

ROLE OF PNEUMATIC LITHOTRIPSY IN PAEDIATRIC BLADDER STONES — “I WILL NOT CUT UPON STONE!”

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ABSTRACT

OBJECTIVE: To study the effectiveness and safety of pneumatic lithotripsy in paediatric bladder stone disease.

METHODOLOGY: This descriptive study was conducted at department of urology at institute of kidney diseases Hayatabad Peshawar from 01-01-2009 till 30-03-2013 on 120 children with bladder stones, selected by nonprobability convenient sampling technique. Stones in the bladder were fragmented by pneumatic lithotripsy using straight working channel paediatric cystoscope. All the pre-operative, per-operative and postoperative data was recorded on structured Proforma and was analyzed on SPSS version 17.

RESULTS: The mean age of the patients was 6.2 ± 2.03 years (range 3-12 years). The mean stone size was 14.1 ± 3.30 mm. Forty-five (37.5%) patients presented with crying while micturation and pulling of the penis, 40 (33.3%) patients with recurrent febrile urinary tract infection and 35 (29.2%) patients with acute urinary retention. Stone was completely fragmented in 97.5% (n=117) cases. Mean operative time was 27.5 ± 5.48 min (range 15-40 min) and the mean hospital stay was 1.23 ± 0.65 days (Range 1-3 days). Bladders stone were successfully fragmented with pneumatic lithoclast in 97.5% (n=117) of cases. The patients with failed procedure (2.5%) were subjected to formal vesicolithotomy in same setting. All the patients were completely stone free by 3rd post-operative day. Early complications were recorded in 12.5% (n=15/120) cases including mild haematuria (5%), pain in urethra (4.2%), febrile UTI (2.5%) and unable to void (0.8%). There was no urethral stricture recorded during 18 months of follow up.

CONCLUSIONS: Pneumatic lithotripsy is minimally invasive, effective and safe modality in management of paediatric bladder stone.

KEY WORDS: Urinary bladder stone, Pneumatic lithotripsy, Endourology, UTI

THIS ARTICLE MAY BE CITED AS: Ali L, Ali S, Shafieullah, Orakzai N. Role of pneumatic lithotripsy in paediatric bladder stones - “I will not cut upon stone!” *Khyber Med Univ J* 2014;6(2): 60-64.

INTRODUCTION

Urinary bladder stone formation is not a new phenomenon in medical literature. As a matter of fact the earliest description of bladder stones can be

traced in Hippocratic oath stating that “I will not cut for bladder stone, even for patients in whom the disease is manifest ...”^{1,2} The presence of stones in the urinary bladder is not common in most

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Date Submitted: January 27, 2014
Date Revised: March 19, 2014
Date Accepted: March 31, 2014

of the developed countries. However owing to poor nutritional status especially the vitamin A deficiency and prevailing infections, it is still a common ailment of suffering in developing world.^{3,4}

Pakistan lies in the stone belt, and paediatric urolithiasis is endemic in this region.⁵ The prevalence of urolithiasis in children ranges from 5-15 % in our part of world as compared to 1-5% in developed world⁶, and very amazingly urinary bladder stones contributes almost 50% of paediatric urolithiasis.^{6,7}

The management of bladder stone in adult is not a big issue, as development of endoscopic equipment in form of trans-urethral cystolitholapaxy for management of adult bladder stone has rendered open stone surgery almost obsolete with very few indications.^{8,9} But problem lies with management of paediatric bladder stone as small urethra of a child does not allow a 24 Fr stone punch sheath to be introduced in to the bladder. So currently, bladder stones in children are managed either by formal open vesicolithotomy or percutaneous cystolithotomy. But there is an issue that which modality is the best for treatment of paediatric bladder stones? The review of literature states both open and endourological management of urinary bladder stones in children are effective with lower complication rate. The supra pubic cystolithotomy offers a shorter hospital stay as compared to open surgery.¹⁰ However, open formal

vesicolithotomy is more safe than percutaneous cystolithotomy.¹¹ However both of procedures results in scar formation, prolong hospital stay, prolong catheterization, risk of surgical site infections and UTI.^{10,11}

The rationale of our paper lies in research question that is there any way to help the children with bladder stones with all the benefits of minimal invasive surgery characterized by short hospital stay or day case procedure, good stone clearance, no scar formation and minimal morbidity. Moreover, it is important that so far only few studies have been published on this topic.¹²⁻¹⁴ This study was planned to observe the effectiveness and safety of transurethral pneumatic lithotripsy in paediatric bladder stone disease.

METHODOLOGY

This descriptive study was conducted at department of urology, institute of kidney diseases Hayatabad Peshawar and department of Paediatric Kuwait teaching hospital, Peshawar Medical College from Jan 2009 till 31st March 2013 total number of 120 patients were collected by Non probability convenient sampling. We have included only bladder stones in children below 13 years irrespective of gender and we excluded the patients with meatal stenosis and urethral stricture. Complete history and examination along with Urine R/E, Urine C/S and estimation of urea and creatinine were carried out in all the patients. Our diagnostic tools for diagnosing bladder stones included X Ray KUB and ultrasound abdomen & pelvis. Pneumatic lithotripsy in all patients were carried out under general anesthesia. Cystourethroscopy was performed using paediatric Wolf straight working channel paediatric cystoscope in all the cases. The bladder stones were fragmented using pneumatic intracorporeal lithotripsy with Swiss lithoclast. Fragments of fragmented stones were removed by Elik's evacuator using 13 Fr Paediatric

resectoscope sheath. Paediatric urethral catheters were passed in selected patients with larger stone size and with risk of haematuria in the end of operation for 24 hours. Figures 1-5 are showing

various procedure related pictures. All the preoperative, intraoperative and post-operative data was recorded on structured proforma and was analyzed on SPSS version 17.



Figure no 1: X-Ray KUB showing Urinary bladder stone in a child



Figure 2: Operation trolley with related equipment for pneumatic lithotripsy

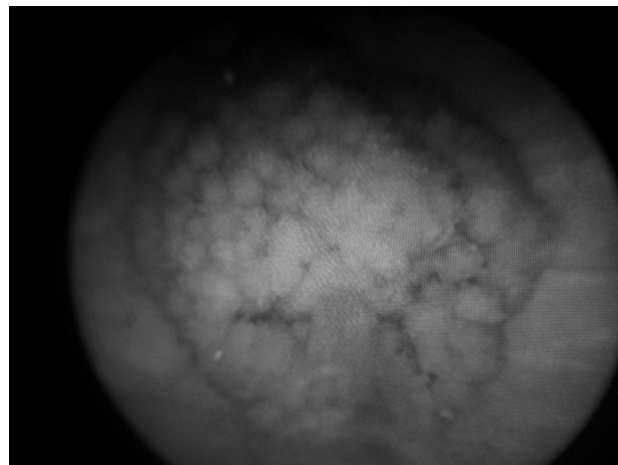


Figure 3: Bladder stone with probe of Swiss lithoclast on target

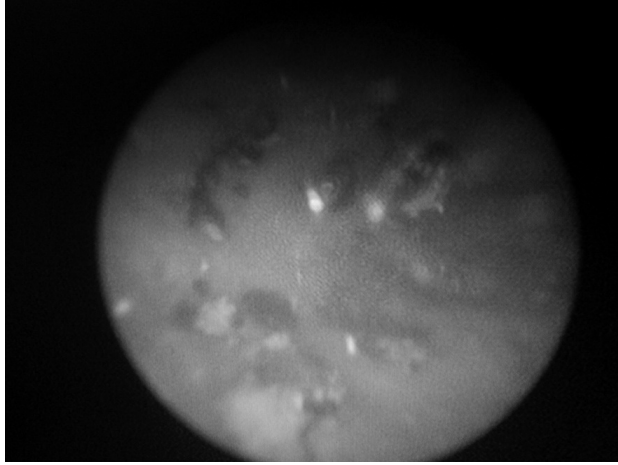


Figure 4: Stone has been fragmented with transurethral pneumatic lithotripsy

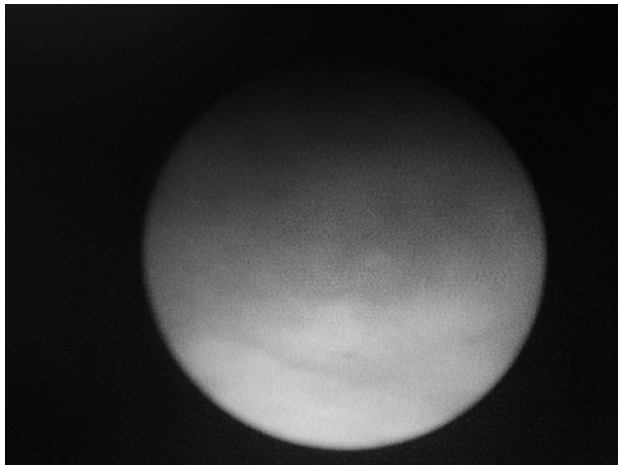


Figure 5 : Complete Stone clearance after procedure

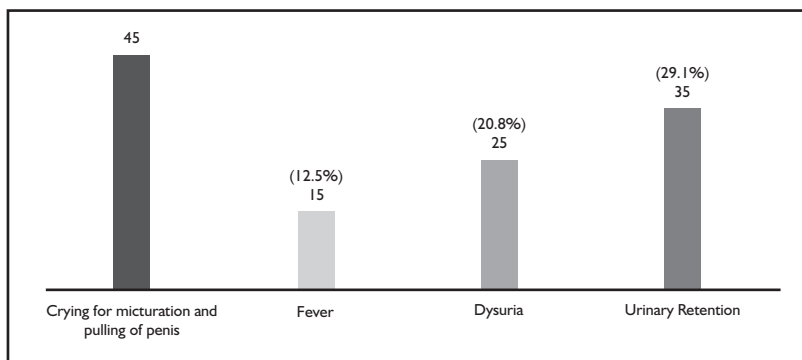


Figure 6: Bar graph showing various clinical presentations of paediatric bladder stones n= 120

RESULTS

Out of 120 patients, 90 (75%) were males and 30 (25%) were females. The mean age of the patients was 6.2 ± 2.03

years, with age ranging from 3-13 years.

Dysuria was commonly presenting symptom in older children while crying for micturation and pulling out their pe-

nises was common in younger children. Even the complications of paediatric bladder stone were also found in study population like acute urinary retention and febrile UTI. The details of clinical presentation is shown in figure 6.

The mean stone size on ultrasonography was 14.1 ± 3.30 mm with size ranging from 6-22 mm. The mean operation time, from positioning the patient until recovery of anesthesia, was 27.5 ± 5.48 minutes with range of 15-40 minutes. The procedure was performed mostly as day case, yet patients were treated as in- patients in situations especially like patients coming from far-flung areas or Afghanistan. The mean hospital stay was 1.23 ± 0.65 days (0-3days).

Bladders stone were successfully fragmented with pneumatic lithoclast in 97.5% (n= 117/120) of cases. The failed procedures (n=3; 2.5%) were due to increase stone size i.e. > 20mm and hardness. All patients with failed procedure (n=3; 2.5%) were subjected to formal vesicolithotomy in same setting.

Among 97.5% (n= 117) patients with successful fragmentation, postoperative catheterization was required in only 35 (30%) children for the median duration of 24 hours with range of (24-72 hours). Amazingly, there was no need of urethral catheterization in 70% (n=82) cases. Both the groups catheterized as well as non-catheterized were completely stone free by 3rd postoperative period.

Transurethral pneumatic lithotripsy was also found safe as we observed minor postoperative complications only 15 patients (12.5 %). The details of minor complications are shown in table no 1

Regarding the fate of different complications, mild haematuria was settled by 1st postoperative day requiring no blood transfusion. Three patients with febrile UTI became afebrile after 48 hours of culture specific antibiotics. One patient who was unable to void and was not

TABLE I: COMPLICATIONS OF TRANSURETHRAL PNEUMATIC LITHOTRIPSY IN PAEDIATRIC BLADDER STONES

Complication	Frequency (n= 120)	Percentage
Mild Haematuria	06	5%
Dysuria	05	4.2%
Febrile UTI	03	2.5%
Unable to void	01	0.8%
Total	15	12.5%

catheterized after surgery was catheterized for 36 hours. The trail of removal of catheter was successful with anti-inflammatory medicines like paracetamol, antibiotics. No major early postoperative complication like perforation of bladder, gross haematuria and urosepsis was recorded in our study. Moreover, with median follow up of 18 months of almost 85 (70.8%) patients; we have not recorded any late complication of urethral stricture and meatal stenosis. No peri-operative mortality was observed in our study.

DISCUSSION

Urinary bladder stone is a common ailment of developing world owing to poverty and malnutrition especially vitamin A deficiency. In addition to conventional open vesicolithotomy and percutaneous cystolithotomy, we have explored the third effective and safe modality in form of transurethral pneumatic lithotripsy in management of paediatric bladder stones.^{15,16}

The strength of our study that, is it is in fact one of the pioneer local studies with a larger sample size and a good follow up in our province and Punjab as so far only two studies have already recently published from province of Sind.^{7,8}

The limitation of our study is that we have discussed only one modality of transurethral pneumatic lithotripsy. Although mentioning the pros and cons of other two modality from literature, yet randomized control trials are required comparing all the modalities in determining their safety and efficacy.

Urinary bladder stone formation affects mainly the younger children and it's more common in boys. The mean age of the patients in different studies were ranging from 4.7 year to 7 years predominantly affecting male gender.^{7,13} Same observation was also present in our study with mean range of 6.2 years.

Fragmentation of bladder stone with pneumatic lithotripsy is relatively new phenomena rather innovation of an older technique of its use in ureteric and renal calculi¹⁷. It is also important to note that as bladder stone is rare in developed world so most of the studies are coming from third world countries.

The clinical presentation of urinary bladder stone is same in different studies; however most authors emphasize on crying during micturition and pulling out the penis as hall mark symptom of bladder stone in children.^{13,14} This was also noted in our study as crying and pulling the penises was present in 45 (37.5 %) patients.

Although there are very few studies on pneumatic lithotripsy in paediatric bladder stone, yet all studies proves that it is very effective in complete stone clearance ranging from 90-100%.^{13,14,17,18} This was also proved in our study as complete stone clearance was achieved in 97.5% of cases. Pneumatic lithotripsy in paediatric bladder stone is a minimal invasive procedure as it offers shorter hospital stay and can be offered as day case procedure. The mean hospital

stay in our study was 1.2 days that is in accordance with literature.^{13,14} It is also important to note that in our study, 82 (70%) did not required any catheterization in post-operative period thus minimizing chances of catheter associated urinary tract infection and prolong hospital stay. These observations are in accordance with literature.^{10,11,13,14}

Post-operative complication of pneumatic lithotripsy varied in different studies from 0-15%.¹⁴ However, all the studies recorded it in early post-operative complication and were of minor and transient nature. No significant morbidity and no mortality have so far been recorded in national and international literature.^{13, 17,18} In our study, the minor post-operative complication occurred in 15 (12.5 %) that although sounds bit on the higher side of range as compared to other studies. However, the critical analysis of those studies showed that the sample size of these studies was low as compared to our study.^{17,18}

Our study is implicated on paediatrician, general and paediatric urologist, general practitioners and general surgeons who are involved in management of paediatric urolithiasis.

As we have shared our experience of one newer procedure, yet further randomized control studies are desired to determine the safety and efficacy of three in fashion procedures i.e. pneumatic lithotripsy, supra pubic cystolitholapaxy and formal open vesicolithotomy.

CONCLUSION

Pneumatic lithotripsy in paediatric bladder stone is a newer technique and is minimally invasive, effective and safe modality in management of paediatric bladder stone. More randomized control trials are required to compare pneumatic lithotripsy with all other modalities in determining their safety and efficacy in managing paediatric vesical stones.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

LA: Conception and design, acquisition of data, drafting the manuscript, final approval of the version to be published

SA: Analysis and interpretation of data, drafting the manuscript, final approval of the version to be published

SH: Acquisition of data, analysis and interpretation of data, final approval of the version to be published

NO: Acquisition of data, critical revision, final approval of the version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE

NIL

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