



Original Article

Comparative study of endoscopic vs. open surgical management in 50 cases of choledocholithiasis

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ABSTRACT

Introduction: Choledocholithiasis, or the presence of gallstones within the common bile duct (CBD), remains a significant clinical challenge, with management strategies ranging from endoscopic to open surgical procedures. The choice of modality depends on disease severity, patient profile, and available expertise. Our aim is to compare the outcomes of endoscopic and open surgical management in choledocholithiasis in terms of success rate, procedure duration, hospital stay, and postoperative complications.

Material and Methods: This prospective clinical study included 50 patients with choledocholithiasis admitted to Civil Hospital, Ahmedabad, between March 2024 and March 2025. Patients were randomly divided into two groups: Group A (endoscopic management, n = 40) and Group B (open surgical management, n = 10). The parameters studied included success rate, procedure duration, hospital stay, and complication profile.

Results: The success rate was 95% in the endoscopic group and 100% in the open surgical group. The median procedure time was 45 min (range 30-60) for endoscopic procedures and 140 min (range 100-180) for open surgery. The median hospital stay was significantly shorter in the endoscopic group (3 days, range 1-5) compared to the open surgical group (10 days, range 7-15). Complications were fewer in the endoscopic group (pancreatitis in 2 cases, cholangitis in 1 case) compared to the open group (surgical site infection (SSI) in 2 cases, bile leak in 1 case).

Conclusion: Endoscopic management of choledocholithiasis offers shorter operative time, reduced hospital stay, and fewer complications compared to open surgical procedures, making it the preferred modality whenever feasible.

Keywords: Bile duct stones, Choledocholithiasis, Comparative study, Endoscopic procedure, ERCP, Open surgery

INTRODUCTION

Choledocholithiasis refers to the presence of gallstones in the common bile duct (CBD), a condition that may lead to biliary obstruction, cholangitis, or pancreatitis if untreated. It commonly occurs in association with cholelithiasis and affects approximately 10-15% of patients with gallstones.¹ The management of choledocholithiasis has evolved significantly over the past few decades. Traditionally, open surgical procedures such as choledochotomy with T-tube drainage or choledochoduodenostomy were considered the mainstay. However, the advent of minimally invasive techniques, particularly endoscopic retrograde cholangiopancreatography (ERCP), has revolutionized management by reducing morbidity, shortening hospital stay, and improving recovery.¹⁻³ This study aims to compare outcomes of endoscopic and open surgical modalities for the management of choledocholithiasis, focusing on success rates, procedure

duration, hospital stay, and postoperative complications.

MATERIALS AND METHODS

A prospective analytical comparative study of 50 patients with choledocholithiasis was conducted at Civil Hospital, Ahmedabad, between March 2024 and March 2025.

The study protocol received approval from the Institutional Ethics Committee (IEC) of B.J. Medical College & Civil Hospital, Ahmedabad. Written informed consent was obtained from all participants.

Sample size

A convenience sample of 50 consecutive patients presenting with choledocholithiasis during the study period was included. This reflects the typical caseload of our center within the study period.

Grouping

- **Group A:** Endoscopic management (n = 40)
Inclusion criteria: single or multiple CBD stones, each <2.5 cm
- **Group B:** Open surgical management (n = 10)
Inclusion criteria: CBD stone size >2.5 cm
Inclusion criteria
 1. Patients aged >18 years.
 2. Radiologically confirmed choledocholithiasis by USG/MRCP.**Exclusion criteria**
 1. Patients with septicemia, organ failure, or pancreatitis.
 2. Laparoscopic procedures were excluded for consistency.

Data Collection

Data were collected via detailed history and clinical examination using a standardized case record, laboratory parameters like complete blood count, liver function test, renal function test, and coagulation profile. Imaging findings in the form of ultrasonography of the abdomen and MRCP were recorded.

Management protocol

Patients were managed either by ERCP (Group A) or open CBD exploration (Group B).

In Group A, patients underwent endoscopy-guided CBD stone removal by balloon extraction technique and sphincterotomy done as and when required. After stone removal, a CBD stent was placed. In Group B, patients underwent open choledocotomy with stone retrieval followed by primary CBD closure over t-tube

Postoperatively, patients were assessed for complications.

Data were entered and analyzed using standard statistical software. Categorical variables were expressed as frequencies and percentages and were compared between groups using Fisher's exact test.

RESULTS

The highest incidence of choledocholithiasis was noted in the age group of 20-40 years (60%), followed by 40-60 years (35%) in this study. The study demonstrated a female preponderance (68%), with a male-to-female ratio of 1:2.1. The most common symptom was abdominal pain (96%), followed by jaundice (80%).

Table 1: Success rate

| Group | Successful cases | Failed cases | Success % |
|----------------------|------------------|--------------|-----------|
| Endoscopic (Group A) | 38 | 2 | 95% |
| Open (Group B) | 10 | 0 | 100% |

Success was achieved in 95% of cases in the endoscopic group compared to 100% in the open group. There was no statistically significant difference in the success rates between the two surgical approaches (Fisher's exact test, $p = 1.000$) [Table 1].^{4,5}

Table 2: Procedure duration

| Group | Median (min) | Range (min) |
|----------------------|--------------|-------------|
| Endoscopic (Group A) | 45 | 30-60 |
| Open (Group B) | 140 | 100-180 |

Endoscopic procedures had significantly shorter durations than open surgical procedures [Table 2].

Table 3: Hospital stay

| Group | Median (days) | Range (days) |
|----------------------|---------------|--------------|
| Endoscopic (Group A) | 3 | 1-5 |
| Open (Group B) | 10 | 7-15 |

Hospital stay was shorter in the endoscopic group than in the open surgical group [Table 3].^{4,5}

Table 4: Complication profile

| Group | Complications | ICU admission | Mortality |
|----------------------|---------------------------------|---------------|-----------|
| Endoscopic (Group A) | 2 pancreatitis, one cholangitis | 1 | 0 |
| Open (Group B) | 2 SSI, one bile leak | 1 | 1 |

ICU: intensive care unit SSI: Surgical site infection

ICU admission rates were identical between groups, with one patient from each group requiring intensive care. There was

no mortality reported in the endoscopic group (0), while one mortality occurred in the open surgical group (1) [Table 4].

DISCUSSION

Choledocholithiasis continues to pose a significant therapeutic challenge due to its variable presentation and potential for serious complications such as cholangitis and pancreatitis. Over recent decades, the management paradigm has shifted from predominantly open surgical approaches to minimally invasive endoscopic techniques.^{6,7} This prospective comparative study evaluates endoscopic vs. open surgical management in 50 patients and provides insights into outcomes relevant to real-world practice in a tertiary care center.

The majority of patients were in the 20-40 year age group with a clear female predominance, findings that are consistent with the higher prevalence of gallstone disease among younger females in the Indian population. Abdominal pain and jaundice were the most common presenting symptoms, reflecting obstructive biliary pathology as the predominant clinical scenario.

The endoscopic management success rate was 95%, which aligns well with reported rates of 85-98% in the literature. Although open surgical management demonstrated a 100% success rate, the difference between the two modalities was not statistically significant. This suggests that ERCP is nearly as definitive as open surgery for stone clearance in appropriately selected patients.^{2,3,8} The slightly lower success in the endoscopic group may be attributed to factors such as difficult anatomy, impacted stones, or technical limitations inherent to ERCP.

Procedure duration was significantly shorter in the endoscopic group, with a median time of 45 min compared to 140 min in the open surgery group. This marked difference reflects the minimally invasive nature of ERCP and the avoidance of extensive surgical dissection. Reduced operative time is particularly beneficial in elderly patients and those with comorbidities, minimizing anesthesia-related risks.

Hospital stay was another critical outcome favoring endoscopic management. Patients undergoing ERCP had a median hospital stay of 3 days, whereas patients undergoing open surgery required a median of 10 days. Prolonged hospitalization following open procedures can be attributed to postoperative pain, wound care, t-tube management, and delayed mobilization. A shorter hospital stay not only enhances patient satisfaction but also reduces healthcare costs and resource utilization, particularly in high-volume public hospitals.

The complication profile further supports the preference for

endoscopic management. Post-ERCP complications included mild pancreatitis and cholangitis, which were managed conservatively with no mortality. In contrast, open surgery was associated with more severe complications, such as surgical site infection (SSI) and bile leak, and one mortality was recorded. Although ICU admission rates were similar in both groups, complications in the open surgery group tended to be more invasive and associated with prolonged recovery.^{6,9,10}

Despite these advantages, open surgical management retains an important role. In this study, open surgery was reserved for patients with large CBD stones (>2.5 cm), where endoscopic extraction is technically challenging or likely to fail. Open exploration offers definitive stone clearance in such cases, particularly in resource-limited settings where advanced endoscopic equipment or expertise may not be universally available.^{7,11,12}

The strengths of this study include its prospective design and direct comparison of two commonly used management strategies. However, limitations include the relatively small sample size, unequal group distribution, and exclusion of laparoscopic approaches, which are increasingly utilized. Long-term outcomes such as stone recurrence and quality of life were also not assessed.

Overall, the findings of this study reinforce current evidence that ERCP should be considered the first-line modality for choledocholithiasis whenever feasible, with open surgery reserved for selected cases.

CONCLUSION

Endoscopic management of choledocholithiasis is a safe, effective, and minimally invasive treatment modality associated with shorter procedure time, reduced hospital stay, and fewer postoperative complications when compared to open surgical management. While open surgery provides definitive stone clearance, it is associated with higher morbidity and longer recovery and should be reserved for patients with large CBD stones. A tailored approach based on stone characteristics, patient condition, and available expertise remains essential for optimal outcomes.

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