DOI: https://doi.org/10.53350/pjmhs211551068

ORIGINAL ARTICLE

Single Centre Experience of Slow Versus Fast Rate Extracorporeal Shock Wave Lithotripsy (ESWL) in Urolithiasis

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ABSTRACT

Aim: To compare the success of slow rate with fast rate extracorporeal shock wave lithotripsy in the treatment of urolithiasis.
Study design: Randomized controlled trial
Place & duration of study: Department of Urology, Shaikh Zayed Hospital, Lahore from 1st October 2010 to 30th April 2011.
Methodology: One hundredpatients 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: The success rate of slow rate extracorporeal shock wave lithotripsy was 76 % and that of fast rate extracorporeal shock wave lithotripsy was 48% (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

It is observed that 12% of the general population is having urinary system stone disease.[1]40-50% of urological work load is urinary stone disease and 12% of population in Pakistan is suffering from urolithiasis[2]. Mean recurrence rate is 75% in 20 years after the first diagnosis[3]. Over the last 20 decades, ureteral stones have significantly promoted the removal of stones in minimum invasive and non-invasive stone disease management[4]. Of the stones in the urinary system, 20%, about 70% and about 70% in distal ureter.

Open surgery before the advent of extracorporeal lithotripsy (ESWL) in 1980 was the only viable treatment for calculus that cannot pass through the urinary tract. ESWL has since grown into the treatment of choice for renal stone disease control. In eligible cases, ESWL is less invasive, and gives the same free stone in contrast with open and endoscopic care ESWL. After ESWL Renal stones broken down after ESWL into fragments that can pass into ureter (4-7mm) also behave as ureteric calculi[5,6].

A wide range of in vivo pig models have shown that artifactual stones have been inserted into the renal calice system by percutaneous access and in-vitro test procedures using the models[7]. Shock waves are delivered at 90 SW/min than at 120 SW/min, have reported better outcomes[8].

The overall success rate between slow shock wave rates versus fast shock wave rate is 89.5% and 73.2%[9]. Effective fragmentations and stone clearance was noted more often in slow group than the fast group. Slow SW firing rate breaks stone more efficiently and higher success rate than fast rate ESWL[10].

Absolute contraindications for extracorporeal shockwave lithotripsy include bleeding diathesis, distal obstruction for stone passage, urosepsis, pregnancy and uncontrolled hypertension. Relative contraindications for extracorporeal shockwave lithotripsy either related to the patient or to the stone, included stone burden larger than 2 cm size requiring retrieval and auxiliary procedure. The development of several small fragments causing distal ureteric obstruction may also result in the stone street (steinstrasse). Extracorporeal shockwave lithotripsy resistant stones e.g. cystine stones are not suitable for ESWL, so it is recommended that patients with renal stone disease having cystinuria, ESWL should not be offered[11].

MATERIAL AND METHODS

This randomized controlled trial was carried out at Urology Department, Shaikh Zayed Hospital Lahore from 1stOctober 2010 to 30th April 2011. A total of 100 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 upto 2cm 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-20.

RESULTS

Group A had a mean age of 33,40+7,41, while group B had a mean age of 32,31 + 6,55 (Table 1). There were 33(66%)

men and 17 (34%) women in group A patients. The ratio of women to men was 1: 1.64. 30(60%) male and 20 (40%) female patients were in the group B group. The ratio of women to men was 1:1.5. (Fig. 1)

In group A, stone clearance was seen among 38 (76%) while in rest of 12 (24%) patients no stone clearance was seen. There were 24 (48%) patients in group B in whom stone clearance was observed while in rest of 26 (53%), 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). In group A, stone fragmentation was seen among 38 (76%) while in rest of 12 (24%) patients no stone fragmentation was seen. There were 24 (48%) patients in group B in whom stone fragmentation was observed while in rest of 26 (53%), 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)

In group A, success was labeled in 38 (76%) while in rest of 12 (24%) patients the treatment was not successful. There were 24 (48%) patients in group B in whom treatment was successful while in rest of 26 (53%), 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 1: Distribution of patients by age (n=100)

Age (years)	Group A		Group B	
	No	%	No.	%
12 – 20	3	6	4	8
21 – 30	15	30	16	32
31 – 40	22	44	26	52
41 – 50	10	20	4	8
Mean±SD	33.40 + 7.41		32.32+6.55	

Fig. 1: Distribution of patients by sex (n=100)

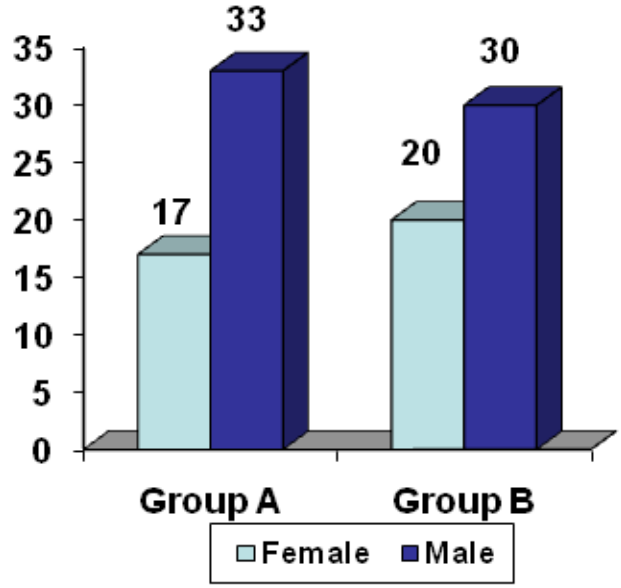

Table 2: Distribution of patients by stone clearance (n=100)

Stone clearance	Group A		Group B		P value
	No.	%	No.	%	
Yes	38	76	24	48	0.012
No	12	24	26	52	

Table 3: Distribution of patients by stone fragmentation (n=100)

Stone fragmentation	Group A		Group B		P value
	No.	%	No.	%	
Yes	38	76	24	48	0.012
No	12	24	26	52	

Table 4: Distribution of patients by Success (n=100)

Success	Group A		Group B		P value
	No.	%	No.	%	
Yes	38	76	24	48	0.012
No	12	24	26	52	

DISCUSSION

This study compared the efficacy of the two techniques of ESWL i.e. slow rate and fast rate in terms of stone clearance. And the results were in favor of slow rate ESWL. The efficacy of the slow rate ESWL group was 76% as compared to fast rate ESWL which was 48% (p-value < 0.05). In literature, there are few other clinical trials which have compared the efficacy of the both techniques.

Muruganandham et al[12] performed a study on 349 patients.Patients obtained either slow rate (between 70 and 80 SS / min) or Fast Rate (120 SS / min), for extracorporeal shockwave lithotripsy. For slower treatment rates, stone free rates (SFRs) were higher than the faster rate. For the one to two cm renal stone range, the difference in stone-free rates was only statistically important. The pill-free SFR prevalence for renal stones between 1 and 2 cm was 67% for the SR Group but 46% for the FR (P=0.05). There were no variations in findings depending on the position of renal stone.

In a Pace et al1 study 3 recorded 220 random patients, including 109-120 per-minute shocks and 111-60 per-minutes shocks. In terms of stent, initial area of stone, age , sex and body mass index, both groups were identical. The success rate was higher for 60 shocks per minute (75% versus 61%, p=0,027). The treatment with 60 shocks per minute in patients with large stones (surface of 100 mm or more) has been more effective. The performance rate for 60 shocks per minute was 71% compared to 32% (p = 0.002) and the free stone rate was 60% versus 28% (p = 0.015). 32 percent of the patients treated with 120 shocks per minute versus 18 percent (p=0.018) needed repeated extracorporeal shockwave lithotripsy. Sixty shocks (2, 423 vs 2.906, p<0.001) per minute were required but the treatment period (40.6 vs 24.2 minutes, p < 0.001) was longer. With 60 shocks a minute (p=0.079), there was a tendency to less complications. Like our report, they concluded that slow rate ESWL care is higher than fast rate.

In 163 patients with at least 5 mm upper ureteric measurements that had not been previously studied, d'A Honey and al14 carried out a clinical trial. Shock wave lithotripsy was performed 60 or 120 shocks a minute. Three month after a simple abdominal x-ray, CT KUB, and ultrasound analysis, the status of stone-free has been confirmed. Of those who got 86 randomized shocks, 77 randomized to 120 per minutes, and 60 shocks per minute. In body mass index, stone area, sex and age these groups were identical. After three months, the average stone-free

rate of 60 shocks per minute community (64.9% vs 48.80% p=0.039) was higher. Patients undergoing care with 60 shocks per minute (mean of 2.680 vs. 2.940, p<0.001) experienced slightly less shocks. The mean therapy periods were, however, longer (44.3 versus 24.5 minutes, p < 0.001). Patients treated with 60 shocks a minute required less auxiliary care (29.9% vs. 45.4%) (p=0.031). The results of this research, like our report, support the use of the ESWL slow pace.

Madbouli and al15 evaluated the use of or rapid wavelength (120 pulses a minute), or sluggish (60 pulses a minute) for SWL patients who had been randomized prospectively. There were 42 women (26.9%) and 114 male (73.1%) with a mean age of 42.1 + 13.3 years in this sample. The mean diameter of stones was 13.2 + 5.9 mm (range 5 to 30). In 62 (39.7%) and 94 (60.3%) patients there were ureteral stones and renal stones. 80 (51.3%) were used fast, 76 (48.7%) were used slow and 76 (58.3%). In the overall patient population, 94.2 percent was the success rate. In the fast-rate group it was 90.0% (72 out of 80) compared to 98.7% (75 out of 76) in the slow-rate group (p = 0.034). The results of this study, like our research, support the use of ESWL slow pace. However, both groups had a higher success rate than ours during their research.

Many authors have proposed that the intensity of lithotripsy extracorporeal shockwave treatment may have an independent influence on its effectiveness. In vitro experiments with stone phantom have shown varying fragmentation rates depending on treatment rates. Vallancienet al16 recorded that the rate for best fragmentation of stone was 75 or 150 shock / min. Nevertheless, in recent in vitro and animal studies, the most efficient treatment rate for the renal or ureteral stone is 30 to 60 shocks / min.17 The optimum treatment pace at the ESWL should be determined. The most appropriate treatment rate should be 30 to 60 shocks / min.

The shockwaves of 30 , 60 , 90, 120, and 150 shocks per min. are measured by using ceramic steel Greenstein et al18. There were no big difference between 30 and 60 shocks / min and the most efficient rate was 60 shocks / min for stone fragmentation. Weir et al17 observed that the number of shocks expected at the frequency of the treatment for solid plaster piercings fragmentation was 60 to 117 shocks / min..

CONCLUSIONS

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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