

## ORIGINAL ARTICLE

## TREATMENT OF DISTAL URETERIC STONES-COMPARATIVE EFFICACY OF TRANSURETERAL PNEUMATIC LITHOTRIPSY AND EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY

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**Background:** Ureteric stones greater than 6mm require intervention. Extracorporeal shockwave lithotripsy (ESWL) and ureteroscopy (URS) with intra-corporeal lithotripsy (ICL) are two least invasive therapies. Both show acceptable stone clearance. What should be the first line of treatment in distal ureteric stones? We conducted this study to compare the efficacy of ESWL and pneumatic ICL in order to develop clear cut treatment guidelines. **Methods:** This randomized control trial was conducted at Institute of Kidney Diseases, Peshawar from June 2011 to June 2012. Two hundred and twenty-four patients with distal ureteric stones 6–12 mm in size were included. Patients were randomized into two groups. Group-A patients were treated with URS plus ICL and Group-B with ESWL. Patients were evaluated for stone clearance after 2 weeks, with X-ray KUB and ultrasound. All the data were recorded in a *pro forma* and analysed in SPSS 10. Fisher's exact test was applied to compare the efficacy and a *p*-value of 0.05 was considered significant. **Results:** Out of 112 patients in Group-A, 75 (67%) were males and 37 (33%) were females while in Group-B 79 (70.5%) were males and 33 (29.5%) were females. The mean age in Group-A was, 48.73±16.23 years whereas it was 46±14.58 years in Group-B. Overall, mean age was 47.36±15.4 years. Mean stone size was 9.18±1.6 mm. At follow up (2 weeks post-operative) URS with ICL was successful in 101 (90.2%) patients while ESWL was successful in 75 (67%) patients (*p*-value=0.0001). **Conclusion:** Extracorporeal shockwave lithotripsy shows acceptable stone clearance but ureteroscopy with intra-corporeal lithotripsy shows superior results in distal ureteric stones.

**Keywords:** Pneumatic lithotripsy, ureteral calculi, ureteroscopy, extracorporeal shockwave lithotripsy

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### INTRODUCTION

Pakistan lies in the Afro-Asian stone belt where ureteric calculi are a common occurrence.<sup>1</sup> The treatment of ureteric stones ranges from watchful wait to ureteroscopy (URS) with intra-corporeal Lithotripsy (ICL), extracorporeal shock wave lithotripsy (ESWL), Dormia basket extraction and ureterolithotomy.<sup>2,3</sup> Technological improvement in extracorporeal and intra-corporeal lithotripsy has dramatically reduced the role of open stone surgery. ESWL and URS with ICL are two least invasive forms of therapy. Whether to go for ESWL or URS with ICL remains debatable till date. Some favours ESWL because, it is minimally invasive<sup>4</sup> in comparison to URS with ICL, does not require anaesthesia in adults, has no risk of complications associated with URS with ICL such as ureteric perforations and avulsions. While others favour URS with ICL because, it is safe and can be done as a day case procedure, has high rates of success and, usually, does not require multiple sessions as the case may be in ESWL.<sup>5</sup>

What should be the first line of treatment for distal ureteric stones? The American Urological Association and the European Association of Urology has strongly recommended conducting ran-

domized controlled trials comparing interventional strategies like URS and ESWL.

As the debate continues, we have conducted this randomized control trial to compare the efficacy of extracorporeal shockwave lithotripsy and ureterorenoscopy with intra-corporeal lithotripsy in the treatment of distal ureteric stones.

### MATERIAL AND METHODS

This randomized control trial was conducted at Institute of Kidney diseases, Peshawar from June 2011 to June 2012. A total of 224 patients, presenting with distal ureteric stones between 6–12 mm in size, were included in the study through OPD, after complete clinical evaluation (History, examination, relevant investigations like urine culture, X-ray KUB, Ultrasound KUB and excretory Urography) and permission from hospital ethical committee and written informed consent. Patients with renal insufficiency, ipsilateral ureteric stricture, active urinary tract infection and obesity (BMI ≥29) were excluded from the study as these factors adversely affect the efficacy of both the treatment modalities. The patients were randomized into two groups using lottery method. One hundred-twelve patients were

included in group-A and 112 in group-B. Group-A was subjected to URS with ICL using an 8Fr semi-rigid ureteroscope (Karl-Storz Germany) with 4Fr working channel and a conventional pneumatic lithotripter with 1mm metallic probe under spinal or general anaesthesia. A 6.5Fr DJ stent was placed post-operatively in all the cases of Group A. Group B was subjected to ESWL on the day of admission after giving an Intramuscular diclofenac sodium injection and in prone position using an electromagnetic lithotripter under fluoroscopic or ultrasound guidance. The shockwave energy was progressively increased until satisfactory fragmentation. All the procedures were performed by the same experienced urologist. All the patients were followed up 2 weeks after the procedure with an X-Ray KUB and Ultrasound KUB. The treatment was considered successful if there was no stone in X-ray KUB or the Ultrasound showed no stone or fragments less than 4 mm in diameter as they are supposed to pass spontaneously. All information was recorded in a predesigned *pro forma*. Data was analysed in SPSS version 10.0. Mean $\pm$ SD was calculated for quantitative variables like age and size of stone. Frequencies and percentages were calculated for categorical variables like gender and effectiveness. Fisher's exact test was applied to compare the efficacy of the treatment modalities. *p*-value of  $\leq 0.05$  was considered significant.

## RESULTS

The study showed that both the groups were comparable. Out of 224 patients 75 (67%) were males and 37 (33%) were females in Group-A with male to female ratio of 2.1:1 while in Group-B 79 (70.5%) were males and 33 (29.5%) were female with male to female ratio 2.39:1. Overall Male to female ratio was 2.2:1.

The mean age of patients in Group-A was, 48.73 $\pm$ 16.23 years whereas it was 46 $\pm$ 14.58 years in Group-B. Overall, mean age was 47.36 $\pm$ 15.4 years (Table-1). In Group-A, 60 stones were located on left side while 52 stones were located on the right side. Whereas in Group-B, 57 were left sided stones and 55 were right sided stones.

The mean stone size was 9.18 $\pm$ 1.6 mm. Thirty seven and 34 stones were 6–8 mm in size in Group-A and B respectively. Fifty-one stones of 9–10 mm in size in Group-A and B respectively and 24 and 27 stones of 11–12 mm in size in Group-A and B respectively (Table-2).

At follow up (2 weeks post-operative) URS with ICL was successful in 101 (90.2%) patients while ESWL was successful in 75 (67%) patients. The *p*-value was calculated using Fisher's exact test to be 0.0001 which is highly significant.

**Table-1: Age wise Distribution of Stones**

Age (in years)	Lithotripsy Procedure		Total
	Pneumatic	Extracorporeal Shockwave	
<=30.00	20	18	38
	17.9%	16.1%	17.0%
31.00–45.00	29	40	69
	25.9%	35.7%	30.8%
46.00–60.00	28	30	58
	25.0%	26.8%	25.9%
61.00+	35	24	59
	31.2%	21.4%	26.3%
Total	112	112	224
	100.0%	100.0%	100.0%

**Table-2: Size wise Distribution of stones**

Size of Stone (in mm)	Lithotripsy Procedure		Total
	Pneumatic	Extracorporeal Shockwave	
6–8	37	34	71
	33.0%	30.4%	31.7%
9–10	51	51	102
	45.5%	45.5%	45.5%
11–12	24	27	51
	21.4%	24.1%	22.8%
Total	112	112	224
	100.0%	100.0%	100.0%

## DISCUSSION

Ureteric stones are very common and responsible for a major burden on healthcare facilities. Depending upon size, location, symptoms and adverse effects on renal tract (Hydronephrosis, pyonephrosis, renal failure, septicaemia, etc), ureteric stones are treated conservatively, by extracorporeal shockwave lithotripsy, Ureterorenoscopy with intracorporeal lithotripsy, laparoscopic or open uretero-lithotomy. Intracorporeal lithotripsy can be done using electro hydraulic, ultrasonic, and pneumatic and LASER lithotripters.<sup>6</sup> The most widely used intra-corporeal lithotripter is pneumatic. It is cost effective, powerful, and less tissue traumatic.<sup>7–9</sup> It is best for impacted ureteric stones.<sup>10</sup> Extracorporeal shockwave lithotripsy can be done using electro hydraulic, electromagnetic and piezoelectric lithotripters. The common form used is electromagnetic. It is less traumatic than electro hydraulic and more powerful than piezoelectric lithotripter.

ESWL is indicated in non-impacted stones, non-infected urinary systems, children and in cases where patient has some contraindication for spinal or general anaesthesia.<sup>11</sup> Older patients would generally prefer a more conservative approach as compared to younger patients who are the earning hands and are having an active life style as they usually prefer a one-off treatment keeping in view that ESWL may require multiple sessions with a possibility of treatment failure.

ESWL does not require any anaesthesia (in adults). It avoids the complications associated with anaesthesia and the complications of a surgical procedure. It can be done on an outpatient basis and the patient does not have to miss his/her working hours. In the contrary URS with ICL requires spinal or general anaesthesia, although it can be done as a day case procedure.<sup>12,13</sup> Complications like ureteric perforation, avulsion, haematuria, sepsis and loin pain may be encountered.<sup>14,15</sup>

Our study is a comparison of efficacy of the two treatment modalities in terms of stone clearance. The two groups in our study are comparable in terms of gender distribution, mean age of study population and stone size and side. Our study showed that ureteric stones are twice as common in males as in females.<sup>3,16</sup>

Our study showed, that majority of our patients with ureteric stones were ranging 30–60 years of age (127 stones, i.e., more than half of patients). Our study also showed that left sided stones were more common as compared to right sided stones. The most common stone size in our study was 9–10 mm (102 Stones).

After treatment, the follow up of patient showed that URS with ICL was effective in 90.20%<sup>17</sup> of cases while the clearance rate in ESWL group was only 67% ( $p$ -value=0.0001). As the lower ureter is anatomically located in the pelvis, completely encased by the pelvic bones and pelvic organs, the ESWL may be less effective in comparison. The other point is that distal ureter is the narrowest part of the ureter and hence it may prevent the stone from expansion and thence non-fragmentation. The 90.2% clearance in URS group reveals that stone which could not be fragmented migrated proximally during the procedure due to dilated proximal system. However the stone can be dealt with later on by ESWL. In cases where ESWL fails, URS with ICL is the next viable option.

It is clear from our study that URS with ICL is more effective in the treatment of distal ureteric stones as compared to ESWL.

## CONCLUSION

Though stone fragmentation using extracorporeal lithotripsy shows good results even in bigger stones and remains a less invasive option but URS with ICL is an efficacious single session treatment for distal ureteric stones.

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