

Evaluation of the outcome of single session Extracorporeal Shock Wave Lithotripsy for the treatment of renal stones - Initial experience at a tertiary care hospital

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Abstract

Aim: To determine the efficacy of Extracorporeal Shock Wave Lithotripsy (ESWL) in patients with renal stones and to investigate the role of ESWL in improving treatment outcomes.

Methods: A total of 93 patients who underwent ESWL for single radio-opaque renal stones of 5 to 20 mm in size were included. Standard treatment procedure for ESWL was done. Success was defined as stone-free status as shown on a plain radiograph within one month.

Results: 74.2 % of patients were stone-free. 89 % of treated patients had a satisfactory clinical result. No significant complications were encountered. Our results suggest that there is no significant difference between the stone size and outcome of stone free rate (p-value = 0.248). In spite, there is a significant difference between the stone location and stone free rate (p value = 0.042).

Conclusion: Our data concludes that almost 75 % of all patients with stones can be completely cured by ESWL alone without ancillary procedures. ESWL is an effective and safe treatment modality for renal stones less than 20 mm size with acceptable stone clearance.

Keywords: Nephrolithiasis, Extracorporeal shockwave lithotripsy, renal stones.

1. Introduction

Nephrolithiasis is one of the common clinical disorders with high prevalence occurring in approximately 10 % of the human population with an average recurrence rate of 25 % [1]. Advances in medicine have enabled better treatment of nephrolithiasis with few complications. Most kidney stones that pass through the renal calyces to the renal pelvis and subsequently to the ureter cause serious symptoms [2]. There are many options for urologists to treat kidney stones including, ESWL and Percutaneous Nephrolithotomy (PCNL) [3,4]. Of these, ESWL has become the most popular noninvasive intervention for stone disease. However, all stones are not easily fragmented by ESWL, and the success rate of ESWL depends on multiple factors, such as stone size, location, body mass index (BMI) and stone composition [5,6]. The aim of this study is to assess the outcome of ESWL for renal stones.

2. Materials and Methods

2.1 Study Population

Between June 2013 and May 2015, a total of 93 patients who underwent ESWL for radio-opaque, single renal

stone of 5 to 20 mm were included. The exclusion criteria included patients with bilateral or multiple stones, radiolucent stones, acute urinary tract infection and repeated treatment and distal ureteral stones. All patients underwent a baseline evaluation, including a medical history, a physical examination, a urinalysis, a complete blood count, Kidneys, Ureters, and Bladder X-ray (KUB), and a computerized tomography (CT). The radiological parameters on KUB included stone location, stone size and surface outline. Patients were provided with an explanation of the advantages, drawbacks and complications associated with each procedure prior to voluntarily selecting treatment option. The study protocol was approved by the Institutional Review Board of Yenepoya University and written informed consent was obtained before trial onset.

2.2 ESWL technique

All patients were managed with intramuscular administration of ketolorac (30 mg) and/or intravenous administration of pethidine (50 mg). All procedures were performed with the same Electrohydraulic EMD Medical

Technologies ESWL (Turkey): associated with Allengers- HF 4912 (India) under fluoroscopy, as described previously [6]. Briefly, a maximum of 3,000 shocks per session were delivered to the stone at a frequency of 55 shocks per minute and the power was set at 15 to 20 kV.

2.3 Statistical analysis

Two sample independent t-test was used to test whether there is a statistically significant difference in the mean size of stones between the stone-fragmented and non-fragmented groups. Chi-square test was used to test whether there is an association between outcomes of stone fragmentation with respect to stone location. $p < 0.05$ was considered as statistically significant.

3. Results

Of the 114 patients who underwent ESWL, 93 patients fulfilled the study criteria (Table 1), in which 77 (82.3%) patients were male and 16 (17.7%) were female. Overall, the mean age (years) was 42.67 (range: 14-73, S.D= 12.31). Calculi were distributed in the kidney, the number of patients with calculi in the renal pelvis, upper, middle and lower calyces were 23 (24.7%), 24 (25.8%), 18 (19.4%) and 28 (30.1%) respectively. The overall success of ESWL treatment was observed in 74.2% of the 93 patients (Table 1).

Table 1: Characteristics and outcome of ESWL in the study group

Characteristics	Sample (n=93)	Male (n=77)	Female (n=16)
ESWL outcome	69 (74.2%)	57(82.6%)	12 (17.4%)
ESWL failure	24 (25.8%)	20 (83.3%)	4 (16.75)

The mean size of fragmented stone was 13.09 mm. Similarly 14.04 mm mean size was detected for non fragmented cases. There is no significant difference between stone size and stone free rate (fragmented p -value =0.248, non fragmented p -value=0.283). The mean frequencies of fragmented and non-fragmented stones with respect to size are shown in figure 1.

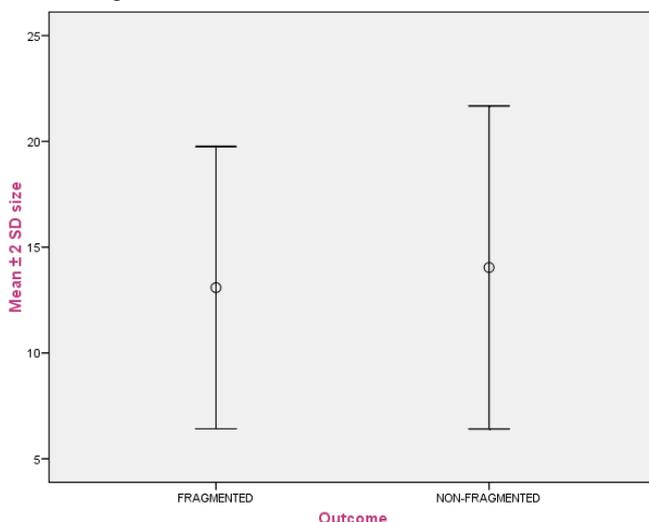


Figure 1: Mean frequency of stone size between fragmented and non-fragmented groups

Totally overall stone free rate was 74.2%. Upper calyx and renal pelvic stones had a high stone free rate in ESWL with respect to lower and middle calyx. There is a significant difference between the stone free rate and the location of the calculi (p -value=0. 042). The data are shown in table 2.

Table 2: Distribution of stones in kidney with respect to outcome of ESWL

Stone location	Stone free rate		Total	$X^2_{(4)}$	P-value
	Positive	Negative			
Middle calyx	12 (66.7%)	6 (33.3%)	18	9.892	0.042
Upper calyx	21 (87.5%)	3 (12.5%)	24		
Lower calyx	18 (64.3%)	10 (35.7%)	28		
Renal pelvis	18 (78.2%)	5 (21.8%)	23		
Total	69 (74.2%)	24 (25.8%)	93		

4. Discussion

ESWL is one of the most frequently used modalities to treat upper urinary tract calculi. The initial results for treatment of renal calculi with SWL were very encouraging and thus resulted in the rapid acceptance of this noninvasive technology as a treatment alternative for renal calculi [7]. The outcome of ESWL is measured in terms of stone fragmentation and clearance. The outcome of this therapy depends on several factors, including stone location, composition, pelvicalyceal anatomy and stone size [6]. However, failure of ESWL will results in unnecessary exposure of renal parenchyma to shock waves and complications.

Our results suggest that successful ESWL would depend on multiple parameters like stone location, stone consistency, shape and protocol of treatment. In our study, stone size was an independent predictive factor for ESWL success. When stones are in the lower pole calyx, the success rate of ESWL depends not only on successful fragmentation but also on stone fragment clearance. ESWL treatment for lower pole calyceal stones is controversial. In our study 30% stones from kidney were in lower calyx in which the stone free rate was 64.3% which is quite lower than reported by Robert *et al.*, having a stone-free rate of 84%, but the size and the instrumentations were variable factors [8].

Some limitations of our study warrant consideration. Firstly, the routine radiological follow-up of this study was performed by using KUB but not CT. Thus, it might be difficult to exactly assess stone-free status. Secondly, we performed only monotherapy in each patient. In clinical practice, an important issue during ESWL treatment for urinary stone disease is the number of ESWL sessions required for success. The complete stone free rate may be possible for two or three sessions. Thirdly, our results did not discuss about the renal anatomy and the frequency of wave

was fixed to all the patients and also we have not taken into consideration of infundibulopelvic angle width of calyceal neck and calyceal length in the inferior calyceal stone clearance. Lastly, we did not investigate stone composition because a considerable number of the passed stones were not collected by the patients.

5. Conclusion

Our data concludes that almost 75 % of all patients with stones can be completely cured by ESWL alone without ancillary procedures. ESWL is an effective and safe treatment modality for renal stones less than 20 mm size with acceptable stone clearance.

Acknowledgement

The authors acknowledge financial support from Yenepoya University in the form of seed grant (YU-Seed grant/ 2011-019).

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