

ERCP in Situs Inversus Totalis: A Case Series of Three Patients from a Tertiary Care Center

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1. Abstract

1.1. Background

Situs inversus totalis (SIT) is a rare congenital anomaly characterized by mirror-image anatomy, posing challenges during endoscopic retrograde cholangiopancreatography (ERCP). Literature on ERCP in SIT is limited to sporadic case reports and small series. We report three cases of ERCP in SIT with emphasis on technical modifications, positioning, safety, and outcomes.

1.2. Case Summary

Three patients with SIT presented with obstructive jaundice due to choledocholithiasis. ERCP was performed successfully in two patients in the left lateral position and one patient in the supine position. Selective CBD cannulation was achieved in all three patients; complete clearance was possible in two, while one required subsequent CBD exploration. No post-ERCP pancreatitis or major complications occurred. Case 1 underwent ERCP with CBD clearance, stenting, followed by laparoscopic cholecystectomy and stent removal. Case 2 had partial CBD clearance with stenting, followed by CBD exploration for complete clearance. Case 3 underwent ERCP with CBD clearance, stenting, laparoscopic cholecystectomy, and stent removal. Special maneuvering in the first part of the duodenum (D1), including temporary scope detachment, loop straightening, and reattachment, facilitated progression. In one case, precut sphincterotomy over a pancreatic duct (PD) stent proved safe and effective.

1.3. Conclusion

ERCP in SIT is technically demanding but feasible with appropriate modifications. Key strategies include performing the procedure in left lateral or supine positions, applying special duodenal maneuvers, and considering precut sphincterotomy over PD stent as a safe rescue option for difficult cannulation.

2. Introduction

Situs inversus totalis (SIT) is a rare congenital condition characterized by mirror-image transposition of thoracic and abdominal organs [1,2], with an incidence estimated at 1 in 5,000 to 20,000 live births [1]. Although often asymptomatic, the condition can complicate diagnostic and therapeutic interventions due to reversed anatomy. Endoscopic retrograde cholangiopancreatography (ERCP) in SIT presents unique challenges, particularly in identifying and cannulating the major papilla, which appears in a mirror-image orientation. In a large multicenter study, the incidence of SIT among patients undergoing ERCP was reported to be 0.02% (14 of 65,838 cases over 10 years) [5]. Literature on ERCP in SIT remains limited, with most reports describing individual cases [3,4]. We present a case series of three SIT patients undergoing ERCP for choledocholithiasis, highlighting technical adaptations, positioning, and outcomes.

3. Case Presentations

3.1. Case 1

A 59-year-old female with SIT presented with obstructive jaundice. Imaging (USG/MRCP) confirmed choledocholithiasis with CBD dilatation. ERCP was performed in the supine position. Selective CBD cannulation and sphincterotomy were achieved, followed by complete clearance. A temporary biliary stent was placed. The patient later underwent laparoscopic cholecystectomy, and the stent was removed uneventfully.

3.2. Case 2

A 36-year-old female with SIT presented with obstructive jaundice and dilated CBD. ERCP was performed in the left lateral position and was technically difficult. Due to repeated PD cannulation, prophylactic PD stenting was performed, followed by needle-knife sphincterotomy and successful CBD cannulation. Partial clearance

was achieved with balloon sweeps, and a biliary stent was placed. Due to residual stone burden, the patient subsequently underwent CBD exploration, which resulted in complete ductal clearance. The postoperative course was uneventful.

3.3. Case 3

A 60-year-old patient with SIT presented with obstructive jaundice. ERCP was started in the supine position but required intra-procedural position changes (supine → left lateral → supine) to complete the procedure. Selective CBD cannulation, sphincterotomy, and stone extraction were performed successfully. A temporary stent was placed. The patient later underwent laparoscopic cholecystectomy, and the stent was removed at follow-up. Recovery was smooth.

3.4. ERCP Procedure Description

ERCP was performed under general anesthesia with endotracheal intubation, as a prolonged procedure was anticipated. The supine position was chosen as the default; two procedures were completed in the supine position, while one was performed in the left lateral position. Endoscopic and fluoroscopic monitors were placed at the patient's head end, and the endoscopist stood on the left

side of the table, as per standard practice. The pharynx, esophagus, and gastroesophageal junction were traversed in the standard manner. In the stomach, a special maneuver was required: the duodenoscope was rotated 180° counterclockwise, advanced into the antrum, and then into the first part of the duodenum (D1). A further rotation allowed smooth entry into the second part (D2). This was followed by temporary detachment of the scope from the processor, straightening of the scope to reduce looping, and subsequent reattachment before continuing. In D2, scope stability remained challenging; therefore, the assistant was instructed to assist in maintaining scope stability. The papillary orifice was visualized between the 1–3 o'clock positions. All procedures were performed with a standard therapeutic duodenoscope and accessories. Wire-guided cannulation was used as the primary technique. In cases with repeated pancreatic duct (PD) cannulation, prophylactic PD stenting was performed. Precut sphincterotomy over the PD stent facilitated selective CBD cannulation when required. Balloon catheters were used for stone retrieval, and plastic biliary stents (10 cm × 7F DPT) were placed in all three patients. Prophylactic rectal indomethacin was administered in all cases during the initial ERCP. All procedures were performed by an experienced endoscopist with independent experience of more than 2,500 ERCPs.

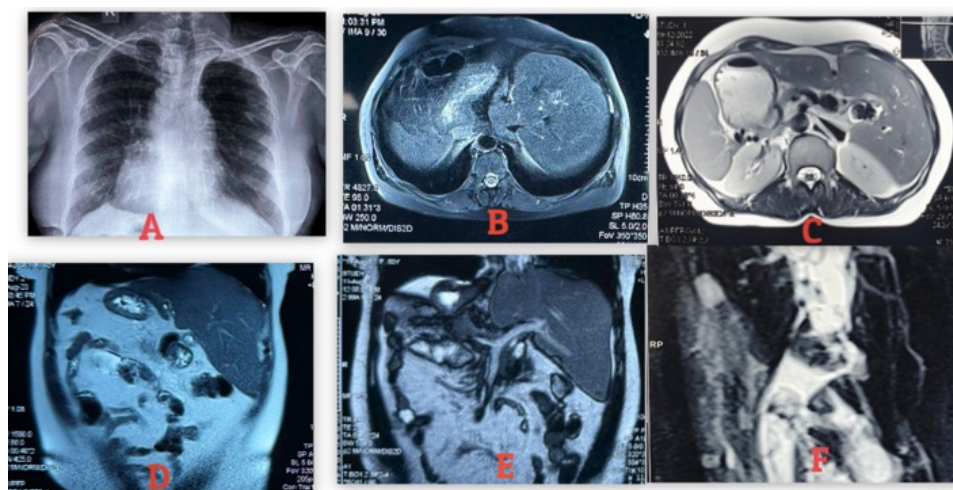


Image 1

- (A) Chest X-ray (PA view) demonstrating dextrocardia with an inverted cardiac position.
- (B, C) Axial MRI images of the abdomen revealing mirror-image transposition of abdominal organs in Patient 1 and Patient 2.
- (D) Coronal MRI image highlighting mirror-image arrangement of abdominal viscera in Patient 1.
- (E) Coronal MRI image showing mirror-image transposition of abdominal viscera in Patient 3.
- (F) 3D MRCP reconstruction depicting multiple large calculi within the common bile duct (CBD)

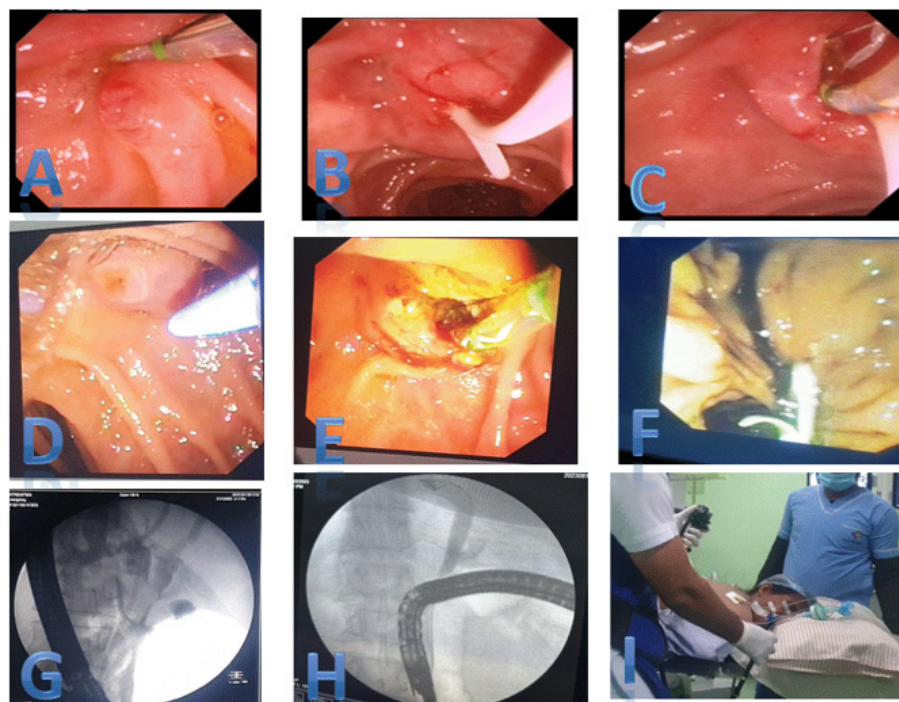


Image 2: Stepwise ERCP findings in three patients.

- (A) Endoscopic view showing the papilla located on the right side with a longitudinal axis at the 2 o'clock position (Patient 1).
 (B) Repeated pancreatic duct (PD) cannulations necessitated prophylactic PD stenting (Patient 1).
 (C) Precut sphincterotomy performed over the PD stent facilitated CBD cannulation (Patient 1).
 (D) Endoscopic view showing the papilla on the right side with a longitudinal axis at the 2 o'clock position (Patient 2).
 (E) Successful direct CBD cannulation achieved after multiple attempts with varied patient positioning (Patient 2).
 (F) CBD stent placed (Patient 3).
 (G) Fluoroscopic image demonstrating large CBD stones with stent in situ; stones could not be removed (Patient 1).
 (H) Fluoroscopic image following stone extraction showing a cleared CBD, with the scope in an abnormal position.
 (I) ERCP procedure performed in the supine position.

4. Discussion

ERCP in SIT is challenging due to mirror-image anatomy [2-6], which complicates identification of the papilla and orientation of endoscopic maneuvers. Positioning plays a critical role [4,6]: while prone is standard, our series highlights the effectiveness of the left lateral and supine positions. These align the papilla in a more familiar orientation, facilitating cannulation. Our results are consistent with a multicenter study reporting higher cannulation success (90.9% vs. 66.7%) and fewer adverse events with modified positions compared to prone [5].

Special maneuvering in the duodenum (D1) is sometimes necessary. In our cases, temporary detachment of the scope from the processor, straightening to reduce looping, and reattachment allowed smoother progression to the second part of the duodenum and improved papilla visualization. This maneuver, although rarely described, proved crucial in our series. In one patient, precut sphincterotomy over a pancreatic duct (PD) stent was performed safely after failed conventional cannulation [8,9]. This technique stabilizes the papilla, reduces the risk of inadvertent pancreatic injury, and provides a controlled approach to biliary access. Our experience supports its use as a safe rescue technique in SIT. Overall, ERCP in SIT can be performed safely with appropriate modifications, corroborating prior reports [1-6,10].

Compared to published data, our series achieved 100% selective CBD cannulation and no pancreatitis, consistent with Ding et al., where no post-ERCP pancreatitis occurred in 14 SIT cases [5]. The absence of complications in our series further supports the safety of ERCP with experienced operators.

5. Limitations

This report is limited by the small sample size and single-center experience, which restricts generalizability. The absence of long-term follow-up data limits assessment of delayed complications or recurrence. Nevertheless, our series adds to the scarce literature on ERCP in SIT and emphasizes practical technical modifications that can aid endoscopists in similar cases. Future multicenter registries and prospective studies are needed to validate these findings, compare different positioning strategies, and develop standardized procedural guidelines for ERCP in SIT.

6. Conclusion

ERCP in patients with situs inversus totalis is technically challenging but feasible. Modified positioning (supine or left lateral), specialized duodenal maneuvers including temporary scope detachment, and PD stent-assisted precut sphincterotomy are effective strategies to improve safety and success. These adaptations reinforce ERCP as an effective therapeutic option in SIT.