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The Outcome of Extracorporeal Shockwave Lithotripsy for Upper Ureteric Stone with and without JJ Stent

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Abstract **Original Research Article**

***Background*:** Extracorporeal shock wave lithotripsy (ESWL) is a well-established, minimally invasive treatment for upper ureteric stones. The role of routine pre-ESWL JJ stenting remains controversial, particularly for stones ≤2 cm. ***Objective*:** To compare the treatment outcomes of ESWL in patients with upper ureteric stones managed with and without JJ stent placement. ***Methods*:** This prospective comparative study was conducted at Sylhet MAG Osmani Medical College Hospital from January 2011 to June 2012. Sixty-two patients with unilateral radio-opaque upper ureteric stones (1.5–2 cm) were randomly divided into two groups: Group A (ESWL with JJ stent, n=31) and Group B (ESWL without JJ stent, n=31). Outcomes assessed included number of ESWL sessions and stone clearance rate. ***Results*:** The two groups were comparable in age and sex distribution (p>0.05). The mean age was 36.9±11.0 years in the stented group and 35.4±11.3 years in the non-stented group. The number of ESWL sessions required did not differ significantly between groups (p>0.05). Stone clearance was achieved in 74.2% of patients in the stented group and 80.6% in the non-stented group, which was not statistically significant (p>0.05). ***Conclusion*:** ESWL is an effective primary treatment for upper ureteric stones ≤2 cm. Routine JJ stenting before ESWL does not improve stone clearance or reduce the number of treatment sessions.

Keywords: Extracorporeal shock wave lithotripsy (ESWL); JJ ureteric stent; Upper ureteric stones; Stone clearance; Minimally invasive treatment.

INTRODUCTION

Urolithiasis is one of the most prevalent urological disorders worldwide [1], and the prevalence of urinary stones has increased in most countries. In the United Kingdom, renal stones develop in approximately 8% of men and 4% of women, while in the United States the male lifetime prevalence has increased to nearly 15% [2]. Renal stone disease is also common in Bangladesh due to geographical location, dietary habits, dehydration, heat exposure, and possible genetic predisposition [3].

The management of urinary calculi was revolutionized in the 1980s with the introduction of extracorporeal shock wave lithotripsy (ESWL), which shifted treatment from open surgery to minimally invasive approaches [4]. ESWL is now considered a safe, effective, and minimally invasive first-line treatment for most upper urinary calculi [2]. The success rates and complications of ESWL depend on stone size, location, composition, lithotripter type, shock wave energy, and anatomical characteristics of the urinary tract [5].

Fragments may become impacted in the ureter and form steinstrasse following ESWL [6]. The European Association of Urology recommends pre-ESWL stenting for renal stones larger than 20 mm to reduce obstructive and infective complications [2-7]. Ureteric stents may facilitate fragment passage by passive ureteric dilatation and may promote ureteric healing [8].

However, several studies have reported that double J (JJ) stent insertion does not significantly improve ESWL outcomes [12]. Therefore, the routine

use of pre-ESWL stenting for upper ureteric stones ≤2 cm remains controversial. This study was designed to evaluate whether JJ stenting influences treatment outcomes, particularly stone clearance and number of ESWL sessions.

Objectives

General Objective

To evaluate the outcome of extracorporeal shock wave lithotripsy (ESWL) in the management of upper ureteric stones with and without Double-J (JJ) stent placement.

Specific Objectives

- To determine the size of the stones and assess stone clearance by plain X-ray KUB and ultrasonography in both groups.
- To compare the number of ESWL sessions required for stone clearance between stented and non-stented groups.
- To compare the stone-free rate between the two groups.

METHODOLOGY

Study Design

This was a quasi-experimental comparative study.

Study Setting and Period

The study was conducted in the Department of Urology in collaboration with the Department of Surgery at Sylhet MAG Osmani Medical College Hospital, Sylhet, from January 2011 to June 2012.

Study Population

Patients admitted with upper ureteric stones who fulfilled the inclusion and exclusion criteria during the study period were included.

Sample Size

A total of 62 patients were included. The sample size was calculated using the Guilford and Frucher formula considering a 3% prevalence rate, 95% confidence interval, and 5% marginal error. Thirty-one patients were allocated to each group.

Sampling Technique

Simple random sampling was used. Patients were randomly assigned into two equal groups (31 each) by drawing folded papers labeled A or B:

- Group A: ESWL with JJ stent
- Group B: ESWL without JJ stent

Inclusion Criteria

- Unilateral radio-opaque upper ureteric stone measuring approximately 2 cm (±2 mm)
- Age between 18 and 60 years
- Normal renal function
- Normal ureter on IVU
- Negative urine culture

Exclusion Criteria

- Radiolucent stones
- Renal failure
- Bleeding disorders
- Previous renal surgery or ESWL
- Congenital renal abnormalities

Intervention Procedure

Patients in the stented group underwent 5 Fr JJ stent placement under regional anesthesia before ESWL. All patients received ESWL using a Siemens Lithoskop machine delivering 3500 shock waves per session at an energy level of 3.5–4 and a rate of 90 shocks per minute.

Outcome Assessment

Patients were followed at 1 week, 1 month, 2 months, and 3 months using plain X-ray KUB and ultrasonography.

Stone clearance was defined as no visible calculus on X-ray KUB and fragments <4 mm on ultrasonography.

The number of ESWL sessions and stone-free rates were recorded and compared.

Statistical Analysis

Data were analyzed using SPSS version 16. Quantitative variables were expressed as mean ± SD and compared using Z-test. Qualitative variables were compared using Chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS

The age of the patients ranged from 18 to 60 years with the mean age of 36.1 (±11.1) years. The age of the patients ranged from 18 to 60 years with the mean age of 36.9 (±11.0) years in group-A; whereas the age of the patients in group-B ranged from 18 to 50 years with the mean age of 35.4 (±11.3) years. The mean age of the patients of both groups did not show any significant difference (Z=0.547; p>0.05). Age distribution of the patients is shown in table 1.

Table-1 Age distribution of the patients

Age	Study group			p value
	Group-A (n=31)	Group-B (n=31)	Total (n=62)	
18-20 years	2 (6.5)	3 (9.7)	5 (8.1)	*p>0.05
21-30 years	6 (19.4)	7 (22.6)	13 (21.0)	
31-40 years	10 (32.3)	10 (32.3)	20 (32.3)	
41-50 years	8 (25.8)	9 (29.0)	17 (27.4)	
51-60 years	5 (16.1)	2 (6.5)	7 (11.3)	
Mean (± SD)	36.9 (±11.0)	35.4 (±11.3)	36.1 (±11.1)	†p>0.05

***Chi-Square (χ^2) Test and †'Z' test were applied to analyze the data. SD: Standard deviation.**

Among the total 62 patients 46 (74.2%) patients were male and 16 (25.8%) patients were female with male to female ratio of 2.76:1. There were 24 (77.4%) male and 7 (22.6%) female in group-A; whereas 22 (71.0%) male and 9 (29.0%) female in group-B. The sex of the patients of group-A and group-B did not show any statistically significant difference (χ^2=0.337; p>0.05). Distribution of patients according to sex is shown in table-2.

Table-2: Distribution of the patients according to sex

Sex	Study group			p value
	Group-A (n=31)	Group-B (n=31)	Total (n=62)	
Male	24 (77.4)	22 (71.0)	46 (74.2)	p>0.05
Female	7 (22.6)	9 (29.0)	16 (25.8)	
Total	31 (100.0)	31 (100.0)	62 (100.0)	

*** Chi-square (χ^2) test was applied to test the level of significance.**
Figure in the parenthesis indicates corresponding percentage.

Table-3 showed the distribution of the patients by side of involvement. Among the total 62 patients right side involved in 33 (53.2%) patients and left side involved in 29 (46.8%) patients. In group–A, right side involved in 18 (58.1%) patients and left side involved in 13 (41.9%) patients; while in group-B, right side involved in 15 (48.4%) patients and left side involved in 16 (51.6%) patients. Side of involvement between the patients of group-A and group-B did not show any statistically significant difference (χ^2=0.583; df=1; p>0.05).

Table-3: Distribution of the patients by side of involvement

Side	Study group			p value
	Group-A (n=31)	Group-B (n=31)	Total (n=62)	
Right	18 (58.1)	15 (48.4)	33 (53.2)	p>0.05
Left	13 (41.9)	16 (51.6)	29 (46.8)	
Total	31 (100.0)	31 (100.0)	62 (100.0)	

*** Chi-square (χ^2) test was applied to test the level of significance.**
Figure in the parenthesis indicates corresponding percentage.

Size of the stone ranged from 1.5 to 2 cm with the mean of 1.81 (SD ± 0.22) cm in group-A; whereas size of the stone in group-B ranged from 1.5 to 2 cm with the mean of 1.88 (SD ± 0.19) cm. Size of the stone did not differ between group A and group-B (Z=-1.218; p>0.05). Distribution of the patients by size of the stone is shown in table-4.

Table 4 Distribution of patients by size of the stone

Stone size in cm	Study group		p value
	Group-A (n=31)	Group-B (n=31)	
Range	1.5 to 2	1.5 to 2	p>0.05
Mean	1.81	1.88	
Standard deviation	± 0.22	± 0.19	

'Z' test was applied to analyse the data

Table-5 shows the distribution of patients by ESWL session. In group-A 10 (32.3%) patients had needed single session ESWL and 21 (67.7%) patients had needed multiple sessions ESWL; while in group-B 9 (29.0%) patients had needed single session ESWL and 22 (71.0%) patients had needed multiple sessions ESWL

Number of ESWL session did not differ between group A and group-B (χ^2=0.076; p>0.05).

Table-5: Distribution of patients by ESWL session

ESWL session	Study group		p value
	Group-A (n=31)	Group-B (n=31)	
Single session	10 (32.3)	9 (29.0)	*p>0.05
Multiple session	21 (67.7)	22 (71.0)	

***Chi-Square (χ^2) Test was applied to analyze the data.**
Figure in the parenthesis indicates corresponding percentage.

Table-6 showed the distribution of the patients according to clearance of stone. Stones were cleared in 23 (74.2%) patients in group-A and 25 (80.6%) patients in group-B. Residual stones remained in 9 (25.8%) patients in group A and in 7 (19.4%) patients in group B. Rate of clearance of stone between groups did not differ statistically significant (χ^2=0.369; p>0.05).

Table-6: Distribution of the patients according to clearance of stone

Stone clearance	Study group		p value
	Group-A (n=31)	Group-B (n=31)	
Cleared	23 (74.2)	25 (80.6)	*p>0.05
Residual stone	9 (25.8)	7 (19.4)	

***Chi-Square (χ^2) Test was applied to analyze the data.**
Figure in the parenthesis indicates corresponding percentage.

DISCUSSION

Obstruction caused by an impacted upper ureteric stone is a potentially serious condition that may lead to progressive renal dysfunction, pyonephrosis, and sepsis if not managed appropriately. Extracorporeal shock wave lithotripsy (ESWL) is an established, minimally invasive treatment modality for upper ureteric stones ≤2 cm. However, the routine placement of a JJ stent before ESWL remains controversial. Traditionally, pre-ESWL stenting was recommended to relieve obstruction and to improve stone fragmentation by creating a better stone–fluid interface [9]. Nevertheless, subsequent evidence has questioned the necessity of routine stenting, demonstrating comparable outcomes between stented and non-stented patients treated with in situ ESWL [10].

The present quasi-experimental study evaluated the outcome of ESWL in upper ureteric stones with and without JJ stenting. Both groups were comparable in baseline characteristics, minimizing confounding effects. The mean age of the patients was 36.1 ± 11.1 years, with no significant difference between the stented and non-stented groups. Similar age distributions were reported by previous authors, indicating that ureteric stones commonly affect individuals in the third and fourth decades of life [11-13].

A marked male predominance was observed in this study, with a male-to-female ratio of approximately 2.7:1. This finding is consistent with earlier reports showing a higher prevalence of urinary stone disease among males [11-13]. The higher prevalence among males may be attributed to hormonal influences, dietary habits, occupational exposure, and metabolic factors.

The side of involvement was almost equally distributed between right and left ureters, and no significant difference was observed between the study groups. Comparable laterality patterns have been reported previously, suggesting that side involvement does not significantly influence ESWL outcome [11-14].

One of the primary outcome measures in this study was the number of ESWL sessions required. Most patients in both groups required multiple sessions, and the difference between the stented and non-stented groups was not statistically significant. Similar retreatment rates have been reported in earlier comparative studies [10]. This indicates that routine JJ stenting does not reduce the need for repeated ESWL sessions.

Stone clearance rate remains the most important indicator of treatment success. In the present study, the stone-free rate was 74.2% in the stented group and 80.6% in the non-stented group, with no statistically significant difference. Comparable findings have been documented in earlier studies, where stone clearance rates were similar irrespective of stent placement [11-15-16]. Ghoneim *et al*. also reported no significant difference in stone-free rates at three months follow-up between stented and non-stented groups [10]. Collectively, these findings suggest that JJ stenting does not significantly enhance fragmentation or improve final stone clearance in upper ureteric stones ≤2 cm.

Ureteric colic is a recognized complication following ESWL, usually resulting from passage of stone fragments. In this study, ureteric colic occurred

significantly less frequently in the stented group compared with the non-stented group. Similar findings have been reported previously, showing reduced post-ESWL colic among stented patients [11-17]. The reduced incidence of colic may be explained by improved drainage and facilitated fragment passage provided by the stent.

However, the benefit of reduced colic must be balanced against increased stent-related morbidity. Suprapubic pain was significantly more common in the stented group in the present study. Similar findings have been reported, attributing suprapubic discomfort to irritation caused by the distal coil of the stent within the bladder [10].

Steinstrasse, a potential complication of ESWL, occurred in both groups without statistically significant difference. Comparable results have been documented in earlier studies [11-10]. Although some authors have suggested a protective role of stenting, others have demonstrated that steinstrasse can occur even in the presence of a ureteric stent [18]. Furthermore, stone size rather than stent placement appears to be the more important determinant of steinstrasse formation [19]. Therefore, routine prophylactic stenting may not be essential for preventing this complication in selected patients.

Fever occurred in both groups without significant difference. Similar observations were reported in previous studies [10-11]. Some authors have suggested that a slightly higher incidence of fever in stented patients may be related to additional instrumentation and the presence of a foreign body in the urinary tract [15]. A ureteric stent may serve as a nidus for bacterial colonization and infection, particularly if left indwelling for prolonged periods [10].

A major finding of this study was the significantly higher incidence of lower urinary tract symptoms (LUTS) in the stented group. Urinary frequency, urgency, and dysuria were markedly more common among stented patients. Similar observations have been consistently reported in previous studies [11-16-15-20]. These symptoms are attributed to trigonal and bladder neck irritation caused by the distal end of the stent acting as a foreign body [11-10]. Although gross haematuria was more frequent in the stented group, the difference was not statistically significant, which is consistent with earlier reports [10].

Overall, the present study demonstrates that routine JJ stenting prior to ESWL does not significantly improve stone clearance rates or reduce the number of ESWL sessions required in patients with upper ureteric stones ≤2 cm. While stenting may reduce ureteric colic, it is associated with significantly higher rates of lower urinary tract symptoms and suprapubic discomfort, which may adversely affect patient quality of life.

Therefore, routine prophylactic JJ stenting before ESWL appears unnecessary in uncomplicated upper ureteric stones ≤2 cm. Stent placement should be individualized and reserved for selected high-risk patients, with careful counseling regarding potential stent-related morbidity.

CONCLUSION

The present study demonstrates that extracorporeal shock wave lithotripsy (ESWL) is an effective and appropriate initial treatment modality for upper ureteric stones measuring up to 2 cm in diameter. Stone clearance rates were comparable between patients treated with and without JJ stenting, with no statistically significant difference observed. Although pre-ESWL stenting significantly reduced the incidence of ureteric colic, it did not improve overall treatment success. Stented patients experienced significantly higher rates of suprapubic pain and lower urinary tract symptoms, including frequency, urgency, and dysuria. The occurrence of steinstrasse, fever, and gross haematuria was similar in both groups. Therefore, routine JJ stenting before ESWL offers no additional therapeutic advantage and is associated with increased patient morbidity.

REFERENCES

1. Teichman JM. Clinical practice. Acute renal colic from ureteric calculus. *N Engl J Med*. 2004; 350:684.
2. Hussain M, Lal M, Ali B, Naqvi SA, Rizvi SAH. Urolithiasis in Sindh: a single centre experience with a review of 10,000 cases. *J Nephrol Urol Transplant*. 1998; 1:10-3.
3. Stamatelou KK, Francis ME, Jones CA, Nyberg LM Jr, Curhan GC. Time trends in reported prevalence of kidney stones in the United States: 1976–1994. *Kidney Int*. 2003; 63:1817–23.
4. Pak CYC, Resnick MI, Preminger GM. Ethnic and geographic diversity of stone disease. *Urology*. 1997; 50:504–7.
5. Tiselius HG. Epidemiology and medical management of stone disease. *BJU Int*. 2003; 91:758-67.
6. Chaussy C, Brendel W, Schmiedt E. Extracorporeally induced destruction of kidney stones by shock waves. *Lancet*. 1980; 13:1265-8.
7. Preminger GM, Tiselius HG, Assimos DG, Alken P, Buck C, Gallucci M, *et al*. 2007 Guidelines for the management of ureteric calculi. *J Urol*. 2007; 178:2418-34.
8. Türk C, Knoll T, Petrik A, Sarica K, Straub M, Seitz C, *et al*. Guidelines on Urolithiasis. European Association of Urology; 2011. p.28.

9. Morgentaler A, Bridge SS, Dretler SP. Management of the impacted ureteric calculus. *J Urol*. 1999; 143:263-6.
10. Pengfei S, Min J, Jie Y, Xiong L, Yutao L, Wuran W, *et al*. Use of ureteric stent in extracorporeal shock wave lithotripsy for upper urinary calculi: a systematic review and meta-analysis. *J Urol*. 2011; 186:1328-35.
11. Ghoneim IA, El-Ghoneimy MN, El-Naggar AE, Hammoud KM, El-Gammel MY, Morsi AA. Extracorporeal shock wave lithotripsy in impacted upper ureteric stones: a prospective randomized comparison between stented and non-stented techniques. *Urology*. 2010; 75:45-50.
12. Mohayuddin N, Malik HA, Hussain M, Tipu SA, Shehzad A, Hashmi A, *et al*. The outcome of extracorporeal shockwave lithotripsy for renal pelvic stone with and without JJ stent—a comparative study. *J Pak Med Assoc*. 2009; 59:43-6.
13. Musa AA. Use of double J stent prior to extracorporeal shock wave lithotripsy is not beneficial: results of a prospective randomized study. *Int Urol Nephrol*. 2007; 40:19-22.
14. Chandhoke PS, Barqawi AZ, Wernecke C, Chee-Awai RA. A randomized outcomes trial of ureteric stents for extracorporeal shockwave lithotripsy of solitary kidney or proximal ureteric stones. *J Urol*. 2002; 167:1981-3.
15. Wazir BG, Iftikhar ul Haq M, Faheem ul Haq, Nawaz A, Ikramullah AN, Jamil M. Experience of extracorporeal shockwave lithotripsy for kidney and upper ureteric stones by electromagnetic lithotriptor. *J Ayub Med Coll Abbottabad*. 2010; 22:20-2.
16. Demirbas M, Samli M, Karalar M, Kose AC. Extracorporeal shockwave lithotripsy for ureteric stones: twelve years of experience with 2836 patients at a single center. *Urol J*. 2012; 9:557-62.
17. Choi JW, Song PH, Kim HT. Predictive factors of the outcome of extracorporeal shockwave lithotripsy for ureteric stones. *Korean J Urol*. 2012; 53:424-30.
18. Madbouly K, Sheir KZ, Elsobky E, Eraky I, Kenawy M. Risk factors for the formation of steinstrasse after extracorporeal shock wave lithotripsy: a statistical model. *J Urol*. 2002; 167:1239-42.
19. Al-Awadi K, Abdul Haleem H, Kehinde EO, Al-Taweed A. Steinstrasse: a comparison of incidence with and without J stenting and the effect of J stenting on subsequent management. *BJU Int*. 1999; 84:618-21.
20. Preminger GM, Kettelhut MC, Elkins SL, Seger J, Fetner CD. Ureteric stenting during extracorporeal shock wave lithotripsy: help or hindrance? *J Urol*. 1989; 142:32-6.