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ORIGINAL ARTICLE

Efficacy of Pneumatic Lithoclast in Management of Different Metabolic Stones in Lower Ureter

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ABSTRACT

Background: Management of ureteral calculi represents one of the complex problems in urological practice.
Aim: To study the efficacy of pneumatic lithoclast as a management option for different metabolic ureteric stones.
Study design: Descriptive study.
Methodology: Study enrolled both male and female patients (n=60) above 12 years of age. Stone size and metabolic type was determined with determining the Hounsfield units of the stone on plain abdominal CT scan and matching them with the predetermined ranges for specific stone types. Renal transplant and cancer patients were excluded. SPSS v.26 analyzed the data. Mean±SD presented quantitative variables.
Results: Calcium oxalate stones were most frequent and were observed in 32 (53.3%) patients followed by Struvite (18.3%). Almost 96.7% ureteric stones were cleared with pneumatic lithoclast.
Conclusion: It was concluded that pneumatic lithoclast is an efficacious procedure in urology in clearing different metabolic stones in lower ureter thus advocates its routine use.
Keywords: Pneumatic Lithotripsy, Metabolic Stones and Ureteric Stone.

INTRODUCTION

According to an estimate, urinary calculi account for major of the urological cases related to urinary tract.[1] Stones in urinary track have varied location that involves tissues like kidneys , ureter or urinary bladder. There are various chemical compositions of calcium stone that include calcium oxalate and calcium phosphate (80%), struvite (10-15%),uric acid (5-10%) and rare are associated with metabolic errors.[2,3] There are several types of kidney stones based on the type of crystals, which they are composed of. Calcium stones are the most common type of kidney stones and constitute approximately 80-90% of all renal stones.[4] Calcium stones are generally a mixture of calcium phosphate and calcium oxalate precipitate. Depending on the main constituent (>50%) of the stone, we call them either calcium oxalate or calcium phosphate stone. Calcium phosphate stone are less common and only about 15% of kidney stones fall in this category[5].

Numerous patho-physiologic processes contribute to their formation. Many medical conditions like hyperparathyroidism, thiazide diuretics and primary hyperoxaluria result in stone formation and cause obstruction. Alternatively, uric acid stones may be an outcome of a high protein diet[6].

Kidney stones usually obstruct a patient's ureter. Literature review showed that due to their free movement in pelvis and ureter with peristaltic movements may result in obstruction. Many reasons cause their impaction in body like and size of stone and degree of inflammation of ureteric mucosa. The clinical symptoms related to ureteric stones include excruciating intermittent radiating pain followed by nausea and vomiting[6-8].

Adult ureter consists of smooth muscles having a length of approximately 25–30cm. It propels urine from the kidney to bladder. It has three anatomical divisions that include proximal, mid and distal ureter. Distal ureter approaches bladder as it is the lower most section. Literature review has revealed that stones usually lodge at distal ureter near ureterovesical junction[9,10].

Pneumatic lithotripsy is a simple and effective procedure in removing stones. Literature has shown that it has high success rate with little complications[11,12]. Among different options of endoscopic stone fragmentation like laser, ultrasonic or ballistic, the pneumatic lithotripsy (ballistic) is effective in fragmentation and also less have less operational costs. It also contains less risk of ureteric trauma as compared to the rest[13,14].

The objective of the research was to study the efficacy of pneumatic lithoclast as a management option for different metabolic ureteric stones.

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METHODOLOGY

Descriptive study was held in Urology Department at Mayo Hospital-Lahore. Study enrolled both male and female patients (n=60) above 12 years of age. Patients had ureteric stones of size 5-15mm. Stone size and metabolic type was determined with determining the Hounsfield units of the stone on plain abdominal CT scan and matching them with the predetermined ranges for specific stone types. Renal transplant and cancer patients were excluded. After ethical approval, patients had a complete workup including preoperative CT KUB. SPSS (v26.0) analyzed data. Mean ± SD presented quantitative variables while frequency and percentage presented categorical variables.

RESULTS

Majority of the patients were aged between 56-70 years (83.3%) as summarized in table-1. Patients (n=33) had left sided renal stones. The estimated Hounsfield units on C.T according to the stone types were given in table-2. Stone clearance was 96.7% at 01 month follow-up. When stratified for age, gender, size of stone and anatomical side insignificant difference in stone clearance frequency was observed among groups. Stone clearance was 96.7% at 01 month follow-up. When stratified for age, gender, size of stone and anatomical side insignificant difference in stone clearance frequency was observed among groups as shown in table-3.

Table-1: General parameters

Characteristics	Study Sample (n=60)
Age (years)	
40-55	10
56-70	50
Mean±SD	42.68±8.08
Gender	
Male	41
Female	19
Stone Size (mm)	
5-10	27
11-15	34
Mean±SD	10.82±2.01

Table-2: Different types of renal stones

Stone type	Mean	Std. Deviation	%age
Calcium oxalate monohydrate	1873.29	139.514	38.8%
Calcium oxalate dehydrate	997.90	77.095	31.0%
Calcium phosphate	1217.00	115.058	12.6%
Struvite	719.64	124.897	14.9%

Table-3: Stratification of stone clearance with age, gender and size

Parameters	**Age in years**	
	12-34	**35-70**
Stone clearance	100%	96%
Treatment Failure	Zero	4%
Gender		
Parameters	**Males**	**Females**
Stone clearance	97.60%	94.70%
Treatment failure	2.40%	5.30%
Stone Size		
Parameters	**5-10 mm**	**11-15mm**
Stone clearance	96.20%	97.10%
Treatment Failure	3.80%	2.90%
Anatomical Site		
Parameters	**Right**	**Left**
Stone clearance	96.30%	97.00%
Treatment Failure	3.70%	3.00%

DISCUSSION

Study enrolled both male and female patients (n=60) above 12 years of age. In the present study, mean age of patients was 42.68±8.08 years. Similarly, previous studies showed similar mean age (42.83±9.24 and 43.4±14.5 years)[15,16.]

Majority of the patients were aged between 56-70 years (83.3%) followed by 40-55 years (16.7%) in present study. In our study, males enrolled were 41 (68.3%) while females were 19 (31.7%). Our results matched with one study that reported similar male dominance (2.1:1)[16]

In present study, stones mean size was 10.82±2.01mm. Majority patients (n=34) i.e., 56.7% had stones with size of 11mm or more. Our results were in line with one previous study that had stone size of 12.16±5.8mm[16].

Plain C.T scan can detect different stone types in vivo when dual energy or helical CT is used and can also be estimated on the basis of Hounsfield units of the stone mass. Determination of stone type preoperatively gives us the opportunity to asses differences in efficacy of different types of stone breaking techniques, and also Motley et al.[17] attempted to determine stone composition using HU density and suggested that HU density was more effective than HU alone[18].

In present study, almost 96.7% ureteric stones were cleared with pneumatic lithoclast. One previous study showed 96.1% success rate in terms of stone clearance although they observed insignificant difference between the clearance rates among males and females with p-value of 0.341 in their study[19].

CONCLUSION

It was concluded that pneumatic lithoclast is an efficacious procedure in urology in clearing different metabolic stones in lower ureter thus advocates its routine use.

Limitations: Small sample size with limited resources.

Conflict of interest: None

Funding: None

Author's contribution: MU: Conceptualized the study, analyzed the data, and formulated the initial draft, **AA**: Contributed to the proof reading, **AJ:** Collected and analyzed data.

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