

# PREVALENCE, CLINICAL PROFILE, DIAGNOSTIC EVALUATION, AND MANAGEMENT OF CHOLEDOCHOLITHIASIS AMONG PATIENTS WITH GALLSTONE DISEASE: A PROSPECTIVE OBSERVATIONAL STUDY FROM A TERTIARY CARE CENTRE IN SOUTH

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## ABSTRACT

### Background

Choledocholithiasis remains one of the most important complications of gallstone disease because of its association with biliary obstruction, cholangitis, acute pancreatitis, and increased surgical morbidity. Early diagnosis using appropriate imaging and timely intervention are essential for preventing complications. This study aimed to determine the prevalence of choledocholithiasis among patients with gallstone disease and to evaluate their demographic characteristics, clinical presentation, diagnostic findings, management strategies, and short-term outcomes.

### Methods

A prospective observational study was conducted in the Department of General Surgery, Sree Balaji Medical College and Hospital, Chennai, between July 2024 and January 2026. Sixty-five adult patients with imaging-confirmed gallstone disease were included. Clinical characteristics, laboratory investigations, ultrasonography, magnetic resonance cholangiopancreatography (MRCP), endoscopic retrograde cholangiopancreatography (ERCP), operative findings, treatment modalities, and postoperative outcomes were recorded using a standardized proforma. Data were analysed using descriptive statistics and appropriate inferential tests.

### Results

Among the 65 patients studied, 42 were diagnosed with choledocholithiasis, giving an overall prevalence of **64.6%**. The highest proportion of patients belonged to the 41–50-year age group (49.2%), and females predominated (60%). Right upper quadrant abdominal pain was the most common presenting symptom (100%), followed by nausea or vomiting (80.9%) and jaundice (50%). Elevated alkaline phosphatase was observed in 85.7% of patients. Ultrasonography detected common bile duct stones in 46.1% of patients, whereas MRCP demonstrated a sensitivity of 95.2%. ERCP achieved successful ductal clearance in 95.2% of treated patients and represented the most frequently employed therapeutic intervention (52.4%). Complete ductal clearance was achieved in 95.2% of cases with no mortality. Most patients (64.3%) were discharged within 4–7 days following treatment.

### Conclusions

Choledocholithiasis was highly prevalent among patients with gallstone disease in this tertiary care population. MRCP demonstrated excellent diagnostic accuracy, while ERCP remained the preferred therapeutic modality with high success rates and low complication rates. Routine evaluation of patients with symptomatic gallstone disease using appropriate imaging facilitates early diagnosis and improves clinical outcomes.

**KEYWORDS:** Choledocholithiasis; Gallstone disease; Common bile duct stones; MRCP; ERCP; Laparoscopic cholecystectomy

## INTRODUCTION

Gallstone disease (GSD) is one of the most common disorders of the biliary tract and remains a major cause of gastrointestinal morbidity worldwide. It affects approximately 10–20% of adults and continues to contribute substantially to hospital admissions and surgical workload across both developed and developing countries [1].

Choledocholithiasis, defined as the presence of calculi within the common bile duct (CBD), is one of the most clinically significant complications of gallstone disease. Common bile duct stones may present with biliary colic, obstructive jaundice, acute cholangitis, or biliary pancreatitis, and therefore require prompt diagnosis and appropriate management [2].

The majority of CBD stones originate from the gallbladder and migrate into the common bile duct, whereas primary ductal stones are less common and are usually associated with biliary stasis or infection [3].

Failure to diagnose choledocholithiasis early may lead to life-threatening complications including ascending cholangitis, acute pancreatitis, hepatic dysfunction, and secondary biliary cirrhosis, resulting in increased morbidity and healthcare utilisation [4].

Recent advances in the understanding of gallstone pathogenesis have demonstrated that cholesterol supersaturation of bile, impaired gallbladder motility, mucin hypersecretion, and chronic inflammation collectively contribute to gallstone formation [5].

Current international guidelines recommend integrating clinical assessment, liver biochemical tests, and risk stratification before selecting the most appropriate imaging modality for suspected choledocholithiasis [6].

The Tokyo Guidelines emphasise that early recognition and timely biliary decompression are essential for reducing morbidity and mortality among patients presenting with acute cholangitis secondary to biliary obstruction [7].

Similarly, evidence-based management bundles recommend early diagnosis, appropriate antimicrobial therapy, and prompt biliary drainage to improve clinical outcomes in biliary infections [8].

Recent systematic reviews have demonstrated that laparoscopic common bile duct exploration provides stone clearance rates comparable to ERCP while offering the advantage of a single-stage procedure in selected patients [9].

Furthermore, evidence from contemporary meta-analyses suggests that both surgical and endoscopic approaches are effective for managing choledocholithiasis, with treatment selection depending on patient characteristics, stone burden, local expertise, and available resources [10].

Despite significant advances in diagnostic imaging and minimally invasive interventions, the prevalence and clinical profile of choledocholithiasis continue to vary across different populations. Data from tertiary care centres in South India remain limited, highlighting the need for institution-specific evidence to optimise diagnosis and management.

Therefore, the present study was undertaken to determine the prevalence of choledocholithiasis among patients with gallstone disease attending a tertiary care teaching hospital and to evaluate their demographic profile, clinical presentation, diagnostic findings, management strategies, and treatment outcomes.

### Aim

To determine the prevalence of choledocholithiasis among patients with gallstone disease and to evaluate their clinical profile, diagnostic findings, management strategies, and treatment outcomes in a tertiary care teaching hospital.

### Objectives

#### Primary objective

- To determine the prevalence of choledocholithiasis among patients diagnosed with gallstone disease.

#### Secondary objectives

- To assess the demographic characteristics of patients with gallstone disease and choledocholithiasis.
- To evaluate the clinical presentation and biochemical profile of patients with choledocholithiasis.
- To assess the diagnostic performance of ultrasonography (USG), magnetic resonance cholangiopancreatography (MRCP), endoscopic retrograde cholangiopancreatography (ERCP), and intraoperative cholangiography (IOC) in detecting common bile duct stones.
- To evaluate the different treatment modalities employed for choledocholithiasis and their short-term postoperative outcomes.

## MATERIALS AND METHODS

### Study design

This prospective observational study was conducted to determine the prevalence of choledocholithiasis among patients with gallstone disease and to evaluate their demographic characteristics, clinical presentation, diagnostic findings, management strategies, and short-term treatment outcomes.

### Study setting

The study was carried out in the Department of General Surgery, Sree Balaji Medical College and Hospital, Chromepet, Chennai, Tamil Nadu, India, a tertiary care teaching hospital catering to both urban and rural populations.

### Study period

The study was conducted over a period of 18 months, from **July 2024 to January 2026**.

### Study population

The study included adult patients admitted to the Department of General Surgery with imaging-confirmed gallstone disease during the study period.

### Sample size

The sample size was estimated using the single population proportion formula for prevalence studies:

$$n = \frac{Z^2 \times p \times (1 - p)}{d^2}$$

where:

- **n** = required sample size
- **Z** = standard normal deviate corresponding to a 95% confidence interval (1.96)
- **p** = anticipated prevalence of choledocholithiasis among patients with gallstone disease
- **d** = absolute precision (margin of error)

Based on previous literature reporting a prevalence of approximately **18%** among patients with gallstone disease, a prevalence (*p*) of **0.18** and an absolute precision (*d*) of **10%** were considered.

$$\begin{aligned} n &= \frac{(1.96)^2 \times 0.18 \times (1 - 0.18)}{(0.10)^2} \\ n &= \frac{3.84 \times 0.18 \times 0.82}{0.01} \\ n &= 56.7 \end{aligned}$$

The minimum required sample size was therefore **57 patients**. To compensate for possible incomplete data and exclusions, all eligible patients presenting during the study period were recruited, resulting in a final sample size of **65 patients**.

### Inclusion criteria

Patients meeting the following criteria were included in the study:

- Adults aged 18 years and above.
- Patients with ultrasonography-confirmed gallstone disease.
- Both symptomatic and asymptomatic patients diagnosed incidentally during imaging.
- Patients willing to provide written informed consent.

### Exclusion criteria

Patients were excluded if they had:

- Previous hepatobiliary surgery, including cholecystectomy or biliary bypass surgery.
- Non-calculus biliary disorders such as biliary strictures, hepatobiliary malignancies, or congenital biliary anomalies.
- Severe uncontrolled systemic illness including advanced liver disease or terminal malignancy.
- Pregnancy.
- Incomplete clinical, laboratory, or imaging data.

### Data collection

After obtaining written informed consent, all eligible patients underwent a detailed clinical evaluation including demographic characteristics, presenting complaints, medical history, physical examination findings, and relevant risk factors.

Baseline laboratory investigations included complete blood count, liver function tests, serum bilirubin, alkaline phosphatase, serum glutamic oxaloacetic transaminase (SGOT/AST), serum glutamic pyruvic transaminase (SGPT/ALT), serum amylase, and serum lipase.

Abdominal ultrasonography (USG) was performed as the initial imaging modality for all patients to confirm gallstone disease and assess biliary dilatation. Patients with suspected choledocholithiasis or inconclusive ultrasonographic findings underwent magnetic resonance cholangiopancreatography (MRCP) for confirmation of common bile duct stones and evaluation of biliary anatomy. Endoscopic retrograde cholangiopancreatography (ERCP) was performed in selected patients for diagnostic confirmation and therapeutic stone extraction whenever indicated. Intraoperative cholangiography (IOC) was performed in patients undergoing common bile duct exploration when clinically indicated.

Operative findings, treatment procedures, postoperative recovery, complications, and follow-up outcomes were documented using a predesigned structured data collection proforma.

### Outcome measures

#### Primary outcome

The primary outcome was the prevalence of choledocholithiasis among patients diagnosed with gallstone disease.

#### Secondary outcomes

Secondary outcomes included:

- demographic characteristics of patients,
- clinical presentation,
- biochemical abnormalities,
- diagnostic yield of ultrasonography, MRCP, ERCP, and intraoperative cholangiography,
- treatment modalities employed,
- postoperative complications,
- duration of hospital stay, and
- short-term clinical outcomes.

#### Statistical analysis

Data were entered into Microsoft Excel and analysed using Statistical Package for the Social Sciences (SPSS) software version 22.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean  $\pm$  standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Associations between categorical variables were analysed using the Chi-square test, and continuous variables were compared using Student's *t*-test where appropriate. A *p* value of  $<0.05$  was considered statistically significant.

#### Ethical approval

The study protocol was reviewed and approved by the **Institutional Ethics Committee of Sree Balaji Medical College and Hospital, Chennai**, before commencement of the study. Written informed consent was obtained from all participants prior to enrolment. Patient confidentiality and anonymity were maintained throughout the study, and all investigations and treatment procedures were carried out according to standard institutional protocols and the ethical principles of the Declaration of Helsinki. The study was self-funded, and the authors received no external financial support.

#### Use of Artificial Intelligence

Artificial intelligence (AI)-assisted language tools were used exclusively to improve the language, grammar, readability, and overall presentation of the manuscript. AI was **not** used for study design, patient recruitment, data collection, statistical analysis, data interpretation, image generation, or formulation of the scientific conclusions. All scientific content, analyses, interpretations, and conclusions were independently reviewed, verified, and approved by the authors. The authors accept full responsibility for the accuracy, integrity, and originality of the manuscript.

## RESULTS

A total of **65 patients** with imaging-confirmed gallstone disease were included in the study. Among these, **42 patients** were diagnosed with choledocholithiasis, giving an overall prevalence of **64.6%**.

#### Demographic characteristics

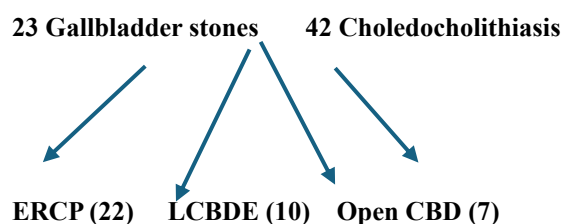
The age of the study participants ranged from **20 to 75 years**, with the highest proportion belonging to the **41–50 years** age group (**49.2%**). Females constituted **60.0%** of the study population, while males accounted for **40.0%**, resulting in a female-to-male ratio of approximately **1.5:1** (Table 1).

**Table 1. Demographic characteristics of the study population (n=65)**

| Variable                 | Frequency | Percentage |
|--------------------------|-----------|------------|
| <b>Age group (years)</b> |           |            |
| $\leq 30$                | 4         | 6.1        |
| 31–40                    | 9         | 13.8       |
| 41–50                    | 32        | 49.2       |
| 51–60                    | 14        | 21.5       |
| $>60$                    | 6         | 9.2        |
| <b>Sex</b>               |           |            |

| Variable | Frequency | Percentage |
|----------|-----------|------------|
| Male     | 26        | 40.0       |
| Female   | 39        | 60.0       |

**Figure 1. Study flow diagram**  
65 patients with gallstone disease



#### Clinical presentation and laboratory findings

Among the **42 patients** with choledocholithiasis, **right upper quadrant pain** was the most common presenting complaint (**100%**), followed by **nausea/vomiting (80.9%)**, **jaundice (50.0%)**, and **fever with chills (35.7%)**. Laboratory evaluation demonstrated a cholestatic pattern, with elevated alkaline phosphatase in **85.7%**, direct bilirubin in **76.1%**, and total bilirubin in **71.4%** of patients (Table 2).

**Table 2. Clinical presentation and laboratory profile of patients with choledocholithiasis (n=42)**

| Variable                        | Frequency | Percentage |
|---------------------------------|-----------|------------|
| <b>Clinical presentation</b>    |           |            |
| Right upper quadrant pain       | 42        | 100.0      |
| Nausea/vomiting                 | 34        | 80.9       |
| Jaundice                        | 21        | 50.0       |
| Fever with chills               | 15        | 35.7       |
| Dyspepsia/bloating              | 12        | 28.6       |
| Dark urine                      | 10        | 23.8       |
| Clay-coloured stools            | 9         | 21.4       |
| Loss of appetite                | 8         | 19.0       |
| Pruritus                        | 4         | 9.5        |
| <b>Laboratory abnormalities</b> |           |            |
| Raised total bilirubin          | 30        | 71.4       |
| Raised direct bilirubin         | 32        | 76.1       |
| Raised ALP                      | 36        | 85.7       |
| Raised AST                      | 27        | 64.2       |
| Raised ALT                      | 25        | 59.5       |

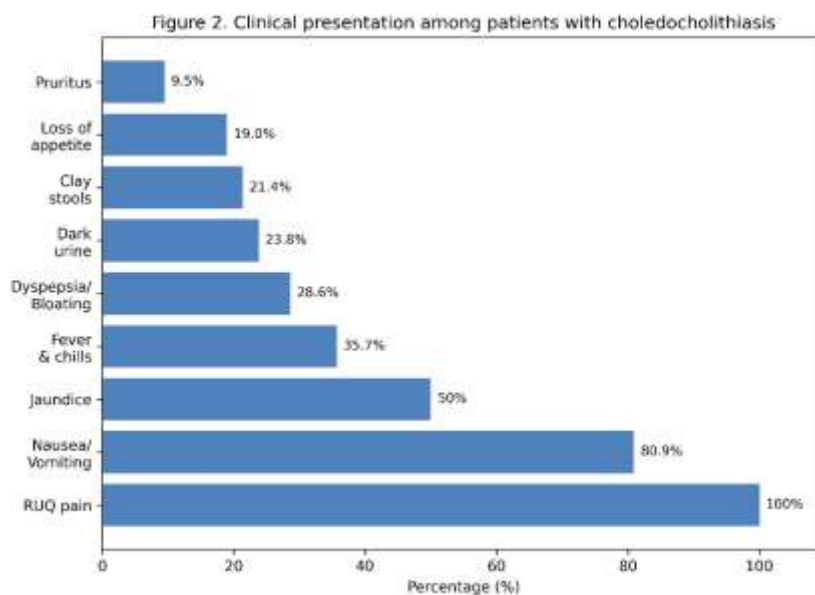


Figure 2. Frequency of presenting symptoms

### Diagnostic evaluation

Abdominal ultrasonography was performed in all patients and identified common bile duct stones in **30 patients**. MRCP demonstrated a diagnostic sensitivity of **95.2%**, while ERCP achieved **96.0%** sensitivity. Intraoperative cholangiography demonstrated **100%** sensitivity among surgically managed patients (Table 3).

Table 3. Diagnostic performance of imaging modalities

| Investigation                  | Patients evaluated | Positive cases | Sensitivity (%) |
|--------------------------------|--------------------|----------------|-----------------|
| Ultrasonography                | 65                 | 30             | 71.4            |
| MRCP                           | 42                 | 40             | 95.2            |
| ERCP                           | 25                 | 24             | 96.0            |
| Intraoperative cholangiography | 12                 | 12             | 100             |

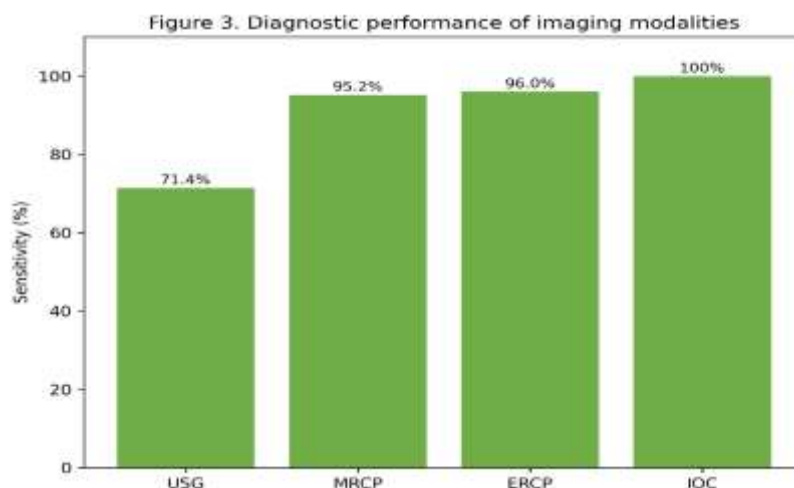


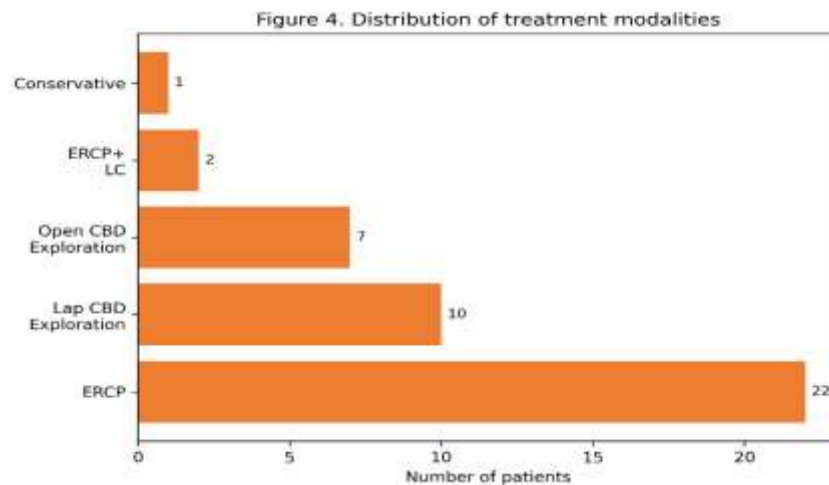
Figure 3. Diagnostic accuracy of imaging modalities

### Management and clinical outcomes

Among patients with choledocholithiasis, **ERCP with stone extraction** was the most commonly performed intervention (**52.4%**), followed by laparoscopic common bile duct exploration (**23.8%**) and open common bile duct exploration (**16.7%**). Complete ductal clearance was achieved in **95.2%** of patients. Minor postoperative complications included wound infection (**4.8%**), post-ERCP pancreatitis (**4.8%**), and bile leak (**2.4%**). No mortality was observed during the study period (Table 4).

**Table 4. Management modalities and postoperative outcomes (n=42)**

| Variable                                      | Frequency | Percentage |
|-----------------------------------------------|-----------|------------|
| <b>Management</b>                             |           |            |
| ERCP with stone extraction                    | 22        | 52.4       |
| Laparoscopic CBD exploration                  | 10        | 23.8       |
| Open CBD exploration                          | 7         | 16.7       |
| ERCP followed by laparoscopic cholecystectomy | 2         | 4.8        |
| Conservative management                       | 1         | 2.3        |
| <b>Postoperative outcomes</b>                 |           |            |
| Complete ductal clearance                     | 40        | 95.2       |
| Residual stone                                | 1         | 2.4        |
| Bile leak                                     | 1         | 2.4        |
| Wound infection                               | 2         | 4.8        |
| Post-ERCP pancreatitis                        | 2         | 4.8        |
| Mortality                                     | 0         | 0          |

**Figure 4. Distribution of treatment modalities****Prevalence of choledocholithiasis and hospital stay**

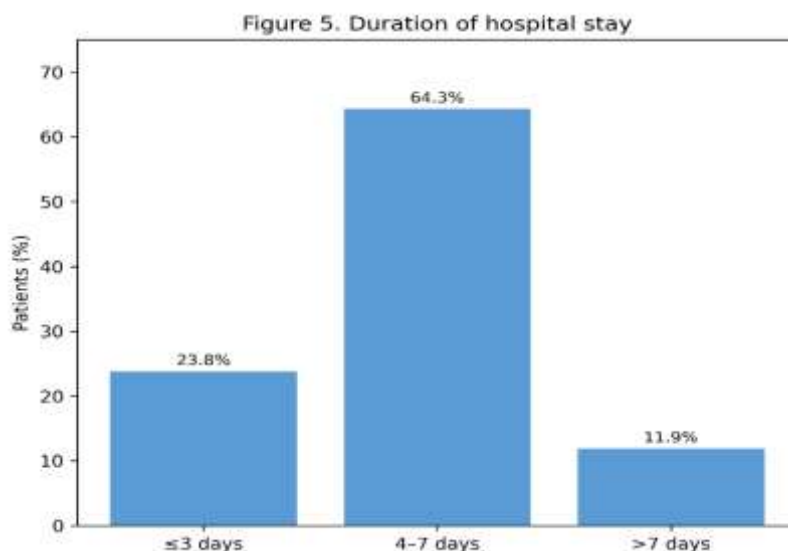
Overall, 42 of 65 patients (64.6%) had choledocholithiasis. Among symptomatic patients, 76.0% had common bile duct stones compared with 26.7% of asymptomatic patients. Most patients (64.3%) were discharged within 4–7 days, while 11.9% required hospitalisation for more than seven days. The mean hospital stay was  $5.2 \pm 1.8$  days (Table 5).

**Table 5. Prevalence of choledocholithiasis, symptom status, and hospital stay**

| Variable                              | Frequency | Percentage |
|---------------------------------------|-----------|------------|
| <b>Disease distribution</b>           |           |            |
| Gallbladder stones only               | 23        | 35.4       |
| Gallbladder + CBD stones              | 37        | 56.9       |
| Isolated CBD stones                   | 5         | 7.7        |
| Overall choledocholithiasis           | 42        | 64.6       |
| <b>Clinical presentation</b>          |           |            |
| Symptomatic patients with CBD stones  | 38/50     | 76.0       |
| Asymptomatic patients with CBD stones | 4/15      | 26.7       |
| <b>Hospital stay</b>                  |           |            |
| ≤3 days                               | 10        | 23.8       |

| Variable           | Frequency      | Percentage |
|--------------------|----------------|------------|
| 4–7 days           | 27             | 64.3       |
| >7 days            | 5              | 11.9       |
| Mean hospital stay | 5.2 ± 1.8 days | —          |

**Figure 5. Duration of hospital stay following treatment**



## DISCUSSION

### Demographic characteristics

In the present prospective observational study, the majority of patients with gallstone disease belonged to the 41–50-year age group (49.2%), with a predominance of female patients (60%). These findings are consistent with the well-established epidemiological pattern of gallstone disease, which predominantly affects middle-aged women. Lammert et al. [4] described gallstone disease as one of the most common gastrointestinal disorders worldwide, with increasing prevalence among middle-aged adults. Similarly, Shaffer [14] reported that female sex, increasing age, obesity, and metabolic disorders remain the principal risk factors for gallstone formation. Portincasa et al. [5] further explained that hormonal influences, cholesterol supersaturation, and impaired gallbladder motility contribute significantly to the higher prevalence of gallstones among women. Di Ciaula et al. [15] also demonstrated that abnormalities in gallbladder contractility play a central role in cholesterol gallstone formation, particularly among females. Although females predominated in the present study, the proportion of affected males (40%) suggests an increasing burden of gallstone disease among men, possibly reflecting the rising prevalence of obesity, diabetes mellitus, and sedentary lifestyles, as highlighted by Ko and Lee [16].

### Clinical presentation

Right upper quadrant abdominal pain was the most common presenting complaint and was observed in all patients with choledocholithiasis. Other frequently encountered symptoms included nausea and vomiting, jaundice, fever with chills, dyspepsia, dark urine, clay-coloured stools, and pruritus. Similar findings have been reported by Ahmed et al. [24], who identified abdominal pain, jaundice, and vomiting as the predominant presenting symptoms among patients with choledocholithiasis. Likewise, Singh et al. [25] reported that biliary colic remained the most consistent symptom, while jaundice and fever were more commonly associated with common bile duct obstruction and cholangitis. The presence of Charcot's triad in a proportion of patients in the present study also supports the observations of Yokoe et al. [7] and Kiriya et al. [8], who emphasised that the combination of abdominal pain, fever, and jaundice is highly suggestive of acute cholangitis requiring urgent biliary decompression.

### Laboratory findings

The present study demonstrated a predominantly cholestatic biochemical profile. Elevated alkaline phosphatase was the most frequent laboratory abnormality, followed by raised direct bilirubin and total bilirubin concentrations. Mild to moderate elevation of serum transaminases was also observed in several patients. These findings are consistent with the pathophysiology of extrahepatic biliary obstruction described by Portincasa et al. [5], who reported that obstruction of bile flow results in conjugated hyperbilirubinaemia and elevation of cholestatic liver enzymes. Williams et al. [12] similarly recommended the use of liver function tests as an essential component of the initial evaluation of patients with suspected choledocholithiasis, although they noted that biochemical abnormalities alone are insufficient to establish the diagnosis. Gurusamy and Davidson [13] also

concluded that liver function tests should always be interpreted together with imaging findings because transient obstruction may produce variable biochemical changes.

### **Diagnostic evaluation**

Ultrasonography served as the initial imaging modality in all patients because of its accessibility and non-invasive nature. However, its diagnostic sensitivity was lower than that of advanced imaging modalities. MRCP demonstrated excellent diagnostic accuracy with a sensitivity of 95.2%, while ERCP achieved a sensitivity of 96.0%. These findings closely agree with the recommendations of the ASGE guideline by Buxbaum et al. [1], which advocates MRCP or endoscopic ultrasound for patients with an intermediate probability of choledocholithiasis before therapeutic ERCP. Similarly, the ESGE guideline published by Manes et al. [2] recommends MRCP because of its high diagnostic accuracy and ability to avoid unnecessary invasive procedures. Nzenwa et al. [18], in a systematic review and meta-analysis, reported that MRCP demonstrates excellent sensitivity and specificity for detecting common bile duct stones, making it the preferred non-invasive imaging modality. Scheiman et al. [19] further suggested that MRCP can safely replace diagnostic ERCP in appropriately selected patients, thereby reducing procedure-related complications. Patel et al. [26] also demonstrated high diagnostic accuracy of MRCP in an Indian tertiary care setting, supporting its routine use in patients with suspected choledocholithiasis.

### **Management and postoperative outcomes**

ERCP with stone extraction was the most frequently performed intervention in the present study, accounting for more than half of all procedures. Complete ductal clearance was achieved in 95.2% of patients, with a low incidence of postoperative complications and no mortality. These findings are consistent with the ASGE recommendations by Buxbaum et al. [1], which recognise ERCP as the preferred therapeutic modality for confirmed choledocholithiasis. Similarly, Manes et al. [2] recommended ERCP as the first-line intervention for patients with common bile duct stones requiring endoscopic treatment.

Laparoscopic common bile duct exploration was successfully performed in selected patients and produced favourable clinical outcomes. Van Dijk et al. [9], in their systematic review, reported that laparoscopic common bile duct exploration provides stone clearance rates comparable to ERCP while allowing definitive treatment in a single-stage procedure. Similar conclusions were reached by Dasari et al. [10] and Ricci et al. [11], who demonstrated no significant difference in stone clearance between endoscopic and laparoscopic approaches, although laparoscopic exploration reduced the need for multiple procedures in experienced centres. ElGeidie [17] also reported excellent outcomes with single-stage laparoscopic management of choledocholithiasis, particularly in specialised hepatobiliary units.

More recent studies have further supported minimally invasive management strategies. Lyu et al. [21] demonstrated that laparoscopic and endoscopic approaches achieve comparable clinical outcomes, with treatment selection largely depending on institutional expertise. Li et al. [22] reported high rates of successful ductal clearance following ERCP with acceptable complication rates. Zhang et al. [23] similarly observed excellent outcomes following laparoscopic common bile duct exploration in the modern era, while Yadav et al. [27] reported favourable results from a prospective Indian study using laparoscopic techniques. Open common bile duct exploration remained necessary in a small proportion of patients with impacted stones or failed endoscopic management, reflecting recommendations by the World Society of Emergency Surgery [28] and the contemporary review by Ansari et al. [29], which acknowledge that open surgery continues to play an important role in complex biliary disease.

### **Prevalence and clinical implications**

The overall prevalence of choledocholithiasis in the present study was 64.6%, which is higher than that reported in many population-based studies but comparable with hospital-based studies involving symptomatic patients referred to tertiary surgical centres. De Mestral et al. [3] observed that referral centres frequently report higher rates of common bile duct stones because they manage patients with more advanced biliary disease. Ahmed et al. [24] and Singh et al. [25] similarly reported a high prevalence of choledocholithiasis among symptomatic patients with gallstone disease. The higher prevalence observed in the present study may also be attributed to the routine use of MRCP, which improves the detection of clinically silent or small common bile duct stones.

Recent advances in the understanding of gallstone disease have further strengthened the importance of early diagnosis and intervention. Portincasa et al. [30] highlighted that improved imaging, evidence-based risk stratification, and minimally invasive therapeutic approaches have significantly enhanced the management of gallstone disease and its complications. The findings of the present study support these observations and reinforce the need for systematic evaluation of patients with gallstone disease using clinical assessment, biochemical investigations, and appropriate imaging before definitive management.

### **Strengths**

The present study provides prospective data on the prevalence, clinical profile, diagnostic evaluation, and management of choledocholithiasis from a tertiary care teaching hospital in South India. Standardised clinical evaluation, biochemical assessment, and imaging protocols ensured uniform data collection. The study also evaluated both endoscopic and surgical treatment modalities, providing clinically relevant information applicable to routine surgical practice.

## **Limitations**

The study was conducted at a single tertiary care centre with a relatively small sample size, which may limit the generalisability of the findings. The observational design precluded assessment of causal relationships between individual risk factors and the development of choledocholithiasis. Long-term follow-up was not available; therefore, recurrence rates and long-term postoperative outcomes could not be assessed. Additionally, advanced imaging and therapeutic interventions were performed according to clinical indications rather than uniformly in all patients, introducing the possibility of selection bias.

## **CONCLUSION**

The present study demonstrated a 64.6% prevalence of choledocholithiasis among patients with gallstone disease admitted to a tertiary care centre, indicating a substantial burden of common bile duct involvement in symptomatic patients. Middle-aged females constituted the majority of affected individuals, and right upper quadrant pain was the predominant presenting symptom. A cholestatic biochemical profile, characterised by elevated alkaline phosphatase and conjugated bilirubin levels, was commonly observed.

MRCP demonstrated excellent diagnostic accuracy and proved to be the preferred non-invasive imaging modality for confirming choledocholithiasis, whereas ERCP remained the primary therapeutic intervention with a high ductal clearance rate and low complication profile. Laparoscopic common bile duct exploration provided an effective alternative in appropriately selected patients, while open surgery continued to have an important role in complex cases.

Early diagnosis through appropriate clinical assessment, biochemical evaluation, and evidence-based imaging, followed by timely minimally invasive intervention, can significantly reduce morbidity and improve patient outcomes. Larger multicentre studies with longer follow-up are recommended to validate these findings and further optimise the management of choledocholithiasis in the Indian population.

## **ACKNOWLEDGEMENTS**

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## **Conflict of interest**

The authors declare that there is no conflict of interest.

## **Ethical approval**

The study protocol was reviewed and approved by the Institutional Ethics Committee of Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India, prior to the commencement of the study. Written informed consent was obtained from all participants before enrolment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and its subsequent amendments.

## **Consent to participate**

Written informed consent was obtained from all participants prior to inclusion in the study.

## **Consent for publication**

Not applicable.

## **Availability of data and materials**

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

## **Authors' contributions**

All authors contributed to the conception and design of the study. The first author was responsible for data collection, data analysis, interpretation of the results, and preparation of the manuscript. The second author provided academic supervision, critically reviewed the manuscript for important intellectual content, and approved the final version of the manuscript. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

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