

## Comparative Study of Ureteroscopy Versus Extracorporeal Shock Wave Lithotripsy in Management of Upper Ureteric Calculi

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### Abstract:-

**Aims and Objective:** To compare and assess the safety and efficacy of Ureteroscopy (URS) versus Extracorporeal shock wave lithotripsy (ESWL) in the management of upper ureteric calculi and identify complications, if any, that are specific to ESWL or Ureteroscopy.

**Methodology:** All patients presenting to a tertiary care hospital with symptoms of ureteric colic/calculi were evaluated. Of them, a total of sixty successive patients who, on evaluation had upper ureteric stones of 5-15 mm were included in this study. Out of 60 patients 30 were treated with ESWL and 30 underwent Ureteroscopy. The safety, efficacy and complications were compared between groups immediately and at three months after the procedure. Data were analysed using Fischer exact test in SPS version 19.

**Result:** The immediate percentage of clearance and clearance at three months follow up for URS and ESWL group was analysed using t-test and it was found that there exists a significant difference in the immediate clearance rate ( $p$  value=0.030), however there was no significant difference in three months follow up for stone clearance in both the groups ( $p$ =0.999). The difference in the number of complications in both the groups was analysed using Fisher's exact test and it was found that complication rate was significantly higher in the URS group compared to the ESWL group( $p$ =0.004).

**Conclusion:** ESWL is the preferred choice of treatment for proximal ureteric stones, in our study results suggest that Ureteroscopy is a viable and safe alternative, with an advantage of obtaining an immediate stone-free status.

**Keywords:** Ureteral calculi; Extracorporeal shock wave lithotripsy; Ureteroscopy.

### Introduction:

Urolithiasis is a health problem worldwide and India falls in the Afro-Asian stone belt stretching from Egypt to Indonesia [1]. It is the third most common affliction of the urinary tract [2]. Males are more commonly afflicted than females (Male:female=4:1) [3]. Most stones, smaller than 5 mm pass spontaneously [4]. Ureteroscopy (URS) and Extracorporeal shock wave lithotripsy (ESWL) are the two most favoured methods for the treatment of ureteric stones [5]. URS was earlier preferred for the treatment of lower third ureteric calculi only with limited success in the management of proximal ureteric stones. But with the modern lithotripters and better imaging, URS is being offered for the management of upper ureteric calculi too. ESWL

enthusiasts counter that although stone-free rates are not as high as with ureteroscopy, ESWL is the less invasive procedure with fewer complications and predictable success. Also, the anaesthesia and hospital admission could be avoided. Our hospital is a tertiary care referral hospital, and we are using in-house lithotriptors and ureteroscopes for the treatment of ureteric calculi. This is a study that is therefore directed to assess the efficacy and safety of Ureteroscopy (URS) versus Extracorporeal shock wave lithotripsy (ESWL) in the management of upper ureteric calculi.

### Material and methods:

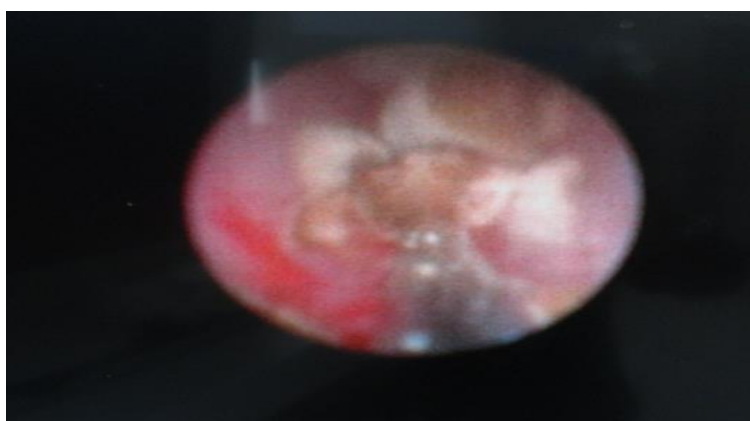
The Research ethical committee of the institution approved the study design before data collection. The study was a Randomised prospective Comparative study. A total of 60 patients were included in this study from July 2012 to July 2014. All patients underwent a thorough evaluation. We define upper ureteric stones as those stones found above the upper border of the sacrum to the ureteropelvic junction. Inclusion criteria comprised patient over 18 years of age of either gender with the solitary Upper Ureteric stone of 5 to 15mm size and with normal renal function. Patients with poorly functioning or non-functioning kidney, bleeding disorder or on an anticoagulant, pregnancy, urosepsis, obstructive calculus, radiolucent calculus, multiple ureteric calculi were excluded from the study. Urinalysis, Urine culture and sensitivity, Complete blood count, Blood Urea, Serum Creatinine, Serum Electrolytes, Blood Sugar level, X-ray KUB, Ultrasonography, Intravenous urography, Non-Contrast Helical CT (Selected cases) were performed before the procedure. Written informed consent was taken from all patients after explaining the merits and demerits of each procedure. All cases of URS were admitted and treated as inpatients. Most of the patients of ESWL were treated on an OPD basis except those who had come from outstation for the treatment. Patients were divided into two groups according to the procedure used by simple random sampling (every odd patient was randomized to Ureteroscopy group and vice versa). All patients in both groups were given Injection Amikacin just before the procedure. Antibiotics were changed if necessary in event of complications. In addition, Post procedure, all patients in both group were covered with Tab Levofloxacin (500mg) for 3 days. Spinal anaesthesia

was used in all cases of URS. Using a 3CCD (charge coupled device) video unit and standard techniques initial cystopanendoscopy was done. Thereafter, using fluoroscopic guidance, a guide wire (0.038/0.035-inch diameter, 150 cm long floppy straight tip Road Runner™ guide wire) was passed into the ureteric orifice, negotiating it beyond the stone, into the pelvi-calyceal system. Ureteroscopy was done thereafter with an 8/9.8 Fr, 45cm Karl Storz™ semi-rigid ureteroscope (Figure: 1). EMS Lithoclast was used for fragmentation of the stone. Post-procedure all patients were stented and underwent X-ray KUB for confirmation of clearance of stone and position of JJ stent (Figure: 2).

ESWL was performed by an Electro Magnetic Lithotripter (Make- Dornier Compact Delta™ manufactured by Dornier Med Tech) (GmbH) under analgesia Inj Tramadol 50 mg IV. Fluoroscopy was used for localization of the stone. Post-procedure all patient underwent X-ray KUB for confirmation of clearance of stone and were sent back to home. A maximum of 3000 shocks per sitting at a cycle of 60/ min with an intensity of 30-40 kV was given. Max of 5 sittings spaced apart, not less than 3 days were given. DJ stenting was done in selective cases on individual merit (Figure: 3&4).

Maximum of two attempts for URS and five sittings for ESWL were permitted after which the procedure was termed as a failure in the presence of non-fragmentation of stone and crossover or alternate method was used to clear the stone. The procedure was also termed as a failure if residual calculi were present at end of 4 weeks on X-ray KUB. However patient was followed up at 2wks, 6 wks and 12 wks with X-ray KUB, USG KUB and urine examination. SPSS version 19 was used for evaluation of results at the end of the study and a 'p' value of 0.05 was taken as significant

**Figure 1: Post fragmented ureteral stone**



**Figure 2: Plain Xray KUB showing JJ stent**



**Figure 3: Dornier Compact Delta**



**Figure 4: Passed stone through urine after ESWL**



**Results:**

In this study, 60 cases with upper urinary tract stones were studied. Among the total number of cases, 30 cases were treated with URS and 30 cases underwent ESWL. The patient’s age, gender and

stone size distribution are shown in table I, II and III. No statistically significant difference was found between ESWL and URS group with respect to age, sex and stone size.

**Table I: Mean age of the patient (in Yrs)**

Energy source	Number of patients	Age (years)		P-value
		Mean	SD	
URS	30	37.50	15.46	0.822
ESWL	30	36.50	18.66	

**Table II: Gender distribution in URS and ESWL groups**

		Group		Total	P-value
		URS	ESWL		
Gender	Female	5	8	13	0.532
	Male	25	22	47	
Total		30	30	60	

**Table III: Mean size of Stone in mm**

	Number of patients	Size of stone(mm)		P-value
		Mean	SD	
URS	30	9.40	2.16	0.319
ESWL	30	8.77	2.69	

### 1. Treatment Failure:

In the ESWL group, stone fragmentation was unsuccessful in three patients even after multiple sittings. URS was done for all these 3 patients with successful stone removal. In the URS group, stone removal failed in three patients. The stone was found to be impacted in one patient and could not be dislodged or fragmented and an open procedure was done. Two patients had stone migrations and ESWL was used for stone clearance. The difference in treatment failure rate was analysed using Fisher's exact test and it was found that the difference in treatment failure rate in URS and ESWL groups was not statistically significant ( $p=0.999$ ). The number of auxiliary procedure assessed by using a Fisher's exact test and found there was no significant difference in the requirement of auxiliary procedure between URS and ESWL groups. Follow up X-rays, USG KUB and urine investigations were done at 2, 6 and 12 weeks, did not reveal any residual stone in any of the 60 patients.

### 2. Clearance Rate:

The percentage of stone clearance rate immediately after the procedure was seen in 27(90%) patient out of 30 in the URS group and 19(63.3%) patient out of 30 in ESWL. At three months follow up stone clearance rate was found to be same for both the groups i.e. 90%. The immediate percentage of clearance and clearance at three months follow up for URS and ESWL group was analysed using t-test and it was found that there exists significant difference in the immediate clearance rate ( $p=0.030$ ), however, there is no significant difference at three months follow up for stone clearance in both the group ( $p=0.999$ ). The success of immediate clearance is more in the URS group as compared to the ESWL group

### 3. DJ Stenting:

The stenting was done in 21(70%) cases of URS and 6(20%) cases in the ESWL group. Three patients were those in which ESWL was not successful and for the remaining cases, DJ stenting was done due to large residual stone burden and ureteric colic. In all cases, stent removal was done under Local anaesthesia after 4 weeks. The percentage of patient with DJ stent was analysed using Fisher's exact test and found a significant difference between the placement of DJ stent in URS group and ESWL group ( $P<0.001$ ).

### 4. Complications:

There were no major complications following URS, however, haematuria was seen in 19 (63.3%) patients in the URS group. This was transient and cleared within 2-3days. Out of 19 patients who had haematuria, 2 patients had stone migration and one patient had culture-positive urinary tract infection which was successfully treated with ESWL, and culture based antibiotics respectively. In the ESWL group, five patients among six stented had haematuria. One patient who was not stented developed both hematuria and *steinstrasse*. One patient had only *steinstrasse*, both of them were treated conservatively. Haematuria was transient and cleared within 2-3days. The difference in a number of complication for both group was analyzed using Fisher's exact test and it was found that complication rates were significantly higher in URS group compared to the ESWL group( $p=0.004$ ).

### Discussion:

URS traditionally constituted the favoured approach for the surgical treatment of mid and distal ureteral stones while ESWL has been preferred for the less accessible proximal ureteral stones. With the development of smaller calibre semi-rigid and flexible ureteroscopes and the introduction of improved instrumentation, URS has evolved into a safer and more efficacious modality for treatment of stones in all locations in the ureter with increasing experience worldwide [6,7]. Both ESWL and URS are accepted treatment modalities for upper ureteric calculus, with ESWL having a better clearance rates compared to URS (90% for ESWL versus 80% for URS for stones less than 10 mm) but for larger stone (>10mm) URS have better clearance (68% for ESWL versus 79% for URS) and overall clearance for proximal calculi 81-82% which was almost similar to this study [8]. The average size of the stone in our study was smaller as compared to some of the studies [9, 10]. Most of our patients are first time stone formers. Any form of pain abdomen and urinary symptoms are thoroughly investigated in-house as per service requirement hence, we tend to catch our patients at an early stage. This may be the reason why the average size of the stone in our study was smaller with male preponderance. The clearance rates by ESWL in our study was similar to the meta-analysis of AUA (90% and 68% for stone sizes below 10mm and more than 10mm respectively). Further, ESWL clearances were comparable to

various studies using the same equipment (Dornier compact Delta lithotripter). In the URS group, clearance rate was higher to the meta-analysis conducted by the AUA group (80% and 79% for stones less than 10mm and more than 10 mm respectively). We have not encountered any major complications following URS. This compares with the decreased trend in complications over the past 20 years because of improvements in ureteroscopes, ancillary devices, intracorporeal lithotriptors, and surgical skills [11]. Studies have reported an overall complication rate after ureteroscopy of 10 – 20%. Many urologists prefer ESWL based on its non-invasiveness, minimal anaesthetic requirements, low morbidity and acceptable efficacy. ESWL treatment is less invasive than ureteroscopy, but has some limitation such as high retreatment rate, and is not available in all centres [12]. Urologists who favour URS claim that although it is an invasive procedure in contrast to ESWL, it has a greater success rate at the first treatment session. The availability of the

equipment, experience of the surgeon with both modalities, and the patient preference will determine the choice.

### Conclusion:

Both procedures i.e. URS and ESWL are feasible for management of upper ureteric calculus. URS had a better immediate clearance rate as compared to ESWL. However, the overall clearance rate was the same for both the group which was not statistically significant. There was no major surgical complication following either of the procedures except for the symptoms related to stent placement. ESWL may, therefore, be more beneficial at the government hospitals where there is an excessive inpatient load compounding acute shortage of manpower. The semirigid ureteroscope which we used in our study is as efficient as ESWL for the treatment of upper ureteric stones with the disadvantage of being invasive.

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