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Research Article

Retroperitoneal Laparoscopic Approach for Retrocaval Ureter: Our Experience on 27 Cases

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Abstract

Introduction: Aim of this study was to describe the retroperitoneoscopic ureterouretostomy technique for retrocaval ureter.

Materials and Methods: Retrospective single centre study of 27 patients who underwent retroperitoneal laparoscopic ureteroureterostomy for retrocaval ureter. Treatment success was defined as the absence of stenosis, reduction of hydronephrosis and complete resolution of symptoms. Intra and post-operative complications and short-term follow-up were assessed. A descriptive statistical analysis was performed. Wilcoxon signed rank test was used to compare hydronephrosis grade and symptoms resolution after 3, 6 and 12 months.

Results: Median operative time was 131 min (IQR: 90-160) and median estimated blood loss was 28,5 ml (10-30); median hospital stay was 3,8 days (IQR: 3-4). No intra-operative complications or conversion to open surgery were observed. After surgery 15% (4 of 27) had a grade 1 of Clavien-Dindo complications. The double-J ureteral stent was removed 4-6 weeks postoperatively. The Contrast-enhanced CT scan performed at 3, 6 and 12 months after surgery, showed no ureteral stricture along the anastomotic tract, perfect ureteric anastomosis and a decrease of hydronephrosis, confirmed at ultrasonography.

Conclusion: Retroperitoneal laparoscopic approach allows to identifying inferior vena cava and ureter faster, with less influence of abdominal organs. Our study showed a feasible and safe surgical approach in a large case series.

ABBREVIATIONS

IVC: Inferior Vena Cava; IVP: Intravenous Pyelography; CT: Computed Tomography; IQR: Interquartile Range

INTRODUCTION

Retrocaval ("circumcaval", "postcaval ureter") ureter is an uncommon venous anomaly in which the ureter runs posteriorly to the inferior vena cava (IVC). Since its first description by Hochstetter in 1893 [1], approximately 200 cases have been reported worldwide [2]. It is usually an asymptomatic condition although functional abnormality might manifest due to the obstruction of the ureter [3]. The incidence of retrocaval ureter is reported to be 1 in 1100 with a male to female predominance of 2.8:1 [4]. Retrocavalureter results from persistence of the posterior cardinal venous system that anomalously forms the Inferior Vena Cava (IVC), and subsequently courses anterior to the ureter for a variable distance. This can cause varying degrees of ureteral obstruction and surgical intervention is often necessary. Bateson and Atkinson distinguished two types of retrocaval ureters according to the radiological appearance and the site of the ureteral narrowing [5]: type I, in which the ureter crosses behind the IVC at the level of the L3 vertebra and exhibits an "S-shaped" deformity and type II in which the renal pelvis and the upper ureter lie horizontally. In the latter type, the retrocaval segment of the ureter is at the same level of the renal pelvis and it exhibits a "sickle shaped" deformity. A retrocaval ureter usually involves the right side; when present of the left side it is commonly associated with either a partial or a complete situs inversus or a duplication of IVC [6]. In 1994, Baba [7] introduced the first laparoscopic pyelopyelostomy for retrocaval ureter using a transperitoneal approach; later in 1999, Salomon performed the first retroperitoneal laparoscopic ureteroureterostomy [8]. The aim of our study was to explore the safety, feasibility and usefulness of retroperitoneoscopic surgery for retrocaval ureter performed in a single centre and to assess the short-terms outcomes of patients treated with this surgical approach.

MATERIALS AND METHODS

This was a retrospective single centre study of 27

consecutive patients who underwent retroperitoneoscopic ureteroureterostomy for retrocaval ureter in the Department of Urology of Chinese PLA General Hospital from April 2002 to September 2013. Data's were collected during a fellowship experience. All patients were counselled about the risks, benefits and alternative treatments for the condition; individual informed consent was obtained for this cohort. Preoperative evaluation, including medical history, physical examination and laboratory tests, was performed in all patients. All patients were evaluated preoperatively with renal ultrasonography, intravenous pyelography (IVP), and Contrast-enhanced Computed Tomography (CT) scan. The grading system for classification of hydronephrosis was used [9,10]. The Bateson and Atkinson Classification were used for recognising the type of retrocaval ureters [5]. Diagnosis of retrocaval ureter was made on IVP and/or retrograde pyelography and Contrast-enhanced CT scan, by demonstrating a typical S-shaped or sickle shaped deformity of the ureter associated with a moderate hydronephrosis and a dilated proximal ureter (Figure 1). Follow-up consisted in a clinical visit associated with renal ultrasound at 1 month and then in a clinical visit associated with Contrast-enhanced CT scan and renal ultrasound at 3, 6 and 12 months,. In case of a favorableevolution (symptom-free and significantdecrease of dilatation), follow-up (clinicalvisit and Contrast-enhanced CT scan) wasdoneannually for 5 yr.

The positioning of the patient, trocar placement and the preparation of the retroperitoneal space has been previously described [11-12]. Briefly, general anaesthesia is administered by tracheal cannulation. Figure 2 described the trocar placement and trocar positioning. The patients are placed in the left lateral decubitus position with overextension and a 2-cm vertical incision is made at the junction of the lower costal margin below the 12th rib in posterior axillary line (Figure 2a, point A). We use forceps to dissect the muscular layer and lumbo-dorsal fascia because it allows for less cutting of muscle without compromising the opening of the fascia. Retroperitoneal fat is dissected by index finger and 500-600 ml air is inflated into a balloon-dilator in order to create enough space to work in. Under the guidance of the index finger extending into the retroperitoneal space through the incision, a 12-mm trocar is inserted below the costal margin of 11th rib in the anterior axillary line (Figure 2a, point B). A 10-mm trocar is inserted 2 cm above the superior border of the iliac crest (Figure 2a, point C) in the mid-axillary line for a 30 degree camera and the carbon dioxide insufflator is connected to achieve the pneumoretroperitoneum (pressure range 12-15 mm Hg). Finally, the last 5-mm trocar is inserted at first incision (Figure 2a, point A). The skin incision is then sutured to avoid gas leakage. The final trocar placement is showed in Figure 2b. The retroperitoneal fat is dissected and the anatomic landmarks of retro-peritoneum are showed (Figure 3a). The Gerota's fascia is just in front of the surgeon and it can be identified very clearly even for operators with less retroperitoneoscopic surgery experience. The Gerota's fascia is incised longitudinally, allowing for a large space to work in. The perirenal fat is dissected by Ultracision Harmonic Scalpel (Ethicon Endo-Surgery, Johnson and Johnson, Cincinnati, OH, USA) in order to reveal the posterior surface of the middle and lower polar of the kidney (Figure 3b). The dilated renal pelvis and the upper ureter are fully mobilized using both blunt and sharp dissection. Following the proximal dilated ureter, IVC and distal ureter are identified. The gonadal vein is usually visible in this space, surrounded by fatty tissue. The upper ureter changes its course and passed behind the IVC. Care must be taken to avoid any injury of the surrounding vessels. The mobilization of the lower ureter should be good enough to facilitate tension-free ureteroureteral anastomosis (Figure 4 a-b). The upper ureter is transacted near the dilated ureter just behind the IVC (Figure 5a) and the retrocaval segment of the ureter is mobilized and transposed anterior to the IVC. Usually, the part of the lower ureter just behind the IVC, is very fragile and not suitable for anastomosis. It was spatulated longitudinally for about 1.5-2cm. The upper ureter is spatulated oppositely about 0.5cm longitudinally, to make sure of oblique anastomosis. The posterior wall of ureteroureteral anastomosis is made with a running suture, using 4-0 Vicryl suture (Ethicon Endo-Surgery, Inc., Johnson and Johnson, Cincinnati, OH, USA), of which every 2 sutures were coupled with a lock-stitch suture (Figure 5b). After the posterior wall is completed, the double-J ureteral stent is pushed into the distal ureter with a guide wire and then into the proximal ureter (Figure 5c). The anterior ureteroureteral anastomosis is then closed with interrupted suture (Figure 5d). Hemostasis is checked carefully after lowering the pressure of the pneumoretroperitoneum. A Jackson-Pratt drainage is finally placed through the port incision into the perinephric space adjacent to the repair.

Demographic data, pre, peri and post-operative information, including short-term follow-up were obtained from medical

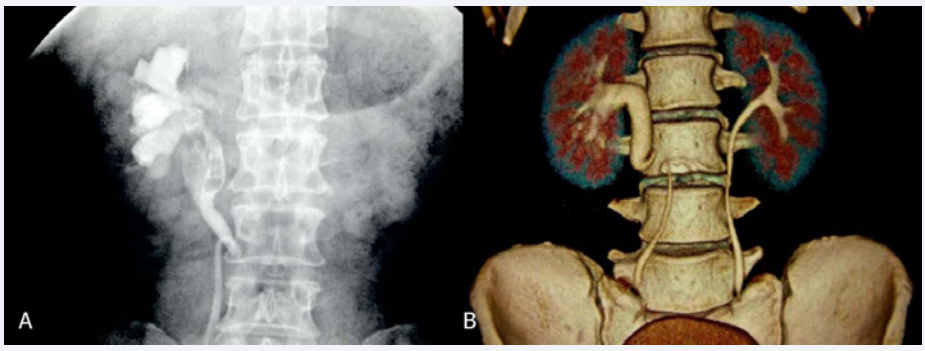

Figure 1 (a) Right side retrocaval ureter on IVP and (b) 3D computed tomography (CT) scan reconstruction with the typical S-shaped deformity.

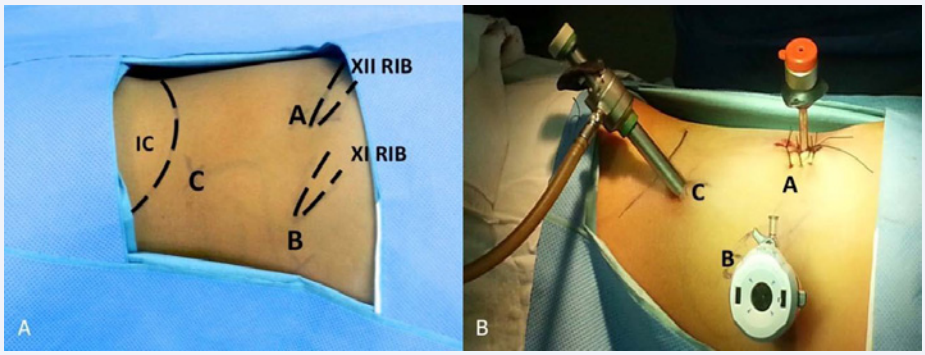

Figure 2 Trocar placement: (a) we can see the anatomic landmark for trocar placement: 12th (point A) and 11th (point B) ribs and iliac crest (IC) (point c). (b) trocar positioning: point A 5 mm trocar, point B 12 mm trocar and point C 10 mm trocar for the camera.

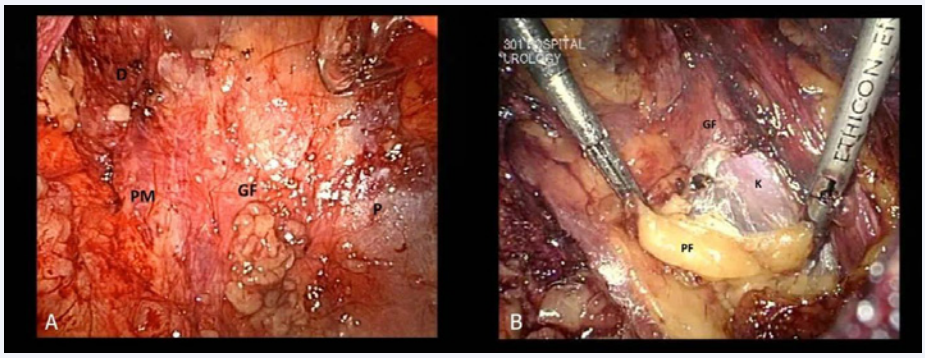

Figure 3 Anatomic landmark in retroperitoneal approach (a): in the center we can see the Gerota's fascia (GF), on the right side the peritoneum (P), on the left side the psoas muscle (PM) and the diaphragm (D). (b) Anatomic landmark after Gerota's fascia (GF) was opened: perirenal fat (PF) and right kidney (R).

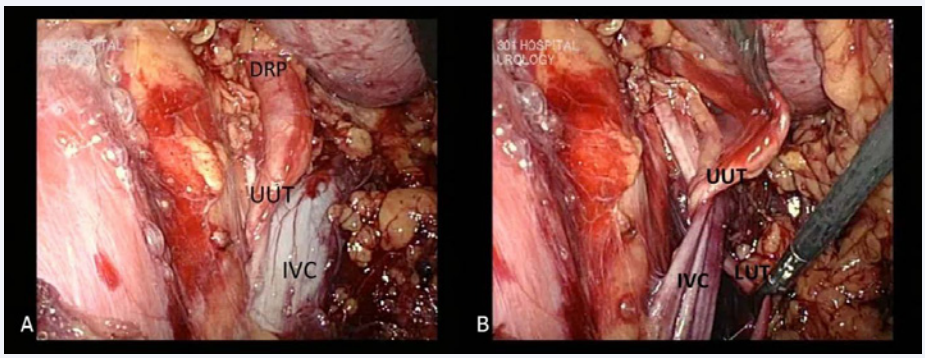

Figure 4 (a) Dilatated Renal Pelvis (DRP), Upper Ureter Tract (UUT) and Inferior Vena Cava (IVC); (b) the UUT and the Lower Ureter Tract (LUT) are mobilized and we can see the tract that pass behind the IVC.

records. Complications were classified according to the Clavien-Dindo classification [14]. Categorical variables were reported as frequencies (%) while continuous variables as median and inter quartile range (IQR). Treatment success was defined as the absence of stenosis, reduction of hydronephrosis and complete resolution of symptoms. Non-parametric Wilcoxon signed rank test was used to assess change in grade of hydronephrosis and symptoms resolution at 3, 6 and 12 after surgery. All statistical analysis were performed using SPSS v. 19 (IBM Corp., Armonk, NY, USA).

RESULTS AND DISCUSSION

27 patients underwent retroperitoneoscopic ureteroureterostomy for retrocaval ureter at our department between April 2002 and September 2013. Table 1 shows the pre, intra and postoperative patient's characteristics. The media age was 28 years (IQR 21-39). 74% was male (20 of 27) and 26% was female (7 of 27). The median BMI was 23.3 (IQR 21-24). The median ASA score was 1 (IQR 1-2) and the median Charlson comorbidity index (CCI) was 1 (IQR 0-2). 14.8% was

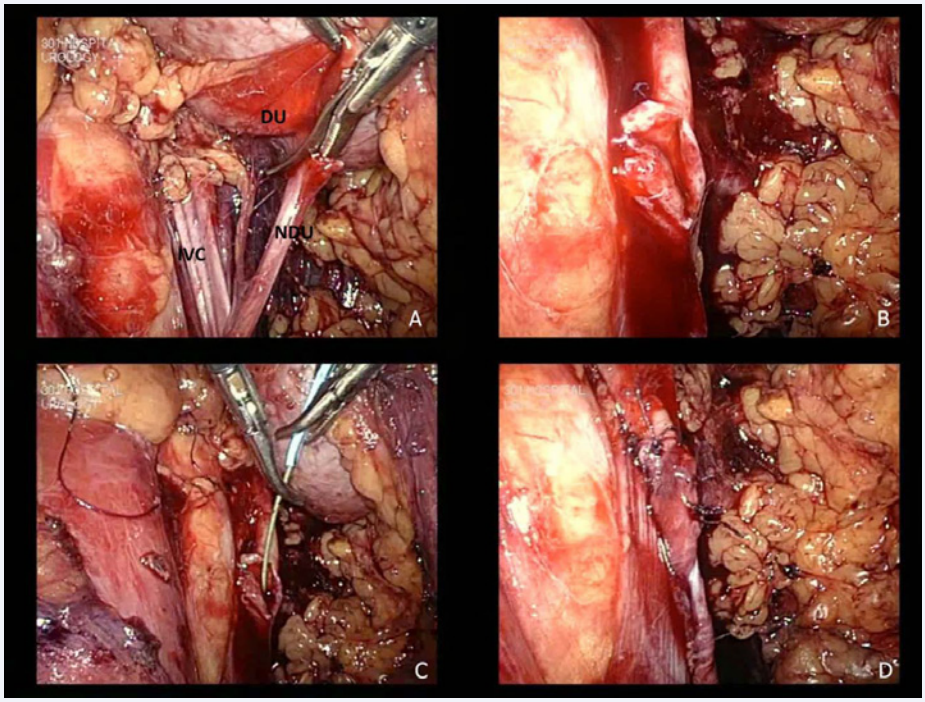

Figure 5 (a) the non dilatated ureter was transected near the dilated ureter (DU) just behind the IVC; (b) the posterior wall of ureteroureteral anastomosis was made with a running suture; (c) the double-J ureteral stent was pushed into the distal ureter with a guide wire, and then in the proximal ureter; (d) the anterior ureteroureteral anastomosis was closed with interrupted suture.

Table 1: Pre, peri and postoperativepatient'scharacteristics.

Variable	Value
Medianage, years (IQR)	28 (21-39)
Gender, no (%)	
Male	20 (74)
Female	7 (26)
Median BMI, kg/m2 (IQR)	23.3 (21-24)
Median ASA (IQR)	1(1-2)
Symptomspresentation, no (%)	
Asymptomatic	4 (14.8)
Flankpain	10 (37.1)
Hematuria	7 (25.9)
UTI	6 (22.2)
Side, no (%)	
Right	26 (96)
Left	1 (4)
Type of retrocavalureter, no (%)	
Type 1	27 (100)
Type 2	0 (0)
Median operative time, minutes (IQR)	131 (90-160)
Median EBL, ml (IQR)	28.5 (10-30)
Median hospital stay, days (IQR)	3.8 (3-4)
Mediandrainage time, days (IQR)	2.5 (2-3)
Earlypostoperativecomplications, no (%)	
Minor (grade 1-2)	4 (15)
Major (grade 3-4)	0 (0)

IQR: Interquartile Range; BMI: Body Mass Index; ASA: American Society of Anaesthesiologists; UTI: Urinary Tract Infections; EBL: Estimated Blood Loss.

asymptomatic (4 of 27), 25.9% (7 of 27) had hematuria, 37.1% (10 of 27) flank pain and 22.2% (6 of 27) urinary tract infections (UTI). The diagnosis was made with IVP, renal ultrasound and CT scan. The IVP and CT scan showed that 96% (26 of 27) had a right retrocaval ureter type 1 and 4% (1 of 27) a left retrocaval ureter type 1. This patient presented a situs viscerum inversus. The renal ultrasound showed that 7.4% (2 of 27) had a grade 1 SFU, 29.6 (8 of 27) grade 2 SFU, 37.1% (10 of 27) grade 3 SFU and 25.9% (7 of 27) grade 4 SFU. All procedures were laparoscopically completed with no open conversion. The median operative time was 131 minutes (IQR: 90-160), the median EBL was 28.5 ml (IQR: 10-30). 15% (4 of 27) had a grade 1 of early postoperative complications according with the Clavien-Dindo classification. The median drainage time was 2.5 days (IQR 2-3) and median hospitalitation 3.8 (IQR 3-4). The JJ-stent was removed 4-6 weeks after surgery. The Contrast-enhanced CT scan performed at 3, 6 and 12 months after surgery, showed no ureteral stricture along the anastomotic tract, perfect ureteric anastomosis and a decrease of hydronephrosis. The ultrasonography confirmed that the hydronephrosis decrease. Table 2 described change in hydronephrosis grade and symptoms resolution at 3, 6 and 12 months. After 3 months 3.7% (1 of 27) had no hydronephrosis, 3.7% (1 of 27) grade 1, 37% (10 of 27) grade 2, 33.3% (9 of 27) grade 3, 22.3% (6 of 27) grade 4 (p-value 0.045). In the clinical visit 81.5% (22 of 27) was symptoms-free (p-value <0.001). After 6 months 11.1% (3 of 27) had no hydronephrosis, 11.5% (5 of 27) grade 1, 37% (10 of 27) grade 2, 22.3% (6 of 27) grade 3 and 11.1% (3 of 27) grade 4 (p-value <0.001). In the clinical visit 88.9% (24 of 27) was asymptomatic (p-value <0.001). After 12 months 37% (10 of 27) had no hydronephrosis, 37% (10 of 27) grade 1, 14.8% (4 of 27) grade 2, 11.2% (3 of 27) grade 3. No

Table 2: Wilcoxonsignedranks test to evaluatechange in hydronephrosis grade and symptomresolutionat 3, 6 and 12 months.

Variable	Preoperative, no (%)	3 months, no (%)	6 months, no (%)	12 months, no (%)
No hydronephrosis	0 (0)	1 (3.7)	3 (11.1)	10 (37)
Grade 1	2 (7.4)	1 (3.7)	5 (11.5)	10 (37)
Grade 2	8 (29.6)	10 (37)	10 (37)	4 (14.8)
Grade 3	10 (37.1)	9 (33.3)	6 (22.3)	3 (11.2)
Grade 4	7 (25.9)	6 (22.3)	3 (11.1)	0(0)
p-value	-	0.046	< 0.001	< 0.001
Variable	Preoperative, no (%)	3 months, no (%)	6 months, no (%)	12 months, no (%)
Symptomatic	23 (85.2)	5 (18.5)	3 (11.1)	1 (3.7)
Symptoms-free	4 (14.8)	22 (81.5)	24 (88.9)	26 (96.3)
p-value	-	< 0.001	< 0.001	< 0.001

grade 4 were reported (p-value <0.001). After 12 months follow-up only 3.7% (1 of 27) was symptomatic (flank pain) (p-value <0.001).

CONCLUSION

The retrocaval ureter is a rare anatomical anomaly, which may become symptomatic in the third or fourth decade of life [15] with urinary tract infections, hematuria or urolithiasis [16]. This study described the biggest case series presented in literature. Only few study reported more than 10 cases [11,21-22]. We reported a predomince of male affected by this pathology (2.8:1) in a young population (median age 28 years). Recent improvements in imaging techniques and better accessibility to medical care are responsible for an earlier diagnosis and treatment of this anomaly. Patients with symptoms and/or with moderate to severe hydronephrosis resulting from ureteral obstruction are recommended to have surgical correction. In this report we made the diagnosis of retrocaval ureter with IVP and CT scan and we use the CT scan for follow-up period. One limitation of this study is that we did not perform diuretic renograms before and after surgery. Contrast-enhanced CT scan or magnetic resonance urography are probably the least invasive way to diagnose retro caval ureter, which demonstrates the anatomy of IVC and ureter clearly [3]. In several studies the follow-up was completed with IVP and/or CT scan [3-4,11,21-22,24]. In developing countries the Contrast-enhanced CT scan and magnetic resonance urography are less expansive for patients than renals can. In this study only 4patients were asymptomatic with a moderate grade of hydronephrosis at diagnosis. For this reason surgery was performed. In the era of mini-invasive surgery, laparoscopy represents an optimal choice for these patients. Laparoscopic magnification provides an excellent exposure of the surgical field, thus allowing an adequate dissection of ureter in situ. Both trans and retroperitoneal approaches have been reported by several authors for the treatment of this condition; furthermore, recent publications claimed the role of robotic surgery as a preferable approach for forretrocaval ureter [17,18]. However, robotic surgery is expensive and not accessible to everyone, especially in developing countries. We believe that retroperitoneal laparoscopy represents a more direct approach to the urinary tract. Retroperitoneoscopy requires little dissection without hindrance of intra-abdominal organs, and allows for a rapid and direct access to the renal pelvis and ureter [23]. The decision of to resect or to preserve the retrocaval segment of the ureter still is controversial. Some authors reported his experience without excision of retrocaval segment [2,21] with good post-operative results. We found that the segment of lower ureter just behind the IVC was usually very fragile and not suitable enough for anastomosis. Excision of the obstructing segment must be followed by a tension-free anastomosis. To facilitate a tension-free anastomosis, adequate dissection and mobilization of the ureter and periureteral tissue is required. The retrocaval segment could be easily freed from the vena cava laparoscopically. The greatest difficulty during the procedure lies in the intracorporeal uretero ureteral anatomosis. For uretero ureterostomy, in our limited experience, intracorporeal suturing and knotting require dexterity. Some surgeons complete all anastomosis using interrupted suture [8,21]. In our series, the posterior anastomosis was performed using continuous suture, of which every 2 sutures were coupled with a lock-stitch suture. This technique is good not only for saving operative time, but also for preventing anastomotic stenosis and leakage. Our results confirmed this theory. After 12 months 74% (20 of 27) presented no hydronephrosis or a grade 1 SFU and no anastomotic stenosis were reported. Furthermore, the higher strength of continuous suture in the posterior wall facilitated the insertion of the double-J stent and reduced the risk of avulsion. Most case reports describe prolonged operative times. In our series, the mean operating time was 131 minutes [90-160]. This can be explained by two reasons. First, our extensive experience with many retroperitoneoscopic procedures. Second, compared with transperitoneal approach, the retro-peritoneal approach provided rapid and direct access to the urinary tract and avoided mobilization of intraperitoneal organs or retraction of organs, suchas the liver. After the posterior wall is completed, the double-J ureteral stent is pushed into the distal ureter with a guide wire, and then into the proximal ureter. In the past years, we have introduced a method of two segments of 4F ureteral catheter passed into the double-J stent serving as the guide wires [11,12]. Recently, we found that one guide wire is good enough for stenting and it is associated with perioperative complications. This study has some limitations. The total number of patients was not sufficient; however, retrocaval ureter is a rare anomaly [19] and it is hard for us to meet them. Our center is an high volume center with more than 5000 cases year. In this study we revised 10 years of laparoscopic experience to select all the patients treated for retrocaval ureter.

This study is an update of our precedent report [11] to show the biggest case series of patients affected by this pathology described in literature [11,16,21,22]. Another limitation was that we not performed renal scan to study the renal function. The contrast-enhancend CT scan, the IVP and the symptoms presentation represent important factors to surgical decision. Patients with symptoms and/or with moderate to severe hydro nephrosis resulting from ureteral obstruction are recommended to have surgical correction. In this report were ported few post-operative complications, no reintervention, no conversion to open surgery and good results in terms of post-operative hydronephrosis. As the retrocavalis a rare anomaly, studies comparing our exeperience are limitated. Looking at literature, several studies or case reports shown intra and post-operative complications similar to our report [11,16,19]. Furthermore, it is limited by its retrospective and noncomparative design with transperitoneal approach. Since we started performing laparoscopic surgery, the retroperitoneoscopic approach has become the favoured technique in our institution and we use this technique for any kidney surgery case although modifications of the original techniques are usually undertaking among different surgeons and according to different disease [20]. Our opinions were similar to those of Gupta et al. [23], who believed that the retroperitoneoscopic approach was after, easier, and less time consuming, and it provided direct access to the ureter and IVC.

REFERENCES

1. Zhang XD, Hou SK, Zhu JH, Wang XF, Meng GD, Qu XK. Diagnosis and treatment of retrocaval ureter. Eur Urol. 1990; 18: 207-210.
2. Simforoosh N, Nouri-Mahdavi K, Tabibi A. Laparoscopic pyelopyelostomy for retrocaval ureter without excision of the retrocaval segment: first report of 6 cases. J Urol. 2006; 175: 2166-2169.
3. Uthappa MC, Anthony D, Allen C. Case report: retrocaval ureter: MR appearances. Br J Radiol. 2002; 75: 177-179.
4. Lautin EM, Haramati N, Frager D, Friedman AC, Gold K, Kurtz A, Self J. CT diagnosis of circumcaval ureter. AJR Am J Roentgenol. 1988; 150: 591-594.
5. Bateson EM, Atkinson D. Circumcaval ureter: a new classification. Clin Radiol. 1969; 20: 173-177.
6. Rubinstein I, Cavalcanti AG, Canalini AF, Freitas MA, Accioly PM. Left retrocaval ureter associated with inferior vena caval duplication. J Urol. 1999; 162: 1373-1374.
7. Baba S, Oya M, Miyahara M, Deguchi N, Tazaki H. Laparoscopic surgical correction of circumcaval ureter. Urology. 1994; 44: 122-126.
8. Salomon L, Hoznek A, Balian C, Gasman D, Chopin DK, Abbou CC. Retroperitoneal laparoscopy of a retrocaval ureter. BJU Int. 1999; 84: 181-182.
9. Venkatesan K, Green J, Shapiro SR, Steinhardt GF. Correlation of hydronephrosis index to society of fetal urology hydronephrosis scale. Adv Urol. 2009;.
10. Fernbach SK, Maizels M, Conway JJ. Ultrasound grading of hydronephrosis: introduction to the system used by the Society for Fetal Urology. Pediatr Radiol. 1993; 23: 478-480.
11. Li HZ, Ma X, Qi L, Shi TP, Wang BJ, Zhang X. Retroperitoneal laparoscopic ureteroureterostomy for retrocaval ureter: report of 10 cases and literature review. Urology. 2010; 76: 873-876.
12. Zhang X, Li HZ, Wang SG, Ma X, Zheng T, Fu B, et al. Retroperitoneal laparoscopic dismembered pyeloplasty: experience with 50 cases. Urology. 2005; 66: 514-517.
13. Nagraj HK, Kishore TA, Nagalakshmi S. Transperitoneal laparoscopic approach for retrocaval ureter. J Minim Access Surg. 2006; 2: 81-82.
14. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg. 2004; 240: 205-213.
15. Tobias-Machado M, Lasmar MT, Wroclawski ER. Retroperitoneoscopic surgery with extracorporeal uretero-ureteral anastomosis for treating retrocaval ureter. Int Braz J Urol. 2005; 31: 147-150.
16. Xu DF, Yao YC, Ren JZ, Liu YS, Gao Y, Che JP, et al. Retroperitoneal laparoscopic ureteroureterostomy for retrocaval ureter: report of 7 cases. Urology. 2009; 74: 1242-1245.
17. Smith KM, Shrivastava D, Ravish IR, Nerli RB, Shukla AR. Robot-assisted laparoscopic ureteroureterostomy for proximal ureteral obstructions in children. J Pediatr Urol. 2009; 5: 475-479.
18. Hemal AK, Nayyar R, Gupta NP, Dorairajan LN. Experience with robot assisted laparoscopic surgery for upper and lower benign and malignant ureteral pathologies. Urology. 2010; 76: 1387-1393.
19. Singh V, Sinha RJ. Laparoscopic dismembered pyeloplasty and pyelolithotomy in a patient with a retrocaval ureter: our experience and review of literature. Urol J. 2011; 8: 231-235.
20. Bachmann A, Ruszat R, Forster T, Eberli D, Zimmermann M, Müller A, et al. Retroperitoneoscopic pyeloplasty for ureteropelvic junction obstruction (UPJO): solving the technical difficulties. Eur Urol. 2006; 49: 264-272.
21. Chen Z, Chen X, Wu ZH, Luo YC, Li NN. Treatment of retrocaval ureter by retroperitoneal laparoscopic ureteroureterostomy: experience on 12 patients. J Laparoendosc Adv Surg Tech A. 2011; 21: 803-807.
22. Jiexiu Zhang, Bianjiang Liu, Ninghong Song, Lixin Hua, Zengjun Wang, et al. Retroperitoneal Laparoscopic Ureteroureterostomy for Retrocaval Ureter: A Report of 15 Cases. Surgical Practice. 2013.
23. Gupta NP, Hemal AK, Singh I, Khaitan A. Retroperitoneoscopic ureterolysis and reconstruction of retrocaval ureter. J Endourol. 2001; 15: 291-293.
24. Ameda K, Kakizaki H, Harabayashi T, Watarai Y, Nonomura K, Koyanagi T. Laparsocopic ureteroureterostomy for retrocaval ureter. Int J Urol. 2001; 8: 71-74.

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