

## Intracorporeal Pneumatic Lithotripsy for Treatment of Vesical Stone in Children

Dhia A. Kareem\*, Esam M. Abd\*\*

### ABSTRACT:

#### BACKGROUND :

Pediatric vesical stones constitute 30% of all urinary tract stones in the developing countries. Management of pediatric urolithiasis has evolved from open surgery to minimally invasive techniques

#### OBJECTIVE :

To evaluate the efficacy and safety of using pneumatic lithotripsy in the treatment of vesical stone in pediatric age group.

#### PATIENTS AND METHODS:

Forty children (2 female and 38 male) with bladder calculi were evaluated in this prospective study and managed by transurethral pneumatic cystolithotripsy at the department of urology in Al-Ramadi Teaching Hospital during the period January 2010 through December 2012. The age ranged between 2 years and 10 years with a mean age of 4.6 years. Bladder stone size ranged from 8mm to 17mm ,plain X-ray kidney, ureter and bladder (KUB) revealed that 28 patient's calculi were radiopaque and 12 patient's calculi were radiolucent , History and physical examination were performed. Laboratory investigations included complete blood count, blood urea, serum creatinine and urine analysis. Radiological examination included plain X-ray kidney, ureter and bladder (KUB) ,ultrasound and Excretory urogram (EU). transurethral pneumatic lithotripsy of bladder stone was done using semi rigid 9FR ureteroscope, after initial cystoscopy, Stone was fragmented with pneumatic lithoclast probe (3mm tip, storz). After completing the procedure 8-12 FR urethral Foley catheter was passed. Foley catheter was removed after 24-72 hours .

#### RESULT:

After one session of cystolithoclast, 92.5% (37) children became stone free. The mean operative time was 41.575 minutes with a range of (35-75 min).In this study the complications included significant hematuria in 5 patients (12.5%), urine retention in one patient (2.5%), and residual stone in 3 patients (7.5%) .

#### CONCLUSION:

Pneumatic lithotripsy using ureteroscope appears to be an effective and safe treatment method for bladder stone in children.

**KEY WORDS:** vesical stone, pneumatic lithotripsy, cystolithotripsy, urolithiasis.

### INTRODUCTION:

Urolithiasis in childhood is rare in developed countries , it represent 1-5% of all urinary tract stones while at the same time in the developing countries, pediatric vesical stones constitute 30% of all urinary tract stones <sup>(1)</sup>. Urolithiasis has been regarded as an uncommon conditions in children.<sup>(2)</sup>The incidence of urolithiasis in a given population is dependent on the geographic area,

racial distribution, and socio-economic status of the community. Changes in socio-economic conditions over time, and the subsequent changes in dietary habits, have affected not only the incidence but also the site and chemical composition of calculi. Renal and ureteric calculi mainly calcium oxalate and phosphate are currently more frequent in economically developed countries, whereas vesical calculi are fairly widespread in Asia, with calculi composed of ammonium urate and calcium oxalate.<sup>(3)</sup> Metabolic factors are more common in pediatric urolithiasis than in adult stone disease.<sup>(4)</sup> Management of pediatric urolithiasis has evolved

\*Ramadi Teaching Hospital, Department of Urology.

\*\* Ramadi Teaching Hospital, Department of Urology.

from open surgery to minimally invasive techniques. With advancements in instrumentation, endourological procedures are being performed more commonly in children. The majority of stones in children can be managed using minimally invasive techniques.<sup>(5)</sup> Transurethral pneumatic cystolithotripsy has proven quite effective in fragmenting large, hard bladder calculi with minimal tissue injury in adults, but its use in paediatric bladder calculi through the transurethral route is not well reported in literatures.<sup>(6,7)</sup> The pneumatic lithotripsy has ability to crack harder stones such as those composed of calcium monohydrate or cystine.<sup>(6,8,9)</sup>

### **PATIENTS AND METHODS:**

Forty children with bladder calculi were evaluated in this prospective study and managed by transurethral pneumatic cystolithotripsy at department of urology in

Al-Ramadi Teaching Hospital during the period January 2010 through December 2012. Their age, sex, addresses were noted. History and physical examination were<sup>(2)</sup> performed. Laboratory investigations included complete blood count, blood urea, serum creatinine and urine analysis. Radiological examination included plain X-ray kidney, ureter, bladder (KUB)(to assess the radio-opacity of the stone )

and was combined with ultrasound ( to assess the stone size and number ) and Excretory urogram (EU) to exclude other urological abnormalities and

consent from the parents had been taken. After pre-anesthetic evaluation these children were prepared for transurethral pneumatic lithotripsy of bladder stone using semirigid 9FR ureteroscope (storz). They were admitted 24 hours before operation. The procedure was done under general anesthesia in lithotomy position. Initial urethro-cystoscopy was performed using 8FR pediatric cystoscope (storz) to exclude stricture, posterior urethral valves and bladder neck obstruction. The stone was then visualized, size and number were assessed, bladder mucosa and shape of ureteric orifices were examined for any abnormality. After initial cystoscopy, 9FR semi rigid ureteroscope was passed, stone visualized. Stone was fragmented with pneumatic lithoclast probe (3mm tip, storz, figure 1). Large stone fragments (figure 2) were extracted by using forceps (storz). During fragmentation, normal saline was used as an irrigation fluid.

Stone free rate was defined intra-operatively at the end of the procedure by doing mapping of bladder for stone size more than 3 mm (by comparing the size of stone fragment with the tip of lithoclast probe) and post-operatively by repeating ultrasound and KUB after one week for residual stone fragments.

After completing the procedure, 8-12 FR urethral Foley catheter was passed into the urinary bladder . Post operatively ,these children were kept for 24 hours in the hospital. Foley catheter was removed after 24-72 hours following stone free plain X-rays (KUB) . Outpatient follow-up was advised.



**Figure 1: Pneumatic lithoclast probe.**



**Figure 2: Large Stone Fragments**

**RESULTS:**

During the period of study (January 2010-throughout December 2012), 40 children (2 female and 38 male ) with bladder calculi were treated with transurethral pneumatic cystolithotripsy. The youngest child was 2 years old and the oldest one was 10 years old with a mean age of 4.6 years. Bladder stone size ranged from 8 – 17mm (Table 1). KUB revealed that 28 patient's calculi were radio opaque and 12 patient's calculi were radiolucent (Table 2). After one session of cystolithoclast, 92.5% (37) children became stone free. The mean operative time was 41.575 minutes

with a range of (35-75 minutes).Foley catheters were removed after 24 hours in 9 patients (22.5%), 48 hours in 22 patients (55%), and after 72 hours in 9 patients (22.5%) (Table3).In this study complications included significant hematuria in 5 patients (12.5%), urine retention in one patient (2.5%), and residual stone in 3 patients (7.5%) (Table 4), which need additional procedure, moreover, two of our patients had more than one stone (the first had two stones and the other had three stones).

**Table 1: stone size range.**

Stone Size range	no. of stones	%
5 – 10 mm	9	21%
11 – 15 mm	29	67%
16 – 20 mm	5	12%

**Table 2: Stone appearance by KUB.**

KUB appearance	No. of patients	%
Radio-opaque	28	70 %
Radiolucent	12	30 %

**Table 3: Time of foley catheter removal.**

Time of removal	No. of patients	%
24 hr	9	22.5%
48 hr	22	55 %
72 hr	9	22.5%

**Table 4: Complications.**

Type of Complication	No. of patients	%
Significant Hematuria	5	12.5%
Urine Retention	1	2.5%
Residual Stone	3	7.5%
No Complication	31	77.5%

**DISCUSSION:**

Paediatric and adolescent urolithiasis can be associated with significant morbidity. Metabolic disorder, urological abnormalities and urinary tract infection (UTI) are all possible underlying causes for urinary stones among this age group.<sup>(10,11)</sup> The treatment options available for managing bladder stones in children include open cystolithotomy , percutaneous supra pubic cystolithotripsy (PSCL), extracorporeal shock wave lithotripsy (ESWL) and transurethral cystolithotripsy, there is no single device that is ideal for use in all situations. The availability of the equipment, financial resources

and level of experience of the surgeon are all factors that determine the method of intervention and choice of the technique used.<sup>(12)</sup> Nowadays , the management of urolithiasis in children has become more similar to that in adult patients, as the instrumentation, catheters, stents, and equipment used for stone manipulation improved and became smaller.<sup>(13)</sup>

In our study, cystolithotripsy was done for patients with a stone size less than 20 mm with a mean size of 12.7 mm (ranged from 8mm to 17 mm), procedure time varied according to stone size,

number and hardness. Moreover, no major complications were observed during the procedures. Though, acute retention was seen in one patient (2.5%) that was treated by re-catheterization for a further 2 days. Residual stone in 3 patients (7.5%) that could be due to hardness of stones (radiopaque stones) and/or development of significant hematuria that mandate procedure discontinuation in 5 patients (12.5%). The factors responsible for such a complication were mucosal edema and inflammation due to presence of vesical stone. Furthermore, it was enhanced by mucosal injury due to striking of the pneumatic probe. Bleeding was minor in most of cases and did not pose any problem during the procedure. The Lithoclast lithotripter is capable of fragmenting all urinary stones (including cystine stones) and to avoid mucosal injury it is important keep direct contact of the tip of the semirigid probe with the stone during the procedure<sup>(14)</sup>. In two distinct studies,<sup>(15,16)</sup> bladder stones have been broken with Swiss lithoclast and used ureteroscope, the authors have reported that ureteroscope itself is of narrow caliber and smooth hence it is safe and none of their patients have developed urethral stricture in accordance with above investigator we have also used ureteroscope and found it friendly with urethra and urethral injury had not developed in any of our patients. Our observation is well supported by Mishra *et al*<sup>(17)</sup> and Manic *et al*<sup>(18)</sup> who have reported their experience in comparison with suprapubic cystolithotripsy and transurethral cystolithotripsy and in favored the later because of stone burden is small. Further, our results are inconsistent with Salah *et al* who are favoring the suprapubic cystolithotripsy over transurethral litholopaxy to prevent trauma to urethra due to narrow caliber of urethra in children,<sup>(19)</sup> but the disadvantage in their study are that multiple and expensive instruments are required. The results obtained in our study are inconsistent with the results of Martin *et al* who were using expensive holmium-YAG laser lithotripter regarding good results with a low complication rate.<sup>(20)</sup> Although, more accessible instruments were used in our study. We used long ureteroscopes for the procedures in our patients. We did not have any difficulty with the length of the ureteroscopes that were used in our procedures. A short ureteroscope may be more useful for such cases. Stones size and their number are important factors in deciding on the proper type of intervention; in this study the stone size was < 20 mm, and as stone size and number increases,

more complications may be seen during the passage of stone fragments through the urethra. We adopted a policy where we first prepared and investigated the case and then advised admission. Therefore, hospital stays were merely a day in most of cases. Long-term follow-up was poor among our patients, and is a common finding in our community. General lack of health awareness and need to travel long distance for healthcare are important factors. Thus, it was difficult to convince stone free patients to make further visits to the hospital. It is conceivable that all of them achieved favorable results with no long term complications otherwise they certainly would have comeback. So before transurethral cystolithotripsy treatment, it is wise to advice the parents on the need for follow-up. This is especially important in our community.

#### CONCLUSION:

Pneumatic lithotripsy with the usage of ureteroscope appears to be an effective and safe treatment method for bladder stone in children. It is minimally invasive and involves reduced hospital stay and lower overall cost.

The likelihood of urethral trauma should be minimized by this treatment option. However, it can cause some problems in terms of spontaneous passage of stone fragments.

#### REFERENCES:

1. M.S.Ansari, Gatinder Kumar and ,Priyadarshi Ranja .Pediatric vesical stone. urolithiasis basic science and clinical practice. *springer verlag London* 2012;81:647-48.
2. Lawrence Copelovitch.Urolithiasis in Children. *pediatric clinics*. 2012; 59, Issue 4 : 881–96 .
3. Michelle López, Bernd Hoppe. History, epidemiology and regional diversities of urolithiasis .*Pediatric Nephrology* January 2010;25:49.
4. Ajay P.Sharma,Guido Filler . Epidemiology of pediatric urolithiasis .*Indian J Urol*.2010; 26:516-22.
5. Desai, Mahesh . Endoscopic management of stones in children. *Current Opinion in Urology*. March 2005;15 - Issue 2 :107–12.
6. Jiakai Zhu, Timothy M. Phillips, Ranjiv I. Mathews. Operative management of pediatric urolithiasis. *Indian J Urol*. 2010;26:536–43.
7. Faerber GJ. Pediatric urolithiasis. *Curr Opin Urol* 2001;11:385-89.
8. Denstedt JD, Eberwein PM, Singh RR. The Swiss Lithoclast: a new device for intracorporeal lithotripsy. *J Urol* 1992;148:1088-90.

9. Khosa AS, Hussain M, Hussain M. Safety and efficacy of transurethral pneumatic lithotripsy for bladder calculi in children. *JPMA* 2012;62:1297-300.
10. Thomas Knoll .Epidemiology, Pathogenesis, and Pathophysiology of Urolithiasis. *European urology supplements* 9 .2010: 802–6.
11. Lawrence Copelovitch. Urolithiasis in Children. *Pediatr Clin North Am.* 2012; 59: 881–96.
12. Papatsaries AG,Varkaris I,Dellis A, et al.Bladder lithiasis from open surgery to lithotripsy .*Urol Res* 2006;34:163.
13. Van Savage JD, Palanca LG, Anderson RD, et al. Treatment of distal ureteral stones in children: Similarities to the American urological association guideline in adults. *J Urol* 2000;164:1089.
14. J. HOFBAUER, K. HÖBARTH, and M. MARBERGER. Lithoclast: New and Inexpensive Mode of Intracorporeal Lithotripsy. *Journal of Endourology.* March 2009; 6:429-32.
15. Isen K, EM S, Kilic V, et al. Management of bladder stones with pneumatic lithotripsy using a ureteroscope in children. *J Endourol*, 2008;22:1037-40.
16. M.Hussain, M.Lal, S.sultan, et al. Transurethral pneumatic lithotripsy for endemic bladder calculi in children. *J Neph Urol Transp.* 2001;2:56-59.
17. Mishra SK, Ganpule A, Manohar.T, et al .Surgical management of pediatric urolithiasis.Indian. *J Urol* 2007;23:428-34.
18. Manick Ramalingam, Krishnasamy Selvarajan, Kallappan Senthil. A Novel technique of cystolithotripsy for large vesical calculi in children. *Ped Endo Innov Tech* 2003; 7:333-37.
19. Morshad A. Salah, Endre Holman, Munim Khan, et al. Percutaneous cystolithotomy for pediatric endemic bladder stone: experience with 155 cases from two developing countries.*J Pediatr Surg.* 2005;40:1628-31.
20. Arrabal MM, Noguerras OM, Arrabal PMA, et al. The treatment of bladder lithiasis with laser. *Arch Esp Urol* 2008;61:985-93.

