A Comparative Study of Laparoscopic and Open Surgical Techniques in the Management of Retrocaval Ureter at a Tertiary Referral Centre

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Abstract

Aim: To compare laparoscopic and open surgical techniques in the management of retrocaval ureter.

Material and Methods: A retrospective review of all patients who underwent surgical correction of retrocaval ureter between January 2007 and February 2018 was performed. Open technique and laparoscopic technique were compared in regard to demographic characteristics, operative data, recovery parameters and outcome.

Results: 20 patients were included in the study with 11 in open group and 9 in laparoscopic group. There was no statistically significant difference between the groups regarding mean estimated blood loss, 57 ± 27.50 in open vs. 35 ± 11 ml in lap, p >0.5. The mean operative time was longer in lap group, 112.77 ± 25.98, min vs. 91.5 ± 26.03 min in open group, p <0.5. Mean hospital stay was longer in open group 5.6 ± 1.71days compared to lap group 3.22 ± 0.44days, p<0.5. The laparoscopically treated patients demonstrated significantly lower analgesic requirements compared to open group. One patient in lap group had ureteric stricture that was corrected by balloon dilatation.

Conclusion: Retrocaval ureter can be managed by laparoscopic techniques with similar postoperative outcome and better cosmesis, faster recovery and shortened hospital stay, as compared to open procedure.

Keywords

Retrocaval ureter; Laparoscopic; Open; Ureteroureterostomy; Outcome

Introduction

Obstruction of the ureter has been described in association with an anomalous course posterior, medial, anterior, and finally lateral to the Inferior Vena Cava (IVC) [1]. This course may lead to extrinsic obstruction of the ureter. Although commonly referred to as circumcaval or retrocaval ureter, a more appropriate term may be preureteral vena cava as it is due to a congenital abnormality in development of the vena cava. The prevailing theory of the development of this anomaly is that the subcardinal vein persists
as the infrarenal IVC, thus crossing anterior to the midportion of the ureter and resulting in its circumcaval course [2]. Others have suggested that the persistence of the posterior cardinal vein as the infrarenal cava is responsible for this anomaly. However, failure of the supracardinal vein to develop into the infrarenal IVC is common to both theories [3]. The reported incidence of circumcaval ureter is approximately 1 in 1100. There is a 2.8 fold male predominance [4]. Symptomatic patients typically present in the third or fourth decade of life [5]. This vascular anomaly is not always associated with ureteral obstruction [6]. Abdominal and flank pain, recurrent urinary tract infection, and hypertension are some of the initial symptoms and signs. A number of cases are now discovered on imaging studies performed to evaluate patients with nonurologic problems [7]. The diagnosis can be confirmed with Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). Diuretic renography is used to confirm the presence and determine the functional impact of obstruction.

The standard repair of retrocaval ureter is ureteroureterostomy. This has been performed by open, laparoscopic, and retroperitoneoscopic approaches and is best dictated by the surgeon’s experience. Retrocaval ureter has been managed successfully with the laparoscopic approach in the clinical setting as shown by a series of sporadic case reports in recent years [8].

Either a transperitoneal or a retroperitoneal approach may be used laparoscopically. The overall clinical results of the laparoscopic repair in the literature have been favorable, providing minimal postoperative patient morbidity, short convalescence, and anastomotic patency on short-term radiographic follow-up. The main limiting factor for both the transabdominal and the retroperitoneal laparoscopic repair of the retrocaval ureter was the intracorporeal anastomosis of the ureter that significantly increased the surgical time. With increasing experience in intracorporeal suturing, operative time has been minimized. The aim of this study was to compare laparoscopic and open surgical techniques in the management of retrocaval ureter.

**Material and Methods**

This was a retrospective study of all patients diagnosed with retrocaval ureter from January 2007 to February 2018 at our institute. Total of 21 patients were diagnosed with this rare anomaly. The decision of open and laparoscopic approach was done on the basis of patient preference. 20 of these patients had radiological evidence of retrocaval ureter on Intravenous Urography (IVU)/CT urography and obstruction demonstrated on diuretic renography (Figure 1). Out of 20 patients 11 underwent open ureteroureterostomy and 9 were corrected by transperitoneal laparoscopic surgery. All the patients were operating by single surgeon. 1 patient was asymptomatic and had normal drainage on DTPA renal scintigraphy and is doing well in follow-up without any symptom and hence not operated and was kept on regular follow-up.

![Figure 1: IVU and CT Urography of a patient with Retrocaval Ureter.](image1)

![Figure 2: Open Ureteroureterostomy.](image2)
Presentation was flank pain, recurrent urinary tract infection and three were diagnosed incidentally when being evaluated for other complaints. The open ureteroureterostomy was performed through right subcostal flank approach. After identifying the ureter, it was dissected proximally and distally. The ureter was divided proximally and transposed anterior to vena cava. The narrow segment was excised and ureteroureterostomy was done after spatulating the two ends over the 5 F double J stent (Figure 2).

The laparoscopic repair was performed through transperitoneal approach. After establishing the pneumoperitoneum with open method three ports were place. 10 mm camera port at the umbilicus, 10 mm port at right midclavicular line below the costal margin and another 5 mm port was placed at middle of right spinoumbilical line. Colon was mobilized medially and ureter identified. Ureter was divided proximally and the transposed anterior to IVC, ureteroureterostomy was performed after spatulating the ureter over the 5F DJ stent (Figure 3).

The DJ stent was removed after 4 weeks. IVU and DTPA scan was performed after 3 months from surgery to see the outcome. The operative time, blood loss, analgesic requirement, perioperative complications, hospital stay were compared. Patients were given paracetamol infusion for first 24 hours and then oral combination of paracetamol and diclofenac. The success was defined as radiologically patent, unobstructed upper ureter with improved or maintained renal function on DTPA scan. Formal chart review was completed with all perioperative data completed and statistical analysis was done by fischers exact test and unpaired t-test.

**Results**

There was no difference between the two groups regarding patient demographics. The mean age of presentation was 29.6 ± 7.34 years in open group and 31.22 ± 8.36 years in lap group. The preoperative characteristics of patients are shown in Table 1.

There was no statistically significant difference between the groups regarding mean estimated blood loss, 57 ± 27.50 [range: 30–90] ml in open vs. 35 ± 11.72 [range: 20–60] ml in lap, p > 0.5. The mean operative time was longer in lap group, 112.77 ± 25.98, [range: 90–160 min] vs. 91.5 ± 26.03 [range: 60–130] min in open group, p value < 0.5. Mean hospital stay was longer in open group (5.6 ± 1.71 [range: 4–9 days] compared to lap group 3.22 ± 0.44 [range: 3–4] days), p value < 0.5. The drain was removed on average postoperative day 2±0.33 (range 2-3) in lap group and 4.6±1.73 (range 3-6) in open group, p value < 0.5. The analgesic requirement was more in open group (5.1± 1.21 days) compared to laparoscopic group (3.11 ± 0.51 days), p value < 0.5. Three patients in open group had wound infection; two of them required secondary suturing (clavien grade 3a). Four patients in open group and two in lap group had fever in postoperative period that responded to conservative means (clavien grade 2). One patient in lap group had ureteric stricture detected on follow-up after 6 months of surgery that was corrected by balloon. None of the patient in laparoscopic group required conversion to open. Comparison of perioperative and postoperative data are shown in Table 2.

### Table 1: Preoperative patient characteristics.

<table>
<thead>
<tr>
<th>Patient profile</th>
<th>Open group</th>
<th>Laparoscopic group</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Age (Mean±SD)</td>
<td>29.6 ± 7.34 years</td>
<td>31.22 ± 8.36 years</td>
</tr>
<tr>
<td>Sex(M:F)</td>
<td>8:3</td>
<td>6:3</td>
</tr>
<tr>
<td>Symptomatic/Incidental</td>
<td>9/2</td>
<td>8/1</td>
</tr>
<tr>
<td>Preoperative imaging</td>
<td>IVU/CT urography and Tc⁹⁹ DTPA scan</td>
<td>IVU/CT urography and Tc⁹⁹ DTPA scan</td>
</tr>
</tbody>
</table>

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Retrocaval ureter is a rare congenital urologic anomaly. It occurs as a consequence of the persistence of the posterior cardinal veins during embryologic development [9]. Today, a definitive diagnosis can be made noninvasively utilizing three-dimensional CT. Procedural intervention is indicated in the presence of functionally significant obstruction leading to pain or renal function deterioration. The first observed case of retrocaval ureter was described by Hochstetter in 1893 [10]. The anomaly predominantly involves the right ureter and in our study, all retrocaval ureter were on right side. If it involves the left ureter then it is usually associated with either partial or complete situs inversus or duplication of the Inferior Vena Cava (IVC). A total of 20% of cases of retrocaval ureter present with concomitant anomalies, mainly from cardiovascular system and genitourinary tract. Associated anomalies are right double inferior cava, ipsilateral ureterocele, glandular hypospadias, supernumerary lumbar vertebrae, Syndactyilia, Partialisitusinversus and Vesicoureteric Reflux (VUR) [11]. In our study, none of the patient had associated anomaly.

Circumcaval ureter has been classified using different parameters based on IVU or retrograde pyelographic findings. Bateson and Atkinson (1969) classified a ureter with an S-shaped, fish hook, or shepherd’s crook appearance as type-I. The ureter typically overlies or is medial to the lower lumbar vertebral processes and eventually crosses anterior to the iliac vessels, where it then assumes a normal distal course in this setting. A less angulated “sickle-shaped” ureteral deformity is classified as type-II. The point of maximal obstruction in type-I is lateral to the lateral margin of the IVC and is associated with a greater degree of hydronephrosis than type-II, in which the point of obstruction is at the lateral border of the IVC [12].

The classical treatment for retrocaval ureter consists of separating the ureter, re-anastomosing its stumps and replacing the ureter in its usual position while maintaining its patency. The open ureteroureterostomy remained the gold standard surgical approach to treat the retrocaval ureter for many years. Matsuda et al first performed the laparoscopic ureteroureterostomy for a retrocaval ureter in 7.5 hours using five laparoscopic ports [13]. The main limiting factor for both the transabdominal and the retroperitoneal laparoscopic repair of the retrocaval ureter, was the intracorporeal anastomosis of the ureter that significantly increased the surgical time. Simforoosh et al reported a series of 6 cases of retrocaval ureter that were successfully treated with a transperitoneal laparoscopic approach. Mean operative duration was 180 minutes (range 150 to 210) and patients were discharged home at a mean of 4 days (range 3 to 5) [14]. Ding et al reported the largest series of transperitoneal approach in 2012. Nine patients underwent pure laparoscopic pyelopyelostomy or ureteroureterostomy. The mean operative time was 135 minutes (range, 70–250 minutes). No intraoperative complications or significant bleeding occurred [15]. Operative time in our study was 112.77 ± 25.98 minutes, which is less than most of the previous studies. We had used 3-4 ports and transperitoneal approach was used. Large space in transperitoneal approach makes suturing easy compared to retroperitoneal approach. With increasing experience in intracorporeal suturing, operative time has been minimized. Our study demonstrates that laparoscopic ureteroureterostomy may be safely and effectively performed in a reasonable operative time, with return to normal activity within short span of time compared to open approach. Comparisons between historical reports about open surgery and laparoscopic surgery for retrocaval ureter have clearly shown the advantages of minimally invasive approaches like less intraoperative bleeding, a shorter post-operative hospital stay,

### Table 2: Comparison of Perioperative and Postoperative Data in Two Groups.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Open group</th>
<th>Laparoscopic group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time (mean ± SD)</td>
<td>91.5 ± 26.03 min.</td>
<td>112.77 ± 25.98 min.</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Estimated blood loss (ml)</td>
<td>57 ± 27.5 ml</td>
<td>35 ± 11.72 ml</td>
<td>&gt;0.5</td>
</tr>
<tr>
<td>Analgesic requirement (Days)</td>
<td>5.1 ± 1.21 days</td>
<td>3.11 ± 0.51 days</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Drain removal</td>
<td>4.6 ± 1.73</td>
<td>2 ± 0.33</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Early Complications</td>
<td>Fever (clavien grade 2)-4 patients</td>
<td>Fever (clavien grade 2)-2 patients</td>
<td></td>
</tr>
<tr>
<td>Late complications</td>
<td>Wound infection-3 patients</td>
<td>Wound infection-none</td>
<td></td>
</tr>
<tr>
<td>Hospital stay</td>
<td>5.6 ± 1.71 days</td>
<td>3.22 ± 0.44</td>
<td>&lt;0.5</td>
</tr>
</tbody>
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reduced postoperative pain, earlier return to daily activities and a significant superior aesthetic effect, while preserving therapeutic efficacy. In our study all nine patients operated by laparoscopic approach had an uneventful recovery without any major complication. All patients operated by laparoscopic approach were asymptomatic in postoperative follow-up with imaging showing correction of obstruction. Only one patient developed stricture at anastomotic site that was rectified by non-cutting high pressure balloon dilatation insufflated up to 12 am for 7 minutes and the ureter was stented for 6 weeks. Follow-up scan was done 6 weeks after stent removal revealed normal drainage. The possible cause of stricture may be inadequate speculation of ureter.

Conclusion

Certainly our series is large, and knowing the advantages of laparoscopy as a minimally invasive technique with less bleeding, less drug requirement, and short hospital stay while performing various procedures for different diseases in urology, it should be proposed as a first-line treatment for retrocaval ureter. The choice of transperitoneal or retroperitoneal approach depends on the preferences of the surgeon.

Protocol/ Project Development: SA Para
Data Collection/ Management: SA Wani and SA Para
Data Analysis: SA Malik and SA Wani
Manuscript Writing/Editing: SA Wani

Conflict of Interest

The authors declare that they have no conflict of interest.

Informed consent was obtained from all individual participants included in the study.

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References