

A descriptive study of experience of laparoscopic repair of retrocaval ureter in a tertiary care institute in Eastern India



Partha Protim Mondal¹, Purba Haldar², Amit Ray³, Malay Kumar Bera⁴

¹Assistant Professor, ⁴Professor, Department of Urology, Medical College Hospital, Kolkata, ²Associate Professor, Department of Anaesthesiology, Rampurhat Government Medical College, Birbhum, ³Associate Professor, Department of General Surgery, North Bengal Medical College, Darjeeling, West Bengal, India

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ABSTRACT

Background: Retrocaval ureter (RCU) is a rare congenital anomaly. It occurs due to anomalous development of inferior vena cava (IVC) and not ureter. Here, we describe our experience in surgical techniques and operative results of laparoscopic reconstruction for patients with RCU. **Aims and Objectives:** The aims of this study were to obtain information regarding clinical presentation, demographic profiles, investigations, indications for intervention, postoperative complications of laparoscopic repair of retrocaval repair, and also to develop laparoscopic surgical skill without causing any untoward effects to the patients. **Materials and Methods:** Twelve patients with RCU were enrolled in this study. The mean age was 32.4-years-old (23–37 years). All patients were preoperatively evaluated with different relevant imaging modalities. Laparoscopic surgery with transperitoneal approach with insertion of double-j stent was performed to all patients by same surgeon without excision of compressed ureter. Post-operative follow-up was done with ultrasonography every 3 months and repeat DTPA renogram every 6 months for 2.4 years. **Results:** All operations were completed laparoscopically without conversion to open surgery. There was no obstruction or symptom after the mean follow-up of 2.4 years. **Conclusion:** Transperitoneal laparoscopic repair is a feasible, safe, and effective modality of The treatment for RCU. Careful dissection along the planes with good respect to tissue and proper hemostasis during each step is the key to success for laparoscopic repair of RCU.

Key words: Hydronephrosis; Laparoscopic repair; Retrocaval ureter; Transperiton

INTRODUCTION

Retrocaval ureter (RCU), also known as circumcaval ureter, postcaval ureter or preureteral venacava, is a rare congenital anomaly with an approximate incidence of one in per 1000 live births,¹ with an overall incidence of about 0.006–0.17%.^{2–5} RCU occurs due to anomalous development of inferior vena cava (IVC) and not ureter. First, RCU is reported by Hochstetter in 1893.⁶ It is more common in males, with a male to female ratio between 3 and 4:1.⁷ Although it is a congenital anomaly, patients do not normally present with symptoms until the 3rd and 4th decades of life, from a resulting obstruction with its consequences such as pain, urinary tract infection,

haematuria, urolithiasis, and deterioration of renal function.^{3,8,9} It may be detected incidentally. The diagnosis of RCU is mainly made by excretory urography (intravenous urography [IVU] or CT urography). At present, magnetic resonance imaging may be the best single study to delineate the anatomy clearly and noninvasively. Ureter becomes retrocaval when either subcardinal vein or posterior cardinal vein forms IVC instead of supracardinal vein.¹⁰ Here, normal ureter becomes entrapped behind the IVC and right ureter encircles the IVC from behind. There are two types of RCU according to the classification scheme proposed by Bateson and Atkinson.¹¹ RCU may be associated with other anomalies mainly in the urogenital and cardiovascular systems. Some of the associated anomalies include

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Address for Correspondence:

Dr. Amit Ray, Associate Professor, Department of General Surgery, North Bengal Medical College, Darjeeling, West Bengal, India.

Mobile: +91-8910946785. **E-mail:** amitraydr@gmail.com

duplication of IVC, situs inversus, imperforate anus, esophageal atresia, myelomeningocele, renal agenesis, horse shoe kidney, ureteral duplication, congenital absence of vas deference, hypospadias, syndactyly, intestinal malrotation, VECTREL, and Turner's branchial arch or Goldenhar syndromes.¹² Surgical repair for RCU when indicated consists of dividing the ureter (preferably across the dilated portion), bringing the distal ureter from the behind the vena cava, and reanastomosing it to the proximal ureter. Open surgery is the gold standard for RCU. Development of laparoscopic instruments, techniques, surgical experiences, and surgical skills of urologists has permitted laparoscopic repair of RCU with equivalent results compared to open surgery. Laparoscopic repair of RCU is safe, effective, less invasive, and more cosmetic. The aim of this study is to obtain information regarding clinical presentation, demographic profiles, investigations, indications for intervention, post-operative complications of laparoscopic repair of retrocaval repair, and also to develop laparoscopic surgical skill in the management of RCU without causing any untoward effects to the patients.

Aims and objectives

The aims of this study were to obtain information regarding clinical presentation, demographic profiles, investigations, indications for intervention, postoperative complications of laparoscopic repair of retrocaval repair, and also to develop laparoscopic surgical skill without causing any untoward effects to the patients.

Ethical approval

The procedures followed were in accordance with the ethical standards of the responsible committee of the institution with addition of the approved study design in the title.

Statistical analysis

The study design was a descriptive and longitudinal study in a tertiary care institute in Eastern India. After compilation of all the collected data, analysis was done using Statistical Package for the Social Sciences, version 20 (IBM, Chicago, USA). Categorical variables are expressed as number of patients, mean age, sex-ratio, and range of amount of blood loss. The mean hospital stay in terms of days and mean post-operative serum creatinine level was also measured.

MATERIALS AND METHODS

The study process began after obtaining consent from the Institutional Ethics Board. Between April 2018 and September 2020, 12 patients (eight males and four females) who underwent laparoscopic repair with the diagnosis of RCU in our department were included into the study. Informed consent was taken from every patient or from

the accompanying relative before commencement of study. Inclusion criteria are all patients with RCU attending in our department without any other significant comorbidity and had consented for inclusion in this study. Exclusion criteria are patients with other significant comorbidities not fit for surgery and not consented for the study. All operations were performed by same surgeon experienced in laparoscopic urologic surgery. The mean age of eight males and four females was 32.4 years old (23–37 years). Male female ratio was 2:1. Patients had intermittent moderate right side flank pain for varied periods of times. None had developed episodes of fever and pyonephrosis. All had serum creatinine levels within normal range 0.7–1.3 mg/dl. Patients underwent investigations protocol in the form of ultrasonography followed by contrast-enhanced computed tomography with digital 3D reconstruction and IVU. All had moderate hydronephrosis with upper hydroureter. In CT, delayed films were taken in these patients to evaluate for the course of ureter. All of them had an RCU with segment traversing downward and crossing the IVC at L3-L4 vertebral level. All patient demonstrated Type I of RCU, according to the classification scheme proposed by Bateson and Atkinson 11. After CT diagnosis of RCU, patients underwent ^{99m}Tc-DTPA renogram. All had obstructed drainage on diuretic renogram with t_{1/2} more than 20 min and glomerular filtration rate varied from 19.6 to 32.2 ml/min. Laparoscopic surgery was performed by transperitoneal approach by same surgeon. Patients were followed up by ultrasonography after 3 and 6 months and thereafter yearly or if symptomatic. Repeat diuretic renogram scan or IVU or CT scan was done 6 months after surgery.

Surgical technique

Operations were performed under general anesthesia with endotracheal intubation. Antibiotic prophylaxis was given to all patients. Patients were firstly placed in the lithotomy position, cystoscopy and retrograde pyelography were performed to confirm the diagnosis and evaluation of lower ureter, followed by placement of 6 Fr ureteric catheter just below the level of kink. The lower end of the catheter was kept in a sterile field. After endoscopic evaluation, patients were placed in the left lateral decubitus position at 45° angles for transperitoneal laparoscopic approach. Once pneumoperitoneum was created, a 10 mm port was placed in the semilunar line just above the umbilicus level on the lateral rectus border. A 5 mm port was placed subcostally in midclavicular line and another 5 mm on the spinoumbilical line midway. Optional 5 mm port below xiphisternum was placed for retraction of liver. After mobilization of the colon, ureter was traced near ureteropelvic junction and dissected lower down till the lateral aspect of IVC and from the level of iliac vessels to the interaortocaval region (Figure 1). Then, the proximal ureter was transected at

the point where it went retrocaval (Figure 2). The lower end was dissected out from the posterior aspect of IVC. Thus, the ureter ends were brought anterior to vena cava. Utmost care was taken to preserve the vascularity of ureter. The segment was inspected for patency and vascularity. If an obliterated segment was detected, it was excised till to the healthy margin. As the dilated ureter above had adequate length because of tortuosity, both the segments could be approximated without undue tension. The renal pelvis or the dilated upper ureter and the lower ureter were reanastomosed with running 4-0 polyglactin suture in a normal anatomic position. Having in consideration the probable risk of ureteral stenosis, suturing was done anterior and posteriorly with two separate stiches. After posterior wall anastomosis was completed, the double-J stent was inserted antegradely (Figure 3). Abdominal drain was placed through one of the lateral port and was removed when drain output was <30 ml/day. Patients were discharged with per urethral catheter on day 3 which was subsequently removed on the day 7 after ruling out any urinary leak. Double-J stent was removed after 6 weeks.

RESULTS

All operations were completed laparoscopically without conversion to open surgery. Mean operative time was 172.4 min. Blood loss varied from 40 to 110 ml. No operative complications were encountered. None developed urinary leak postoperatively. Mean time for hospital stay was 4.3 days. None of the patients had significant symptoms related to stent placement. After removing the stent, patients were followed clinically and by ultrasound every 3 months. All patients were asymptomatic on follow-up. Ultrasound was suggestive of resolution of hydronephrosis in all. Drainage was unobstructed in follow-up DTPA renal scan. The mean post-operative

serum creatinine was 0.83 mg/dl (range, 0.52–1.2). There were no long-term complications after the mean follow-up of 2.4 years.

DISCUSSION

The RCU is a rare congenital anomaly that causes external compression of the proximal ureter and usually becomes symptomatic in the 3rd or 4th decade of life. The incidence rate is approximately one in 1000 or 1500 autopsies. However, the developing of this clinical entity is due to a vascular malformation, making the designation preureteric vena cava more embryologically accurate. Several theories tried to explain this condition. The one described by Schulman in 1997, which states the persistence of the subcardinal vein as IVC, seems to be the most accepted one.¹³ Others suggest the persistence of the posterior cardinal veins developing the IVC. Regardless of the theory,

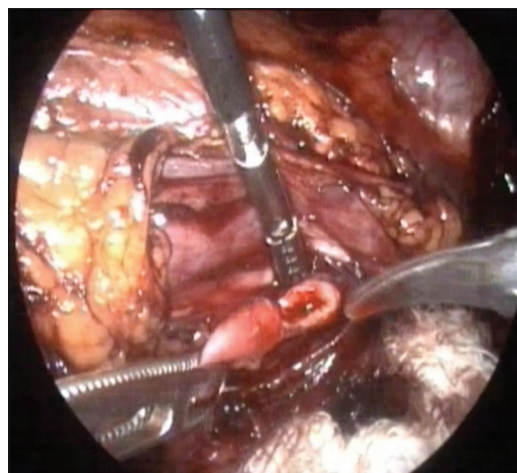


Figure 2: Proximal ureter was transected using cold scissor at the point where it went retrocaval

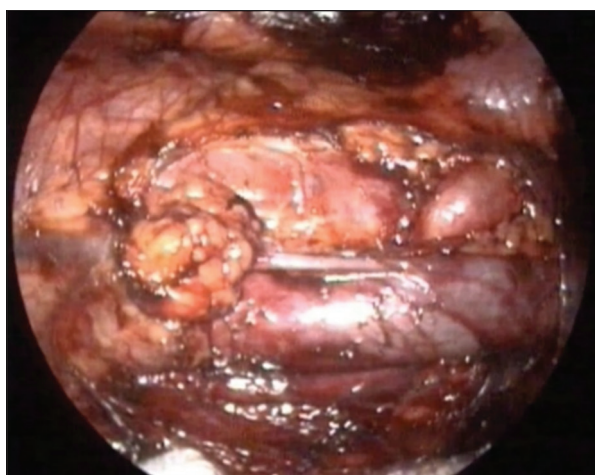


Figure 1: Dilated renal pelvis, proximal ureter, and retrocaval portion of ureter dissected and mobilized

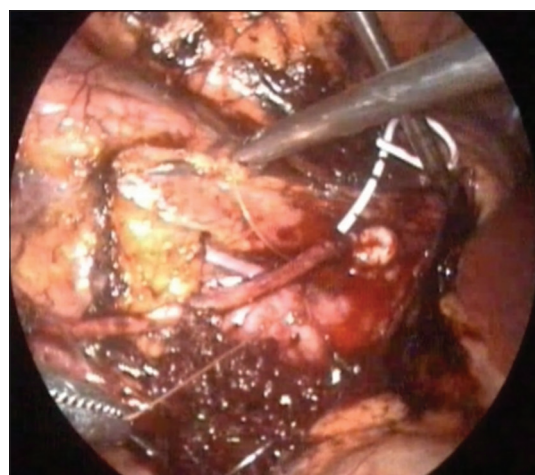


Figure 3: After posterior wall anastomosis was completed, the double-J stent was inserted antegradely. Completion of anterior wall anastomosis with interrupted 4-0 vicryl

we find that the failure of the supracardinal vein to persist as IVC is a common to all. Because of the pathogenesis, it usually occurs on the right side. Bateson and Atkinson classified RCU radiologically into two types, Type 1 and Type 2. Type I has the typical S-shaped, “fish hook,” or “Shepherd crook” deformity and associated with extreme medial deviation in 50% of the cases at the level of third lumbar segment and moderate-to-severe hydronephrosis (Figure 4). The main causes of hydronephrosis are compression by the psoas muscle, spinal column, and IVC itself. This type accounts for most of the symptomatic cases. Type II associated with a more gentle curve appearing as J-shaped or “sickle-”shaped deformity with mild medial deviation at the level of renal pelvis; with mild or no hydronephrosis in 10% of the cases and most are asymptomatic. Another classification scheme uses the level of obstruction in which Type 1 is at the level of third lumbar vertebra and Type II crosses at the level of ureteropelvic junction (Figure 5). RCU has been associated with different anatomical abnormalities in 21% of cases.¹⁴

Abdominal ultrasound demonstrates hydronephrosis. Medial deviation of the upper ureter on ultrasonography may suggest this diagnosis, but this depends on the degree of distension and should be confirmed by other imaging modalities. IVU usually does not demonstrate the middle and distal ureter. Spiral CT scan is considered the investigation of choice compared to IVU because it can delineate both the ureter and IVC. MRI may be better than the CT scan as it can delineate the course of the entire ureter and it is not associated with exposure to radiation as compared to IVU or CT. Diuretic renography with diethylenetriaminepentaacetic acid or mercaptoacetyltriglycine can be assess the level of obstruction and determine the best therapeutic modality. The diagnosis of RCU must be confirmed preoperatively with an intra-operative retrograde pyelography.

The surgical treatment of the RCU is indicated in the evidence of signs or symptoms of obstruction.¹⁵ For the treatment of this condition, classical open pyeloplasty techniques had been the gold standard for many years.¹⁶ The first successful open dismembered pyeloplasty, published by Anderson and Hynes in 1949, was performed on a RCU.¹⁷ The first laparoscopic reconstruction of RCU was performed in 1994 by Baba et al.¹⁸ That operation took 9.3 h with 2.5 h for anastomosis. With time, improvements in techniques of hemostasis, availability of newer energy sources, the experience, and the lessons learned with other laparoscopic procedures, especially when involving intracorporeal suturing technique, opened way for the standardization of the laparoscopic approach for RCU all over the world.¹⁹ Laparoscopic approach through transperitoneal or retroperitoneal route²⁰ is less invasive and

associated with less morbidity, less post-operative pain, early recovery, short hospital stay, and cosmetically acceptable scar. Patients who are treated generally have an uneventful course and an excellent prognosis, as observed in our cases. Ricciardulli et al.,²¹ have described vast experience of retroperitoneal laparoscopic approach in 27 cases of RCU. In this, operative time is reduced as there is no need for colon mobilization and liver retraction. One can get early access to urinary tract. They have mean operative time of 131 min in 27 cases. Proponents of transperitoneal approach say that in transperitoneal space, there is more working space and ease of intracorporeal suturing.²² In comparison, there is a risk of hemorrhage during the creation of working space in case of retroperitoneoscopy. Ding et al.,²³ commented that urologist is more familiar with transperitoneal approach and urine leak can be contained if peritoneum and Gerota’s fascia are reapproximated after



Figure 4: Intravenous urography images showing the typical Type I retrocaval ureter; moderate hydronephrosis, dilatation of the proximal ureter with sharp upward curving (“S” shape or “fish hook” deformity) of proximal ureter and abrupt termination of contrast in the ureter at the level of L3 with non-visualization of the distal ureter

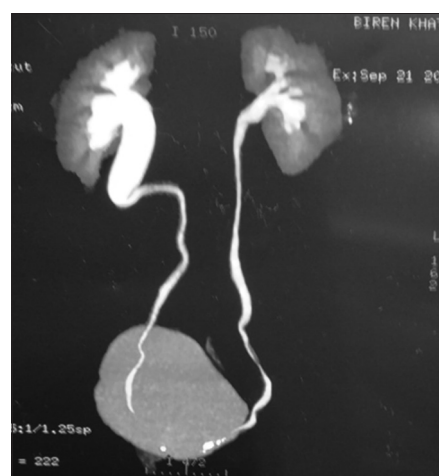


Figure 5: Computed tomography urography images show Type I retrocaval ureter

the procedure and fourth port is generally not required. Fidalgo et al., described the technique of suspending the pelvis with monofilament suture from abdominal wall for the ease of suturing eliminating the need of extra hand.²⁴ Fidalgo N et al., used RGP followed by double-J stenting on the table for better dissection of ureter which also ensured patency of ureter on the table. Excision of retrocaval segment is unnecessary unless found atretic on table. Regarding the excision of retrocaval portion Nayak B et al., for the 1st time demonstrated that retrocaval segment may not be excised without compromising on long-term patency rates. After that, multiple studies have omitted excision of retrocaval portion.²⁵ Regarding the anastomosis type, either pyeloplasty^{22,24} or pyelo-ureterostomy¹ or ureter-ureterostomy^{23,24} can be performed. All have shown good results in follow-up.

Limitations of the study

The study was performed in a single center with twelve patients over a period of twenty nine months. It would be better if it was a multicentric one with bigger sample size over a longer period of follow up.

CONCLUSION

A RCU is a rare anomaly and needs a high index of suspicion to be detected early in life. In our study, complications rates are lower because the anastomosis is done at the level of the renal pelvis. Careful dissection along the planes with good tissue respect and good hemostasis during each step is the basic principles, followed in each case which is the key to success for RCU repair by minimally invasive approach. Transperitoneal or retroperitoneal approach can be considered equivalent, as parameters such as operative time, hospital stay, and results are comparable for these modalities. We preferred transperitoneal approach as it provides good working space for intracorporeal suturing.

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Authors Contribution:

PPM- Concept of the study, study design, and prepared the first draft of the study; **PH**- Interpreted the results, manuscript preparation, and statistical analysis; **AR**- Concept, study design, coordination, review of the literature, and interpretation; and **MKB**- Concept, revision of manuscript, and analysis

Work attributed to:

Medical College Hospital, Kolkata, West Bengal, India

Orcid ID:

Dr. Partha Protim Mondal - <https://orcid.org/0000-0001-9971-6698>

Dr. Purba Halder - <https://orcid.org/0000-0003-2308-4959>

Dr. Amit Ray - <https://orcid.org/0000-0001-8548-1306>

Dr Malay Kumar Bera - <https://orcid.org/0000-0001-5973-3979>

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