Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 8
Open Access

USG Guidance Extra Corporeal Shock Wave Lithotripsy in 30 cases of Renal Calculi

Mohammed Rafiqul Islam[1], Md. Jahangir Hossain[2], Md. Mostafizur Rahaman[3], Md. Nabid Alam[4], Samira Choudhury[5], Sayem Al Monsur Faizi[6], A K Al Miraj[7]

[1]Assistant Professor, Department of Urology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh
[2]Assistant Professor, Department of Surgical Oncology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh
[3]Assistant professor, Department of Urology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh
[4]Assistant Professor, Department of Urology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh
[5]Assistant Professor, Department of Gynae and Obs, ICMH, Matuil, Dhaka, Bangladesh
[6]Assistant Professor, Department of General Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh
[7]Research Assistant, Department of Vascular Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh

Corresponding author: Mohammed Rafiqul Islam, Assistant Professor, Department of Urology, BSMMU, Dhaka, Bangladesh, E-mail: drrafiqurology@hotmail.com

Cite this paper as: Mohammed Rafiqul Islam, Md. Jahangir Hossain, Md. Mostafizur Rahaman, Md. Nabid Alam, Samira Choudhury, Sayem Al Monsur Faizi, A K Al Miraj, (2024) USG Guidance Extra Corporeal Shock Wave Lithotripsy in 30 cases of Renal Calculi. *Frontiers in Health Informatics*, 13(8), 3460-3465

ABSTRACT

Extracorporeal shock wave lithotripsy (ESWL) is a noninvasive procedure that uses shock waves to break up stones in the kidney, including the upper ureter. Ultrasound or X-rays guide the shock waves to the stone's location during the procedure. The patient may lie on a padded table or sit in a tub of water while the shock waves are delivered. To evaluate the outcome of extracorporeal shock wave lithotripsy (ESWL) for upper ureteric calculi of size ≤ 20mm without ureteral stenting. This was a prospective study conducted in the department of Urology BSMMU from July 2023 to August 2024. A total of 30 patients aged between 10 and 70 years with renal calculi underwent ESWL using the Dornier Compact Sigma Lithotripter. Stone size was calculated by measuring the largest dimension of the stone in KUB plain films. In each session, 3000–3500 shocks were given at a frequency of 60–90 per minute and intensity between 1 and 4. A maximum number of five sessions were provided. Successful treatment was defined as complete clearance or residual stones smaller than 4 mm on KUB performed 3 months after the first session. Of 30 patients, the M: F ratio was 1:1.2. The stone size ranged from 5 to 20 mm. The overall success rate was 94.6%. For stones >15 mm, the success rate was only 77.7%. The number of sessions increases as the stone size increases. The most common complication encountered was haematuria. Our study showed ESWL as a primary modality for less than 20mm upper ureteric stones.

Keywords: Calculi, Lithotripsy, Renal.

INTRODUCTION

Renal calculi are a common urological problem across the globe. There has been a paradigm shift in the management of ureteric calculi in the last 20 years. Extracorporeal shock wave lithotripsy (ESWL) is a standard, nonsurgical procedure to treat kidney stones. It uses high-energy shock (pressure) waves to break up stones. Tiny pieces of the stones can then move through your urinary tract and out of your body more easily. Nowadays, open surgery for Renal calculi has been replaced by minimally invasive and non-invasive procedures like extracorporeal shock wave lithotripsy (ESWL) and ureterorenoscopy (URSL) [1–3]. In 1980, Chaussey et al. revolutionized the management of urinary tract calculi by introducing ESWL [4]. Many studies have recommended ESWL as first-line treatment for upper ureteric calculi with a success rate of 80-90% [5-7]. According to El-Nahas et al. (17) recommendations, ESWL should be recommended for renal stones localized in the renal pylon up to 24 mm for the upper or middle stones to 15 mm and lower stones with sizes up to 11 mm. The success of ESWL depends on stone composition, size, and location [8]. This procedure uses high-energy shock (sound) waves to break up stones in your ureters. The smaller pieces of your stones move through your urinary tract more easily when pee. Shock wave lithotripsy is the least invasive treatment option, but it may not be right for all people. ESWL is a non-invasive procedure with fewer complications; still, on the other hand, even with the advent of small-caliber and flexible ureteroscopy, it is an invasive procedure and associated with complications. This prospective study aimed to assess the success rate of ESWL as a monotherapy for ≤ 20mm upper ureteric calculi and the safety of this therapy without prophylactic DJ stenting.

MATERIAL AND METHODS

This was a prospective study conducted in the department of Urology BSMMU from July 2023 to August 2024. Patients with congenital anomalies of the kidney or who underwent ESWL following percutaneous nephrostomy, any previous surgery, previous stenting, distal ureteral obstruction, bilateral ureteric calculi, abnormal coagulation profile, and chronic renal failure were excluded from the study. A total of 30 patients with renal calculi aged between 10 and 80 years were included in the study that fulfilled the criteria. The treatment used "Dornier Compact Sigma Lithotripter (Dornier Medtech, Germany)."

All patients were evaluated with X-ray KUB (kidney, ureter, and bladder), ultrasonography KUB, and excretory urography before treatment. Routine investigations like complete hemogram, bleeding Time (BT), coagulation Time (CT), Urine R/E and C/S, and Kidney function test (KFT) were done according to hospital protocol. Follow-up monitoring of stone fragmentation and clearance was done using ultrasonography KUB and X-ray KUB at 1-week, 1-month, and 3-month periods. Stone size was calculated by measuring the maximum dimension of the stone on X-Ray KUB.

Patients were kept on a liquid diet after bowel preparation with two tablets of Dulcolax and 4 tablets of charcoal the previous night after dinner. They were given analgesic medication in the form of diclofenac 75 mg intramuscular injection just before starting the session. All patients were treated in a supine position with a number of shocks per session ranging from 3000 to 3500 at a frequency of 60–90 per minute with an intensity between 1 and 4, depending on the individual's tolerance level. Proper antibiotics, analgesics, and haemostatics were prescribed post-procedure to each patient. All patients were discharged on the same day with appropriate instructions to report even minor complications after treatment. One week after the treatment, an X-ray KUB or ultrasound KUB was performed to check the existence of any residual calculi or hematoma formation. Criteria for successful treatment were complete clearance or residual stones ≤4 mm on KUB at 3 months after the first session. A maximum of five sessions were given, after which it was labeled ESWL failure. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS 21) for Windows. All categorical data was analyzed using frequencies and percentages. The Chi-square test and ANOVA test assessed associations between different categorical variables. A p-value ≤ 0.05 was considered statistically

significant.

RESULTS

A total of 30 patients were enrolled for the study who underwent ESWL for upper ureteric calculi. No patient left the study in between. The male-to-female ratio was 1:1.3 (M = 13, F = 17). The mean age of the patients was 39.1 years. More than 80% of the patients were in the 21–50 age group. Table I shows the characteristics of the patient and stone.

The stone size ranged from 5 to 20 mm. Out of 30 cases, 16 had calculus in the right ureter (53.3%), while the remaining 14 had calculus in the left ureter (46.7%). The maximum number of calculi ranged between 11 and 15 mm (61.4%). Table II shows the number of cases as per the different sizes of the ureteric calculi in the present study and their laterality.

The mean number of ESWL sessions required to break the stones varied with the size of the ureteric calculi. For stones of size 5 to 10mm, the mean number of sessions received was 1.2, while for rocks of 11 to 15mm, sessions were 1.97, and stones of 16 to 20mm received 2.33 mean sessions of ESWL. The results of our study are shown in Table III. The success rate is depicted based on the imaging findings at 3 months.

The overall success rate was 93.3%. There were 2(6.6%) cases in which, even after five sessions, there was minimal to nil stone fragmentation. Hence, such cases were not subjected to further ESWL. Overall, the failure rate was 6.6% (n = 2). The mean number of sessions increased as the stone size increased while the success rate decreased with increasing stone size. Among the complications encountered, the most common was haematuria (73.3%), followed by steinstrasse (26.7%). The complications encountered are presented below in Table IV.

Haematuria was transient, mild, and subsided within 2–3 days with the help of oral tranexamic acid thrice a day for 3 days and adequate bed rest and fluid intake. The incidence of stein Strasse was highest in the group with stone size >15 mm (50.0%). Five (62.5%) of the patients were symptomatic, having features like flank pain, fever, and nausea. The remaining cases were diagnosed incidentally on the follow-up X-ray KUB. All patients were initially treated by conservative management using adequate hydration, tamsulosin (0.4 mg HS), and analgesic on demand for a maximum of 2 weeks. If there was minimal or no stone clearance even after this period, they were taken up for URSL (ureteroscopic lithotripsy). Five (62.5%) of the Stein Strasse cases were managed conservatively, whereas the remaining nine (37.5%) underwent URSL for clearance. None of the patients had undergone open ureter lithotomy. One (3.3%) patient developed perirenal hematoma after the fifth session, which subsided in 3 months with conservative management. Three (10.0%) patients developed skin bruises, which subsided with conservative treatment.

Table I: Patient and stone characteristics.

Number of patients	**30**
Male: female	**1 : 1.3**
Male	13 (43.3%)
Female	17 (56.7%)
Age group	**10-80 Years**
Laterality	
Right	16 (53.3%)
Left	14 (46.7%)
Stone size	**5-20 mm**

Table II Size and laterality of stones.

Stone Size (mm)	**Total No. of cases**		**Total No. of Cases (%)**
	Right Kidney	**Left Kidney**	
5-10	6	4	10 (33.1)

11-15	9	9	18 (60)
16-20	1	1	2 (6.9)
Mean size ± SD	10.85 ± 3.46 mm		

Table III: Success of ESWL in upper ureteric calculi.

Stone size (mm)	No. of Cases	No. of sessions (mean ± SD)	Stone free patients (including Clinically insignificant fragments)	Non stone free patients	Overall success rate (%)	ANOVA p value
5-10	10	1.22 ± 0.515	9	01	97.67	
11-15	18	1.97 ± 1.01	17	04	94.8	0.031
16-20	2	2.33 ± 1.21	2	02	77.7	

Table IV: Complications of ESWL.

Complication	**Total no. of cases (%)**
Hematuria	22 (73.3)
Steinstrasse	8 (26.7)
Stone size	
5-10mm	1/10 (10.0)
11-15mm	3/18 (16.6)
16-20mm	1/2 (50.0)
Presentation	
Symptomatic	5/8 (62.5)
Incidental	3/8 (37.5)
Management	
Conservative	5/8 (62.5)
URSL	3/8 (37.5)
3.Skin Bruise	3 (10.0)
4.Perirenal hematoma	1 (3.3)

DISCUSSION

Extracorporeal shock wave lithotripsy (ESWL) is a noninvasive procedure that uses shock waves to break up stones in the urinary tract, including the upper ureter. Ultrasound or X-rays guide the shock waves to the stone's location during the procedure. The patient may lie on a padded table or sit in a tub of water while the shock waves are delivered. ESWL is a noninvasive procedure that breaks down stones in parts of the urinary system, the pancreas, and the bile ducts. It uses shock waves that are aimed at stones with the help of X-rays or ultrasound. Stones in the kidneys and ureter often pass on their own after EWSL. The treatment modalities for upper ureteric calculi are multiple, ranging from spontaneous clearance of ureteric calculi ± medical expulsion therapy to ESWL, URSL, and even ureter lithotomy. Among these, ESWL is considered a non-invasive, effective, and convenient way of treating ureteric calculi with success rates. The study by Chaussey et al. reported a 95% stone-free rate for the upper ureteric calculi treated without any prior manipulation using a Dornier HM3lithotripter [9]. Our study's overall success rate was 94.6%, comparable to other published data [5-7]. This procedure uses high-energy shock (sound) waves to break up stones in your ureters. The smaller pieces of your stones move through your urinary tract more easily when pee. Shock wave lithotripsy is the least invasive treatment option, but it may not be right for all people. The American Ureteral Stones Clinical Guidelines Panel

reported that for upper ureteric calculi, the success rate of ESWL was 87% for <10 mm stone and 76% for >10 mm calculi [10]. In our study, the success rate decreases as the stone size increases. The success rate was 97.67% in <10 mm stone, 94.8 % when stone size was between 11- 15mm, and 77.7 % when stone size was between 16- 20 mm. Literature showed that the causes of ESWL failure were the inability to fragment or localize the stones; failure to clear the fragments may be due to anatomical obstruction of the urinary tract. In addition, the authors also evaluated variables such as types of lithotripters, number of ESWL sessions and shocks, and calculus composition [11]. In our study, none of the patients was stented. Studies have not revealed any advantage of pushing renal stones back to the renal pelvis before ESWL. If the stone can be well localized, it should be treated in situ [10]. The pushback technique for ureteral manipulation is associated with a perforation rate of 5.1% [12]. The complication rate increases with many shock waves, higher energy levels, and after multiple sessions [10]. In our study, as the size of the stone increases, the number of sessions also increases, and that is why steinstrasse is highest (50.0 %) when the stone size > 15mm. According to 2007 AUA guidelines, ESWL and URSL are acceptable first-line first-line treatments for proximal ureteral calculi, but URSL is associated with higher complications [13]. ESWL is not complication-free despite its relatively non-invasive nature. The most common complication encountered in our study was haematuria (73.3%), which was primarily mild and transient and treated conservatively. Another common complication was steinstrasse, which was seen in 26.7% of our cases (n= 8). Interestingly, its incidence was more common in patients with stone size >15mm. Goyal et al. reported that the incidence of steinstrasse increases as the size of the stone increases [14]. Steinstrasse was associated with pain and fever in 62.5% of patients and URSL in 37.5% of our patients (n = 3). Other patients of steinstrasse were managed conservatively.

CONCLUSION

ESWL is a good option for managing renal stones and includes different treatment modalities, including URSL. ESWL is non-invasive, with greater stone clearance and fewer complications. Our study showed ESWL as a primary modality for upper ureteric stones of size ≤ 20mm, with an overall success rate of 94.6%. With the availability of newer machines, ESWL can be done without anesthesia as an outpatient procedure.

REFERENCES

1. Denstedt J, Clayman RV. Electro hydraulic lithotripsy of renaland ureteral calculi. J Urol. 1990; 143:13.
2. Matsuoka K, Iida S, Nakanami M, Koga H, Shimada A, MiharaT, Noda S. Holmium: yttrium-aluminum-garnet laser for endoscopiclithotripsy. Urology 1995; 45:947.
3. Scarpa RM, Delisa A, Porru D, Usai E. Holmium: YAG laserureterolithotripsy. Eur Urol. 1999; 35:233.
4. Chaussy C, Schmiedt E, Jocham D, Brendel W, Forssmann B, Walther V. First clinical experience with extracorporeally induced destruction of kidney stones by shock waves. J Urol. 1982; 127:412.
5. Padhye AS, Yadav PB, Mahajan PM, Bhave AA, Kshirsagar YB, Sovani YB et al. Shock wave lithotripsy as a primary modality for treating upper ureteric stones: A 10-year experience Indian J Urol. 2008; 24:486–9.
6. Mogensen P, Anderson JT. Primary in situ extracorporeal shock wave lithotripsy for Ureteral calculi. Scand J UrolNephrol Suppl. 1994; 157:159–63.
7. Gnanapragasam VJ, Ramsden PD, Murthy, Thomas DJ. Primary in situ extracorporeal shock wave lithotripsy in management of ureteric calculi: Results with a third generation lithotripter. BJU Int. 1999; 84:770–4.
8. Fetner CD, Preminger GM, Seger J, Lea TA. Treatment of ureteric calculi by extracorporeal shock wave lithotripsy at multi-user center. J Urol. 1988; 139:1192–4.
9. Chaussy C, Schmiedt E. Extracorporeal shock wave lithotripsy (ESWL) for kidney stones: an alternative to surgery? UrolRadiol1984; 6:80-7.

10. Segura JW, Preminger GM, Assimos DG, Dretler SP, Kahn RI, Lingeman JE, et al. Ureteral Stones Clinical Guidelines Panel summary report on management of Ureteral calculi. J Urol. 1997; 158:1915–21.
11. Grasso M, Loisides P, Beaghler M, Bagley D: The case for primary endoscopic management of upper urinary tract calculi: a critical review of 121 extracorporeal shock-wave lithotripsy failures. Urol 1995; 45:363-71.
12. Rauchenwald M, Colomco T, Petritsch PH, Vilits P, Hubmer G. In situ extracorporeal shock wave lithotripsyof Ureteral calculi with the MPL 9000 lithotripter. J Urol. 1992; 148:1097–101.
13. Preminger GM, Tiselius HG, Assimos DG, Alken P, Buck AC, Gallucci M, Knoll T, Lingeman JE, Nakada SY, Pearle MS, Sarica K, Türk C, Wolf JS Jr; American Urological Association Education and Research, Inc; European Association of Urology. 2007 Guideline for the management of ureteral calculi.Eur Urol. 2007;52:1610-31.
14. Goyal R, Dubey D, Khurana N, Anil Mandhani, Ansari MS, AneeshSrivastava, et al. Does the type of steinstrasse predict the outcome ofexpectant therapy? Indian Journal of Urology 2006; 22:135–8.