COMPARISON OF URETERIC STONE MIGRATION AND FRAGMENTATION WITH AND WITHOUT STONE CONE

Sarhad Khan, Khalid Farooq, Ishfaq Ur Rehman, Farman Ullah Khan, Bilal Ahmad

ABSTRACT

Aims And Objectives: To compare the safety and efficacy of ureteroscopic pneumatic lithotripsy with use of stone cone and without stone cone

Methodology: This study was undertaken at Department of urology Lady Reading hospital Peshawar. This was a comparative study. A total of fifty patients were enrolled during the study period. All the patients were randomized into two groups. The total duration of this study was nine from Feb 2015 to Nov 2015.All adult males and females of age >18 years and above with single ureteric stone were included in the study. Patients with ureteral stricture, concomitant renal stone and failed ureteroscopy were excluded from studies

Results: During the study period from, Feb2015 to Nov 2015, a total of fifty patients were divided into two groups with 25 in each group. In the first group stone cone was used in which the stone clearance rate was 100%.

Conclusion: It is concluded from my study that the Stone Cone is safe and efficient in preventing proximal stone migration during ureteroscopic pneumatic lithotripsy.

Key Words: Stone cone, Lithotripsy, ureterorenoscopy

INTRODUCTION

Urological treatment of urinary calculi has changed much in the past 20yrs. Ureterorenoscopy (URS) is one of the less-invasive approach in urology, It has fewer adverse effects even if the procedure is repeated as compare to other treatment modalities. Despite liberal use of shock waves lithotripsy, URS is considered the first choice of procedure for treating ureteric calculi, as it has a success rate of >97%. Many technical advances in the ureteroscope manufacture and stone-retrieval instruments have led to a widespread acceptance and prevalence of endoscopic management for ureteric calculi. After the development of semi-rigid, flexible ureteroscopes and different grasping devices the success rate of the ureteroscopy achieved new peaks.[1-3]The main problem faced while doing ureteroscopic stone manipulation was upward migration or retropulsion of the stone, because of propulsion effect of the irrigant, as well as kinetic energy used for stone disintegration. The reported retropulsion rate is 16–48%[4], and this wide range of variation in migration rate depends upon the site of the stone, as proximal ureteric stones have a higher retropulsion rate than those located distally in the ureter. In order to solve this problem instruments such as the stone cone have been devised. The stone cone is ureteric occlusion device designed to stop the upward migration of ureteric calculi and enable the safe extraction of stone fragments. In addition, the stone cone can be used as a substitute of the ureteric guidewire.[5] Despite low proximal migration rate with laser lithotripsy and its limited availability in developing countries led to our evaluation of these occlusive devices. Here we present our experience with use of the stone cone and without stone cone during the pneumatic lithotripsy for ureteric stones, and assess their safety and efficacy

Department of Urology LRH Peshawar

Address for Correspondence:
Dr. Sarhad Khan
Associate Professor Department of Urology LRH Peshawar
Cell: 0312-5106674

PATIENTS AND METHODS

This prospective, randomized study was performed in the Urology Department, Lady reading hospital Peshawar, during the period between February 2015 and November 2015. A total of 50 patients suffering from ureteral stone disease were included in this study. The patients included in this study were adult patients ≥18 years old with radiological evidence of ureteral stone (6–20 mm) on plain X-ray film of the kidneys, ureter, and bladder (KUB) or spiral CT scan.

These patients were randomly divided into two groups, each group containing 25 patients. In the first group the Stone Cone device was used while in the second group, no stone cone was used to prevent proximal stone migration during ureteroscopic lithotripsy. The randomization list was concealed from the investigators during this study to avoid selection bias as subjects were enrolled.

The rate of retrograde stone migration during ureteroscopic lithotripsy procedures and the stone-free rate using the Stone Cone device versus without were the primary and the secondary aim of the study, respectively.

Patients with the presence of any degree of ureteral stricture distal to the stone, failed ureterorenoscopy, stone impaction, clinical evidence of sepsis, coexistence of a kidney stone on KUB, ultrasound or with occurrence of ureteral perforation during the procedure were excluded from the study.

All patients in this study were radiologically examined with KUB, excretory urography (IVU) and spiral CT scan when indicated.

All patients in this study had solitary ureteral stone. The site of the stone was in the proximal ureter in sevenpatients (15%), midureter in five patients (10%), and in the distal ureter in 38 patients (75%).

Preoperative criteria in both groups

The ureteroscope used in this study was semi-rigid ureteroscope 'Karl Storz' 7.5 Fr with 4Fr working channel using pressure bag irrigation. Stone Cone (Boston Scientific Corp, Natick, MA) with 7 mm diameter, and Pneumatic Swiss Lithoclast were used during this study.

Technique

Group I (Stone Cone group)

After placing a safety guide wire, and once the stone was endoscopically identified during ureterorenoscopy, the collapsed Stone Cone was passed through the working channel until the black lines proximal to the cone were behind the calculus. The cone was then released and brought caudally to rest against the stone. The ureteroscope was reintroduced again into the ureter beside the Stone Cone and advanced to the level of the stone. Now, the probe of the Swiss Lithoclast was advanced through the working channel of the semi-rigid ureteroscope and applied over the stone under direct vision where it was fired and the process was continued until the stone was too fragmented. After complete fragmentation of the stone into small particles (approximately 2–4 mm particles), the probe of the pneumatic Lithoclast was removed from the working channel, and a double J stent was advanced into the ureter over the guide wire after removal of the collapsed Stone Cone from the ureter.

Group II (simple ureteroscopic lithotripsy)

After placing a guide wire and reaching the stone with the semi-rigid ureteroscope, the probe of the pneumatic Lithoclast was advanced through the working channel to start the process of stone fragmentation.

After the stone had been fragmented to the same particle size as the Stone Cone group, the stone fragments were left in place .A double J stent was inserted over the guide wire.

The procedure was considered successful in either group if no proximal stone migration occurred, if the stone was fragmented completely (approximately 2–3 mm particles).

Stone migration was defined as proximal or upward stone migration to the kidney as visualized preoperatively while doing ureteroscopic lithotripsy or determined by postoperative KUB and spiral CT scan on first post-operative day. KUB was used as the imaging standardized test except in only four cases with radiolucent stones (three cases in the Stone Cone group and one case in the control group) where spiral CT was used (its limited use was due to its high cost). All cases of migration were treated with adjunctive extracorporeal shock wave lithotripsy (ESWL).

Statistical Analysis

Statistical analysis of data was performed with the SPSS (Statistical Package for the Social Sciences, Inc., Chicago, IL) for Windows, version 11.0 by using Student's t-test and chi-square test. Type I error was set at $\alpha = 0.05$ and $p < 0.05$ was considered statistically significant

RESULTS

This study included 50 adult patients, suffering from ureteral stone disease at different sites of the ureter, documented by radiological studies. There were 35 males (70%) and 15 females (30%) with ages ranging from 21 to 68 years (mean, 38.6 ± 9.3).

The size of stones was ranged from 6 to 20 mm, with a mean stone size of 12.6 ± 0.8 mm. In proximal ureter, the stone size was ranged from 8 to 20 mm (mean, 13.9 ± 0.4). In the midureter, the stone size was ranged from 7 to 18 mm (mean, 12.6 ± 0.8) while in the distal ureter the stone size was ranged from 6 to 16 mm (mean, 11.9 ± 0.7).

The state of the renal dilatation showed normal pelvicalyceal system in 10 patients (20%), mild hydronephrosis in 27 patients (55%) and moderate hydronephrosis in 13 patients (25%). No patient in this study had severe hydronephrosis.

The pneumatic Lithoclast allowed successful fragmentation of all calculi into small fragments. Upward stone migration did not occur in any patient of the stone cone group, while in the without stone cone group it occurred in seven patients (28%).

The operative time in the Stone Cone group ranged from 30 to 55 minutes (mean, 41.8 ± 5.3), while in the without stone cone group it was ranged from 40 to 71 minutes (mean, 51.4 ± 3), and this difference was statistically significant ($p < 0.05$).

Follow up on first post-operative day by KUB or spiral CT scan showed complete clearance of the stone in 25 patients in the Stone Cone group. In the without stone cone group, complete clearance of the stone

occurred in 18 patients while 7 patient had a clinically significant residual fragment.

In the Stone Cone group, hospital stay was ranged from 1 to 4 days (mean, 1.7 ± 0.3) and the patients returned to normal daily activities after 2–6 days (mean, 3.3 ± 0.7). In without stone cone group, hospital stay was ranged from 1 to 5 days (mean, 1.9 ± 0.1) and the patients returned to normal daily activities after 2–5 days (mean, 3.1 ± 0.4),.

Most common complication was bleeding occurred during or after fragmentation of the stone in 15 patients (30%).

DISCUSSION

Intracorporeal lithotripsy modalities and stone removal devices have been developed to facilitate the endoscopic management of ureteral stones. These new devices have resulted in stone free rate of >90% but still the limitations are there due to which 100% results couldn't be achieved by only doing simple ureteroscopic lithotripsy.

Retrograde calculus migration during ureteroscopic procedures remains a significant problem. Clinical studies have reported an incidence of 26.7% for ureteral stone migration from the proximal ureter and 5–10% for migration from the distal ureter. [6]

There are different risk factors which influence stone migration like site, Size of the stone, impaction of stone and proximal dilatation.[7]

Pneumatic and electrohydraulic lithotrites cause more retrograde propulsion (27%) of the ureteral stones as compare toholmium:YAG laser and ultrasonic lithotrites(4%). Proximal stone migration is more likely with smaller stones, and greater proximal ureteral dilation or hydronephrosis.[8]

Retrograde stone migration is one of the most common problems faced by urologists while doing intracorporeal lithotripsy for which the surgeons have devised different methods like Normal saline irrigation behind the stone through ureteric catheter but at the cost of long opearative time.[9]

In Our centre we are using pneumatic lithotripsy for the ureteric stones because we have no access to the lasers because of the economic constraints and low budget. Recently we have started use of stone cone (Boston Scientific)

The Stone Cone showed ease of placement, safety and efficacy for preventing retrograde stone migration without apparent ureteral damage. In our study, the Stone Cone device prevented proximal stone migration in all patients, giving a 100% success rate. The Stone Cone was easily deployed, and all stones were fragmented into small particles without proximal migration.

Similarly, Gonen and colleagues used the Stone Cone in 23 consecutive cases of upper and lower ureteral calculi with 100% success, and no need for auxiliary procedures.[10]

Waleed and colleagues also compared intacorporeal lithotripsy with and without stone cone. There was statistical significant difference in both the groups favoring stone cone group with 97.1% clearance .The difference between their and ours study result is probably because they have only included patients with distal ureteric stones. In their study the difference between operative durations is not statistically significant whereas in our study the difference is significant favouring stone cone group with mean operative time of 41min.[11]

In a descriptive study of 15 patients, Han soo Chung and colleagues achieved a significantly higher stone-free rate using the Stone Cone, they also concluded that the Stone Cone was safe and effective.[12]

Recently a comparative prospective study was conducted by Sen.H et al in turkey in which the stone migration rate in stone cone group was 4% whereas in our study not a single stone migrated into pelvocalyceal system ,on the other hand stone migration rate in the control group was comparable i.e 28%.[13]

In 2004 Maislos SD et al conducted a study and their results are also in support with us having 100% stone clearance with stone cone.[14]Different reports showed 79% clearance in ureteroscopic lithotripsy without stone cone, whereas in our study the stone clearance with same procedure is low that is 68%. [15] Even in the large scale studies stone clearance rate is upto 73%.[16]

In our study we compared stone cone group with the control group and the difference was significant in favour of stone cone group and the main reason behind this was that the coils of stone cone prevents the upward migration of the stone gravels .

CONCLUSION

The Stone Cone is safe and efficient in preventing proximal stone migration during ureteroscopic pneumatic lithotripsy. It maintained continuous ureteral access and demonstrated a statistically significant advantage over the simple ureteroscopic lithotripsy in terms of proximal stone migration, stone-free rate, and operative time.

REFERENCES

1. Mugiya S, Nagata M, Un-No T, Takayama T, Suzuki K, Fujita K. Endoscopic management of impacted ureteral stones using a small caliber ureteroscope and a laser lithotriptor. J Urol. 2000;164:329–331.
2. Dubosq F, Pasqui F, Girard F, Beley S, Lesaux N, Gattegno B, Thibault P, Traxer O. Endoscopic lithotripsy and the FREDDY laser: initial experience. J

Endourol. 2006;20:296–299.

3. Marks AJ, Teichman JM. Lasers in clinical urology: state of the art and new horizons. World J Urol. 2007;25:227–233.

4. Robert M, Bennani A, Guiter J, Avérous M, Grasset D. Treatment of 150 ureteric calculi with the lithoclast. Eur Urol1994; 26: 212–5.

5. Eisener BH, Dretler SP. Use of the stone cone for prevention of calculus retropulsion during holmium YAG laser lithotripsy: case series and review of literature. Urol Int. 2009;82: 356-60.

6. Khan AH, Hussain SA, Khan N, Majeed SM. Safety and efficacy of ureteroscopic pneumatic lithotripsy. Coll Physicians Surg Pak.2011; 21: 616-619.

7. Cristopher J, Pagnani, Akkad M, Bagley DH. Prevention of stone migration with the accordion during endoscopic ureteral lithotripsy. J Endourol. 2012; 26:484-488.

8. Farhan DS.Evaluation ofHolmium:YAG Laser Versus Pneumatic Lithotripsy for the Intra Corporeal Lithotripsy of the Ureteric Stones. Iraq Post Med J. 2012;11:668-674.

9. Sun L, Peng FL. Simultaneous saline irrigation during retrograde rigid ureteroscopiclasertripsy for the prevention of proximal calculus migration.Can UrolAssoc J.2013; 7(1-2): E65–E68.

10. Gonen M1, Cenker A, Istanbulluoglu O, Ozkardes H.Efficacy of dretler stone cone in the treatment of ureteral stones with pneumatic lithotripsy. Urol Int. 2006;76(2):159-62.

11. Shabana W, Teleb M, Dawod T. Safety and efficacy of using the stone cone and an entrapment and extraction device in ureteroscopic lithotripsy for ureteric stones. Arab J Urol. 2015; 13(2): 75-79.

12. Chung HS, Park JY, Kim HK, Park CM.Efficacy of the Stone Cone for Treatment of Proximal Ureteral Stones: an Initial Clinical Experience. Korean J Urol. 2006 ;47(4):412-417.

13. Sen H, Bayrak O, Erturhan S, Urgun G, Kul S, Erbagci A, Seckiner I.Comparing of different methods for prevention stone migration during ureteroscopic lithotripsy.UrologiaInternationalis. 2014; 92(3): 334-338.

14. Maislos SD, Volpe M, Albert PS, Raboy A. Efficacy of the Stone Cone for treatment of proximal ureteral stones.J Endourol. 2004; 18(9): 862-4.

15. Qadhi ME. Outcome of ureteroscopy for the management of distal ureteric calculi: 5-years' experience. African J Urol. 2015; 21(1): 67-71.

16. Hong YK, Park DS.Ureteroscopic Lithotripsy Using Swiss Lithoclast for Treatment of Ureteral Calculi: 12-Years Experience .J Korean Med Sci. 2009; 24(4): 690-694.