

# Modified laparoscopic cholecystectomy technique for treatment of situs inversus totalis: A case report

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## Abstract

Laparoscopic cholecystectomy is a broadly used technique for gallbladder treatment. However, situs inversus, a rare anomaly, is reportedly difficult to treat by conventional laparoscopic cholecystectomy. A 36-year-old woman with chronic cholecystitis and multiple gallstones was found to have dextrocardia on a chest X-ray. Magnetic resonance imaging demonstrated situs inversus, cholecystitis, and cholelithiasis. We successfully performed laparoscopic cholecystectomy using our modified technique, which mainly involved a left-handed operation and adjustment of the port positions. This case will be very instructive for right-handed surgeons in the management of cholelithiasis by laparoscopic cholecystectomy in patients with situs inversus.

## Keywords

Situs inversus, laparoscopic cholecystectomy, left hand

Date received: 16 December 2016; accepted: 15 March 2017

## Introduction

Situs inversus is a rare autosomal recessive condition characterized by the mirror-image transposition of viscera. The incidence of situs inversus varies from 1 in 5,000 to 1 in 20,000 live births.<sup>1</sup> Situs inversus viscerum can be either total or partial. Situs inversus totalis (SIT), also called mirror-image dextrocardia, is characterized by the presence of the heart and stomach on the right side of the midline while the liver and gallbladder are present on the left side. The rarity of this

disease and its varied presentations make diagnosis and management difficult. Laparoscopic cholecystectomy is the standard procedure for most cases of cholecystitis

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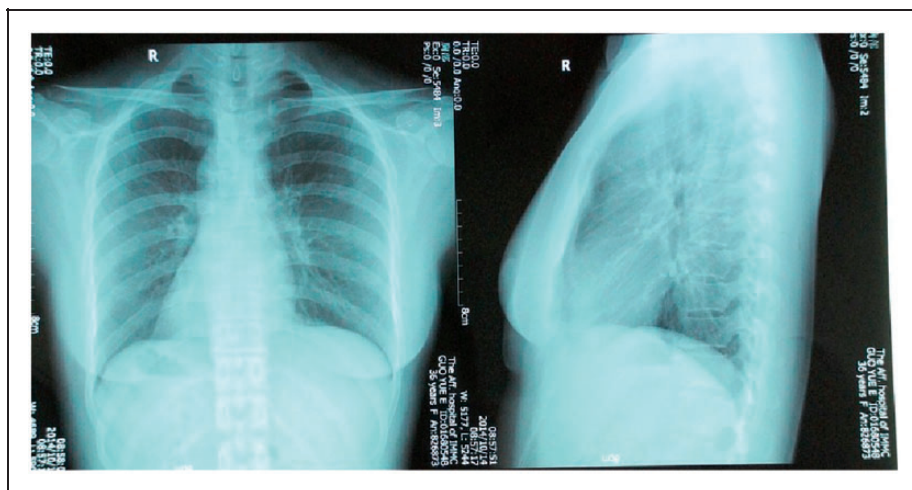
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**Figure 1.** Chest X-ray demonstrating dextrocardia.

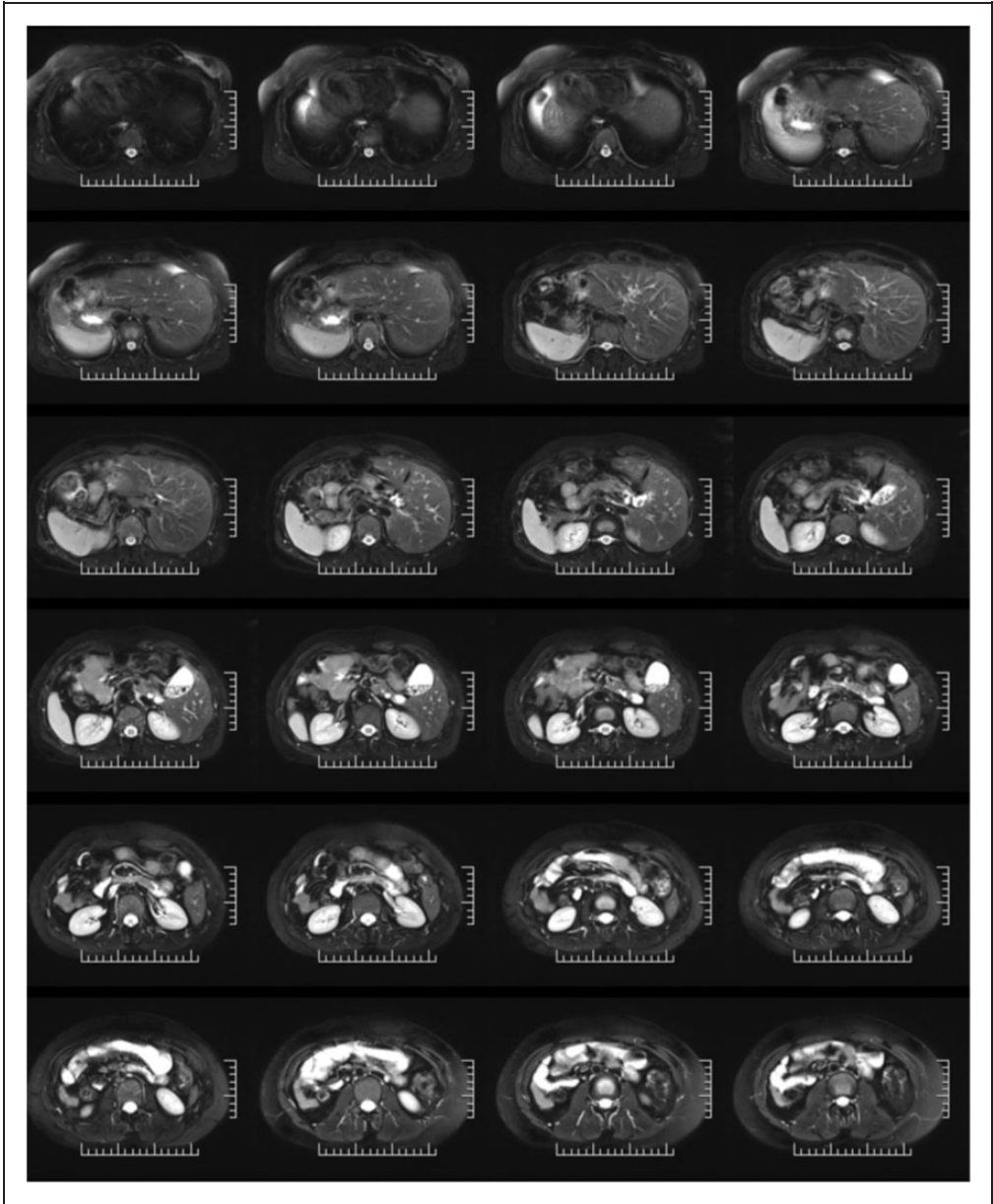
and can be performed without difficulty. Although some cases of SIT have reportedly been treated by laparoscopic cholecystectomy,<sup>2-7</sup> this technique is still challenging, especially for right-handed surgeons. We herein report a case involving a patient with SIT who successfully underwent laparoscopic cholecystectomy by our modified technique.

### Case report

A 36-year-old woman with a >6-month history of left epigastric swelling and pain that had become aggravated with ingestion of fatty food in the past 20 days was referred to our hospital in October 2014. Physical examination revealed no fever or jaundice. The patient showed normal skin and sclerae, subcostal collarbone midline tenderness, and no rebound pain or muscle tension; Murphy's sign was negative. Laboratory biochemical examination showed no obvious abnormalities. Chest X-ray imaging revealed dextrocardia (Figure 1), and an ultrasound scan showed abdominal situs inversus with a left-sided liver and gallbladder and a right-sided spleen. The size of the

gallbladder was about 76 × 30 mm, and the wall was rough and thick. Dozens of strongly echogenic foci with a diameter of 3 to 7 mm were detected. The common bile duct was 6 mm in diameter and unobstructed. Magnetic resonance imaging (Figure 2) showed situs inversus, cholecystitis, and cholelithiasis. Therefore, the patient was diagnosed with situs inversus and chronic cholecystitis with multiple gallstones. She was admitted to our hospital in October 2014, and laparoscopic cholecystectomy was performed.

The surgical approach was modified in the operating room. The patient was positioned head-end-up and left-side-up to optimize the views of the gallbladder and Calot's triangle. Initially, the surgeon was positioned on the right side of the patient and the first assistant was positioned on the left. A four-port technique was used. The first 12-mm subumbilical port was inserted, and pneumoperitoneum (13 mmHg pressure) was established. A 30° laparoscope was then inserted, and the presence of SIT was confirmed (Appendix). The gallbladder was located in its bed under the liver as viewed from the left epigastrium (Figure 3).



**Figure 2.** Magnetic resonance imaging showing situs inversus, cholecystitis, and cholelithiasis.

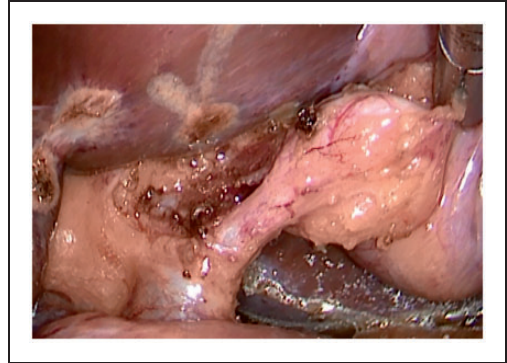
Three additional ports were inserted 2 to 5 cm below the subcostal margin of the left midclavicular line (5 mm), 3 cm below 3 cm below the left side of subxiphoid midline (10 mm), and 5 cm below the costal margin

of the left anterior axillary line (5 mm) under the 30° laparoscope. At the beginning of the operation, the port placed on the left side of the subcostal margin of the left midclavicular line was used as the main dissecting port,

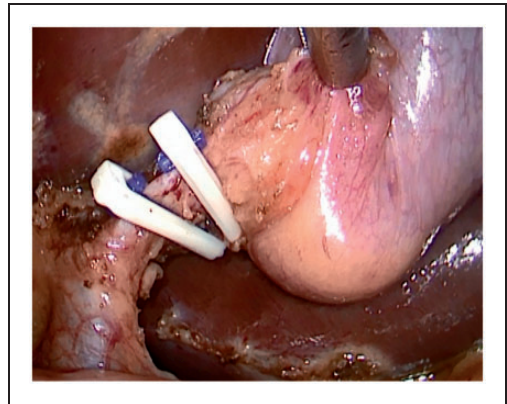


**Figure 3.** The gallbladder located in its bed under the liver as viewed from the left epigastrium.

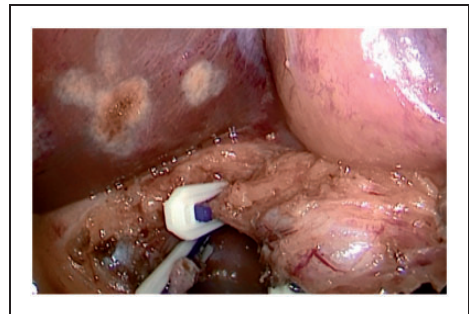
and the holding port (first auxiliary port) was placed on the left side of the subxiphoid midline. The electrocautery device was operated by the right hand, and the gallbladder grasping forceps were held with the left hand. However, the operation was very difficult because these two devices interfered with each other. Therefore, we modified the operation technique by choosing the port positioned on the left side of subxiphoid midline as the main operating port and the one positioned on the left side of the subcostal margin of the left midclavicular line as the holding port (first auxiliary port). The second auxiliary holes were then placed at the costal margin of the left anterior axillary line. Therefore, Calot's triangle was clearly identified (Figure 4). The cystic duct was isolated and clamped with the left hand at a distance of about 0.5cm from the common bile duct. It was then clipped with a titanium clamp (Figure 5). The left hand was also used to separate the gallbladder artery with pliers and clip the cystic artery with a biological clamp (Figure 6). The gallbladder was separated from its bed by electrocautery and successfully removed via a retrograde method. The whole operation was performed with the left hand of a right-handed surgeon. The operation was successfully completed within 45 minutes, and the patient showed no obvious bleeding. Postoperative 24-h electrocardiographic observation showed that the



**Figure 4.** Identification of Calot's triangle.



**Figure 5.** The cystic duct was clipped using a titanium clamp.



**Figure 6.** The cystic artery was clipped using a biological clamp.

patient's condition was stable without bile leakage, intestinal fistulas, abdominal bleeding, fever, or other complications. Postoperative pathological examination confirmed the presence of gallstones with chronic cholecystitis. The patient recovered very quickly and was discharged 2 days postoperatively. No abnormalities were observed at the 30-day follow-up.

## Discussion

Laparoscopic cholecystectomy for the treatment of gallstones in patients with a normal anatomy is a frequently performed procedure that is broadly applied in the clinical setting. However, situs inversus, a rare condition characterized by an abnormal anatomy, causes great difficulty performing this operation. Surgeons must overcome the adverse effects of habitual thinking and operative techniques. The locations at which the laparoscopic equipment are placed, location at which the assistant stands, identification of Calot's triangle, and gallbladder dissection method are completely different from those typically utilized for patients with a normal anatomy. Surgeons must clearly understand the anatomy of the gallbladder bile duct, portal vein, hepatic artery, and other important structures on the right side of the gallbladder in patients with SIT. In this case, the surgeon initially stood on the left side of the patient to perform the operation as suggested by some researchers.<sup>5-8</sup> The ports on the left midclavicular line and left anterior axillary line were used as the main operating ports. However, this setup was not conducive to the operation. The surgeon then stood on the right side of the patient, and the dissecting port was placed at the left midclavicular line. However, the dissection instruments and auxiliary ports interfered with each other. Therefore, we placed the dissecting ports on the left side of the subxiphoid midline and performed the surgery with the

left hand. As a result, the operation was successful. Although the left hand of right-handed surgeons is generally not as flexible as the right hand during surgery, it can still be used to conveniently coordinate the operating instruments. The gallbladder was easily rotated and pulled by the surgeon's right hand in this case, allowing the anatomy around Calot's triangle to be clearly seen. Notably, Calot's triangle was clearly revealed and no obvious bleeding was observed during the operation. Additionally, violent separation of the triangle area was avoided, and the conventional cholecystectomy protocol was strictly followed (i.e., attachment of the neck of the gallbladder with separation along the gallbladder wall). Therefore, based on our experience, we believe that such an operation should be performed gently to avoid bleeding and to ensure that the operative field remains clear. Additionally, the instruments used should be arranged well to make full use of them. In this case, the operation was successfully completed without any complications.

Since Campos and Sipes<sup>9</sup> first reported a successful laparoscopic cholecystectomy in a patient with SIT in 1991, 70 other cases have been reported in the literature to date. The mirror-image anatomy and technical difficulties are surgeons' main challenges when performing operations in patients with SIT, especially right-handed surgeons. A modified four-port laparoscopic cholecystectomy in which right-handed surgeons can use the left midclavicular port for dissection has also been reported as an optional method.<sup>8</sup> Single-port or single-incision cholecystectomy confers some advantages for dissection with the right hand. Different access ports have been used in several successful operations.<sup>10,11</sup> In addition, the positions of the surgical instruments can be adjusted to facilitate operations in patients with SIT.<sup>12</sup> However, this has been quite troublesome for other operations in patients with a normal anatomy. Some right-handed

surgeons have tried to stand on the left of the patient to perform the dissection and encountered conflicts between the instruments.<sup>7</sup> In the present case, the surgeon stood on the right of the patient to easily approach Calot's triangle. The operation was performed with the left hand, although it remained difficult. For experienced surgeons, however, the dissection can be performed flexibly and successfully.

In conclusion, laparoscopic cholecystectomy in patients with SIT is not easily performed by right-handed surgeons. However, we used a modified technique to successfully complete the surgery mainly by using the left hand and adjusted port positions, which is more ergonomic. Our modified laparoscopic cholecystectomy technique will be very useful for right-handed surgeons when managing cholelithiasis in patients with situs inversus.

### Ethics approval

All protocols were performed in accordance with the approved national and international guidelines. The clinical study was performed with the approval of the ethics committee of Inner Mongolia Medical University (YKD2015053).

### Consent

Written informed consent was obtained from our patient for publication of this case report and all accompanying images.

### Availability of data and materials

The authors declare that all data supporting the findings of this study are available within the article.

### Authors' contributions

JR modified the technique and was a major operator during the surgery. SL and YG helped to perform the surgery and summarize the

procedure. RX summarized the technique and wrote the manuscript. All authors read and approved the final manuscript.

### Acknowledgments

We thank Dr. Hui Wu for her interpretation of the magnetic resonance images and Dr. Chuanling Zhang, who critically revised our manuscript draft.

### Declaration of conflicting interest

The authors declare that there is no conflict of interest.

### Funding

The study was supported by the talents team funds from Inner Mongolia Medical University (NYTD-2015001 and NYTD-2015101) and the Grassland Talents Program of Inner Mongolia Autonomous Region (years 2013 and 2015).

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**Appendix.** The abdomen with port positions as viewed under the camera.

