

ORIGINAL ARTICLE

# Stone Clearance rate of Intracorporeal Pneumatic Lithotripsy for Mid Ureteric Stone of Size 1-2cm

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## ABSTRACT

**Introduction:** Urinary stones are a common urological issue with high recurrence and potential complications. Treatment options include Shock wave Lithotripsy, Ureterorenoscopy, and surgery, chosen based on stone size, location, and resources. The EAU recommends Shock wave Lithotripsy or Ureteroscopic Laser Lithotripsy for middle ureteral stones due to their minimally invasive nature. Advances in ureteroscopes and laser lithotripsy have improved outcomes for stones >1 cm.

**Objectives:** To determine the frequency of clearance of middle ureteric stone of size more than 1cm with ureterorenoscopic lithotripsy in patients presenting to tertiary care hospital.

**Study Design:** A Descriptive Study.

**Duration and Place of Study.** Department of Urology, LRH, Peshawar from 30-01-24 to 30-07-24.

**Materials and Method:** This 6-month descriptive study at a tertiary care hospital in Peshawar included 183 patients aged 18–60 years with middle ureteric stones sized 1–2 cm. Patients were selected through non-probability consecutive sampling. Stone clearance was defined as the absence of ureteric stones on non-contrast CT KUB after 2 weeks.

**Results:** The mean age of the patients was  $39.89 \pm 12.38$  years. In our study, 103 patients (56.3%) were male and 80 patients (43.7%) were female. Stone clearance was confirmed by CT KUB in 147 patients (80.3%).

**Conclusions:** In our study, ureterorenoscopic lithotripsy achieved an 80.3% clearance rate for >1 cm mid-ureteric stones, with higher success in older patients and right-sided stones.

**Keywords:** Ureteric stone, Stone size, Ureterorenoscopic lithotripsy, Stone clearance

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## INTRODUCTION:

Urinary stones, one of the most common urological diseases, require active treatment due to its prevalence, high recurrence rates, and various complications<sup>1</sup>. There are many therapeutic approaches for the treatment, that is, complete stone clearance with minimal patient morbidity, of ureteral stones<sup>2</sup>. The most commonly used approaches include shock wave lithotripsy (SWL), ureteroscopy (URS), percutaneous nephrolithotripsy, laparoscopic, ureterolithotomy, and open ureterolithotomy. However, there is a lack of definite evidence-based options for managing large proximal ureteral stones<sup>3</sup>. Moreover, the optimal choice of treatment depends on various factors, including stone size, composition and location, clinical factors, equipment availability, and surgeon capability<sup>4</sup>. The European Association of Urology guidelines recommend SWL or ureteroscopic laser lithotripsy (URSL) as the first-line treatment for middle ureteral stones<sup>5</sup>. Both these procedures are preferred because they are less invasive than other approaches, have low complication rates, and are well tolerated by patients. In general, SWL is preferred by both patients and physicians<sup>6</sup>. Although SWL and URS remain the most common modalities for the treatment of middle ureteral stones, there is still an ongoing debate among the academicians and medical practitioners regarding the best treatment modality<sup>7</sup>. In a study by Aboutaleb et al, the stone-free rate (SFR) for the URSL treatment was 86.2%<sup>2</sup>. This was similar to the findings of Salem et al, who reported that the initial SFRs for URSL, when applied to stones  $\geq 1$  cm, was 88.0%<sup>6</sup>. In the past two decades, the technological advancements achieved in ureteroscope manufacturing and laser

lithotripsy have considerably improved the outcomes of treatment of middle ureteral stones exceeding 10 mm in diameter. However, the local data about the stone clearance by this technique is limited leading to inadequate understanding about the effectiveness of the technique. Hence the study has been planned. Results of my study will help in better understanding of URSL for the treatment of middle ureteral stones exceeding 10mm in our local population.

## MATERIALS AND METHODS

**Sample Size:** Sample size was calculated using WHO sample size calculator taking the following assumptions, Anticipated rate if stone clearance with ureterorenoscopic lithotripsy = 86.2%<sup>2</sup> Margin of error = 5% Confidence Level = 95% Sample size, n = 183

**Sampling Technique:** Non Probability Consecutive Sampling

**Sample Selection:**

**Inclusion criteria**

- Patient age 18 to 60 years
- Both genders
- Stone size 1cm-2cm
- Radiopaque stones

**Exclusion criteria**

- patients with history of any intervention on the corresponding ureter
- patients with coagulopathy
- all pregnant females
- UTI

## DATA COLLECTION PROCEDURE

After taking approval from the Ethical Review Committee of the hospital (**Ref: no.1049/LRH/MTI**), patients fulfilling the inclusion criteria were enrolled from the indoor department of urology of the institute. Informed consent were taken from the enrolled participants. Baseline information like age (years), gender, height in centimeters, weight in

kilograms and BMI (weight in kg/height in meter<sup>2</sup>) were recorded. Detailed history, Physical examination, laboratory findings, X-ray KUB, ultrasonography KUB and CT-KUB without contrast were ordered preoperatively. The procedure was performed under general/spinal anesthesia, using semi rigid ureteroscope 6/8.9 Fr. Our standard technique for ureteroscopic treatment of mid ureteric calculi includes cystourethroscopy with placement of a 0.035-inch floppy tip guide wire past the stone (glide wire when necessary) to maintain access and for placement of a safety wire with a direct vision. For URSL, Swiss Pneumatic Lithoclast was used to disintegrate the stone. Low pressure continuous flow irrigation and/or intermittent manual pumping of irrigant was used to maintain a clear ureteroscopic view when the Swiss lithoclast was used. Dormia baskets were used in all cases to prevent stone migration. All significant gravels were removed using Dormia basket. All patients were treated on a day-case basis, and all procedures were scheduled as outpatient procedures unless any complications occurred during the procedure. At the end of the procedure, 6FR DJ ureteric stents were optional in some cases. In case of excessive manipulation, mucosal edema, injury or residual fragments are seen, a double J ureteric stent was placed for 2 weeks. The double J stent was removed after complete stone clearance. All patients were invited for follow up at 2 weeks after intervention. Data were recorded by the researcher himself on especially designed proforma.

#### DATA ANALYSIS PROCEDURE

Data were analyzed using IBM SPSS version 25. Frequencies and percentages were computed for qualitative variables. Means + SD were computed for quantitative data. Stone clearance was

stratified by age, gender, BMI, laterality of the ureter and pain duration. Post stratification chi square test at 5% level of significance was applied. P value < 0.05 was considered statistically significant.

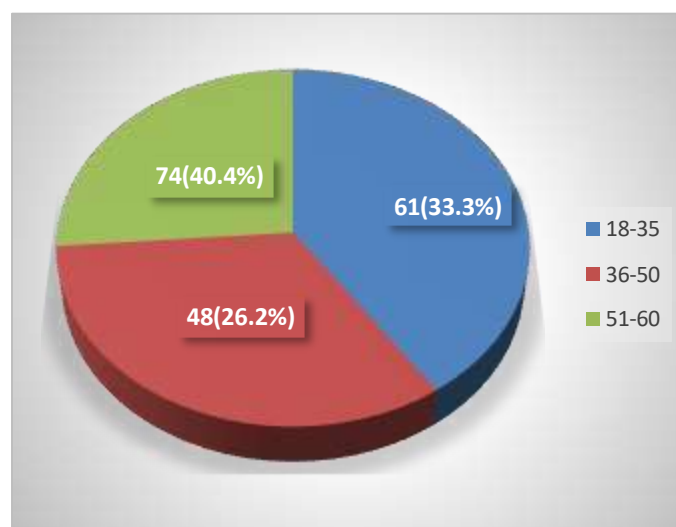
#### RESULTS:

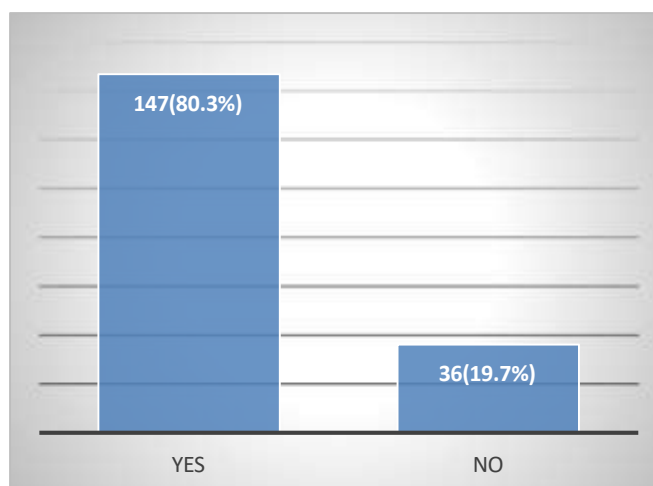
A total of 183 patients were included in the study. The mean age of participants was  $39.89 \pm 12.38$  years. The sample comprised 80% males (n = 146) and 20% females (n = 37). Descriptive statistics of key clinical parameters are summarized in Table 1.

Table 1. Descriptive Statistics of Study Variables

Variable	Mean	Standard Deviation
Age (years)	39.89	$\pm 12.38$
Pain duration (days)	5.26	$\pm 1.96$
Stone size (cm)	1.57	$\pm 0.30$
BMI (kg/m <sup>2</sup> )	25.59	$\pm 2.44$

Figure 1 Age Distribution



**Figure 2. Stone Clearance**

Statistically significant correlation was observed between stone clearances with different age ranges and as per the results increasing age is associated with relative less clearance of stone as shown in the Table.2. As per the age is concerned male gender have relative better clearance of stone with URS compare to female gender as statically significant results were obtained as shown in Table.2. Right Ureter have better clearance of stone as compared to left one. Stone clearance is associated with more pain duration than those with incomplete clearance. Higher BMI is associated with less clearance of stone as compared to low BMI.

**Table 2. Stratification of Stone Clearance with Demographic Variables**

Variable	Subgroups	Stone Clearance (Yes)	Stone Clearance (No)	P-value
Age (years)	18–35	57 (38.8%)	17 (47.2%)	0.047
	36–50	52 (35.4%)	9 (25.0%)	
	51–60	38 (25.9%)	10 (27.8%)	
Gender	Male	81 (55.1%)	22 (61.1%)	0.051
	Female	66 (44.9%)	14 (38.9%)	
Laterality	Right	89 (60.5%)	19 (52.8%)	0.039
	Left	58 (39.5%)	17 (47.2%)	
Pain Duration	2–5 days	79 (53.7%)	15 (41.7%)	0.019
	>5 days	68 (46.3%)	21 (58.3%)	
BMI (kg/m <sup>2</sup> )	18–25	85 (57.8%)	15 (41.7%)	0.008
	>25	62 (42.2%)	21 (58.3%)	

In summary ureteric stones in males, middle age patients having low BMI and involving right ureter have relatively high clearance of stone compared to female, old age having high BMI and involving left ureter.

## DISCUSSION:

Pneumatic lithotripsy is currently used as technique of choice for distal ureteric calculi in many countries of the world with high stone clearance and relative rare complications although it is invasive

Technique in comparison to shock wave lithotripsy(SWL) is noninvasive but still is preferred by many urologist<sup>8-10</sup>. Pneumatic lithotripsy is widely used for the treatment of mid ureteric stone with high clearance rate reported between 70

to 85% with many factors which will effect this outcome such as stone size, location, anatomical complexity of ureter and several other factors<sup>11</sup>. In our study the clearance rate of 80.3% was reported. The key factor which will determine stone clearance is its size. Stone between 1-2cm although can be treated with ICPL but its clearance is challenging and may leads to incomplete fragmentation. Additionally, the stone's composition plays a critical role, as stones made of more durable materials tend to have lower clearance rates experienced operators may struggle with stone positioning and fragment management, lowering clearance rates. The choice of equipment also influences the outcome, with advanced pneumatic lithotriptors offering more precise shock wave delivery. These modern tools improve the ability to break down larger stones, enhancing clearance success<sup>14</sup>. The size of stones being fragmented is also of critical consideration. The ICPL should fragment the stone to the size so that they can be passed naturally via urinary track. As per the literature majority of the stone of 1-2cm being fragmented to the size so that they can be passed without any hindrance sometimes the fragments are large enough that they should be removed via forceps or basket etc<sup>15</sup>. History of patient is also important if the patient is having recurrent stone or having recurrent UTIs of distal urinary track obstruction due to benign prostatic hyperplasia or any other cause then in such condition recovery is complicated and complete clearance of stone is challenging<sup>16</sup>. The perioperative proper management of patient is also of utmost importance. Adequate hydration, procedural skills postoperative pain management and to look for postoperative urinary retention. All these factors sum-up to and are important for adequate stone clearance<sup>17</sup>.

compared to softer ones, like uric acid stones<sup>12</sup>. The anatomical position of the ureter also affects its clearance rate. Narrow ureter or tortuous ureter may affect the visualization of lithotripter resulting in inadequate delivery of shock waves and thus making its clearance challenging and May results in incomplete fragmentation and clearance<sup>13</sup>. The experience of the operating urologist plays a vital role in stone clearance rates. Skilled practitioners can better manipulate the catheter and target stones effectively, leading to higher success. Less

## Conclusion

In our study ureterorenoscopic lithotripsy achieved a stone clearance rate of 80.3% (147 patients) for middle ureteric stones larger than 1 cm. Clearance rates were notably higher in patients aged 51–60 years and in those with right-sided mid-ureteric stones.

## REFERENCES

1. Almasoud NA, Safar O, Elatreisy A, Alshahrani ST, Libdah SB, Alkhaldi SM, et al. Super pulsed thulium fiber laser outcomes in retrograde intrarenal surgery for ureteral and renal stones: a systematic review and meta-analysis. *BMC.urology*.2023;23:179.doi: <https://doi.org/10.1186/s12894-023-01355-x>.
2. Chen H, Pan Y, Xiao M, Yang J, Wei Y. The Outcomes of Pre-Stenting on Renal and Ureteral Stones: A Meta-Analysis. *Urologia internationalis*. 2022;106:495-503. doi: <https://doi.org/10.1159/000519473>.
3. Constante-Amores CR, Kahouadji L, Williams JG, Turney BW, Shin S, Chergui J, et al. Role of Kidney Stones in Renal Pelvis Flow. *Journal of biomechanical engineering*.2023;145:doi: <https://doi.org/10.1115/1.4056461>.
4. Fakhr Yasseri A, Saatchi M, Khatami F, Dialameh H, Rahimzadeh H, Aghamir SMK. The Prevalence of Renal Stones and Outcomes of Conservative Treatment in Kidney Transplantation: A Systematic Review and Meta-Analysis. *Urology.journal*.2021;18:252-8.doi: <https://doi.org/10.22037/uj.v18i02.6531>.
5. Gauhar V, Traxer O, Castellani D, Sietz C, Chew BH, Fong KY, et al. Could Use of a Flexible and Navigable Suction Ureteral Access Sheath Be a Potential Game-changer in Retrograde Intrarenal Surgery? Outcomes at 30 Days from a Large, Prospective, Multicenter, Real-world

Study by the European Association of Urology Urolithiasis Section. European urology focus. 2024;10:975-82.doi:

<https://doi.org/10.1016/j.euf.2024.05.010>.

6. Geraghty R, Lombardo R, Yuan C, Davis N, Tzelves L, Petrik A, et al. Outcomes of Flexible Ureterscopy vs Extracorporeal Shock Wave Lithotripsy for Renal Stones in Pediatric Patients: A European Association of Urology Urolithiasis Guidelines Systematic Review and Meta-Analysis. The Journal of urology. 2023;210:876-87.doi: <https://doi.org/10.1097/ju.0000000000003696>.

7. Mosquera L, Pietropaolo A, Brewin A, Madarriaga YQ, de Knecht EL, Jones P, et al. Safety and Outcomes of using ureteric access sheath (UAS) for treatment of Pediatric renal stones: Outcomes from 2 tertiary endourology centers. Urology. 2021;157:222-6. doi: <https://doi.org/10.1016/j.urology.2021.04.011>.

8. Panthier F, Pauchard F, Traxer O. Retrograde intra renal surgery and safety: pressure and temperature. A systematic review. Current opinion in urology. 2023;33:308-17.doi: <https://doi.org/10.1097/mou.0000000000001102>.

9. Papatsoris A, Alba AB, Galán Llopis JA, Musafer MA, Alameedee M, Ather H, et al. Management of urinary stones: state of the art and future perspectives by experts in stone disease. Archivio italiano di urologia, andrologia : organo ufficiale [di] Societa italiana di ecografia urologica e nefrologica. 2024;96:12703.doi: <https://doi.org/10.4081/aiua.2024.12703>.

10. Rai A, Hsieh A, Smith A. Contemporary diagnosis and management of pelvi-ureteric junction obstruction. BJU.international.2022;130:285-90.doi: <https://doi.org/10.1111/bju.15689>.

11. Redfern V, Mortimore G. Renal and ureteric stones: a clinical review. British journal of nursing (Mark Allen Publishing). 2022;31:S14-s22. doi: <https://doi.org/10.12968/bjon.2022.31.9.S14>.

12. Sandberg M, Cohen A, Escott M, Temple D, Marie-Costa C, Rodriguez R, et al. Bladder Stones in Renal Transplant Patients: Presentation, Management, and Follow-up. Urologia internationalis. 2024;108:399-405. doi: <https://doi.org/10.1159/000539091>.

13. Soleimani MJ, Shahrokh H, Soraki VV, Fakhar V, Ghaed MA, Narouie B. Investigating ESWL success rate in the treatment of renal and ureteral stones in children. Urologia. 2023;90:570-5.doi: <https://doi.org/10.1177/03915603231162663>.

14. Subiela JD, Kanashiro A, Emiliani E, Villegas S, Sánchez-Martín FM, Millán F, et al. Systematic Review and Meta-Analysis Comparing Fluorless

Ureterscopy and Conventional Ureterscopy in the Management of Ureteral and Renal Stones. Journal of endourology. 2021;35:417-28.doi: <https://doi.org/10.1089/end.2020.0915>.

15. Tiwari AK, Sarkar D, Pal DK. Emergency extracorporeal shock wave lithotripsy: A study on feasibility and efficacy in stone clearance and reducing morbidity in ureteric and renal stones with colic. Urologia. 2023;90:516-21.doi: <https://doi.org/10.1177/03915603221140444>.

16. Tonyali S, von Barga MF, Ozkan A, Gratzke C, Miernik A. The heat is on: the impact of excessive temperature increments on complications of laser treatment for ureteral and renal stones. World journal of urology. 2023;41:3853-65. doi: <https://doi.org/10.1007/s00345-023-04652-0>.

17. Tsaturyan A, Boviatsis V, Peteinaris A, Adamou C, Pagonis K, Natsos A, et al. Non-Papillary Access for the Percutaneous Antegrade Treatment of Renal and Ureteral Stones. Urology. 2023;171:71-6.doi: <https://doi.org/10.1016/j.urology.2022.08.037>.



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