

Total Laparoscopic Donor Nephrectomy In Situs Inversus Totalis: A Case Report

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Abstract

Situs inversus totalis is a rare anomaly characterized by the total inversion of all abdominal and thoracic organs. For the first time, we report a case of a donor nephrectomy in a patient with situs inversus totalis, completed with a full laparoscopic approach. At the time of this writing, the donor and the recipient are doing well after 6 month's follow-up. Our experience shows that patients with situs inversus totalis may be eligible candidates for laparoscopic donor nephrectomy, provided that detailed preoperative imaging studies as well as precise preoperative planning are performed before the transplant.

Key words: *Situs inversus, Laparoscopy, Donor*

Introduction

Situs inversus totalis (SIT) is a rare congenital malformation characterized by transposition of organs to the opposite side of the body in a mirror image of the usual.¹ The term situs inversus is a short form of the Latin phrase *situs inversus viscerum*, meaning inverted position of the internal organs. Situs inversus is generally an autosomal recessive genetic condition, although it can be a cross-linked genetic disorder with an incidence of 1 in 10 000.²

Fabricius, in 1600, reported the first case of situs inversus in humans. Since Aristotle's time, this condition of abnormal visceral rotation has been known in animals.³ It describes an anatomy that is a perfect mirror image of the usual physiologic positions of the visceral organs with preservation of anteroposterior relations.⁴ Yet because this arrangement is a perfect mirror image, the relation between the organs is not changed, so functional problems rarely occur. Generally, patients with SIT are asymptomatic and have a normal life expectancy.⁵ Situs inversus totalis may pose several technical difficulties during operative procedures, especially during laparoscopic operations. The mirror image of laparoscopic view creates unfamiliarity for the surgeon and his usual maneuvers. Additionally, all instrument designs are for right-handed surgeons.⁶ We present the first reported case of laparoscopic donor nephrectomy via totally laparoscopic approach in a patient with SIT.

Case Report

A 37-year-old man was admitted for a voluntary kidney donation to his 38-year-old wife who had end-stage renal disease for 5 years. He had no history of hypertension, anemia, renal diseases, diabetes, or prior surgical operations. His body mass index was 29.7 kg/m². During preoperative investigation, radiologic imaging studies showed the presence of complete SIT. The results of blood biochemistry and urine tests were in normal ranges with a preoperative creatinine level of 80.44 µmol/L. A chest radiograph showed no signs of active pulmonary disease (Figure 1). Grade 1 hepatosteatorosis was the only abnormality detected in abdominal ultrasonography. Renal computed tomography-angiography demonstrated

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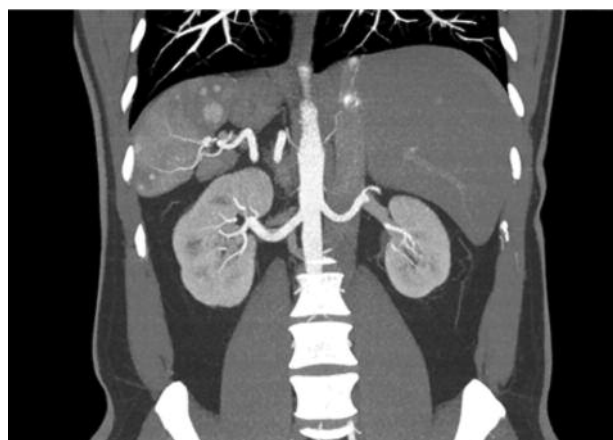
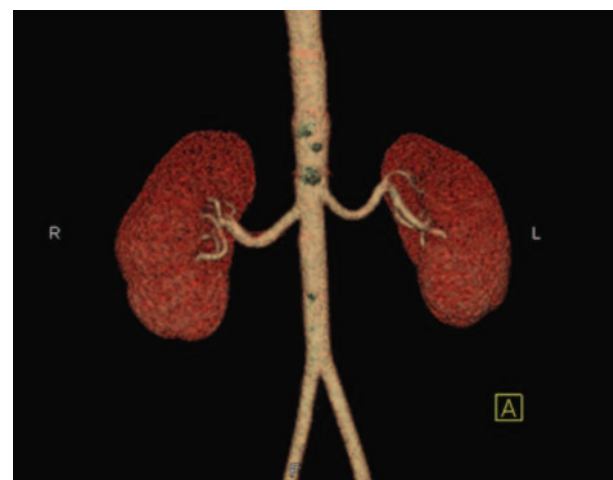
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Figure 1. Chest Radiograph Demonstrating Dextrocardia

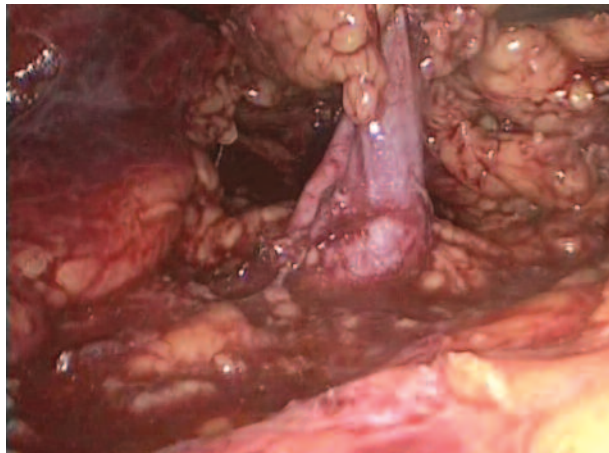
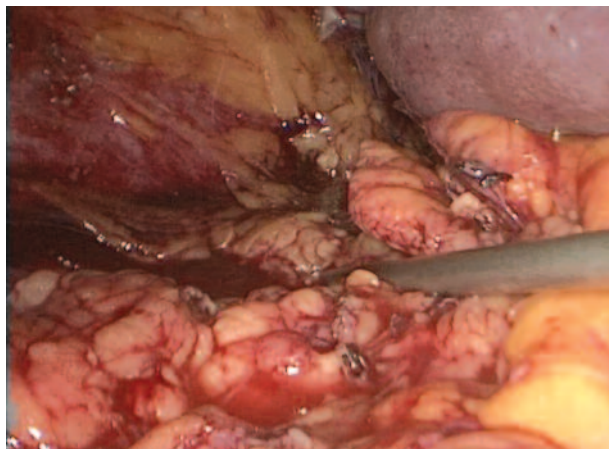
a single renal artery without prior branching on both sides with no signs of stenosis in both arteries (Figures 2A and 2B). Functional comparison of the kidneys on renal kidney scan (DMSA) revealed the left side to be superior to the right side by 51.7% to 48.3%; thus, we decided to remove the right kidney.

The patient is positioned in left lateral decubitus position on the operating table. The first 10/12 millimeter (mm) port is placed inferior-lateral to the rectus muscle under direct vision and the abdomen is insufflated to intraperitoneal pressure of 12 mm Hg. Afterwards, other ports including a 10-mm port placed just right of the umbilicus for a camera, a 5-mm working port placed at the right upper quadrant, and a 5-mm working port placed 4 cm superior to the anterior superior iliac spine are positioned. Situs inversus totalis was observed (Figure 3A). The white line of Toldt is incised and the colon is mobilized medially from the pelvic brim to the splenic flexure. Gerota's fascia is opened. The ureter and gonadal vessels are defined and tractioned. Because of the SIT, the right renal vein and artery and the other venous vessels (including the gonadal, right adrenal, and lumbar veins) are anatomically consistent with those of the left side. After hilar dissection and exposure of renal artery and vein, the kidney is released from the surrounding structures and the adrenal gland. The gonadal vein and other lumbar veins are ligated with LigaSure device (Valleylab, a division of Tyco Healthcare Group LP, Boulder CO, USA). The renal artery and vein are determined to have satisfactory lengths as expected on the left side (Figure 3B). A

Figure 2A. Computed Tomography Angiogram: Long Right Renal Vein**Figure 2B.** 3D Reconstruction of an Abdominal Computed Tomography Angiogram Showing the Kidney's Arterial Structure

6-cm lower ilioinguinal incision is performed while the muscle attached to the peritoneum is not incised to preserve the pneumoperitoneum. When the recipient is ready, the ureter is clipped with Hem-o-Lok clip (Weck Closure Systems, Research Triangle Park, NC, USA) and is cut. The renal artery and vein are secured and transected with a multifire Endo GIA 30 stapler (Tyco Auto suture; Tyco Healthcare Group LP, Mansfield, MA, USA). The kidney is extracted from the previously opened ilioinguinal incision, and the layers are closed anatomically, after controlling hemostasis (Figure 3C). The procured kidney was transplanted to the recipient's right iliac fossa.

The operative time was 2 hours 17 minutes. Warm ischemia was 2 minutes 17 seconds, and cold ischemia time was 40 minutes. He drank water on the evening of the operation and had a light breakfast the following morning. He was mobilized thereafter. Only paracetamol was used as an analgesic, when

Figure 3A. Sigmoid Colon and the Spleen in the Right Side of the Abdomen**Figure 3B.** Renal Hilum**Figure 3C.** After Removal of the Right Kidney

needed. He was discharged from the hospital on the second postoperative day. His creatinine level was 135.25 $\mu\text{mol/L}$ at discharge while 116.68 $\mu\text{mol/L}$ at the end of 6-month follow-up. The recipient's creatinine level was 106.08 mmol/L at discharge while it was 88.4 mmol/L at the end of the sixth month.

Discussion

Situs inversus is a morphologic anomaly of the positioning of internal viscera wherein there is reversal of the usual "handedness" of visceral topography. Usual development requires a 270° counterclockwise rotation that yields the usual anatomy of the visceral structures. In situs inversus, the 270° rotation occurs in the clockwise direction.⁷ In 1995, Ratner and associates described the laparoscopic technique for a living-donor nephrectomy.⁸ Now, various contraindications to a laparoscopic donor nephrectomy (eg, a right donor kidney), multiple vessels and anomalous vasculature have been outdated with increased experience. In 2003, the percentage of laparoscopies in the United States was approximately 67%. Live-donor nephrectomies have become the standard means for procuring kidney grafts of living donors in many centers.⁹ Many laparoscopic procedures (eg, cholecystectomy, gastrectomy, colectomy, and splenectomy) have been reported to be performed safely in patients with SIT, despite the fact that there are some technical difficulties owing to mirror image of anatomy.¹⁰⁻¹⁴

We found few articles describing kidney donation in patients with complete situs inversus. Black and associates¹⁵ reported the first case, and they used hand-assisted laparoscopic technique for the right side. van Dellen and associates¹⁶ reported 2 cases with aberrant inferior vena caval anatomy, while in 1 of them with SIT, successful right-sided hand-assisted nephrectomy was documented to be performed. Deceased-donor donation in patient with complete situs inversus has been described by Polak and associates,¹⁷ and they procured both kidneys. An open nephrectomy in a patient with SIT has been reported as well,¹⁸ with complex vascularity reported as the most likely reason for the open approach, while in this case, the patient's 1-year urine output and baseline creatinine levels were reportedly within the normal range. Complete laparoscopic kidney removal in a patient with SIT has been reported, but the reason was a renal mass.¹⁹ Our case is the first complete laparoscopic donor nephrectomy in a patient with a successful outcome. We preferred the right side because of less functionality and a longer vein. We evaluated this case as an anatomic variant, and the operation was performed, as usual, in the left-sided laparoscopic donor nephrectomy. After trocar

placement, the surgical team was oriented with the mirror image laparoscopic view. The operation time was rational. Thus, we recommend precise preoperative planning and detailed imaging studies before the transplant process. With correct description of renal vascularity, laparoscopic donor nephrectomy is more feasible.

Our findings indicate that laparoscopic donor nephrectomy can be performed safely in patients with SIT, provided that detailed preoperative imaging studies and precise preoperative planning are done before the transplant, and the center has sufficient experience in laparoscopic donor nephrectomy, particularly in patients with abnormal vascularity.

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