ORIGINAL ARTICLE

Efficacy of Pneumatic Lithoclast in the Management of Upper Ureteric Stones

ABART JOSHI[1], MUHAMMAD AKHLAQUE[1], IRUM SHAHZAD[2], SARMAD IMTIAZ[1], SAIRA KHAN[3]
[1]*Department of Urology King Edward Medical University, Lahore Pakistan*
[2]*Department of Radiology Lahore Medical and Dental College, Lahore Pakistan*
[3]*Lahore Garrison University, Lahore Pakistan*
Correspondence to Dr. Muhammad Akhlaque, Associate Professor, Email: drmakhlaque87@gmail.com Cell:0321-4431350

ABSTRACT

Aim: To determine the stone clearance rate with pneumatic lithoclast in upper ureteric stones.
Study design: case series.
Methods: 102 patients of any gender were taken in the study. Inclusion criteria included individual's 1-2 cm upper ureteric calculi diagnosed preoperatively by USG KUB, XRAY KUB & IVP. Patients were evaluated for stone clearance in the 1st & 14th POD with X-ray KUB, ultrasound. Per procedure consent was taken in all cases.
Results: The mean age of the participants varied from 10 years to 70 years with a mean of 35.87±12.867. Majority of the people were between 35-60 years (49%) followed by 10-34 years (47.1%) & 3.9% of the study population were in the 61-85 years group. There were 70(68.6%) male and 32(31.4%) females in the study with a male to female ratio of 2.18:1. Stone size ranged from 10mm to 17mm with a mean of 12.31±1.63mm. Stone was in right side in 47(46.1%) and left ureter in 55(53.1%) patients.
Conclusion: The frequency of stone clearance was found to be 57.8% with pneumatic lithoclast in patients with single stone of 10-20mm in upper ureter which is slightly lower than that with newer methods like laser but can be used safely and efficiently in places where laser is not available which advocates that pneumatic lithoclast could be used in management of upper ureteric stones in future urological practice.
Keywords: Intracorporeal lithotripsy, pneumatic lithotripsy, ureteric stone

INTRODUCTION

Stone disease is the third most common disorder of the urinary tract, exceeded only by Urinary infections and prostatic disease[1]. Stone disease is a frequently encountered problem with the life-time prevalence around 10% in male and 5% in females, in the US[2]. The overall prevalence of in-patient nephrolithiasis remained stable around 5% in the US from 1998 to 2003, but the male:female ratio decreased from 1.7:1 to 1.3:1[3]. In Pakistan prevalence of renal calculi ranges from 4% to 20%[4]. Kidney stones are a recurrent disorder, with lifetime recurrence as high as 50%[5]. The stone that obstructs a patient's ureter originates in the Kidney. Once it is free in the pelvis it may pass into the ureter. The hallmark of stone that obstruct the ureter or renal pelvis is renal colic, a pain that starts in the lumber region goes back or to the lower part of abdomen and accompanied by microscopic blood in urine, nausea and vomiting. Some patients also have costovertebral angle tenderness[6]. In some cases urinary infection, hydro nephrosis, and pain in bouts that comes and goes have been observed in stone patients. Urologic procedures for management of ureteral calculi consists of ESWL, ureterscopic lithotripsy, laparoscopic uretero-lithotomy and open ureterolithotomy[7]. Now a days most ureteric calculi are easily managed with shockwave lithotripsy (SWL) or retrograde Ureterorenoscopy. Technological advances and innovations by physicians has improved the endourological treatment of ureteric stones. Ureteroscopy was initially explained by Hugh Hampton Young in 1912, but became a standardized procedure by late 1970[4].

Received on 17-06-2020
Accepted on 24-11-2020

MATERIALS AND METHODS

Size of sample (n) of 102 people estimated by using 90% c.l, 8% absolute precision, with expected percentage efficacy of pl in treating stone in upper ureter as 60 %. [8] Patient either sex, age group 15 years and above and diagnosed as having upper ureteric stone of size 1-2 cm on USG KUB, X-RAY KUB & IVP were included. Ureteric stricture or stenosis. (diagnosed on IVU), any congenital conditions like ectopic kidney, mal-rotated kidney, Horse shoe kidney, duplication of ureter.(diagnosed on ultrasonography) and urinary infection (presence of > 5 WBC/HPF). (diagnosed on urine C/E) were excluded. 102 patients fulfilling inclusion criteria were admitted in Department of Urology and Renal transplant MHL. Consent were obtained from patient or family members. Demographic information (name/age/contact) were recorded. Investigations include preoperative complete blood count, serum creatinine, blood urea, urine complete (if in case patient has urinary tract infection a course of antibiotic will be given for 7 days and urine complete will be repeated and once the infection subsides the patient will be included in the study) USG KUB, X-RAY KUB and IVU. Stone were fragmented via the pneumatic lithoclast and DJ stent inserted afterwards if required (as in cases of stone migration, hematuria and ureteric perforation or for facilitation of stone clearance. Stone migration was diagnosed on USG KUB, X-RAY KUB. In the 1st pod the patient were have a x ray kub and us kub done. Follow up were done after 2 weeks of the surgery with x ray kub and us kub to see the clearance of calculi. Stone migration was considered as a study failure. Then the data were collected in accordance to patients Performa. Data was entered and evaluated over SPSS 22.0. Numerical variables like age/stone size have been presented by mean ±SD.

Categorical variable gender, anatomical side and stone clearance have been presented by frequency and percentage.

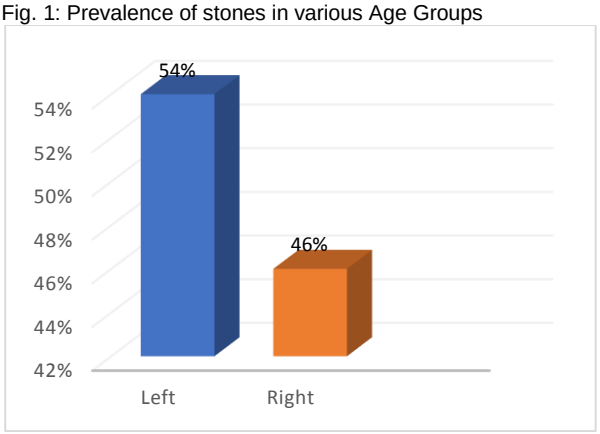
RESULTS

Various demographic features of study participants have been summarized in Table 1. Participant were of the age 10-70 yrs with a mean of 35.87 ± 12.86 years. Majority of the patients were aged between 35-60 years (49%) followed by 10-34 years (47.1%) and the least no of patients were in the group 61-85 years (3.9%) as shown in Fig.1. There were 70 (68.6%) male and 32 (31.4%) female in the group studied with a ratio of male to female 2.2:1 as shown in Pie-Chart Fig. 2. Stone magnitude varied from 10mm-17mm with a mean 12.31±1.635mm. 98(96%) participants had size of stone ranging 10-15 mm while 4(3.9%) patients had stone with size of 15-20mm as shown in Bar-Chart in Fig. 3. It was in right ureter in 47 (46.1%) and left ureter in 55(53.9%) patients as shown in Pie-Chart in Fig.4. Stone clearance was observed in 55(53.9%) patients at 1st postoperative day and on the in 59(57.8%) patients in the 14th postoperative day as shown in Figure 1. When stratified, there was insignificant variation in the frequency of stone clearance across various age (p=0.660), gender (p=0.832), size (p=0.746) and anatomical side (p=0.258) groups as shown in Bar-Charts in Fig. 5 to Fig.10.

Table 1: Baseline Characteristics of Study Population (n=102)

Characteristics	Study Sample
Age (years)	35.87±12.86
• 10-34 years	40 (47.1%) 50(49%)
• 35-60 years • 61-85 years	4 (3.9%)
Gender	
• Male	32 (31.4%)
• Female	70 (68.6%)
Stone Size (mm)	12.31±1.63
• 10-15 mm	98 (96%)
• 16-20 mm	4 (3.9%)
Anatomical Side	
• Right	47 (46.1%)
• Left	55 (53.9%)

Fig. 1: Prevalence of stones in various Age Groups



X-axis shows age in years and Y-axis represents prevalence in percentage

Fig. 2: Prevalence of stones on the basis of gender Distribution

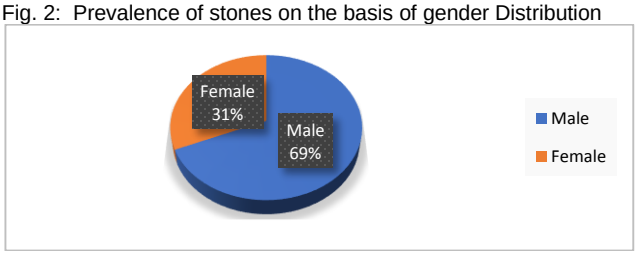
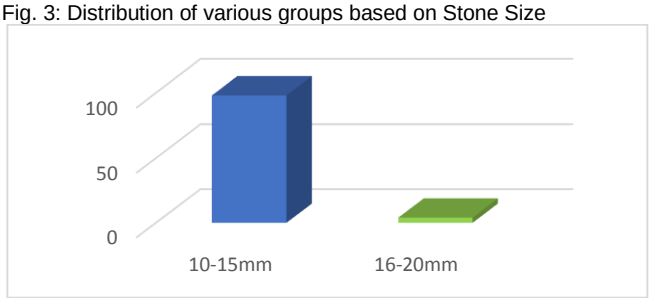


Fig. 3: Distribution of various groups based on Stone Size



X-axis represents stone size in millimeters and Y-axis the prevalence in percentage

Fig. 4:Distribution of patients according to anatomical side of stone

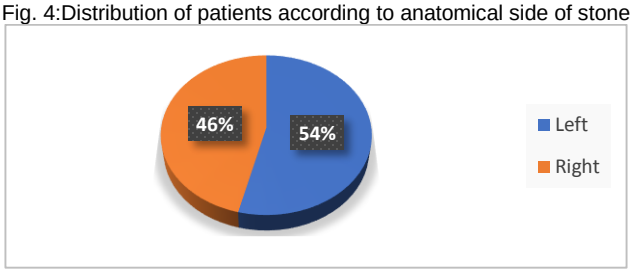


Fig. 5: Distribution of pts according to anatomical side of stone

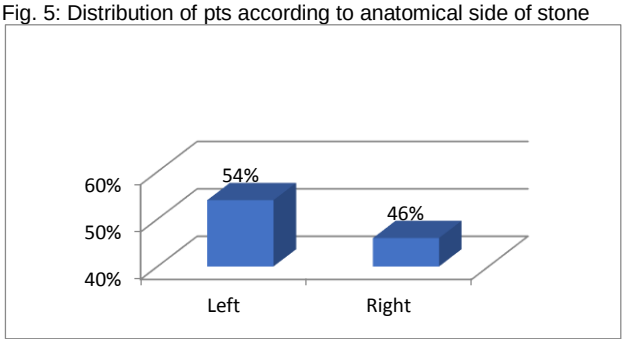


Fig. 6: Treatment Outcome of Pneumatic Lithoclast in upper Ureteric Stones

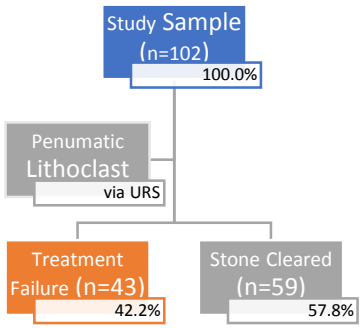
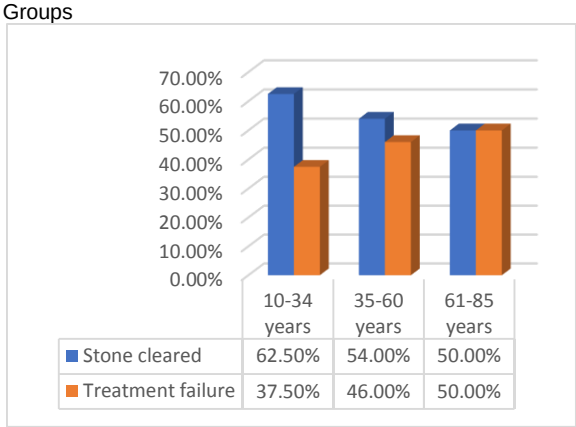
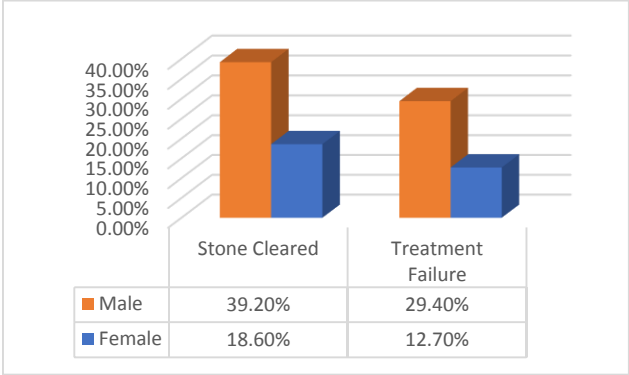


Fig. 7: Comparison of Frequency of stone clearance across Age Groups



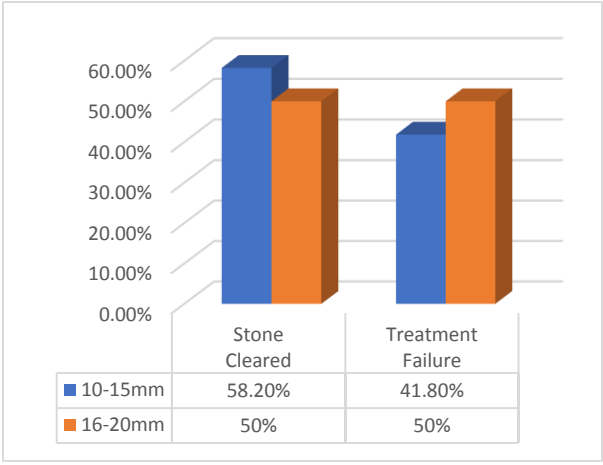
Chi-square test, observed difference was statistically insignificant (p=0.660)

Fig. 8: Comparison of Frequency of stone clearance across Gender Groups



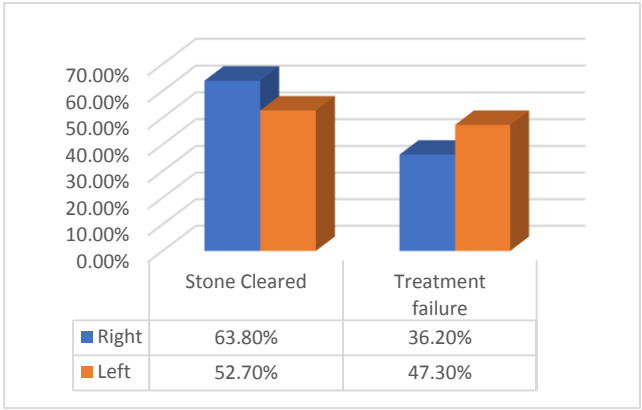
Chi-square test, observed difference was statistically insignificant (p=0.832)

Fig. 9: Comparison of Frequency of stone clearance across Size of Stone



Chi-square test, observed difference was statistically insignificant

Fig. 10: Comparison of Frequency of stone clearance across anatomical Side of Stone



Chi-square test, observed difference was statistically insignificant (p=0.258)

DISCUSSION

Stone disease of the urinary tract is an extremely common clinical condition. Approximately about 12% of the total population of the United States of America will have urinary stone at least once in their lifetime [9]. Stone disease is also a major burden to healthcare centers in developing countries like ours. The treatment of stone in ureter is one of the difficult situations in urology but being a common problem it is a challenge to urologist. But with the paradigm shift in the treatment pattern and increasing trend of treating ureteric stone with the least invasive method, open surgeries have lost its place and are being obsolete. Eswl and intracorporeal (endoscopic) litho are popular these days. Among the intracorporeal lithotripsy laser and pneumatic (Swiss) lithotripsy are commonly being used worldwide. But due to unavailability of newer methods like lasers in many centers one has to rely on easily available pl which is also the same for our setup at Mayo Hospital. It is a known fact that PL is an good modality of stone fragmentation even in hard stones like calciumoxalate monohydrate and cystine stones, and is atraumatic to tissue [10]. In various studies it has been seen that pneumatic lithoclast shows successful fragmentation of ureteral stone, fragmentation rates varying from 70.7% to 96.8% in different site of stone in the ureter[11].

The aim of research was to evaluate the ability of pl in treatment of stone in the upper ureter. This study involved 102 patients of both genders aged between 10 to 70 years. After successfully being involved in the study in all patient URS and Pneumatic lithotripsy for upper ureteric stone was done. Stone was broken into small fragments which would go down the ureter on itself was assessed at 2 weeks' time. Out of the 102 patients included in the study 59(57.8%) patients were successfully treated which is in accordance with literature[12]**.** Andreoni et al treated patients of upper ureteric stone of size <15 millmet. and reported an initial sfr of 70%[13]. Degirmenci et.al. who reported stone clearance frequency (67.9%) in study patients[14]. Lin et al. in 2015 reported 70% frequency of stone clearance in similar study group[15]. Slightly higher stone clearance rate was observed in few mentioned international studies which could be attributed to availability of better instruments, energy

source and also to the use of anti-retropulsion devices. In 23(22%) patients there was retropulsion of stone back to the kidneys. In all cases, during URS PL the head end of the operation table was elevated by 15-20 degree and irrigation fluid pressure was kept low all the time so that the stone would not be pushed back to the kidneys. Other options that could have been used to prevent stone pushback are stone cone, stone baskets and antegrade balloon occlusion catheter but the use of these device are time consuming and also increase the economic burden and is not always available in all places[16]. In 15(14.7%) patients stone was partially fragmented and found to be on the same location on the 14th day of follow up. In 5 patients the stone could not be fragmented as there was narrowing of the ureter. Out of the study failure group 6 patients had to undergo urteroliothotomy, 10 patients again underwent URS, predominantly those with partially fragmented stones and remaining with stone migration to the kidney were subjected to ESWL. Complication of pneumatic lithoclast include puncture of the ureter (0-4.7%),(179) mucosal injury(3.6%),sudden seperation of the ureter from kidney (0.06-0.4%),ureteral stricture (3.5%), severe infection involving kub (1.8-3%) and post-operative Hematuria (1.2-7.3%)[17]. In our study major complications like ureteral perforation and avulsion were not encountered minor complications like post-operative Hematuria (3%), Fever (1%) and tenderness of the flank in 1%. Although incidence of severe infection in kidneys is about 3% we did no have to face such outcomes. It could be because of use of routine perioperative and post-operative antibiotics. DJ stent was routinely placed at the end of the procedure. The aim of DJ stent placement was to ensure unobstructed urine flow from kidneys to the bladder. Obstruction of the urine flow could result from residual or retained fragments of stone in ureter of due to edema of the ureteral wall. Thus placement of DJ stent could significantly reduce the incidence of post-operative complications in general. Although in many studies it has been advocated that in the presence of short operating time and where there is not injury to the ureteral wall there is no need to place DJ stent post URS[18]. Absolute indication for putting an double J include injury to the ureter, stricture of the ureter, only one functioning kidney, renal inadequacy and large number of remaining fragments after procedure. Unavailability of CT KUB, for prior to surgical identification and to see the post-surgical clearance especially in stone that are not seen on x rays, is an important shortcoming of this study.

CONCLUSION

According to numerous research and literature review laser lithotripsy with holmium laser is the most widely advocated treatment for upper ureteric stone of size 1-2 cm but since its availability is an important issue so one has to rely on easily available pneumatic lithotripsy. PL is dependable, good, safe and cheap management option and despite of its few short comings can be used in the management of upper ureteric stone when newer modalities like laser are not available.

REFERENCES

1. Al-Jebouri MM, Atalah N. A Study on the Interrelationship between Renal Calculi, Hormonal Abnormalities and Urinary Tract Infections in Iraqi Patients. OJU. 2012;2(1):6-10.
2. Noori N, Honarkar E, Goldfarb DS, Kalantar-Zadeh K, Taheri M, Shakhssalim N, et al. Urinary lithogenic risk profile in recurrent stone formers with hyperoxaluria: a randomized controlled trial comparing DASH (Dietary Approaches to Stop Hypertension)-style and low-oxalate diets. Am J Kidney Dis. 2014;63(3):456-63.
3. Nowfar S, Palazzi-Churas K, Chang DC, Sur RL. The relationship of obesity and gender prevalence changes in United States inpatient nephrolithiasis. Urology. 2011;78(5):1029-33.
4. Papadoukakis S, Stolzenburg J-U, Truss MC. Treatment strategies of ureteral stones. eeus. 2006;4(5):184-90.
5. Ranabir S, Baruah MP, Devi KR. Nephrolithiasis: endocrine evaluation. IJEM. 2012;16(2):228.
6. Soleimanpour H, Hassanzadeh K, Vaezi H, Golzari SE, Esfanjani RM, Soleimanpour M. Effectiveness of intravenous lidocaine versus intravenous morphine for patients with renal colic in the emergency department. BMC urology. 2012;12(1):13.
7. Khan AA, Hussain SA, Khan N-U, Kamran Majeed S, Sulaiman M. Safety and efficacy of ureteroscopic pneumatic lithotripsy. J Coll Physicians Surg Pak. 2011;21(10):616-9.
8. Rafique Ahmed Sahito MASM, Muhammad Saleh Khaskheli. Role of Pneumatic Lithoclast in the management of the ureteric stone. Medical channel. 2010;16(2):110-4.
9. Smith RC, Levine J, Rosenfeld AT. Helical CT of urinary tract stones: epidemiology, origin, pathophysiology, diagnosis, and management. Radiologic clinics of north America. 1999;37(5):911-52.
10. LEONG TEH C, ZHONG P, PREMINGER GM. Laboratory and clinical assessment of pneumatically driven intracorporeal lithotripsy. Journal of endourology. 1998;12(2):163-9.
11. Sözen S, Küpeli B, Tunc L, Şenocak Ç, Alkibay T, Karaoğlan Ü, et al. Management of ureteral stones with pneumatic lithotripsy: report of 500 patients. Journal of endourology. 2003;17(9):721-4.
12. YINGHAO S, LINHUI W, SONGXI Q, GUOQIANG L, Chuanliang X, XU G, et al. Treatment of urinary calculi with ureteroscopy and Swiss lithoclast pneumatic lithotripter: report of 150 cases. Journal of endourology. 2000;14(3):281-3.
13. Andreoni C, Afane J, Olweny E, Clayman RV. Flexible ureteroscopic lithotripsy: first-line therapy for proximal ureteral and renal calculi in the morbidly obese and superobese patient. Journal of endourology. 2001;15(5):493-8.
14. Degirmenci T, Gunlusoy B, Kozacioglu Z, Arslan M, Koras O, Arslan B, et al. Comparison of Ho: YAG laser and pneumatic lithotripsy in the treatment of impacted ureteral stones: an analysis of risk factors. The Kaohsiung journal of medical sciences. 2014;30(3):153-8.
15. Yang C, Li S, Cui Y. Comparison of YAG laser lithotripsy and extracorporeal shock wave lithotripsy in treatment of ureteral calculi: a meta-analysis. Urologia internationalis. 2017;98(4):373-81.
16. Dretler SP. Prevention of retrograde stone migration during ureteroscopy. Nature Reviews Urology. 2006;3(2):60.
17. Gunlusoy B, Degirmenci T, Arslan M, Kozacioglu Z, Nergiz N, Minareci S, et al. Ureteroscopic pneumatic lithotripsy: is the location of the stone important in decision making? Analysis of 1296 patients. Journal of endourology. 2008;22(2):291-4.
18. Ceylan K, Sünbül O, Şahin A, Güneş M. Ureteroscopic treatment of ureteral lithiasis with pneumatic lithotripsy: analysis of 287 procedures in a public hospital. Urological research. 2005;33(6):422-5.