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Original Article

Comparative Study between Open CBD Exploration and Laparoscopic CBD Exploration in Choledocholithiasis Patients in a Tertiary Care Centre

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ABSTRACT

Background Choledocholithiasis or CBD stone, is one of the most common complications of gall stone disease. Though the detection of choledocholithiasis has seen significant improvement with the advent of MRCP (Magnetic Resonance Imaging), there is no clear consensus regarding the treatment protocols that include open CBD exploration, lapraroscopic CBD exploration and the two stage laparoscoic-endoscopic method. However, the use of laparoscopic approach has seen an increasing trend with an increase in laparoscopic experience and expertise of the surgeons.

Methods Records of patients undergoing CBD exploration in the Department of General Surgery, DMCH, between October 2023 and October 2025 were collected. Patients were divided into two groups- those who underwent laparoscopic CBD exploration and those who underwent open CBD exploration. The rate of stone clearance, length of surgery, post-operative complications, and length of hospital stay were also compared between the two groups.

Results The laparoscopy group had a longer mean surgical time (112.56±20.53 min) than the open group 2 (108.56±18.58 min). In terms of clinical infection, wound dehiscence rate, billiary leakage, and post-operative pancreatitis, there was no discernible difference between the two study groups. Six (13.33%) of the patients in group 2 had residual stones, compared to none of the patients in group 1 ($p=0.084$). Group 1's mean hospital stay was substantially shorter (5.20±1.76 days) than Group 2's (8.89±1.45 days) ($p<0.0001$).

Conclusion According to the study, laparoscopic procedures were linked to fewer problems, including post-operative infection, wound dehiscence, pancreatitis, and residual stones, as well as a shorter hospital stay following the treatment, with the exception of a slightly longer procedure length.

Keywords*: Common Bile Duct Stones, Laparoscopic CBD Exploration, Open CBD Explorati.*

INTRODUCTION

One of the most prevalent conditions on the globe, gallstone disease affects between 6% and 10% of adults.[1] Choledocholithiasis or CBD stone is one of the most common complications of gall stone disease and is seen in almost every 7th to 10th patient having gall bladder stones.[2] Patients with common bile duct stones commonly present with a history of recurrent attacks of biliary colic, obstructive jaundice, cholangititis and occasionally attacks of pancreatitis. Workup of a case of CBD stone includes thorough physical examination, blood investigations, specifically liver function tests and radiological investigations- ultrasonography of the abdomen and MRCP and endoscopic USG.[3] Though the detection of choledocholithiasis has seen significant improvement with the advent of MRCP, there is no clear consensus regarding the most appropriate treatment protocol amongst the multiple options that are available for the same. Removal of the gallbladder and clearance of the bile duct stones remains the cornerstone in the management of combined gallstones and CBD stones.[4] Until recently open cholecystectomy with choledocholithotomy remained the only treatment option for CBD stones.[2] With the widespread use of laparoscopic procedures in recent times, and the ever increasing experience and

expertise of the surgeons, the focus has now shifted towards lapraroscopic CBD exploration and two stage laparoscoic-endoscopic method. Increased blood loss, wound infections, pain, and post-operative complications such as incisional hernia, wound infection, seroma, and abscesses are common outcomes of open cholecystectomy with open CBD exploration.[5] Complications include haemorrhage, duodenal perforation, and pancreatitis are also linked to ERCP, an approved technique for CBD exploration. Because of their value and effectiveness for CBD exploration, the emphasis has shifted mostly to laparoscopic or open operations.[6] Conversely, it has been demonstrated that laparoscopic exploration reduces post-operative pain and blood loss. However, problems such as bile duct damage, bile leakage, haemorrhage, sub-hepatic access, and retained bile duct stones have been linked to laparoscopic exploration.[7]

In our facility, cholecystectomy and CBD exploration are routinely performed using both open and laparoscopic techniques. The goal of the current study was to compare the results of open and laparoscopic CBD exploration in patients who came to our hospital with CBD stones.

AIMS AND OBJECTIVES

Aim

To compare the outcomes of laparoscopic CBD exploration and open CBD exploration in patients with CBD stones.

Objectives

1. To compare the rate of stone clearance in the two groups
2. To determine the difference in operative time between laparoscopic and open CBD exploration procedures.
3. To compare the post operative complications in the two groups
4. To compare the length of hospital stay in the two groups

MATERIALS AND METHODS

This cross sectional, single centre comparative study was conducted between October 2023 and October 2025 in the department of General Surgery, DMCH.

Inclusion Criteria

- Age≥18 years
- Documented CBD stone patients

Exclusion Criteria

- Severe cholangitis or gallstone pancreatitis
- Patients with abnormal liver function tests

Approvals and Permissions

The Dhubri Medical College & Hospital's Institutional Ethics Committee granted the study approval.

Between October 2023 and October 2025, records of patients undergoing CBD exploration in the DMCH Department of General Surgery were gathered. We collected demographic data. Reports from the pre-operative blood investigation, ultrasound, and MRCP (if completed) were evaluated. Patients were split into two groups: those who had laparoscopic CBD exploration and those who had open CBD exploration. Under general anaesthesia, the same skilled surgical team performed each treatment. Additionally, the two groups' rates of stone clearance, length of surgery, post-operative complications, and length of hospital stay were compared.

The patient was in the reverse Trendelenberg position with a slight left rotation during the conventional four-port laparoscopic CBD exploration procedure. A 10 mm camera port was positioned in the supraumblical area, and a 10 mm working trocar was positioned in the epigastric area. Two 5 mm functioning trocars were placed at the right midclavicular line and close to the subcostal boundary in the anterior axillary line. The CBD was found and the cystic duct and artery were skeletonised after the Calot's triangle exposure. A longitudinal choledochotomy was performed over the anterior surface of the supraduodenal section of the CBD. To see and remove stones, a 5mm flexible fiberoptic choledochoscope was frequently utilised. The CBD was milked, saline irrigation was used, and a stone retrieval (Dormia) basket was passed through a choledochoscope to extract the stones. A choledochoscope was utilised to evaluate the ductal system's clearing following stone removal. Interrupted 3-0 polygycolic acid sutures, either with or without a T-tube, were used to close the choledochotomy incision. After that, a laparoscopic cholecystectomy was performed. Morison's pouch was regularly fitted with a drain. Conventional open cholecystectomy with choledocholithotomy was performed on the second group. Using interrupted 3-0 polygycolic acid sutures, the choledochotomy incision was sealed over a T-tube. In every instance, a subhepatic drain was installed. The rate of stone clearance, length of surgery, post-operative complications, and length of hospital stay were among the outcomes examined.

Statistical Analysis

The data was analysed using the Statistical Package for Social Sciences (SPSS) version 21.0. Chi-square and independent samples "t"-tests were used to compare the data. A "p" value of less than 0.05 indicated a statistically significant link.

RESULTS

For individuals with choledocholithiasis, the current study compared laparoscopic and open common bile duct investigation. For this reason, 75 patients who met the study's eligibility requirements were taken into consideration.

Group	Procedure	Number	Percentage
1	Patients who had laparoscopic CBD exploration because to simple choledocholithiasis	30	40
2	Patients who underwent open operation for CBD exploration and had simple choledocholithiasis	45	60

Table 1: Number of Patients Undergoing Laparoscopic and Open CBD Exploration

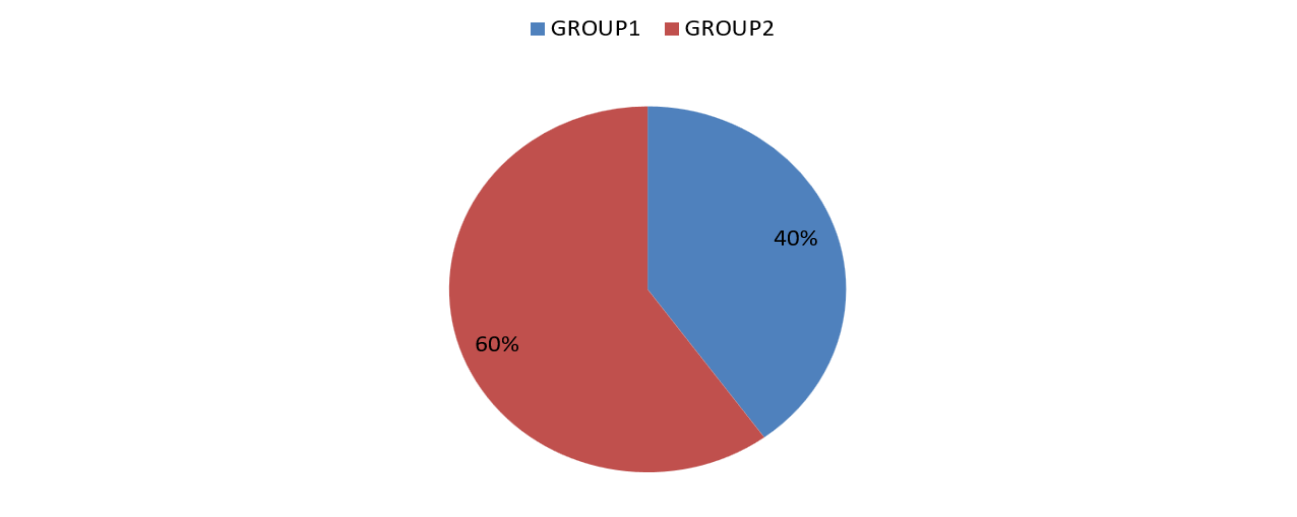

Figure 1: No. of Patients Undergoing Laparoscopic and Open CBD Exploration

Of the 75 patients who had CBD exploration during the study period, 30 (40%) underwent a laparoscopic procedure and made up Group 1, while the remaining 45 (60%) patients underwent an open procedure and made up Group 2.

Sl. No.	Age Group	Group 1		Group 2		Total	
		No	%	No	%	No	%
1	18-20	1	3.33	0	0	1	1.33
2	21-30	6	20	7	15.56	13	17.33
3	31-40	8	26.67	14	31.11	22	29.33
4	41-50	7	23.33	12	26.67	19	25.33
5	51-60	5	16.67	8	17.78	13	17.33
6	≥61	3	10	4	8.88	7	9.33

Table 2: Age Distribution of the Patients Undergoing CBD Exploration

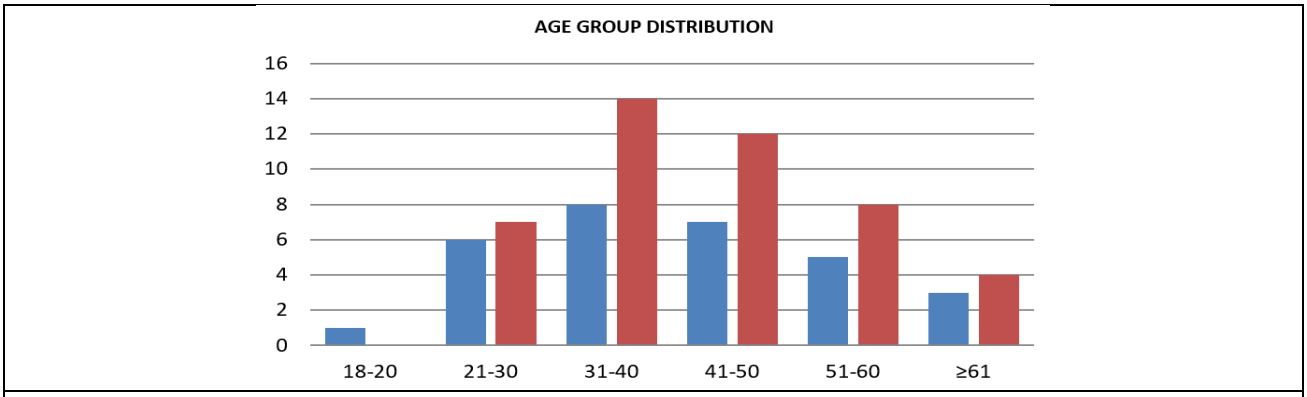

Figure 2: Age Wise Distribution of the Patients in the Two Groups

The patients' ages varied from 19 to 66. The majority of patients (73.33%) were < 50. Just 7 patients (9.33%) were >60 years. The patients' average age was 41.71±7.62 years. The bulk of patients in both categories were <50. Patients in Groups 1 and 2 had mean ages of 40.86±6.32 and 42.68±5.82 years, respectively. The mean age of the patients did not significantly differ between the two groups (p=0.2).

Sl. No.	Sex	Group 1		Group 2		Total	
		No	%	No	%	No	%
1	Male	10	33.33	17	37.77	27	36
2	Female	20	66.67	28	62.22	48	64

Table 3: Sex Distribution of Patients in the Two Groups

2=0.050; p=0.823

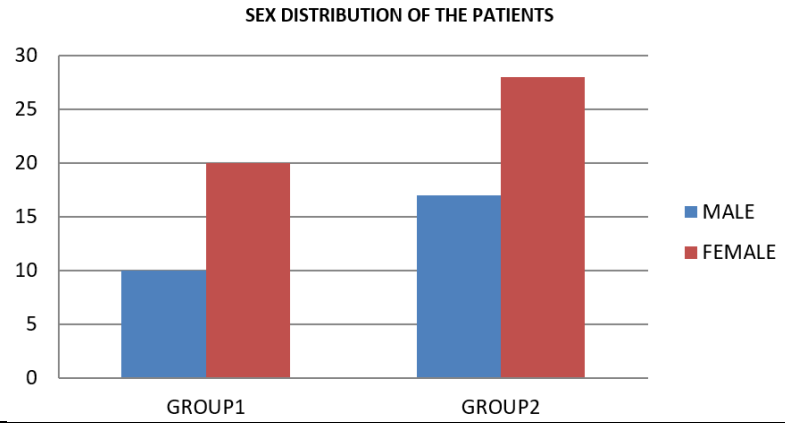

Figure 3: Sex Distribution of Patients in the Two Groups

In both groups, the majority of patients were female. In Groups 1 and 2, the percentage of males was 33.33% and 37.77%, respectively. In total, there were 48 (64%) females and 27 (36%) males. When the data were statistically compared, there was no discernible difference in the patients' sex between the two groups (p=0.69).

Sl. No.	Blood Test	Group 1(n=30)		Group 2(n=45)		Statistical Significance	
		Mean	SD	Mean	SD	t	P
1	Hb%	12.51	1.16	12.48	1.12	-0.112	0.911
2	TC	7.84	2.03	8.02	2.11	0.367	0.7144
3	PT (sec)	12.22	1.13	12.18	1.30	-0.137	0.8911
4	RBS	135.56	13.45	136.84	12.96	0.413	0.681

Table 4: Hb, TLC, PT & RBS Reports of the Two Group of Patients

Group 1's mean haemoglobin and TLC levels were 12.51±1.16 g/dl and 7.84±2.03 thousands/cumm, respectively, whereas Group 2's were 12.48±1.12 g/dl and 8.02±2.11 thousands/cumm, respectively. Regarding haemoglobin and total leukocyte count, there was no statistically significant difference between the two groups (p>0.05).

Group 1's mean prothrombin time and INR were 12.22±1.13 seconds and 0.71±0.13, respectively, whereas Group 2's were 12.18±1.30 seconds and 0.69±0.13, respectively. For both of these parameters, there was no statistically significant difference between the two groups (p>0.05).

There was no statistically significant difference between Groups 1 and 2, with mean random blood sugar levels of 135.56±13.45 mg/dl and 136.84±12.96 mg/dl, respectively (p>0.05).

Sl. No.	Blood Test	Group1(n=30)		Group 2(n=45)		Statistical Significance	
		Mean	SD	Mean	SD	t	P
1	S.Bilirubin (mg/dl)	0.81	0.19	0.79	0.18	-0.461	0.646
2	SGPT(IU/L)	33.45	9.88	34.65	9.76	0.519	0.605
3	SGOT(IU/L)	34.56	9.32	35.11	9.82	0.242	0.809
4	S. Urea(mg/dl)	43.47	15.93	46.43	14.22	0.842	0.402
5	S Creatinine (mg/dl)	1.08	0.15	1.05	0.20	-0.700	0.486
6	Sodium(mEq/L)	138.65	2.34	139.01	2.21	0.675	0.5018
7	Potassium(mEq/L)	3.97	0.28	4.01	0.25	0.647	0.519

Table 5: LFT, RFT &Sr Electrolyte Findings in the Two Groups

Group 1 had mean serum bilirubin, SGPT, and SGOT levels of 0.81±0.19 mg/dl, 33.45±9.88 IU/L, and 34.56±9.32 IU/L, respectively, while Group 2 had mean levels of 0.79±0.18 mg/dl, 34.65±9.76 IU/L, and 35.11±9.82 IU/L. The difference between the two groups was not statistically significant for any of these characteristics (p>0.05).

Group 1's mean serum urea and creatinine levels were 43.47±15.93 and 1.08±0.15 mg/dl, respectively, whereas Group 2's were 46.43±14.22 and 1.05±0.20 mg/dl, respectively. The difference between the two groups was not statistically significant (p>0.05). Group 1's mean serum sodium and potassium levels were 138.65±2.34 and 3.97±0.28 mEq/L, respectively, whereas Group 2's were 139.01±2.21 and 4.01±0.25 mEq/L, respectively. The statistical difference between the two groups for both electrolytes was not significant (p>0.05).

Sl. No.	Observation	Group 1(n=30)		Group 2(n=45)		Statistical Significance	
		Mean	SD	Mean	SD	t	P
1	Duration of surgery	112.56	20.53	108.56	18.58	-0.876	0.384
2	Duration of hospital stay	5.20	1.76	8.89	1.45	9.906	<0.0001

Table 6: Duration of Surgery and Duration of Hospital Stay in the Two Groups

Group 1 had a longer mean surgical time (112.56±20.53 min) than Group 2 (108.56±18.58 min) (p=0.384).
Group 1's mean hospital stay was substantially shorter (5.20±1.76 days) than Group 2's (8.89±1.45 days) (p<0.0001).

Sl. No.	Observation	Group 1(n=30)		Group 2(n=45)		Statistical Significance
		No	%	No	%	P value
1	Post operative infection (LRTI/UTI)	4	13.33	8	17.78	0.609
2	Wound dehiscence	0	0	4	8.89	0.095
3	Residual stone	0	0	6	13.33	0.038
4	Bile leak	2	6.67	1	2.22	0.338
5	Pancreatitis	1	3.33	3	6.67	0.532

Table 7: Post Operative Complications and Retained Stones in the Two Groups

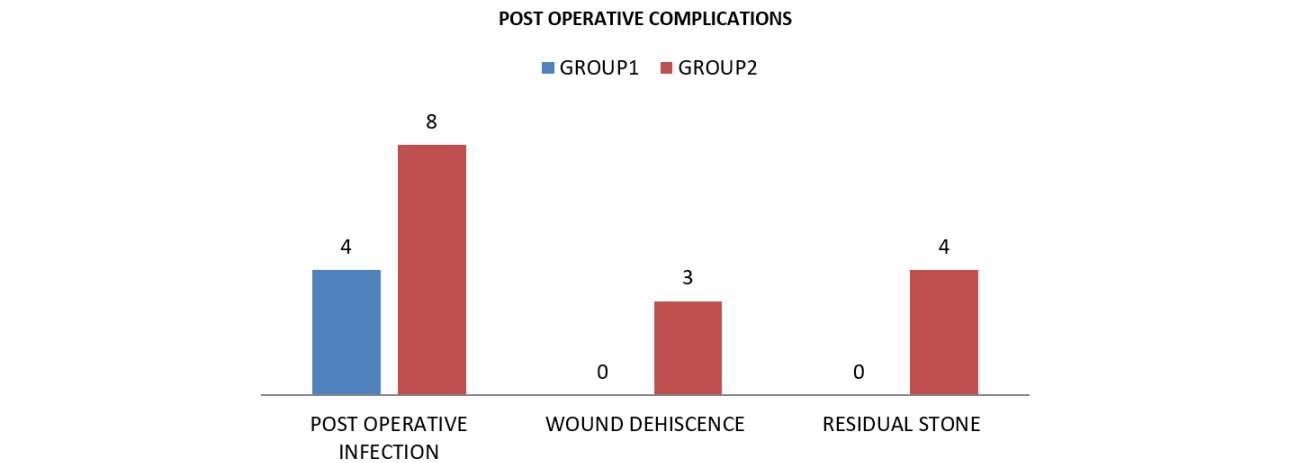

Figure 4: Post Operative Complications and Retained Stones in the Two Groups

Clinical symptoms of infection (LRTI/UTI) were observed in 4 (13.33%) of Group 1 patients and 8 (17.78%) of Group 2 patients by day 14 post-operative follow-up. Four (8.89%) of the patients in Group 2 had wound dehiscence, whereas none of the patients in Group 1 had it. The statistical difference between the two groups was not significant for either infection or wound dehiscence (p>0.05). Two patients (6.67%) in group 1 and one patient (2.22%) in group 2 had biliary leakage. One patient (3.33%) in group 1 and three patients (6.67%) in group 2 experienced postoperative pancreatitis. Regarding bile leakage and post-operative pancreatitis, there was no statistically significant difference between the two groups.

In contrast to six (813.33%) of the Group 2 patients, none of the Group 1 patients had residual stones. The two groups' differences were statistically significant. (p = 0.038). Neither of the two groups had any cases of bile duct damage. Conversion to open surgery was not necessary for any of the Group 1 patients.

Image 1

DISCUSSION

The goal of the current study was to compare the results of open and laparoscopic CBD exploration in patients who came to our hospital with CBD stones. The following are the study's conclusions and a comparison with recent literature.

Age and Sex Profile

The majority of patients in this study (73.33%) were under 50. The patients' average age was 41.71±7.62 years. The mean age of patients in Groups 1 and 2 was 40.86±6.32 years and 42.68±5.82 years, respectively. Statistically, there was no significant difference in the mean age of patients between the two groups (p=0.2). In both groups, the majority of patients were female. In Groups 1 and 2, the percentage of males was 33.33% and 37.77%, respectively. In total, there were 48 (64%) females and 27 (36%) males. When the data were statistically compared, there was no discernible difference in the patients' sex between the two groups (p=0.69).

"According to Tiwari et al.,[8] study, the majority of patients were female (64.8%) and under 40 (63.6%). The patients' average age was 37.81±8.63 years. Regarding the patients' age and sex, there was no statistically significant difference between the two groups. Additionally, Helmy et al.[9] stated that the mean age of the patients was forty years, and that 61.66% of the total patients were female. Bhar and Karmakar[10] observed similar results, with a mean patient age of 37.5±11.71 years and a female percentage of 62%. The high prevalence of gallstone disease, which is significantly more common in women than in men, may be the main cause of the high frequency of middle-aged patients and women in much research."

The haematological and biochemical profiles of the two groups were compared in this study. For both of these parameters, there was no statistically significant difference between the two groups (p>0.05).

Intraoperative Outcomes

Although Group 1's mean surgical time was longer (112.56±20.53 min) than Group 2's (108.56±18.58 min), the difference was not statistically significant (p=0.384). According to Grubnik et al. (2011),[11] the average length of an open procedure was 90 minutes (range 60-150 minutes), while the average length of a laparoscopic procedure was 82 minutes (range 40-160 minutes). According to Tiwari et al.[8], Group 1's surgery was substantially longer (127.73±26.40 min) than Group 2's (115.68±19.70 min) (p=0.017). According to Bayranov et al. (2012),[12] the laparoscopic group's mean operating time was 123±7 minutes, while the open group's was 121±8 minutes. The variations in competence and exposure levels for the two approaches across studies may be the cause of the variations in the trend of operating time.

Post-Operative Complications

Clinical symptoms of infection (LRTI/UTI) were observed in 4 (13.33%) of Group 1 patients and 8 (17.77%) of Group 2 patients by day 14 post-operative follow-up. Four (8.89%) of the patients in Group 2 had wound dehiscence, whereas none of the patients in Group 1 had it. The statistical difference between the two groups was not significant for either infection or wound dehiscence (p>0.05). Two patients (6.67%) in group 1 and one patient (2.22%) in group 2 had biliary leakage. One patient (3.33%) in group 1 and three patients (6.67%) in group 2 experienced postoperative pancreatitis. Regarding bile leakage and post-operative pancreatitis, there was no statistically significant difference between the two groups (p>0.05).

Compared to six (13.33%) individuals in Group 2, none of the patients in Group 1 had residual stones. There was a statistically significant difference (p=0.038).

Group 1's mean hospital stay was substantially shorter (5.20±1.76 days) than Group 2's (8.89±1.45 days) (p<0.0001).

A postoperative hospital stay (LC-LCBDE Group 5.20±0.77 d, and OC-OCBDE Group 8.55±0.71 d, P=0.0001) and serum amylase increase were reported by Du et al.[13] (1 case in the laparoscopic group and 2 cases in the open Group, P<0.01). The rates of residual bile duct stones (LC-LCBDE Group 4.08% and OC-OCBDE Group 3.50%) and postoperative biliary leakage (LC-LCBDE Group 2 cases and OC-OCBDE Group 2 cases) did not differ across the groups.

"According to Gui et al.[14] (2014), there was no statistically significant difference in the rates of stone clearance (93.4% against 94.2%, P >.05), short-term complications (9.8% versus 13.4%, P =.547), or recurrent stones (6.6% versus 5.8%, P >.05) between the laparoscopic and open groups. In contrast to group B, group A had a shorter hospital stay (4.7 ± 2.5 days versus 11.3 ± 3.1 days, P <.001)." In a retrospective record review of 2635 CBDEs, Halawani et al.[15] discovered that residual CBD stones were 2.8 times more common in the LCBDE than in the OCBDE. In the current study, the OCBDE group had a greater stone retention rate than the LCBDE group, and this difference was statistically significant.

"Redwan and Omar[16] discovered that while the stone clearance rate was 95% in the open and 96% in the laparoscopic groups, the hospital stay was considerably shorter and the postoperative morbidity rate was lower in the laparoscopic surgery than in the open procedure."

The results of this study are consistent with the majority of recent research that supports the value of laparoscopic CBD exploration as a safe, economical technique with fewer postoperative complications and a shorter hospital stay. Additionally, laparoscopy permits an early return to work, which increases the procedure's financial advantage.

CONCLUSION

The goal of the current study was to assess the results of open and laparoscopic CBD exploration in 75 patients with CBD stones who had surgery at our institution between October 2023 and October 2025. The majority of patients were female (64%) and under 50 (73.33%). The patients' average age was 41.71±7.62 years. Group 1 had a greater mean surgical duration (112.56±20.53 min) than Group 2 (108.56±18.58 min). Regarding clinical infection, wound dehiscence rate, biliary leakage, and post-operative pancreatitis, there was no discernible difference between the two research groups. Compared to six (13.33%) individuals in Group 2, none of the patients in Group 1 had residual stones. Group 1's mean hospital stay was significantly shorter (5.20±1.76 days) than Group 2's (8.89±1.45 days) (p<0.001).

The results of the study indicate that, with the exception of a slightly longer operation length, laparoscopic procedures were linked to fewer problems, including wound dehiscence, pancreatitis, post-operative infection, and residual stones, as well as a shorter post-operative hospital stay. Therefore, the best technique for CBD exploration may be laparoscopic exploration, which has a superior clinical outcome and fewer problems.

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