

Laparoscopic management of cholecystoduodenal fistulae and the value of pneumobilia as a diagnostic clue- a case series and review of the literature

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Introduction

Cholecysto-Duodenal Fistula (CDF) is a rare but serious complication that arises from chronic cholecystitis, accounting for a significant portion of biliary enteric fistulas. The condition typically results from prolonged inflammation that leads to the formation of an abnormal connection between the gallbladder and the duodenum. While the incidence of CDF remains low, it presents a unique diagnostic challenge due to its nonspecific clinical symptoms, which often mimic those of uncomplicated cholecystitis. As a result, CDF is frequently diagnosed only during surgery, making preoperative identification crucial for optimal surgical planning and patient outcomes.

One important but uncommon imaging finding associated with CDF is pneumobilia, or air within the gallbladder, which can be a vital clue to the presence of a biliary enteric fistula in patients with no prior biliary interventions. The use of cross-sectional imaging, such as computed tomography (CT) or magnetic resonance imaging (MRI), has become essential in raising the suspicion of this rare condition. In this case series, we present four patients who were diagnosed with CDF based on preoperative imaging that revealed pneumobilia. This study underscores the diagnostic value of cross-sectional imaging and highlights the transformative role of laparoscopic management in treating CDF, with favourable patient outcomes.

Methodology and Results

This is a retrospective case series from a tertiary care centre in South India. CDF is infrequently diagnosed prior to surgery. However, during the study period from August 2022 to August 2024, we had 4 patients with a preoperative suspicion of biliary enteric fistula based on air within the GB on cross-sectional imaging. All of them had Fistulous communications

between the GB and the duodenum were managed intraoperatively using a laparoscopic approach. All patients had uneventful postoperative recovery with no morbidities. The clinical characteristics of each patient were presented in Table 1.

The first patient is a 68-year-old woman who presented with two months of intermittent, dull right upper abdominal pain, nausea, and occasional low-grade fever, with no jaundice or gastrointestinal bleeding. Ultrasound showed a distended gallbladder with stones, and CT revealed pneumobilia (Figure1).

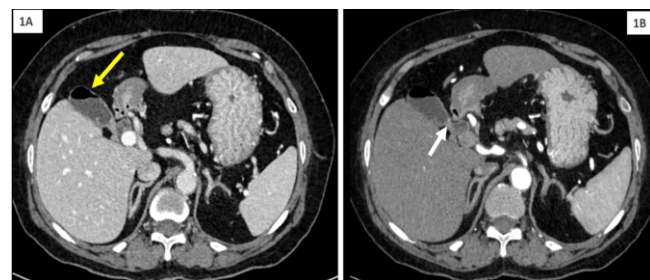


Figure 1A: CECT scan with yellow arrow showing pneumobilia inside GB

Figure 1B: White arrow pointing the suspected area of CDF where duodenum was adherent to the GB

During laparoscopic surgery, a fistula between the gallbladder neck and the first part of the duodenum was identified (Figure2). The fistula was transected with an endoscopic stapler, and the gallbladder was removed after ligating the cystic duct and artery. The fistula was transected with an endoscopic stapler, and the gallbladder was removed after ligating the cystic duct and artery.

The second patient is a 47-year-old male who presented with right upper quadrant pain and fever for four days. Examination showed tenderness in the epigastric and right hypochondrial regions, and blood tests revealed leucocytosis. A CECT scan identified an abscess in the left lobe of the liver, a contracted gallbladder with stones, which was adherent to the duodenum (Figure 3). There was air inside the gallbladder, and he also had a dilated common bile duct (10 mm). He

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initially underwent drainage of the liver abscess, followed by laparoscopic cholecystectomy 4 weeks later. During the surgery, he underwent disconnection of the cholecysto-duodenal fistula and suture repair of the duodenal defect(Figure 4).

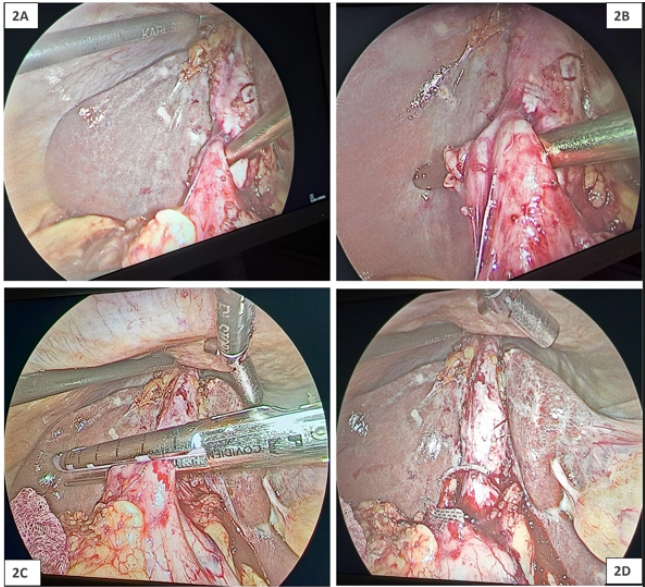


Figure 2A: Identifying the CDF after releasing adhesions around the GB infundibulum
Figure 2B: Defining the fistula all around
Figure 2C: Endoscopic stapler applied ensuring other structures are free around
Figure 2D: Secure closure of the duodenum and GB infundibulum

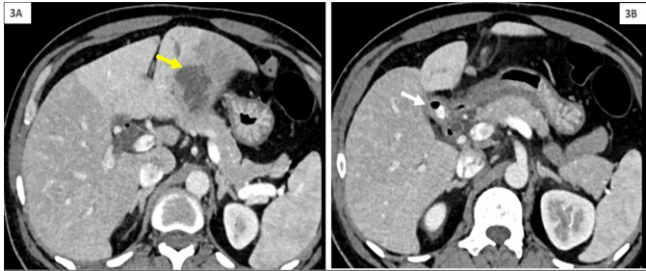


Figure 3A: CECT scan with the yellow arrow showing abscess in the liver (segment 2, 3)
Figure 3B: White arrow showing contracted GB with radio dense calculus and air, to which duodenum was adherent.

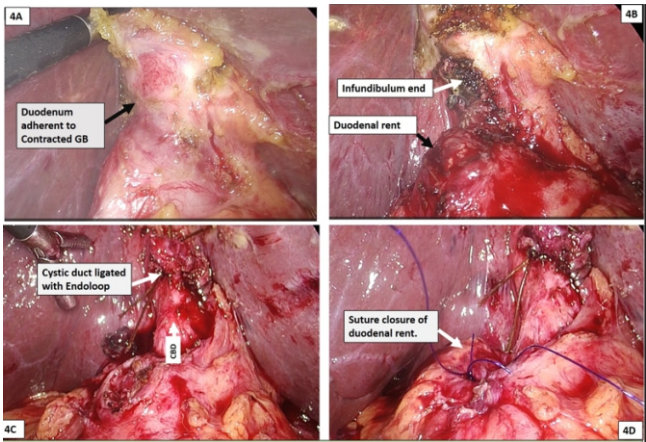


Figure 4A: First part of the duodenum adherent to the infundibulum of GB
Figure 4B: Fistula divided showing the duodenal rent and infundibular end
Figure 4C: Cystic duct ligated with endloop after skeletonizing the calots triangle
Figure 4D: Duodenal rent closed with absorbable monofilament sutures (3-0 Polydioxanone)

Table 1: Patient characteristics

Clinical Parameter	Patient 1	Patient 2	Patient 3	Patient 4
Age	68	47	22	63
Sex	Female	Male	Female	Female
Symptomatology	Chronic calculus cholecystitis	Acute cholecystitis, Cholangitis with Liver abscess	Chronic calculus cholecystitis	Chronic calculus cholecystitis
Imaging findings	Distended GB with air and calculi inside GB.	Contracted GB with stone and air. Abscess in the left lobe of liver with Cholangitis features.	Thickened and contracted GB with multiple calculi and pneumobilia.	Distended GB with calculi and air. Duodenum was adherent to the fundus suspicious for fistula.
Location of Fistula	Infundibulum of GB to the first part of duodenum	Infundibulum of GB to the first part of duodenum	Body of GB to the first part of duodenum	Fundus of GB to First part of duodenum
Fistula closure method	Stapler Closure	Suture Closure	Suture Closure	Suture closure
Post operative complications	Nil	Nil	Nil	Nil

The third patient is a 22-year-old woman who presented with recurrent episodes of right hypochondrial pain for 4 years. She was diagnosed with gallstones 4 years ago. She deferred surgery due to personal reasons. In view of severe symptoms, she came for surgery now. Her imaging showed a contracted GB with stones and pneumobilia. She had a fistulous communication between the body of the GB and the first part of the duodenum, which was disconnected, and a suture repair of the duodenum was done.

The fourth patient is a 63-year-old lady with recurrent right hypochondrial pain for 2 months with intermittent low-grade fever. On evaluation, her CECT showed a distended gall bladder with stones and air (Figure 5). The wall of the GB was thickened, and the duodenum was adherent to the fundus. Intraoperatively, she had fistulous communication between the fundus of the GB and the first part of the duodenum, which was closed using a 3-0 polydioxanone suture (Figure 6).

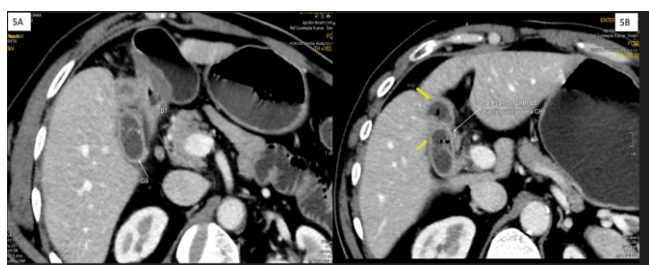


Figure 5A: CECT scan with white arrow showing distended, thickened GB adherent to the duodenum

Figure 5B: Yellow arrow pointing to the presence of pneumobilia inside the distended GB

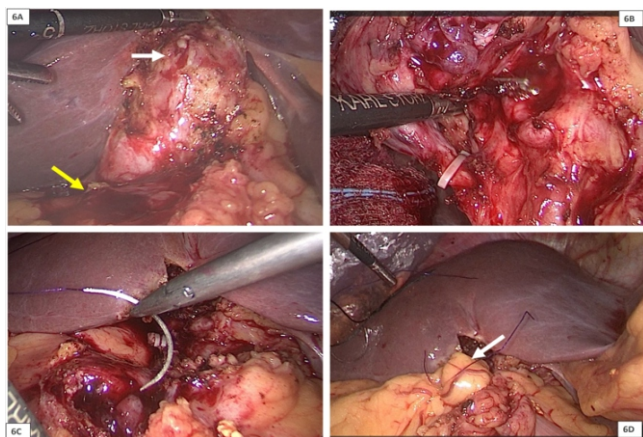


Figure 6A: CDF between the fundus (white arrow) and the duodenum first part (yellow arrow)

Figure 6B: Calot's triangle dissection completed and cystic duct ligated with hemlock

Figure 6C: Sutures closure of the duodenal rent after completion of cholecystectomy

Figure 6D: Omental buttressing (white arrow) over the duodenal rent closure site to provide additional protection from leak

Discussion

Biliary enteric fistula often occurs spontaneously. Their incidence in patients with cholelithiasis ranges from 0.15% to 8%. [1] The proposed mechanism of fistula formation is due to impaction of gall stone in the Hartmann's pouch which will create severe inflammation and the formation of adhesions of GB with duodenum. Impacted stone with persistent inflammation will further cause erosion and necrosis of the GB wall, resulting in the formation of a fistula tract. This will result in reflux of enteric contents into the biliary system, predisposing the patients for infection. Slippage of stones through the fistula into the intestinal tract rarely causes bowel obstruction due to impaction at the level of the terminal ileum, and this was termed "gallstone ileus". [2] Rarely, patients with aggressive mucinous malignancy arising from the GB can infiltrate the duodenum, resulting in fistula formation. [3]

Patients with CDF due to stone disease often present with nonspecific symptoms like pain the right upper quadrant, nausea, vomiting and fever in the presence of infection. The recent systematic review by Liu et al on cholecystoenteric fistula showed that clinical manifestations of biliary enteric fistula are always latent. Despite the advances in imaging, preoperative diagnosis is difficult. [4] The diagnosis is made intraoperatively in more than 90% of the time. [1,5] The routine ultrasound scan of patients with gallstones is not enough to diagnose CDF. Pei et al did a prospective study on 23 patients with suspected CDF using an ultrasound scan after administering oral gastrointestinal contrast medium. This ultrasound with contrast was able to diagnose 90% of patients with CDF. They concluded that dynamic ultrasound by giving oral contrast is a simple, non-invasive and effective method of diagnosing CDF. [6]

Cross-sectional imaging in the form of CT or MRI is often needed to diagnose CDF. Pneumobilia is the most consistent finding in a patient with CDF. It is defined as the presence of air within the biliary system in imaging. It is seen after sphincterotomy, biliary enteric anastomosis and infection by gas-forming organisms (Emphysematous cholecystitis). Spontaneous pneumobilia is a very specific finding of biliary enteric fistulae in patients who have never had any biliary surgery or prior instrumentation of the biliary tree, like ERCP. [7] Pneumobilia is often accompanied by an atrophic and contracted gall bladder in CDF patients. However, two of our patients had a distended gall bladder with air inside, which was uncommon. The surgical approach will be more meticulous when you have a suspicion of biliary enteric fistula.

Preoperative diagnosis of CDF will also help in selecting the

appropriate surgical modality to treat the patient effectively.

Before the era of laparoscopic surgery, the standard treatment of CDF was open cholecystectomy with repair of the duodenal defect. The advances in laparoscopy and improvement in surgical expertise have made laparoscopic management of CDF possible in the last 2 decades. [8,9] The difficulties encountered in laparoscopic surgeries are intense tissue inflammation, dense local adhesions, bleeding and suturing difficulties. The introduction of endoscopic stapling devices increased the chance of successful completion of these difficult surgeries laparoscopically. Laparoscopic suture closure of the duodenum after disconnecting the fistula is another option, which needs expertise in intracorporeal suturing. The clinical condition of the patient, expertise of the surgical team and availability of resources are the key elements that influence decision-making with respect to the surgical approach in the management of patients with CDF. [10]

Laparoscopic division of the fistula and closure of the duodenal defect with intracorporeal sutures is another way of dealing with CDF. This technique of suturing has little risk of peritoneal contamination. In cases where a fistula is avulsed inadvertently during dissection, intra-corporeal suturing is advised. The advantages of endoscopic stapling devices are a reduction in operative time and avoidance of contamination. [11] The CDF must be identified with care and skeletonized adequately before firing the stapler. The end of the deeper blade must be kept in vision in order to avoid damaging the collateral structures inadvertently.

Preoperative diagnosis of CDF remains a challenge with routine investigations. We present these four cases to emphasise that preoperative pneumobilia seen in cross-sectional imaging is almost synonymous with the presence of a biliary enteric fistula. Expertise in laparoscopic surgery with intracorporeal suturing skills is essential in the successful management of this rare complication of gallstone disease.

Conclusion

Cholecystoduodenal fistulas (CDF) often mimic cholecystitis, with pneumobilia as a key imaging clue. While preoperative diagnosis is difficult, modern imaging has improved detection. Our series confirms that laparoscopic repair—using endoscopic staplers when needed—is safe and effective for CDF, supporting minimally invasive surgery as the preferred approach.

Conflict of interest

The Authors declare no conflict of interest.

Abbreviations

CDF – Cholecysto duodenal fistula

GB – Gall bladder

CT – Computed Tomography

MRI – Magnetic Resonance Imaging

ERCP – Endoscopic Retrograde Cholangio Pancreatography

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Learning Points:

- Pneumobilia strongly suggests biliary enteric fistula in the absence of prior biliary instrumentation.
- Cross sectional imaging enables preoperative diagnosis of CDF and helps in surgical planning.
- Pneumobilia is a valuable diagnostic clue which should not be ignored.
- Laparoscopic repair of CDF is feasible and safe with good post operative outcomes.