Case Report

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Percutaneous nephrolithotomy and retroperitoneal laparoscopy in treatment of retrocaval ureter with right renal and ureteral calculi: a case report

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Abstract

Retrocaval ureter is a rare disease associated with abnormal embryonic development. Here, we describe a patient who exhibited retrocaval ureter complicated by renal and ureteral calculi, which were treated by percutaneous nephrolithotomy combined with retroperitoneal laparoscopy. A 64-year-old man was admitted to our hospital because of intermittent back pain that had been present for more than 10 years. During hospitalization, he was diagnosed with retrocaval ureter, right renal calculi, and right ureteral calculi with right hydronephrosis; he underwent percutaneous nephrolithotomy combined with retroperitoneal laparoscopic surgery. After the operation, his condition was stable and he exhibited good recovery. Our findings in this case suggest that percutaneous nephrolithotomy combined with retroperitoneal laparoscopy is a suitable option for the treatment of retrocaval ureter with renal and ureteral calculi.

Keywords

Retrocaval ureter, percutaneous nephrolithotomy, ureteral calculus, renal calculus, retroperitoneal laparoscopy, hydronephrosis

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Introduction

Retrocaval ureter (also known as circumcaval ureter) occurs during embryonic

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development due to the development of an abnormal inferior vena cava that leads to ureter passage behind the vena cava.[1] In patients with severe conditions, the malformation develops into a duplicate inferior vena cava, which is penetrated by the right ureter. Most affected patients are asymptomatic; typical symptoms comprise discomfort or intermittent dull pain and colic in the right abdomen. Symptoms in patients with severe obstruction include hematuria, pyuria, fever, hydronephrosis, renal calculi, and ureteral calculi.[1] Treatment of retrocaval ureter depends on the degree of renal functional damage and the type of retrocaval ureter in an affected patient.[2] Asymptomatic patients without obstructions visible in imaging examinations can undergo regular follow-up without active treatment. When obstruction leads to renal failure and the contralateral kidney is normal, nephrectomy is feasible; when ureteral obstruction and corresponding symptoms occur, ureteroplasty (i.e., ureteral reduction and orthopedic surgery [anterior to inferior vena cava transposition, combined with ureter anastomosis]) is the main treatment approach.[2] Notably, laparoscopic surgery is the gold standard of treatment.[3] The incidence of retrocaval ureter is approximately 0.13%.[1,4] As diagnostic technology improves, greater numbers of asymptomatic patients have been identified. Soft ureteroscopy combined with laparoscopy has been used to treat retrocaval ureter.[1,4] Here, we describe a patient who exhibited retrocaval ureter with right renal and ureteral calculi, all of which were treated by percutaneous nephroscopy combined with laparoscopy.

Case report

Presenting symptoms and clinical findings

A 64-year-old man was admitted to our hospital in November 2019 because of intermittent right lumbar pain that had been present for more than 10 years. He was otherwise healthy and had no other complaints. His previous history included four extracorporeal shock wave lithotripsy treatments for right-sided kidney stones 10 years prior; the postoperative course of stone discharge was unknown. No obvious signs were observed during a physical examination. Laboratory investigations revealed that urine leukocytes were present at 12.3 per high-power field. Other laboratory parameters were within normal limits. Renal ultrasound revealed a hyperechoic mass of 2 cm within the renal sinus in the middle of the right kidney. Computed tomography examination of the ureter showed an irregular high-density shadow in the middle calyx of the right kidney and another shadow at the level of the third lumbar vertebra (Figure 1, Figure 2, Figure 3); the respective sizes of these shadows were approximately 2.5 cm and 2 cm. Pyelography revealed the presence of a "fish-hook" ureter (Figure 4).

Diagnosis and surgical treatment

Clinical diagnosis of the patient comprised retrocaval ureter, right ureteral calculi with right hydronephrosis, and right renal

Figure 1. Sagittal computed tomography image of renal stone.

Figure 2. Coronal computed tomography image of ureteral stone.

Figure 3. Sagittal computed tomography image of ureteral stone with ureter passing behind the vena cava.

calculi. Thus, the patient first underwent right ureteroscopy following induction of general anesthesia. Approximately 15 cm into the ureter, the tract exhibited movement towards the midline. Because of angular factors, a rigid ureteroscope could not be advanced; a 4-Fr ureteral catheter was able to advance to the renal pelvis. Urine outflow was observed at the end of the tail. Consistent with the ureteral computed tomography and pyelography findings, the surgical observations supported a diagnosis

Figure 4. Pyelography image of "fish-hook" changes in ureteral morphology.

of retrocaval ureter. A 6-Fr ureteral catheter was inserted into the renal pelvis to establish artificial hydronephrosis. In contrast to the preoperative computed tomography indications, the junction of the 12th rib and the right posterior axillary line was used as the puncture point. Under ultrasound guidance, percutaneous transluminal kidney puncture was performed; the channel was expanded in a conventional manner and 24-Fr percutaneous nephrolithotomy was performed. Following fragmentation and intraoperative removal of intrarenal calculi, no stricture was observed at the right ureteropelvic junction; the upper segment of the ureter deviated medially and posteriorly, and the enclosed stones were also removed. Upon completion of percutaneous nephrolithotomy, laparoscopic surgery was performed with the patient in the left lateral decubitus position. Incisions were made at the right midaxillary line, 1.5 cm above the anterior superior iliac spine, 2 cm below the 12th rib at the posterior axillary line, and 2 cm below the 12th rib tip at the anterior axillary line. A surgical channel was established and three 10-mm trocars were placed. The inferior vena cava was identified at the level of the

inferior pole of the kidney, while the distal ureter was identified outside of the inferior vena cava. The proximal end of the ureter moved inward and upward through the front of the inferior vena cava, curved from the medial side of the inferior vena cava to the dorsal side of the inferior vena cava, and became a dilated proximal ureter outside of the inferior vena cava (Figure 5).

The surrounding ureter was completely dissociated from the inferior vena cava; the ureteral lumen became obviously thinner behind the inferior vena cava, which confirmed that the ureter was located behind the inferior vena cava (Figure 6). The ureter behind the inferior vena cava (approximately 2 cm) was removed; distal and proximal portions of the ureter were restored via end-to-end anastomosis in front of the vena cava (i.e., via double J-stent placement). No tension or distortion of the ureter were observed after anastomosis (Figure 7).

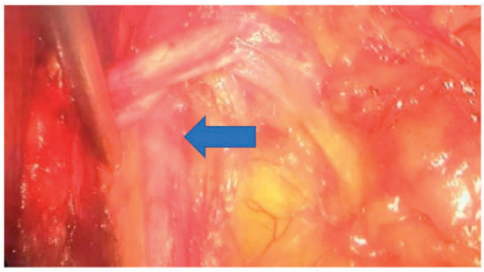

Figure 5. Intraoperative image demonstrating disappearance of the hydroureter following percutaneous nephrolithotomy (blue arrow indicates ureter).

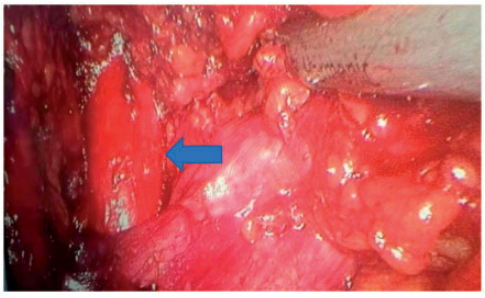

Figure 6. Intraoperative image demonstrating ureter passage behind the vena cava (blue arrow indicates ureter).

Postoperative course and patient consent

Postoperatively, the patient did not exhibit fever or urine leakage; the ureteral stent was removed at 2 months postoperatively. Infrared spectroscopy analysis revealed that the stone comprised a mixture of calcium oxalate monohydrate and hydroxyapatite. This case report is a retrospective analysis of an individual patient; thus, no ethics committee approval was required. The patient provided oral informed consent for the publication of the report.

Discussion

Retrocaval ureter comprises ureteral obstruction due to ureteral compression of the ureter by the inferior vena cava and psoas major muscle, which results in hydronephrosis and secondary calculi.[4] The disease occurs threefold more frequently in men than in women.[1] Clinical symptoms most frequently occur in middle age. According to the relationship between the

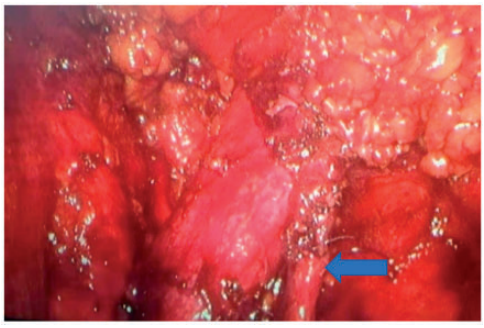

Figure 7. Intraoperative image demonstrating absence of ureter tension and distortion after anastomosis (blue arrow indicates ureter).

ureter and the vena cava, retrocaval ureter can be classified as type I, type II, and type III.[2] The periureteral space is narrower in patients with type II retrocaval ureter. The pressure of the ureter towards the vena cava readily causes clinical symptoms and secondary calculi; notably, type II retrocaval ureter is more commonly encountered in clinical practice, with the characteristic imaging finding of "fish-hook" morphology.[2] The principles of retrocaval ureteral treatment are as follows: (1) patients who exhibit mild hydronephrosis or calyceal hydronephrosis without hydronephrosis can be closely observed and regularly re-examined, without active treatment; (2) surgical treatment should be performed as soon as possible when severe hydronephrosis is present and the upper ureter exhibits obvious dilation that affects the function of the right kidney; (3) patients with recurrent infection, secondary stones, and bleeding require urgent surgical treatment.[2,5]

Our patient exhibited retrocaval ureter and right ureteral calculi with right hydronephrosis and right renal calculi. Ureteral calculi occur above the site where the vena cava causes pressure to the ureter; their presence constitutes a surgical indication. In 1994, Baba et al.[6] first reported laparoscopic treatment of retrocaval ureter. Laparoscopy is currently the first-line treatment for retrocaval ureter. In the past 5 years, some clinicians have reported the use of soft ureteroscopy combined with laparoscopy for treatment of retrocaval ureter accompanied by ureteral calculi.[7] Based on the preoperative findings of patients with retrocaval ureter, we propose that these patients exhibit risks of ureteral injury or rupture during transvesical indwelling of a ureteroscope sheath because of ureteral calculi and renal calculi combined with heavy stone load and extended operative time. Flexible ureteroscopic lithotripsy can increase the risk of perioperative infection and postoperative stone residue, whereas percutaneous nephrolithotomy involves a short operative time and high stone removal efficiency.[8] Therefore, we use percutaneous nephrolithotomy in our clinic. In addition, we presume that the simultaneous occurrence of right ureteral calculi and right renal calculi are related to the ureteral obstruction caused by retrocaval ureter. Thus, the removal of ureteral calculi does not relieve ureteral obstruction. Patients with retrocaval ureter have a long-term risk of recurrence of ureteral obstruction and continued deterioration of renal function; concurrent laparoscopic surgery is sufficient for relief of ureteral obstruction. This reduces hospitalization costs while avoiding difficulty with second-stage laparoscopic surgery due to local tissue adhesion during first-stage percutaneous nephroscopy.[1] For treatment of our patient, an ultrasonic lithotripsy system was used first. The high efficiency of stone removal, low intrapelvic perfusion pressure, and absence of obvious exudation in the operation area during laparoscopic surgery were key factors that contributed to the success of the operation. If laparoscopic surgery is performed to correct the retrocaval ureter, a percutaneous nephrolithotomy channel cannot be established by puncture in patients with artificial hydronephrosis. In our experience, ureteral suturing is less effective than vascular suturing, which leads to ureteral ischemia; subsequent fluid extravasation from the site of ureteral anastomosis will enhance the risks of urinary fistula, local inflammation, edema, and restenosis. Our department has efficient lithotripsy equipment, as well as clinicians skilled in percutaneous nephrolithotomy and laparoscopic lithotripsy; thus, for patients with retrocaval ureter accompanied by multiple upper urinary tract calculi, simultaneous percutaneous nephrolithotomy lithotripsy combined with laparoscopic surgery is a suitable treatment approach.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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