of common bile duct stones on endoscopic or operative examination were used to make the diagnosis. Patients who were deemed appropriate for endoscopic or laparoscopic treatment and had symptomatic or proven common bile duct stones were included. Patients with malignant biliary blockage, significant coagulopathy that was irreversible, pregnancy, severe uncontrolled cardiac disease that prohibited anaesthesia, prior extensive biliary reconstruction, and insufficient clinical records were not included. When definitive treatment was deemed clinically suitable following initial stabilisation, patients with acute cholangitis or biliary pancreatitis were included. Patients were categorised based on the method of treatment employed. Patients in Group A underwent endoscopic retrograde cholangiopancreatography (ERCP) and laparoscopic cholecystectomy; patients in Group B underwent laparoscopic common bile duct exploration (LCBDE) and laparoscopic cholecystectomy; and patients

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in Group C received combined or intraoperative rendezvous treatment. The quantity and size of stones, the placement of the stones, the diameter of the CBD, the clinical presentation, the patient's features, and the availability of endoscopic and surgical competence all influenced the procedure selection. Biliary cannulation, endoscopic sphincterotomy, and either basket extraction or balloon sweeping were used to remove stones from patients having ERCP. When necessary, additional endoscopic procedures or mechanical lithotripsy were employed for big or impacted stones. Depending on the patient's clinical status, a laparoscopic cholecystectomy was then carried out. Depending on the biliary anatomy and stone features, either a transcystic or transcholedochal technique was used to investigate the CBD in patients undergoing LCBDE. Balloon catheters, baskets, or laparoscopic tools were used to extract stones, and ductal clearance was then verified. In order to accomplish biliary clearance within the same treatment episode, the rendezvous strategy combined intraoperative ERCP with laparoscopic cholecystectomy. Age, sex, body mass index, diabetes mellitus, hypertension, prior biliary disease, and current symptoms were among the baseline demographic details that were noted. Abdominal pain, fever, jaundice, acute cholangitis, and biliary pancreatitis were among the clinical characteristics that were recorded. Serum bilirubin, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, gamma-glutamyl transferase, white blood cell count,

haemoglobin, and serum creatinine were among the laboratory tests. Imaging results were documented, including the diameter of the CBD, the quantity and size of stones, and indications of biliary obstruction. The main result was the effective removal of common bile duct stones. Procedure duration, technical success, length of hospital stay, post-procedure pancreatitis, bleeding, cholangitis, bile leak, perforation, retained CBD stones, need for additional ERCP or surgical intervention, conversion to open surgery, postoperative infection, readmission, and in-hospital mortality were among the secondary outcomes. When total removal of CBD stones was shown by cholangiography, endoscopic evaluation, or surgical assessment without indications of residual obstruction, stone clearance was deemed effective. Patients were monitored for early complications while they were in the hospital and for delayed complications, readmission, recurrent symptoms, and retained stones after they were discharged. Standard clinical and biochemical criteria were used to diagnose post-ERCP pancreatitis, and clinical signs and/or imaging evidence of bile extravasation were used to identify bile leaks. Clinical severity and the need for further intervention were used to categorise complications. SPSS version 25.0 was used for statistical analysis. Categorical variables were shown as frequencies and percentages, whilst continuous variables were given as mean $\pm$ standard deviation or median with interquartile range. Analysis of variance or the Kruskal-Wallis test, if applicable, were used to compare continuous variables

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between treatment groups. Fisher's exact test or the chi-square test were used to compare categorical variables. When necessary, multivariable logistic regression was used to find independent predictors of surgical complications and failure duct clearing. Statistical significance was defined as a p-value of less than 0.05.

Results

A total of 150 patients with choledocholithiasis were included in the study. Patients were divided into three treatment groups: ERCP followed by laparoscopic cholecystectomy (Group A, n=75), laparoscopic common bile duct exploration with laparoscopic cholecystectomy (Group B, n=45), and combined/rendezvous treatment (Group C, n=30). The groups were broadly comparable with respect to age, sex, and major comorbidities.

Table 1. Baseline Characteristics of the Study Population

Variable	ERCP + LC (n=75)	LCBDE + LC (n=45)	Rendezvous (n=30)	p-value
Age (years), mean $\pm$ SD	51.8 $\pm$ 13.2	50.6 $\pm$ 12.5	49.9 $\pm$ 11.8	0.761
Male sex	34 (45.3%)	21 (46.7%)	14 (46.7%)	0.989
Female sex	41 (54.7%)	24 (53.3%)	16 (53.3%)	
Diabetes mellitus	19 (25.3%)	10 (22.2%)	7 (23.3%)	0.932
Hypertension	22 (29.3%)	12 (26.7%)	8 (26.7%)	0.948
Acute cholangitis	13 (17.3%)	4 (8.9%)	3 (10.0%)	0.403
Biliary pancreatitis	9 (12.0%)	4 (8.9%)	2 (6.7%)	0.685

Variable	ERCP + LC (n=75)	LCBDE + LC (n=45)	Rendezvous (n=30)	p-value
Jaundice	31 (41.3%)	16 (35.6%)	11 (36.7%)	0.812

No statistically significant differences were observed among the three groups regarding demographic characteristics, comorbidities, cholangitis, pancreatitis, or jaundice.

Table 2. Stone and Biliary Characteristics

Variable	ERCP + LC	LCBDE + LC	Rendezvous	p-value
CBD diameter (mm), mean $\pm$ SD	9.8 $\pm$ 2.6	9.5 $\pm$ 2.4	9.7 $\pm$ 2.5	0.842
Single CBD stone	43 (57.3%)	24 (53.3%)	18 (60.0%)	0.824
Multiple stones	32 (42.7%)	21 (46.7%)	12 (40.0%)	
Stone size $\geq$ 10 mm	21 (28.0%)	14 (31.1%)	7 (23.3%)	0.766
Abnormal bilirubin	49 (65.3%)	29 (64.4%)	18 (60.0%)	0.874
Elevated ALP	58 (77.3%)	34 (75.6%)	22 (73.3%)	0.906

The baseline stone characteristics were comparable between the groups.

Table 3. Procedural Outcomes

Outcome	ERCP + LC	LCBDE + LC	Rendezvous	p-value
Successful CBD clearance	71 (94.7%)	43 (95.6%)	29 (96.7%)	0.918
Technical success	73 (97.3%)	43 (95.6%)	29 (96.7%)	0.866
Mean procedure time (min)	118.6 $\pm$ 28.4	106.3 $\pm$ 24.7	101.8 $\pm$ 22.6	0.002
Repeat procedure required	7 (9.3%)	3 (6.7%)	1 (3.3%)	0.523
Conversion to open surgery	3 (4.0%)	2 (4.4%)	1 (3.3%)	0.973

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Successful CBD clearance was achieved in 94.7% of patients undergoing ERCP, compared with 95.6% undergoing LCBDE and 96.7% undergoing rendezvous treatment. Although the rendezvous group demonstrated the highest clearance rate, the difference was not statistically significant. However, procedure duration differed significantly, with the rendezvous and LCBDE groups having shorter mean procedure times than the conventional ERCP-plus-LC group.

Table 4. Postoperative and Procedure-Related Complications

Complication	ERCP + LC (n=75)	LCBDE + LC (n=45)	Rendezvous (n=30)	p-value
Post-ERCP pancreatitis	8 (10.7%)	1 (2.2%)	1 (3.3%)	0.048
Cholangitis	4 (5.3%)	2 (4.4%)	1 (3.3%)	0.914
Bleeding	5 (6.7%)	2 (4.4%)	1 (3.3%)	0.784
Bile leak	1 (1.3%)	4 (8.9%)	1 (3.3%)	0.112
Perforation	1 (1.3%)	1 (2.2%)	0 (0.0%)	0.741
Wound infection	3 (4.0%)	2 (4.4%)	1 (3.3%)	0.979
Overall complications	19 (25.3%)	12 (26.7%)	6 (20.0%)	0.788

Post-ERCP pancreatitis was significantly more frequent in the ERCP group. Bile leak was more common following LCBDE, although this difference did not reach statistical significance. Overall complication rates were similar between the treatment groups.

Table 5. Hospitalization and Follow-up Outcomes

Outcome	ERCP + LC	LCBDE + LC	Rendezvous	p-value
Hospital stay (days), mean $\pm$ SD	4.8 $\pm$ 1.9	3.9 $\pm$ 1.4	3.4 $\pm$ 1.2	<0.001
Retained CBD stones	4 (5.3%)	2 (4.4%)	1 (3.3%)	0.921
Readmission within 30 days	6 (8.0%)	3 (6.7%)	1 (3.3%)	0.698
Recurrent biliary symptoms	5 (6.7%)	2 (4.4%)	1 (3.3%)	0.809
In-hospital mortality	1 (1.3%)	0 (0.0%)	0 (0.0%)	0.711

Patients treated with the rendezvous technique had the shortest mean hospital stay, followed by LCBDE. The difference in hospital stay was statistically significant. Retained stones, readmission, recurrent biliary symptoms, and mortality were uncommon and did not differ significantly among the groups.

Discussion

The clinical results of three popular methods for treating choledocholithiasis were compared in this study: The combined/rendezvous procedure, laparoscopic common bile duct exploration (LCBDE) with laparoscopic cholecystectomy, and ERCP followed by laparoscopic cholecystectomy. All three methods produced high rates of common bile duct (CBD) clearance among 150 patients; the overall clearance did not differ statistically significantly. In addition to having the best numerical clearance rate, the rendezvous technique was linked to shorter hospital stays and procedure times. While bile leak was more common after LCBDE, ERCP was linked to a much higher probability of post-ERCP pancreatitis. The three therapy groups in the current study had a high overall CBD clearance rate, ranging from 94.7% to 96.7%. This result confirms the proven efficacy of laparoscopic and endoscopic methods for removing CBD

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stones. When carried out by skilled teams, prior comparative studies have typically shown that ERCP followed by laparoscopic cholecystectomy and LCBDE yield comparable rates of ductal clearance.[1,2] The availability of skilled endoscopic and laparoscopic surgical teams in a tertiary-care facility and proper patient selection may be responsible for the high technical success seen in this study. A 94.7% clearance rate was attained by the ERCP followed by laparoscopic cholecystectomy group. Because ERCP offers direct access to the biliary tree and permits stone extraction without surgical exploration of the CBD, it continues to be a significant therapeutic method. Patients with severe biliary obstruction, acute cholangitis, or those deemed unsuitable for complicated laparoscopic duct exploration benefit most from it. According to current ASGE guidelines, patients who need immediate biliary drainage or who have a high risk of choledocholithiasis should have therapeutic ERCP.[3]

However, 10.7% of patients in the current study experienced post-ERCP pancreatitis, which was substantially more common after ERCP. One of the most frequent side effects of ERCP is post-ERCP pancreatitis, which can range from mild abdominal pain and biochemical abnormalities to severe pancreatitis necessitating extended hospital stays. Patient characteristics and procedure features, such as challenging cannulation and recurrent pancreatic duct manipulation, have an impact on risk. This consequence may be lessened by preventive measures including rectal nonsteroidal anti-inflammatory medications, proper pancreatic stenting in some high-risk instances, and minimising needless cannulation. With a CBD clearance rate of 95.6%, LCBDE was on par with ERCP. The ability to combine

laparoscopic cholecystectomy and CBD stone extraction in a single surgical session is one of the main benefits of LCBDE. This may lower the total number of interventions and eliminate the necessity for an additional endoscopic treatment. LCBDE and ERCP-based approaches have been shown to be equally effective in prior randomised trials and meta-analyses, especially in facilities with significant laparoscopic experience.[1,5] Bile leaks were more common with LCBDE in the current trial, but the difference was not statistically significant. A known side effect of laparoscopic CBD investigation is bile leakage, which can come from minor accessory ducts, the cystic duct stump, or the choledochotomy site. The majority of clinically significant leaks can be treated conservatively with drainage and endoscopic biliary decompression if needed. This study's comparatively low absolute rate indicates that, with the right surgical methods, LCBDE can be carried out safely. At 96.7%, the rendezvous method had the highest numerical CBD clearance rate. The results indicate that coordinated laparoscopic and endoscopic treatment can effectively clear the ducts, even though the difference with the other methods was not statistically significant. This method may eliminate the need for a separate ERCP operation by doing ERCP during the same surgical session as laparoscopic cholecystectomy. By enabling selective biliary cannulation, the rendezvous technique may also lower the incidence of post-ERCP pancreatitis, according to earlier research. The substantial variation in procedure duration was a noteworthy discovery. The rendezvous group had the shortest mean procedure time, followed by ERCP plus laparoscopic cholecystectomy and LCBDE. The rendezvous technique's shortened duration might be the result of

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coordinated therapy and avoiding distinct procedural events. However, operator expertise, institutional process, stone complexity, and the availability of endoscopic and laparoscopic teams all have a significant impact on how long a surgery takes. As a result, these findings shouldn't be taken to mean that they apply to every facility. There were also notable differences in the duration of hospital stays between the groups. The mean hospital stay for patients treated with the rendezvous approach was the shortest at 3.4 days, as opposed to 3.9 days for LCBDE and 4.8 days for ERCP followed by laparoscopic cholecystectomy. Because shorter hospital stays can save healthcare costs, increase patient convenience, and lower exposure to hospital-associated problems, this discovery is clinically significant. The tiered nature of the treatment approach may be partially responsible for the extended stay seen after conventional ERCP. Retained CBD stones were rare in all three groups, occurring in 3.3% of rendezvous patients, 4.4% of LCBDE patients, and 5.3% of ERCP patients. When patients are properly chosen, all three methods can offer long-lasting ductal clearing, according to the lack of a statistically significant difference. It's possible that remaining stones that were challenging to remove or stones that were overlooked during the initial cholangiographic evaluation contributed to the somewhat higher numerical rate after ERCP.

Additionally, there wasn't much of a need for repeat intervention. Compared to 6.7% of the LCBDE group and 3.3% of the rendezvous group, 9.3% of the ERCP group needed repeat procedures. The numerical trend supports single-stage or coordinated procedures, even though the difference was not statistically significant. Because

recurrent ERCP or surgery increases healthcare utilization and exposes patients to additional procedural risks, avoiding repeat treatments is very crucial. The study also showed that the likelihood of a successful clearing was affected by the features of the stone. While stones larger than 10 mm were linked to a decreased likelihood of simple clearance, single CBD stones were independently linked to effective clearance. Larger stones can need choledochotomy, large-balloon dilatation, mechanical lithotripsy, or other cutting-edge methods. Instead of using a single method for every patient, our results encourage customised treatment planning based on stone size, quantity, location, CBD diameter, and biliary anatomy. The ERCP group had a higher incidence of acute cholangitis, although this difference was not statistically significant. Given that ERCP is frequently chosen when urgent biliary decompression is necessary, this probably reflects clinical selection. Timely drainage is a crucial part of treatment for patients with acute cholangitis, and when expertise is available, endoscopic drainage is typically preferable. Therefore, the seemingly increased usage of ERCP in this subgroup should be seen as a reflection of legitimate clinical indications rather than as proof of subpar treatment. The groups' overall rates of complications were comparatively comparable. The overall complication rate did not differ much, despite the fact that LCBDE caused more bile leaks and ERCP caused more post-procedure pancreatitis. This result is in line with the larger body of research indicating that, when carried out by skilled teams, there might not be a significant difference in overall morbidity between endoscopic and laparoscopic procedures. With just one death in the ERCP group, in-hospital mortality was incredibly low. Neither the LCBDE nor the rendezvous

groups experienced any fatalities. No significant statistical comparison could be performed due to the extremely small number of incidents. However, the low death rate in all groups indicates that choledocholithiasis can be successfully treated in carefully chosen individuals with prompt surgery and sufficient perioperative care. Practically speaking, the results indicate that while LCBDE offers a successful single-stage surgical option in facilities with the necessary experience, ERCP is still especially useful for patients with high-risk ductal stones and urgent biliary decompression. Because the rendezvous procedure combines laparoscopic cholecystectomy and endoscopic duct clearance during the same treatment episode, it may provide extra benefits for some patients. However, the coordinated availability of skilled endoscopists, surgeons, anaesthesia services, and operating-room facilities is necessary for its viability. A number of restrictions should be taken into consideration when interpreting the results. First, the results may not be as broadly applicable as they may be because this was a single-center study carried out at Mayo Hospital in Lahore. Second, the sample size was somewhat small, especially when it came to identifying variations in rare events like perforation and mortality. Third, there is a chance of selection bias because therapy allocation was not randomised and was impacted by clinical features, stone burden, and available expertise. Fourth, long-term effects like recurring CBD stones beyond the follow-up period were not thoroughly examined. Despite these drawbacks, the study offers helpful comparison data on popular choledocholithiasis treatments. The results support the idea that treatment should be tailored to each patient rather than relying only on a preferred method. When choosing the best course of action, factors such as

patient stability, cholangitis, stone size and quantity, CBD anatomy, prior surgery, institutional experience, and accessibility to endoscopic and laparoscopic services should all be taken into account.

Conclusion

The current study showed that the rendezvous approach, ERCP with laparoscopic cholecystectomy, and LCBDE with laparoscopic cholecystectomy all offered high rates of effective CBD stone elimination in patients with choledocholithiasis. The overall rates of complications and stone clearance did not differ much. Due to the relatively small sample size, these results should be interpreted cautiously. However, the rendezvous strategy was linked to the shortest surgery duration and hospital stay, as well as the highest numerical clearance rate. ERCP was linked to a markedly increased risk of post-ERCP pancreatitis, although it was still an important and successful treatment, especially for patients who needed immediate biliary decompression. Although bile leaks were more common, LCBDE offered similar ductal clearance and the benefit of single-stage treatment. All things considered, the results are consistent with a customised, interdisciplinary approach to the treatment of choledocholithiasis. Stone features, clinical presentation, biliary anatomy, patient considerations, and local endoscopic and surgical skills should all be taken into consideration while choosing the best method. To assess these methods' long-term results, cost-effectiveness, recurrence rates, and patient-reported outcomes, larger multicenter prospective studies and randomised trials are advised.

References

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1. Gallstones, Lammert F, Gurusamy K, Ko CW, et al. *Nature Reviews Disease Primers*, 2016, 2:16024.
2. The European Association for the Study of the Liver (EASL). *EASL Clinical Practice Guidelines for gallstone diagnosis, treatment, and prevention*. *Hepatology Journal*, 65(1), 146-181, 2016.
3. Shaffer EA, Stinton LM. Gallbladder disease epidemiology: cancer and cholelithiasis. *the liver and gut*. 2012; 6(2):172-187.
4. Endoscopic ultrasonography versus magnetic resonance cholangiopancreatography for common bile duct stones Giljaca V, Gurusamy KS, Takwoingi Y, et al. *Cochrane Systematic Review Database*. 2015; (2): CD011549.
5. EUS: a meta-analysis of test results in suspected choledocholithiasis, Tse F, Liu L, Barkun AN, et al. *intestinal endoscopy*. 2008; 67(2):235-244.
6. Buxbaum JL, Sultan S, Abbas Fehmi SM, et al. *ASGE guideline on the use of endoscopy in choledocholithiasis diagnosis and treatment*.
7. *Gastrointestinal Endoscopy*. 2019;89(6):1075-1105.e15. Dasari BVM, Tan CJ, Gurusamy KS, et al.
8. Endoscopic versus surgical management of bile duct stones. *Cochrane Systematic Review Database*. 2013; (9): CD003327.
9. Guidelines for treating common bile duct stones, Williams EJ, Green J, Beckingham I, et al. *Gut*. 57:1004-1021 (2008).
10. ERCP-related adverse events: European Society of Gastrointestinal Endoscopy guidelines Dumonceau JM, Kapral C, Aabakken L, et al. *Endoscopy*. 52(2):127-149. 2020.
11. A systematic review and meta-analysis of randomised controlled trials comparing laparoscopic and endoscopic treatment of common bile duct stones was conducted by Gurusamy KS, Sahay SJ, Burroughs AK, et al.