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Original Research Article

To Evaluate the Outcome of Surgical Treatment of Ureteric Calculus with Ureterorenoscopy Followed by Pneumo Lithotripsy

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Abstract:

Background: Various methods have been adopted for the removal of ureteric calculi. Ureteroscopic pneumatic lithotripsy has been used to treat ureteric calculi for more than a decade.

Objectives: To determine successful stone fragmentation by ureteroscopic pneumatic lithotripsy in the management of ureteric calculi as well as intra-operative and post-operative complications related to it.

Materials and Methods: Fifty patients having ureteric stones were treated with intracorporeal pneumatic lithotripsy. The size, side and site of stones along with the results of preoperative routine investigations were noted in the patients. The pneumatic lithotripter was introduced through a rigid ureteroscope (Karl Storz) to break the stones. Successful stone fragmentation, lithotripsy time, intra-operative and post-operative complications were recorded.

Results: Complete stone fragmentation was achieved in about 92 % of cases. The mean lithotripsy time was 21 minutes. About 92% of patients were stone-free at one week follow-up after the procedure, 96% by the end of eight weeks while 100% stone-free status was achieved by the end of 12 weeks. The mean hospital stay was 1.82 days and complications (both significant and minor) occurred in 24 % of cases. However, majority of them were minor and successfully managed.

Conclusion: Intra-operative pneumatic lithotripsy is a minimally invasive, effective and rapid procedure for the management of ureteric calculi. Though it can give rise to considerable complications, they are mainly minor. It seems to be a good alternative in patients where ESWL is unsuccessful or not indicated and in patients who need early stone removal.

Keywords: ESWL- Extracorporeal shockwave lithotripsy, ureterorenoscopy, ureteric calculi, lithotripsy.

Introduction

Urinary stones have plagued humans since the earliest record of civilization. Following urinary tract infections and prostatic pathologies, they are the third most common conditions affecting the urinary tract [1, 2]. A high incidence of urolithiasis have been reported in the countries lying in the Afro-Asian stone belt (Egypt, Sudan, Middle East, India, Pakistan, Burma, Thailand, Indonesia and Philippines), that fall within the tropical and sub-tropical regions [3].

In contrast, calculi more than 6mm have a less than 5% chance of spontaneous passage. However, this does not mean that a 1-cm stone will not pass or that a 1- to 2-mm stone will always pass uneventfully[1].Non- steroidal anti-inflammatory drugs are used for pain along with smooth muscle relaxants. Various types of dissolution agents have also been used for dissolving stones [4].Stone removal may be done by Extracorporeal Shockwave Lithotripsy (ESWL), endoscopically or by open surgery. In developed countries, open surgical stone extraction is almost non- existent comprising only 0.5% of all cases of ureteric calculi [5].

The advent of ESWL in the early 1980s and ultra-thin ureteroscope in the early 1990s have revolutionized the management of these calculi. ESWL is non-invasive with a success rate of 84% for upper ureteric calculi. But the efficacy is lower in the middle and lower ureter due to poor accessibility, impacted stones in former and small stones in the latter. Overall success rate ranges between 58% and 72%. Another limitation of ESWL is the high rate of re-treatment sessions (38%) and high cost [6].

Laser lithotripsy was first introduced commercially in the late 1980s with the pulsed dye laser. The first pneumatic lithotripter was the Swiss Lithoclast, developed at the University Teaching Hospital in Lausanne, Switzerland in 1989. It works along the principle of a jack-hammer[7]. A projectile in the hand piece is propelled by compressed air through the probe. The compressed air originates from a small generator that is connected to a dry, clean air supply. The ballistic energy produced is conveyed to the probe base at a rate of 12 Hz [7]. Continued impaction of the probe tip against the stone results in stone breakage once the tensile forces of the calculus are overcome.

Materials and Methodology

All Patients visiting the OPD &/or admitted in the IPD, diagnosed as ureteric calculi from June 2022 to May 2023 at Dept of Urology, GRMC, Gwalior.

A minimum of 50 patients from June 2022 to May 2023 fitting into inclusion criteria were selected into each group and subjected to detailed medical history, general physical examination, systemic examination and required Investigations with prior consent of the patients was done and the results of which are statistically analyzed.

Inclusion criteria:

- Age >18 and <50
- Patients with ureteric calculi(<1.5cm)
- Hydroureteronephrosis
- Diabetes mellitus
- Renal failure
- Bilateral ureteric calculi with obstructive uropathy
- Benign prostatic hyperplasia with ureteric calculus

Exclusion criteria:

- Ureteric stone >1.5cm.
- Stone in upper ureter.
- Pregnancy
- Congestive cardiac failure
- Ischemic heart disease
- Pyonephrotic kidneys
- Orthopedic anomalies
- Bleeding diathesis
- Periureteric fibrosis

Statistical Analysis-

The statistical analysis was performed using SPSS for windows version 22.0 software (Mac, and Linux). The findings were present in number and percentage analyzed by frequency, percent, and Chi-squared test. Chi-squared test was used to find the association among variables. The critical value of *P* indicating the probability of significant difference was taken as <0.05 for comparison.

Results

50 Patients visiting the OPD &/or admitted in the IPD, diagnosed as ureteric calculi from June 2022 to May 2023 at Dept of Urology, GRMC, Gwalior

Were taken for study. All the data were analyzed as per the proforma sheet.

Table 1: Age wise distribution of study participants

Age Group (Yrs)	Number	Percentage
18-26	7	14%
27-35	23	46%
36-44	6	12%
45-53	14	28%
Total	50	100%

As per table 1 In our study, 7 patients out of 50 belonged to age group 18-26yrs (14%), 23 in the age group 27-35yrs(46%), 6 in age group 36-44yrs(12%), and 14 in age group of 45-53yrs(28%). In our study of 50 patients, 26 patients were males and 24 patients were females. Male to female ratio being 1.08: 1. 50 patients included in the study group – 82% of patients had flank pain, 54% had haematuria and 30% of patients had burning micturition.

Table 2: Comorbidities among Study participants

Comorbidity	Number	Percentage
Diabetes mellitus	7	14%
Renal failure	4	8%
Bladder outlet obstruction	1	2%

As per table 2 out of 50 patients included in the study group – 14% of patients had Diabetes mellitus, 8% had renal failure and 2% had bladder outlet obstruction.

Table 3: Stone size versus lithotripsy time

Stone Size	Number	Percentage%	Lithotripsy Time {Range}
<5mm	12	24%	10-12 min
5-10 mm	23	46%	12-23 min
11-15mm	15	30%	12-32 min
Total	50	100%	Min-10min / max time 32min

Out of 50 patients included in the study group – 24% of patients had stone size <5mm, 46% of patients had stone size 5-10mm, 30% of patients had stone size 11-15mm. Lithotripsy time for patients with stone size <5mm is 10-12min, for stone size of 5-10mm is 12-23min, for stone size of 11-15mm is 12-32min. Out of the patients included in the study group – calculi was present in right ureter in 42% of patients and in left ureter in 58% of patients. Out of patients included in the study group – calculi was present in middle third of ureter in 46% of patients, in lower third of ureter in 54% of patients.

Table 4: Site of Stone Versus Fragmentation& Migration of The Stone

Site of Calculi	Complete Fragmentation	Stone Migration	Total
Middle third	20(86.95%)	3(13.04%)	23
Lower third	26(96.3%)	1(3.7%)	27
Total	46(92%)	4(8%)	50

Out of 50 patients having middle third ureteric calculi – 86.95% of calculi achieved complete fragmentation and 13.04% had stone migration. Out of patients having lower third ureteric

calculi – 96.3% of calculi achieved complete fragmentation and 3.7% calculi had stone migration.

Table 5: Complications Associated

Intraop Complications	**No**	**%**
Upward stone migration	4	8%
Significant bleeding	2	4%
Mucosal injury	1	2%
Ureteral perforation	0	-
Early Complications		
Fever/urosepsis	3	6%
Persistent haematuria	1	2%
Late Complications		
Ureteral stricture	1	2%
Total	12	24%

Out of 50 patients included in the study group – Intraoperatively, 8% had upward stone migration, 4% had significant bleeding and 2% had mucosal injury. Post operatively, 6% had fever, 2% had persistent haematuria and 2% had ureteral stricture.

Table 6: Ancillary procedures required after stone fragmentation

Ancillary Procedures	**Number**	**Percentage (%)**
JJ stenting	5	10%
ESWL	4	8%
JJ stenting/ ESWL	2	4%
Open surgery	1	2%
Total	12	24%

Out of 50 patients included in study,10% of patients required JJ stenting, 8% of patients required ESWL, 4% patients required ESWL&JJ Stenting, 2% required open surgery.

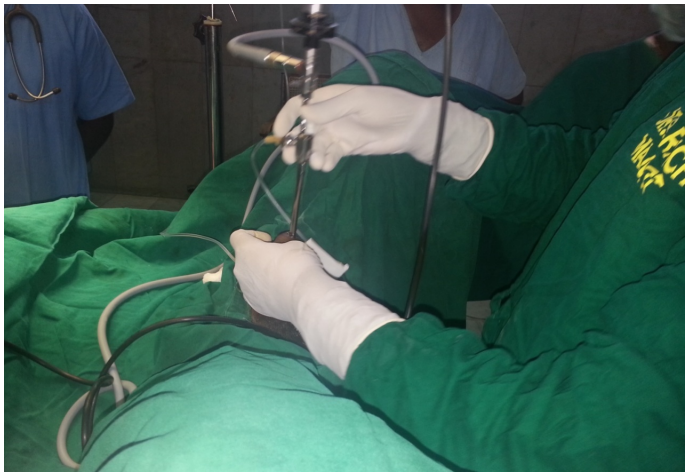

Figure 1: Ureterorenoscopy in Progress

Discussion

Improved technology has revolutionized the management of urinary stones. The advent of semi-rigid, flexible and narrow-calibre ureteroscopes have expanded minimally invasive options in addition to conventional open surgical procedures. [8] Among the various methods of ureteroscopic techniques, the pneumatic lithotripsy has gained worldwide popularity owing to its low cost and high degree of effectiveness. [9,10] We noticed that the time taken for the procedure varied depending on factors including the size of stone and the site of stone. In general, lithotripsy time tends to increase proportionately with the size of stone as

shown. It also varies with the nature of the stone and greater time is taken to break harder monohydrate stones. [11,12] As it is known, none of the procedures for removal of ureteric stones are yet immune to complications. We faced complications in 24% of our patients. Though it sounds alarming, it mainly includes stone migration into the kidney (8%) and minor complications such as significant bleeding (4%) and mucosal injury (2%). All the complications were tackled successfully in the end. We didn't have any mortality or unmanageable morbidity related to the procedure. A similar study by Sana Ullah et al [11] had an overall complication rate of 25%. Aridogan et al [12] had reported 3.5% mucosal injuries and post-operative macroscopic haematuria in 7.3% of patients.

Conclusion

A comparative randomized prospective study with various therapeutic modalities for ureteric stones to compare their efficacy is recommended so that the procedure with the least morbidity rates in each urology unit can be selected. In order to maximise the efficacy and minimise complications of pneumatic lithotripsy, patients with ureteric calculi should be cautiously selected. More failure was observed in stones in upper third of ureter, which could have been effectively managed with other modalities like ESWL. To minimise major complications, vigilance is required for early recognition and treatment of ureteric injuries during the procedure. Further studies to evaluate the use of newer devices such as Dretler Stone Cone and Lithovac suction device for minimising upward migration of stone during pneumatic lithotripsy are desirable.

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