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Case Report

Laparoscopic Cholecystectomy in Situs Inversus Totalis, Challenges From the Surgeon's Perspective: A Case Report

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ABSTRACT

Situs inversus totalis (SIT) is a rare birth defect marked by a complete reversal of the positions of abdominal and thoracic organs, resembling a mirrored image. This condition can raise challenges both in diagnosis and treatment procedures. Management of cholelithiasis in SIT patients presents difficulties due to the anatomical differences. We present a case involving a 47-year-old male patient who experienced intermittent left upper abdominal pain over the course of 4 months; the pain had worsened in the last 2 months. The pain was felt radiating to the waist and left back and was accompanied by nausea and vomiting. After clinical assessment and radiological investigations, such as thoracic X-ray and abdominal ultrasound, the patient was suspected of having cholelithiasis and SIT. The patient underwent an elective laparoscopic cholecystectomy without complications and experienced an uneventful recovery. Several intraoperative adjustments were implemented to address the technical challenges arising from the underlying anatomical variation.

Key words: Situs inversus totalis, cholelithiasis, cholecystitis, laparoscopic cholecystectomy, case report

INTRODUCTION

Situs inversus is a rare congenital developmental disorder, estimated to occur in 1 in 5,000 to 20,000 live births, and is more prevalent in males (1.5:1). [1-3] It involves a range of visceral transpositions, situs inversus totalis (SIT) involving the reversal of both thoracic and abdominal organs, resulting in mirrored anatomical structures, or as situs inversus partialis, where either thoracic or abdominal organs are reversed. [4] This condition occurs early in development, can be influenced by genetic factors, involving more than 100 genes. [1] Although the exact cause remains unclear, genetic mutations on chromosomes 7, 8, and 14 are involved, indicating an autosomal recessive pattern. [5,6] Situs inversus often occurs together with other congenital abnormalities, such as congenital heart disease, renal dysplasia, and biliary atresia. [4]

SIT is a rare congenital condition, but because cholelithiasis is common, surgeons frequently encounter SIT patients who require cholecystectomy. There have been about 100 reported cases of laparoscopic cholecystectomy in SIT patients, highlighting the technical challenges due to the unusual anatomy. [4] Even though it has no impact on other diseases, SIT can complicate the diagnosis of some diseases by causing misleading

symptoms. As with cholelithiasis, the presenting symptom is not the usual right upper abdominal pain, but upper left abdominal pain, causing challenges and delays in diagnosis. [7,8]

Following the first successful laparoscopic cholecystectomy in patients with SIT performed by Campos and Sipes in 1991, [9] literature has documented 91 reported cases. [4] None of these cases reported any complications or required conversion to open cholecystectomy. Therefore, this procedure is considered safe and is not contraindicated in SIT. [10,11] However, it raises technical challenges due to its inverted anatomical structure. [12]

Diagnosing and treating symptomatic cholelithiasis in SIT patients presents challenges, especially for right-handed surgeons, because mirror-image anatomy requires reorientation during surgery. A gallbladder on the left side, as well as potential abnormalities in the hepatobiliary pathway, can complicate the procedure and increase the risk of injury. Nevertheless, with accurate anatomical identification, minimally invasive approaches are considered safe. [13] Despite the technical challenges, laparoscopic cholecystectomy remains the gold standard therapy for cholelithiasis. [7,14] The reverse anatomy complicates "Calot's Triangle" surgery, requiring both preoperative and intraoperative adjustments. [8] Several techniques, such as mirror port placement and single port surgery, have been suggested to overcome this challenge and have had positive outcomes documented in the medical literature. [15] Because situs inversus is uncommon and distinct, surgical management presents difficulties and frequently calls for modifications to standard protocols. Even though situs inversus may not have any symptoms, it is crucial to recognize situs inversus in an emergency. In surgical planning, advanced imaging tools can aid in the assessment of anatomy. Management of cholelithiasis in SIT patients requires a multidisciplinary approach. The surgical team also needs to be creative and adaptable. [1,4,7,8,13–18]

This case report documents a successful laparoscopic cholecystectomy performed in a patient with cholelithiasis with SIT and emphasizes the importance of technical adaptation and preoperative planning. This report was prepared in accordance with the 2020 Surgical Case Reporting (SCARE) Guidelines. [19]

CASE REPORT

A 47-year-old male came to the emergency room presenting complaints of left upper quadrant pain that was felt intermittently for 4 months, and had worsened in the last 2 months, associated with nausea and vomiting. He described the pain as radiating to his waist and left back with no other associated symptoms. He has no history of chronic diseases such as hypertension, diabetes, and heart disease, as well as smoking and drinking alcohol. No known family history. Clinical examination was unremarkable with no evidence of jaundice or abdominal tenderness. His blood test results showed a normal complete blood count, liver function, and slightly decreased kidney function. Chest X-ray revealed dextrocardia as shown in **Figure 1**. Abdominal ultrasonography features solid organ transposition, multiple cholelithiasis, and suspected cholecystitis with the liver and



Figure 1: Chest X-ray showing dextrocardia.

gallbladder on the left side, with multiple stones measuring 12.5 mm in the largest size and wall thickening. It confirmed the previously noted findings, showed no evident anomaly within the biliary tree, and confirmed the diagnosis of SIT as shown in **Figures 2 and 3**. The patient was scheduled for an elective laparoscopic cholecystectomy.

The operating room equipment setup was personalized accordingly, mirroring the routine laparoscopic cholecystectomy. The monitor is placed on the left side of the patient. The surgeon with a camera assistant is on the right side of the patient, and the first assistant is on the left side of the patient. The first assistant is on the patient's left side. The abdomen is scrubbed and draped using standard aseptic technique. The laparoscopic technique uses the Storz Laparoscopic Set with an intra-abdominal pressure set at 15 atmospheres, carried out using three



Figure 2: Abdominal ultrasound showing multiple stones in the gallbladder located on the left side.

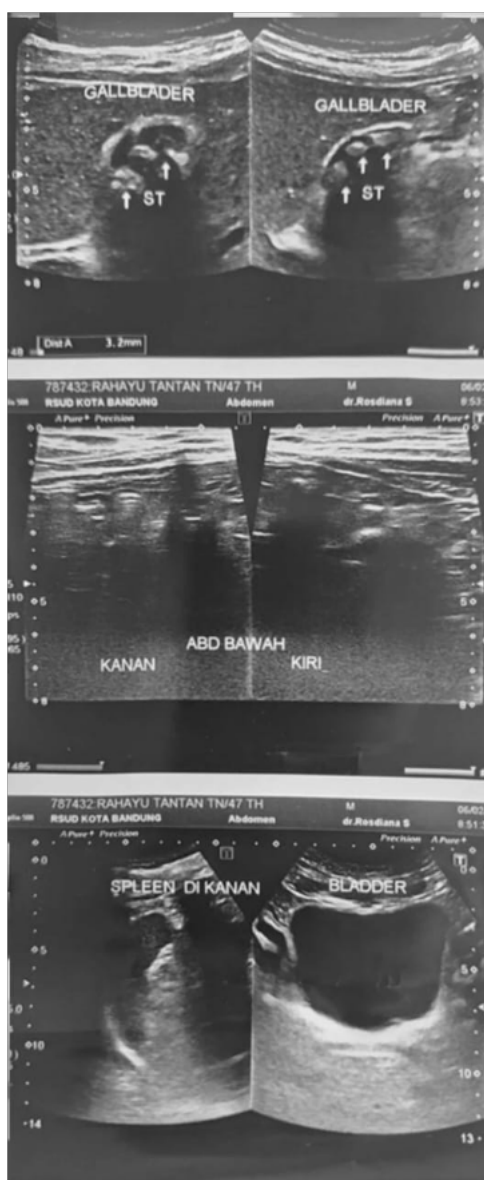


Figure 3: Abdominal ultrasound showing the liver located on the left side.

trocars. Each is placed in the umbilical, supraumbilical, and left hypochondrium. Inspection of the abdominal cavity confirmed SIT by discovering the position of the liver, stomach, ligamentum teres, and gallbladder in the opposite position. The gallbladder was then identified, and no adhesions were found in the gallbladder. Then the sulcus rouviere, common bile duct, and cystic duct were identified. Intraoperatively, found gallbladder was found to be the size of 6 × 4 × 2 cm, thickened wall, containing multiple brownish stones, measuring the largest in size is 1 cm, and the smallest is 0.8 cm, as shown in **Figure 4**. The cystic duct and the choledochal duct were not dilated. Bleeding control was performed with 50 cc of bleeding. The duration of operation from induction to completion was 63 minutes.

The patient underwent an uneventful postoperative course and was discharged on the second postoperative day. Pathological examination of the gallbladder revealed

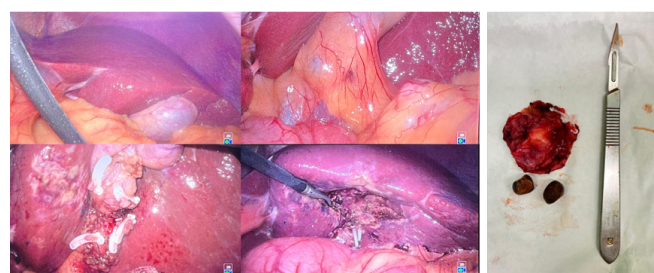


Figure 4: Intraoperative findings.

gallstones with chronic cholecystitis. The patient was given antibiotics and painkillers after being discharged. No further postoperative complications were noted during follow-up in the outpatient department.

DISCUSSION

Situs inversus, a rare autosomal genetic disorder, involves a reversal of the usual positions of the internal organs. It's found in approximately 1 out of 5,000 to 20,000 live births and can manifest as either total or partial. In the case of total situs inversus, or mirror-image dextrocardia, the heart and stomach are situated on the right side of the midline, with the liver and gallbladder on the left. [3]

Diagnosing biliary colic in patients with situs inversus poses challenges because of the unusual anatomical structure. These patients often experience non-typical symptoms like pain in the left upper quadrant or upper abdomen. These symptoms can potentially cause delays in both diagnosis and treatment, particularly in those unaware of their SIT condition, [7,20,21] as illustrated in the mentioned case. Ultrasonography, abdominal CT scan, and abdominal MRI can verify the visceral transposition, identify its type, help plan the surgical procedure, and reduce unexpected events during surgery, as well as post-operative complications. [21] Nevertheless, there's no evidence that people with SIT have a higher risk of developing cholelithiasis. [4]

The initial case report of laparoscopic cholecystectomy in a patient with situs inversus was documented by Campos and Sipes in 1991. [9] Since that time, over 91 additional case reports have been recorded. [4] The study indicated that numerous procedures can result in a successful and safe laparoscopic cholecystectomy. There was no mortality, and there were no significant complications reported, particularly concerning bile duct injuries. Therefore, laparoscopic cholecystectomy is the recommended approach for treating symptomatic and complicated cholelithiasis. [4,20-22]

Laparoscopic cholecystectomy can be difficult to perform on individuals who have situs inversus; particular technical modifications are needed to ensure an ergonomic position. It is necessary to modify visuomotor abilities to concentrate on the left upper quadrant. Getting used to their dominant hand is a big difficulty for the surgeon in situs inversus situations. [23] It is crucial to expose the Calot triangle clearly. It is necessary to pull the gallbladder neck lower and to the left, while lifting the gallbladder fundus upward and to the left. This method guarantees that the cystic duct and common bile duct are properly aligned and provides a clear view. The cystic

duct or common bile duct junction should be clearly visible during the dissection of the Calot triangle, which should be done next to the cystic artery lymph node. [21]

Ergonomics is not a major issue if the surgeon uses their left hand or both hands efficiently. But the process gets more difficult if the surgeon is only right-handed. In order to mitigate this, the surgeon may choose to lie between the patient's knees or on their right side. It has also been observed that employing two extra ports improves posture and field reorientation. Dissection can be done with inaccurate and potentially dangerous movements when the gallbladder is held in the right hand, and the left hand is used for the movements. This method could result in hand-or instrument-switching often, awkward manipulation, and technical difficulties. [24]

To ensure optimal vision and reduce the chance of bile duct damage, trocar placement is an important consideration. Several cases have reported that four-port laparoscopic cholecystectomy is performed by surgeons and assistants using a "mirror image" port insertion approach. [4,7,9,25]

The surgical team also switches positions, with the first assistant on the left and the surgeon and second assistant on the right. But the primary limitation of this strategy may be that it requires the surgeon to be skilled with their non-dominant hand to use the energy instrument with their non-dominant hand. [7]

Meng et al. employed a three-port approach, using two 10 mm trocars at the lower edge of the umbilicus and a 10 cm and 5 mm trocar placed to the left, below the xiphoid process, to create an additional operating port. While this method decreases the number of incisions, it demands strong left-hand surgical skills from the surgeon, making it more suitable for right-handed doctors. Compared to the four-port technique, this three-port configuration minimizes surgical trauma, significantly reducing both the operation time and postoperative recovery period. [26]

The strength of this study is that the performed laparoscopic cholecystectomy was done with three ports only, which was feasible without causing any major complications for the patient. The patient left the hospital within 48 hours after the surgery without the requirements of any specific postoperative care. Limitations within this study are that technical difficulties were experienced during the surgery due to anatomical differences, and the surgery was performed by a right-handed surgeon. Surgical tools were placed according to the right-hand surgeons so that the surgeon often took the tools with the left hand while the right hand held the grasper to position the gallbladder. Future implications should include the consideration of cholecystitis in SIT in patients with chronic pain originating from the opposite anatomical site, accompanied by other presenting symptoms that support the diagnosis.

CONCLUSIONS

Surgeons might face challenges while performing a laparoscopic cholecystectomy on individuals with SIT. Due to variations in clinical presentations and symptom localization, establishing a diagnosis might be difficult and will impact

when treatment is started. One procedure that can be performed without causing any major complications for the patient is laparoscopic cholecystectomy. To guarantee the success of the procedure, though, certain preparations need to be done, especially for right-handed surgeons as opposed to the standard procedure.

PATIENT CONSENT

Written informed consent was obtained from the patient for publication of this case report.

AUTHORS' CONTRIBUTION

All authors have significantly contributed to the work, whether by following the case at the bedside, conducting literature searches, drafting, revising, or critically reviewing the article. They have given their final approval of the version to be published, have agreed with the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

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CONFLICT OF INTEREST

None.

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