

Comparative Study for the treatment of Lower third ureteral calculi between Laser Lithotripsy and other Lithotripsies

Prathvi^{1*}, Karthik Are²

¹Associate Professor, Department of Urology, Rajarajeshwari Medical College & Hospital, Bangalore, Karnataka, India

²Senior Resident, Department of Urology, Rajarajeshwari Medical College & Hospital, Bangalore, Karnataka, India

Received: 16-08-2021 / Revised: 05-09-2021 / Accepted: 24-10-2021

Abstract

Background and objectives: To compare and to assess the safety and efficacy of laser lithotripsy versus other lithotripsies in the management of lower third ureteral calculi. To look for complications and clinical outcome which are specific to laser lithotripsy and other lithotripsies. **Methods:** The study includes 50 patients with lower third ureteral calculi. Clinical manifestations were studied. Patients with lower third ureteral calculi were treated with laser lithotripsy and pneumatic lithotripsy. Response to the above treatment modalities was noted. **Results:** In our study a total of 50 patients with 50 ureteral calculi were treated. Twentyfive cases treated with pneumatic lithotripsy (PL group) and 25 cases with HO YAG laser lithotripsy (LL group). From 25 patients on PL group, 11 cases were males with; and 14 cases were females, from 25 patients on LL group, 15 cases were males and 10 cases were females. The average age of patients in LL was 36.48years and in PL was 36.40 and there was no significant difference in age demographics. The average size of calculi was 9.40mm and in laser group was 9.32mm and in pneumatic group was 9.48mm **Conclusion:** HO:YAG laser has advantage over PL in high efficacy of stone fragmentation and a low retrograde migration of uretral stone treatment.

Keywords: Laser lithotripsy, pneumatic lithotripsy, Uretral calculi, clinical Manifestations, HO YAG laser

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Ureteral calculi are a common multifactorial disease that has been recognized and documented in medical literature since Greek and roman physicians. It is estimated that up to 5% of the world population is affected by this disease and the life time risk of getting urinary stone is 8-15%. Of course, this data varies from region to region depending upon the local climate and dietary habits of the population even more so. Fifty percent of patients will have recurrent stone disease within 5 years. So it can be considered as a disease for lifetime [1].

Until 1980's urinary calculi were a major health problem, with significant proportion of patients requiring extensive surgical procedures and a sizable minority losing their kidney. Stone fragmentation by laser lithotripsy, pneumatic lithotripsy, eswl and other endoscopic techniques has revolutionised stone management [2]. Ureteric stones account for 2/3rd of all urinary calculi brought to attention of doctor [3], the presentation of the typical patient with ureteral colic is well recognized. The traditional diagnostic tools of KUB radiograph and intravenous urography remain the most useful methods of evaluation. Ultrasound combined with a KUB is usually diagnostic [4]

The treatment of ureteral stones has undergone a remarkable revolution in the last 15 years. Majority of ureteral stones pass without any intervention at all. Open ureterolithotomy and stone basket manipulation used to be the main stay of surgical stone management. Today, the treatment options include laser lithotripsy, pneumatic lithotripsy and eswl and other endourological procedures and percutaneous procedures. Because of this newer technique the treatment of ureteral calculi has become much more easier [4]. Because of expenses of technology classical medical and surgical treatments are still practiced in developing countries.

A good number of patients underwent surgical procedures i.e. both the laser lithotripsy and pneumatic lithotripsy for lower third ureteral calculi. This thesis is an effort to show the comparison of treatments of lower third ureteral calculi using laser lithotripsy and other lithotripsies who have undergone surgical intervention.

Aims and Objectives of the Study

1. To compare and to assess the safety and efficacy of laser lithotripsy versus other lithotripsy in the management of lower third ureteral calculi.
2. To look for complications and clinical outcome which are specific to laserlithotripsy and other lithotripsies.

Materials and Methods

This is a clinical study of 50 cases of Ureteric Calculus admitted to Department of Urology in Rajarajeshwari Medical College & Hospital, Bangalore during the period Feb 2021 to Aug 2021.

This prospective study includes selection of patients who underwent endourological treatment for LOWER THIRD ureteric calculus disease. The patients were selected after they were diagnosed as having ureteric calculus on the basis of a detailed history, thorough physical examination and both routine and supportive investigations

*Correspondence

Dr. Prathvi

Associate Professor, Department of Urology, Rajarajeshwari Medical College & Hospital, Bangalore, Karnataka, India

E-mail: shettyprathvi@yahoo.com

like ultrasonography and KUB radiography. The patients were asked details of history regarding symptoms particularly pain and hematuria. A detailed general survey and per abdominal examination was carried out. Hb% urine routine, urine culture and sensitivity blood urea, serum creatinine, ultrasonography, KUB radiograph, intravenous urography were obtained. Ethical clearance has been obtained from research and dissertation committee/ethical committee of the institution for this study. General anaesthesia or spinal anaesthesia was used. Patients underwent both laser as well as pneumatic lithotripsy 25 cases each respectively. Postoperative care was meticulously followed; intake and output charts and vital signs charts were maintained. Patients were given antibiotics, analgesics, and sedation if needed at night. Most of the operated patients had uneventful recovery. Patients were advised to come for follow-up on OPD days. Follow up period was 2 weeks. They patients were asked for symptoms like pain, hematuria and urinary tract infection.

Results

The “comparative study for the treatment of lower third ureteral calculi between laser lithotripsy and other lithotripsies” was conducted at Department of Urology, Rajrajeshwari Medical College & Hospital, Bangalore over a period of 7 months. A total of fifty patients with lower ureteric calculi were included in the study and were randomized to laser and pneumatic lithotripsy

Sex

In this study of fifty patients twenty seven (54%) were male and twenty three (46%) were female. In the laser group, sixteen (32%) were male and ten (20%) were female. In the pneumatic group ten (20%) were male and fourteen (28%) were female.

Table 2. Sex distribution among the 2 therapy groups

Sex	Laser	Pneumatic
Male	16	10
Female	10	14

Table-3: Age distribution between the 2 groups

Age (years)	Laser	Pneumatic
16-20	1	1
21-30	12	8
31-40	3	4
41-50	6	10
51-60	4	1

Age

In this study patients aged between 16 years and 60 years were included. Most common age group was between twenty one to thirty years (40%). Average age was 36.5 years and Median age was 34 years.

Table-4: Size of calculi in the 2 groups

Size(mm)	Laser	Pneumatic
8MM	9	6
9MM	5	6
10MM	8	7
11MM	4	5

The average size of calculi was 9.40mm and in laser group was 9.32mm and in pneumatic group was 9.48mm.

Table -5: Symptoms among study subjects

Symptom	No of patients
Pain	50
Radiation	44
Haematuria	10
Burning micturition	18
Vomiting	20

Pain was most common symptom, with every patient presenting with colicky abdominal pain. Radiating pain was noted in forty five patients. Other symptoms noted were vomiting, burning micturition and haematuria.

Table-6: Duration of Surgery

	A	B	Total
N	25	25	50
$\sum X$	459	775	1234
$\sum X^2$	8571	24165	32736
SS	143.76	140	2280.88
Mean	18.36	31	24.68

Results

Mean _a -Mean _b	T	df	One-tailed	<.0001
-12.64	-18.38	48	Two tailed	<.0001

F – test for the significance of the difference between the variance of the two samples.

df ₁	df ₂	F	P
24	24	1.03	0.471439

Independent t-test significantly shows lesser duration of time laser lithotripsy than compared to pneumatic with p value (0.471439). Duration of surgery in laser group was much lesser than pneumatic group. The average duration of surgery in laser group was 19.56mins, whereas in pneumatic group was 31mins.

Complications

No complications were noted intraoperatively or early and late postoperative.

Discussion

The present study titled “Comparative Study For The Treatment Of Lower Third Ureteral Calculi Between Laser Lithotripsy And Other Lithotripsies” was conducted At Rajrajeshwari Medical College & Hospital, Bangalore.

The objective of the study was to know the efficacy of the laser lithotripsy over pneumatic lithotripsy for lower ureteric calculi and to look for complications and clinical outcome which are specific to laser lithotripsy and other lithotripsies.

Forty cases treated with pneumatic lithotripsy (PL group) and 39 cases with HO:YAG laser lithotripsy (LL group). From 40 patients on PL group, 29 cases were males with mean age of 38.5 ± 6.4 years; and 11 cases were females with mean age of 42.5 ± 4.3 years, from 39 patients on LL group, 28 cases were males with mean age of 35.71 ± 4.1 years and 11 cases were females with mean age of 51.09 ± 5.1 years. Two cases in LL group and one in PL group had bilateral ureteral stones [1].

Mean stone size was 12.07 ± 2.1 mm in LL group and 10.2 ± 2.8 mm in PL group with a range of 6-15 mm in both groups. Stones located in lower ureter (below the iliac crest on the base of KUB) in 30 cases of LL group and 29 cases of PL group. In other patients stones location was in the upper ureter (above the iliac crest).

The LL group showed significant benefits compared with the PL group in terms of mean operative time (28±9.2 vs 41±12.4 min, P=0.001) and early stone-free rate (80.8% vs 91.3%, P=0.04), but there was no statistically significant difference at the third month (92.6% vs 95.5%, P=0.15). In the LL group, 24 postoperative cases of stricture were seen, whereas only 5 cases occurred in the PL group (P=0.02). The other complications, such as perforation, bleeding, and mucosal injury, were comparable in the two groups. The average postoperative stay was also similar (1.7±2.4 days for PL and 1.5±3.1 days for LL (P=0.62) [2].

The preoperative, operative, and post-operative follow-up findings were analyzed and compared. The average stone size was similar in both groups (11.88 ± 5.83 mm(2) vs. 11.07 ± 5.44 mm(2)). The calculi were located in the distal ureter in most of the patients in both groups (65% in pneumatic group and 52.5% in laser

group). The operation time was significantly diminished in the laser group ($P = 0.001$). The stone-free rates after a single ureteroscopic procedure were 80 and 97.5% in the pneumatic and laser groups, respectively ($P = 0.03$). Auxiliary treatments were needed in seven patients in the pneumatic group, while only one patient in the laser group ($P = 0.05$) needed this treatment. After the additional procedures, a 100% success rate was achieved in both groups [3].

In our study a total of 50 patients with 50 ureteral calculi were treated. Twenty five cases treated with pneumatic lithotripsy (PL group) and 25 cases with HO:YAG laser lithotripsy (LL group). From 25 patients on PL group, 11 cases were males with; and 14 cases were females, from 25 patients on LL group, 15 cases were males and 10 cases were females. The average age of patients in LL was 36.48 years and in PL was 36.40 and there was no significant difference in age demographics. The average size of calculi was 9.40mm and in laser group was 9.32mm and in pneumatic group was 9.48mm [4].

Impacted calculi were located in bilateral ureters in 22 patients and unilateral ureters in 5 patients with a solitary or single functioning kidney. Acute renal failure was demonstrated with oliguria or anuria and a significant increase in serum creatinine and blood urea nitrogen. Ureteroscopy and laser lithotripsy were successfully performed in all patients. The mean operative time was 29.2 minutes (range 15-60). The successful fragmentation rate in the ureteroscopic procedure was 93.9% (46 of 49), and the overall stone-free rate was 88.9% (24 of 27).

In 193 patients (mean stone size 12.3 mm), pneumatic lithotripsy was used; in 201 patients (mean stone size 11.5 mm), laser lithotripsy was performed. Patients were monitored as outpatients at 2 weeks, at 3 months, and then annually with a kidneys, ureters, and bladder radiograph and ultrasonography. Fragmentation of stones to fine pieces that pass eventually was assessed at 2 weeks. This did not include proximal migration of a stone or fragments that required auxiliary treatment. This occurred in 166/193 (86.01%) patients in the Lithoclast group and in 195/201 (97.01%) in the laser group. Ureteral perforations were nine in the Lithoclast group and six in the laser group. Auxiliary procedures included SWL (27/193 [13.98%] patients in the Lithoclast group and 4/201 [1.99%] patients in the laser group) or repeated URS (two in the Lithoclast group). Urosepsis after URS occurred in 11/193 patients in the Lithoclast group and 5/201 patients in the laser group [5].

Of the patients, 117 had pneumatic and 113 had laser lithotripsy for the fragmentation of the stones. Treatment outcomes based on evidence of being stone free were evaluated. Preoperative, operative, and postoperative follow-up findings were analyzed and compared. There was a difference between the two groups according to overall stone clearance rate (93.8% vs. 80.3%, $p = 0.002$). There was no statistically significant difference for distal location between the laser and pneumatic groups (96.8% vs. 91.7%, $p = 0.288$). For 10 patients with intrarenally migrated stones who were managed with flexible ureterorenoscopy in the same session, laser lithotripsy was more successful than pneumatic for proximal ureteral stone (94.4%

vs. 67.9%, $p = 0.007$). The overall complication rate was 26.1%. There was no statistically significant difference between the two groups (29% vs. 23%, $p = 0.296$). Multivariate logistic regression analysis revealed that the proximal location was a statistically significant parameter for the occurrence of complications in both groups ($p = 0.001$ for PL, $p = 0.004$ for laser). The pneumatic and holmium:yttrium-aluminum-garnet laser lithotripsy are effective in the treatment of distal impacted stones. Both treatments with semirigid ureteroscopy are acceptable for proximal impacted ureteral stones, but holmium laser lithotripsy has an advantage of use with flexible ureteroscope for intrarenally migrated stone [5].

Patients' files were retrospectively reviewed by dividing cases as groups that underwent pneumatic (PL) or laser lithotripsy (LL) procedures. Age, sex, stone burden and localization, duration of follow-up, operative times were evaluated. Stone-free rates were evaluated by ureteroscopic examination, postoperative scout films and ultrasonography. Group PL consisted of 109 and group LL of 107 patients. Median age was 43.93 ± 15.94 years in Group PL and 46.15 ± 14.54 years in Group LL. Male to female ratio, stone burden and localization were similar for both groups. Overall success rate was 89.9% in Group PL and 87.9% in Group LL, respectively ($p < 0.791$). With the aid of additional procedures, success rate was 100% for both groups at the end of the first month. Groups were not different as for operative time, rate of insertion of an ureteral catheter and its removal time. Hospitalization period was apparently somewhat shorter in Group LL ($p = 0.00$) [5].

Conclusion

- HO:YAG laser has advantages over PL in high efficacy of stone fragmentation and a low-retrograde migration of ureteral stone treatment. Other complication of ureteral stone treatment with LL and PL are the same and very rare.
- Patients treated with laser lithotripsy have lower recurrence rate.

References

1. Nishioka NS, Teng P, Deutsh TF. Mechanism of Laser induced fragmentation of urinary and biliary calculi. *LaserLife Sciences*, 1987; 1:231.
2. Rink K, Delacretaza, Salathe RP. Fragmentation process of current laser lithotriptors. *Laser Surg Med* 1995; 16: 134.
3. Watson G, Murray 5, Drettler SP. An assessment of the pulsed dye laser for fragmentating calculi in the pig ureter. *J urol* 1987; 138: 199.
4. Fegulso P, Neel PM. Endoscopic laser lithotripsy. Safe effective therapy for ureteral calculi. *J Urol* 1991; 145: 949.
5. Teichman JM, Vassor GJ, Bishoff JT. Holmium: YAG lithotripsy yields smaller fragments than lithoclast, pulsed dye laser or electrohydraulic lithotripsy. *J Urol* 1998; 159: 17.

Conflict of Interest: Nil Source of support: Nil