FREQUENCY OF STONE FREE RATE FOLLOWING LASER LITHOTRIPSY FOR THE MANAGEMENT OF URETERIC CALCULI IN THE TERTIARY CARE CENTRE OF LALITPUR, NEPAL

Mohammad Nasim Alam, Binod Shrestha, Rajesh Batajoo, Atul Kasaju

Department of Urology, B & B Hospital, Gwarko, Lalitpur, Nepal

ABSTRACT

Urolithiasis is one of the most common diseases of the urinary tract. The lifetime prevalence of urinary stones is around 1 to 15%, and the peak age of incidence is at 30 years. Ureteric stones account for 20% of the calculi in urolithiasis. Different modalities are being used for intracorporeal stone fragmentation such as pneumatic, electrohydraulic, ultrasonic, and laser lithotripsy. Ureteroscopy (URS) is the primary modality for management of ureteral stones. Laser lithotripsy is an established endourological modality. The aim of proposed synopsis is to determine the frequency of stone-free rate (SFR) following laser lithotripsy for the management of ureteric calculi. This was a hospital based descriptive cross-sectional study which conducted between 26th May 2022 and 27th November 2022, at Department of Urology, B & B Hospital. Of 71 patients, the mean age of the patients was 44.79±7.92 years. The frequency of successful stone clearance was observed in 62 (87.3%) patients. The mean size of ureteric calculi was 5.98 ±1.28 cm and the mean duration of ureteric stone disease was 4.14 ±0.91 months. Majority of the patients reported stone free rate following laser lithotripsy for the management of ureteric calculi.

KEYWORDS

Laser lithotripsy, stone free rate, ureteric calculi

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CORRESPONDING AUTHOR

Dr. Mohammad Nasim Alam
Lecturer,
Department of Urology,
B & B Hospital,
Gwarko, Lalitpur, Nepal
Email: nasimalam323@gmail.com
Orcid No: https://orcid.org/0009-0004-4286-5720
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INTRODUCTION

Urolithiasis is one of the most common diseases of the urinary tract. The lifetime prevalence of urinary stones is around 1% to 15%, and the peak age of incidence is at 30 years.[1] Ureteric stones account for 20% of the calculi in urolithiasis and about 70% of ureteric calculi are present in the distal third of the ureter at the time of presentation.[2] Different modalities are being used for intracorporeal stone fragmentation such as pneumatic, electrohydraulic,ultrasonic, and laser lithotripsy.[3] Ureteroscopy (URS) is the primary modality for management of lower and mid-ureteral stones and also for most upper-ureteral stones.[4] Review of published series on the treatment of ureteric calculi with URS, using a variety of ureteroscopes and intracorporeal lithotripsy devices, revealed success rates of 86–100%.[5]

Laser lithotripsy is an established endourological modality. The cornerstone for the laser lithotripsy was laid when the ruby laser was invented in 1960 by Maiman.[6] The first destruction of kidney stones with a pulsed ruby laser (λ: 694 nm) was described in 1968 in an in vitro experiment by using quartz rods to deliver the laser light to the treatment site by Mulvaney *et al.*[7] The introduction of the Ho:YAG laser have broadened the indications for ureteroscopic stone managements to include larger stone sizes throughout the whole upper urinary tract.[8] The pneumatic lithotripter has a high chance of stone migration and an electro hydraulic probe generates large amounts of heat which may damage the ureter.[9] The only true contraindication to laser lithotripsy is the presence of untreated UTI, because of the risk of urosepsis.[10] The laser is one of the safest intracorporeal lithotripters and the most significant complication of its use is the injury of the urothelial tissue adjacent to the treated stone. Well-known complications include a lost stone, ureteric perforation, extravasation and avulsion. As the depth of tissue penetration of the Ho:YAG laser is 0.4 mm, in the vast majority, injuries can be managed conservatively, although a ureteric stricture can be a chronic event.[11] Treatment of ureteric calculi with Ho:YAG lithotripsy is superior ($p < 0.05$) to pneumatic lithotripsy when comparing stone-free rate (SFR) (95–98.6% vs. 80–86%).[12-14]

The aim of proposed synopsis is to determine the frequency of SFR following laser lithotripsy for the management of ureteric calculi. As studies have reported huge variability in stone SFR after URS. This may be due to differences in the use of different modalities for stone fragmentation such as pneumatic, electrohydraulic, ultrasonic and laser lithotripsy. No local study found on this topic during last 5 years. Therefore, the present study is designed to estimate the current magnitude of success of laser lithotripsy, and if found to be higher, than the same modality will be recommended in patients with ureteric stone.

MATERIALS AND METHODS

This was a hospital based descriptive cross-sectional study using non probability consecutive sampling technique. The study was conducted between 26th May 2022 and 27th November 2022, at Department of Urology, B & B Hospital. All in-patients admitted in Department of Urology aged 14 to 70 years presented with single ureteric calculus with maximum stone size less than or equal to 10mm for 2 or more weeks duration undergoing laser lithotripsy were included. Patients with calculus involving other than ureter or ureteric calculi associated with other anomalies like neurogenic bladder, stricture urethra or patients with untreated urinary tract infections (UTI) diagnosed on routine clinical examination and urine analysis report were excluded. After approval from Institutional Review Committee (IRC) of the institute, patients who were presented in urology department of B & B Hospital, Lalitpur Kathmandu fulfilling the inclusion criteria was included in this study until the required sample size of 71 patients was completed. An informed consent was taken from all the patients before including them in this study taking care of their privacy and safety. After inclusion in study, data regarding baseline study variables such as age, gender, BMI, hypertension (systolic blood pressure more than or equal to 140 mmHg), and duration of disease was calculated. After that URS laser lithotripsy was done in all patients by consultant urologist of the hospital. After 3 months, CT KUB was done to determine the SFR. All the gathered information regarding stone clearance and other relevant information regarding patient was recorded on a pre-designed Proforma. Data analysis was carried out using SPSS-25. Chi-square test was applied at P-value ≤0.05 to find the association between the variables.

RESULTS

A total of 71 patients included for the management of ureteric calculi by laser lithotripsy.

Table 1: Mean age of the study population, years (n=71)		
Mean ±SD	**Minimum**	**Maximum**
44.79 ±7.92	**25**	**84**

As shown in table 1, the mean age of the study population was 44.79±7.92 years

Table 2: Mean size of ureteric calculi, cm (n=71)		
Mean ±SD	**Minimum**	**Maximum**
5.98 ±1.28	**4**	**9**

As shown table 2, the mean size of ureteric calculi was 5.98 ±1.28 cm.

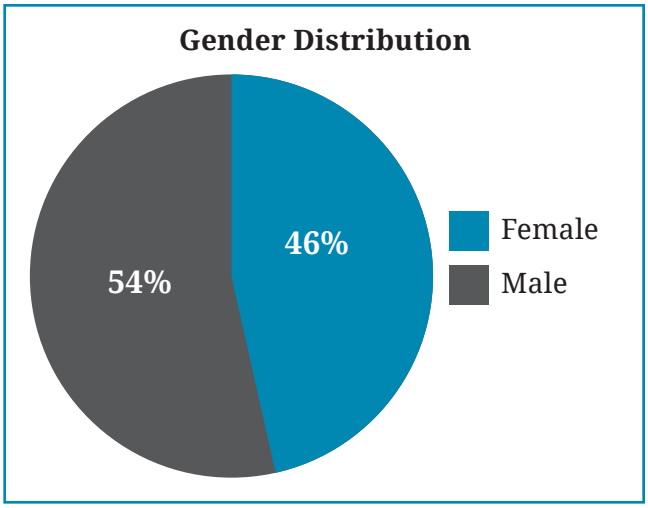

Fig. 1: Gender distribution of the study population (n=71)

Table 3: Comparison of SFR with size of ureteric calculi, cm (n=71)				
Size of Ureteric Calculi, cm	**SFR**		**Total**	**p-value**
	Yes	**No**		
≤6	48 (94.1)	3 (5.9)	51 (100)	0.012
>6	14 (70.0)	6 (30.0)	20 (100)	
Total	**62 (87.3)**	**9 (12.7)**	**71 (100)**	

Table 4: Comparison of SFR with anatomical location of stone (n=71)				
Anatomical location of stone	**SFR**		**Total**	**p-value**
	Yes	**No**		
Upper Ureter	25 (92.6)	2 (7.4)	27 (100)	
Mid Ureter	23 (79.3)	6 (20.7)	29 (100)	0.241
Lower Ureter	14 (93.3)	1 (6.7)	15 (100)	
Total	**62 (87.3)**	**9 (12.7)**	**71 (100)**	

As shown in Fig. 1, 38 (53.5%) patients were males and 33 (46.5%) were females.

As shown table 3, there were 51 (71.8%) patients with ≤6 cm and 20 (28.2%) with >6 cm of distribution of size of ureteric calculi. The stone free rate was higher in the size ≤6 cm (94%) and in table 4, there were 27, 29 and 15 stones in the upper, mid and lower Ureter respectively.

As shown in table 5, laterality of stone was 35 in the left Ureter and 36 in the right Ureter.

As shown in Fig. 2, Frequency of successful stone clearance was observed in 62 (87.3%) patients.

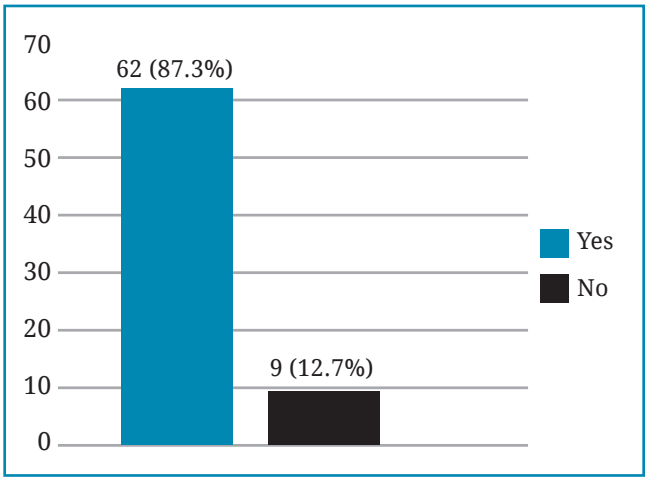

Fig. 2: Frequency of successful stone clearance (n=71)

Table 5: Comparison of SFR with side of stone (n=71)				
Side of stone	SFR		Total	p-value
	Yes	No		
Left	27 (77.1)	8 (22.9)	35 (100)	0.114
Right	35 (97.2)	1 (2.8)	36 (100)	
Total	**62 (87.3)**	**9 (12.7)**	**71 (100)**	

DISCUSSION

Over the last decade, lasers have been increasingly used for intracorporial lithotripsy.[15] Ho:YAG laser has become one of the most widely accepted lasers for this purpose as compared to ultrasonic, pneumatic and other laser devices.[16] The meta-analysis of the EAU/AUA nephrolithiasis guideline panel demonstrated that URS yields significantly greater stone-free rates for the majority of stone stratifications.[15]

In our study, the mean age of the patient with ureteric calculus undergoing laser lithotripsy was 44.79±7.92 years which is similar to a study done southwestern part of Nepal, the mean age of the patients with ureteric calculus was little high (46.74 ±14.99).[17] Studies done in other parts of the world also show a higher mean age in the patients presenting with ureteric calculi.[18] There were more male patients (53.5%) than female patients (46.5%) in our study which is very similar to other studies.[19,20] In our study, the mean volume of ureteric calculi was 7.30 ±0.78 mm^3 and the mean size of ureteric calculi was 5.98±1.28 cm. There were 51 (71.8%) patients with ≤6 cm and 20 (28.2%) with >6 cm distribution of size of ureteric calculi. Other studies show variation in the size of the calculus undergoing laser lithotripsy, the mean stone size ranging from 7.08±1.66 mm to 14.44±3.56 mm.[20,21]

In the study conducted by Jagannath *et al*,[22] Abedi *et al*,[20] and Koju *et al* [19] Right ureteric calculi undergoing laser lithotripsy was slightly more common (60.7%, 50.3% and 51.4% respectively). However, in the study conducted by Rashid *et al*[23]and Ali *et al*[24] left side ureteric calculi was more. In our study left side of stone was observed in 35 (49.3%) and right side in 36 (50.7%) patients. In the study conducted by Zheng *et al*, [25] the most common site for calculus was upper ureter. Contrast to this, lower ureteral involvement was seen in a study done in Iran and India. [20,22] However in our study, anatomical location showed that upper ureter was observed in 27 (38%) patients, mid ureter in 29 (40.8%), and lower ureter in 15 (21.1%) patients.

According to the current study findings, frequency of successful stone clearance was observed in 62 (87.3%) patients. Study done in Nepal also suggest that laser lithotripsy as a better option in regards to SFR (99%).[19] Many other studies showed SFR of 83.3% to 99%.[22,25] It has been seen that laser lithotripsy is successful in treating the patients with ureteric calculus with high SFR and low complications.[26,27]

In the study conducted by Subedi *et al*,[28] the association of SFR among different variables in different groups like - male and female patients, patients with stone size < and ≥10 mm, stone density < and ≥1000 HU and sites (upper, middle and lower) was statistically not significant. Gurcak *et al*[29] also found that there was no association in terms of SFR and other variables like gender, stone size and location. However in our study, SFR was higher in the stone size ≤ 6 cm and was statistically significant but not with other variables.

The findings of the current study could be highlighted in the light of limitation that this was a single center study conducted on a limited number of samples. Further multicenter studies with larger follow-up are recommended to preclude the findings of this study.

In conclusion, majority of the patients reported stone free rate following laser lithotripsy for the management of Ureteric calculi. Holmium laser lithotripsy via URS is a safe and effective method of management of ureteric calculi.

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