ORIGINAL ARTICLE

FREQUENCY OF STONE CLEARANCE AFTER TRANSURETHRAL FRAGMENTATION OF LARGE URINARY BLADDER CALCULI USING PNEUMATIC SWISS LITHOCLAST

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Background: Vesical calculi refer to stones in the urinary bladder. The causes of bladder stones include bladder outlet obstruction, neurogenic voiding dysfunction, infection, or foreign bodies. Very rarely, these vesical calculi may reach very large sizes and the largest dimension can sometimes reach 13 centimetres. **Methods:** This descriptive cross-sectional study was conducted from 1ST May 2019 to 31st October, 2019 at Institute of Kidney Diseases, Urology Department, Hayatabad Peshawar. 164 patients with vesical stone were included in study. Ultrasound-KUB was used for diagnosis of vesical stone and after informed consent, and they underwent transurethral nephroscopic lithotripsy via the pneumatic Swiss Lithoclast. **Results:** Frequency of stone clearance was 96.34%. No statistically significant association of stone clearance was observed with age, gender, number of stones or max dimension of largest stone in the bladder (p>0.05). **Conclusion**: Transurethral nephroscopic pneumatic lithotripsy via pneumatic Swiss Lithoclast is safe and effective procedure for treatment of large vesical stones. However, this being the first such study in adults, more data is needed to confirm these findings.

Keywords: Urolithiasis; Stone removal; Lithotripsy; Swiss Lithoclast; Trans-urethral nephroscopic pneumatic lithotripsy

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INTRODUCTION

Vesical calculi refer to stones in the urinary bladder. The causes of bladder stones include bladder outlet obstruction, neurogenic voiding dysfunction, infection, or foreign bodies.[1] Rarely, these vesical calculi may reach very large sizes and the largest dimension can sometimes reach 13 centimetres.[2,3] The incidence of vesical calculi has declined significantly in developed nations because of improvements in nutrition and socioeconomic conditions.[4] Currently, vesical stones represent about 5 percent of stone disease in the developed nations.[5] However, these are still common in developing countries. Regarding the treatment of vesical stones, recently the emphasis has shifted from open surgery to endoscopic modalities and one of these modalities is the transurethral use of nephroscope.[6] The Swiss Lithoclast is an endourologic probe used in the treatment of vesical stones that can be administered via a rigid endoscope (a nephroscope for the purpose of this study) and has pneumatic lithotripter modality.[7] Pneumatic lithotripsy is an effective modality for the treatment of bladder stones in children and is comparable to laser lithotripsy.[8] Endoscopic treatment of large bladder calculi that is >3 cm in largest dimension using stone punch is bothersome & many times not possible as stone punch can hold & break stones up to 2.5–3 cm in largest dimension. That is why more invasive procedures, i.e., open cystolithotomy or percutaneous cystolithotomy are preferred methods in most centers for large urinary bladder calculi.

This study aims to find out the frequency of stone clearance after pneumatic lithotripsy for large bladder stones via transurethral nephroscopic use of pneumatic Swiss Lithoclast. This procedure is less invasive and faster than above mentioned procedures. Secondly urethral injury can be prevented by avoiding multiple entries to urethra. The results of this study will be used for future comparative and interventional studies to compare the efficacy of stone clearance of this procedure against that of other modalities.

MATERIAL AND METHODS

A total of 164 patients over a period of five months from 1st May to 31st October, 2019 were included in this cross-sectional study which was conducted in Urology ward of Institute of Kidney

Diseases, Peshawar. Sample size was calculated using the World Health Organization software "Sample Size Determination in Health Studies". The formula for "Estimating a population proportion with specified absolute precision" was used based on Confidence Interval Strength 95%, Absolute Precision of 4% and anticipated proportion of stone clearance 96%, The sampling technique was non-probability consecutive sampling. Informed consent was taken from the patients before data collection.

Data was collected through a structured proforma. Approval of the Hospital Ethical Committee was obtained at the time of the study. All the patients included in the study were between 20 to 70 years old and of either sex with large vesical stones. Those patients with any urethral stricture (as diagnosed on cystoscopy) and those with coexisting benign prostatic hyperplasia (as diagnosed on cystoscopy) were excluded from the study as the passage of nephroscope is difficult in these patients. The data was analyzed by SPSS version 23. Descriptive statistics was used to analyze the data. Frequencies and percentages were calculated for categorical variables such as gender and achievement of stone clearance. Mean and standard deviation were calculated for the numerical variables for example age, number of stones and greatest dimension of largest stone. The stone clearance was stratified according to different age groups, gender, and number of stones and greatest dimension of largest stone. Post stratification chi squared test was applied in which a *p*-value of 0.05 or less was considered significant.

RESULTS

A total of 164 patients with vesical stones were included in this study. The mean age of the patients was 59.24±5.11 years with a range of 52–68.

The mean number of stones in patients was 2.57±1.10 with a range of 1–4. Similarly, the mean maximum dimension of largest stone was 5.96±1.76 centimeter with a range of 3.1–9 cm. There were 149 (90.85%) males and 15 (9.15%) females in the study. Stone clearance was achieved in 158 (96.34%) patients. When stone clearance was stratified by age, sex, number of stones and maximum dimension of largest stone, no statistically significant association was found between stone clearance and sex of patients (p=0.012).

All results are being displayed in the form of tables below.

Table-1: Stone clearance with age

Stone clearance	Age of patients(yrs.)		Total	*p*-value
	≤60	>60		
Yes	92	66	158	0.69
No	3	3	6	
Total	95	69	164	

≤=Less than & equal to, >=more than, $p \leq 0.05$

Table-2: Stone clearance with gender

Stone clearance	Male	Female	Total	*p*-value
Yes	143	15	158	0.43
No	6	00	6	
Total	149	15	164	

$p \leq 0.05$

Table-3: Stone clearance with number of stones

Stone clearance	Number of stones		Total	*p*-value
	<2	>2		
Yes	72	86	158	0.83
No	3	3	6	
Total	75	89	164	

≤=less than & equal to, >=more than, $p \leq 0.05$

Table-4: Stone clearance with maximum dimension of largest stone

Stone clearance	Max dimension		Total	*p*-value
	≤6	>6		
Yes	81	77	158	0.83
No	4	2	6	
Total	85	79	164	

≤=less than & equal to, >=more than, $p \leq 0.05$

DISCUSSION

The frequency of stone clearance in this study was 96.34% and no statistically significant association was observed with age, gender, number of stones and maximum dimension of largest stone (p>0.05). A recent study from Korea reported that the use of pneumatic lithoclast was associated with complete stone clearance.[9] This study compared three endoscopic techniques used to treat bladder stones: transurethral cystoscopy used with a pneumatic lithoclast or nephroscope used with a pneumatic lithoclast and nephroscope used with an ultrasonic lithoclast. One hundred and seven patients with bladder calculi underwent endoscopic treatment. Patients were categorized into three groups based on the endoscopic techniques and energy modalities used in each group as: group 1 (transurethral stone removal using a cystoscope with pneumatic lithoclast), group 2 (transurethral stone removal using a nephroscope with pneumatic lithoclast), and group 3 (transurethral stone removal using a nephroscope with ultrasonic lithoclast). Baseline and perioperative data were compared retrospectively between all three groups. No statistically significant difference in the groups was observed in age, sex ratio, and stone size. A statistically significant intergroup difference was observed in the operation time-group 1, 71.3±46.6 min; group 2, 33.0±13.7 min; and group 3, 24.6±8.0 min. All patients showed complete stone clearance. The number of urethral entries was higher in the first group than in the other groups. Significant complications did not occur in any patient.[9]

A study from Rawalpindi Pakistan determines the efficacy and safety of transurethral pneumatic lithotripsy for bladder calculi in paediatric male patients.[10] A total of 57 paediatric male patients with bladder stone were included in the study by non-probability convenient sampling. Transurethral pneumatic lithotripsy was done in all the patients. Efficacy of the procedure was assessed by the duration of stay in the hospital, duration of the procedure, stone fragmentation and safety was assessed by the type and number of per or post-operative complications. Mean hospital stay was 1.05±0.225 days. Mean operating time was 28.12±9.44 minutes. Minor complications were noted in 28.07% patients which included dysuria in 10.5%, haematuria in 7% difficulty in passing urine in 5.3%, fever in 3.5% patients and acute urinary retention in 1.8% patients.

Researchers in a study from Denmark reported their clinical experience using the Swiss LithoClast Master (SLM). They reported that 27 patients were treated for bladder calculi (24 men). Five had a neurogenic voiding dysfunction, 3 had prostate cancer, and 19 had Median age was 74 years (range 45–86 years). Stone clearance was achieved in 26 (96%) patients. Stone burden was one or multiple bladder stones. Median size of the stone of the largest stone in each patient was 20 (5–40) mm. Under the same anesthesia, two patients underwent a transurethral resection of the prostate because of prostatic hypertrophy. Median lithotripsy time was 60 (range 20–144) minutes. All patients were discharged within 24 hours.[7] Yet another study from Germany reported endoscopic fragmentation of all urinary bladder stones was achieved using the Swiss lithoclast.[11] The principle of this lithotriptor is based on pneumatic shock waves induced by the central compressed air system or by a compressor. This device was used to treat 151 patients with calculi in the kidney, ureter, bladder or a Kock pouch continent urinary diversion. Endoscopic fragmentation was achieved in all patients. Independent of the composition, all stones were disintegrated within a short period.[11]

Yet another study, from China, reported that they found Swiss Lithoclast pneumatic lithotripsy to be a safe, effective, and economical treatment method for urinary calculi. 145 patients with ureteral stones and 5 patients with urethral stones were treated with the Swiss Lithoclast. In the ureteral calculi group, ureteroscopic addressing of the stones was successful in 133 patients. In 27 patients, the calculi were partially fragmented and remained in situ or were pushed back to the calices. They were subsequently treated successfully with SWL. Stones were fragmented in a single session in 101 patients. Complications that occurred with the procedure included five perforations and four urinary tract infections. All five urethral stone patients were treated successfully with pneumatic lithotripsy. The overall successful fragmentation rate thus was 70.7% (106 of 150) and 88.7% (133 of 150) in combination with adjuvant SWL.[12] Our study had comparable results in terms of gender distribution and total frequency of stone clearance.

It is pertinent to disclose that a detailed search of google scholar and PubMed database did not reveal local data with the Swiss lithoclast in adults. A couple of studies in paediatric population with bladder stones did report its efficacy, but no study involving adults was found on searching the aforementioned database.

In view of paucity of data, it is recommended that the findings of this study be approached with caution and more studies either replicating the same study design or randomized controlled trials comparing the Swiss lithoclast with other methods of endoscopic stone fragmentation in adults be

performed to determine the true significance of my results.

CONCLUSION

Transurethral nephroscopic lithotripsy via the pneumatic Swiss Lithoclast is a safe and effective procedure for treatment of large vesical stones. However, this being the first such study in adults, more data is needed to confirm these findings.

AUTHORS' CONTRIBUTION

SA: Study design, data collection, data analysis BG: Literature search, conceptualization of study design, data collection, data interpretation, write up. MJ: write up, proof reading, data analysis, data interpretation. SAK: Literature search. RB: Proof reading. HR: Data collection.

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