

Original Article

Evaluation of Pneumatic Vs Holmium: YAG Laser Lithotripsy in the Treatment of Ureteric Stone

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ABSTRACT

Background and objectives: Among many lithotripters for fragmentation of ureteric stones, pneumatic and Holmium: YAG laser lithotripsy has reported favorable outcomes. The aim of this study is to compare the efficacy of pneumatic lithotripsy with laser lithotripsy in ureteral stone.

Materials and methods: In this prospective study, 60 patients with diagnosis of ureteral calculus underwent ureteroscopic lithotripsy in Urology Unit, Department Surgery, National Medical College and Teaching Hospital over period of 2020 to 2021. They were divided randomly into two groups, each group with 30 patients.

Group PL was treated with Pneumatic lithotripsy and Group LL was treated with Holmium: YAG laser lithotripsy. History and detailed clinical examination was performed as per the working proforma which included. Result of both the

procedures was assessed. Chi-Square test was used for correlation analysis. Data analysis was done using SPSS version 25.

Results: Mean age was 26.5 years and 36.33 years in group PL and LL respectively (P=0.58), there was no significant difference in male to female ratio and mean stone in both groups. Duration of operation was significantly lower in LL group and Hospital was slight lower in LL group as compare to PL group (0.95).

Conclusion: Ho:YAG laser and pneumatic lithotripsy are efficient and safe procedures for ureteral stones. Though operative time is higher in pneumatic lithotripsy.

Keywords: Duration of hospital stay; Ho:YAG laser lithotripsy; Operative time; Pneumatic lithotripsy; Ureteric Stone

INTRODUCTION

Ureteric colic is an important and frequent emergency in medical practice. It is most commonly caused by the obstruction of the urinary tract by calculi. The classic presentation of a ureteric colic is acute, colicky flank pain radiating to the groin. The pain is often described as the worst pain the patient has ever had experienced. Ureteric colic occurs as a result of obstruction of the urinary tract by calculi at the narrowest anatomical parts of the ureter [1].

Calcium stones (calcium oxalate, calcium phosphate and mixed calcium oxalate and phosphate) are the most common type of

stone, while up to 20% of cases present with uric acid, cystine and struvite stones.

Usually ureteric stones drop down from the kidney and increase in size as they remain in the urinary tract. Most stones, smaller than 5 mm pass spontaneously. However some stones may then arrest in the ureter producing colicky pain [2-3]. The history of treatment of urinary stones almost begins and goes parallel with the history of civilization [4]. Asutu in Mesopotamia between 3200 and 1200BC describe to dissolve the stone [5]. Sushruta (around 600 BC) described first descriptions to cut for the stone are perineal lithotomy [6].

There is a variety of modalities for stone fragmentation including ultrasonic, electrohydraulic, pneumatic lithotripsy (PL) or laser lithotripsy (LL). The newest technique approved for fragmentation of the ureteral calculi is pneumatic lithotripsy. Pneumatic lithotripsy provides an effective method for stone fragmentation in urinary tract and for stones of all compositions with wide margin of safety. As heat is not produced during lithotripsy, there is no chance of thermal injury [6].

The development of laser for the fragmentation of ureteral calculi and advances in laser fibers and power generation systems have propelled laser lithotripsy, in many practitioners hand, as the treatment of choice for ureteral stones. Laser lithotripsy is one of the safest, most effective and most versatile lithotripter. Holmium YAG laser fragments stones of all composition but unlike pneumatic lithotripter, reduces the chances of retropulsion of stones or its fragments [7].

The aim of this study is to compare the efficacy and results pneumatic lithotripsy with laser lithotripsy in ureteral stone.

MATERIALS AND METHODS

The prospective randomized single blinded study carried out in Urology Unit, Department Surgery, National Medical College and Teaching Hospital, Birgunj over period of 2020 to 2021. Approval was taken by Institutional review committee. F- NMC 511/076/077

Total 60 patient were included in this study who were diagnosed with ureteric stone. Those patient with Renal insufficiency, Abnormal anatomy & associated renal stones, Bleeding disorder , Bilateral and multiple ureteral stones, positive urine culture were excluded from this study. Total 60 patients were randomly divided into 2 groups. Group LL who went laser lithotripsy and Group PL who went for Pneumatic Lithotripsy sterile water. Diagnostic imaging such as X- KUB, ultrasonography of abdomen and CT KUB in some cases was done. Relevant blood investigation was sent to laboratory.

In group LL, 30 patients with ureteral stones underwent ureteroscopy and stone fragmentation was done by Ho: YAG LL which operates at the wavelength of 365 nm and in group PL, 30 patients underwent by using Semi-rigid ureteroscope (Wolf) used for stone access in all of the patients. Under spinal Anesthesia patients were placed in lithotomy position and lithotripsy was done by semi-rigid ureteroscope 7.5 F Wolf and Holmium laser by standard methods. All of the procedures were done by the single urologist and in the single center. All postoperative as well as follow-up events was noted

After informing patients about the procedure and its complication, written consents were obtained from them. The data were collected and statistical analysis of parameter was presented as mean±standard deviation. Categorical value was mentioned in numbers

and percent. Chi square test were used for correlation analysis. P value of <0.05 was consider as significant. Statically Software SPSS 25.0 were used for statically analysis.

RESULTS

Mean age was 26.50 years and 36.33 years in group PL and LL respectively ($P = 0.58$). There was no significant difference in male to female ratio in both groups, p-value: (0.43).

Table 1: Variables among PL group and LL group

Group	PL n= 30	LL n=30	P value
Mean Age	26.5	36.33	0.58
Male	20	17	0.43
Mean stone size	12.2	12.16	0.77
Stone Laterality			
Right side	20	19	0.79
Left side	10	11	
Stone location			
Proximal	6	9	0.53
Middle	9	10	
Distal	15	11	
Stone Number			
< 1	17	16	0.79
>1	13	14	
Mean OT Time	35.16	31.33	<0.0001
Hospital Stay	2.3	1.93	0.95

Various characteristics of ureteral stone were compared in both groups including stones' size, laterality, location, number, duration of operation and hospital stay. No significant morbidity and no mortalities were seen in patients of both groups. The significant difference was observed between the mean operation time of 2 groups 35.16 minutes in group PL vs 31.33 minutes in group LL, P value was <0.0001. Mean hospital stay was the 2.3 and 1.93 in both groups PL and LL respectively.

DISCUSSION

Urinary calculus is most common problems dealt in surgical outdoor patient. There are

various modalities of treatment for ureteric calculus which depend on location, size, density and obstructive features.

Minimally invasive procedures have gradually replaced open ureterolithotomy for treating impacted ureteral stones [8]. Shock wave length is a reasonable option for patients but it is associated with longer hospital stay, high retreatment rates and general anesthesia complication [9].

URS has high fragmentation rates and minimal tissue damage for ureteral stone. As, push-back technique is not possible in SWL it is difficult to manipulate impacted ureteral stone. Thus, Such a maneuver needs URS which defeats the noninvasive advantage of SWL [10]. Due to extensive availability of flexible ureteroscope with a laser and pneumatic lithotripters it is now most effective treatment modality for ureteral stones with high fragmentation time and minimal tissue damage [11]. A Laser lithotripsy can fragment any stone and can reach the entire urinary tract because it can be used with rigid and flexible ureteroscopes [12]. Compared to other intracorporeal lithotripters; Ho:YAG LL yields the smallest fragment size, even smaller than 1 mm [13]. The procedure results in minimal ureteral trauma and postoperative edema with smaller remaining fragments likely to pass spontaneously [12]. Due to these technological advances, many changes have occurred in traditional practice patterns, like routine postoperative stenting and complete intra-operative fragment extraction.

Pneumatic Lithotripsy is another effective lithotripsy technique that offers cheap, safe, and effective [14] and cheaper than the Ho:YAG laser [11]. The pneumatic lithotripter needs a wider, straight working channel, which is major drawback, especially for upper

ureteral calculi [15]. Therefore, it can be used within a rigid probe, which prevents its usage with flexible instruments. Pneumatic Lithotripsy is usually used for hard stone its success rate is about 88% [16].

In the present study, Incidence of ureteral calculi was found to be higher in men which was similar to the study done by others [17-18]. Similarly The mean operative time in Pneumatic group was 35.16 minutes which was significantly longer than the laser group which was 31.33 minutes with $P = < 0.0001$. These findings are comparable to study done others [17, 19] (33.09 vs 23.33) in PL vs LL respectively, [20]. No statistically significant difference in mean hospital stay after surgery was observed in both groups (PL 2.3 days vs LL 1.9 days $P = 0.95$). Comparable findings were reported by others too [17-18].

Each group was composed entirely of consecutive patients and there were no significant differences between the groups with respect to age, number of stone and size and location of the stones. The anaesthesia was also the same for both group and none of the cases had any complications.

CONCLUSION

The study concludes that both the techniques are safe and effective. However, in the laser group, the duration of operation was shorter and the hospital was less than Pneumatic.

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