

## **Efficacy of Semi-Rigid Ureteroscopy and Holmium:YAG Laser Lithotripsy in the Treatment of Ureteric Calculi, a Retrospective Study**

Badreldin A Alzain<sup>1</sup>, Abdelazeem H K<sup>2</sup>, Maawia M Elhassan<sup>3</sup>  
Eltayeb B E Shamseldin<sup>4</sup>, Ibnouf M A M<sup>5</sup>

### **Abstract:**

**Background:** Urolithiasis is a common worldwide health problem. Many endosurgical treatments became available for urinary calculi.

**Objectives:** To find out the success clearance and complication rates of ureteric stone treatment using semi-rigid ureteroscopy and Holmium:YAG laser lithotripsy as a day case procedure.

**Methods:** In the period from April 2011 to October 2013, a total of 64 patients who were treated by laser lithotripsy were reviewed retrospectively using Fedail Hospital data. Diagnosis was radiologically confirmed. Semi-rigid ureteroscopy and Holmium:YAG laser lithotripsy was conducted as a day case surgery. Operative details, clearance of stone fragments, failure and complications were analysed. Cases were followed clinically and radiologically after one week and one month.

**Results:** The studied cases were 47 males and 17 females with average age of 47.3 years and ASA I in 52(81.3%). Those who had left ureteric stones were 28(43.8%) patients, only one patient had bilateral stones and 60(93.8%) patients had single stones. The largest stone diameter was 1.9cm. 68.8% had distal ureteric stones, 14.1% had mid third stones, and 17.2% had upper third stones. Most cases 96.9% were operated under spinal anaesthesia with mean operation time 61.2 minutes. Seven patients needed VUJ balloon dilatation to get access to the ureter. 20 watt Holmium:YAG laser fibres were used for stone disintegration. 92.2% of cases had uncomplicated clearance, 3.1% minor complications and 4.7% failure of the procedure. 100% clearance was confirmed during follow up.

**Conclusion:** Semi-rigid ureteroscopy and Holmium:YAG laser lithotripsy is a safe treatment for ureteric calculi and can be conducted as a day case with high success rate and very low morbidity.

**Key words:** ureteric stone, Semi-rigid ureteroscopy, Holmium:YAG laser lithotripsy.

Since 1987 ureteroscopic procedures were used to be performed on an outpatient basis<sup>1</sup>. There are two types of ureteroscopes (URS) used for the treatment of ureteric stones. These are flexible and semirigid URS.

Many endoscopic methods were used to fragment ureteric stones, these include electrohydraulic lithotripsy which is less effective than laser lithotripsy especially with hard stones, and mechanical lithotripsy which has main limitations as rigid URS which is difficult to manipulate, as well as an extractor to remove the stone fragments, and it has a high rate of stone migration. Flexible pneumatic lithotripsy depends on flexible URS which deflection inversely affects the efficacy of retrieving stone fragments.

1. Consultant Urologist, Fedail Hospital
2. Consultant Urologist Elwatani Hospital
3. Consultant Urologist Shargelneel Hospital
4. Registrar of Surgery, Fedail Hospital
5. Professor of Surgery OIU

\*Correspondence to: Badreldin A. Alzain  
E.mail: kaboshia15@gmail.com

Laser lithotripsy, is based on a light energy that is delivered in a pulsatile fashion through quartz fibres to fragment the stone. It started by using light of 504nm wavelength which is replaced by other sources as it delivers low energy weak against cysteine stones. YAG laser is now the used as energy source, but with different elements like Holmium, Neodymium, Erbium, and Thulium. Currently, Holmium:YAG laser is the standard method<sup>2</sup>. It delivers a high energy of 2150nm with the smallest quartz fibres that makes it usable with different URS and can be manipulated to reach even lower calyx stones, beside it can fragment the hardest stones like cysteine and uric stones. The holmium laser is able to fragment stones of all compositions<sup>3,4</sup>. After Lithotripsy JJ stent is introduced routinely by many urologists, while others use it when there is tissue damage or when balloon dilation was done. Traditionally, the rationale for the placement of a temporary indwelling ureteral stent after ureteroscopic stone removal was to facilitate fragment passage, prevent ureteral obstruction and renal colic secondary to ureteral oedema, promote ureteral healing, and therefore reduce ureteral stricture formation<sup>5,6</sup>. Potential complications associated with stenting include lower urinary tract symptoms (stent dysuria, frequency, and nocturia), flank pain, haematuria, stent migration, urosepsis, and ureteral erosion.

#### **MATERIALS AND METHODS:**

**Objectives:** To find out the success clearance and complication rates of ureteric stone treatment using semi-rigid ureteroscopy and Holmium:YAG laser lithotripsy as a day case procedure.

**Methodology:** This is a retrospective descriptive audit conducted in Fedail Hospital, Khartoum Sudan in the period from April 2011 to October 2013.

**Inclusion criteria:** Patients who had symptomatic or complicated ureteric stones that did not pass spontaneously or after medical treatment and were treated latter with laser lithotripsy.

**Exclusion criteria:** Patients who had severe complications like pyelonephritis, uraemia, or non-functioning kidney who were treated without laser (meatotomy, stone extraction, or by ESWL later).

**The procedure:** Ureteric stones were confirmed by ultrasound, i.v. urography, or CT-KUB. URS and Holmium: YAG laser lithotripsy was used for treatment. The procedure was conducted as a day-case surgery. Semirigid URS size 8.5F (Karl Storz, Germany) was used for most patients with Holmium:YAG laser 20 watt (Dorneir, Germany).

All patients were followed up one week latter and after one month then after two months after discharge.

**Statistical analysis:** Data of 64 patients were analysed.

#### **RESULTS:**

Of the 64 patients, 48(75%) were males. Their mean age was 43.4 (range 25-61years). 52 patients were ASA I (81.3%), while 20 patients were ASA II (18.7%). In 62(96.9%) patients the procedure was done under spinal anaesthesia, one patient received general anaesthesia because he refused spinal anaesthesia, and one patient spinal was converted to general anaesthesia for ureteric implantation.

The mean operative time was 61.2 minutes (range 45.6-76.8minutes). Balloon dilation of the ureteric orifice was done in 7(10.9%) patients. Single stone was found in 60(93.8%), two patients each had two stones, and another two patients each had three stones. The largest ureteric stone was 19mm in its widest diameter. 35(54.7%) patients had left ureteric stones, 28(43.8%) patients had right side ones, and only one

patient had bilateral stones. Most stones were at distal third (68.8%), but 14.1% were in middle third and 17.2% were in the upper third of ureter.

Laser lithotripsy was applied and uncomplicated complete clearance in 59(92.2%) patients was achieved, 2(3.1%) patients got minor complications as minor mucosal injury in one, and minor ureteric catheter perforation in another. Lithotripsy failed in 3(4.7%) patients, two of them were converted to open ureterolithotomy and one was converted to ureterolithotomy and implantation of the ureter in the dome of urinary bladder.

In all patients, size 5 or 6mm JJ stent and 16F Foley catheter were inserted. Within 24 hours 61 patients were discharged after removal of Foley catheter with oral analgesia on demand with oral 3rd generation cephalosporin for 10 days. The open procedures cases were discharged in the third day with the same medications, and the Foley catheters in two of them were removed before discharge while in one it was removed after seven days as outpatient.

The follow up of all patients after one week was uneventful. 63(98.4%) patients had IVU in the 4<sup>th</sup> post-operative week before removal of the stent. Complete clearance was confirmed. The patient who had ureteric implantation had DTPA two months later with resultant good renal function, thereafter, his stent was removed.

#### **DISCUSSION:**

Urinary stone disease is common, affecting with male to female ration 3:1, with a peak incidence at between 40 and 50 years of age. Ureterscopy can handle urinary stones of the ureter as well as in the kidney, being thus a serious alternative to percutaneous nephrolithotomy<sup>7</sup>. However, the first reported use day-case rigid ureterscopy with laser stone fragmentation was in 1998<sup>8</sup>. Demographic

data showed wide range in age and gender with good fitness for the procedure (ASA I or II). These finding is similar to YIP study that included 40 males and 24 females with average age of 46.7 years and ASA of I or II in all patients<sup>1</sup>. Also, the type of anaesthesia and the operative time were similar to the published reports<sup>2-6</sup>. The average operation time was 61 minutes and most patients were operated under spinal anaesthesia except children who had general anaesthesia.

In our study distal ureteric stones comprised 68.8%, mid-ureter 14.1% and proximal third of the ureter 17.2%. This distribution does not correspond to that reported in Gazira middle of Sudan<sup>9</sup> as 33.3%, 17.5% , 33.3% respectively.

In spite of the variation in the stone load, the clearance in our study was 95.3% intra-operatively and 100% after one month of follow up. These results are fairly comparable with the previously mentioned studies<sup>10,11</sup>.

In all patients, size 5 or 6mm JJ stent and 16F Foley catheter were inserted. Patients who received postoperative stenting had a higher postoperative pain score on day 3 (1.1 versus 0.4,  $P < 0.001$ ) and a higher complication rate compared with those who required no postoperative stenting (16.8% versus 4%,  $P < 0.001$ )<sup>12</sup>.

In our study 3(4.7%) patients had unplanned hospital admission. This is in keeping with the reported unplanned admission rate reported in the literature<sup>13</sup>.

The frequency of complications in our study was 3.1%. This is fairly comparable with the reported complications in the literature<sup>14,15</sup>. Treatment success is defined by absence of residual fragments and annual follow-up is recommended to be based on plain x-ray and ultrasonography or low-dose CT scan<sup>16</sup>. The strengths of our study are the availability of detailed medical records for each patient and limitation of the study to ureteric stones by

exclusion of renal stones. However, the limitations of our study were the small number of population in the study and the short period of follow up to detect recurrence and stricture formation.

### CONCLUSION:

Holmium:YAG laser lithotripsy with semi-rigid ureteroscopy is an efficient intracorporal modality to treat ureteric calculi as a day case procedure in low risk patients, with high success rate and very low morbidity.

### ETHICAL CLEARANCE:

Consent was taken from the hospital administration for review of the patient's files.

### COMPETING INTERESTS:

The authors declare that they have no competing interests.

### FUNDING:

None.

### AUTHORS' CONTRIBUTIONS:

Badreldin A. Urologist operated cases and contributed in planning the study, Abdelazeem H.K Urologist operated cases and contributed in planning the study, Maawia M.E Urologist operated cases and contributed in planning the study, Eltayeb B.E. Collected the data and wrote the first version of the manuscript. Ibnouf MAM Bibliography research and revised manuscript. All authors read and approved the final version of the manuscript.

### REFERENCES:

1. Wills TE1, Burns JR. Ureterscopy: an outpatient procedure? *J Urol.* 1994 May; 151(5): 1185-7.
2. Yin X, Tang Z, Yu B, et al. Holmium: YAG laser lithotripsy versus pneumatic lithotripsy for treatment of distal ureteral calculi: a meta-analysis. *Journal of Endourology* 2013; 27(4): 408-414.
3. SoferM.,WattersonJ.D., WollinT.A., et al. Holmium: YAG laser lithotripsy for upper urinary tract calculi in 598 patients. *J Urol.* 2002;167:31-34.
4. ChanK.F.,VassarG.J., PfeferT.J., et al. Holmium:YAG laser lithotripsy: a dominant photothermal ablative mechanism with chemical decomposition of urinary calculi. *Lasers Surg Med.* 1999;25:22-37.
5. DenstedtJ.D.,WollinT.A., SoferM., et al. A prospective randomized controlled trial comparing nonstented versus stented ureteroscopic lithotripsy. *J Urol.* 2001;165:1419-1422.
6. Hollenbeck B.K., SchusterT.G.,FaerberG.J., et al. Routine placement of ureteral stents is unnecessary after ureteroscopy for urinary calculi. *Urology.* 2001;57:639-643.
7. Hyams ES, Shah O. Percutaneous nephrolithotomy versus flexible ureteroscopy/holmium laser lithotripsy: cost and outcome analysis. *J Urol.* 2009; 182: 1012-7.
8. Yip KH, Lee CW, Tam PC. Holmium laser lithotripsy for ureteral calculi: an outpatient procedure. *J Endourol.* 1998;12: 241-6.
9. Mohamed El Imam1, Omran O1, Osman Taha2 et al. Audit of Extracorporeal Shockwave Lithotripsy in 210 Sudanese Patients at Gezera Hospital for Renal Diseases & Surgery (GHRD&S) Sudan. *Sudjms.* 2008; 3(1): 11-16.
10. Chan KY, Zulkifli MZ, Nazri MJ, et al. A review of day care ureteroscopy of a teaching hospital in Malaysia. *Med J Malaysia.* 2005;60:5-9.
11. Bromwich EJ, Lockyer R, Keoghane SR. Day-case rigid and flexible ureteroscopy. *Ann R CollSurg Engl.* 2007;89:526-8.
12. Cheung MC1, Lee F, Leung YL,et al. See comment in PubMed CommonsbelowOutpatientureteroscopy: predictive factors for postoperative events.*Urology.* 2001;58(6):914-8.
13. Tan H-J, Strobe SA, He C, et al. Immediate unplanned hospital admission after outpatient ureteroscopy for stone disease. *J Urol.* 2011;185:2181-5.
14. Tan H-J, Strobe SA, He C, et al. Immediate unplanned hospital admission after outpatient ureteroscopy for stone disease. *J Urol.* 2011;185:2181-5.
15. Taylor AL, Oakley N, Das S, Parys BT. Day-case ureteroscopy: an observational study. *BJU Int.* 2002; 89: 181-5.
16. Chabannes É1, Bensalah K, Carpentier X, et al. Management of adult's renal and ureteral stones. Update of the Lithiasis Committee of the French Association of Urology (CLAFU). General considerations.*Prog Urol.* 2013;23(16):1389-99.