Original Article

Large proximal ureteral stones: Ideal treatment modality?

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Abstract

Background and Purpose: Ideal treatment modality for patients with large impacted proximal ureteral stone remains controversial. We compared laparoscopic transperitoneal ureterolithotomy (Lap-TPUL) and semirigid ureteroscopy for large proximal ureteric stones to evaluate their efficacy and safety.

Patients and Methods: From November 2012 to December 2014, we enrolled 122 patients with large (≥1.5 cm) proximal ureteral stone in the study. Patients were randomly divided into two groups: Group A (60 patients), retrograde ureteroscopic lithotripsy using a semirigid ureteroscope; Group B (62 patients), transperitoneal LU (Lap-TPUL).

Results: The overall stone-free rate was 71.6% and 93.5% for Group A and Group B respectively ($P = 0.008$). Auxiliary procedure rate was higher in Group A than in Group B (27.3% vs. 5.6%). The complication rate was 11.2% in Group B versus 25% in Group A. Mean procedure time was higher in laparoscopy group as compared to ureterorenoscopy (URS) groups (84.07 ± 16.80 vs. 62.82 ± 12.71 min). Hospital stay was 4.16 ± 0.67 days in laparoscopy group and 1.18 ± 0.38 days in URS group ($P < 0.0001$).

Conclusion: Laparoscopic transperitoneal ureterolithotomy is a minimally invasive, safe and effective treatment modality and should be recommended to all patients of impacted large proximal stones, which are not amenable to URS or extracorporeal shock-wave lithotripsy or as a primary modality of choice especially if patient is otherwise candidate for open surgery.

Key Words: Laparoscopic ureterolithotomy, ureteral stone, ureterorenoscopy

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INTRODUCTION

Ever since the introduction of shock-wave lithotripsy (SWL), technical advancements in endoscopic approaches, including ureterorenoscopy (URS) and percutaneous nephrolithotomy (PCNL), surgical management of urinary stone disease has been revolutionized from an open approach to a minimally invasive one.

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With the technical advancements in extracorporeal lithotripters, flexible ureteroscopes, and miniature semirigid ureteroscopy along with holmium laser, most of the upper ureteral stones can be managed with a minimally invasive approach with the excellent surgical outcome. However, large ureteral stones are a challenge to minimally invasive techniques. The optimal management of large proximal ureteral stones (>15 mm) is yet to be defined.

PATIENTS AND METHODS

From November 2012 to December 2014, 122 patients (age 15–60 years) with a single large radio-opaque proximal ureteral stone (≥15 mm in the greatest dimension) were included in the study. Patients were randomly divided into two groups: Group A (60 patients), retrograde ureteroscopic lithotripsy (URS) using a semirigid ureteroscope; Group B

(62 patients), transperitoneal laparoscopic ureterolithotomy (Lap-TPUL).

Institutional ethical committee approval was taken prior to the commencement of the study. Written and informed consent were taken from the patients. The upper ureter was defined as the segment of ureter between the pelviureteric junction and the upper border of the sacroiliac joint.

Patients with previous history of renal/ureteric surgery, congenital genitourinary anomaly, active urinary tract infections (UTI) and pregnant patients, radiolucent calculus, bleeding disorders and deranged renal parameters were excluded from the study. After detailed history and physical examination, investigations like complete hemogram, liver function tests, renal function tests, prothrombin time, urine routine microscopy and urine culture sensitivity was done. Preoperative radiologic evaluation like X-ray Chest, X-ray kidney, ureter and bladder (KUB) region, intravenous urography and ultrasonography, were performed.

Single dose of a first-generation cephalosporin was administered at the time of anesthesia induction. Postoperatively ultrasonography and X-ray KUB was done at discharge and 3 weeks later. If a residual stone (≥4 mm) was identified in a postoperative imaging, the case was designated as a failure in this series and was subjected to auxiliary procedures like SWL or PCNL.

In Group A, procedure was done under regional anesthesia using 7F/9.5F semirigid ureteroscope (KARL STORZ Endoscopy-Germany) after placement of glidewire past the stone or just below the stone where it could not pass beyond to maintain access. The Holmium laser (LUMENIS, Versa Pulse Power Suite, 100 watt) and 365-nm SlimLine laser fiber was used for intracorporeal lithotripsy. The setting of the laser machine was adjusted to produce 0.3–0.6 Joules/pulse and the frequency was between 10Hz and 30 Hz. Double-J stent (5F) was placed after the procedure in all the cases, and it was removed 3 weeks later.

In Group B, procedure was done under general anesthesia. laparoscopic ureterolithotomy (LU) was done via transperitoneal route in all the cases. Under cystoscopic and fluoroscopy guidance, a 4F ureteric catheter was placed past the stone. Patient was placed in a flank position at a slanted angle of 60° and trocars were inserted. After colon mobilization, ureter was identified, and stone was localized. Stone was extracted through vertical ureterotomy. Double-J stent (5F) was placed, and ureterotomy was closed using interrupted 4'0 Vicryl. Drain was kept through port. Follow-up protocol was same for both the groups.

Statistical analyses were performed using SPSS@17, Chi-square, unpaired *t*-test, and Fisher's Exact tests as necessary, and $P < 0.05$ was considered as significant.

OBSERVATION AND RESULTS

A total of 122 patients were included in the present study and were randomly divided into two groups; Group A (URS)-60 patients and Group B (lap-TPUL)-62 patients. The two groups were comparable in age, gender, stone size, and stone location with no statistical significance [Table 1].

The duration of symptoms was less than a month only in 27.9% of patients in URS group and 22.2% of patients in lap-TPUL group whereas duration of symptoms was more than a month in 72.1% patients in the URS group and in 77.8% of patients in the lap-TPUL group. This is probably due to large stone size selection and delayed presentation of the patients. Local population is having the habit of taking indigenous remedial medicines and definitive treatment getting delayed or neglected leading to the long duration of presenting complaints.

The most significant outcome measurements of any procedure are the stone-free rates, complications, procedural time and need of auxiliary procedures. Treatment outcomes are summarized in Table 2. Hospital stay and procedure time was significantly higher in lap-TPUL group. Auxiliary procedure rate was higher in URS group. Two patients were converted to open surgery in Group B. Complication rate was more in URS group, stone up migration being the most common complication [Table 3]. Comparing to other studies, complication rate was slightly higher in our study in Group B, which can be due to less laparoscopy exposure of the operating surgeon. These complications were seen in initial few cases after which there were no significant complications in lap-TPUL group.

Table 1: Demographic characteristics

Variable	Group A	Group B
Cases (n)	60	62
Age (mean±SD) (years)	44.3±3.2	42.1±2.7
Sex (male/female)	38/22	37/25
Stone location (left/right)	20/40	17/45
Stone size (mean±SD) (mm)	16.8±1.5	17.2±1.9

SD: Standard deviation

Table 2: Treatment outcome

	Group A (%)	Group B (%)	*P*
Mean procedure time (min)	62.8±12.7	84.1±16.8	<0.0001; significant
Hospital stay (mean±SD) (days)	1.18±0.38	4.16±0.67	<0.001; significant
Auxiliary procedure rate	6/60 (10)	2/62 (3.2)	-
Stone free rate	43/60 (71.6)	58/62 (93.5)	0.008

SD: Standard deviation

Table 3: Complications

	Group A (%)	Group B (%)
Proximal migration of stone	9 (15)	2 (3.2)
Hematuria	-	1 (1.6)
Severe pain	-	2 (3.2)
Conversion to open	-	2 (3.2)
Mucosal injury	3 (5)	-
Ureteral perforation	2 (3.3)	-
Sepsis	3 (5)	-
Total	15 (25)	7 (11.2)

DISCUSSION

Urolithiasis is the third most common affliction of the urinary tract, exceeded only by UTIs and pathologic conditions of the prostate (benign prostatic hyperplasia and prostate cancer). The treatment of urinary lithiasis has been revolutionized during the last three decades. Minimally invasive therapies in the form of endoscopic surgery in conjunction with the advent of SWL have diminished the role of open stone surgery.[1,2]

Before the 1980s, ureteral stones were managed by open ureterolithotomy. With the refinement of SWL, small-caliber semirigid ureteroscopes, flexible ureterorenoscopes and laparoscopic procedures, management of ureteral calculi has changed dramatically. Each technique is highly effective when implemented for the appropriate indication. Various factors such as stone size, location, composition, and surgeon's and patient's preferences each play a major role in the decision-making process. Currently, ureteroscopy and SWL are regarded by many as the first-line treatment modalities for the management of ureteral stones, and the exact role of LU remains poorly defined.[3]

Although, for proximal ureteral stones, SWL is minimally invasive and can be performed as an outpatient procedure, disadvantages include a high retreatment rate, long treatment time, and poor patient compliance. AUA recommends SWL as the first-line of management for small (<1 cm) with excellent results but indications were unclear for proximal ureteral stones >1 cm.[4]

First time reported in 1980 (Perez-Castro-Ellendt and Martinez-Pineiro, 1980), Ureteroscopic stone removal (URS) has become the most preferred modality of stone removal for stones >1 cm. Currently, the holmium: Yttrium-aluminum-garnet laser is the most commonly used laser for lithotripsy because of its superior stone-free rates as compared with pneumatic and electrohydraulic lithotripters. Despite these improvements, the optimal treatment of ureteral stones, especially with large proximal ureteral stones (>1 cm), remains controversial.

Wickaham[5] introduced laparoscopic retroperitoneoscopic ureterolithotomy in 1979, and Raboy *et al*.[6] performed laparoscopic transperitoneal ureterolithotomy for the first time in 1992. Gaur[7] proposed balloon dissection to modify the technique of retroperitoneal LU. Compared with the transperitoneal approach, the retroperitoneal approach is reported to have better outcomes in terms of pain, ileus, port-site hernia, and hospital stay. Nevertheless, when the transperitoneal approach was used, a larger working space could be secured, and the anatomical landmark could be easily confirmed, unlike in the retroperitoneal approach.

Various studies have compared URS with laparoscopy for large proximal ureteral stones with excellent results in laparoscopy group. Kumar *et al*.[8] compared laparoscopy with URS for proximal ureteral stones >2 cm and recommended LU as the modality of choice for large proximal ureteral stones. Similarly, Ko *et al*.[9] in their study compared LU with URS in patients with stone size >1.5 cm and concluded that LU has high stone clearance rate (100% vs. 77%). Fang *et al*.[10] included 50 patients in a study comparing LU and ureteroscopic holmium laser lithotripsy with higher stone clearance rate (100%) as compared to URS (88%) and shorter operation time compared with ureteroscopic lithotripsy for upper ureteral stones >1 cm. In yet another study by Nasseh *et al*.,[11] 33 patients underwent laparoscopic transperitoneal ureterolithotomy with a success rate of 95.8%. As recommended by various authors, laparoscopy ureterolithotomy is associated with excellent stone-free rates, lower postoperative morbidity, shorter hospital stays and lesser time to convalescence.

Mean operation time in our study was 84.07 ± 16.80 min, which is higher as compared to that of many transperitoneal reports. This difference may be due to the fact that our procedures were performed by surgical team receiving training. In our study, the stone-free rate was 93.5% due to two conversion and stone up migration in two cases.

Although the stone-free rates are higher in laparoscopy group, it is associated with longer hospital stay, more procedural time, and less complication rate and it involves transperitoneal entry with possible risk of damaging intraperitoneal structures, thus adding to morbidity.

CONCLUSION

For large proximal ureteral stones of size >15 mm, LU has a greater stone clearance rate, lesser need for the auxiliary procedure, less complication rate but higher procedure time and hospital stay as compared to URS. We strongly recommend LU

for large proximal ureteral stones (≥15 mm) as the treatment modality of choice.

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