



Impacted Mid Ureteric Stone: Comparative Study of Treatment by Transperitoneal Laparoscopic Ureterolithotomy versus Ureteroscopy

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Abstract

Objective: To compare the effectiveness and complications of ureteroscopy (URS) with pneumatic lithotripsy and transperitoneal laparoscopic ureterolithotomy (TPLU) in treatment of impacted mid ureteric stones larger than 1 cm.

Materials and Methods: In this prospective randomised study, 60 patients with impacted mid ureteric stone underwent URS with either pneumatic lithotripsy (group 1) or TPLU (group 2). Patient's demographic profile, success rate, re-treatment rates, operation time, hospital stay, auxiliary procedures and complications were compared between group A and group B.

Results: Sixty patients (URS group 30, TPLU group 30) met inclusion criteria. It was seen that both methods were effective in the treatment of large mid ureteric stone; however, TPLU provide higher stone clearance rate (100 vs. 86.67%), lower complication rate and shorter operation time (61.66 ± 8.34 vs. 85.67 ± 7.62 min). On the other hand, patients treated with pneumatic ureteroscopy had less postoperative pain, shorter hospital stay and faster return to daily activities.

Conclusions: For treatment of impacted large mid ureteric stone, TPLU provides significantly higher success rate and lower retreatment rate compared with pneumatic ureteroscopy; however, URS provides similar stone free rates at three months as a minimal invasive procedure.

Keywords: Mid ureteric stones, pneumatic ureteroscopy, transperitoneal laparoscopic ureterolithotomy.

Introduction

Ureteral calculus is more symptomatic and prone to deterioration of renal function when compared to renal stones. Indications for active treatment of ureteral stones include large calculi with low spontaneous passage, persistent pain, obstruction, or renal failure. Extracorporeal shock-wave lithotripsy (SWL) and uretero-rensoscopy (URS) are the first choices for active treatment of ureteral calculi. Necessity of open or laparoscopic procedures is limited with the evolution of modern

lithotripsy and ureteroscopy. URS has been found to be more effective than SWL for ureteral calculi that are bigger than 10 mm in diameter with success rates of more than 80%. URS success rates are decreased in mid-or-upper-ureter stones. Currently, laparoscopic ureterolithotomy is indicated for large impacted stones when other minimal invasive procedures fail.

Large impacted mid ureteral calculus is defined as a stone of more than 10 mm size located between fifth lumbar vertebra to lower border of sacro-iliac

joint, remaining in the same position for at least 2 months with or without failure of visualization of ureter distal to mid ureter stone in intravenous urography (IVU) / CT urogram confirming the presence of the stone in same position since two months. Failure of retrograde passage of a guide wire beyond the stone is sometimes present with impaction; however, this may be due to the transient lie, mucosal oedema and irregular surface of the stone making a niche in the ureteric wall.

The optimal management of impacted mid ureteric stone is still controversial with no established guidelines for the treatment of choice. Considering this we undertook a comparative trial of URS with pneumatic lithotripsy versus transperitoneal laparoscopic ureterolithotomy (TPLU).

Materials and Methods

We conducted this prospective randomised comparative study over a period of 24 months (Jan 2016 to Jan 2018) on patients admitted in Department of General surgery, LLR and associated hospital, Kanpur and Kanpur urology centre, Kanpur. Inclusion criteria comprised patients with solitary, mid ureteric stone, stone size of 10mm and above, located between fifth lumbar vertebra to lower border of sacro-iliac joint, and diagnosed by excretory urography or CT. Stone size was measured using ultrasound KUB or CT. Apart from clinical history and examination, complete blood count, renal function test, liver function test, serum calcium, serum uric acid, urine culture and sensitivity, renal and bladder ultrasound, coagulation profile, and kidney, ureter, bladder X-ray or CT were performed. Informed written consent was obtained before randomization and surgical intervention. The randomization was done on a 1:1 basis. Group 1 consisted of patients who underwent URS with pneumatic lithotripsy and group 2 consisted of those treated with TPLU.

Operative Techniques

URS Procedure

The patient in group 1 underwent URS with 6/7.5 URS. Wherein the guide wire was placed on ipsilateral side and all attempts were made to bypass the stone. A 10mgfrusemide was given intravenous before putting the guide wire. In difficult situation of failure to bypass its tip was placed at distal end of the stone under fluoroscopic control (flagging of stone). The pneumatic lithotripter was used to fragment the stone and all stones were retrieved with the aid of forceps. A DJ stent was placed in the end along with a 16F Foley catheter.

Transperitoneal laparoscopic ureterolithotomy

The patients in group 2 were placed in supine position and three standard ports were made. One camera port (10mm) at the umbilicus, one 10mm port in mid clavicular line at level of umbilicus and one 5mm port at supra pubic region. CO₂ pneumoperitoneum was maintained at 12 mm Hg. The port site could be varied depending upon the obesity of patients. The head end was lowered down and bowels were reflected upwards and the ureter was identified by bulge of the stone and peristalsis. The peritoneum over it was reflected and the stone was locked by bowel grasper (clamping the ureter proximally). A hook was used to cut the ureter and the stone was delivered in. A double J stent was placed from above using the hollow suction probe. The ureter was stitched by interrupted 3-0 vicryl suture. A tube drain was put in the lower abdomen after covering with overlying peritoneum. The stone was taken out by the 10mm port using 5mm telescope. The post-operative drugs, analgesia and recovery, including immediate and late complications were also charted and recorded for up to three months of the procedure. The DJ stent placed preoperatively was removed after 15 days. The post op IVU/CT urogram was done after 3 months of procedure to ascertain the renal functional recovery & to rule out ureteric stricture/ residual stones.

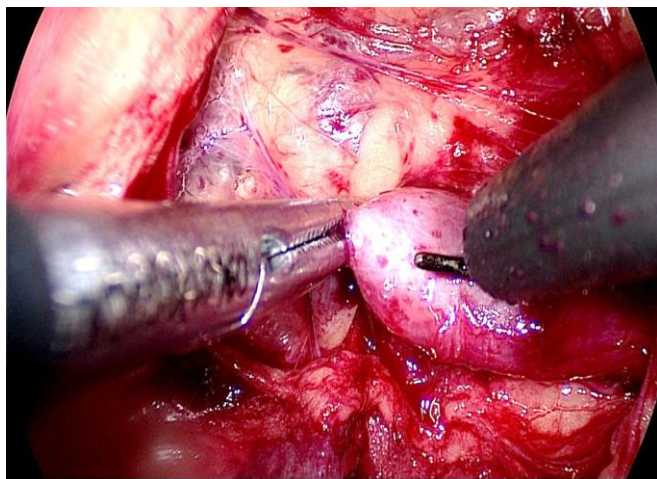


Figure 1- shows stony bulge and incision for ureterotomy

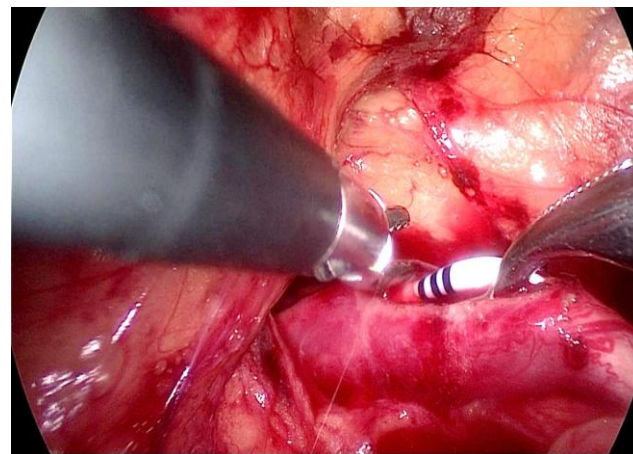


Figure 3-DJ stenting after removal of ureteric stone

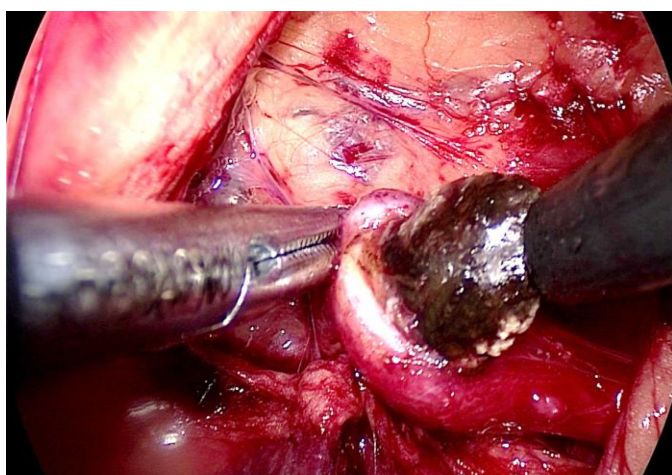


Figure 2- shows delivery of stone from ureter

Statistical analysis

Statistical analysis was performed using SPSS version 16.0, using unpaired ‘t’ test and ‘z’ test for testing the proportion and difference between the two groups. Statistical significance was considered at $p < 0.05$.

Results

The demographic characteristics of the 2 groups are shown in table 1. There was no significant difference between the 2 groups with respect to gender, serum creatinine, serum uric acid levels, side of involvement, stone size.

Table 1 Patient demographics, perioperative data

	Group 1	Group 2	t	p value
No. of patients	30	30	-	-
Mean \pm SD patient age	40 \pm 12	46.77 \pm 7.05	2.66	0.009
No of male/ female	22 : 8	19 : 11	-	-
Mean \pm SD serum creatinine	1.07 \pm 0.21	1.07 \pm 0.17	-	-
Mean \pm SD uric acid	5.30 \pm 1.77	5.86 \pm 1.44	1.34	0.1841
No of Rt : Lt side of involvement	13 : 17	16 : 14	-	-
Mean \pm SD stone size (mm)	15.18 \pm 1.59	14.60 \pm 2.02	1.23	0.2215
Mean \pm SD operative time (min)	85.67 \pm 7.62	61.66 \pm 8.34	11.64	0.0001
Stone clearance rate (plain x- ray + ultrasound KUB)	86.67 %	100 %	-	-
Mean \pm SD hospital stay (days)	3.1 \pm 1.02	4.6 \pm 0.81	6.30	0.0001
% auxiliary procedure	16.67 %	0	-	-

Table 2. Comparison of postoperative complications

	Group 1	Group 2	p value
No of paralytic ileus (absent bowel sound more than 36 hrs)	2/30 (6.67%)	4/30(13.33%)	0.86 (z test)
No haematuria	3/30(10%)	2/30(6.67%)	0.57 (z test)
No febrile urinary tract infection	3/30(10%)	2/30(6.67%)	0.57 (z test)
No of ureteral perforation	2/30(6.67%)	0	-

For URS, patients were placed in lithotomy position after receiving spinal (85%) or general anaesthesia (15%). Mean duration of procedure ranged from 55 to 130 minutes (mean 85.67 ± 7.62) and mean radiation exposure was 3.2 ± 1.8 minutes. A semi rigid ureteroscope was passed into ureter using safety wire and stone visualization was possible in 88 % of procedures. Fragmentation was performed through pneumatic lithotripsy. Intra-operative push up of stone fragments was noted in 36 % of procedures. A double J ureteral catheter was placed in 92% cases, and second look ureteral procedure was necessary in 28.5%. In 2 patients ureteral perforation was occurred, and were managed conservatively. Urinary tract infection developed in 3 patients (reverted). No major complication occurred.

Laparoscopic ureterolithotomy was performed through a transperitoneal route with the patient under general anaesthesia. Ureterotomy size varied from 1 to 3 cm. Difficulties during surgical procedures included an intense peri-ureteral inflammation, stone migration and difficult ureteral catheter placement. A double J stent was placed. Neither urinary leaks nor major complications occurred.

Overall stone clearance rate after 1 and 4 weeks of treatment was (100 % vs. 86.67 %) significantly higher for TPLU than URS with pneumatic lithotripsy. The auxiliary procedure rate (16.67 %) was significantly higher for URS than TPLU. The mean duration of hospital stay between 2 groups were statistically significant. The most common postoperative complication was paralytic ileus (absent bowel sound for more than 36 hours) seen in 4 patients in group 2 (statistically not significant).

Discussion

Urinary stone treatment has evolved in recent decades and minimally invasive procedures can be performed for urinary calculi in almost all situations. However, large, impacted mid ureteric stones are still a point of controversy. The success

of procedures in treating these calculi varies according to different series, but in majority of centres ureterolithotomy (open or laparoscopic) seems to be mostly indicated after failure of SWL or URS. In this context laparoscopic ureterolithotomy seems to be more advantageous than open procedure.

When defining the best procedure to treat these calculi, it should be not only minimally invasive but highly effective. There is no doubt that URS is less invasive and laparoscopic ureterolithotomy is most invasive procedure. However, although URS is less invasive, it has some limitations for these impacted stones. Ureteroscopic procedures are mostly limited by an inability to reach the stone, especially in men, and also by frequent ureteral lesions (oedema, polyps, and strictures) associated with impacted stones. It has been postulated that long term impaction is the most important predictor of failure in these cases.

Our study has some important findings. URS is a minimally invasive procedure and is associated with acceptable success rate (86.67%). Laparoscopic ureterolithotomy has significantly higher morbidity than URS, requires long hospital stay (4.6 ± 0.81 vs 3.1 ± 1.02 days, $p < 0.0001$), causes more post treatment pain and requires more opioids to treat the pain. However success rate of TPLU is more satisfactory than that of URS (100 % vs 86.67%).

Conclusion

Large impacted mid ureteric stone treatment requires multiple procedures until complete stone free status is achieved. TPLU is associated with higher success rate, and a lower number of surgical procedures, but with more postoperative pain, and a longer stay than URS; however, URS provides similar stone free rates at three months as a minimal invasive procedure.

Declarations

Funding: None

Conflicts of interest: None declared.

Ethical approval: The work has been approved by the Institutional Ethics Committee, GSVM Medical College, Kanpur, UP, India.

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