

## Endourological treatment of ureteral stone: a quasi-experimental comparative study at public sector hospital focusing on assessment of holmium: Yag laser with pneumatic lithotripsy

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### ABSTRACT

**Objective:** To assess the efficacy of Holmium: YAG laser in comparison with pneumatic lithotripsy for the management of ureteral stones.

**Study Design:** A quasi-experimental comparative study

**Place and Duration:** Urology Department, Liaquat University of Medical and Health Sciences Jamshoro, from 1<sup>st</sup> January 2015 to 31<sup>st</sup> January 2016.

**Methodology:** Total of 100 patients were categorized into 2 equal groups. All the patients who were having radio opaque stones of 10mm to 15 mm size underwent ureteroscopy. Stone size and location was confirmed by doing ultrasound KUB (kidney ureter and bladder), X- Ray KUB and CT KUB with different combinations. In Group A, 1mm probe of pneumatic lithotripsy was used to section the stone and in Group B Holmium YAG laser 600-micronfiber size was used. Patients were followed those with residual stones were labeled as failure.

**Results:** Stones clearance was 64% in Group A (Pneumatic lithoclast). While in Group B (Ho: YAG laser lithotripsy) 94% of the patients had stone clearance with a significant p-value of 0.006

**Conclusion:** The utilization of Holmium: YAG laser lithotripsy is a better and effective modality than pneumatic lithoclast.

**Keywords:** Ureteric stone, Radio opaque, Endourological Treatment, Pneumatic lithotripsy, YAG laser, Efficacy

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### INTRODUCTION

Kidney stone disease also known as Urolithiasis is 2 to 3 times more come in male gender as compared to females, predominantly occurring in middle aged persons and accounts for more than half of all the admissions in urology department of tertiary care hospital in Karachi<sup>1</sup>.

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Endourology is one of rapidly evolving field of surgical sciences, it's been dream in last century to develop certain type of equipment to minimize surgical morbidity and to avoid cutting. It was observed that an intervention is needed for the ureteral calculi which do not respond to conventional treatment. The management of stones of ureter must be assessed in terms of typical efficacy and safety and accomplishment rates including the viability of the technique, number of sessions that are needed for complete removal of stone, rate of complications, and the necessities of the removal of the stones. Nevertheless, the However, the recognition of popularity of every technique is usually evaluated by the cost affectivity, particularly in developing countries<sup>2</sup>. Improvements in ureteroscope design (semirigid and small diameter scopes) have resulted in better outcomes. The two most commonly used ureteroscopic modalities for stone disintegration are pneumatic and laser lithotripsy<sup>3</sup>. In a meta-analysis conducted in 2017, Pneumatic Lithotripsy was compared with Holmium YAG laser lithotripsy in a total of eight studies with a total of 1,555 participants. It was found that Holmium YAG LL reduced the mean operative time, significantly<sup>4</sup>. In another study, it was reported that both Laser Lithotripsy and Pneumatic Lithotripsy had a comparably high success rate in the management of ureteral stones. However,

the former had the advantage over the latter in terms of shorter operative time<sup>5</sup>.

Evaluation of the literature revealed many studies that compared the pneumatic lithotripsy with laser lithotripsy. Some of the studies reported similarities between the two procedures<sup>6-9</sup> while, others claimed that laser lithotripsy is better than the pneumatic lithotripsy in terms of OT time, efficacy, and postoperative complications<sup>10-12</sup>.

To the best of our knowledge, there have been very limited studies conducted to assess the efficacy of Holmium YAG laser in comparison with pneumatic lithotripsy for the management of ureteral stones. We conducted this study with the objective to compare the efficiency and outcome of Holmium YAG laser lithotripsy and pneumatic lithotripsy.

### METHODOLOGY

This quasi-experimental comparative study was performed at Department of Urology in Liaquat University of Medical and Health Sciences Jamshoro, from 15<sup>th</sup> January 2015 to 15<sup>th</sup> January 2016, A total of 100 patients were included in the study using convenience sampling technique and classified into two equal groups designated as "A" and "B". After detailed history and clinical examination with special regard to ureteric stone, patients were counseled about research protocol and their safety was ensured, after getting their consent all those patients having ureteric stone anywhere in the ureter between the size of 1- 1.5 cm stone were incorporated in the study while patients aged less than 15 years, with associated stones in kidney, formerly unsuccessful ureteroscopy, concomitant infection of urinary tract, pregnancy, severe skeletal malformations, patients weak for anesthesia, radiolucent stones, patients who did not give informed consent for surgery not willing for surgery and those patients who might require DJ Stents were expelled from the study. Stone size and location was confirmed by doing ultrasound KUB (kidney ureter and bladder), X- Ray KUB and CT KUB with different combinations.

After scrutiny all those patients who fulfill inclusion and exclusion criteria patients were allotted group A and B by lottery method. Group A then undergo through pneumatic lithotripsy with 1 mm pneumatic lithoclast probe for stone fragmentation and while group B underwent laser lithoclasty with 600-micron laser fiber with energy 8mJ and frequency 8 Hz for stone fragmentation, in both groups 7.5 frKarl's Storz semi rigid ureteroscope was used.

Patients were observed for 24 hours for pain management and for any other complication. X-ray KUB was done on first postoperative day of procedure for assessment of any residual fragment of stone. Patient was discharged on pain killer on first postoperative day after X rays. Those patients who retain fragment of stones were followed for 2 weeks after discharge with fresh x-ray KUB again for any residual stones, if stone fragment persist they were labeled as failure.

**Data Analysis:** Data was entered and analyzed through SPSS version 20. Qualitative data was expressed as frequency and percentage. Chi square test was used to assess the association

with significant p value set at 0.05.

### RESULTS

A total of 100 participants were enrolled in the study. Out of these, 72 (72%) were male and 28 (28%) were female, with male to female ratio of 2.5:1. The mean age was 34±4.1 years and median age was 30 years. There was wide variation of age ranging from a minimum of 15year to 45 years in both groups. The frequent site of stone was found at upper 1/3<sup>rd</sup> of ureter in 44% patients followed by lower 1/3<sup>rd</sup> and middle 1/3<sup>rd</sup> in 29% and 27% patients respectively (Table-I). The removal of the stone was observed after the therapy within 24 hours. It was observed that the stones were removed in 10% in upper, 6% middle and 8% lower 1/3rd of ureter during the procedure with Pneumatic lithoclast (Group-A). Whereas, 18% in upper, 10% in middle and 10% in lower 1/3<sup>rd</sup> of ureter, the removal of stone were found in YAG laser lithoclast (Group-B). The location of the stone was upper mid and lower in 21(42%), 13(26%) and 16(32%) in Group A and it was 23(46%), 14(28%) and 13(26%) in group B respectively.

The best results were found after 15days of procedure. Stones clearance were seen 26% in upper, 14% middle and 24% lower 1/3 ureter in Pneumatic lithoclast procedure (total 64% of patients had stone clearance). While 42% upper, 26% middle and 26% lower 1/3 ureteric stone clearances were observed in YAG laser lithoclast procedure (total 94% of patient had stone clearance) (Table-I).

**Table-I: Frequency and association of Stone clearance after 15days in different groups (N=100)**

Variable		Stone Clearance				p-value
		Group A (n=50)		Group B (n=50)		
		Yes	No	Yes	No	
Location of ureteric Stone	Upper	13(26%)	8(16%)	21(42%)	2(4%)	0.006
	Mid	7(14%)	6(12%)	13(26%)	1(2%)	
	Lower	12(12%)	4(8%)	13(26%)	0(0%)	
Overall clearance		32(64%)	18(36%)	47(96%)	3(6%)	

### DISCUSSION

In our study male patients were dominant and there were 72 males and 28 females, with male to female ratio of 2.5:1. Mahmood et al also reported that out of 100 patients 56% were male and 44% female with male to female ratio of 1.2:1. This finding shows that males are more prone to develop ureteric stones than females<sup>13</sup>.

In our study commonest location of stone 44% cases were lying in upper 1/3 ureteric stone followed by lower 1/3 ureteric stones which accounted for 29% stones and 27% were present in middle 1/3 ureteric stones. While one of the international studies, reported 27.8% patients had stones in the proximal ureter, 58.6% had in the distal ureter and 13.4 % had multiple ureteric stones<sup>14</sup>.

Intracorporeal lithotripsy using Holmium YAG laser is considered and recommended as the standard technique by

European Association of Urology (EAU)<sup>15</sup>. It has the advantage to break all kinds of stones regardless of their composition in comparison to additional lithotripters. Furthermore, the chances of migration of stone are also reduced due to weak shock waves. In the current study it was observed that clearance of stone with therapy of holmium; YAG laser was higher in comparison to pneumatic lithotripsy (96% VS 64%) respectively. Our results are also comparable with a study of Farhan SD in 2012 which suggested that comparing pneumatic lithotripsy with laser lithoclast results showed clearance of stone at 4 weeks to be 84% in laser lithoclast group in contrast to 72.5% in pneumatic lithotripsy group<sup>16</sup>. Another study also having comparable results with our work. The Ho:YAG laser lithotripsy group had better stone free rate, less double J stent insertion rate and less secondary intervention rate as compared with pneumatic lithotripsy (53.4% vs. 40.1%; 72.1% vs. 91.9%; 25% vs. 48.5% respectively<sup>17</sup>.

The causal method of stone disintegration in laser lithotripters in which the majority of calculi can be fragmented into both extractable fragments or into small sand-like particles that does not need exclusion is the major reason of dominance in the instantaneous stone free rate in contrast to the pneumatic lithotripters.

One of the prospective study in Pakistan performed on 90 patients observed 92 % stone clearance<sup>18</sup>. Another study predicted the overall stone free rate by Laser therapy as 95.9 % and pneumatic lithotripsy as 92.6%<sup>19</sup>. Yet another recent study reported similar results<sup>20</sup>. One of the meta-analysis also established that Holmium LL for ureteral stones can attain short mean operative time, improved early and delayed stone free rate with larger sample size and more high quality studies<sup>21</sup>.

Correspondingly, in our study after 15 days stone-free rate was observed in 94% patients (94%) in laser group, whereas it was found 64% patients in pneumatic group. This result was statistically important ( $p = 0.006$ ) and was in accordance with result reported by Mahmood et al., in 2016<sup>13</sup>.

It is acknowledged that due to a moderate sample size the study findings have limited generalizability and need to be verified by more rigorous study designs.

### CONCLUSION

The study results showed that the utilization of Holmium: YAG laser lithotripsy is a better and effective modality than pneumatic lithoclast and can readily remove the stone from the ureter.

**Recommendation:** In light of the study results, large scale studies are recommended in order to further evaluate and establish Ho: YAG laser lithotripsy as the first line therapy for ureteric stones.

### CONTRIBUTION OF AUTHORS

**Rajpar ZH:** Conceived idea, Designed methodology, Data analysis, Literature review

**Memon II:** Manuscript writing, Data analysis, Statistical analysis.

**Soomro KQ:** Final Critical review of Manuscript.

**Qayoom A:** Data collection

**Disclaimer:** None.

**Conflict of Interest:** None.

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