

ABSTRACT Objective: The treatment of choice for large upper ureteral stones is controversial. In the developing nations, semi rigid ureteroscopy is the preferred treatment modality for ureteric stones even in upper ureter. However, Laparoscopic ureterolithotomy has started gaining acceptance for the treatment of large proximal ureteral stones. This study was done to compare solely the outcomes of semi-rigid pneumatic ureterolithotripsy (URSL) and transperitoneal laparoscopic ureterolithotomy (LU) for large upper ureteric stones. **Methods:** In all, 30 patients who met the inclusion criteria were randomised into 2 groups: URSL and LU. The groups were compared for stone clearance rate, operative time, complication rates. **Results:** LU had significantly higher stone clearance rate both at discharge (p=0.014) and at 3 weeks post operatively (p=0.033) than URSL. On the other hand, URSL had significantly shorter mean operating time (p<0.0001), length of hospital stay (p=0.0013) and required less auxiliary procedures than LU group. No major complications were observed and the complication rate clearance rate but with longer hospital stay and operative time than URSL, however the complications were similar. Consequently, the procedure of choice for large proximal ureteric calculi should be based on the expertise of the surgeon, patient's choice and the availability of equipments.

KEYWORDS: laparoscopy, lithotripsy, ureteral calculi, ureteroscopy.

Introduction

Large upper ureteral stones are frequently encountered in daily practice. The best treatment modality for large upper ureteral stones is still debatable. Various treatment modalities include extracorporeal shock wave lithotripsy (ESWL), ureterolithotripsy (URSL), percutaneous nephrolithotomy (PCNL), ureterolithotomy (laparoscopic or open) [1]. As per EAU (European Association of Urology) guidelines, the first option for upper ureteric stones of size > 10 mm is URSL or ESWL. However, PCNL or Laparoscopic ureterolithotomy (LU) is a suitable alternative [2-3].

In the developing countries, there is clear inclination over URSL for the treatment of ureteric stones. As flexible ureteroscopies are not widely available, semi rigid ureteroscopy has been used for the treatment of ureteric stones even those in upper ureter [4]. PCNL is associated with high risk of surgical complications; however, LU has started gaining more acceptances among surgeons for treatment of large proximal ureteral stones even in developing countries [5-6].

In the previous studies, semi-rigid URSL (pneumatic/laser) has been compared with LU (transperitoneal) [7], semi-rigid URSL (pneumatic) versus LU (transperitoneal and retroperitoneal combined) [8] or semi-rigid laser URSL was compared to LU either retroperitoneal or transperitoneal access [6,9-11]. To our knowledge, this is the first prospective randomised study to compare solely the outcomes of semi-rigid pneumatic URSL and LU by transperitoneal access for large upper ureteric stones.

MATERIALAND METHODS

The study was conducted from July 2018 to June 2019 after obtaining approval from institutional review board. Inclusion criteria were: patients aged \geq 18 years, stone diameter \geq 10 mm, duration \geq 3 months, single ureteric stone above the upper edge of sacroiliac joint. Exclusion criteria were: acute urinary tract infection, operative history on ipsilateral ureter, pregnancy, multiple ureteric stones, stricture of ureter or those who refused to enrol in the study.

In all, 38 patients were enrolled in the study, of which 30 patients met inclusion criteria. After providing written and informed consent, patients were randomised into 2 groups- URSL and LU based on computer generated random number table.

A detailed preoperative assessment along with history taking and physical examination was done. Patients in both the groups underwent ultrasound KUB (kidney ureter bladder) and CT urogram to identify the size and location of stones. Prior to surgery, localisation of stone was performed by X-ray KUB in all cases. All operations were performed by same group of surgeons. All the details were recorded on the questionnaire designed for this study.

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URSL with pneumatic lithotripsy (Swiss LithoClast®) was performed under spinal anaesthesia using 7.5 Fr semi-rigid ureteroscope (Karl Storz, Germany) as described in the literature [12]. All patients were stented for 3 weeks if there was no overt ureteral injury.

LU was performed through transperitoneal access. After insertion of trocars at umbilical, lateral umbilical and subcostal sites in midclavicular line, colon was mobilised and ureter dissected. After localisation of stone, ureter above the stone was clamped with a babcock forceps to avoid proximal migration of stone. Then, ureter at the stone was slivered and stent was placed. Ureterotomy was closed using 4-0 polyglactin suture and a drainage tube was kept.

In post-operative day-1, X-ray KUB was done to identify any residual stones and the position of stent. In the URSL group, catheter was removed and the patient was discharged on post-operative day 1-2. In the LU group, drainage tube was removed when drainage was ≤ 10 ml/24 hours.

Postoperative follow up protocol included X-ray KUB/CT KUB at the time of discharge and at 3 weeks period. Success was defined as complete stone clearance or residual fragments \leq 4mm. Stent was removed after 3 weeks of the procedure if no complication or any residual fragments left in both the groups.

The Statistical Package for the Social Sciences (SPSS ® version 21; SPSS Inc. Chicago, IL, USA) was used for analysis. The mean and standard deviations were calculated for continuous variables. The χ 2-test was used to compare categorical variables. The Welch two sample t-test was used to compare the difference between two continuous variables. AP < 0.05 was considered to be statistically significant.

RESULTS

The demographic data of the patients were summarised in Table 1. There was no statistical difference in mean age or mean stone size in both the groups. The outcome indexes of the patients were provided in Table 2. URSL had significantly shorter mean operating time (p<0.0001) and length of hospital stay (p=0.0013) than LU group. LU provided a significantly higher stone clearance rate both at discharge (p=0.014) and at 3 weeks post operatively (p=0.033) than URSL.

In the URSL group, 3 patients had retropulsion of the stone in the kidney and managed successfully by PCNL. In 2 patients ESWL was performed to treat residual stones. In one patient ureteroscope was unable to reach up to the stone, therefore double J stent was kept for 2 weeks before second look URSL. In the LU group, 1 patient required adjunctive PCNL for stone migration.

No major complications were observed (Table 3). In the URSL group, 1 patient each had fever, pain and hematuria, treated conservatively. 2

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patients each had pain and ileus, 1 patient developed fever after LU and managed conservatively. No patient had urinary leak and conversion to open procedure.

Table-1 Demographic data

Characteristics	URSL	LU	p value
No. of patients (n)	15	15	
Mean age, years (SD)	31.7 (9.27)	33.6 (5.35)	0.50
Mean stone size, mm (SD)	14.01 (2.05)	15.31 (2.64)	0.14
Gender (male, %)	66.67	60	0.70
Side (right, %)	53.33	60	0.71

Table-2 Out come of the procedures

	URSL	LU	p value
Mean operative	62.73 (12.94)	127.33 (26.97)	< 0.0001
time, min. (SD)			
Hospital stay,	1.53 (0.71)	3.46 (1.96)	0.0013
days (SD)			
% Stone –free at	53.33 (8)	93.33 (14)	0.014
discharge (No.)			
% Stone –free at	60 (9)	93.33 (14)	0.033
3 weeks (No.)			
% Ancillary	40 (6)	6.6 (1)	0.033
procedures (No.)			

Table-3 Complications of different modalities to Clavien grading system

Clavien grade	URSL	LU	p value
1	2	4	0.37
2	1	1	1
3a	0	0	-
3Ъ	0	0	-
4a	0	0	-
4b	0	0	-
5	0	0	-
Total	3 (20%)	5 (33.3%)	0.41

DISCUSSION

ESWL, URSL, LU are all effective options for the treatment of upper ureteric calculi, each associated with its own success rate and morbidity [13-15]. The treatment of upper ureteric stone has evolved in the last few decades favouring minimally invasive procedures. However, treatment of large upper ureteric stone is still debatable. Few studies consider ureterolithotomy as an auxiliary procedure after the failure of ESWL or URSL [8, 16] while others advocate ureterolithotomy as first line treatment of these stones due to better stone free rates in a single session [9].

While planning for the best procedure to manage the upper ureteric calculi, the risk and benefit of each procedure must be considered. There is no uncertainty that URSL is less invasive than LU but with inferior success rates [14,15]. In our study also, the final success rates of LU is significantly better than URSL (93.3% vs 60%, p=0.033. The mean operative time for LU and URSL was 127.33 ± 26.97 and 62.73 ± 12.94 min. respectively, p=< 0.0001 and LU required a longer mean hospital stay (3.46 \pm 1.96 days) as compared to URSL (1.53 \pm 0.71 days), p=0.0013. Our findings were also consistent with world literature [14,17].

In contrary to URSL, laparoscopic ureterolithotomy required less auxiliary procedures when performed as a first choice procedure [14,17]. Our study showed that one patient in LU group required auxiliary procedures in the form of PCNL whereas, six patients in URSL group had to undergo auxiliary procedures (PCNL, ESWL, second look URSL), p=0.033. These numbers are especially significant when we are considering treatment in developing countries where the waiting period for urological consultation is quite long. Moreover, ESWL for proximal ureteric stones is associated with increased number of post-treatment office visits and higher post-treatment costs [18].

As per the evidence, LU was more invasive technique but the risk of complications; even severe complications (Clavien \geq 3) were similar with URSL [19]. Our study was also consistent with the available literature.

study, the semirigid ureteroscope and pneumatic lithotripter were available. If the URSL would have been done with flexible nephroscope, laser, then the success rates may be at par with laparoscopic ureterolithotomy. Moreover, the sample size was small. A large multicentre randomised trial is required. Additionally, stone analysis and metabolic evaluation could not be assessed. However, the stone density on CT was similar among the study groups.

CONCLUSIONS

Although, the laparoscopic ureterolithotomy was associated with higher success rate but the hospital stay and operative time were longer than URSL, however the complications are similar. Consequently, the procedure of choice for large proximal ureteric calculi should be based on the expertise of the surgeon, patient's choice and the availability of equipments.

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Study Limitations: Our study has multiple limitations also. In this