


Case Report

Laparoscopic ileal ureteral replacement to preserve the natural anti-reflux system: An initial case report

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Abbreviations & Acronyms

VUR = vesicoureteral reflux

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Introduction: Ileal ureteral replacement is one of the treatment options for long ureteral strictures. Most ileal ureteral replacements anastomose the distal side of the ileal segment directly to the bladder. We have reported here an initial case of laparoscopic ileal ureteral replacement for preserving the natural anti-reflux system.

Case presentation: A 29-year-old male presented with right flank pain, and his imaging results revealed multiple strictures of the right upper-middle ureter. Hence, we performed a laparoscopic ileal ureteral replacement surgery. The normal distal ureter was preserved, and the distal side of the ileal segment was anastomosed to it. As such, the natural anti-reflux system could be completely preserved. Following this, the renal function was maintained, and no urinary tract infection was recorded.

Conclusion: Laparoscopic ileal ureteral replacement, which preserves the natural anti-reflux system, can be considered as a treatment option for refractory upper-middle ureteral strictures.

Key words: anti-reflux, ileal ureteral replacement, laparoscopic surgery, ureteral reconstruction, ureteral stricture.

Keynote message

We performed a laparoscopic ileal ureteral replacement surgery for multiple strictures of the right upper-middle ureter. We preserved the natural anti-reflux system by anastomosing the distal side of the ileal segment with the normal distal ureter. Laparoscopic ileal ureteral replacement, which preserves the natural anti-reflux system, is a feasible treatment option for cases of long refractory upper-middle ureteral strictures and lower ureter, including those where ureterovesical junction is normal.

Introduction

The reconstruction of the ureter is required for correcting various causes such as trauma, iatrogenic ureteral injury, and ureteral stenosis due to tuberculosis or malignant tumor. Especially, when the ureter that requires reconstruction is long, ureteral replacement using the ileum is one of the treatment options. To date, various reports have proposed proximal and distal anastomosis methods of the ileum segment to the urinary tract, but none have been completely established. In most cases, the distal side of the ileum segment is anastomosed directly to the bladder.

In the recent years, minimally invasive approaches, such as laparoscopic and robotic procedures, have been adopted in several urinary tract reconstruction surgeries.

Herein, we have reported an initial case of laparoscopic ileal ureteral replacement that preserved the natural anti-reflux system.

Case presentation

A 29-year-old male presented with persistent right flank pain since the past 2 years. Intravenous pyelography (Fig. 1), computed tomography, and retrograde pyelography revealed



Fig. 1 Preoperative intravenous pyelography displaying multiple right-upper ureteral strictures.

grade-1 right hydronephrosis and multiple strictures of the right-upper ureter. There was no history of systemic inflammatory disease or malignant tumor, and all blood tumor markers were negative. The patient's serum tuberculosis antigen and quantiferon test were negative. Ureteroscopic biopsy revealed pathologically nonspecific chronic inflammation without any malignant findings. Accordingly, the patient underwent transurethral balloon dilation thrice, transurethral

ureterotomy with holmium yttrium-aluminum-garnet laser thrice, and retroperitoneal laparoscopic ureterotomy once. However, the dilating effect of the ureter was not sustained. Finally, the patient was referred to our hospital. As shown in Figure 1, the ureteral stricture in this case was long (13 cm) and had multiple sites, from the upper to the middle part of the ureter. Therefore, we chose ileal ureteral replacement.

The patient was placed in a modified flank position under general anesthesia. A 4-cm flank incision was made using the Hasson open technique at the level of the right midclavicular line, and the Alexis® wound retractor (Applied Medical, Rancho Santa Margarita, CA, USA) was placed. The wound retractor was then covered with a surgical glove for the surgical glove-port technique. A 12-mm Hasson trocar and a 5-mm trocar were inserted via the glove-port. Additionally, two 5-mm trocars were placed at the lateral border of the right rectus muscle and at the right anterior axillary line, respectively (Fig. 2). The peritoneum was carefully incised along the white line of Toldt up to the hepatic flexure, and the ascending colon was rotated medially to expose the retroperitoneum, with difficulties for strong adhesions. As shown in Figure 1, the ureter at the level from the renal pelvis to the iliac blood vessels adhered tightly to the surrounding tissues, and the ureteral wall was fibrous and thickened. Therefore, this portion of the ureter was resected. In contrast, the ureter below the iliac blood vessel level looked normal and was preserved, which indicated that a natural anti-reflux system could be completely preserved. On stopping the laparoscopic procedure, the ileum was pulled out of the abdominal cavity through the wound retractor and a 15-cm ileal segment was harvested for subsequent ureteral reconstruction. After resuming the laparoscopic procedure, the distal ureter and the ileal segment were first anastomosed and then the proximal ureter (immediately below the renal pelvis) and the ileal segment were anastomosed in an end-to-end fashion with interrupted

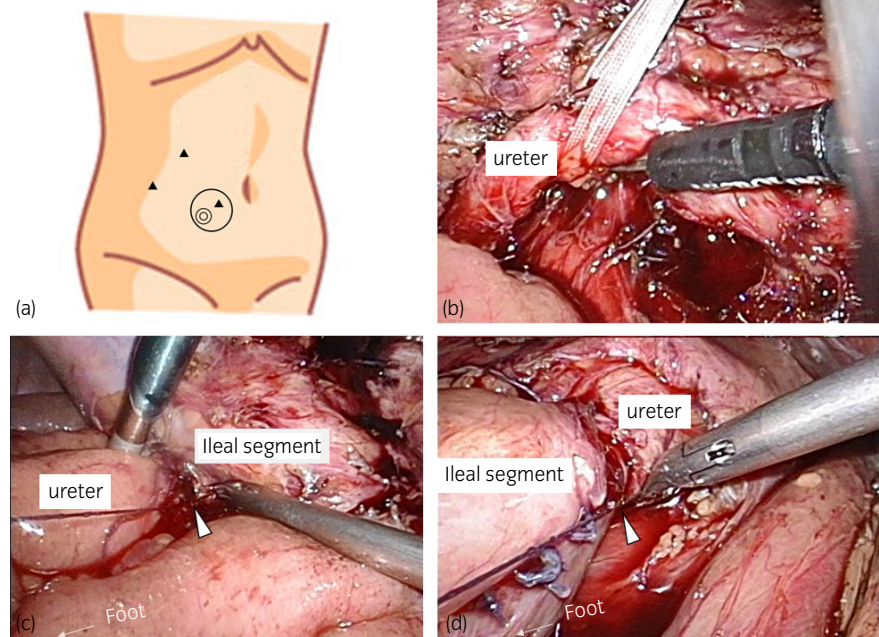


Fig. 2 (a) Trocar placement for right laparoscopic ileal ureteral replacement. Alexis® wound retractor (circle) with a 12-mm (double circle) and a 5-mm (black triangle) trocars through a 4-cm skin incision at the right midclavicular line. Two 5-mm trocars (black triangle) were added at the lateral border of the right rectus muscle and at the right anterior axillary line, respectively. (b) Isolation of the ureter at the level of the renal pelvis to the iliac blood vessels. (c) Anastomosis (arrowhead) of the ileal segment and distal ureter. (d) Anastomosis (arrowhead) of the ileal segment and proximal ureter.

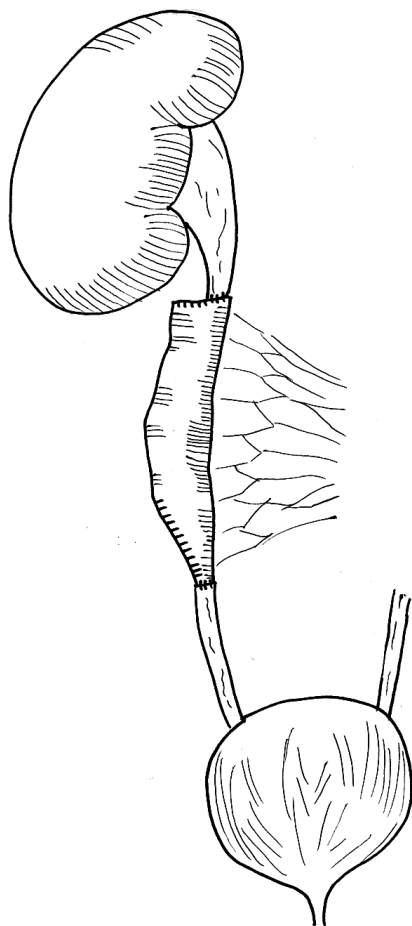


Fig. 3 Schematic illustration of laparoscopic ileal ureteral replacement that could preserve the natural anti-reflux system. The distal side of the ileal segment was tapered to fit to the diameter of the ureter.

sutures using a 4-0 absorbable braided suture (Vicryl; Ethicon, Somerville, NJ, USA). A 7-Fr double J stent was placed transurethrally during the proximal ureter-ileal anastomosis. Two drains were placed at each ileal-ureteral anastomosis sites. The pneumoperitoneum time totaled 437 min. Due to a urine leak from the distal anastomosis, repair was performed 1 day after the surgery. The ileal segment just above the distal ileal-ureteral anastomosis was dilated obviously, therefore the distal side of the ileal segment was tapered to fit precisely to the diameter of the ureter (Fig. 3).

The postoperative course was good following this, and the double J stent was removed 22 days after the surgery. In the postoperative follow-up, urine passage at the anastomotic site was smooth as per magnetic resonance imaging performed 54 months after the surgery (Fig. 4). The serum creatinine level at 5 years was 0.74 mg/dL, ultrasonography at 10 years revealed grade-1 hydronephrosis, and no febrile urinary tract infection was recorded throughout the entire follow-up duration.

Discussion

The crucial goal in ureteral reconstruction and ureteral replacement is the preservation of renal functions. In general,



Fig. 4 Magnetic resonance urography performed at 54 months after the surgery.

the indication for ileal ureteral replacement is considered as long benign ureteral stricture (>2 cm), which is incurable by other treatment options, such as balloon dilation and laser ureterotomy.¹ Various methods of anastomosis to the urinary tract have been reported in ureteral replacement using the ileum, wherein the distal side of the ileal segment was directly anastomosed to the bladder in most cases. Of these, some techniques allow prevention of a VUR to the bladder at the anastomotic site. However, it remains unclear whether these techniques are actually effective in preventing VUR, as there is no long-term follow-up data available.² In contrast, if the distal ureter can be preserved, the natural anti-reflux system can be completely preserved as well. To the best of our knowledge, there is only one case report on robotic surgery that could preserve the distal ureter and natural anti-reflux system in ileal ureteral replacement.³ Robotic surgery can result in precise suturing in an easier manner than laparoscopic surgery in sites where suturing is difficult, such as ureters; however, it remains expensive and unavailable to everyone. Therefore, it is more realistic to apply laparoscopic surgery. For the success of laparoscopic ileal ureteral replacement, surgeons are required to be skilled in suturing during laparoscopic surgery, diagnosing lesion localization and length accurately, and determining the suitable trocar position preoperatively to plan the appropriate surgical approach. In this

case, we performed laparoscopic ileal ureteral replacement that could preserve the natural anti-reflux system.

In general, urinary diversion using the gastrointestinal tract increases the risk of subsequent carcinogenesis in the gastrointestinal tract.⁴ One of the speculated causes is the exposure of the intestinal epithelium to urine for prolonged periods, which induces an inflammatory reaction causing carcinogenesis.⁵ In our procedure, the distal side of the ileal segment was tapered to fit to the diameter of the ureter. A previous study demonstrated that tapering the cross-sectional diameter of the ileal segment enhances peristalsis via early stretching of the peristalsis-inducing muscle fiber.⁶ Therefore, by enhancing peristalsis, our procedure may also smoothen urine passage in the ileal segment to prevent carcinogenesis.^{6,7}

The main limitation of the present study is that there is only one case with no long-term functional follow-up data available for reference. However, this is a proof-of-concept study that has demonstrated the feasibility of using laparoscopic surgery. Further studies with more cases and long-term follow ups are thus warranted.

Conclusions

The laparoscopic ileal ureteral replacement, which preserves the natural anti-reflux system, is a feasible treatment option for refractory upper-middle ureteral strictures.

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Conflict of interest

The authors declare no conflict of interest.

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