

A Prospective Randomized Study of Large Proximal Ureteral Stones: Uretero-lithotripsy v/s Laparoscopy

Sahaj Garg¹, Naveen Kumar Agarwal², Preeti Gupta³

¹Assistant Professor, ²Associate Professor, Department of General Surgery, Muzaffarnagar Medical College, Muzaffarnagar, ³Consultant Radiologist, Kare Imaging Centre, Muzaffarnagar

ABSTRACT

Background: Upper one third ureteric stones has plethora of treatment, choice being medical expulsive therapy, shock wave lithotripsy (SWL), ureteroscopy (URS), laparoscopic and open ureterolithotomy. With the advent of newer generation lithotripters, flexible ureteroscopes and miniature semi-rigid ureteroscopy, most of the upper ureteral stones can be managed with a minimally invasive approach. However, large ureteral stones are a challenge to minimally invasive techniques. The optimal management of large proximal ureteral stones (>15mm) is still to be defined. **Method:** A total of 39 cases of large proximal ureteral stones (>15mm) were included in this prospective study. All patients were randomly divided in to two groups: Ureterolithotripsy with Pneumatic lithotripter (URS-P) - 21 cases and Transperitoneal Laparoscopic Ureterolithotomy (LAP-TPUL)-18 cases. **Results:** Mean stone size was 16.79±1.51 and 17.14±1.96 in URS-P and TPUL respectively. The overall stone-free rate was 13/21(61.9%) for URS-P versus (17/18) 94.4% for TPUL. Auxiliary procedure rate was higher in URS-P than in TPUL (38 % vs. 5.6% respectively). The complication rate was 22.2% in TPUL versus 23.8% in URS-P. Mean procedure time was higher in Lap-TPUL group as compared to URS group (84.07±16.80 vs 65.17±12.78 minutes). Hospital stay was 4.16±0.67 days in Lap TPUL group and 1.32±0.43 days in URS group (p<0.0001). **Conclusion:** For large proximal ureteral stones of size greater than 15mm, Laparoscopic Ureterolithotomy has a greater stone clearance rate, lesser need for auxiliary procedure, less complication rate but higher procedure time and hospital stay as compared to URS. We strongly recommend Laparoscopic ureterolithotomy for large proximal ureteral stones.

Keywords: Ureteral stones, Uretero-lithotripsy, Laparoscopy.

INTRODUCTION

Urolithiasis is the third most common affliction of the urinary tract. Minimally invasive therapies in the form of endoscopic surgery in conjunction with the advent of shock wave lithotripsy have diminished the role of open stone surgery.¹

Ureteral stones are a major cause of morbidity and anxiety among urologic patients. Currently, ureteroscopy and shock-wave lithotripsy are regarded by many as

the first-line treatment modalities for the management of ureteral stones, and the exact role of laparoscopic ureterolithotomy remains poorly defined.²

Stones that are larger than 5 mm in diameter have a low probability of spontaneous passage and over 50% of such patients will require some type of surgical intervention. A patient who has a ureteric stone with a low probability of spontaneous should be informed of the relative benefits and risks associated with each type of treatment.^{2,3}

For the management of the upper ureteric stones, it is recognized that the advent of new non-invasive/minimally invasive procedures for treating urinary stones, such as ESWL, flexible ureterorenoscopy, percutaneous surgery has resulted in a marked decrease in morbidity.

Corresponding Author:

Naveen Kumar Agarwal

Associate Professor, Department of General Surgery,
Muzaffarnagar Medical College, Muzaffarnagar,
E-mail: drnaveenagarwal@gmail.com

Laparoscopic ureterolithotomy is primarily indicated as a salvage procedure in the event of a failed ureteroscopy and ureteric stones where open surgery is contemplated.³

Many studies⁴⁻⁶ have shown that laparoscopic ureterolithotomy represents a safe and effective treatment option for ureteral stones either as primary for large impacted stones or as a salvage procedure after failed shock wave lithotripsy or ureteroscopy.

This procedure fulfils the advantages of minimal blood loss and analgesia requirements, good cosmetic appearance, and short hospital stay and convalescence period

MATERIALS AND METHOD

This prospective study which consists of management of large proximal ureteral stones using ureterolithotripsy versus laparoscopy in 39 cases was conducted at Department of General Surgery, Muzaffarnagar Medical College, Muzaffarnagar between November 2014 to October 2016. Patients randomly divided into following groups:

Group A: Ureterolithotripsy with Pneumatic lithotripter (URS-P) - 21 cases.

Group B: Transperitoneal Laparoscopic Ureterolithotomy (LAP-TPUL)-18 cases.

Inclusion criteria:

- Patients in the age group between 15 yrs to 60 yrs.
- Patients diagnosed to have proximal ureteric stone measuring >15mm on USG.

Exclusion criteria:

- Pregnancy
- Patients with active urinary tract infection, congenital anomalies and previous SWL, stent placement or open surgery of the ureter were excluded.

After preliminary investigations, confirmation of diagnosis and pre-anaesthetic check-up, patients were subjected to the required procedure. Written and informed consent was taken from all patients for the procedure to be undertaken. All patients were given

intravenous antibiotic prophylactically. Operative time was recorded from induction of anesthesia till completion of surgery. Stone size, which was defined as the maximal transverse diameter on USG, and location of the stone were identified by intravenous urography (IVU) in all patients. Stone clearance was labelled when there are no residual stone in postoperative X-ray of the kidney, ureter, and bladder (KUB). DJ stenting (5F) was done in all cases & it was removed after 3 weeks postoperatively. Perioperative outcomes, including stone-free rate in a single session, operation time, and complications, were analysed. The stone-free rate in a single session, which is the primary end point in this series, was defined as a no residual stone on postoperative X-ray KUB taken at 1 day after procedure. If a residual stone was identified in a postoperative image, the case was designated as a failure in this series, whether the identified stone was removed spontaneously or required auxiliary procedures, like SWL or PCNL. Complications were noted such as: Stone Migration, Ureteral Injury, Sepsis, Hematuria, and Ureteral Stricture.

Steps for URS:

- URS was done as a primary therapy under regional anesthesia using 7F/9.5F semirigid Ureteroscope, with diameter graduated from its tip till its base (Karl Storz Endoscopy-Germany).

- Cystoscopy with retrograde pyelography & placement of 0.035" floppy-tip guidewire past the stone or just below the calculus where it could not pass beyond to maintain access.

- Intracorporeal lithotripsy (Swiss LithoClast EMS, Nyon, Switzerland) was used to fragment the stones, which were then extracted by forceps [Figure 1].

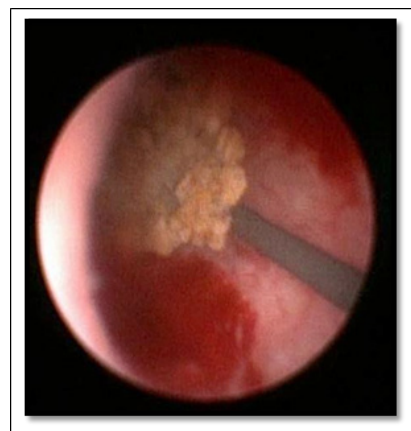


Figure 1: Intra-Operative View.

- At the end of the procedure, 5F double J (DJ) stenting was done.

Steps for Transperitoneal Laparoscopic Ureterolithotomy (Lap-TPUL):

- All cases of Lap-TPUL were done under General anesthesia.

- Lap-TPUL will be conducted using the conventional three laparoscopic ports under flank position. Three trocars are usually sufficient for removal of proximal ureteral calculi (one 10 mm at the umbilicus for the laparoscopic lens and two 5 mm at the ipsilateral midclavicular line, 1 subcostal and 1 in the lower quadrant.

- Colon was reflected medially for identification of the proximal ureter.

- Localization of the stone by the bulge in the ureter and gently pinching with the instruments [Figure 2].

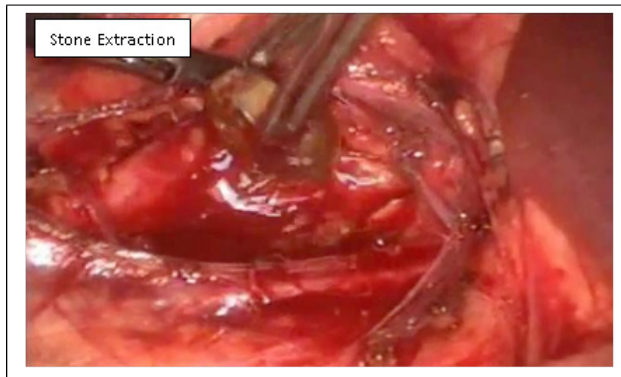


Figure 2: Stone Extraction

- Ureterotomy and removal of the stone by cold knife (No.11)

- Placement of the double J stent.

- Suturing the ureterotomy incision by 5.0 vicryl

- Drain inserted through one of the port

- Stone retrieval is by inserting the thumb of the rubber glove through the 10 mm port.

Statistical analysis

Statistical analysis of the results was performed using SPSS@12. The statistical inference was obtained by computing Z test for difference between any two values and considered statistically significant if the P value was < 0.05.

RESULTS

Symptomatology: Pain was the most common symptom in both the groups affecting 76.2% (16) patients in URS group and 72.2% (13) patients in the LAP-TPUL group followed by vomiting which was present in 23.8% (5) patients in URS group and 22.2% (4) patients in LAP-TPUL group.

Duration of Symptoms: The duration of symptoms was ≤ 1 month in 23.8% (5) patients in the URS group and in 22.2% (4) patients in the LAP-TPUL group whereas the duration of symptoms was more than 1 month in 76.2% (16) patients in the URS group and in 77.8% (14) of patients in the LAP-TPUL group.

Side Distribution: We recorded the distribution of patient with respect to side of stones as determined on X- Ray. In the URS group 66.7% (14) patients were having right sided upper ureteric stones and in the LAP-TPUL group 72.2% (13) patients were having right sided upper ureteric stones whereas left upper ureteric stones were found in 33.3% (7) of patients in the URS group and in 27.8% (5/18) patients in the LAP-TPUL group.

Mean Stone Size (mm): Mean stone size in both URS and LAP-TPUL groups were compared and was found that URS had stone size from 15-20.5 mm with mean size of 16.69 mm and LAP-TPUL group had stone size ranging from 15-22 mm with mean size of 17.14 mm.

Stone Free Rate: Of the 21 patients in URS-P group, 13 (61.9%) patients were stone free. In LAP-TPUL group, there was 94.4 % stone clearance rate.

Table 1: Significant Complications in URS Group.

	URS-P Number (%)
Mucosal Injury	1 (4.8%)
Proximal Migration of stone	3 (14.2%)
Sepsis	1 (4.8%)
Ureteral Perforation	1(4.8%)
TOTAL	6 (28.6%)

Of the 21 patients in URS-P group, 6 (28.6%) patients had significant complications. Transient haematuria

was noted in cases of mucosal injury. Proximal stone migration was the most common complication in both the groups. (Table 2)

Table 2: Complication of Laparoscopic Ureterolithotomy.

	LAP-TPUL Number (%)
Proximal Migration of stone	1 (5.5%)
Hematuria	1 (5.5%)
Severe Pain	2 (11.1%)
TOTAL	4 (22.2%)

Of 18 patients in LAP-TPUL group, 4 (22.2%) patients had complications. Post-operative pain was the commonest complication of all in Lap-TPUL group (Table 3).

Procedure Time: The mean procedure time in URS-P and LAP-TPUL group was 67.53 mins and 84.07 mins respectively. Mean procedure time in LAP-TPUL group was higher as compared to URS groups.

LAP-TPUL group had longer Mean hospital stay (4.16 ± 0.67 days) as compared to URS-P wherein mean hospital stay was 1.47 ± 0.49 days.

Auxiliary Procedures: PCNL and SWL were done in 5 and 4 cases respectively when there was complete stone up migration or residual stone was present. Complete clearance was achieved at 3 months in all cases who underwent auxiliary procedures.

DISCUSSION

Evolution of technology has revolutionized the treatment of ureteric calculi. Stones less than 5mm are more likely to be expelled by medical expulsive therapy. Most of the upper ureteral stones require intervention because the spontaneous expulsion rate is only 22%.

URS is one of the most common modalities used for upper ureteral stones. It is minimally invasive, has a good stone clearance rate, and cosmetic value. Ureteroscopy with holmium laser lithotripsy is less affected by the stone size; the efficacy has been well established for stones larger than 1 cm. The disadvantages being stone upmigration and a higher retreatment rate for larger stones.⁷⁻⁹

Laparoscopic ureterolithotomy (LU) can be done through the transperitoneal or retroperitoneal route. The advantage of LU is complete stone clearance in a single sitting, disadvantage being long learning curve and experience.^{10,11}

With these factors in mind this study was carried out to compare the outcome of URS versus Laparoscopic ureterolithotomy in patients having solitary upper ureteric calculus of more than 1.5 cm.

In the Lap-TPUL group, 27.8% patients had stones in their left upper ureter and 72.2% patients had stones in their right upper ureter while in the URS-P, 33.3% patients had stones on the left side respectively. The difference in the two groups with regard to the side of the stone was not significant ($P = 0.8573$). The mean stone size in the URS-P and Lap-TPUL groups were 16.79 ± 1.51 mm and 17.14 ± 1.96 mm respectively ($p = 0.615$). The difference between the three groups with regard to the mean stone size was not statistically significant ($P > 0.05$). Hence both the groups were comparable for the stone factors.

The most significant outcome measurements of any procedure are the stone-free rates, complications, procedural time and need of auxiliary procedures. Many studies have compared success rates of Laparoscopy and URS for treatment of large upper ureteric stones.¹²⁻¹⁶

In URS-P group, 61.9% patients were stone free. Various other authors have shown the stone free rates ranging from 62.5% to 88 % depending upon the stone size although the mean stone size was more than 10mm (Table 3).

Table 3: Stone Free Rate by URS

STUDY	STONE FREE RATE
Zhu et al ¹⁷	77.3%
Kumar et al ¹⁸	76.0%
Basiri et al ¹⁹	76.0%
Khaladkar et al ²⁰	79.2%
Lopes et al ²¹	62.5%
Ko et al ²²	77%
Fang et al ²³	88%
Present Study	61.9%*

In LAP-TPUL group complete clearance was achieved in 94.4% cases. Various other authors in

their studies have reported stone free rates ranging from 80% to 100% using either transperitoneal route or retroperitoneal route. We have done all cases via transperitoneal route only. Our study shows comparable stone free rate for the Lap-TPUL group. (Table. 4)

Table 4: Stone Free Rate by Laparoscopy

STUDY	STONE FREE RATE
Zhu et al ¹⁷	90.5%
Kumar et al ¹⁸	100%
Basiri et al ¹⁹	90%
Khaladkar et al ²⁰	100%
Lopes et al ²¹	93.3%
Ko et al ²²	100%
Fang et al ²³	100%
Present Study	94.4%

Various authors have conducted comparative studies for the analysis of the two treatment methods i.e. URS and Laparoscopy Ureterolithotomy for large proximal ureteric stones. In their observations, they found out that large sized stones (≥ 10 mm) had higher stone free rates by Laparoscopic Ureterolithotomy as compared to URS. Our study reports a higher stone free rate for stones in Lap-TPUL as compared to URS groups and it was statistically significant ($p=0.008$).

In the present study, proximal stone migration was the most common complication affecting 14.2% of patients in the URS-P group. Significant complications in URS-P group were 28.6%. Proximal stone migration was also the most common complication in the other studies.

Out of 18 patients in Lap-TPUL group, 4 (22.2%) patients had complications, the most common being postoperative severe pain followed by hematuria (5.5%) and proximal stone migration (5.5%). Comparing to other studies, complication rate was slightly higher in our study which can be due to less Laparoscopy exposure of the operating surgeon. These complications were seen in initial 10 cases after which there were no complications in Lap-TPUL group.

There were higher complications rate in URS group as compared to Lap-TPUL group but it statistically

insignificant ($p=0.71$).

In our study, mean hospital stay was 1.32 ± 0.43 and 4.16 ± 0.67 days in URS and Lap-TPUL groups which was statistically highly significant ($p<0.001$). Various studies^{4,8,12} have compared the mean hospital stay ranging from 1.14 days to 3.4 days in URS group and 2.2 ± 0.7 days to 5.9 ± 2.1 days in Laparoscopic ureterolithotomy.

CONCLUSION

- Mean stone size was comparable in all the groups being 16.79mm and 17.14mm in URS-P and Lap-TPUL groups respectively.
- Mean procedure time was higher in Lap-TPUL group and it was statistically significant.
- Higher complication rates are seen in URS groups as compared to Lap-TPUL group but not statistically significant.
- Laparoscopic ureterolithotomy achieved a higher stone free rate as compared to URS for large proximal ureteric stones >15 mm.
- Lap-TPUL group had longer hospital stay as compared to URS group and it was statistically highly significant.
- Laparoscopic Ureterolithotomy is treatment of choice for stones >15 mm in size as there are better chances of stone clearance in single sitting as compared to URS.

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