



RESEARCH ARTICLE

FLUORESCENCE-GUIDED LAPAROSCOPIC CHOLECYSTECTOMY WITH CONCURRENT MAYO'S REPAIR IN AN HIV-POSITIVE PATIENT WITH SITUS INVERSUSTOTALIS: A RARE CASE REPORT

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ABSTRACT

Background: Situs inversustotalis (SIT) is a rare congenital anomaly characterized by complete right-to-left transposition of thoracic and abdominal viscera, occurring in approximately 1 in 10,000–25,000 live births. Although the condition itself is usually asymptomatic, surgical intervention becomes technically demanding because of mirror-image anatomy. Laparoscopic cholecystectomy remains the gold standard treatment for symptomatic cholelithiasis; however, altered orientation requires modifications in operative strategy and surgeon ergonomics. The coexistence of Human Immunodeficiency Virus (HIV) infection, previous abdominal surgery, incisional hernia, and extensive intra-abdominal adhesions further increases operative complexity. **Case Presentation:** A 44-year-old HIV-positive female presented with left hypochondriac pain for four days. She had a history of hypertension, pulmonary tuberculosis (treated), poor compliance with antiretroviral therapy, and paraumbilical incisional hernia following tubal ligation performed 15 years earlier. Ultrasonography and Magnetic Resonance Cholangiopancreatography (MRCP) demonstrated cholelithiasis with situs inversustotalis. The patient underwent fluorescence-guided laparoscopic cholecystectomy with simultaneous Mayo's repair of the incisional hernia. Dense intra-abdominal adhesions were encountered and carefully divided using a harmonic scalpel. Intraoperative Indocyanine Green (ICG) fluorescence cholangiography facilitated identification of the cystic duct and cystic artery in mirror-image anatomy. Following achievement of the Critical View of Safety, the cystic duct and artery were clipped and divided, and laparoscopic cholecystectomy was completed successfully without bile duct injury or conversion to open surgery. The postoperative course was uneventful, and the patient was discharged on postoperative day two. **Conclusion:** Laparoscopic cholecystectomy in situs inversustotalis is technically demanding but can be safely performed with meticulous preoperative planning, ergonomic modifications, and adherence to the Critical View of Safety. Fluorescence-guided biliary imaging further enhances anatomical orientation and may reduce the risk of bile duct injury in complex cases.

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INTRODUCTION

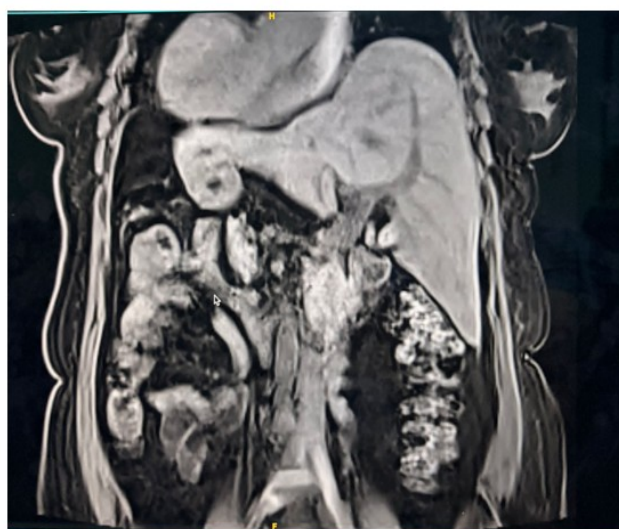
Situs inversustotalis (SIT) is a rare congenital anomaly characterized by complete mirror-image transposition of thoracic and abdominal organs, with an estimated incidence ranging between 1 in 10,000 and 25,000 live births. The condition results from abnormal embryological rotation and left-right axis determination during early fetal development. Most affected individuals remain asymptomatic throughout life, and the anomaly is frequently discovered incidentally during imaging or surgery. Gallstone disease occurs in patients with SIT at a frequency similar to the general population. However, diagnosis is often delayed because patients typically present with pain in the left upper quadrant rather than the classical right hypochondrium. Once diagnosed, laparoscopic cholecystectomy remains the treatment of choice, although the procedure poses unique challenges due to mirror-image

anatomy. Standard trocar placement, surgeon positioning, instrument handling, and hand-eye coordination require significant modifications. The presence of HIV infection introduces additional perioperative considerations, including assessment of immune status, continuation of antiretroviral therapy, strict adherence to universal precautions, and optimization of postoperative recovery. Previous abdominal surgery and associated adhesions further increase technical complexity. The incorporation of near-infrared Indocyanine Green (ICG) fluorescence cholangiography has recently emerged as an adjunct to improve visualization of biliary anatomy during laparoscopic cholecystectomy. Nevertheless, reports describing its application in patients with SIT remain exceedingly rare. We report a successful fluorescence-guided laparoscopic cholecystectomy with simultaneous Mayo's repair performed in an HIV-positive patient with situs inversustotalis, previous abdominal surgery, extensive intra-abdominal adhesions, and paraumbilical incisional hernia.

REVIEW OF LITERATURE

Situs inversustotalis (SIT) is an uncommon congenital anomaly characterized by complete mirror-image transposition of the thoracic and abdominal viscera, with an estimated incidence of approximately 1 in 10,000–25,000 live births. It results from abnormal embryological rotation and disturbances in left–right axis determination during early fetal development. Most patients remain asymptomatic, and the diagnosis is often incidental during imaging or surgery. The first successful laparoscopic cholecystectomy in a patient with SIT was reported by Campos and Sipes in 1991, demonstrating that minimally invasive surgery was feasible despite the mirror-image anatomy. Since then, fewer than 150 cases have been published worldwide, making this a rare surgical encounter. Several authors have emphasized that the greatest challenge during laparoscopic cholecystectomy in SIT is not altered anatomy alone but the reversal of surgeon ergonomics. Conventional right-handed dissection becomes counterintuitive, requiring modified trocar placement, altered operating positions, and adaptation of hand-eye coordination. Yaghan et al. reported that operative times are generally longer in SIT because of unfamiliar orientation. However, with adequate planning, complication rates are comparable to those in patients with normal anatomy. The introduction of near-infrared indocyanine green (ICG) fluorescence cholangiography has significantly improved intraoperative visualization of biliary anatomy. Fluorescence imaging enables real-time identification of the cystic duct, common hepatic duct, and common bile duct without the need for routine intraoperative cholangiography. Several recent studies have demonstrated reduced biliary injury and improved surgeon confidence when ICG is used in difficult cholecystectomies.

However, reports describing ICG-assisted laparoscopic cholecystectomy in patients with SIT remain extremely limited. The coexistence of HIV infection introduces additional perioperative considerations, including assessment of immune status, optimization of antiretroviral therapy, strict universal precautions, and prevention of occupational exposure. Contemporary evidence suggests that laparoscopic surgery in HIV-positive patients offers the same benefits as in the general population, including reduced wound infection, shorter hospital stay, and earlier recovery, provided immune status is optimized.

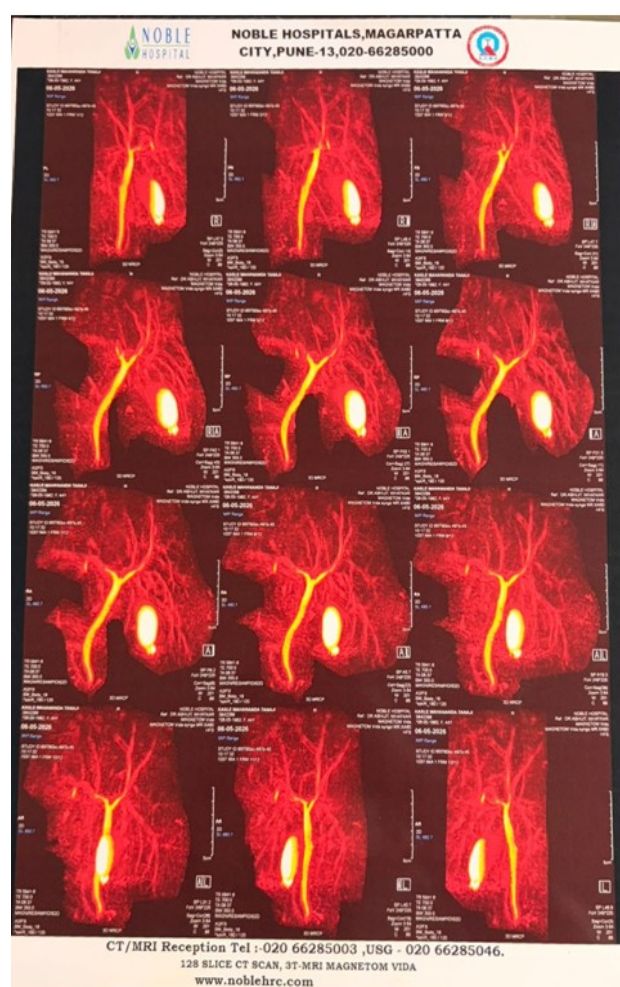


Our case is particularly unique because it combines several uncommon clinical scenarios:

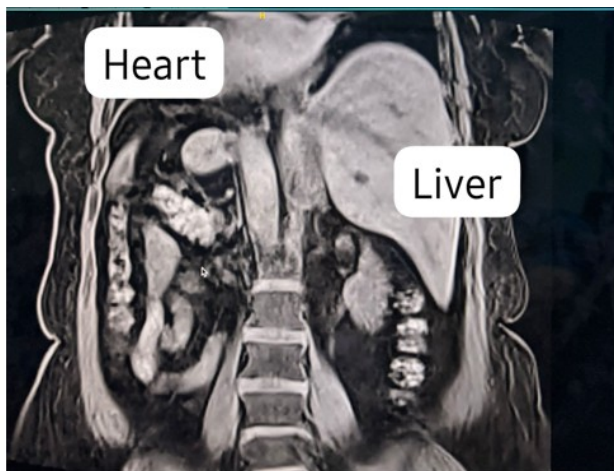
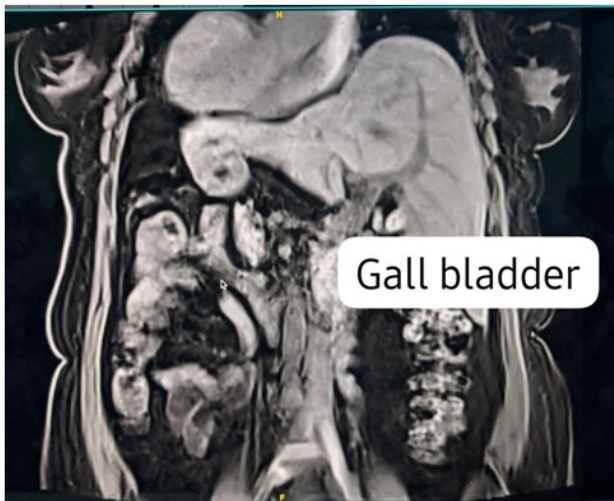
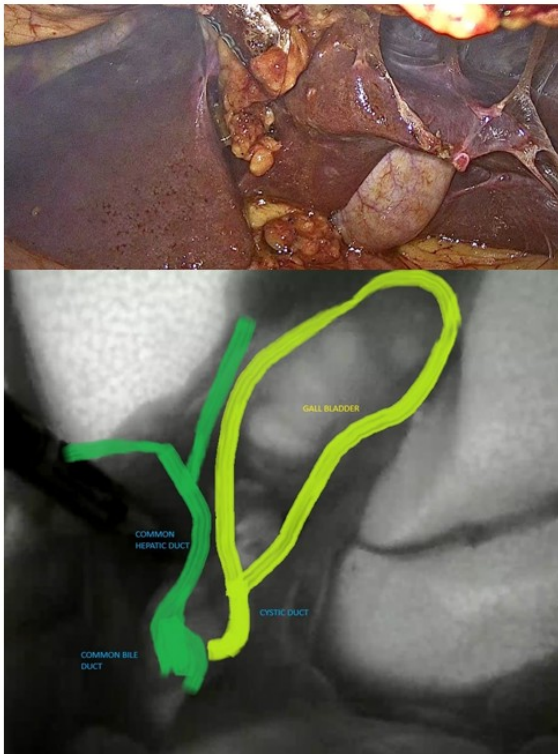
- Situs inversustotalis
- Symptomatic cholelithiasis
- HIV seropositivity
- Previous lower abdominal surgery
- Long-standing paraumbilical incisional hernia
- Extensive intra-abdominal adhesions
- Fluorescence-guided laparoscopic cholecystectomy
- Simultaneous Mayo's repair

To our knowledge, very few published reports describe the successful management of this combination of conditions in a single minimally invasive procedure.

Case: A 44-year-old female presented with intermittent left hypochondriac pain for four days associated with dyspeptic symptoms.



She denied fever, jaundice, or vomiting. Her medical history was significant for hypertension under treatment for one year and HIV infection diagnosed 15 years previously, with irregular compliance to antiretroviral therapy. She had completed treatment for pulmonary tuberculosis several years earlier. Fifteen years before presentation, she underwent tubal ligation complicated by development of a paraumbilical incisional hernia. On examination, vital signs were stable. A reducible paraumbilical incisional hernia was noted. Tenderness was localized to the left upper quadrant. Routine laboratory investigations were within acceptable limits.



Liver function tests were normal. Ultrasonography demonstrated cholelithiasis with left-sided gallbladder. MRCP confirmed complete situs inversustotalis with mirror-image biliary anatomy and multiple gallstones without evidence of choledocholithiasis.

The patient was optimized medically and scheduled for laparoscopic cholecystectomy with concurrent Mayo's repair.

Operative Technique: Under general anesthesia, the patient was positioned supine. Following induction, pneumoperitoneum was established through the paraumbilical hernia defect after careful dissection and reduction of incarcerated omental contents. A laparoscope introduced through this port confirmed complete situs inversustotalis, with the liver and gallbladder located in the left upper quadrant and the stomach and spleen on the right side.

Additional trocars were inserted under direct vision in mirror-image configuration:

- Epigastric working port
- Right midclavicular port
- Left midclavicular working port
- Left anterior axillary retraction port

The operating surgeon stood on the patient's right side while the assistant stood opposite, allowing ergonomic adaptation to the reversed anatomy. Extensive dense, string-like adhesions involving the anterior abdominal wall, omentum, liver, and surrounding viscera were encountered, likely secondary to previous abdominal surgery. Adhesiolysis was meticulously performed using a harmonic scalpel until adequate exposure of Calot's triangle was achieved. Intravenous Indocyanine Green administered preoperatively enabled near-infrared fluorescence imaging of the biliary tree. Fluorescence cholangiography clearly delineated the cystic duct and common bile duct despite mirror-image orientation. The Critical View of Safety was meticulously established before clipping and dividing the cystic duct and cystic artery. The gallbladder was dissected from the liver bed using harmonic energy and retrieved laparoscopically. Hemostasis was confirmed, and a Jackson-Pratt drain was positioned in the left-sided Morrison's pouch through the lateral port. The paraumbilical fascial defect was repaired using Mayo's overlapping fascial repair technique, and port sites were closed in layers.

Outcome and Follow-up: The postoperative recovery was uneventful. The patient commenced oral liquids on postoperative day one and tolerated diet well. The drain was removed after minimal output. She was discharged in satisfactory condition on postoperative day two. Follow-up demonstrated satisfactory wound healing without evidence of biliary complications or hernia recurrence.

DISCUSSION

Laparoscopic cholecystectomy in patients with situs inversustotalis remains an uncommon surgical scenario requiring adaptation to mirror-image anatomy. Since the first reported laparoscopic cholecystectomy in SIT by Campos and Sipes in 1991, fewer than 150 cases have been documented worldwide. The principal challenge lies in surgeon orientation and altered ergonomics. Standard instrument movements become reversed, often increasing operative time and requiring considerable experience in advanced laparoscopy. Our patient presented with multiple additional complexities including HIV infection, previous abdominal surgery, long-standing incisional hernia, and extensive intra-abdominal adhesions. Dense adhesions significantly obscured anatomical landmarks and

increased the potential risk of biliary injury. Careful adhesiolysis using harmonic energy facilitated safe exposure while minimizing thermal spread and bleeding. A major strength of this case was the use of fluorescence-guided cholangiography. Indocyanine Green fluorescence allowed real-time visualization of biliary anatomy despite mirror-image orientation and dense adhesions. This technology enhanced identification of the cystic duct, common hepatic duct, and common bile duct before clipping, thereby improving surgical confidence and reducing the likelihood of bile duct injury. Universal precautions were meticulously followed throughout surgery owing to the patient's HIV-positive status. Appropriate perioperative management and continuation of antiretroviral therapy contributed to an uneventful recovery. Concurrent repair of the paraumbilical incisional hernia avoided the need for a second surgical procedure while utilizing the hernia defect for initial laparoscopic access. This case demonstrates that even highly complex anatomical and clinical scenarios can be managed safely through meticulous preoperative imaging, ergonomic planning, advanced energy devices, fluorescence guidance, and strict adherence to the Critical View of Safety.

CONCLUSION

Laparoscopic cholecystectomy in patients with situs inversustotalis is technically demanding but feasible in experienced hands. Preoperative imaging, modified port placement, mirror-image operative strategy, and ergonomic adaptation are essential for successful outcomes. The adjunctive use of Indocyanine Green fluorescence cholangiography significantly enhances identification of biliary anatomy and may reduce the risk of bile duct injury, particularly in the presence of dense adhesions. Simultaneous repair of associated abdominal wall defects can be safely performed, offering the benefits of a single minimally invasive procedure.

LEARNING POINTS

- Left upper quadrant pain should raise suspicion of biliary disease in patients with situs inversustotalis.
- Thorough preoperative imaging is essential for operative planning.
- Mirror-image port placement and surgeon positioning improve ergonomics.
- ICG fluorescence cholangiography facilitates safe identification of biliary anatomy in reversed anatomy.
- Simultaneous repair of associated incisional hernia is feasible in selected patients.
- HIV infection alone is not a contraindication to minimally invasive surgery when appropriate precautions are observed.

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