Original Article

Comparison of Treatment Efficacy of Extracorporeal Shock Wave Lithotripsy and Pneumatic Ureteroscopic Lithotripsy for Lower Ureteric Stones

Muhammad Adnan[1], Fazal-ur-Rehman Khan[2], Rana Ata-ur-Rehman[3], Abdul Rauf[2], M. Muzamil Tahir[2] and Hafiz Muhammad Aeymon[2]

ABSTRACT

Objective: To compare the treatment efficacy of ESWL and pneumatic lithotripsy for lower Ureteric Stones at six weeks after the procedure.

Study Design: A Randomized Controlled Trial Study

Place and Duration of Study: This study was conducted at the Department of Urology at Shaikh Zayed Hospital Lahore from February, 2016 to August, 2016.

Materials and Methods: A total 100 cases were included 50 in each group, after informed consent. By lottery method, patients were divided into group A or B. In group A ureteroscopic pneumatic lithotrips was performed with semi rigid 8 Fr ureterorenoscope. Swiss lithoclast was used for stone fragmentation. Prophylactic antibiotics were given to all patients. In group B, calculi were localized with fluoroscopy or ultrasound guidance in prone position and ESWL done. Analgesics were given to all patients. CT scan at 6 weeks follow-up was done to document complete stone clearance.

Results: Total 100 cases with lower ureteric stone were included in this study. The mean age of the patients was 38±10.41 years (range 19-63 years). Male patients were more 72 (72%). When the treatment groups were compared there were more stone clearance in URSL group 44 (88%) and less in 33 (66%) (p 0.016).

Conclusion: URSL was found to be more effective in terms of removal of lower ureteric stone as compared to ESWL.

Key Words: ESWL, URSL, Ureteric stone

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INTRODUCTION

Various factors such as, size of the calculus, degree of impaction and ureteral edema has contribution in obstructive uropathy due to lower ureteric stone. Colicky pain is the main symptom of ureteric colic, although it may remain asymptomatic in some cases.[1] 70% of ureteric calculi are situated in the lower third part of the ureter and Ureteric stone disease is the third most common phenomenon of the urinary tract.

[1.] Department of Urology, Bakhtawer Amin Hospital, Multan.
[1.] Department of Urology, Shaikh Zayed Hospital, Lahore.
[2.] Department of Urology, Nishtar Medical University, Multan.

Correspondence: Dr.. Muhammad Adnan, Assistant Professor of Urology, Bakhtawer Amin Hospital, Multan.
Contact No: 0331-4249121
Email: adnanshaheen123@yaoo.com

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Currently, options for the treatment of lower ureteral stones are extracorporeal shock wave lithotripsy (ESWL) and ureteroscopy (URS). ESWL was first introduced in early 1980s and has been widely used of urinary stone disease.[2] It is a clinically proven cost effective method, noninvasive and no or short hospital stay. Ureteroscopy (URS) is more invasive as a compared to ESWL and require general or spinal] anesthesia. The advantage of URS is better in breaking of hard stones and the ureter opening is dilated simultaneously by the scope to facilitate passage of broken fragments subsequently.[3] Complete stone clearance depends upon several factors, such as stone size and location, level of obstruction, composition and proficiency of the operator. Several studies reported that for lower ureteral stones extracorporeal shock wave lithotripsy appeared to be better treatment option. Nevertheless, some patients may needs repetitive ESWL whose stones not fragmented completely.[4] Some studies documented that ESWL was a safe, effective and noninvasive method to treat majority of stones with a minimal or no complications.[5]

In a study, ESWL was reported an effective and minimally invasive method for treating ureteral stones. In this study patient satisfaction was 94% for ESWl and 75% for ureteroscopy.[6] In another study conducted by Mostafa Kamal and colleagues the URSL has a significantly higher (p <0.005) stone free rate (80%) than ESWL (67.6%).[7] In a study success rates of SWL and URS were 82.9% and 97.7% respectively (p.001).[8] In another study the stone free status for ESWL and URS was 76.3% and 97.5% respectively (p <0.0001).[9]

MATERIALS AND METHODS

This randomized controlled study trial was conducted at Urology Department and comprised 100 patients (50 in each group) Patients included in this study were above 18 years age and less than 65 years of both sex and with distal ureteric stone size less than 15mm. While patients excluded were, refused to participate in the study, patients with solitary functioning kidney (absent second kidney on USG or nonfunctioning as determined by DTPA Renal Scan) and patients with creatinine more than 3mg/dl, ipsilateral ureteric stricture on CT scan, history of kidney transplant and ureter re-implantation. (URS not done due to difficult approach and increased risk of complications), urinary tract infection (p >10000 organism per HPF under microscope) diagnosed on urine culture and sensitivity. (risk of sepsis) and distal obstruction in ureter diagnosed on CT scan. (ESWL not recommended).

By lottery method, group A patients were treated with ureteroscopic intracorporeal pneumatic lithotripsy and group B were treated with ESWL. In group A patients were admitted after anesthesia, while the patients in group B no admission was required. For ESWL MODULITH SLX-F2 lithotripter was used. Patients were put in prone position for ESWL and ureteric stones were localized with ultrasound guidance for radiolucent stones and fluoroscope for the radiopaque stones and for focusing. All patients in group B were given intravenous fluid and analgesics according to the level of shock wave energy that was progressively stepped up till fragmentation of stones. In group A, URS was performed with semi rigid 8 Fr. Korl Storz (R) ureteroscope and stones were fragmented with pneumatic lithotripsy by using Swiss Lithoclast. All patients were given prophylactic antibiotics. CT scan at 6 weeks follow-up was done to document complete stone clearance.

RESULTS

Total 100 cases with lower ureteric stone were reported in this study. The mean age was 38±10.41 years (range 19-63 years) (Table 1). Male patients were more 72 (72%) while the female patients were 28 (28%) (Table 2). Efficacy in terms of stone clearance was observed in 82 (82%) while it was failure in 18 (18%) (Table 3). When the treatment groups were compared there were more stone clearance in URSL group 44 (88%) and less in 33 (66%) and this difference was significant (p 0.016) (Table 4). Mean stone size was 9.80±2.06mm. On stratification it was found that efficacy was noted same in all age groups and no significant difference with respect to efficacy of both treatment as URSL had shown efficacy in 14 (31.8%) and ESWL in 9 (27.3%) in 19-30-year age group patients while 30 (68.2%) in URSL and 24 (72.7%) in ESWL group of age 31-65 years was noted (Table 5). Gender had also did not shown significant difference for both treatment modalities as p 0.663 for male and 0.746 for female calculated for comparison of treatment groups (Table 6). Similarly, stone size did not had effect on the both treatment modalities (Table7).

Table No.1: Distribution according to age of the patients (n=100)

Groups	Mean±SD
URLS	38.10±11.203
ESWL	38.14±9.676
Minimum age	19.00
Maximum age	63.00

P value=0.30

Table No.2: Distribution according the gender of patients

Gender	No.	Percentage
Male	72	72.0
Female	28	28.0
Groups		
	URLS	**ESWL**
Male	36 (72.0%)	36 (72.0%)
Female	14 (28.0%)	14 (28.0%)

Table No.3: Distribution for efficacy of treatment

Efficacy treatment	No.	Percentage
Yes	82	82.0
No	18	18.0

Table No.4: Comparison ofefficacy in the different treatment groups

Groups	Efficacy	
	Yes	No
URSL	44 (88.0%)	6 (12.0%)
ESWL	33 (66.0%)	17 (34.0%)

P 0.016

Table No.5: Stratification of efficacy with respect to age

Age (years)	Efficacy		P value
	Yes	No	
19-30			
URSL	14 (31.8%)	3 (50.0%)	0.396
ESWL	9 (27.3%)	6 (35.3%)	
31-65			
URSL	30 (68.2%)	3 (50.0%)	0.746
ESWL	24 (72.7%)	11 (64.7%)	

Table No.6: Stratification of efficacy with respect to gender

Gender	Efficacy		P value
	Yes	No	
Male			
URSL	31 (70.5%)	5 (83.3%)	0.663
ESWL	23 (69.7%)	13 (76.5%)	
Female			
URSL	13 (29.5%)	1 (7.5%)	0.746
ESWL	10 (30.3%)	4 (23.5%)	

Table No.7: Stratification of efficacy with respect to size of stone

Stone size	Efficacy		P value
	Yes	No	
5-8 mm			
URSL	23 (52.3%)	1 (16.7%)	0.192
ESWL	14 (42.4%)	6 (35.3%)	
>8 mm			
URSL	21 (47.7%)	5 (83.3%)	0.763
ESWL	19 (57.6%)	11 (64.7%)	

DISCUSSION

Crystallization of concentrated urinary substances results in urinary lithiasis is most common theory of stone formation. Not drinking enough water is the most common cause of kidney stones, besides dietary factors. Dietary factors such as increase intake of red meat results in over acidification of urine causing the increased excretion of calcium, uric acid and oxalate, whereas the urinary excretion of citrate which has protective role against stone formation is decreased that ultimately results in calcium and uric acid stone formation. Hence main risk factor for the formation of uric acid stones is production of acidic urine.

Kidney stones are more common in men than in women which is in accordance with this study and similar results were documented by Stapleton.[10] Thus, predisposition of stone formation is due to increased metabolic waste because of tissue breakdown. Asplin et al documented in his study that higher prevalence of stone formers ranging from 21-40 years of their age which is similar to our study results. Increased prevalence of urinary stones when men enter into their 40s and continues to rise into their 70s is documented in some studies. For female gender, the prevalence of stone formation peaks in their 50s.[10,11] In the treatment of ureteric stones extra corporeal shockwaves lithotripsy and ureterorenoscopy are the most common therapeutic methods. Our study assessed the effectiveness of each modality. Odds ratio were lower than 1 regarding the stone clearance in each study for patients with upper and lower ureteral stones, which shows that ureterorenoscopy with lithoclast is favored over extra corporeal shockwaves lithotripsy. Odds ratio were higher than 1 for the retreatment during extra corporeal shockwaves lithotripsy which also suggest that ureterorenoscopy with lithoclast as a better modality.[12]

Stone clearance of ureteric stones ranges from 70.7% to 96.8% in different studies, showing a trend of better success rate as the number of patients increases in each study.[13,14] About ureterorenoscopy with pneumatic lithotripsy, our results are comparable with those of other available data. Proximal stone migration during ureterorenoscopy with pneumatic lithotripsy is known disadvantage. The overall migration of stone rate in this study was 11.36 and 27.27%. Proximal stone migration during ureterorenoscopy with pneumatic lithotripsy can be decreased by the use of occlusion devices (balloon catheter, stone cone, basket), suction device (Lithovac) or occlusion material (lidocaine jelly).[14]

Lithotripter has several advantages such as greater comfort for patient during procedure, a great comminution of the stone, better imaging because of the very high quality of the fluoroscopy. Our results of ESWL are comparable with published literature success rates of 40-91%.[15] Computerized tomography (CT) scan is used to estimate the stone type by measuring density. It was documented in some studies that success rate of extra corporeal shockwaves lithotripsy for urinary stones cannot be predicted on densities measured by CT scan. These densities also cannot predict the number of sessions required during extra corporeal shockwaves lithotripsy[16]. Stones with densities <500 Hounsfield units (HU) are highly likely to result in successful extra corporeal shockwaves lithotripsy. Conversely, stone densities ≥800 HU are less likely to be fragmented.[17] In a study extra corporeal shockwaves lithotripsy for lower ureteric calculi resulted in a success rate of 81% compared with 99% for URSL. However, patients treated with URS were stone-free within 2 days, whereas patients in the extra corporeal shockwaves lithotripsy group required up to 4 months which showed that URSL was having higher efficacy as compared to extra corporeal shockwaves lithotripsy.[15] Similarly in a review of seven RCTs (1205 patients), it was found that stone-free rates were lower in patients who underwent extracorporeal shockwaves lithotripsy (7 studies, 1205 participants: RR 0.84, 95% CI 0.73 to 0.96) but re-treatment rates were lower in ureteroscopy patients (6 studies, 1049 participants: RR 6.18, 95% CI 3.68 to 10.38.18. So the fact is that, the URSL is more convenient and efficacious procedure for the treatment of lower ureteric calculi. There is a need to replace the ESWL procedure with this new modality so that patients could be treated more effectively in a lesser time irrespective of the gender or age discrimination.

CONCLUSION

Both URSL and SWL enable an effective and safe primary treatment option for the stone in the lower ureter. The URSL has a significant higher initial stone-free rate; however, after six weeks of follow-up, the

stone-free rate of SWL has been further increased and the difference between the two procedures becomes less significant.

Author's Contribution:

Concept & Design of Study:	Muhammad Adnan
Drafting:	Fazal-ur-Rehman Khan, Rana Ata-ur-Rehman
Data Analysis:	Abdul Rauf, M. Muzamil Tahir and Hafiz Muhammad Aeymon
Revisiting Critically:	Muhammad Adnan, Fazal-ur-Rehman Khan
Final Approval of version:	Muhammad Adnan

Conflict of Interest: The study has no conflict of interest to declare by any author.

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