Management of Proximal Ureteric Stones: Extracorporeal Shock Wave Lithotripsy (ESWL) Versus Ureterorenoscopic Lithotripsy (URSL)

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ABSTRACT

Background

Urolithiasis is the third most common disease of the urinary tract after urinary tract infections and pathologic conditions of prostate. Debate is ongoing regarding the effectiveness of Extracorporeal Shock Wave Lithotripsy (ESWL) and ureterorenoscopic lithotripsy (URSL) in the management of ureteral stones.

Objective

We aim to compare the efficacy of Extracorporeal Shock Wave Lithotripsy and Ureterorenoscopic Lithotripsy in the management of upper ureteric stones in terms of stone clearance.

Method

This prospective hospital based study included patients with upper ureteric calculus managed with Ureterorenoscopic Lithortripsy with Double J stenting or Extracorporeal Shock Wave Lithotripsy at Dhulikhel Hospital, Kathmandu University Hospital from August 2014 to July 2015. Stone size, stone clearance, number of sittings, complications and need of other procedure were recorded.

Result

There were 90 patients with upper ureteric calculus. Among these patients, 45 patients underwent Extracorporeal Shock Wave Lithotripsy and 45 patients underwent Ureterorenoscopic Lithotripsy. There was no difference in male/female ratio, age and stone diameter between two groups ($p>0.05$). Total stone-free ratio was 88.9% (40/45) for Extracorporeal Shock Wave Lithotripsy and 82.2% (37/45) for URSL, partial fragmentation requiring shift of modality of treatment was 8.88% (4/45) for Extracorporeal Shock Wave Lithotripsy and 13.33% (6/45) for Ureterorenoscopic Lithotripsy. Failure of procedure was noted in 11.1% in Extracorporeal Shock Wave Lithotripsy group and 17.8% in URSL group In the Extracorporeal Shock Wave Lithotripsy group, 8.89% (4 out of 45) patients required Ureterorenoscopic Lithotripsy for complete stone clearance. Complete stone clearance could not be achieved in 2.23% (1 out of 45) patient with both Extracorporeal Shock Wave Lithotripsy and Ureterorenoscopic Lithotripsy and had to undergo open ureterolithotomy.

Conclusion

Both Extracorporeal Shock Wave Lithotripsy and Ureterorenoscopic Lithotripsy are equally effective in the management of upper ureteric calculus with no significant difference in age, male/female ratio, stone diameter and stone free ratio.

KEY WORDS

Extracorporeal shock wave lithotripsy, Ureterorenoscopic lithotripsy, Ureteric stone

INTRODUCTION

Urolithiasis is the third most common disease of the urinary tract after urinary tract infections and pathologic conditions of prostate.[1] Stone in the ureter usually descends from the kidney.[2] Stones obstructing the renal pelvic outlet or ureter typically present acutely, with pain, hematuria, and possibly nausea, vomiting and ileus. The optimal treatments of ureteral stones are controversial. Because of minimally invasive nature, Extracorporeal Shock Wave Lithotripsy (ESWL) has been preferred treatment modality for ureteral stones, although ureteral stones are known to fragment less effectively than renal stones.[3,4] In cases where ESWL fails, Ureteroscopic Lithotripsy (URSL) has been recommended as the first line therapy, which may potentially save resources and time resulting from the decreased effectiveness of ESWL.[5] In this study, we aim to compare and assess the safety and efficacy of ESWL and URETERO RENOSCOPIC LITHOTRIPSY in the management of upper ureteric stones.

METHODS

This is a single institution based quasi randomized prospective study encompassing all patients undergoing treatment for upper ureteric calculus with URSL with DJ stenting or ESWL at Dhulikhel Hospital, Kathmandu University Hospital from August 2014 to July 2015. Patients with upper ureteric calculus ranging from 5 mm to 20 mm with normal renal function test were included in the study. Patients with calculi less than 5 mm, pregnant women, patients with features of urinary tract infection/urosepsis, deranged renal function, radiolucent calculi, age below 16 years and patients with bleeding diathesis were excluded from the study. Institutional approval was taken for the study from Ethical committee. Informed consent was taken from each participant. Patients were allotted to ESWL and URSL group on alternate basis. All cases of ESWL group were treated on OPD basis whereas patients of URSL group were admitted and treated as inpatients. ESWL was performed by Electro Magnetic Lithotripter (Siemens Modularis Variostar). Ureteroscopy was performed using Semirigid 7/9.5 F, 10 degree Ureteroscope (Olympus and Karl Storz) along with The Swiss Lithoclast and stone retrieval device (Forceps/Dormia basket) under spinal anesthesia in Lithotomy position. Outcome of the procedures were documented as completely fragmented if clearance of stone is noted and failed procedure if retained stone is found in follow up X-ray KUB/USG after 4 weeks of the procedure. Maximum of two attempts for URSL and three sittings for ESWL were permitted after which the procedure was termed failure in the presence of non-fragmentation of stone and cross over or alternate method was used to clear the stone. Procedure was also deemed as failure if residual calculi or inability of stone fragmentation is noted at end of 4 weeks on X-ray KUB.

SPSS 20.0 software (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis. Frequency analysis was performed for scalar and ordinal variables. For nominal variables, descriptive analysis was performed with calculation of mean, range, standard deviation. Independent sample t-test was performed for comparision of parametric scalar variables between two groups. For non parametric categorical variables, Chi square test was performed. The p value of less than 0.05 was considered significant.

RESULTS

During the study period there were total 90 patients with upper ureteric calculus, 45 in ESWL group and 45 in URSL group. Of these cases, male to female ratio was 1.64 in ESWL group and 2.46 in URSL group. In this study, average age of patients in ESWL group was 33.04±11.46 years and in URSL group was 35.80±12.09 years. Differences between the mean age of patients in two groups was not statistically significant (p>0.05).

Table 1. Distribution of patients according to age group.

Age Group	ESWL	URSL
<20	3(6.67%)	1(2.22%)
20-39	32(71.11%)	32(71.11%)
40-59	7(15.55%)	9(20.0%)
≥60	3(6.67%)	3(6.67%)
Total	45(100%)	45(100%)

As shown in Table 1, Majority of patients, 32(71.11%) in ESWL group and 32(71.11%) in URSL group were in the age group 20-39.

Table 2. Comparison of stone size.

	ESWL	URSL	p
Stone size (Mean±SD (Range)	11.038±2.65 (6.9-16.8)	11.438±2.90 (6.0-18.0)	0.497

As shown in the Table 2, the average stone size was similar in both ESWL and URSL groups.

Table 3. Comparison of patients according to stone clearance

Stone clearance	Yes	No	p
ESWL	40(88.9%)	5 (11.1%)	0.368
URSL	37 (82.2%)	8(17.8%)	

As shown in the Table 3, complete stone clearance is seen in 88.9 % in ESWL group and 82.2 % in URSL group. Failure of procedure was noted in 11.1% in ESWL group and 17.8% in URSL group respectively.

In the ESWL group, 8.89% (4 out of 45) patientsrequired URSL for complete stone clearance. Complete stone clearance could not be achieved in 2.23% (1 out of 45) patient with both EWSL and URSL and had to undergo open ureterolithotomy.

In URSL group, 13.33% (6 out of 45) patients needed ESWL for complete clearance of stone due to retained stones after URSL. Stone removal failed in 4.44% (2 out of 45) patients. In the first patient, ureteroscope could not be negotiated through the ureteric ostium due to bleeding. In the second patient, stone was impacted in the ureter which could not be dislodged or fragmented. Open procedure (ureterolithotomy) was done for the same patient.

Differences between the patients in two groups in terms of stone clearance was not statistically significant.(p>0.05).

As shown in the Table 4, number of settings was lesser in URSL group but was not statistically significant.

Table 4. Comparison of patients according to number of settings of procedure.

	ESWL	URSL	p
Number of Settings (Mean ± S.D)	2.16±0.424	1.07 ±0.252	0.230

Table 5. Comparison of outcome according to stone size group.

Procedure	Stone size	Complete stone clearance	Incomplete/ Failed stone clearance	p
ESWL	≤10 mm	20	1	0.205
	>10 mm	20	4	
URSL	≤10 mm	18	2	0.222
	>10 mm	19	6	

Five patients in ESWL group required DJ insertion while all patients in URSL group had DJ stenting except in one patient in whom ureteric ostium could not be visualized due to bleeding.

As shown in Table 5, In this study, among the patients with procedure failures, in ESWL group, 4 out of 5 patients with ESWL failure had stone size >10 mm and in URSL group, 6 out of 8 patients with URSL failure had stone size >10 mm. In both groups, patients with stone size >10 mm were found to have more failed procedures; however this is not statistically significant. (p>0.05).

As shown in Table 6, In this study, among the patients with procedure failures, in ESWL group, 3 out of 5 patients with ESWL failure were male patients and in URSL group, 7 out of 8 patients with URSL failure were male patients. In both groups, male patients were found to have more failed procedures; however this is not statistically significant. (p>0.05)

Hematuria was noted in 5 patients in ESWL group and 16 patients in URSL group. This was transient and subsided after 2-3 days. One patient in ESWL group had steinstrasse and managed with DJ stenting. Five patients in ESWL group developed petichae at lumbar region after the procedure. In URSL group, two patients developed Postdural puncture headache (PDPH), managed with analgesics and rehydration.

No incidence of any major complications was noted in both groups of patients.

Table 6. Comparison of outcome according to sex.

Procedure	Sex	Complete stone clearance	Incomplete / Failed stone clearance	p
ESWL	Male	25	3	0.913
	Female	15	2	
URSL	Male	25	7	0.259
	Female	12	1	

Table 7. List of complications.

Complications	ESWL	URSL
Pain	8	5
Echimosis	5	0
Hematuria	5	16
Steinstrasse	1	0
Postdural puncture headache (PDPH)	0	2

DISCUSSION

In this study, the mean age of the patients was 33.04 years ± 11.46 in ESWL group and 35.80±12.092 in the URSL group. The difference was not statistically significant (p=0.270). In the study by Pearle et al. mean age in ESWL group was 41.2±14.9 years and URSL group was 41.2±12.8 years respectively.[6] In the study by Lee et al. mean age in ESWL group was 54.2±16.7 years and URSL group was 48.5±13.3 years respectively.[7] Youssef et al. has found mean age 43.2±10 years and 47.5±10 years in ESWL and URSL group respectively.[8] Patients in our study were found to have ureteral stones in younger age as compared to above mentioned studies, the probable reasons could be subtropical geographical location of our country, habit of drinking less water in general population.

The prevelance of urolithiasis is more in male population in our study with Male: Female ratio of 1.65:1 (28:17) in ESWL group and 2.45:1 (32:13) in URSL. Salem et al. has reported similar findings with Male: Female ratio for >1 cm stone size 27:15 and <1 cm stone size 43:15 in ESWL group and for >1 cm stone size 30:18 and <1 cm stone size 35:17 in URSL group respectively.[9] The lifetime risk of urolithiasis in the general population is 13% in men and 7% in women.[10]

In our study, in ESWL group, the size of stone ranged from 6.9 mm to 16.8 mm with mean size of 11.038±2.65 mm and in URSL group, the size of stone ranged from 6 mm to 18 mm with mean size of 11.438±2.90 mm. The difference of the stone size in both groups were not statistically significant (p=0.497). Lee et al. has found the stone length to be 17.9±3.9 mm in ESWL group and 18.5±2.9 mm in URSL group and stone width to be 9.8±2.5 mm in ESWL group and 10.3±2.1 mm in URSL group respectively.[7] Youssef et al. has found the stone length to be 10.7 mm (5-17) in ESWL group and 10.7 mm (5-17) in URSL group.[8]

Stone clearance rate in this study in ESWL group was 88.9% (40 out of 45 patients) and in the URSL group, there was

82.2% stone clearance (37 out of 45 patients). Our findings are comparable to that as reported by other studies. The joint EAU/AUA Nephrolithiasis Guideline Panel has reported the stone clearance rate for proximal ureteral stones <10 mm to be 90% (85-93%) in ESWL group and 80% (73-85%) in URSL group and for proximal ureteral stones > 10 mm to be 68% (55-79%) in ESWL group and 79% (71-87%).[11] Joshi et al. have reported 86.6 % stone clearance rate for ureteric calculus by ESWL.[12]

In our study, 3 out of 5 patients with ESWL failure and 7 out of 8 patients with URSL failure were male patients; 4 out of 5 patients with ESWL failure and 6 out of 8 patients with URSL failure had stone size >10 mm. Male patients and Patients with stone size > 10 mm were found to have more procedure failure and need of auxiliary procedures, however this was not statistically significant (p >0.05). Our findings corresponds with Salem et al. as shown stone size >10 mm and male gender as predictors of failure for ESWL and URSL.[9]

Stenting was done in all cases in the URSL group in this study except for one patient in which ureteric ostium could not be visualized due to excessive bleeding during the procedure. Five patients in ESWL group required DJ stent placement either due to steinstrasse or due to large ureteric calculus. In all patients with DJ stent placement, stents were removed after 6 weeks under local anesthesia. There is an increasing trend to avoid stents in clinical practice as stents have been shown to cause distressful lower urinary tract symptoms and impair quality of life.[13]

CONCLUSION

This study has shown that in patients with upper ureteric calculi, satisfactory stone clearance can be achieved equally with ESWL and URSL. Advantages of ESWL are itsnon invasive nature, higher levels of patient acceptance, lack of need of general anesthesia and provision of treatment in outpatient facilities. Drawback of ESWL is the need for more sessions to achieve stone free status as compared to URSL. Advantages of ureterorenoscopy are earlier stone free status, lesser numbers of hospital visits and wider availability of equipments. The need for second treatment was higher in the ESWL group. Both ESWL and URSL are safe with only hematuria as more common complication after URSL. ESWL in outpatient setting can be used as first line treatment of patients with upper ureteric calculus with comparable outcomes as those attained by URSL.

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