

A prospective and retrospective observational study on residual gallbladder stones after cholecystectomy



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ABSTRACT

Background: A small number of post-cholecystectomy syndrome cases result from residual stones in a lengthy cystic duct or recurrence of lithiasis in a remaining gallbladder (GB) tissue. In laparoscopic procedures, up to 13.3% may involve incomplete GB removal due to surgical complexities and anatomical variations such as adhesions or challenging morphology. **Aims and Objectives:** (1) To assess the incidence of retained stones in patients undergoing cholecystectomy, (2) to compare incidences among open and laparoscopic cholecystectomies, (3) to study various presenting ways and different investigational methods helping in early diagnosis and proper management, and (4) to study different operative interventions for different cases. **Materials and Methods:** This was a prospective and retrospective observational study. After getting ethical committee approval and informed consent, 35 patients were included in the study. The study was carried out in the Department of General Surgery at I.P.G.M.E.R./S.S.K.M. Hospital, Kolkata. **Results:** Most patients were post-open cholecystectomy cases. The incidence of retained GB stones was 4.48%, with females affected 2.8 times more than males. Common symptoms were pain abdomen (80%) and fever (25%). Ultrasonography diagnosed stump calculi in 85.71% of cases; magnetic resonance cholangiopancreatography (MRCP) was preferred when ultrasound was inconclusive. **Conclusion:** Cases underwent subtotal cholecystectomy or had long cystic duct stumps in rural hospitals, referred to tertiary hospital for further management. Symptoms included pain abdomen, fever, and sometimes jaundice. MRCP confirmed diagnoses before open re-exploration; completion cholecystectomy addressed residual stones for symptom relief and cure.

Key words: Cholecystectomy; Partial cholecystectomy; Calot's triangle

BACKGROUND

Partial cholecystectomy

Partial cholecystectomy, whether open or laparoscopic, is indicated in cases of severe acute cholecystitis, gangrenous cholecystitis, or necrotizing cholecystitis, where the degree of inflammation precludes safe visualization of biliary structures.¹ Partial cholecystectomy, involves leaving in situ part or all of the wall of the gall bladder which lies directly in relation to the liver and/or structures in the porta hepatis. It is reportedly tolerated well, with few minor post-operative complications; however, the issues that do occur include recurrent symptoms, choledocholithiasis, and persistent

biliary fistula. Historical accounts have documented partial cholecystectomy performed in the 1950s with washout and removal of GB contents with placement of a drain in the orifice of the cystic duct when dissection of the hilar structures would be too dangerous, or the GB was densely adherent to the liver bed. It should be noted that even though technically possible, partial cholecystectomy is less than the ideal procedure, which is a complete cholecystectomy, with total removal of the GB and closure of the cystic duct remnant.

Partial cholecystectomy may not provide a cure in all patients because leaving a portion of the GB in situ in connection to the common bile duct (CBD) may contribute

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not only to the formation of new stones but also leave a path intact for continued biliary colic and obstruction.

Reasons of difficult Calot's dissection

- Elderly patients are more likely to have a difficult laparoscopic cholecystectomy (LC)
- Females undergo this surgery more frequently, but males tend to have a higher number of difficult cases
- Recurrent cholecystitis is a predictor
- Obese patients and those with recurrent cholecystitis tend to have more difficulties during surgery
- Previous surgery predisposes toward difficulties in cholecystectomy
- Patients who needed pre-operative endoscopic retrograde cholangiopancreatography (ERCP) had more chances of having a difficult cholecystectomy
- Abnormal serum hepatic and pancreatic enzyme profiles were associated with difficulty in surgery
- Pre-operative ultrasonography (USG) can predict difficulties during LC
- Features such as distended or contracted GB, intraperitoneal adhesions, grossly thickened GB wall, structural anomalies or distortions, and the presence of a cirrhotic liver are signs that are associated with subsequent difficulties during the surgery.

Aims and objectives

This prospective and retrospective study was done on patients attending the General Surgery Outpatient Department (OPD) and Emergency in IPGME&R/SSKM Hospital with the following objectives:

1. To assess the incidence of retained stones in patients undergoing cholecystectomy
2. To compare incidences among open and laparoscopic cholecystectomies
3. To study various presenting ways and different investigational methods helping in early diagnosis and proper management
4. To study different operative interventions for different cases.

MATERIALS AND METHODS

Study area

Patients attending General Surgery OPD / admitted under Dept of General Surgery in Tertiary Care Hospital.

Study population

Patients of IPGME and R/SSKM Hospital hailing mostly from the eastern part of India were enrolled.

Period of study

The study period was from January 2021 to 2023 (retrospectively two years).

Table 1: Gender distribution of the patients

Gender	Number	%
Male	9	25.7
Female	26	73.4
Total	35	100.0
Male: female	1.0:2.8	

Table 2: Operative procedures for the patients

Procedure	Number	%
Laparoscopy	2	5.71
Open	33	94.28
Total	35	100.0

Table 3: Presence of number of stones in MRCP

Stone	Number	%
Single	6	17.14
Multiple	29	82.86
Total	35	100.0

MRCP: Magnetic resonance cholangiopancreatography

Table 4: Modes of presentation

Symptoms	Number	Percentage
Pain abdomen	28	80
Fever	9	25
Jaundice	3	8.5
Incidental finding	7	20

Table 5: Modes of treatment

Treatment	Number	Percentage
Open	32	91.4
Laparoscopy	2	5.7
Treatment refused	1	2.9
Total	35	100

Table 6: Ultrasonography in the diagnosis of stump calculi

Ultrasonography	Number of patients	Percentage
Calculi detected	30	85.71
Calculi not detected	5	14.29
Total	35	100

Sample size

Total 35 patients with the diagnosis of Gall stones who underwent cholecystectomy previously in the rural hospitals were included in the study.

Study design

This was a prospective and retrospective observational study.

Parameters to be studied

- To assess the incidence of retained stones in patients undergoing cholecystectomy

- To compare incidences among open and LC
- To study various presenting ways and different investigational methods helping in early diagnosis and proper management

Table 7: Pain during initial operation		
Pain	Number of patients	Percentage
Present	24	68.57
Absent	11	31.43
Total	35	100

Table 8: Length of cystic stump		
Stump length	Number	Percentage
More than 5 mm	18	51.43
<5 mm	17	48.57

Table 9: Location of initial operative center		
Place	Number of patients	Percentage
Rural	33	94.28
Urban	2	5.72
Total	35	100

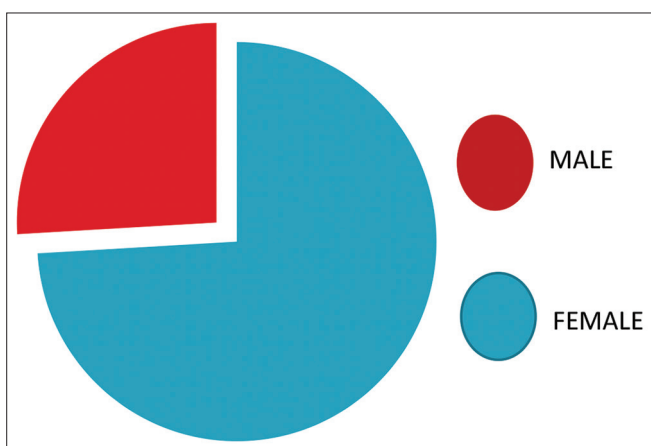


Figure 1: Gender distribution

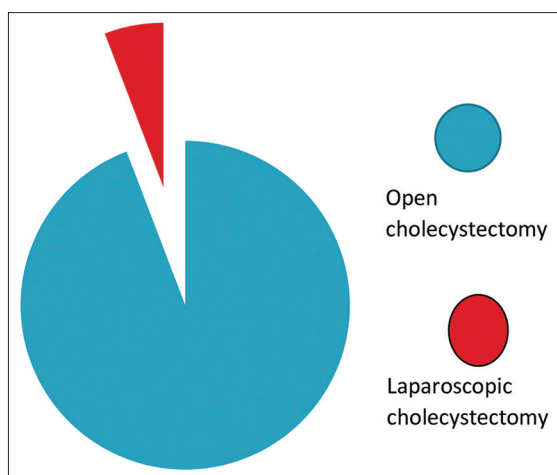


Figure 2: Procedure

- To study different operative interventions for different cases.

Inclusion criteria

All cases of post-cholecystectomy attending the study area within the mentioned timeline were included in the study.

Exclusion criteria

- Patients unwilling to take part in this study
- All patients in whom signs and symptoms mimic residual stones but ultimately proved not such a case were excluded from the study.

Plan for analysis

Appropriate statistical tools will be used for the analysis of the cumulated data.

Study tools and technique

- Questionnaire
- Clinical examination
- Complete blood count
- Blood biochemistry
- Imaging studies – chest X-ray, USG, and magnetic resonance cholangiopancreatography (MRCP).

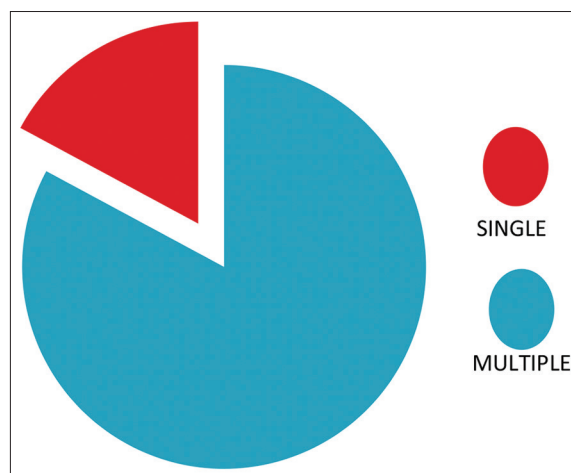


Figure 3: Number of stones in gallbladder stump

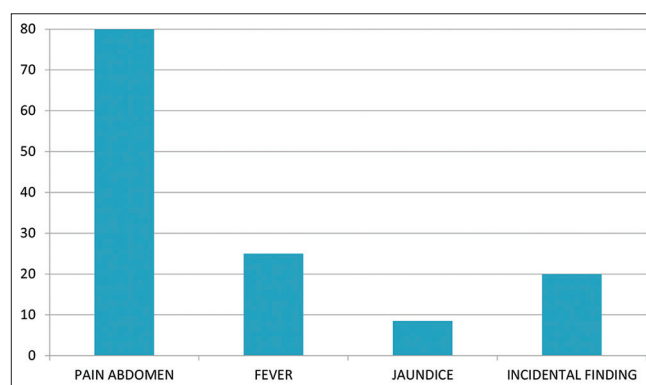


Figure 4: Presentation

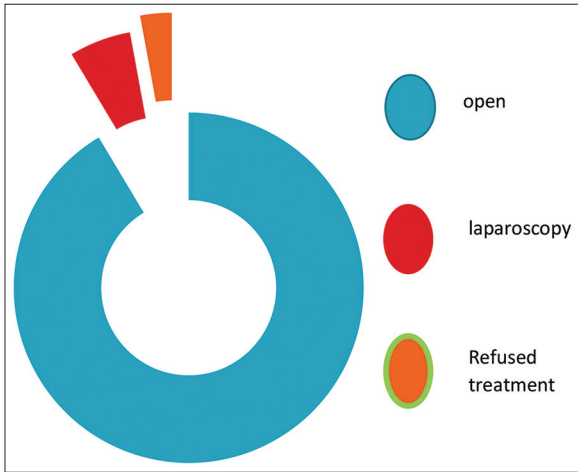


Figure 5: Treatment

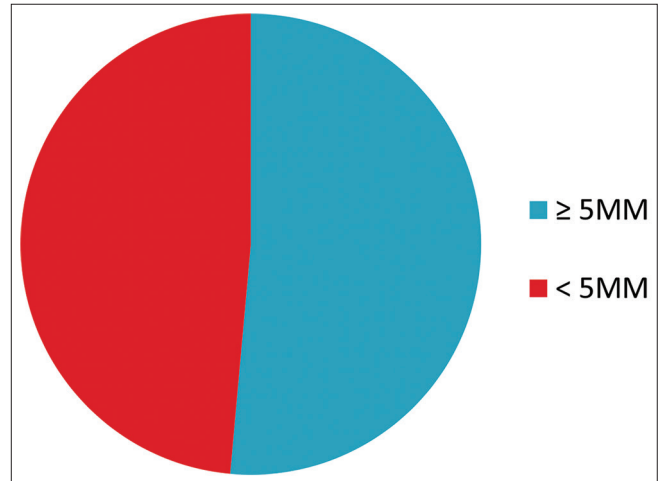


Figure 8: Stump length

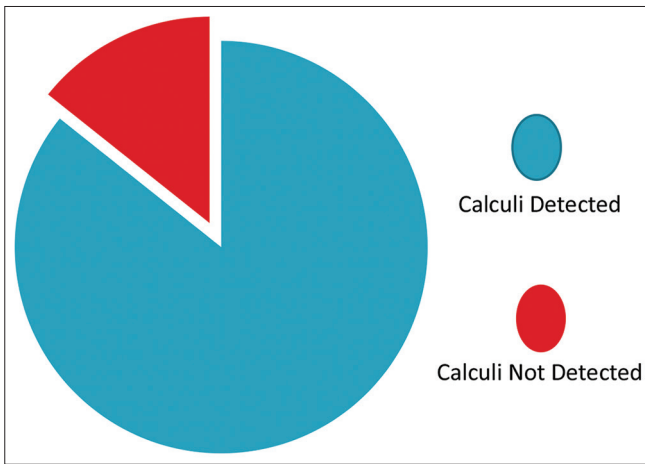


Figure 6: Ultrasonography

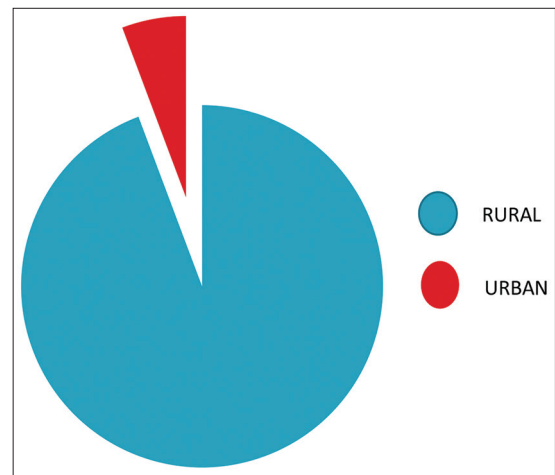


Figure 9: Location

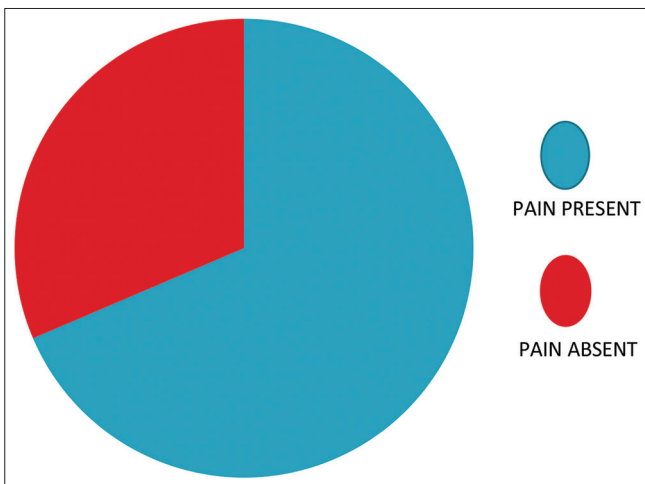


Figure 7: Pain

Procedure

After getting ethical committee approval and informed consent, 35 patients were included in the study. The study

was carried out in the Department of General Surgery at I.P.G.M.E.R./S.S.K.M. Hospital, Kolkata.

RESULTS

1. Most of the patients were open post-cholecystectomy cases
2. The incidence of retained GB stones is 4.48
3. Females were mostly affected, 2.8 times >males
4. Most patients presented with features of pain abdomen (80%) and fever (25%), and incidental findings were around 20%
5. USG diagnosed stump calculi in 85.71% of cases, as few patients came up with the MRCP reports, and ultrasound findings were inconclusive in those cases.

However, USG remains the first line of investigation.

6. MRCP was the investigation of choice in detecting stump calculi.

In 82.86%, single stones were found in the stump, and multiple stones were detected in 17.14% of cases

In one case, almost entire GB was found intraoperatively during re-operation.

7. During re-exploration, open cholecystectomy was the treatment of choice in most of the cases (91.4%) due to intense adhesions in the area adjoining the GB fossa
8. Most of the stump calculi (94.28) occurred in patients who underwent operative intervention in rural set-up nursing homes
9. 51.43% of patients had stump length more than 5 mm, and 48.57% had stump length <5 mm.

The proportion of females (73.4%) was significantly higher than that of males (25.7%). The ratio of males and females was 1.0:2.8.

DISCUSSION

The persistence of symptoms after cholecystectomy may be due to retained stones or the formation of new stones in the remnant GB. Gender distribution of our study is shown in the Table 1 and Figure 1. In our study, majority of the operations was open [Table 2 and Figure 2]. Patients were investigated further with USG and MRCP. In MRCP, majority of the patients had multiple calculi [Table 3 and Figure 3 And Table 6 and Figure 6]. Patients usually present with right upper quadrant abdominal pain and dyspepsia, with or without jaundice [Table 4 and Figure 4]. The modes of treatment is shown on the Table 5 & Figure 5. Patients complaining of pain during initial operation were 24 [Table 7 and Figure 7]. Patients usually present with right upper quadrant abdominal pain and dyspepsia, with or without jaundice. The causes of post-cholecystectomy syndrome are often non-biliary such as peptic ulcer disease, gastroesophageal reflux disease, pancreatic disorders, liver diseases, irritable bowel syndrome, and coronary artery disease. However, in some of these patients, the cause may be biliary such as choledocholithiasis, traumatic biliary stricture, sphincter of Oddi dysfunction, or cystic duct/GB remnant. Patients with symptoms suggestive of gallstone disease such as biliary colic and obstructive jaundice justify a detailed evaluation to rule out any retained stone. The causes of post-cholecystectomy syndrome are often non-biliary like peptic ulcer disease, gastroesophageal reflux disease, pancreatic disorders, liver diseases, irritable bowel syndrome and coronary artery disease. The length of the cystic duct stumps in initial operations is shown on the Table 8 and Figure 8. However, in some of these patients the cause may be biliary such as choledocholithiasis, traumatic biliary stricture, sphincter of Oddi dysfunction or cystic duct/gallbladder remnant. Patients with symptoms

suggestive of gallstone disease such as biliary colic and obstructive jaundice justify a detailed evaluation to rule out any retained stone. Most of the patients 94.28% from Rural operative centre [Table 9 and Figure 9].

Residual gallstones are more often reported in cystic duct remnants. The possible etiology of such an occurrence is often a failure to define the cystic duct and CBD junction. This is more likely to occur in the presence of acute local inflammation or fibrosis. It may be prudent to dissect the cystic duct up to the common duct defining their junction in selected patients. Patients at increased risk of harboring stones in the cystic duct are patients with a history of biliary colic, pancreatitis, and obstructive jaundice and those having undergone therapeutic ERCP. Stones in the cystic duct may be evident on visualization or may also be palpated with the dissector. Adhesions around the cystic duct may be another indicator of an impacted stone within it. In these circumstances, dissection should continue proximal to the stone toward the junction of the cystic duct and CBD. With increasing experience, it is almost always possible to apply clips on the cystic duct proximal to the stone. No attempt should be made to “milk” the stone distally, as such a maneuver may fragment the stone that may pass into the common duct and lead to biliary colic in the post-operative period. By definition, any length of cystic duct more than or equal to 1 cm remaining following surgery is considered a cystic duct remnant. Bodvall and Overgaard found that a cystic duct remnant larger than 1 cm was present in 67% of patients with CBD stones and 82% of patients with severe post-operative biliary distress. It was reported the cause of post-cholecystectomy syndrome to be due to cystic duct stump syndrome in 16% of patients. Although the exact incidence is not known, cystic duct or GB remnant with or without stones seems to be emerging as one of the leading causes of post-cholecystectomy syndrome, especially in this era of minimally invasive surgery where subtotal cholecystectomy has started gaining popularity.²

Grade 1 (easy / uncomplicated cholecystectomy)

Grade 2 (medium difficulty, for example mild cholecystitis, cystic duct or artery obscured by adhesions or fatty tissue; mucocele may be present)

Grade 3 (difficult cholecystectomy due to either gangrenous cholecystitis; shrunken fibrotic gallbladder; severe cholecystitis; subhepatic abscess formation; Hartman pouch adherent to the CHD; cases in which the cystic duct or artery are difficult or impossible to dissect; or liver cirrhosis with portal hypertension)

Grade 4 (conversion to open surgery is required)

Does the incidence of cystic duct remnant calculi increase following LC when compared to the open technique? This question remains unanswered so far. According to Cuschieri's grading system, grade III and IV GBs seem to

be at higher risk as the distorted biliary anatomy misleads the inexperienced surgeon, leading to this syndrome in as many as 17–25% of cases. Patients with cystic ducts which run parallel to the CBD and have a low insertion are at high risk of being divided closer to the GB-cystic duct junction. In the era of minimally invasive surgery, it is likely that inexperienced surgeons tend to be overenthusiastic to avoid injury to the CBD at the cost of leaving behind too long a cystic duct. Incompletely removed GBs or inadvertently left out cystic duct remnants significantly add to the morbidity. It is prudent to evaluate the entire biliary tree radiologically to avoid missing any other conditions like CBD calculus. Keiler *et al.*, in their intravenous cholangiography study of 115 post-cholecystectomy patients, found that >65% of patients had a >1 cm cystic duct left in situ, rendering them at risk of developing post-cholecystectomy syndrome. Hence, they advised the routine use of intraoperative cholangiography to reduce the incidence, as have others. It has been postulated that the length of the ideal cystic duct stump should be just under 0.5 cm; in other words, the cystic duct should be cut very close to the CBD. Some authors recommend the removal of the entire cystic duct along with the GB at the time of cholecystectomy itself to produce better outcomes.³ Once the patient has been diagnosed with remnant cystic duct stones, surgical excision should be undertaken to avoid potentially life-threatening complications, such as carcinoma, recurrent cholangitis, mucocele, recurrent cholelithiasis with gross dilatation of remnant, and Mirizzi syndrome. Other modalities such as ERCP with basket, laser/electrohydraulic or mechanical lithotripter over a guide wire, cholangioscopy, ESWL with or without endoscopic removal of fragmented stones, and transcatheter Fogarty balloon catheter deployment have been successfully tried in an attempt to remove stones in these remnants as an alternative to surgery. These procedures are particularly helpful when the patient is unfit for surgery, provided the expertise is available. Traditionally, the open technique was considered the procedure of choice for tackling these cystic duct remnant stones.⁴

Mini laparotomy incisions were used to remove such cystic remnants, as laparoscopic intervention was thought to be a risky endeavor in view of local scarring of the area. As in other surgical disciplines, minimally invasive surgery has revolutionized the management protocol of these patients, subject to the availability of expertise. Many experts have successfully excised the cystic duct remnant laparoscopically, thus leading to full recovery of the patient without significant post-operative morbidity. Although the techniques of laparoscopic sacrocolpopexy (LSC) were standardized in institutes of advanced laparoscopic facilities initially for cirrhotic patients, we have gradually incorporated it for the so-called “difficult” cholecystectomies even in non-cirrhotic patients.

Finally, the all-important question is how do we prevent remnant duct calculi? Recommendations include:

- Correct identification of the GB-cystic duct junction
- Milking of cystic duct toward the GB before clipping it
- Removal of impacted calculus from neck or cystic duct and observe the free flow of normal bile
- Cystic duct stump should not be more than 0.5 cm long
- Transfixation of cystic duct stump, if indicated, should be done only with absorbable suture material
- Intraoperative cholangiography as a routine for all patients without acute inflammation
- Look for the long cystic duct running parallel to the CBD with a low insertion.

The consensus is not to attempt excessive “blind” dissection in acute inflammatory situations, as cystic duct remnant pathology is easier to handle rather than the risk of a bile duct or vascular injury. Moreover, they believe that the LSC is a very useful procedure in complicated GB disease and has served us well in difficult pathological situations. We do not perform intraoperative cholangiography in all patients, and certainly not in difficult cases.

The incidence of post-cholecystectomy remnant/stump calculi is <2.5%, but in our studies, the incidence was around 4.48%, due to the fact that our hospital is a tertiary care center and majority of patients are referred cases for definitive management of complications.

A review of literature showed that pain abdomen and biliary symptoms were the most common presenting symptoms in cases of stump calculi. In our studies, around 80% of patients presented with pain and 20% presented with biliary symptoms.

A review of literature found that a GB stump length of size more than 1 cm predisposed a patient to stump calculi formation. In our study, we had cystic duct stump >5 mm in 51.43% of cases and stump <5 mm in 48.57% of cases.

Kim *et al.*, and Terhaar *et al.*, showed how USG was useful as a first-line investigation for early assessments of suspected GB remnant stones and MRCP as a gold standard for diagnosis. In our studies, we also performed USG for initial investigation and MRCP for a definitive diagnosis and before operative intervention.

Limitations of the study

1. The sample size was small. Only 35 patients were not sufficient for the study.
2. The study has been done in a single center.
3. The study was carried out in a tertiary care hospital, so hospital bias cannot be ruled out.

CONCLUSION

All the cases primarily underwent either subtotal cholecystectomy or had post-operative long cystic duct stump.

All the cases were operated in rural nursing homes and were sent for further management to our SOPD.

Most patients presented to us with complaints of pain abdomen and fever with/without jaundice.

USG was the first line of investigation, but MRCP was the investigation of choice for definitive diagnosis before re-exploration.

Most of them had various comorbidities requiring treatment.

Open procedure was done in all the cases during re-exploration.

Subtotal/partial cholecystectomy still is the choice, when needed, in difficult situations for cholecystectomy, but the patient should be counseled regarding the recurrence of symptoms.

Completion cholecystectomy is the treatment of choice for the relief of symptoms and permanent cure for residual GB stones.

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IC - Concept, design, and data collection; **MS** - Material preparation; **AKG** - Proofreading and data analysis; **AR** - Revision, drafting, and final approval

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