

Experience with Laparoscopic Ureterolithotomy in Large Proximal Ureteral Calculi

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Abstract: ***Aim:** To evaluate the outcome and safety of Laparoscopic Ureterolithotomy (LAP-UL) for large proximal ureteral calculi. **Design:** Prospective observational study. **Methods and Material:** From March 2018 to December 2019, 50 patients with proximal ureteral calculi ≥ 15 mm who underwent LAP-UL were evaluated for clearance, auxiliary procedure need and complications. **Results:** Complete clearance was 100% in LAP-UL with none needing auxiliary procedures. Operation time was 110.12 ± 10.13 min, the hospital stay was 2.08 ± 0.40 days, post operative analgesic use was 5.2 ± 0.87 days and no major complications were encountered during the procedures. **Conclusions:** Laparoscopic ureterolithotomy may prevent the need for auxiliary procedures while treating large ureteral calculi if used as a primary modality rather than a last resort after failed endourological procedures.*

Keywords: Upper ureteral calculi, Laparoscopic ureterolithotomy

1. Introduction

Modalities for upper ureteral calculi include extracorporeal shockwave lithotripsy (SWL), ureteroscopy lithotripsy (URSL), percutaneous nephrolithotomy (PCNL) and laparoscopic or open ureterolithotomy.^[1] Choosing the best option is debatable. Ureteroscopy is often the first line treatment^[2] with a success rate of 88% to 100%^{[3],[4]}. Flexible ureteroscopy may overcome difficult access but has a limitation with availability and affordability^[5]. Percutaneous nephrolithotomy is preferred in large stone burden and concomitant renal stones^[6]. This study aimed to analyse the outcome and safety of laparoscopic ureterolithotomy as a primary modality in large ureteral calculi.

2. Materials and Methods

From March 2018 to December 2019 at the Department of Urology, in a tertiary care centre in Pune, India, 50 patients with large upper ureteral calculi meeting the inclusion criteria underwent Laparoscopic ureterolithotomy (LAP-UL) after written informed consent and prior approval of the Institutional Ethics Committee. Primary endpoints were complete clearance and need for auxiliary procedures while secondary endpoints were intra and post operative events and complications. Complete clearance was defined as no visible fragments on X-Ray and ultrasonography on post operative day 1.

Inclusion criteria were patients with a single ureteral calculus ≥ 15 mm in longest diameter and located ≤ 5 cm from the pelviureteric junction on computerized tomography. Exclusion criteria were 1) Ipsilateral renal calculi, 2) Previous history of surgery on the kidney or ureter, 3) Untreated urinary tract infection, 4) Pregnancy and coagulopathies.

All enrolled participants underwent complete blood count, coagulation profile, blood sugar and urea/creatinine, urine analysis and culture sensitivity, X-ray, ultrasonography and

contrast enhanced computerized tomography of kidney ureter and bladder region (KUB). Standard of care was intravenous Cefuroxime 1.5g at induction of anaesthesia and two subsequent doses 12 hourly. Intravenous Paracetamol 1g was provided eight hourly post operatively for three doses and further analgesic requirement if needed was recorded and was oral Paracetamol 500 mg doses.

Laparoscopic ureterolithotomy was performed transperitoneally under general anaesthesia with three trocars, ureterotomy was done with electrocautery hook and the stone extracted. A double-J ureteral stent was placed in all cases and the ureterotomy was sutured interruptedly by 4-0 vicryl.

3. Results

Table 1 demonstrates the basic patient demography and calculus characteristics.

Primary endpoints

The success of the procedure measured by the complete clearance of the calculus was 100% in LAP-UL and none of the cases needed any auxiliary procedure (Table 2).

Secondary endpoints

The operative time was 110.12 ± 10.13 min, the hospital stay was 2.08 ± 0.40 days, post operative analgesic use was 5.2 ± 0.87 days and no major complications were encountered during the procedures.

The complication rates were measured by the Clavien-Dindo scale (Table 3) There were no major complications, pleural or organ injuries in the study.

Table 1: Demography and calculus characteristics

Characteristics	LAP-UL
Total	50
Age (years)	46.80
Gender n (%)	36 (72)
Male	14 (28)
Female	

Stone side n (%)	38 (76)
Right	12 (24)
Left	
Stone size (mm)	20.28±5.24
Stone Density (HU)	1167.84±181.73

Table 2: Patient outcomes after the procedure

Variable	LAP-UL
Complete clearance n (%)	50 (100)
Auxiliary procedure needed n (%)	0 (0)
Operating time (min)	110.12±10.13
Hospital stay (days)	2.08±0.40
Analgesic use (doses)	5.2±0.87

Table 3: Complications/ adverse events

Variable n (%)	LAP-UL
Fever	03 (06)
Perforation	0 (0)
Urinary Tract Infection	2 (4)
Blood Transfusion	0 (0)
Urine leak	0 (0)
Shock/ Death	0 (0)

4. Discussion

The European Association of Urology (EAU) guidelines mention ureteroscopy as first line treatment option for large proximal ureteral calculi while also considering PCNL when the pelvicalyceal system is dilated. Laparoscopic ureterolithotomy is often done when endoscopic methods fail but has the problem of retropulsion and the need of additional procedures^{[7],[8]}. PCNL by directly puncturing the kidney is useful in large calculi or those not accessible by ureteroscopy and combined renal stones can also be tackled^{[9],[10]}. A working sheath, free drainage of debris and direct removal of large fragments enable PCNL to achieve high stone free rates^{[11],[12]} while Mini-PCNL was introduced with the hope of decreasing the morbidity associated with larger tract^[13]. Laparoscopic ureterolithotomy can avoid the nephron injury occurring in PCNL and though more invasive it has a great probability of stone clearance in a single sitting^{[14],[15]}.

A meta analysis by Wu et al^[16] which included 14 studies, 7 randomized control trials and 7 non randomized control trials demonstrated that LAP-UL and PCNL had significantly higher stone free rates when compared to URSL (OR 0.17; 95%CI 0.1-0.28; $P<0.001$; OR 0.28; 95%CI 0.18-0.44; $P<0.001$). It found a significant shorter operative time in the URS group (weighted mean difference [WMD]: -30.4 min, 95% CI -43.86 to -16.94; $P<0.001$) while no significant difference in hospital stay between the URS and LAP-UL group (WMD: -1.26days, 95% CI -2.71 to -0.19; $P=0.09$). URS led to a significant shorter hospital stay (WMD: -2.57 days, 95% CI -3.31 to -1.82; $P<0.001$) when compared to the PCNL group.

In a metaanalysis by Deng et al^[17] comparing final stone free rate (after 1 month) between URSL and LAP-UL the results favoured LAP-UL over URSL (OR 0.11; 95% CI 0.05-0.25; $P<0.00001$). Six studies compared the requirements of auxiliary procedures after PCNL and URSL and no

significant difference was found between them (OR 0.66; 95% CI 0.08-5.58; $P=0.71$). Comparing PCNL and LAP-UL in operating time, no significant difference was found (WMD= -7.54 min; 95% CI - 49.09 to 34.02; $P= 0.72$) while between URSL and LAP-UL showed that URSL shared significantly shorter operation time than LAP-UL (WMD= -32.13 min; 95% CI - 47.53 to -16.73; $P<0.00001$). Patients receiving PCNL had significantly longer hospitalization time than those receiving URSL (WMD=2.75 days; 95% CI 1.59-3.91; $P<0.00001$) While PCNL had significantly longer hospitalization time than LAP-UL (WMD=1.64 days; 95% CI 1.06-2.22; $P<0.00001$), no significant difference was found in hospitalization time between URSL and LAP-UL (WMD= -1.54 days; 95% CI - 3.15 to 0.07; $P=0.06$).

Wang et al^[18] in their metaanalysis found significantly better difference in stone clearance by laparoscopic ureterolithotomy versus URSL or PCNL at 98.5%, 87.08% and 92.54% respectively, while overall complication rates were higher in URSL and PCNL compared to laparoscopy ($P<0.001$). A review of 5 RCTs 1 prospective and 4 retrospective cohort studies with 837 patients comparing rigid URSL with PCNL^[19], found URSL had significantly higher risk of conversion to other auxiliary procedures (RR, 4.28; 95% CI, 1.93 to 9.46; $P=0.0003$) as compared those who underwent PCNL.

Our study had 100% immediate clearance for LAP-UL with no auxiliary procedure requirement. At 110.12±10.13 min it had a surgery time longer than most endourological methods. A hospital stay of 2.08±0.40 days even though more than URSL was comparable to PCNL in most studies. Importantly there were no major complications.

Limitations of the study were it being a single centre experience. Long term follow up would be needed to assess complications like ureteral strictures which can be due to these large calculi rather than surgery.

5. Conclusion

Laparoscopic ureterolithotomy has the advantage of ensuring complete clearance in a single procedure without major complications and outcomes similar to various metaanalysis comparing endourological methods and therefore in select cases may be chosen as a primary modality rather than be used when other methods fail.

6. Conflict of Interest

The authors declare no conflict of interest.

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