DOI: https://doi.org/10.54393/pjhs.v4i12.1224

PAKISTAN JOURNAL OF HEALTH SCIENCES

https://thejas.com.pk/index.php/pjhs

Volume 4, Issue 12 (December 2023)

Original Article

Ureteric Laser Tripsy with and without Stone Cone

Muhammad Salman Khan[1] and Khalid Farooq[1*]

[1]Lady Reading Hospital, Peshawar, Pakistan

ARTICLE INFO

Key Words:

Stone Cone, Lithotripsy, Ureteroscopy

How to Cite:

Khan, M. S., & Farooq, K. (2023). Ureteric Laser Tripsy with and without Stone Cone: Ureteric Laser Tripsy. Pakistan Journal of Health Sciences, 4(12). https://doi.org/10.54393/pjhs.v4i12.1224

***Corresponding Author:**

Khalid Farooq

Lady Reading Hospital, Peshawar, Pakistan

drkhalid846@gmail.com

Received Date: 10th December, 2023

Acceptance Date: 30th December, 2023

Published Date: 31st December, 2023

ABSTRACT

Stones may block the ureter causing pain and discomfort. Ureteric laser lithotripsy, a notable breakthrough in urology, has transformed the treatment of urinary tract stones. **Objectives:** To compare the efficacy of ureteroscopic laser lithotripsy with and without stone cone. **Methods**: This retrospective analysis was done at LRH Peshawar's urology department from 1st December 2022 to 31th October 2023. Over the time, 50 patients had ureteroscopic holmium laser lithotripsy. Our research comprised adults over 18 with proximal ureteric stones (>10mm) and hydro ureters on CT KUB. Patients were split into two groups. Group A included 27 patients and employed a 7mm stone cone (Boston Scientific Corp, Natick, MA). No stone cone was utilized in group B (23). **Results:** This prospective research included 50 adults with radiologically confirmed uretric stones in diverse ureteric sites. Male 35 (70%) and female 15 (30%) were 21–68 years old (mean 38.6 years). Stones size varied from 6 to 20 mm, averaging 12.6mm. Proximal stones were 8–20mm (mean 13.9). Mid-ureter stones were 7–18mm (mean 12.6). Lower ureter stones ranged from 6 to 16mm, with a mean of 11.9mm. Ten (20%) patients have normal pelvicalyceal systems. Patients with moderate hydronephrosis were 27 (55%). **Conclusions:** The use of a stone cone during ureteroscopic lithotripsy is a safe and effective technique for the management of ureteric stones.

INTRODUCTION

Ureteric laser lithotripsy, a notable breakthrough in urology, has transformed the treatment of urinary tract stones [1]. Ureteroscopy, a minimally invasive method, is used for both diagnosis and treatment, especially when there are kidney stones blocking the ureter, which is an important conduit connecting the kidneys to the bladder [2, 3]. The management of ureteric calculi has undergone substantial alterations in the last two decades. Ureterorenoscopy is a less intrusive and safe technique for treating ureteric stones in urology, particularly when performed repeatedly, in comparison to other methods. Although shock wave lithotripsy is often used, URS is considered very effective in treating ureteric stones, with a success rate of 97% [4]. Endoscopic therapy is the favored method due to the progress and improvement in instruments and techniques [5]. The success rate of URS has significantly increased as a result of advancements in semi-rigid, flexible URS and holding gear. The endoscopic ureteroscopic lithotripsy has several drawbacks. The primary challenge faced was the backward movement of the stone, caused by the propulsive force of the irrigant and the energy needed to break the stone into fragments [1, 6]. The observed retropulsion ranged from 16 to 48%, with a higher likelihood of retropulsion occurring in proximal ureteric stones. The introduction of the stone cone has greatly reduced stone retropulsion. The stone cone serves as a device for occluding the ureter and securing the stone in position. Additionally, it functions as a guide wire for the ureter [7, 8]. The process entails the insertion of a thin ureteroscope into the urethra, enabling direct observation of the stone [9, 10]. Ureteric laser lithotripsy is a procedure that uses laser light sent over a fiber-optic cable to

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accurately break down stones in the ureter [11-13]. This novel approach provides a less intrusive option compared to conventional surgical procedures, while also offering the benefits of shorter recovery periods and less potential problems.

This study aimed to compare the efficacy of ureteroscopic laser lithotripsy with and without stone cone. This study explored ureteric laser lithotripsy, by critically assessing its effectiveness and safety, taking into account method variables such stone cones. Results of this study will educate clinical decision-making, improve patient care, and help us understand how to best use ureteric laser lithotripsy in modern healthcare.

METHODS

The Urology department at Leady Reading Hospital Peshawar undertook this prospective, randomized trial from 1st December 2022 to 31th October 2023. The trial was registered with clinical trial registry (Clinicaltrial.gov ID: NCT0585647). Permission for the conduct of the study was granted by institute ethical review board vide no: 225/LRH/MTI, dated 11th November 2022. A total of 50 ureteric stone patients were studied. This study included adults over 18 with plain kidney, ureter, bladder (KUB) x-ray films or spiral CT scan evidence of ureteric stone (6-20mm) and proximal hydro ureter. Sample size was calculated using WHO sample size calculator. The sample size was obtained using the procedure for comparing two proportions with 80% power and 5% significance. Stone migration was projected to be 10% in the control group (without stone cone) and 40% in the intervention group (with stone cone). These assumptions yielded 23 patients per group. Patients were enrolled using non-probability convenient sampling technique. Patients were split into two groups. Groups A and B included 27 and 23 patients, respectively. Group A patients employed a stone cone to avoid stone retropulsion, but group B did not. Keeping the randomization list private from researchers reduced selection bias. The study's main and secondary aims were retrograde stone migration during ureteroscopic laser lithotripsy and stone-free rate with and without stone cone device. Patients with urethral strictures distal to stone, renal stones, ineffective URS, clinical symptoms of urosepsis, and stone impaction were excluded from the research. All patients got spiral CT scans, intravenous urograms, and KUB as needed. Every patient in this study had a ureteric stone. Seven patients (15%) had proximal, five (10%) mid, and 38 (75%), distal ureteric stones. The semi-rigid "Karlz storez" 7.5fr URS with 4fr working channel and pressure poor irrigation was employed in our investigation. Boston Scientific Crop, Natrick,MA 7mm stone cone. There are several laser machines. 100W, 150W, 60W Quanta system. A 100W Quanta system with a Holmium: YAG Laser is employed in our OT. Stone fragmentation began at 10W and 1.0 J and accelerated to 12.5.15.18 and 20. Stone retropulsion increases after 20. Install guide wire and run collapsible stone cone over it until black lines are beyond the stone following endoscopic spotting. The cone was released and dragged caudally against the stone. URS has stone-level advancement. The laser lithotripsy probe is positioned over the stone and shot under eyesight. When stone is totally shattered, the probe leaves the working channel. A double J stent was put over guide wire after the stone cone was removed from the ureter. The laser lithotripsy probe was pushed down the ureteroscope working channel to initiate stone breakup after placing a semi-rigid URS over a guide wire. When the stone fragments were little, DJ stent went over guide wire and left them alone. Both groups considered the surgery successful if stone shattered to 2-3mm fragments and did not migrate. Proximal or upward stone migration to the kidney was observed during ureteroscopic lithotripsy or on the first post-op day by spiral CT KUB or KUB x-ray. Due to the high expense of CT scans, all patients except four (three from group A and one from group B) were evaluated by x-ray KUB. Additional therapy for migrating stones was ESWL.

RESULTS

In this prospective study, 50 adult patients with radiologically proven uretric stone at various ureteric locations were included. Age ranged from 21 to 68 years (mean 38.6) with male 35 (70%) and females 15 (30%). Normal pelvicalyceal systems were noted in 10 (20%) patients. Patients with mild hydronephrosis were 27 (55%). And patients with moderate hydronephrosis were noted in 13 (25%) patients (table 1).

Table 1: Patient Demographics

Characteristics		Total Patients (n=50)
Gender	Female	35 (70%)
	Male	15 (30%)
Age Range (years)		21 - 68
Mean Age		38.6
Normal Pelvicalyceal Systems		10 (20%)
Mild Hydronephrosis		27 (55%)
Moderate Hydronephrosis		13 (25%)

Gender-wise distribution of the study subjects is shown in figure 1.

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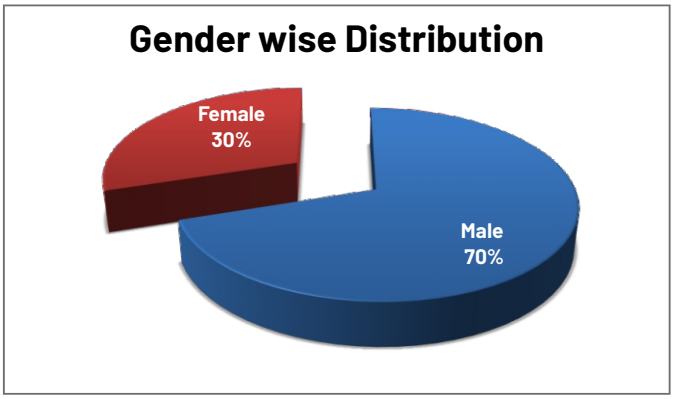

Figure 1: Gender-wise Distribution

The stones size ranged from 6 to 20 mm with a mean of 12.6mm. The size of proximal stones ranged from 8 to 20mm (mean 13.9mm). The size of stone in mid ureter ranged from 7 to 18mm (mean 12.6mm). And with mean of 11.9mm, the size of stones in lower ureter varied from 6 to 16mm. Stone was successfully fragmented inn all patients. No stone migration noted with patient of group A in which stone cone was noted, however in seven patients (28%), in whom stone cone was not used, stone migrated proximally as show in table 2.

Table 2: Patients' Stone Characteristics

Characteristics	Values (mm)
Stone Size Range	6 - 20
Mean Stone Size	12.6
Proximal Stone Size Range	8 - 20
Mean Proximal Stone Size	13.9
Mid Ureter Stone Size Range	7 - 18
Mean Mid Ureter Stone Size	12.6
Lower Ureter Stone Size Range	6 - 16
Mean Lower Ureter Stone Size	11.9

The operative time varied between 30 to 55 minutes, with mean operative time of 41.8 min, in the stone cone group, whereas it varied in without stone cone group from 40 to 71 minutes with mean operative time of 51.4 minutes; this difference was statistically significant (p 0.05)(table 3).

Table 3 : Operative Time and Post-operative Radiographic Clearance

Group	Mean Operative Time (minutes)	Complete Stone Clearance (%)
Stone Cone (Group A)	41.8	100%
Without Stone Cone (Group B)	51.4	70%

KUB or spiral CT scan on first pot-operative day was done. As demonstrated in table 4, In 27 patients of stone cone group, Radiographs showed complete stone clearance while in 23 patients of group B, 7 patients retained clinically significant remaining fragments.

Table 4 : Stone Fragmentation and Migration

Group	Stone Fragmentation Success (%)	Stone Migration (%)
Stone Cone (Group A)	27 (100%)	0 (0.0%)
Without Stone Cone (Group B)	23 (100%)	7 (30.4%)

The hospital stay in stone cone group was one to four days with mean hospital stay of 1.7 days and were back to normal routine after 2 to 6 days (mean 3.3). In contrast the average hospital stay in without stone cone group was 1 to 5 days (mean hospital stay of 1.9 days) and was back to normal routine after 2-5 days (mean 3.1 days) show in table 5.

Table 5 : Hospital Stay and Return to Normal Routine

Group	Mean Hospital Stay (days)	Mean Return to Normal Routine (days)
Stone Cone (Group A)	1.7	3.3
Without Stone Cone (Group B)	1.9	3.1

Out of total patients, minor bleed was seen either during or following stone fragmentation, in 15 (30%) patients, making it the most frequent complication.

DISCUSSION

The research found that the average age of patients was 38.6 years, with a male to female ratio of 70:30. This is comparable to the research conducted by Sarkar et al., which reported a mean age of 39.5 years and a male to female ratio of 2.3:1 [14]. In this research, the average stone size was found to be 12.6 mm, which is similar to the findings of Jain et al., who reported an average stone size of 12.8 mm [15]. Regarding the location of stones, the current research revealed that 28% of stones were located in the proximal ureter, 26% in the mid ureter, and 46% in the lower ureter. Similar findings were reported in the research conducted by Lai et al., whereby 30% of the stones were located in the proximal ureter, 25% in the mid ureter, and 45% in the lower ureter [16]. In this research, 20% of patients had normal pelvicalyceal systems, whereas 55% displayed mild hydronephrosis and 25% showed significant hydronephrosis. This is analogous to the research conducted by Sen et al., which reported that 22% of patients had normal pelvicalyceal systems, 56% displayed mild hydronephrosis, and 22% showed significant hydronephrosis [17]. Regarding stone clearing, the current research observed that all patients in the stone cone group achieved total elimination of stones, but 28% of patients in the group without stone cone still had pieces left. This is comparable to the research posted in Research and Reports in Urology in 2021, where 100% of patients in the stone cone group had total stone removal, whereas 25% of patients in the sans-stone cone group had leftover fragments [18]. In this investigation, the average duration of the operation was 41.8 minutes for the group using the

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stone cone, and 51.4 minutes for the group not using the stone cone. This is similar to the research conducted by Siddiqui et al., which reported that the average duration of the operation was 40.5 minutes in the group with stone cones and 50.2 minutes in the group without stone cones. The most prevalent consequence in the current research was mild bleeding, observed in 30% of patients. Similar findings were seen in research conducted by Goyal et al., where 32% of patients had mild bleeding [20]. The research revealed that the average duration of hospitalization was 1.7 days for patients in the stone cone group and 1.9 days for patients in the group without a stone cone. This is similar to the investigation conducted by Kaleeswaran et al., in which the average duration of hospitalization was 1.8 days for the stone cone group and 2.1 days for the group without stone cone. In summary, the results of this investigation align with other published studies, demonstrating the efficacy and safety of using a stone cone during ureteroscopic lithotripsy.

CONCLUSIONS

Utilizing a stone cone during ureteroscopic lithotripsy is a secure and efficient method for treating ureteric stones. It may aid in minimizing the duration of surgery, enhancing the rate at which stones are removed, and reducing the length of hospitalization. The most prevalent event seen in 30% of individuals was minor hemorrhage. Additional research with bigger sample numbers and several centers is necessary to validate the results of this study.

Authors Contribution

Conceptualization: MSK, KF
Methodology: MSK, KF
Formal analysis: MSK, KF
Writing-review and editing: MSK, KF
All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

All authors have read and agreed to the published version of the manuscript.

REFERENCES

[1] Garg S, Mandal AK, Singh SK, Naveen A, Ravimohan M, Aggarwal M, et al. Ureteroscopic laser lithotripsy versus ballistic lithotripsy for treatment of ureteric stones: a prospective comparative study. Urologia Internationalis. 2009 May; 82(3): 341-5. doi: 10.1159/000209369.

[2] Berent AC. Ureteral obstructions in dogs and cats: a review of traditional and new interventional diagnostic and therapeutic options. Journal of Veterinary Emergency and Critical Care. 2011 Apr; 21(2): 86-103. doi: 10.1111/j.1476-4431.2011.00628.x.

[3] Rodríguez D and Sacco DE. Minimally invasive surgical treatment for kidney stone disease. Advances in Chronic Kidney Disease. 2015 Jul; 22(4): 266-72. doi: 10.1053/j.ackd.2015.03.005.

[4] Shabana W, Teleb M, Dawod T. Safety and efficacy of using the stone cone and an entrapment and extraction device in ureteroscopic lithotripsy for ureteric stones. Arab Journal of Urology. 2015 Jun; 13 (2): 75-9. doi: 10.1016/j.aju.2015.02.005.

[5] Sen H, Bayrak O, Erturhan S, Urgun G, Kul S, Erbagci A, et al. Comparing of different methods for prevention stone migration during ureteroscopic lithotripsy. Urologia Internationalis. 2014 Jul; 92(3): 334-8. doi: 10.1159/000351002.

[6] Farahat YA, Elbahnasy AE, Elashry OM. A randomized prospective controlled study for assessment of different ureteral occlusion devices in prevention of stone migration during pneumatic lithotripsy. Urology. 2011 Jan; 77(1): 30-5. doi: 10.1016/j.urology.2010.05.063.

[7] Delvecchio FC and Preminger GM. Management of residual stones. Urologic Clinics of North America. 2000 May; 27(2): 347-54. doi: 10.1016/S0094-0143(05)70263-9.

[8] Eisner BH, Pengune W, Stoller ML. Use of an antiretropulsion device to prevent stone retropulsion significantly increases the efficiency of pneumatic lithotripsy: an in vitro study. BJU International. 2009 Sep; 104(6): 858-61. doi: 10.1111/j.1464-410X.2009.08540.x.

[9] Vanlangendonck R and Landman J. Ureteral access strategies: pro-access sheath. Urologic Clinics. 2004 Feb; 31(1): 71-81. doi: 10.1016/S0094-0143(03)00095-8.

[10] Geavlete PA, Georgescu D, Mulţescu R, Geavlete B. Retrograde Ureteroscopy in the Treatment of Upper Urinary Tract Lithiasis. Retrograde Ureteroscopy. Academic Press; 2016 Jan; 105-216. doi: 10.1016/B978-0-12-802403-4.00006-1.

[11] Keller EX, De Coninck V, Traxer O. Next-generation fiberoptic and digital ureteroscopes. Urologic Clinics of North America. 2019 May; 46(2): 147-63. 10.1016/j.ucl.2018.12.001.

[12] Antonelli JA. Innovations in surgical stone disease. Current Opinion in Urology. 2016 May; 26(3): 240-7. doi: 10.1097/MOU.0000000000000286.

[13] Domnick EB. Laser Lithotripsy for Treatment of Canine Urolithiasis. Current Techniques in Small Animals Surgery. 5th Edition. Teton NewMedia; 2014.

[14] Sarkar C, Sharma MC, Deb P, Singh R, Santosh V,

DOI: https://doi.org/10.54393/pjhs.v4i12.1224

Shankar SK. Primary central nervous system lymphoma-A hospital-based study of incidence and clinicopathological features from India (1983-2003). Journal of Neuro-oncology. 2005 Jan; 71: 199-204. doi: 10.1007/s11060-004-1385-z.

[15] Jain R, Raju K, Bali RS, Chander J, Neogi S. Prognostic implications of double J ureteral stenting in patients with renal stones undergoing extracorporeal shockwave lithotripsy. International Journal of Research in Medical Sciences. 2017 Sep; 5(9): 3831. doi: 10.18203/2320-6012.ijrms20173639.

[16] Lai S, Jiao B, Diao T, Seery S, Hu M, Wang M, et al. Optimal management of large proximal ureteral stones (> 10 mm): A systematic review and meta-analysis of 12 randomized controlled trials. International Journal of Surgery. 2020 Aug; 80: 205-17. doi: 10.1016/j.ijsu.2020.06.025.

[17] Sen SS, Menon P, Malik MA, Sodhi KS. Outcome of Patients with Antenatally Diagnosed hydronephrosis with Respect to Postnatal Diagnosis and Need for Surgical Intervention. Journal of Indian Association of Pediatric Surgeons. 2022 May; 27(3): 333.

[18] Bhanot R, Jones P, Somani B. Minimally invasive surgery for the treatment of ureteric stones–state-of-the-art review. Research and Reports in Urology. 2021 May; 227-36. doi: 10.2147/RRU.S311010.

[19] Siddiqui AJ, Kumari N, Adnan M, Kumar S, Abdelgadir A, Saxena J, et al. Impregnation of Modified Magnetic Nanoparticles on Low-Cost Agro-Waste-Derived Biochar for Enhanced Removal of Pharmaceutically Active Compounds: Performance Evaluation and Optimization Using Response Surface Methodology. Water. 2023 Apr; 15(9): 1688. doi: 10.3390/w15091688.

[20] Goyal NK, Goel A, Sankhwar SN, Singh V, Singh BP, Sinha RJ, et al. A critical appraisal of complications of percutaneous nephrolithotomy in paediatric patients using adult instruments. BJU International. 2014 May; 113(5). doi: 10.1111/bju.12506.

[21] Kaleeswaran B, Ramadevi S, Murugesan R, Srigopalram S, Suman T, Balasubramanian T. Evaluation of anti-urolithiatic potential of ethyl acetate extract of Pedalium murex L. on struvite crystal (kidney stone). Journal of Traditional and Complementary Medicine. 2019 Jan; 9(1): 24-37. doi: 10.1016/j.jtcme.2017.08.003.