

## EVALUATION OF PNEUMATIC LITHOCLAST EFFICACY IN TREATMENT OF URETERIC STONES

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### ABSTRACT

To evaluate the use of ureteroscopic pneumatic lithotripsy in the treatment of ureteral stones and to present our clinical experience in the endoscopic management of ureteral calculi. From February 2005 to January 2007, 60 consecutive patients underwent ureteroscopic pneumatic lithotripsy of ureteral stones. Twenty five patients were females and 35 patients were males with male to female ratio of 1.4: 1. The age range was from 17- 52 years. Thirty six patients had radiolucent stones while 24 patients had radio-opaque stones. Of the 14 patients with upper ureteric stones, the stone free rate for the radio-opaque stones were 50% and for the radiolucent were 75%. Of the 16 patients with midureteric stones, the stone free rate for the radio-opaque stones were 75% and for the radiolucent ureteral calculi was 62.5%. Thirty patients had lower uretric stones; the stone free rate for the radio-opaque stones were 60% and for the radiolucent stones were 85%. The overall stone free rate for ureteral calculi was 71.66%. We conclude that ureteroscopy pneumatic lithotripsy found to be safe, and cost effective mean of clearing ureteric calculi at all levels. It is tolerated well by the patients with short hospital stay.

### INTRODUCTION

Ureteral stones were managed by open ureterolithotomy for a long time.<sup>[1]</sup> Bardenheuer removed a calculus from the upper ureter using an open surgical technique in 1882 and this represents one of the earliest recorded cases of ureterolithotomy.<sup>[2]</sup> Percutaneous and ureteroscopic approaches have decreased the frequency of open surgery.<sup>[3]</sup> Ureteroscopy (URS) with pneumatic lithotripsy was developed in 1990 and was reported to be the most effective procedure to treat ureteral stones, but ureteroscopy requires anesthesia and hospitalization.<sup>[3,4]</sup> URS often yields higher rate of stone clearance,<sup>[5]</sup> allows reaching of urinary stones into the ureteral channel and it is a safe method particularly in the presence of calculus obstruction or non-opaque stones.<sup>[3,4]</sup> Prolonged stones can cause ureteral adhesions and impaction which impede the clearance of the stone. It is very difficult to eliminate this problem with extracorporeal shock wave lithotripsy (ESWL), but can be solved effectively with URS. Also URS can clear the stone streets which are formed after ESWL treatment.<sup>[4,6,7]</sup> The success rate of in-situ ESWL of upper ureteric stones approximately 84%. With location problems and impacted stones in the middle ureter and small stones in the lower ureter, the success rate is even lower and ranges between 58% and 72%.<sup>[8]</sup> Due to the high rate

(38%) of retreatment sessions with ESWL, URS has become the method of choice for the quickest way of rendering patients stone-free.<sup>[9]</sup> Various forms of energy including electro hydraulic, ultrasonic, laser and pneumatic have been used for breaking stones. Pneumatic lithotripsy has been found the most effective, safe and economical mode of treatment.<sup>[10,11]</sup> Several pneumatic lithotriptors are in current use. In the Swiss Lithoclast compressed air repeatedly drives a metal bullet onto a metal rod creating a chisel and hammer affects that fragments the targeted stone. The lithoclasts are capable of fragmenting all stones, irrespective of their size or composition. Its advantages include simple use, no disposable parts, easy to maintain and comes in both rigid and flexible fibers and can be utilized in rigid and flexible URS, and unlike laser or ultrasonic lithotriptors, there are no thermal sequelae.<sup>[12]</sup> The disadvantages include a tendency to propel the stone or fragmented stone toward the upper ureter and the flexible fibers may have some decline in force compared to standard rigid probes.<sup>[12,13]</sup>

### PATIENT AND METHODS

From February 2005 to January 2007, 60 consecutive patients underwent ureteroscopic pneumatic lithotripsy in the Urology

Department of Basrah General Hospital as inpatient procedures. Ten patients (16.7%) were referred from hospitals in the nearby provinces while the rest of the patients (83.3%) were seen in the Outpatient Urology Department of Basrah General Hospital and the private clinics. The age ranges from 17-52 years and the mean age was 30.8 years. Twenty five patients (41.7%) were females and 35 (58.3%) were males, 36 patients (60%) were harboring radiolucent ureteral stones while 24 patients (40%) were harbouring radio-opaque calculi. The stone sizes in the largest diameters range from 8mm to 15mm. Fourteen patients (23.3%) had upper, 16 (26.7%) middle and 30 patients (50%) lower ureteric stones. History and physical examination were performed. Laboratory investigations include renal function tests, urine analysis and in certain cases urine culture and sensitivity. Radiological and imaging studies were performed include ultrasonography (U/S), intravenous urography (I.V.U) and on occasions computerized tomography scan (CT scan). The procedure was performed under general anesthesia with patient in lithotomy position; we used 9 French Storz ureteroscope and CALCUSPLIT pneumatic lithotripsy.

**RESULTS**

The overall stone free rate for 14 patients with upper ureteric stones was (24.3%) (Table-1). In six patients with radio-opaque stone, the stone free rate achieved in 3 patients (50%) while residual stones were observed in 2 patients (33.3%) and a propulsion of the stone up to the kidney with failure of fragmentation occurred in 1 patient (16.7%). The stone free rate for the radiolucent stone (8 patients) was reached in 6 patients (75%) while residual stone were observed in 1 patient (12.5%) and a propulsion of the stone up to the kidney with failure of fragmentation occurred in 1 patient (12.5%).

**Table 1. The results of ureteroscopic lithotripsy of the stones in the upper ureter.**

Type of the stones	% Stone free	% Residual stones	% Missed stones
Radio-opaque	50	33.3	16.7
Radiolucent	75	12.5	12.5

In cases with midureteric stones (16 patients), the stone free rate for the radio-opaque stones (8 patients) was 75% including 2 patients in whom the stones were propelled up in the ureter; followed and fragmented. The residual stones were observed in 2 patients (25%). The stone free rate for radiolucent stones (8 patients) was 62.5%. The residual stones were observed in 3 patients (37.5%). The overall stone free rate for patients with midureteric stones was (68.75%). (Table-2)

**Table 2. The results of ureteroscopic lithotripsy of the stones in the mid ureter.**

Type of the stones	% Stone free	Residual stones%
Radio opaque	75	25
Radiolucent	62.5	37.5

Of the 30 patients with lower ureteric stones, 10 patients were harbored radio-opaque stones. The stone free rate of those patients was (60%) whereas, the residual stones were observed in 4 patients (40%). 20 patients were harboring radiolucent stones. The stone free rate was (85%) including 2 patients in whom the stones were propelled up in the ureter; followed and fragmented. Residual stones were observed in 3 patients (15%). The overall stone free rate for patients calculi was (76.6%). (Table-3).

**Table 3. The results of ureteroscopic lithotripsy of the stones in the lower ureter.**

Type of the stones	% stone free	Residual stones
Radio – opaque	60	40
Radiolucent	85	15

The overall stone free rate of ureteral calculi was 71.6%.

Ten patients out of the total number required placements of double J (DJ) stent due to large stone burden and missed stones. The migration rate of the ureteral stones was 11.66%.

## DISCUSSION

Transureteral lithotripsy has emerged as a popular and standard treatment modality for the management of ureteric calculi at all locations.<sup>[14]</sup> The stone free rate obtained with intracorporeal lithotriptors used in the treatment of ureteral stones differ throughout the literature. We believe that numbers, diameters, locations, types of stones, as well as energy sources used and the experience of endoscopist are responsible for these differences. The total stone free rate is defined as stones with diameters of 2mm or less.<sup>[15]</sup> The overall stone free rate obtained in this study (71.66%) was below the one that obtained by Shahid et al members of Armed Forces Institute of Urology in Pakistan (AFIU) (92%)<sup>[14]</sup> and Hussain et al from Ziauddin University and hospital, Karachi (87.9%)<sup>[16]</sup> and, also below the results obtained by Mareno et al; 64.3% versus 76.9% for the upper ureteric calculi, 68.75% versus 91.6% for the midureteric calculi and 76.6% versus 85.5% for the distal ureteric stones.<sup>[17]</sup> Also our results were below the results obtained by Akhtar et al from Lahore General Hospital, Pakistan 64.3% versus 71.1% for the upper ureteric stones; 68.75% versus 97% for the mid ureteric stones and 76.6% versus 99.1% for the lower ureteric stones.<sup>[18]</sup> Our results were better than the results obtained by Sun, et al from Department of Urology, Charaghai Hospital (69.7%).<sup>[19]</sup> We observed in this study that stone free rate for patients with radioluscent ureteral stones is better than for those with radio-opaque stones except for the midureteric stones. This observation can be explained by the fact that the calcium containing stones are radio-opaque and usually harder than the radioluscent stones like the uric acid stones which are considered to be the weakest stones. The residual stone rate (25%) was not only because of inefficiency of the lithoclast but also because the stone fragments became inaccessible due to their upward migration to the kidney. Poor vision and massive stone burden were also responsible for partial stone fragmentation and residual stones. Although our results were below most of the results in the literature, no perforation occurred in this study compared to 4.7%, 8.3% and 44% perforation rate in the lower, mid and upper ureters respectively obtained by Artur, et al from

University of Sao Paulo, Brazil.<sup>[20]</sup> The migration rate obtained in this study was approximately similar to that obtained by Kiper et al<sup>[15]</sup> (12% and 11.66%). The occurrence of migration can be explained by the presence of ureteral dilatation.

*In conclusion*, we conclude that ureteroscopic pneumatic lithotripsy found to be safe, cost effective mean of clearing ureteric calculi at all levels. It is well tolerated by the patient with short hospital stay. The reoccupation with lithotripsy usually takes only few days unlike the open surgery in addition to the possible wound complications.

*We recommend*, the use of intracorporeal ureteroscopic lithotripsy of ureteral stones as the procedure of choice to start with and the open ureterolithotomy as an alternative in cases of failure to achieve complete fragmentation and stone Free State. It is safe with short hospital stay.

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