

Experience of Ureteroscopic Pneumatic Lithotripsy In Management of Lower and Mid Ureteric Calculi

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Purpose of Study: To formulate results of our experience with ureteroscopy and intracorporeal pneumatic lithotripsy during management of mid and lower ureteric stones.

Design of Study: Prospective.

Period of Study: January 2004 to April 2006.

Setting: American General Hospital, Ahmadpur Road Bahawalpur.

Patients and Methods: All patients of mid and lower ureteric stones above 18 years of age were included in this study. Initially 115 patients were selected but 15 patients were lost during follow-up. Patients with previous history of surgery for ureteric stones were not included. Ureteroscopy and intracorporeal pneumatic lithotripsy were used for patients whose stones failed to progress on conservative trial.

Results: Intracorporeal pneumatic lithotripsy with ureteroscopy has best results especially in single session with 94.2% stone clearance rates. Conservative management of ureteric calculi is very promising and practicable provided the infection and pain remains under control and stone size is smaller than 06mm.

Conclusion: Wait and Watch treatment for ureteric calculi is safe. Ureteroscopy and pneumatic lithotripsy is effective and can be advocated as first line treatment for ureteric calculi if opted by the patient.

Key Words: Ureteric calculi, Ureterorenoscopy (URS), Intracorporeal Pneumatic lithotripsy. UreteroRenoscopic Lithotripsy (URSL).

Introduction:

As Bahawalpur is situated in the heart of stone belt in Pakistan covering an area of almost 300 square miles, the number of patients suffering from urolithiasis is enormous. Therefore we come across a vast majority of patients suffering from ureteric calculi. The early presentation of these patients is due to development of colic.

Most of the ureteric stones pass spontaneously and do not require intervention. Spontaneous passage depends on the stone size, shape, location and associated ureteral edema (which is likely to depend on the length of time that a stone has not progressed). Ureteral calculi 4-5 mm in size have a 40-50% chance of spontaneous passage. In contrast, calculi more than 6mm have a less than 05% chance of spontaneous passage. This does not mean that 01cm stone will not pass or that a 01-02 mm stone will always pass uneventfully. The vast majority of stones that pass do so within a 06 weeks period after the onset of symptoms. Ureteral calculi discovered in the distal ureter at the time of presentation have 50% chance of spontaneous passage, in contrast to 25% and 10% chance in the mid and proximal ureter.

Recent advances in endourology and utilization of shock wave physics in urological stone disease, have changed the management of urolithiasis altogether. Since the advent of Extracorporeal and Intracorporeal lithotriptors,

surgery for stone disease has been very limited to selective cases only. Unfortunately the public sector at Bahawalpur has not been provided with these modern facilities in all aspects, surgical treatment is still the mainstay of management of urinary stones. With the emergence of fine ureteroscopes, the ureteric stones are now rarely treated with open surgery. Intracorporeal lithotripsy with ureterorenoscopy has emerged as treatment of choice for ureteric (especially mid and lower) stones. Pneumatic lithotripsy is cheaper and simple to manage rather than hydraulic, ultrasonic, laser lithotriptors. Therefore the combination of ureterorenoscopy and pneumatic lithotripsy is being vastly used by the urologist all over this country.

This study was formulated to highlight the success of conservative treatment of mid and lower ureteric stones. If the stone has not progressed in 03 weeks and patients developed proximal hydronephrosis on check ultrasonography, then these patients were subjected to ureterorenoscopy and pneumatic lithotripsy.

Materials and Methods

This study was conducted at American General Hospital, Bahawalpur in a private setup from January 2004 to April 2006. The patients above 18 years of age with ureteric

calculi were included in this study. In paediatric patients with ureteric stones we preferred open ureterolithotomy. One hundred and fifteen diagnosed patients with ureteric calculi were included in this study, whether presented with colic or otherwise. Urine routine examination, ultrasonography abdomen, scout abdominal film for KUB, Serum uric acid were obtained routinely. Intravenous urography was obtained in all patients under study. Potassium citrate and alkalinizing agents were added to treatment along with analgesics (diclofenac sodium). Antibiotics were added only if urine examination revealed >10 pus cells PHF. Three weeks of expectant treatment was offered to these patients. Failure to progress of stone, subjected the patients to uretero-reno-scopy and pneumatic lithotripsy. Ureterorenoscope used was semi-rigid, oblique view 9 Fr scope with 5 Fr. instrument channel. Stuck stones were broken with pneumatic lithotripsy with the help of ureteroscope.

Procedure of Ureterorenoscopy and Intracorporeal Lithotripsy

Patients were prepared in lithotomy position under general anaesthesia with skeletal muscle paralyzing agents. Uretero-rensoscopy was done to localize the stone in the ureter. Pneumatic lithotripter probe of 1mm tip positioned with hand piece and under focused vision of ureteroscopes, the stone was disintegrated with multiple transmitted shocks. Stone gravel usually passed down along the flow of irrigant solution. Few pieces sometimes required removal with grasper. Double J stent was routinely placed in these patients who underwent pneumatic lithotripsy, for 02 to 03 weeks, so as to reduce the manipulatory edema and passage of gravel in unobstructed urinary flow. Double J stents were removed endoscopically, when the particular renal unit under treatment was clear of stones, checked on ultrasonography.

Results

Initially, 115 patients were enrolled in this prospective study, but fifteen patients were lost during follow-up and did not turn up, therefore the results were formulated on 100 available patients. The stone size of up to 12 mm in mid or lower ureter was selected for the conservative management. The patients less than 18 years, previous history of open surgery for ureteric stone on same side, non functioning renal unit on intravenous urography and upper ureteric stones were not included in this study.

Age:

Age of the patients in this study was more than 18 years.

Age	No. of patients	% age
18-30 years	38 patients	38%
31 to 50 years	42 patients	42%
51 years above	20 patients	20%

The stone location detected on ultrasonography and confirmed on intravenous urography was as follows;

Site of stone	No. of patient	%age
Mid ureter	33	33%
Distal ureter	67	67%

Spontaneous passage of these ureteric calculi after a trial of 03 weeks and detected on weekly basis with the help of ultrasonography, were as follows;

Site	No. of Patients	Need of Intervention
Lower Ureter	48 (71.64%)	19 (28.35%)
Mid ureter	17 (51.51%)	16 (49.49%)

A total of 35 patients were subjected to uretero renoscopy and intracorporeal pneumatic lithotripsy including 19 patients (28.35%) of lower ureteric and 16 patients (49.49%) of mid uretric stones. In two of these 35 patients, ureteric orifice was narrow and ureterorenoscope was inserted over a guide wire. During lithotripsy, upward migration of stone was noted in two (2/35=05.70%) of the patients. In these two patients procedure was abandoned and they were subjected to extracorporeal lithotripsy, which is available in the same setup after confirmation of stone site with ultrasonography and X-Ray abdomen for KUB.

Ureteric perforation was observed in two patients during the procedure (02/35=05.71%). In one of these patients with perforation, only double J stent was inserted endoscopically and patient settled. One patient with perforation of ureter required open surgery and repair of ureter over a double J stent.

Stone clearance with ureterorenoscopy and pneumatic lithotripsy was 94.3% at the end of 04 weeks time when stent was removed. Procedure time with ureterorenoscopic lithotripsy in these 35 patients was between 25 minutes to 90 minutes. Hospital stay ranged between 24 hours to 48 hours in un complicated patients and 96 hours in one case who underwent open surgery for ureteric perforation.

Complications

A total of 35 patients were exposed to ureteroscopic intracorporeal lithotripsy. The following complications were observed as tabulated. The success rates as for stone clearance was 94.30%.

Complication	No. of patients	%age
Stone migration	02	05.70%
Ureteric perforation	02	05.70%
Residual stone	02	05.71%
Hematuria	06	17.10%

Discussion

The management of ureteric stones has been changing aspects from conservative to open surgery, minimal invasive surgery, extra-corporeal shock wave lithotripsy, endoscopic removal, and laparoscopic surgery. Intra-corporeal lithotripsy devices and ureteroscopes invention has made treatment of ureteric stones much convenient. This study was initially designed to see the progress of mid and lower ureteric stones conservatively, but failure to progress lead to embark on intervention with ureteroscopy and intracorporeal pneumatic lithotripsy. The results with conservative treatment were very promising if the patient symptoms remained under control especially pain. Our study concludes that size of stone does not matter, with success of ureteric stone passage spontaneously up to 71.64% in lower ureteric and 51.51% in mid ureteric stones. Overall success rate of 65% was achieved. The studies in international literature also quote 40-60% of ureteric stones pass spontaneously without intervention.^{1,2} These studies strictly conclude that no stone of more than 7mm could pass without intervention.² But it is not hard and fast rule that a stone of less than 7mm will pass spontaneously and more than 10mm will not pass.¹ In a study conducted locally, few years ago, the patients subjected to or opted for conservative management of ureteric stones, the success rate was 85% with stones size of almost >8mm.³ The strict criteria described for intervention is continuous pain, infection, ipsilateral loss of function.² The conservative management is safe, provided radioisotope renography is used to identify those renal units requiring timely intervention.¹⁻³

Majority 80% of patients in our study were young adults with age range from 18-65 years with mean age of 45 years with Male to Female ratio of 2.5 : 1. The studies conducted for the management of ureteric stones internationally and nationally reveal the age range between 16-70 years with a mean age of 46.8 years and male to female ratio of 2 : 1 especially with a chance of interventional requirements.³⁻⁶ The number of patients analyzed for conservative or intervention in case of ureteric stones ranges from hundred to thousands in different studies for formulating strategy for treatment.⁷⁻¹¹

The size of stone observed in this study was between 06mm to 25 mm, while for conservative management size of stone in our study was upto 12 mm while in other studies is 05 mm to 08 mm.¹⁻³ For intervention no size is the limit provided that particular renal unit is functional. Different studies has noted the size of ureteric stones between 04 mm to 22 mm.^{2,3,4,6,8,12} During the conservative trial of treatment in mid and lower ureteric stone of our study 35 patients has recurrent symptoms and their stones progressed a little causing proximal pressure effects and hydronephrosis. These patients were offered single shot removal of stones with ureteroscopy and intracorporeal pneumatic lithotripsy under general anaesthesia with skeletal muscle paralysis. The decision about how to treat a patient of mid or lower ureteric stone should be done on the basis of availability of proper

equipments, experience of urologist and preference of patient.¹² In a study,¹³ ureteroscopy has been performed as a day case procedure with 98% stone clearance success rate in patients between 19-78 years in a dedicated day surgery unit and implementation of analgesia protocols and antibiotic prophylaxis. The main indication of ureteroscopy is the treatment of ureteric stones, 73.6 %.¹⁴

Technical failure during ureteroscopy means inability to negotiate ureteric orifice for transgression of ureteroscope. In two patients of our study, we had difficulty but scope was negotiated over a guide wire successfully. In all other patients we had bare go without guide wire. Technical failure with ureteroscopy has been reported up to 8%⁶ while diagnostic success up to 97-100% in different studies.^{4,5,7,8,15-17}

Primarily the development of modern intracorporeal lithotripsy probes and extraction instruments along with reduction in ureteroscope diameter has improved efficacy and reduced morbidity.¹⁸ Probe size used is 0.8 mm to 1.2 mm and stone fragmentation is done up to the size of 05 mm to 8.5 mm per gram of stone mass.¹⁹ Ureteroscopy allows a rate of stone free patient in one session than ESWL. The ultimate goal treating ureteric stones by whatever means is to get patient stone free and prevent recurrence.¹⁷ Due to high success rates ureteroscopy can be advocated as initial management of ureteric stones.⁵

The procedural time with ureteroscopy and intracorporeal lithotripsy recorded during this study was between 25 minutes to 95 minutes. Different studies with larger series has reported procedural time between 10 minutes to 180 minutes with the same procedure, depending upon stone burden and location of stone.^{4,10,12,20,21} Procedure time prolongs in treating post ESWL "steinstrasse" cases and double J stent placement.^{10,13,15,20,22} The stone fragmentation rate of our study was 94% due to proximal migration of two stone during lithotripsy. The reported fragmentation rate ranges between 69-95%.^{3,5,6,9,19,20,21,23-25} Stone particle extraction also sometimes accompany the lithotripsy procedure. Fragmentation is done to make particle size nearly to <5mm which may pass spontaneously.

The complications observed during our study were ureteric injury in two patients (5.71%). In one patient it was partial and at spot double J stenting helped. This patient recovered without any extravasations or urinoma formation. In one patients, (2.85%) open surgical repair was done over a double J stent. The ureteric perforation rates observed in different studies are 6.9% (23), 6.1% (6), 3.05% (24), 1%.²⁵ The open surgical repair required rates are as 2.1% (23), 0.8% (6), 2.3% (5), 1.3% (10), 3.3% (7), 0.3%.²⁵ Proximal migration of ureteric stones observed during procedure in our study was in two patients (5.8%), and these patients were treated successfully with ESWL. The studies abroad has stone migration rates of 1% (4), 0.8% (8), 5.8% (10), which were also treated with ESWL.

In comparison to ESWL, stone evacuation rates of ureteroscopic lithotripsy (URSL) are 93.3% against 78.1% with ESWL. Retreatment rates with ESWL are 11.9% and

02.2% with URSL, but ESWL causes no ureteric perforations.^{7,8,17,23} URSL may be required in patients being treated with ESWL(8).URSL requires admission and general anaesthesia,^{8,13,16-23} while ESWL is done on outdoor basis, best with ultrasonographic stone localization. URSL can be offered to patients with ureteric stones when immediate relief is required or ESWL fails⁸. URSL have higher stone clearance rates in single session,- but more ureteric perforations.^{7,8,12,15}

In single session we achieved stone free rates of 94% while 90-97% stone free rates have been achieved in different studies.^{12,24-26} We routinely place doubleJ stent at the end of the procedure in all cases. The stent placement has been argued to be unnecessary in every patient treated with intracorporeal pneumatic lithotripsy provided there is no ureteric injury or ureteral dilatation and this may reduce procedure and anaesthesia time along with cost.^{10,13,15,22} At 48 hours stone clearance was 66.3%, at 15 days 93.8% and 6.1% failure of clearance of gravel at 30 days.⁶ At 30-45 days stone clearance is observed and checked with ultrasonography and stent if placed is to be removed. We routinely remove DJ stent at 02-03 weeks after the procedure. In our study, re treatments were not required as compared to 02 to 4.5% repeat procedure rates in different studies.^{7,26} Re-treatment improves overall success rate.

The majority of renal and ureteric stones are managed with minimally invasive techniques. The modern management requires multi disciplinary approach. Imaging and ultrasonography plays a central role in the diagnosis and planning therapy.^{27,28} The patients with ureteric stones treated with URSL has shorter hospital stay and earlier to work. In our study patients were discharged within 24-48 hours of the procedure. In comparison the hospital stay in other studies was 2.4 days,²⁶ 24hours to 72 hours,⁴ 1-4 days (10), 04-07 days.²¹ Lithoclasty is safe, simple and effective procedure for ureteric stones. However complications of procedure may prolong the usual 48 hours hospital stay seen in uncomplicated cases.^{15,26}

We have achieved complete stone clearance rate of 94.2% at 45 days followup, as checked with ultrasonography, when double J stent was removed. In a study (26) up to 03 months and in another study even longer periods were required.²² The success rates with URSL reported in literature are between 69.5% to 98.99%.^{3,5,6,7,9-15,20-26} The therapeutic effects of URSL are reliable and safe in treatment of ureteral stones with rapid post operative recovery.⁹ The ureteroscopy is a good alternative for the ureteric stones when patient asks for "single shot" treatment.¹⁰ Ureteroscopic lithotripsy is the most effective treatment choice in lower ureteric stones, no matter what kind of energy is used. The pneumatic lithotripsy is the most effective and least morbid approach.¹¹ Ureteroscopy with pneumatic lithotripsy is minimally invasive, effective and comparatively safe method of treatment for complicated ureterolithiasis.²¹ URS and pneumatic lithotripsy is safe, effective as primary procedure for impacted ureteric stones.²⁵ Routine ureteral stenting does not appear to be warranted in URS treated ureteric

stone patients, who do not require ureteral orifice dilatation. This may reduce operative time, surgical cost and patient morbidity.²²

Conclusion

The conservative management of ureteric stones is safe and practicable in majority of patients provided the pain and infection remain under control. It is independent of stone size and depends upon stone type and location. Main indications of intervention with ureteroscopy are treatment of ureteral Lithiasis especially impacted ones. Lithoclasty is safe, simple and effective method of fragmentation of ureteric stones. However the ultimate goal of treating ureteral stones by whatever means is to get the patient stone free and prevent recurrence. The decision about how to treat a patient with ureteral stones should be done on the basis of availability of proper equipment, experience of urologist and preference of patient. Intracorporeal lithotripsy with ureteroscopes is the most effective choice in ureteric stones, no matter what kind of energy is used. However, pneumatic lithotripsy is the most effective and least morbid approach as regards to stone clearance in one sitting especially when patient demands "single shot "treatment. The majority of renal and ureteric stone are now treated by minimally invasive techniques. Imaging and ultrasonography plays a central role in both diagnosis and planning therapy for these patients of ureteric calculi.

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