

Original Article

Determining the success rate of extracorporeal shock wave lithotripsy in renal pelvis stone of 1-2 cm in size.

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Abstract

Background: Despite its historical significance, ESWL has witnessed changes in its role, necessitating refined technical approaches and stringent patient selection criteria for optimal outcomes. This study aims to assess the efficacy of extracorporeal shock wave lithotripsy (ESWL) for treating renal pelvis stones ranging from one to two centimeters in size.

Methodology: A descriptive case series was conducted at the Department of Urology and Renal Transplantation, SIUT, Karachi. The study enrolled 81 patients aged 20 to 60, of both genders, with a single renal pelvis stone sized 1-2 cm. Patients with ureteral obstruction were excluded. Informed consent was obtained before performing ESWL. Follow-ups were carried out regularly, and final success was assessed one-month post-ESWL session.

Results: The mean age of participants was 41.93 ± 9.67 years, with the majority (54.32%) falling within the 41 to 60 age range. Out of 81 patients, 49 (60.49%) were male and 32 (39.51%) were female, resulting in a male-to-female ratio of 1.5:1. The mean stone size was 14.22 ± 2.01 mm. In the study, the success rate of ESWL for renal pelvis stones sized 1-2 cm was 85.19%, with 69 patients showing successful outcomes.

Conclusion: In conclusion, the success rate of ESWL for treating renal pelvis stones sized 1-2 cm is notably high. This finding underscores the effectiveness of this non-invasive procedure in managing such cases.

Keywords

Extracorporeal, Shock Wave, Lithotripsy, Renal Stone, Laparoscopic.



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Introduction

Within the Afro-Asian region, including Pakistan, the prevalence of calculi, commonly referred to as stones, ranges between 4% and 20%¹. While smaller stones, below 4 mm, often pass spontaneously in 80% of cases, the need for intensive intervention arises when stones exceed 6-7 mm in the ureter². Various treatment methods, such as laparoscopic surgery, endoscopic removal, and intracorporeal shock wave lithotripsy, have been employed to address ureteric stones³. Among these, shockwave lithotripsy (SWL), percutaneous nephrolithotomy, and retrograde intrarenal surgery (RIRS)⁴ have gained prominence for larger stones, leading to a dynamic landscape of stone management. Over the past two decades, the evolution of endourology and minimally invasive techniques has elevated the success rates of these approaches, gradually diminishing the prominence of extracorporeal shock wave lithotripsy (ESWL) as a primary choice⁵.

Despite its historical significance, ESWL has witnessed changes in its role, necessitating refined technical approaches and stringent patient selection criteria for optimal outcomes. The effectiveness of ESWL is commonly assessed based on stone clearance and fragmentation^{6,7}. Earlier studies, like Wiesenthal et al., revealed a success rate of 70.2% for single ESWL sessions targeting renal stones sized between 1 to 2 cm⁸. Subsequent investigations demonstrated promising outcomes, with a substantial proportion of patients becoming stone-free or exhibiting residual fragments smaller than 4 mm after ESWL^{9,10}.

This study aims to assess the efficacy of ESWL for treating renal pelvis stones ranging from one to two centimeters in size. The research seeks to extend our understanding by providing localized statistics and contributing to the existing body of knowledge. By addressing the specific context of renal pelvis stones in this size range, the study endeavors to enhance clinical decision-making and improve patient outcomes in the realm of stone management.

Methodology

This study adopts a descriptive case series design and was conducted within the Department of Urology & Renal Transplantation at SIUT, Karachi. The study spanned from December 3, 2018, to June 2, 2019. Ethical clearance for the study was sought and obtained from the ethical review committee as well as CPSP.

A sample size of 81 was determined with a confidence level of 95%, a 10% margin of error, and an anticipated ESWL success rate of 70.2%. Non-probability consecutive sampling was employed to select participants. Inclusion criteria encompassed patients with a solitary renal pelvis stone meeting specific size (1-2 cm) and duration (>1 month) parameters, aged 20 to 60 years, and encompassing both genders. Exclusion criteria factored in aspects like pregnancy (confirmed through ultrasonography), PUJO (assessed via CTU), ureteral obstruction beyond the stone (evaluated through IVU), and patients with pyonephrosis or sepsis (clinically assessed).

Upon securing informed consent, the study enrolled 81 eligible patients from the Urology & Renal Transplantation outpatient unit. ESWL was conducted by a skilled surgeon with extensive post-fellowship experience, with each patient receiving pre-ESWL antibiotic and analgesic treatment. A singular ESWL session was administered per patient. Regular follow-ups allowed for the assessment of success rates based on predefined criteria, with data on age, gender, stone size, BMI, and success outcome meticulously recorded using a dedicated proforma.

Data analysis was performed using SPSS version 22.0. Descriptive statistics, such as mean and standard deviation, were employed to portray age, BMI, duration of stone, and stone size. Gender distribution and success rates were presented as frequencies and percentages. To account for potential effect modifiers (age, gender, BMI, duration of stone, and stone size), a stratification approach was adopted. Furthermore, post-stratification chi-square analysis was executed to discern the impact of these variables on treatment

success. A significance level of $p \leq 0.05$ was utilized to determine statistical significance.

Results

The study included individuals within an age range of 20 to 60 years, with a mean age of 41.93 ± 9.67 years. The majority of the patients, 44 (54.32%), fell between the age group of 41 to 60 years. Among the total of 81 patients, 49 (60.49%) were male, and 32 (39.51%) were female, reflecting a male-to-female ratio of 1.5:1. The average duration of the disease within the study was 5.73 ± 2.44 months. The mean size of the stone under investigation was 14.22 ± 2.01 mm.

Within the scope of this study, the success rate of extracorporeal shock wave lithotripsy (ESWL) for

treating renal pelvis stones within the size range of 1-2 cm was found to be 85.19%, encompassing 69 patients who achieved success out of the total 81 patients.

The stratification of ESWL success based on various patient characteristics was explored. For age groups, patients aged 20-40 years exhibited a success rate of 88.64%, while those aged 41-60 years had a success rate of 81.82%, yielding a non-significant p-value of 0.352. With regard to gender, 89.86% of males and 81.25% of females experienced successful outcomes, with a p-value of 0.42. In terms of the duration of the disease, success rates for patients with a disease duration of 1-6 months and >6 months were 83.93% and 88.00% respectively, with a p-value of 0.634.

Table 1: Patient baseline characteristics.

Variables	N(%)
Age (years); Mean±SD	41.93±9.67
20-40 years	37(45.68)
41-60 years	44(54.32)
Gender	
Male	32(39.51)
Female	49(60.49)
Duration of disease (months); Mean±SD	5.73±2.44
1-6 months	56(69.14)
>6 months	25(30.86)
Size of stone (mm); Mean±SD	14.22±2.01
11-15 mm	59(72.84)
16-20 mm	22(27.16)
BMI (kg/m²)	
<27 kg/m ²	40(49.38)
≥27 kg/m ²	41(50.62)

Table 2: Stratification of success with respect to patient characteristics.

Variables	Success [N(%)]		p-value
	Yes (n=69)	No (n=12)	
Age	20-40 years	33(47.82)	0.352
	41-60 years	36(52.17)	
Gender	Male	43(62.31)	0.420
	Female	26(37.68)	
Duration	>1-6 months	47(68.11)	0.634
	>6 months	22(31.88)	
Size	11-15 mm	50(72.46)	0.855

	16-20 mm	19(27.53)	3(25.00)	
BMI	$\leq 27 \text{ kg/m}^2$	36(52.17)	4(33.33)	0.228
	$> 27 \text{ kg/m}^2$	33(47.82)	8(66.66)	

* $p < 0.05$ is considered significant.

Discussion

It is well acknowledged that several stone characteristics, including fragility, size, location, and composition, can significantly impact treatment outcomes, as highlighted in previous literature¹¹⁻¹⁴. The present study was conducted to determine the success rate of extracorporeal shock wave lithotripsy (ESWL) for treating renal pelvis stones ranging in size from 1 to 2 cm. The research cohort included participants aged 20 to 60, with a mean age of 41.93 ± 9.67 years. Notably, the majority of the 44 patients (54.32%) fell within the age range of 41 to 60. Among the 81 patients enrolled, there was a male to female ratio of 1.5, comprising 49 (60.49%) men and 32 (39.51%) women. The average stone size was determined to be 14.22 mm by 2.01 mm.

In this investigation, a noteworthy 85.19% of patients (69 individuals) experienced successful outcomes following ESWL for treating renal pelvis stones sized between 1 and 2 cm. This observation aligns with previous studies, including a retrospective analysis of 305 patients who underwent ESWL for calculi up to 2.0 cm. This analysis revealed an impressive 83% success rate after three months, with success defined as patients free of calculi or fragments smaller than 4 mm. Further substantiating these findings, Wiesenthal et al. reported a success rate of 70.2% with a single ESWL session for renal stones within the 1-2 cm range, following a 3-month follow-up. It's notable that the aforementioned 305 participants underwent ESWL for calculi up to 2.0 cm^{15,16}.

Studies have indicated that in non-lower polar regions, ESWL results are promising for stone sizes exceeding 2 cm. The highest rates of clearance have been observed for calculi at the pelvi-ureteric junction (PUJ) and the renal pelvis^{17,18}. Overall, stone-free rates (SFRs) achieved through SWL range from 86% to 89% for renal pelvic stones.

Interestingly, the effectiveness of SWL is more strongly associated with stone burden rather than stone position, as emphasized in Khalil's study involving 438 patients¹⁹. The influence of variables such as stone composition, stone size, patient characteristics like BMI, and stone location on SWL outcomes has also been investigated.

Studies have reported varying ESWL success rates for different types of stones, with calcium oxalate monohydrate/cystine stones showing rates between 60% and 63%, and uric acid/calcium oxalate dihydrate stones exhibiting rates between 38% and 81%. Notably, Krishnamurthy et al. explored the effects of SWL in patients with a single pelvic stone larger than 2 cm and found that stone size between 1 and 10 mm did not significantly affect stone-free rates²⁰.

Limitations

While our study contributes valuable insights, it has certain limitations. The absence of a randomized control trial, relatively limited sample size, and the need for a longer follow-up period are notable limitations that warrant consideration. These factors could affect the generalizability and depth of our findings.

Conclusion

In conclusion, our study underscores the high success rate of extracorporeal shock wave lithotripsy (ESWL) as an effective approach for treating renal pelvis stones within the 1-2 cm size range. Given its noninvasive nature, minimal failure rate, and avoidance of anesthesia, ESWL emerges as a viable primary treatment choice for patients with renal pelvis stones of this size. While our study offers significant insights for clinical practice, addressing its limitations through larger sample sizes, randomized trials, and extended follow-up periods would further consolidate these findings.

and potentially shape standard treatment recommendations.

Conflicts of Interest

Authors declared no conflict of interest.

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