

EVALUATION OF URETEROSCOPIC PNEUMATIC LITHOTRIPSY FOR URETERAL STONES

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ABSTRACT:

OBJECTIVE:

To evaluate success rate, auxiliary procedures and complications associated with ureteroscopic pneumatic lithotripsy of ureteric stones.

PATIENTS AND METHODS:

The study was conducted among 100 patients between May 2011 to July 2013. The mean age of the patients was 32 ± 3 years. Ureteroscopic pneumatic lithotripsy was performed using rigid Wolf ureteroscope and Swiss Lithoclast. Stone diagnosis and localization was done by C.T KUB without contrast. IVU was done in cases where indicated. Stone size range was between 0.6 cm to 2.0 cm with mild to marked obstructive changes in collecting system. All patients were having normal renal function tests.

RESULTS:

Majority of the patients 60/100 (60%) presented with lower ureter calculi, 28/100 (28%) presented with upper ureter calculi and 12/100 (12%) with middle ureter calculi. The patients were followed with plain X-ray KUB and USG for 2 months. Stone free status was declared as complete clearance of stone fragments from urinary tract. Overall success rate was 96%. Auxiliary procedures conducted include balloon dilatation of ureterovesical junction 67% and of upper ureteric stricture 1%, retrograde urography 1%, dormia basket manipulation 88% and D-J stent placement 87%. Complications encountered were mild transient hematuria 67%, stone fragments migration 4%, urosepsis 2%, and residual stone fragments 4%, D-J stent associated discomfort 33% and repeat procedure 2%.

CONCLUSION:

Ureteroscopic Pneumatic Lithotripsy is effective and safe treatment modality with unremarkable complications for ureteric stones.

KEYWORDS: Ureteroscopic, ureteric stone, pneumatic, auxiliary, balloon dilatation, stone migration.

INTRODUCTION:

Urinary stones is a common and recurrent disease and as old as human civilization (8). Twelve percent of the population will have urinary stone during their life time and recurrence rate reaches 50% (12). The oldest known urinary stone was found in a mummy dated 4800BC (8). Urinary stone disease is most common in the people of Caucasian ancestry and stone belt of subcontinent.

Ureteral stones account for 54% of the urinary stones.

Ureteral calculi is a common disease in UAE. Endoscopic stone surgery is developing day by day and is highly popular among the people because of its minimal invasive

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nature. In this era open ureterolithotomy is now a historical event. As the stone sizes increase chances of spontaneous passage of stone decreases (16). Ureteral stones may cause interruption of urinary flow and progressive back pressure on the ureter and kidneys. It may lead to severe recurrent colicky attacks and hydronephrosis. If ureteral stones left untreated impairment of kidney function may occur. There are variety of treatment options available for ureteral stones such as extracorporeal shock wave lithotripsy (ESWL), ureteroscopic lithotripsy, percutaneous nephrolithotomy, laparoscopic nephrolithotomy and open ureterolithotomy (1). All the procedure are reported with different efficacy rates and complications.

In our study we evaluated the success rate, auxiliary procedures and complications associated with pneumatic lithotripsy for treatment of ureteric stones.

PATIENTS AND METHODS:

The study was conducted among 100 patients between May 2011 to July 2013. Of these patients, 82 were male and 18 were female. Their age range was between 20 years to 70 years with mean age of 32 years. Ureteroscopic pneumatic lithotripsy was performed with 8/9.5 rigid ureterorenoscope (R.Wolf Germany) and Swiss Lithoclast (Electromedical systems Switzerland). This device uses a 0.8 mm to 1 mm rigid probe connected to hand piece for stone fragmentation. Twenty patients were treated under general anesthesia and 80 patients under spinal anesthesia. Routine investigations performed include CBC, B.T, C.T, RBS, serum creatinine, serum urea, serum uric acid, and routine urinalysis. Urine culture and sensitivity was performed in patients where indicated. Viral serology was done in all patients before surgery. Hydronephrotic changes were diagnosed by ultrasonography while stone diagnosis and localization was done by C.T KUB without contrast. Intravenous urography was done in one case where there was history of ureterolithotomy in the past. In the same patient retrograde urography was also performed during endoscopic surgery to locate the stenotic part of the ureter for

balloon dilatation. Auxiliary procedures performed during endoscopic surgery were balloon dilatation of vesicoureteric junction and of upper ureteric stricture, stone basket manipulation and Double-J stent placement after the end of the procedure. Foley; catheter was inserted in all the patients at the end of the procedure. Stones were fragmented up to 2mm to 3mm size particles. Foley,s catheter was removed within 10-24 hours while Double-J stent was removed within 10-35 days. Prophylactic intravenous antibiotics were given to all patients at the time of anesthesia. Stone free status was declared as complete absence of stone fragments from the urinary tract within two months of treatment. Successful fragmentation was considered when stone disintegrated into 2 mm to 3 mm size particles. All patients were discharged within 24 hours of treatment. All patients were followed after 15 days interval up to 2 months with plain X-Ray KUB, Urine analysis and abdominal ultrasound. Plain C.T KUB without contrast was performed in patients where patients complained of persistent pain on operated site after removal of Double-J stent.

RESULT:

In our study among 100 patients, sixty (60%) were with lower ureter calculi, twenty eight (28%) were upper ureter calculi, and twelve (12%) patients presented with middle ureter calculi. Stone size range was between 0.6cm to 2.0cm with mean stone size 1.50cm. Successful fragmentation was achieved in 98% cases and stone free status was observed in 96% cases. Stone fragments migration was observed in 4 cases (4%) however these patients were treated with Double-J stent and stone clearance was observed within two months.

Stone free status observed in lower ureter was (59/60) 98.3%, in middle ureter (11/12) 91.6% and in upper ureter was (26/28) 92.8% within 2 months of treatment. Main complications observed were transient mild hematuria in 67 cases that lasted for 1-4 days, stone fragments migration into the respective kidney in 4 cases and residual stone fragments in 4 cases at the end of two

months. Residual stone fragments were observed in cases where stone size was around 2 cm. urosepsis was observed in 2 patients. Clinically these patients presented with high grade fever with rigors. These patients were treated according to urine culture and sensitivity report. Double-J stent associated complications like urgency, frequency, terminal hematuria, pain in the corresponding flank at the time of voiding, Painful micturition, heaviness in the perineum was observed in 33% patients. These patients were treated symptomatically however in two patients with urosepsis Double-J stent was removed early. Repeat procedure was performed in two patients. In these patients stone migrated into the kidney, we passed Double-J stent and after 1 month stone returned back into the ureter, then procedure was repeated and complete stone clearance was observed within two months. Auxiliary procedure performed include balloon dilatation of ureterovesical junction in 67 cases (67%), stone basket manipulation in 88 cases (88%) and Double-J stent placement in 87 cases (87%) at the end of the procedure. In one patient with history of ureterolithotomy retrograde urography was performed during the procedure and stricture was identified at operated site in the upper ureter. In this patient balloon dilatation of upper ureteric stricture was performed to get access to the stone. In our study no ureteric perforation was observed. ESWL treatment for residual stone fragments and percutaneous nephrostomy were also not required in any patient.

Table 1- SUCCESS RATE ACCORDING TO STONE LOCATION

STONE LOCATION	SUCCESSFUL FRAGMENTATION		STONE FREE STATUS	
	N	%	N	%
LOWER URETER	60/60	100	59/60	98.3
MIDDLE URETER	12/12	100	11/12	91.6
UPPER URETER	26/28	92.8	26/28	92.8

Table 2 – COMPLICATIONS

No	COMPLICATIONS PERCENTAGE	N	%
1.	Transient mild hematuria	67/100	67%
2.	Stone fragments migration into kidney	4/100	4%
3.	Complete stone migration into kidney	2/100	2%
4.	Residual stone fragments at the end of 2 months	4/100	4%
5.	Incomplete fragmentation	2/100	2%
6.	Urosepsis	2/100	2%
7.	Double-J stent associated complications	33/100	33%
8.	Repeat Procedure	2/100	2%

Table 3 – AUXILIARY PROCEDURES

No.	AUXILIARY PROCEDURE	N	%
1.	Balloon dilatation of V-U Junction	67/100	67%
2.	Balloon Dilatation of Upper Ureteric Stricture	1/100	1%
3.	Retrograde Urography	1/100	1%
4.	Stone Basket Manipulation	88/100	88%
5.	Double-J stent Placement	87/100	87%

DISCUSSION:

Two types of treatment modalities are more popular for treatment of ureteral stones extracorporeal shock wave lithotripsy and intracorporeal (endoscopic) lithotripsy. The use of extracorporeal shock wave lithotripsy once approved by AUA as treatment modality of choice (7), now progressively declining day by day owing to its low success rate and advances and improvements in endoscopic instruments and fiberoptics (intracorporeal lithotripsy) (14,3).

There are several intracorporeal lithotripsy alternatives, such as electrohydraulic lithotripsy, ultrasonic lithotripsy, pneumatic lithotripsy and laser lithotripsy (4) although trend of laser lithotripsy is rising but high treatment cost and ureteral tissue damage seem to be main problems with this technique.

Among these treatment options we used pneumatic lithotripsy successfully for ureteral stone treatment.

According to the literature the overall success rate of ureteroscopic pneumatic lithotripsy varies from 90.6% to 92.3% (2, 4 & 10) we achieved over all success rate of 96% which is relatively better as reported in the literature. Mean stone size reported varies from 1 cm to 1.50 cm (1, 2, 4, & 6). In our study mean stone size was also 1.50 cm. These results show effectiveness of this ureteroscopic pneumatic lithotripsy for ureteric stones.

The success rate reported for upper middle and lower ureteric stone is 84%, 89.7% and 95.6% respectively (4). Our success rate for upper ureteric status is 92.8% for middle ureteric stone 91.6% and lower ureteric stone is 98.3%. Our success rate is relatively higher. Lotfi Tune et al 2007 described its low success rate in upper and middle ureter due to difficult success and associated complications. We did not have such experience of difficult access and associated complications rather we used stone basket to engage especially upper and middle ureter stones which helped in adequate pulverization. Basket entrapment of stone also decreases upward stone migration.

Kurtulus et al 2012 reported in his study that stone free rate after ureteroscopy were low in patients who underwent previous intraureteral manipulation. We have not noticed such relationship in our study of 100 patients. Auxiliary procedure performed in our study include balloon dilatation of V-U junction in 67% cases. Balloon dilatation of upper ureteric stricture and retrograde urography was performed in 1 case (1%). This case underwent uretholithotomy 5 years before and developed stricture at operated site. So urography and balloon dilatation was performed to get access to the stone. Other auxiliary procedure includes stone basket manipulation in 88% and D-J stent placement in 87% cases. As we go through literature auxiliary procedures performed during ureteroscopy varies from study to study and include secondary ESWL 47%, second URS 5%, double-J catheter placement 33%, ureteral catheterization 69.2% guide wire stretching of U-V junction 14% (4, 11, & 15). We think difference in use of auxiliary procedures is due to personal experience of

every surgeon and associated institution. The common things between our study and other studies is double-J catheter placement but we inserted double-J stent in 87% of cases and in other studies is around 33%; we think this difference is due to personal experience of every surgeon. Double-J catheter insertion although associated with complications but its presence causes ureteral dilatation and also bypasses the ureteral obstruction secondary to post operative ureteral edema and stone fragments following pneumatic ureteroscopic lithotripsy. This is the reason why evidence of post operative ureteric colic is nonexistent in our study while its reported incidence is 23% (4, 5). Ureterovesical junction is narrow point and it sometimes requires dilatation to get access to the ureter we did balloon dilatation of ureterovesical junction for easy access to the ureter in 67% of cases while others reported vesicoureteral junction stretching with two guide wires to get access to the ureter (15). Dormia basket entrapment of upper and middle ureteric stone is most important aspect of our study. That is why our results are comparatively better than others (2,4,10) because stone engagement in the basket has two important effects

1. It reduces the chances of stone or stone fragments migration into the kidney.
2. It reduces the stone mobility in the ureter and stone can be adequately disintegrated into 2-3 mm particles.

Complications encountered in our study associated with ureteroscopic pneumatic lithotripsy were transient mild hematuria 67%, stone fragments migration 4%, stone migration 2%, residual stone fragments 4%. Urosepsis 2% repeat procedure 2% and D-J stent associated complications 33%. D-J stent associated complications were urgency frequency, terminal hematuria, and flank pain during micturition act, perineal heaviness and painful voiding. Reported complications associated with ureteroscopy and pneumatic lithotripsy are ureteral perforation 0.65%-1.3%, complete stone migration 3.8%, migration of fragments 3.2% unsuccessful access to the stone with URS 2-5%. Urosepsis 1.13%-4.5% persistent hematuria 2.04%. renal colic 2%-23%, Ureteral stent migration 0.66% ureteral avulsion 0.11%-3.75%. false

passage formation 15% and ureteral mucosal trauma 41.5% (4,5,7).

In our study we have not encountered severe form of complications like ureteral perforation, ureteral avulsion, false passage formation and loss of ureteral segment.

We think this is because of the long experience in endourology, and use of adequate auxiliary procedures at appropriate time. We also maintained high irrigation pressure during ureteroscopy. High irrigation pressure keeps the ureteral mucosa away from the forward moving ureteroscope and good vision and there is less evidence of false passage and ureteral perforation and ureteral avulsion. This is also reported by Taie K et al 2012.

Although high irrigation pressure leads to increase intrarenal pressure which may lead to forniceal tear and hematuria (3). That is why hematuria was found in 67% of cases. But it was mild and transient. High pressure irrigation may not only be the cause of transient hematuria but ureteral mucosal trauma incurred during pneumatic lithotripsy is another cause of hematuria observed after treatment (2, 4).

A limitation of this treatment modality is that ureteral stones could not be analyzed biochemically in all the patients. The stones pass in 2-3 mm particles during micturition. The patient does feel that something has passed but cannot collect. Hence stone analysis is not possible. Thus the goal of to take prophylactic steps to prevent stone recurrence is difficult to achieve.

CONCLUSION:

Ureteral stones account for 54% of the urinary stones and it is a common disease in UAE. Endoscopic stone surgery is popular among the people because of its minimal invasive nature. Although intracorporeal lithotripsy (ESWL) is noninvasive in nature but it has significantly low success rate as compared to intracorporeal lithotripsy. Although trend of laser lithotripsy is rising but its high treatment cost and inadvertent ureteral tissue damage seems to be main limitation factors. In our opinion because of its cost effectiveness adequate stone fragmentation, early stone clearance and high

success rate, pneumatic lithotripsy could be considered as a first line treatment modality for ureteral stones up to 1.5 cm, in patients who need safe and early stone removal even in long term infection and obstruction. Furthermore physician expertise must also be considered.

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Sinning is a disease, repentance is its medicine, and abstinence from it a sure cure.

Speech is like a medicine, a small dose of which cures but an excess of which kills.

Anger is a fire kindled, he who restrains anger extinguishes the fire; he who gives vent to it is the first to be consumed by such fire.

Hazrat Ali
(Razi Allah Tala Anho)