CASE REPORT

Laparoscopic Cholecystectomy in a Patient with Situs Inversus Totalis: A Case Report and Review of Operative Technique

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Abstract

Introduction: Situs inversus totalis (SIT) is a rare congenital condition with complete mirror-image transposition of visceral organs, often associated with Kartagener's syndrome. Laparoscopic cholecystectomy (LC) in SIT poses technical challenges due to altered anatomy and reversed orientation, particularly for right-hand-dominant surgeons. This case report presents a successful LC in a patient with SIT using a modified port placement technique and reviews current literature to guide surgical practice.

Methods: We describe the clinical presentation, imaging, operative approach, and postoperative outcome of a 74-year-old male with SIT and symptomatic cholelithiasis. A literature review of LC in SIT cases from 2022 to 2025 was conducted using PubMed, focusing on port positioning, surgical outcomes, and operative strategies.

Results: The patient underwent elective LC one month after an acute cholecystitis episode. A modified "Mirror American" port configuration was used to accommodate the right-hand-dominant surgeon, allowing the primary operating port to remain in alignment with the surgeon's dominant hand. The procedure was completed successfully, achieving the critical view of safety and maintaining dissection above Rouviere's sulcus. No intraoperative complications occurred, and the patient was discharged the following day. Literature review of 15 recent cases revealed that 86% used a four-port approach, with the majority favoring the mirror American setup. Most cases reported successful outcomes with minimal complications.

Conclusion: Laparoscopic cholecystectomy in SIT is safe and effective with proper preoperative planning. A modified mirror port configuration can improve ergonomics for right-handed surgeons and reduce the risk of vasculobiliary injury by restoring familiar hand–eye coordination. This approach may help standardize the technique and improve outcomes in rare SIT cases. This case supports adapting port placement based on surgeon handedness and contributes to the limited but growing evidence base in managing SIT patients.

Keywords: Case report, Cholelithiasis, Laparoscopic cholecystectomy, Situs inversus totalis.

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Introduction

Situs inversus totalis (SIT) is a congenital condition characterized by the complete mirror-image transposition of visceral organs from their normal anatomical position and is associated with Kartagener's syndrome (situs inversus, sinusitis and bronchiectasis), congenital heart disease, renal dysplasia, and biliary atresia.[1] Situs inversus totalis is rare condition, with an incidence of 1:10,000–1:20,000.[2] This means that a typical district general surgeon may only ever operate on a patient with SIT once during their entire career.

Although minimally invasive surgery is preferred for treating symptomatic cholelithiasis, operating on patients with SIT is challenging as the anatomy of the gallbladder and vasculobiliary structures are mirrored, requiring surgeons to modify operating room setup and port placement, demonstrate ambidexterity, and recognize unique visuo-perceptual illusions in Calot's triangle.[3] This work was prompted by a recent clinical case operated on by the senior author. It became clear, there was a relative paucity of available literature to guide management, having envisaged difficulty as a right-hand-dominant surgeon with dissection entirely through a left-handed epigastric port, as would be the case if port positioning was truly mirrored. We present our case of LC in a patient with SIT, in line with the SCARE criteria, perform a literature review summarizing available evidence, and suggest adaptations to the port positioning that may make the operation more comfortable for right-handed surgeons.[4]

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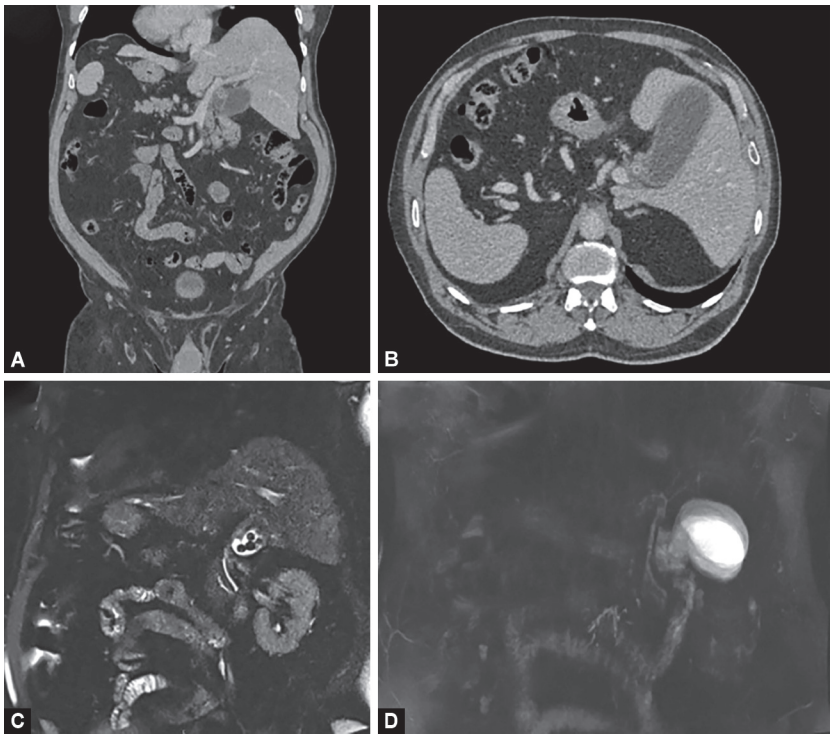
Case Description

A 74-year-old male with Kartagener's syndrome presented to the physicians with recurrent left upper quadrant (LUQ) pain.



Figs 1A to D: (A) Computed tomography scan of the abdomen and pelvis coronal view showing situs inversus of the abdominopelvic viscera and dextrocardia; (B) CT scan of the abdomen and pelvis axial view showing position of the gallbladder in the left upper quadrant and cholelithiasis; (C) MRCP T2 haste view showing multiple gallstones in the neck of the gallbladder; (D) MRCP T2 space view showing mirror image of conventional ductal anatomy

The pain was intermittent, colicky in nature, and aggravated by fatty meals, with no other associated symptoms. He was initially managed with analgesia and proton pump inhibitors, leading to mild symptomatic relief. Upon discharge, he was referred to our surgical outpatient clinic. Gastroscopy was performed in the interim which showed no additional cause for abdominal pain. Abdominal ultrasound confirmed situs inversus of the gallbladder and revealed cholelithiasis, but no convincing pericholecystic fluid or hyperemia to suggest acute cholecystitis.

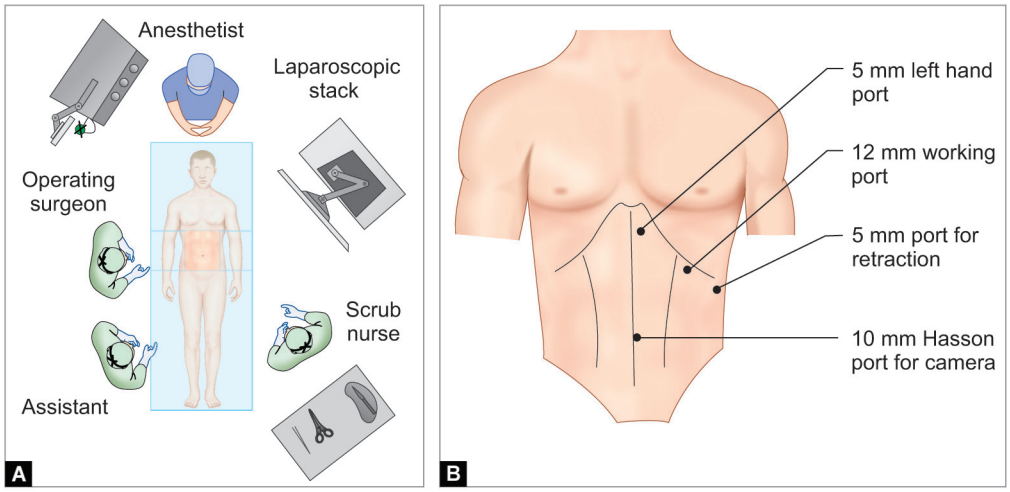
While awaiting his surgical clinic appointment, he presented to the emergency department with acute cholecystitis. The notable clinical findings were LUQ tenderness and pyrexia. A computed tomography (CT) scan of the abdomen and pelvis (Figs 1A and B) confirmed SIT and showed diffuse wall thickening and distention of the gallbladder. Magnetic resonance cholangiopancreatography (Figs 1C and D) was performed to delineate the ductal anatomy in anticipation of future surgery. This showed a 1 cm gallstone within the proximal cystic duct/gallbladder junction and multiple stones in Hartmann's pouch, but no evidence of biliary filling defects. The biliary anatomy was a mirror image of conventional anatomy. He was treated with a 7-day course of oral co-amoxiclav, and his surgery was expedited.

A month later, he underwent LC. The patient was under general anesthesia in the supine position, with the operating surgeon and assistant on the right side and the scrub nurse on the left side (Fig. 2A). A 12 mm infraumbilical port was placed using the open Hasson technique, and pneumoperitoneum was achieved with CO_2 at 12 mm Hg. A 5 mm air seal port was placed in the epigastrium, and a 10 mm port was placed in the LUQ midclavicular line as the primary operating port and to allow insertion of swabs and Hem-o-lok clip applicator (Fig. 2B).

The gallbladder wall was thickened, reflecting his recent cholecystitis. First, the gallbladder was aspirated to allow retraction, and at this point, a mucocele was diagnosed. Severe omental adhesions were then divided to allow visualization of the gallbladder body. After this, Calot's triangle was dissected, the critical view of safety was obtained, and the cystic duct and artery were divided between Hem-o-lok clips. Dissection remained above Rouviere's sulcus throughout, and the gallbladder was retrieved in a Bert bag through the umbilical port. Bleeding near the cystic artery stump was controlled with direct pressure and Floseal hemostatic particles. A 24 French Robinson drain was placed, and the patient was admitted overnight for observation. This was removed the following day, and the patient was discharged home. The patient remains asymptomatic at 3-month follow-up. Final histopathology showed chronic cholecystitis with cholelithiasis.

Discussion

We performed a literature review using the terms LC and SIT on CENTRAL via PubMed from 2022 to 2025. This yielded 15 English-language case reports (see Supplementary Information). Approaches varied from three ports (7%) to five ports (7%), with most cases opting for the standard four-port technique (86%). Port position was "mirror American" in 13 (87%) and "mirror French" in 2 (13%) cases. Mirror American refers to port placement mirroring the standard port position, with the surgeon standing on the patient's right, whereas in mirror French the surgeon operates between the patient's legs. A systematic review of LC in SIT between



Figs 2A and B: (A) Operation room setup: Modified mirror American approach; (B) Diagram of port placement: A 12 mm infraumbilical port. A 5 mm air seal port in the epigastrium and left flank and a 10 mm port placed in the left upper quadrant midclavicular line

1991 and 2021 concurred with these findings.[5] We found the average operating time was 63 minutes. The critical view of safety was achieved in 93% of cases. One case reported not achieving the critical view of safety, resulting in common bile duct (CBD) injury noticed on postoperative day 5, which was managed with Roux-en-Y hepaticojejunostomy (Supplementary Information).[6] Other cases reported minor postoperative complications such as bradycardia, respiratory distress, and pain, all of which were conservatively managed with good outcome. The average length of hospital stay was 1.6 days.

This review highlights that LC should not be a contraindication for symptomatic cholelithiasis in patients with SIT, as there are many case reports describing safe and successful outcomes. The principles of standard LC should be adhered to, such as achieving the critical view of safety and ensuring dissection above Rouviere's sulcus, reduce the risk of major vasculobiliary complications, which most commonly occur due to misidentification of critical structures. Regarding setup, a four-port mirror American approach has the most anecdotal evidence for successful outcome. However, we acknowledge that surgeon preference is an important factor, and one should not hesitate to insert a fifth port or convert to open if challenges arise. In this case, the operating surgeon was right-hand dominant. To accommodate for this, we used a novel modification to the published "Mirror American" technique to keep the working port correlated with the surgeon's right hand. We therefore term this port positioning a "modified Mirror American" approach, to differentiate it from the classical Mirror American approach. Our justification was that re-establishing surgical memory of hand movements will help to reduce the risk of CBD injury by bringing some routine during the setting of unfamiliar visual anatomy.

Conclusion

Our case highlights the successful use of a modified "Mirror American" port configuration tailored for a right-hand-dominant surgeon, allowing familiar hand movements and reducing cognitive dissonance in a reversed anatomical field. Laparoscopic cholecystectomy in patients with SIT, though technically challenging, can be successfully performed with good outcomes, improving surgical comfort and safety for right-handed surgeons. Given the rarity of SIT, shared experiences such as this contribute valuable insight and practical guidance for surgeons who may encounter the condition infrequently. We advocate for flexibility in port placement based on surgeon handedness and experience, and support the use of preoperative imaging, thoughtful setup, and intraoperative vigilance to optimize outcomes in SIT cases.

Supplementary Materials

The supplementary files are available on the website www.wjols.com.

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References

1. Akbulut S. Comment on "A systematic review of laparoscopic cholecystectomy in situs inversus". J Invest Surg 2021;34(6):637. DOI: 10.1080/08941939.2019.1673854.
2. Shah AY, Patel BC, Panchal BA. Laparoscopic cholecystectomy in-patient with situs inversus. J Minim Access Surg 2006;2(1):27–28. DOI: 10.4103/0972-9941.25674.
3. Campos L, Sipes E. Laparoscopic cholecystectomy in a 39-year-old female with situs inversus. J Laparoendosc Surg 1991;1(2):123–126. DOI: 10.1089/lps.1991.1.123.
4. Sohrabi C, Mathew G, Maria N, et al. The SCARE 2023 guideline: updating consensus Surgical CAse REport (SCARE) guidelines. Int J Surg 2023;109(5):1136–1140. DOI: 10.1097/JS9.0000000000000373.
5. Enciu O, Toma EA, Tulin A, et al. Look beyond the Mirror: Laparoscopic cholecystectomy in situs inversus totalis – A systematic review and Meta-analysis (and report of new technique). Diagnostics (Basel) 2022;12(5):1265. DOI: 10.3390/diagnostics12051265.
6. Aburayya BI, Obeidat LR, Kitana FI, et al. Complete common bile duct injury after laparoscopic cholecystectomy in situs inversus totalis: A case report, review of the literature and illustrative case video. Int J Surg Case Rep 2024;115:109265. DOI: 10.1016/j.ijscr.2024.109265.