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ORIGINAL ARTICLE

Comparison of Slow Rate versus Fast Rate Extracorporeal Shock Wave Lithotripsy in Patients with Urolithiasis

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ABSTRACT

Objectives: To compare the success of slow rate with fast rate extracorporeal shock wave lithotripsy in patients undergoing treatment of urolithiasis.

Study design: Randomized controlled trial

Place & Duration of Study: This study was conducted in Urology Department of Sandeman Civil Hospital, Quetta for one year duration from 1stApril 2020 to 30thMarch 2021.

Methods: Total ninety patients who were divided in two equal groups i.e. Group A in which patients received treatment with slow rate extracorporeal shock wave lithotripsy and group B in which patients received treatment with fast rate extracorporeal shock wave lithotripsy.

Results: There were 32 (71.1%) male patients and 13 (28.9%) female patients in group A. In group B, there were 28 (62.2%) male patients and 17 (37.8%) female patients. Mean age in group A was 35.61±4.19 years while in group B, the mean age was 34.11±69.32 years. The success rate of slow rate extracorporeal shock wave lithotripsy was 36 (80%) and that of fast rate extracorporeal shock wave lithotripsy was 21 (46.7%) (p-<0.05).

Conclusions: The slow rate extracorporeal shock wave lithotripsy is better than fast rate extracorporeal shock wave lithotripsy for elimination of urolithiasis.

Keywords: Extracorporeal shock wave lithotripsy, Slow rate ESWL, Fast rate ESWL

INTRODUCTION

Child upper tract stone treatment has been transformed by the use of ESWL [1]. When used in children, extracorporeal shock wave lithotripsy is innocuous, safe, and very successful [2-4]. Size, location, composition of the stones, anatomical aspects of the urinary tract, and the type of lithotripter utilized impact the success rates and problems of ESWL [5]. In addition to steinstrasse, impacted fragments in the ureter can cause post-ESWL difficulties [6]. Ureteric stenting, however, has not been proven to be effective in preventing steinstrasse and other post-ESWL issues. The number of stones and their size, composition, location and presence of hydronephrosis, and other anatomical factors such as ureteric anomalies, the presence of a solitary kidney, strictures, and morbid obesity are all taken into account when selecting an appropriate treatment approach for urolithiasis [7-8]. Children who had ESWL had a higher stone-free rate than adults, according to a study [9]. In children, the lower body volume permits shockwaves to be transmitted with minimum energy loss [10].

Patients' selection, stone size, stone location and composition, the type of lithotripter, the operator's skill level, the total number of shocks administered and the energy delivered as well as frequency and mode of delivery are all thought to influence the ultimate SWL results. [11,12] A number of changes have been made to the treatment strategy to improve results, including voltage stepping, a slower shock wave delivery speed, and improvements to analgesic program protocols. [13] This treatment approach is now more carefully selected based on stone size and placement, low attenuation coefficients as evaluated by computed tomography, and a stone skin distance of less than 10 centimeters. Several in vitro and in vivo experiments have shown that reducing the number of shocks per minute improves stone fragmentation. [14,15]

According to the newly introduced network meta-analysis, randomized controlled trials are compared directly, and cross-trial comparisons are made using a common comparator.

MATERIAL AND METHODS

This randomized controlled trial was conducted in Urology Department of Sandeman Civil Hospital, Quetta for one year duration from 1stApril 2020 to 30thMarch 2021. Patients' detailed demographics were recorded after taking written consent. Patients with severe medical illness and those did not provide written consent were excluded from this study.

A total of 90 patients who were divided in two groups; group A (slow rate ESWL) and group B (fast rate ESWL). Single renal an upper ureteric stone on intravenous urography (IVU), stone up to 2 cm in size on ultrasound of kidneys, ureters and bladder (KUB) and radio-opaque stone were included. All patients who have Pregnant, bleeding disorders (INR > 1.5) and urinary tract infection (urine culture and sensitivity) were excluded. Total number of shockwave per session was 3200 in each group. Patients were followed up at 10th day after ESWL with x-ray, kidneys, ureters and bladder (KUB) for assessment of success. Data was analyzed using SPSS-24.

RESULTS

There were 32 (71.1%) male patients and 13 (28.9%) female patients in group A. In group B, there were 28 (62.2%) male patients and 17 (37.8%) female patients. Mean age in group A was 35.61±4.19 years while in group B, the mean age was 34.11±69.32 years.(Table 1)

Table 1: Baseline details of enrolled cases

Variables	Group A (45)	Group B (45)
Gender		
Male	32 (71.1%)	13 (28.9%)
Female	28 (62.2%)	17 (37.8%)
Age (years)		
12 – 20	4	5
21 – 30	17	16
31 – 40	20	20
41 – 50	4	4
Mean±SD	35.61±4.19	34.11±69.32

In group A, stone clearance was seen among 36 (80%) while in rest of 9 (20%) patients no stone clearance was seen. There were 21 (46.7%) patients in group B in whom stone clearance was observed while in rest of 24 (53.3%), there was no stone clearance. The two groups were compared for test of significance. There was statistically significant difference between the two groups (p-value < 0.05) (Table 2).

Table 2: Distribution of patients by stone clearance (n=90)

Stone clearance	Group A		Group B		P value
	No.	%	No.	%	
Yes	36	80	21	46.7	0.012
No	9	20	26	53.3	

In group A, stone fragmentation was seen among 36 (80%) while in rest of 9 (20%) patients no stone fragmentation was seen. There were 21 (46.7%) patients in group B in whom stone fragmentation was observed while in rest of 24 (53.3%), there was no stone fragmentation. The two groups were compared for test of significance. There was statistically significant difference between the two groups (p-value < 0.05) (Table 3)

Table 3: Distribution of patients by stone fragmentation (n=90)

Stone fragmentation	Group A		Group B		P value
	No.	%	No.	%	
Yes	36	80	21	46.7	0.012
No	9	20	26	53.3	

In group A, success was labeled in 36 (80%) while in rest of 9 (20%) patients the treatment was not successful. There were 21 (46.7%) patients in group B in whom treatment was successful while in rest of 26 (53.3%), it was not successful. The two groups were compared for test of significance. There was statistically significant difference between the two groups (p-value < 0.05) (Table 4)

Table 4: Distribution of patients by Success (n=9)

Success	Group A		Group B		P value
	No.	%	No.	%	
Yes	36	80	21	46.7	0.012
No	9	20	9	53.3	

DISCUSSION

In order to treat urinary stones, shock wave lithotripsy has been the primary treatment approach since 1980. As many as 70 percent of symptomatic upper urinary stones are treated with SWL, although roughly 50 percent of patients treated with SWL do not have their stone loads cleared by this method. [16-18]

In this study we examined the efficiency of two ESWL technologies, namely slow rate and rapid stone clearing rates. And the results supported the ESWL slow pace. The ESWL group was 80% effective compared with the ESWL fast rate (p-value <0.05) that was 46.3%. Few clinical investigations have compared the effectiveness of these approaches in literature.[19]

A study by Hyuk Kang et al , patients who were treated with extracorporeal shockwave lithotripsy were classified as Slow Rate (SR) or Fast Rate (FR) patients. Stone-free rates (SFRs) were higher when treatment was delayed. Statistically significant differences in free stone rates were found in the category of renal stones with a diameter of one to two centimeters. Renal stones between 1 and 2 cm were more common in the SR group (P=0.05) than in the FR group (P=0.04). The location of the kidney stone had no effect on the results. According to CT Hounsfield units [21,22], anatomical position and stone architecture are important. In our study in group A, stone clearance was seen among 36 (80%) while in rest of 9 (20%) patients no stone clearance was seen. There were 21 (46.7%) patients in group B in whom stone clearance was observed while in rest of 24 (53.3%), there was no stone clearance. The two groups were compared for test of significance. There was statistically significant difference between the two groups (p-value < 0.05)

Similarly, Kato et al. [23] found that stone fragmentation rates increased from 47 to 65 percent after one session while using a 60-impulse-per-minute rate as opposed to 120-impulses-per-minuterate.Stone fragmentation was seen among 36 (80%) while in rest of 9 (20%) patients no stone fragmentation was seen in group A. There were 21 (46.7%) patients in group B in whom stone fragmentation was observed while in rest of 24 (53.3%), there was no stone fragmentation. The two groups were compared for test of significance. There was statistically significant difference between the two groups (p-value < 0.05)

In our study, success was labeled in 36 (80%) while in rest of 9 (20%) patients the treatment was not successful. There were 21 (46.7%) patients in group B in whom treatment was successful while in rest of 26 (53.3%), it was not successful. The two groups were compared for test of significance. There was statistically significant difference between the two groups (p-value < 0.05). Our findings were comparable to the previous some studies. 60 shocks per minute (1 Hz) and 90 shocks per minute (1.5 Hz) have both been demonstrated to have better outcomes than 120 shocks per minute (2 Hz).

CONCLUSIONS

We found that the efficacy of slow rate ESWL is better than fast rate ESWL. So, the use of slow rate ESWL is recommended in our setup for patients who present with urolithiasis. However, multi-center studies for a longer period are required to better estimate of outcomes.

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