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Original Article

In Situ Extracorporeal Shock Wave Lithotripsy (ESWL) and ESWL after Push Back For Upper Ureteric Calculi: A Comparative Study

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Abstract

Background

ESWL is one of the most important modality for the treatment of urolithiasis. In situ ESWL is a non-invasive and safe procedure for renal and upper ureteric stones in selected cases & can be performed on outpatient basis. However, some urologists claim a higher success rate of ESWL after push back procedures for upper ureteric calculi.

Materials & Methods

This prospective study was done to compare the results of treatment of upper ureteral calculi by in situ ESWL and ESWL after push back. 90 consenting patients with single upper ureteric stones of ≤ 1 cm in size with no distal obstruction were selected and divided into two groups. 50 patients in group 1 were treated by in situ ESWL while 40 patients in group 2 were treated by push back followed by ESWL.

Results

Better clearance was achieved with ESWL after push back (92.5% clearance after 90 days) than with in situ ESWL (90% clearance after 90 days) but it was not statistically significant ($p > 0.05$). The mean shock wave was 1994 ± 449 for in situ ESWL group and 1757.5 ± 255 for ESWL after push back group, which was statistically very significant ($p < 0.01$). The mean energy used was 5.07 ± 0.81 in the in situ ESWL group and 4.6 ± 0.48 in ESWL after push back group and this difference was also statistically significant ($p < 0.01$). Post procedure complications like loin pain, hematuria, lower urinary tract symptoms (LUTS) and fever were more common in ESWL after push back group than in the in situ ESWL group and the differences were statistically significant.

Conclusion

In situ ESWL is a better option than ESWL after push back for the management of upper ureteric stones in selected group of patients.

Key Words: *ESWL, Pushback, Stone clearance, Upper ureteric stones*

Introduction

Urolithiasis is the third most common disease of the urinary tract, urinary tract infections and pathological conditions of the prostate being the first and second respectively [1]. There are various modalities of treatment of stone disease

ranging from open surgical procedures to non-invasive ESWL; in between these two are minimally invasive PCNL, URS and laparoscopic removal. Most of the urologist prefers ESWL as it is non-invasive and safe procedure [2]. In the early days ESWL was used to disintegrate renal stones only and

ureterolithotomy was practiced for upper ureteral stones. However, ureterolithotomy requires anaesthesia, prolonged hospitalization and convalescence and may be associated with significant morbidity.

Ureteroscopic or percutaneous management of ureteral stones has variable success rate depending on the site of stones which is 50% in the upper ureters [3], but it also requires anaesthesia and has a complication rate of 2-4% [4].

Therefore, it was a natural extension to use ESWL for the management of ureteral stones after the success achieved in the management of renal stones. The treatment of upper ureteral calculi has been markedly altered by recent developments in shock wave lithotripsy (in situ or after push back), ureteroscopy and percutaneous stone removal. The non-invasive nature of ESWL has a strong appeal to the patients and physicians, and has become the first line treatment option for proximal ureteral stones [5]. Although some urologists claim a higher success rate of ESWL after push back procedure, the invasiveness of the additional ureteral manipulation must be considered [6]. On the other hand, in situ ESWL for uncomplicated upper ureteric calculi is appealing because it is non-invasive, requires no anaesthesia, low morbidity, low cost and can be performed as an outpatient therapy and offers acceptable results. So, this study has been done to compare the results of treatment of uncomplicated upper ureteral calculi by in situ ESWL and ESWL after push back.

Materials and Methods

This prospective study was done in the Department of Urology, Morang Sahakari Hospital, Biratnagar from April 2015 to April 2017 after getting institutional ethical clearance. 90 patients with single upper ureteric stones of ≤ 1 cm in size with no distal obstruction were selected and divided into two groups. Stones located

< 2 cm lateral to the spine, size > 1 cm in size, pregnant women and patients with bleeding disorders were excluded from the study. After taking the informed consent, 50 patients of group 1 was treated by in situ ESWL while 40 patients of group 2 was treated by push back followed by ESWL. In all case, ESWL was done by Allengers UROLITH⁺ lithotriptor.

All patients were thoroughly examined and routine investigations done. IVU was done in all patients to see the condition of kidneys, grade of hydronephrosis, location and size of stone. All patients were advised to take mild laxative and ultracarbon in the night before ESWL. All patients were given nothing per oral from morning on the day of procedure and were given intravenous fluid & diclofenac suppository half hour prior to the procedure. Additional analgesia or sedation was given on demand basis. In patients of group 2, a pre-ESWL push back procedure was done under spinal anaesthesia and fluoroscopic guidance. After dislodging the stone back into the kidney, a DJ stent was kept in situ and ESWL was done.

After ESWL, all patients were advised to follow up after 7 days with a plain X-ray of KUB region, and if necessary second & third session of ESWL were given at one-week interval. If the stone fails to clear after third session, the patient was observed for 90 days to see stone clearance. Refractory cases were referred for other modalities of treatment. The data were analysed using SPSS version 16. Students- t test and chi- square test were used and p-value of < 0.05 was considered significant.

Results

50 patients were treated by in situ ESWL (Group 1) while 40 patients were treated by push back followed by ESWL (Group 2). The demographic and baseline characteristics of the patients are shown in

Table I. The mean age in both groups was approximately 35 years. Most of the patients were males with the left ureter being involved predominantly (70 – 75%).

Table I: Demographic & baseline characteristics among the groups

Characteristics	Group 1 (N = 50)	Group 2 (N = 40)
Mean age ± SD Range (years)	34.86 ± 11.74 17-62	35.12 ± 14.48 16-62
Sex distribution		
Male	32 (64%)	30 (75%)
Female	18 (36%)	10 (25%)
Involved ureter		
Left	35 (70%)	30 (75%)
Right	15 (30%)	10 (25%)
Size of stone		
< 1 cm	28 (56%)	15 (37.5%)
1 cm	22 (44%)	25 (62.5%)

The outcome variables were stone clearance rates (table II), ESWL sessions required, shock wave & energy required, post procedure complications and hospital stay (table III).

Table II: Stone clearance rates between the groups.

Stone clearance rates	Group 1 (in situ)	Group 2 (push back)	p-value
Clearance after 1 st session			
< 1 cm	18 (36%)	8 (20%)	> 0.05 ⁿ
1 cm	10 (20%)	13 (32.5%)	
Clearance after 2 nd session			
< 1 cm	5 (10%)	5 (12.5%)	> 0.05 ⁿ
1 cm	7 (14%)	7 (17.5%)	
Clearance after 3 rd session			
< 1 cm	3 (6%)	2 (5%)	> 0.05 ⁿ
1 cm	2 (4%)	2 (5%)	
Overall clearance after 90 days			
< 1 cm	26 (92.86%)	15 (100%)	> 0.05 ⁿ
1 cm	19 (86.36%)	22 (88%)	

ⁿχ² test was not significant

Table III: Number of ESWL sessions, shock wave & energy required, complication & hospital stay between the groups.

Variables	Group 1 (in situ)	Group 2 (push back)	p-value
Avg. ESWL sessions required(n)			
< 1 cm	1.54	1.46	> 0.05 ⁿ
1 cm	1.77	1.48	
Shock waves required (n)			
Mean ± SD	1994 ± 449	1757 ± 255	< 0.01*
Range	1500-5000	1000-2000	
Energy required (KV)			
Mean ± SD	5.07 ± 0.81	4.63 ± 0.48	< 0.01*
Range	4-8	4-6	
Complications (n)			
LUTS	12 (24%)	28 (70%)	< 0.001 ^a
Loin pain	20 (40%)	25 (62.5%)	< 0.01 ^a
Fever	5 (10%)	12 (30%)	< 0.01 ^a
Haematuria	15 (30%)	28 (70%)	< 0.001 ^a
Hospital stay (days)			
Mean ± SD	1.06 ± 0.24	2.4 ± 0.74	< 0.001*
Range	1-2	2-5	

ⁿχ² test was not significant; * t test was significant; ^aχ² test was significant

Discussion

In the in situ ESWL group, 28 (56%) cases were cleared of stone after 1 week of first session, among which 18 (36%) were < 1 cm in size and 10 (20%) were 1 cm in size. However, the higher clearance rate of the smaller stones was not statistically significant. It was also observed that 12 (24%) cases required second and 5 (10%) cases required third sessions for complete clearance of stone. Overall clearance was achieved in 45 (90%) cases after 90 days in this group. These findings are similar to those by El-Gammal et al. who reported 94.8% clearance rate for upper ureteric stones treated by ESWL in situ with 66.7%

patient stone free after first session, 17.7% needed two sessions and 8.5% required three sessions [7]. Similarly, Shameen et al. also reported good results with 96.6% stone free rates in a study on 118 patients of ureteral stones of mean 11.1 mm in size treated with in situ ESWL using Lithostar plus lithotripter [8].

In the ESWL after push back group, 21 (52.5%) cases were cleared of stone after 1 week of first session, among which 8 (20%) were <1 cm in size and 13 (32.5%) were 1 cm in size. However, the higher clearance rate of the larger stones was not statistically significant. It was also observed that 12 (30%) cases required second and 4 (10%) cases required third sessions for complete clearance of stone. Overall clearance was achieved in 37 (92.5%) cases after 90 days in this group. Although more clearance rate was achieved in ESWL after push back, it was not statistically significant ($p > 0.05$). Danuser et al. also reported 96% stone free rates at 3 months after ESWL in situ and 94% stone free rate at 3 months after push back followed by ESWL [6]. Similarly, Kumar et al. in a similar comparative study showed 80% clearance rate in group 1 and 88.5% clearance in group 2 at 3 months [9]. These results compare favourably with our study although making comparison between them is difficult since the criteria for disintegration and the type of lithotripter used varied.

The number of average ESWL sessions in our study was 1.54 for stone <1 cm and 1.77 for stone of 1 cm in the in situ ESWL group (group 1), whereas it was 1.46 and 1.48 respectively for stones <1 cm and of 1 cm respectively in the push back followed by ESWL group (group 2). Although less number of ESWL sessions were required in push back group, it was not statistically significant. In a study by Kumar et al., the number of average sessions was 1.86 ± 1.2 and 2.03 ± 1.2

respectively for in situ ESWL & ESWL after push back [8].

In our study, more shock wave and energy was needed in the in situ ESWL group than in ESWL after push back group. The mean shock wave was 1994 ± 449 for group 1 and 1757.5 ± 255 for group 2. The difference between the two groups was statistically very significant ($p < 0.01$). The mean energy used was 5.07 ± 0.81 in group 1 and 4.6 ± 0.48 in group 2 and this difference was also statistically significant ($p < 0.01$). However, Danuser et al. found that more shock wave and energy was required for in situ ESWL rather than ESWL after push back [6].

Post procedure complications like loin pain, haematuria, lower urinary tract symptoms (LUTS) and fever were more common in group 2 than in group 1 in our study and the differences were statistically highly significant. All these complications were treated by conservative measures. Similarly, the mean hospital stay was 1.06 ± 0.24 days for group 1 while it was 2.4 ± 0.74 days for group 2 which is again highly significant ($p < 0.001$). Hendrix et al. in a similar study reported an average hospital stay of 0.85 and 1.2 days for in situ ESWL and ESWL after push back groups respectively [10].

Although exact cost of the procedure could not be determined, the cost of group 2 was higher due to the charges for the push back procedure in addition to the charges of ESWL. For ESWL and patients in group 1, they have to pay only a one-time charge of Rupees 25000 irrespective of the number of sessions required. Moreover, the mean hospital stays in group 2 was longer with more working day loss for the patient. Thus, ESWL after push back was costlier than in situ ESWL.

Conclusion

Considering the findings of this study, it can be concluded that in situ ESWL is a

better option than ESWL after push back for the management of upper ureteric stones in selected group of patients and thereby avoids a more invasive procedure. Besides, ESWL after push back may be reserved for the case that fails to clear the stones after in situ ESWL. A major limitation of this study was the non-homogenous nature of study subjects, so further study with homogenous and large sample size is recommended to determine the optimum treatment option for upper ureteric stones more precisely.

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