

Safety and Efficacy of Transurethral Cystolithotripsy in Pediatric Population: A Single Center Study

TARIQ AHMAD¹, SOHAIL SHABBIR², MUSHTAQ AHMAD³, MUHAMMAD ASIF AMMAR⁴¹Assistant Professor Paediatric Urology Institute of Kidney Diseases Hayat abad Medical Complex Peshwar²Honorary SHO Urology, Shaikh Zayed Hospital³Registrar Institute of Kidney Diseases Hayat abad Medical Complex, Peshwar⁴Assistant Professor Urology, CMH Kharian Medical CollegeCorresponding author: Mushtaq Ahmad, Email: surgeon.mushtaq@gmail.com

ABSTRACT

Introduction: Bladder stone treatment in children is evolving rapidly. Vesicolithotomy has now been rarely used except in very large stone and even larger stones are treated with percutaneous cystolithotripsy, which is still more invasive compared with transurethral cystolithotripsy. We have evaluated a series of 150 case of bladder stone in children with this minimal approach through natural orifice i.e. urethra to assess its feasibility, efficacy and complications.

Objective: To assess the safety and efficacy of transurethral cystolithotripsy for bladder stone in pediatric population.

Material and Methods: This study was conducted in the Institute of Kidney Diseases and Transplant HMC Peshawar Pakistan from Jan 2020 to Apr 2022. A series of 150 patients were assessed with a mean age of 7.5+2.9 years and mean stone size of 11.2+3.6mm. Mean operative time was 28.1+ 5.8 minutes, mean hospital stay was 0.2+-1. A total of 89.33% of were treated as a day case. Two patients (1.3%) needed re-cystolithotripsy while in none of the cases were converted to open or PCCL. Postoperatively 16 (10.67%) patients developed Clavien grade 1 complications and 2(1.33%) patients developed Clavien grade III complication.

Conclusion: Trans-urethral cystolithotripsy is feasible and effective in pediatric population with acceptable clearance rate and low grade complication for stones up to 20 mm. However comparison with open method is needed.

Keywords: Bladder stone, Trans-urethral, Cystolithotripsy.

INTRODUCTION

The prevalence of the bladder stone has been reported 2 to 3% however it varies widely according to geographical location. (1,2,3,4) There is an increase in the incidence of bladder stone shown in the recent studies. (5) The stone can be primary formed in the bladder with normal function and no infection or it may be formed in anatomically or functionally abnormal bladder or it may be migratory from upper tract. [6]. Primary or endemic bladder stones occur in the absence of other urinary tract pathology, typically seen in children in areas with a diet deficient in animal protein, poor hydration and recurrent diarrhea [7]. There are different treatment options available for paediatric patients that range from conservative treatment to minimal invasive and open Vesicolithotomy. The minimal invasive procedures are per-urethral cystolithotripsy and percutaneous Vesicolithotomy. With advances in the field of surgery access through natural orifices are gaining popularity because of scarless surgery with minimal post-operative discomfort and shorter hospital stay. (8) In such case urologists are lucky that they have separate access to genitourinary system through urethra. Although percutaneous cystolithotripsy is a minimal invasive procedure as compare to Vesicolithotomy it is still more invasive than per-urethral approach. Open Vesicolithotomy and percutaneous cystolithotripsy not only violate the bladder wall but also needs extra tubes and there is also fear of urine leak and pelvic collection with sepsis. In contrary per-urethral cystolithotripsy does not need extra tube with no fear of urine leak only catheter needed that is for very short duration. Other advantage is less pain postoperatively and the procedure can be performed on day case basis. With recent advances in miniaturization of endoscopic equipments, access to the pediatric bladder is not a problem.

MATERIAL AND METHODS

This study was conducted from Jan 2020 to Apr 2022 in the Institute of Kidney Diseases and Transplant a tertiary care Hospital in KPK province Pakistan with the state of the art facilities for urologic and nephrologic patients. In this prospective study demographic and other parameters that were required entered in a proforma. Data analysis was done using IPSS software version 27. We include all pediatric age patients with bladder stone with a maximum size of 20 mm and excluded those with a larger stone size more than 20mm. A total of 150 paediatric age patients were

included in which male were 120 (80 %) and female were 30 (20%) with a ratio of 4:1. The mean age of the patient was 7.3 + 2.9 years. Stone size and number was assessed by ultrasound and plain x-ray KUB and in 15 cases where these investigations were equivocal or doubtful we performed CT KUB. The mean stone size was 11.2 + 3.6 mm. 98 (65.33%) patients had stones 5-10mm, 33 (22%) had 11-15mm and 19 (12.67%) had 16-20mm. Mean stone number was 1.3 + 0.6 (1-3). Majority of the patients 115 (76.67 %) had single stone, 23 (15.33%) had 2 stones and 12 (8%) had 3 stones. 115 (76.67%) patients had primary stones while 27 (18%) and 8 (5.8%) secondary and migratory stones respectively. The most common abnormality was neurogenic bladder which were found in 19 (12.6%) patients. Three patients (2%) had previous augmentation cystoplasty, 2 (1.33%) had bladder outflow obstruction and 3 (2%) had previous DJS in place. Majority of the patients 123 (82%) had no identifiable urinary tract abnormality. All these data shown in Table 1.

Table 1: Patient and Stone Characteristics

Characteristic	Result
N	150
Gender	
Male	120 (80 %)
Female	30 (20%)
Age (Years)	7.3 + 2.9
Stone Size (mm)	11.2 + 3.6
5-10 mm	98 (65.33 %)
11-15 mm	33 (22 %)
16-20 mm	19 (12.67 %)
Stone Number	1.3 + 0.6 (1-3)
1	115 (76.67 %)
2	23 (15.33%)
3	12 (8%)
Stone Origin	
Primary	115 (76.7 %)
Secondary	27 (18 %)
Migratory	8 (5.3%)
Associated Abnormality	
None	123 (82 %)
BOO	2 (1.33 %)
Neurogenic Bladder	19 (12.67 %)
DJS	3 (2 %)
Augmentation Cystoplasty	3 (2 %)

Mean operative time was 28.1 + 5.8 (20-53) while mean hospital stay was 0.2 + 0.8 (0-7) days. Majority of the patients 141 (94%) were done as a day cases where as 9(6%) patients needed hospital admission. Seven (4.6%) patients had one day stay while 26 (17.33%) had more than a day. Postoperatively 131(87.33) patients were catheterized with a mean catheter duration of 1.2 + 1.0 (0-7) day, out of which 105 (70%) patients' catheters were removed on the same day while 26 (17.33%) patients had being catheterized for more than day. Only 19 (12.67%) had no catheter in place. None of the patient had need conversion to open or PCCL however only 2 (1.33%) patients needed Re-Cystolithotripsy. Stone free rate was 148 (98.67%). Seven (4.6%) patients had suffered intraoperative complications out of which 5 (3.33%) had mild bleeding while 2 (1.33%) had patients suffered extra peritoneal bladder perforation. Sixteen (10.6%) patients suffered early postoperative complication with Clavien Grade I, that were postop fever, transient haematuria and pain urethra in 4 (2.67%),4 (2.67%) and 6 (4%) patients respectively. Only 2 (1.33%) patients suffered acute urinary retention that were classified as Clavien Grade III complication.(Table 2.)

Table 2: Perioperative and Postoperative characteristics of patients

Characteristic	Total
N	150
Operative Time (minutes)	28.1 + 5.8 (20-53)
Hospital Stay (days)	0.2 + 0.8 (0-7)
Day Case	141 (94%)
> 1 Day	9 (6%)
Catheter Duration	1.2 + 1.0 (0-7)
No Catheter	19 (12.67%)
< 1 Day	105 (70%)
> 1 Day	26 (17.33%)
Conversion Rate	0
Open Vesicolithotomy	0
PCCL	0
Stone Free Rate	148 (98.67%)
Additional Procedure	
Re-Cystolithotripsy	2 (1.33%)
Intraoperative Complications	7 (4.67%)
Mild Bleeding	5 (3.33%)
Extra peritoneal Bladder Perforation	2 (1.33%)
Early Postoperative Complications	16 (10.67%)
Clavien Grade I	
Postop Fever	4 (2.67%)
Transient Haematuria	4 (2.67%)
Pain Urethra	6 (4%)
Clavien Grade II	0
Clavien Grade III	
AUR	2 (1.33%)
Clavien Grade IV	0

DISCUSSION

Bladder stone is still very common in children in developing countries although its prevalence is decreasing in developed country due to improvement in children nutrition and care.(8) The most common cause of bladder stone in developing countries related to nutrition while in developed counties it is related to congenital lower urinary tract abnormality.(8) In our study 76.7% of children had developed primary bladder stone in anatomically and functionally normal lower urinary tract and 18% related to abnormal tract while only 5.3% stones were migratory. It shows that majority of these stones like in any other developing countries are mainly related to nutrition and standard of life. (9) Male children are more prone to developed these stones as female with short urethra rapidly wash the crystals from bladder and prevent their nucleation. In our study male to female ratio was 4:1 that correlates with the findings of La B et al and Ni YH et al. (10,11).

Different treatment modalities are available for treating bladder stone in children among these the endoscopic perurethral approach is considered cost effective with shorter hospital stay and less comorbidity. In our study 94% of patients were treated as a day case and only 6% patients stayed for a day or longer. Studies have shown that endoscopic procedure are more cost effective

due to shorter hospital stay.(12) In our study we have shown that endoscopic procedure can be offered as a day case in majority of cases which have not been shown by other studies. (13.)

The mean stone size in our study was 11.2 + 3.6 mm the maximum size of stone was 20 mm. Most studies recommend the maximum size of 20 to 25 mm.(14 15) The mean operative time we spend was 28.1 + 5.8 (20-53) minutes which is according to study done almost the same duration reported in the literature. (16) Majority of the patients (88%) were catheterized while 12% were not catheterized. Those who were catheterized, 70% of them were catheterized for less than a day. Most studies on transurethral cystolithotripsy whether using laser or pneumatic energy used perurethral catheter to avoid initial discomfort. (17,18).

In our study stone free rate was 98.6%. Same rate of clearance have been reported by different authorities. (19,20). In none of the case procedure needed conversion to open or PCCL while only two case 1.33% needed redo-perurethral cystolithotripsy. Mishra et al reported one case to PCCL and in one case needed redo-transurethral cystolithotripsy (21). We did not convert any case to open procedure it might be due the fact that we excluded stone size more than 20mm. Post-operative complications were developed in 10.6% case among this 9.3% developed Clavien grade I complications that were Postop Fever, Transient Hematuria and Pain in Urethra and only 1.33% developed Clavien grade III complication that was acute retention which needed catheterization. These complications were comparable to other studies while in some case we had even better out-come. (22, 23)

CONCLUSION

Transurethral endoscopic cystolithotripsy is safe and effective in treated bladder stone. However more study with larger stone different energy source and comparison with open procedure with longer duration of follow up is needed.

REFERENCES

- 1 Malek RS, Kelalis PP. Pediatric nephrolithiasis. J Urol. 1975 Apr;113(4):545-51.
- 2 Andersen DA (1962) The nutritional significance of primary bladder stones. Br J Urol 34:160-177
- 3 Rizvi SA, Naqvi SA, Hussain Z, Hashmi A, Hussain M, Zafar MN, Sultan S, Mehdi H (2003) Management of pediatric urolithiasis in Pakistan: experience with 1440 children. J Urol 169(2):634-637.
- 4 Loutfi AH, Haamid GA, Francis M, Salam IA (1972) Study of urinary tract calculi in Egyptian children. J Egypt Med Assoc 55:805-812
- 5 Shah J, Whitfield HN (2002) Urolithiasis through the ages. Br J Urol 89:801-810
- 6 Philippou P, Moraitis K, Masood J, Junaid I, Buchholz N. The management of bladder lithiasis in the modern era of endourology. Urology. 2012 May;79(5):980-6.
- 7 Soliman NA, Rizvi SAH. Endemic bladder calculi in children. Pediatr Nephrol. 2017 Sep;32(9):1489-1499.
- 8 Halstead SB. Epidemiology of bladder stone of children: precipitating events. Urolithiasis. 2016 Apr;44(2):101-8.
- 9 Loutfi A, Van Reen R, Abdel-Hamid G (1974) Studies on bladder stone disease in Egyptian children. V. Composition of bladder stones. J Egypt Med Assoc 57(3-4):124-136
- 10 Lal B, Paryani JP, Memon SU. Childhood bladder stones: an endemic disease of developing countries. J Ayub Med Coll Abbottabad 2015;27(1): 17-21
- 11 Ni YH, Tsau YK, Chen CH, Hsu TC, Lee JD, Tsai WS. Urolithiasis in children. Zhonghua Min Guo Xue Er Ke Yi Xue Hui Za Zhi. 1991 Jan-Feb;32(1):9-16.
- 12 Esposito C, Autorino G, Masieri L, Castagnetti M, Del Conte F, Coppola V, Cerulo M, Crocetto F, Escolino M. Minimally Invasive Management of Bladder Stones in Children. Front Pediatr. 2021 Jan 26;8:618756.
- 13 Gangkak G, Yadav SS, Tomar V, Vyas N, Jain D. Pneumatic cystolithotripsy versus holmium:YAG laser cystolithotripsy in the treatment of pediatric bladder stones: a prospective randomized study. Pediatr Surg Int. 2016 Jun;32(6):609-14.
- 14 Javanmard B, Karkan FM, Razzaghi MR, Ghiasy S, Ranjbar A, Rahavian A. Surgical management of vesical stones in children: a comparison between cystolithotomy, percutaneous cystolithotomy

- and transurethral cystolithotripsy with holmium-YAG laser. *J Laser Med Sci.* 2018; 9:183-8.
- 15 Zafar GM, Javed N, Humayun F, Iqbal A. Transurethral fragmentation of bladder stone in children: Our experience. *J Pediatr Adolesc Surg.* 2020; 1:32-36
- 16 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; 6:60-4
- 17 Mishra DK, Bhatt S, Mukhilesh R, Somani BK, Agrawal MS. Mini-percutaneous cystolithotripsy (mPCCL) versus transurethral cystolithotripsy (TUC) in pre-school children: Prospective comparative non-randomized outcomes over 8 years. *J Pediatr Urol.* 2020
- 18 Ramakrishnan PA, Medhat M, Al-Bulushi YH, Gopakumar KP, Sampige VP, Al-Busaidy SS. Holmium laser cystolithotripsy in children: initial experience. *Can J Urol.* 2005 Dec;12(6):2880-6.
- 19 Sakhaei S, Fallah-Karkan M, Razzaghi M, Kazemzadeh Azad B, Aliakbari F. Retrograde-Assisted Percutaneous Cystolitholapaxy Versus Transurethral Cystolithotripsy With Holmium-YAG Laser: A Retrospective Study. *J Lasers Med Sci.* 2019 Fall;10(Suppl 1):S54-S58
- 20 Aboulela W, ElSheemy MS, Shoukry AI, Shouman AM, ElShenoufy A, Daw K, Morsi HA, Badawy H. Transurethral Holmium Laser Cystolithotripsy in Children: Single Center Experience. *J Endourol.* 2015 Jun;29(6):661-5
- 21 Mishra DK, Bhatt S, Mukhilesh R, Somani BK, Agrawal MS. Mini-percutaneous cystolithotripsy (mPCCL) versus transurethral cystolithotripsy (TUC) in pre-school children: Prospective comparative non-randomized outcomes over 8 years. *J Pediatr Urol.* 2020
- 22 Gangkak G, Yadav SS, Tomar V, Vyas N, Jain D. Pneumatic cystolithotripsy versus holmium:yag laser cystolithotripsy in the treatment of pediatric bladder stones: a prospective randomized study. *Pediatr Surg Int.* 2016 Jun;32(6):609-14
- 23 Mahran MR, Dawaba MS. Cystolitholapaxy versus cystolithotomy in children. *J Endourol.* 2000 Jun;14(5):423-5; discussion 426.
- 24 Isen K, Em S, Kilic V, Utku V, Bogatekin S, Ergin H. Management of bladder stones with pneumatic lithotripsy using a ureteroscope in children. *J Endourol.* 2008 May;22(5):1037-40)