



COMPARISON OF ANTEGRADE PERCUTANEOUS VERSUS RETROGRADE URETEROSCOPIC LITHOTRIPSY FOR MANAGEMENT OF UPPER URETERIC CALCULUS.

Urology

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ABSTRACT

Background: Technical advancements in urology have profoundly changed the management of upper ureteric calculus, however, its optimal management remains controversial. **Methods:** To compare antegrade percutaneous nephrolithotripsy (PCNL) and retrograde ureteroscopic lithotripsy (URSL) for management of upper ureteric calculus by measuring stone clearance rates, morbidity and complications. A prospective, observational, single centre, study including patients of either sex presenting with upper ureteric stone [size > 8 mm and > 800 Hounsfield Unit (HU)]. Patients underwent either antegrade PCNL or retrograde ureteroscopic lithotripsy with follow up on outpatient (OPD) basis at 1 week, 1 month and 3 months post-surgery with Visual Assessment Score (VAS) and radiological investigations. **Results:** Stone clearance rate for antegrade PCNL was 89.1 % and 72.7% for retrograde ureteroscopic lithotripsy which is a statistically significant difference. Incidence of pain in antegrade PCNL at 1st and 4th week follow-up was 10.9 % and 1.8% respectively compared to 5.5% and 0% for retrograde ureteroscopic lithotripsy. Two patients (1.8%) who underwent PCNL developed segmental artery pseudoaneurysm; one was managed conservatively while other required angioembolization. One patient in the antegrade PCNL group and two in retrograde ureteroscopic lithotripsy group had post operative urine culture proven urinary tract infection (UTI) and were treated with antibiotics. **Conclusion:** As compared to retrograde ureteroscopic lithotripsy, PCNL is a safer and more effective procedure with higher stone-free rates and acceptable complication rates to treat patients with large impacted upper ureteral stones.

KEYWORDS

Percutaneous Cutaneous Nephrolithotripsy (PCNL), Extra Corporeal Shock Wave Lithotripsy (ESWL), Ureteroscopic lithotripsy (URSL), Upper ureteric calculus.

INTRODUCTION

Technical advancements in urology have changed the management of upper ureteric calculus, however, optimal management remains controversial. Various minimally invasive options are available including, Extracorporeal Shock Wave Lithotripsy (ESWL), retrograde ureteroscopic lithotripsy (URSL) and antegrade percutaneous ureterolithotripsy (APCUL).^{1,2} For stones ≤ 10 mm, American Urological Association (AUA) and European Association of Urology (EAU) both recommend observation for 4–6 weeks, provided patient is well informed, colic controlled on analgesic, without signs of infection or high-grade obstruction.² Success rate with observation is higher in stones ≤ 5 mm whereas > 50% patients with stone size 6–10 mm ultimately require surgical intervention.³

When observation fails, options are SWL or URSL with stone-free rates in both being comparable for stones ≤ 10 mm; management of > 10 mm upper ureteric calculi is controversial. URSL has higher stone-free rates in single sitting but higher morbidity and complication rates compared to SWL (11% vs. 4%). Currently, percutaneous access for upper ureteric calculus is recommended in few situations such as large impacted calculi with failure of other treatment modalities, associated with distal-ureteric stricture or stones in patients with urinary diversions. Stone-free rates with URSL for large upper ureteric calculus > 10 mm range between 71% and 87% with stone retropulsion rates ranging from 5.4% to 27.7% amongst various studies.^{5,6}

Role of percutaneous access has been assessed only for large, impacted calculi with reported stone-free rates of > 90%–95% in multiple prospective studies and complication rates similar to standard PCNL.^{7,8} There is added advantage of removal of concurrent renal calculi. Hence, percutaneous ureterolithotripsy can be utilized for upper ureteric stones > 10 mm with better stone-free rates and reduced need of secondary procedures to clear retropulsed stones at an acceptable morbidity and complication rate. Here, we compared URSL with antegrade ureterolithotripsy for upper ureteric calculi with size greater than 8 mm and Hounsfield Unit (HU) > 800 with regard to stone clearance, morbidity, and complications.

MATERIALS AND METHODS

A prospective observational comparative single center study was

conducted at a tertiary care centre from 31st August 2020 till 30th November 2021 after obtaining approval from the hospital ethics committee. It was an observational study with all procedures being performed as part of routine care. Written informed consent was taken from all patients enrolled in the study.

Inclusion Criteria

Patients of either sex, above 18 years of age with upper ureteric stone [longest diameter > 8 mm by Xray/USG/CT KUB Stone Protocol, HU > 800 density], located between ureteropelvic junction and lower body of L4 vertebral body.

Exclusion Criteria

Patients with coagulopathy, concurrent renal and ureteric stones, sepsis, stone size < 8mm and HU < 800. Pregnant patients, orthopedic contraindications for prone position and patients where pre operative imaging suggested unsafe collecting system access.

Procedure Followed

Patient underwent either antegrade PCNL or retrograde URSL based on patient and surgeon preferences.

Antegrade PCNL

Patients underwent standard PCNL-tract size of minimum 24 F with DJ stenting as a protocol. Stent was removed after 4 weeks.

Retrograde URSL

Patients underwent retrograde URSL, either semirigid (4.5/6 F or 8/9.8 F) scope or flexible scope (7.5 F size) was used depending on the caliber of the ureter. In all patients, holmium laser was used to fragment the stone and nitinol basket was used to retrieve the stone fragments. DJ stenting was done at the end of procedure, with stent removed after 4 weeks.

Method Of Measurement Of Outcome Of Interest

Assessed in postoperative period and on follow-up at 1st week, 4th week and 3rd month

1. Stone clearance rate at 4th week follow up (complete stone clearance is residual stone < 3 mm).
2. Morbidity
3. Complications

RESULTS

A total of 110 cases with 55 cases in each arm were enrolled. Of the total enrolled patients, 83 were males and 27 were females with mean age being 48.4 ± 14.7 years.

Average size of calculus was significantly larger in patients undergoing PCNL vs retrograde URSL (9 mm vs 12 mm). Although average stone density of PCNL group was comparatively higher than retrograde URSL group (1100 HU vs 1121 HU), this difference was not significant.

Significantly higher percentage of patients undergoing retrograde URSL had calculus fragmented using energy source while a significantly higher percentage of patients undergoing PCNL achieved complete stone clearance. DJ stent was placed in all patients and no patients had any intraoperative complications.

For PCNL, Bulls eye technique was used in 20 patients and triangulation in 35; nephrostomy tube placed in 7 (12.7%) patients.

3 patients from Retrograde URSL group and 6 from PCNL group experienced pain post-surgery at 1 week and only 1 patient in PCNL group at week 4.

At week 1, 7 patients had mild pain of which 3 underwent retrograde URSL and 4 underwent PCNL; whereas 2 patients, both post PCNL had severe pain. Injectable analgesics were required for 2 patients. At week 4, 1 patient, post PCNL had mild pain and was managed with oral analgesics.

Follow Up Imaging At Week 1

- Out of 55 patients 2 (1.8%) who underwent PCNL showed CT Renal Angiogram-Right renal segmental artery-pseudoaneurysm.
- One patient required angioembolisation while the other was managed conservatively.

Follow Up Imaging At Week 4

- Evidence of calculus was seen in 15 patients post Retrograde URSL and 6 patients post PCNL. Thus, final stone clearance rate was higher for antegrade PCNL compared to retrograde URSL and the difference was statistically significant ($p=0.050$).

DISCUSSION

Optimal management of upper ureteric calculus remains a gray area wherein expertise and available instrumentation at a particular center determines success of technique in terms of stone clearance rates, morbidities and complication rates. In case of retrograde ureteroscopy, ureteric caliber and pliability determines the individual success rate.

Significantly higher percentage of patients undergoing PCNL achieved complete stone clearance as compared to patients who underwent retrograde URSL ($p<0.05$) (intraoperative stone clearance rates).

Final Stone Clearance Rates For Both Groups

Evidence of calculus was seen in 15 patients post Retrograde URSL and 6 patients post PCNL at week 4. Stone clearance rate was 72.7 % in retrograde URSL and 89.1% in antegrade PCNL with difference being statistically significant ($p=0.050$). Thus, antegrade PCNL had a higher stone clearance rate as compared to retrograde URSL.

At week 1, 7 patients had mild pain of which 3 were post URSL and 4 post PCNL; 2 patients, both post PCNL had severe pain. At week 4, 1 patient, post PCNL had mild pain and was managed with oral analgesics.

Incidence of pain in case of antegrade percutaneous lithotripsy at 1st week follow-up was 10.9 % as compared to retrograde URSL which was 5.5 % (the difference was not statistically significant).

Incidence of pain in case of antegrade percutaneous lithotripsy at 4th week follow-up was 1.8 % as compared to retrograde URSL which was 0%.

Thus, patients who underwent antegrade PCNL had higher incidence of pain.

In both techniques, there were no intraoperative complications.

Out of 55, 2 patients (1.8%) with PCNL were detected with renal

segmental artery pseudoaneurysm during first 2 weeks post surgery. One patient post antegrade PCNL vs 2 patients post retrograde URSL had culture proven urinary tract infections (UTIs) and were treated with i.v. antibiotics. Two patients post retrograde URSL had urine culture proven UTIs during hospital stay and required antibiotics. No other complications were seen at 1st and 4th week follow-up. At 3rd month follow-up, no patient showed any complications.

In the study by Bozkurt IH et al.,⁸ stone clearance rates were 82.9% and 97.8% in the retrograde Ureteroscopic Lithotripsy and antegrade percutaneous lithotripsy groups, respectively ($p = 0.001$). Our study reaffirmed these findings.

In the study by Elgebaly O et al.,¹¹ comparing Antegrade mini-percutaneous flexible ureteroscopy versus retrograde ureteroscopy for management of upper ureteric calculi between size 1-2 cm, stone clearance rate was 83.3 % for antegrade technique versus 60 % for the retrograde technique. Both groups showed few minor complications with no major complications.

Our study has also shown superiority of antegrade technique for stone clearance rates as compared to retrograde access for management of upper ureteric calculi.

CONCLUSION

Compared to retrograde ureteroscopic lithotripsy, PCNL appears to have higher stone clearance rates and lower re-treatment rates. This study shows PCNL is a safe and effective procedure with higher stone-free rates and acceptable complication rates which may be used to treat patients with large (size>8 mm and HU >800), impacted upper ureteral stones.

Table 1: Common Intraoperative Details Of Both Surgeries

	Retrograde uretero-scopic (n=55)		Percutaneous Nephro-lithotomy (n=55)		P value
	Freq.	%	Freq.	%	
Calculus fragmented using energy source	55	100	43	78.2	0.001
DJ stent placed	55	100	55	100	---
Complete stone clearance achieved	36	65.5	53	96.4	0.001
Intraoperative complications	0	0	0	0	---

Table 2: Severity Of Pain

	Retrograde uretero-scopic (n=55)		Percutaneous Nephro-lithotomy(n=55)		P value
	Freq.	%	Freq.	%	
Week 1					
Mild pain (25-35 mm)	3	5.5	4	7.3	Not significant
Severe pain (80-90 mm)	-	-	2	3.6	
Week 4					
Mild pain (15 mm)	-	-	1	1.8	Not significant

Table 3: Evidence Of Calculus At Week 4 Imaging (final Stone Clearance Rates)

	Retrograde uretero-scopic (n=55)		Percutaneous Nephro-lithotomy (n=55)		P value
	Freq.	%	Freq.	%	
Calculus evident	15	27.3	6	10.9	0.050
Calculus not evident	40	72.7	49	89.1	

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