ORIGINAL ARTICLE

COMPARISON OF MINI-PERCUTANEOUS CYSTOLITHOTRIPSY AND TRANSURETHRAL CYSTOLITHOTRIPSY IN CHILDREN WITH BLADDER STONE

Imdad Ullah, Tariq Ahmad, Murad Ali, Syed Muhammad, Sajjad Ali, Ejaz Ullah

Department of Urology, Khyber Teaching Hospital, Peshawar, Pakistan

ABSTRACT

Objective: This study aims to compare mini-percutaneous cystolithotripsy and transurethral cystolithotripsy in children with bladder stones at our hospital.

Materials and Methods: A total of 84 patients were divided equally (42 in each group) into two groups (A and B) based on self-selection of stone size, and the type of management was decided by the researcher after clinical examination. Mini-percutaneous cystolithotripsy was performed on patients in Group A utilizing a mini-nephroscope and a 15 Fr access sheath. 4.5/6 Fr or 6/7.5 Fr pediatric ureteroscopes were used to treat transurethral cystolithotripsy in patients in Group B. A Holmium YAG laser was used to break apart the stone.

Results: Patients in group A had an average age of 8.38 ± 3.48 months, while those in group B were 8.30 ± 3.23 months old. Of the 84 patients, 49 (58.33%) were male and 35 (41.67%) were female, with a male-to-female ratio of 1.4:1. In my study, the mean operative time for group A (mini-percutaneous cystolithotripsy) was 31.43 ± 5.43 minutes, and for group B (transurethral cystolithotripsy), it was 39.52 ± 7.31 minutes, with a p-value of 0.0001.

Conclusion: PCCL allows for easier fragmentation, quicker extraction of larger bladder stone fragments, fewer urethral complications, and reduced operative time.

Keywords: Urinary bladder calculi, Lithotripsy, Operative time.

This article may be cited as: Ullah I, Ahmad T, Ali M, Muhammad S, Ali S, Ullah E. Comparison Of Mini-Percutaneous Cystolithotripsy And Transurethral Cystolithotripsy In Children With Bladder Stone. J Med Sci 2026 January - March;34(1):21-25

INTRODUCTION

Although bladder stones are not commonly found in young people, they pose specific challenges for diagnosis and treatment. [1] Although bladder stones are more frequently seen in adults, children can also develop these crystalline formations. In the evolving field of therapeutic options, two notable procedures have gained recognition for their effectiveness in treating bladder stones in children: mini-percutaneous cystolithotripsy. [2-4]

Mini-percutaneous cystolithotripsy is a less invasive method for removing bladder stones. This technique involves making a small incision in the lower abdomen and inserting a narrow-diameter nephroscope. [5] This enables direct visualization and feeling of the stones in the bladder. After examination, the stones are broken up using laser or ultrasonic energy, and the fragments are then removed by vacuum. [6]

A surgical technique called transurethral cystolithotripsy removes the need for external incisions by entering the bladder through the urethra. A cystoscope is inserted into the bladder via the urethra to perform this surgery. [7] The cystoscope is equipped with a lithotripsy tool, such as a laser or pneumatic lithotripter, which breaks the stones into smaller pieces. These smaller fragments can be expelled through urination or removed using a cystoscope. [8] For larger stones, mini-percutaneous cystolithotripsy is typically the best option because it provides rapid and direct access to the stone. [9] A less invasive approach suitable for small stones or when protecting the urethra is crucial is transurethral cystolithotripsy. [10] According to a study, children with bladder stones required an average of 33.5±8.42 minutes for mini-percutaneous cystolithotripsy and 38.2±6.76 minutes for transurethral cystolithotripsy. [11]

Given the limited local literature on the subject, the aim of this study is to compare transurethral and mini-percutaneous cystolithotripsy in children with bladder stones at our hospital. This comparison is expected to evolve as

Correspondence
Dr. Tariq Ahmed
Associate Professor
Department of Pediatric Urology, Khyber Teaching Hospital, Peshawar
Cell: +92-345-9228080
Email: drtariqurologistikd@gmail.com
Date Received: 23/12/2025
Date Revised: 24/03/2026
Date Accepted: 24/03/2026

technological and surgical advances continue, offering more sophisticated and tailored methods to address the specific challenges of bladder stones in children.

MATERIALS AND METHODS

The study included 84 patients (42 in each group) who presented to the Department of Urology, Khyber Teaching Hospital, Peshawar (from January 2025 to August 2025). The Sample size calculation is performed by the WHO sample size calculator with the help of the following assumptions: mean operative time in mini-percutaneous cystolithotripsy (33.5+8.42 min) in children with bladder stones, mean operative time in transurethral cystolithotripsy (38.2+6.76 min) in children with bladder stones, confidence level of 95%, and power of 80%. The determined sample size is 84 (42 in each group). [11] After obtaining approval from the hospital's ethics committee, research was initiated. The patients' guardians were given a brief explanation of the study's purpose and benefits, and reassured that there would be no risks associated with participating. Written informed consent was obtained from each patient's guardians.

Patients aged 1 to 12 months with urinary bladder stones (presenting with dark-colored or cloudy urine, hematuria, and dysuria) were included. Diagnosis was confirmed through ultrasound examination showing bright echoes within the bladder lumen and a shadow posteriorly. Patients with bladder dysfunction, outlet obstruction, or neurological defects were excluded.

A total of 84 patients were equally divided into two groups (42 each) (A and B) based on self-selection of stone size, and the researcher decided the management type after clinical examination.

Mini-percutaneous cystolithotripsy was performed on patients in Group A using a mini-nephroscope and a 15 Fr access sheath. After filling the bladder with saline, the first puncture was guided by ultrasound. A screw dilator was used for single-step dilation, and a 15 Fr access sheath was inserted into the bladder. The stone was fragmented with a mini-nephroscope, and the pieces were removed using the "vacuum-cleaner effect." Post-surgery, steri-strips were applied to dress the puncture site without sutures. No suprapubic catheter was inserted. All patients had a 6 or 8 Fr plain or Foley's urethral catheter placed for 24-hour drainage. For transurethral cystolithotripsy in Group B, 4.5/6 Fr or 6/7.5 Fr pediatric ureteroscopes were used. A Holmium YAG laser was employed to break the stones. The mean operative time was calculated as the period from the start to the end of the procedure, in minutes, for both groups.

IBM-SPSS v.27 software was used to analyze the data. Mean ± SD or Median (IQR) were determined for numerical variables. Frequencies and percentages were calculated for categorical data. Operational times for both groups were compared using the Mann-Whitney U test or the Independent Samples T-test, with a p-value of <0.05 considered significant.

RESULTS

The mean age was 8.87 ± 3.31 months. Patients in group A averaged 8.38 ± 3.48 months, while those in group B averaged 8.30 ± 3.23 months. Among 84 patients, 49 (58.33%) were male, and 35 (41.67%) were female, resulting in a male-to-female ratio of 1.4:1. The average stone size in group A was 8.90 ± 4.36 mm, compared to 8.88 ± 5.42 mm in group B. The mean hospital stay was 2.57 ± 1.11 days in group A and 2.61 ± 1.14 days in group B. Table 1 shows the distribution of various variables across both groups.

In my study, the mean operative time in group A (mini-percutaneous cystolithotripsy) was 31.43 ± 5.43 minutes, and in group B (transurethral cystolithotripsy) was 39.52 ± 7.31 minutes, with a p-value of 0.0001 (Table 2). Stratification of operative time based on age, gender, length of hospitalization, stone size, mother's education level, mother's employment status, socioeconomic status,

Table No 1: Distribution of different variables (n=84).

Variable	Group A (n = 42)	Group B (n = 42)
Age (months)		
1–6	18 (42.9%)	16 (38.1%)
7–12	24 (57.1%)	26 (61.9%)
Gender		
Male	23 (54.8%)	26 (61.9%)
Female	19 (45.2%)	16 (38.1%)
Stone size (mm)		
≤10	28 (66.7%)	27 (64.3%)
>10	14 (33.3%)	15 (35.7%)
Length of hospitalization (days)		
≤2	25 (59.5%)	29 (69.0%)
>2	17 (40.5%)	13 (31.0%)
Residence		
Rural	24 (57.1%)	26 (61.9%)
Urban	18 (42.9%)	16 (38.1%)
Socioeconomic status (SES)		
Poor	15 (35.7%)	16 (38.1%)
Middle	16 (38.1%)	13 (31.0%)
Upper	11 (26.2%)	13 (31.0%)
Mother's education		
Uneducated	23 (54.8%)	25 (59.5%)
Educated	19 (45.2%)	17 (40.5%)
Mother's occupation		
Unemployed	31 (73.8%)	33 (78.6%)
Employed	11 (26.2%)	9 (21.4%)

Table No 2: Comparison of mean operative time (n=84).

Variable	Group A (n = 42) Mean ± SD	Group B (n = 42) Mean ± SD	p-value
Operative time (minutes)	31.43 ± 5.43	39.52 ± 7.31	0.0001

Table No 3: Distribution of operative time based on age, gender, length of hospital stay, stone size, mother's education level, mother's occupation, socioeconomic status, and residence.

Variable	Group A (n = 42) Mean ± SD	Group B (n = 42) Mean ± SD	p-value
Age (months)			
1–6	32.78 ± 4.78	39.65 ± 6.95	0.0001
7–12	30.46 ± 5.71	40.21 ± 7.68	0.0001
Gender			
Male	31.89 ± 5.30	40.78 ± 6.78	0.0001
Female	32.68 ± 4.92	39.59 ± 7.43	0.0001
Stone size (mm)			
≤10	29.83 ± 6.12	38.56 ± 6.75	0.0001
>10	33.09 ± 4.68	40.34 ± 7.13	0.0001
Length of hospitalization (days)			
≤2	30.28 ± 6.19	37.32 ± 6.72	0.0001
>2	34.62 ± 5.36	41.17 ± 7.39	0.0001
Residence			
Rural	32.44 ± 5.60	39.89 ± 6.73	0.0001
Urban	31.26 ± 4.78	39.25 ± 7.09	0.0001
Socioeconomic status (SES)			
Poor	31.68 ± 4.79	38.43 ± 7.32	0.0001
Middle	32.58 ± 5.24	38.56 ± 6.75	0.0001
Upper	32.49 ± 5.76	40.34 ± 7.13	0.0001
Mother's education			
Uneducated	31.89 ± 5.56	39.59 ± 7.43	0.0001
Educated	31.22 ± 4.97	38.56 ± 6.75	0.0001
Mother's occupation			
Unemployed	32.25 ± 5.78	40.34 ± 7.13	0.0001
Employed	31.15 ± 5.52	37.32 ± 6.72	0.0001

and residence is shown in Table 3.

DISCUSSION

According to the current study, PCCL is faster and safer than TUCL, has a shorter operative time, and is associated with fewer urethral complications. The goal of all endoscopic procedures is to remove all stones as quickly as possible, with the fewest complications and a shorter hospital stay.

Aron M et al. claim that PCCL has lower morbidity than open cystolithotomy and fewer problems than TUCL. [12] Some studies suggest that in terms of safety and stone-free rate, PCCL is faster than TUCL and is not less effective. [13, 14] According to Tzortzis V et al., PCCL can be performed safely and efficiently under local anesthesia. It may also be useful when extended urethral instrumentation is not recommended. [15] According to Torricelli FC et al., bladder stones 2-4 cm in size respond equally well to percutaneous or transurethral approaches. [16]

In the current study, a mini-nephroscope and a 15 Fr access sheath were utilized. The stone was subsequently broken up and extracted. Demirel F et al. conducted a similar study.[17]

For this, Akmal M et al.[18] used a percutaneous procedure guided by ultrasound, with gradual dilation using dilators followed by an Amplatz sheath. In this work, we employed a percutaneous approach under direct cystoscopic guidance, followed by repeated dilatation and placement of an Amplatz sheath. The PCCL technique in this study had a significantly shorter mean operative time than the TUCL treatment. Similar results were reported by several other authors. [19-21]

The need for additional stone fragmentation to remove the stone in the TUCL group may have contributed to the lengthy surgical procedure due to the smaller lumen, decreased vision, and the potential for bladder mucosal damage. Lastly, the postoperative stay was considerably shorter in the TUCL group, whereas it was longer in the PCCL group due to suprapubic catheter placement.

The results mentioned above were statistically significant. Similar findings were reported by Karkee RJ et al., who found that the mean length of hospital stay for the TUCL group was 1.9±0.8 days, while the mean length of stay for the PCCL group was 2.7±0.9 days. [22] The results indicated that the operative time for PCCL was significantly shorter than that for TUCL in male children.

Additionally, this conclusion was corroborated by the complication incidence findings for the two surgical procedures, which indicated a higher incidence of urine retention following TUCL than PCCL. The study by Yağmur et al., which included preschool-aged children with bladder stones undergoing PCCL and TUCL, reported mean operative times of 41.1 ± 9.9 minutes and 39.0 ± 12.3 minutes for the PCCL and TUCL groups, respectively, which differ from our results. [23]

Another study by Shahat et al. indicated that children under 14 years old with a median stone size of 10 mm had shorter surgery times for PCCL. [24] Although there was no noticeable difference in the length of hospitalization between the two groups, we observed that patients treated with PCCL had a longer catheter retention period than those treated with TUCL.

By comparing the effectiveness of TUCL and PCCL

in children, this study offers important insights; however, it is essential to recognize the limitations inherent in our research. First, information bias could have resulted from the study's quasi-experimental design. Second, our small sample size may have affected the statistical power of the findings. This limitation might have introduced bias into our research, restricting how broadly the results can be generalized.

CONCLUSION

In PCCL, the wider lumen of the Amplantz sheath and the use of a nephroscope allow for easier fragmentation, better visibility, faster removal of even larger bladder stone fragments, fewer urethral-related complications, and a shorter operative time. Because of this, it appears to be a superior treatment for bladder stones compared to TUCL.

REFERENCES

1. Donaldson JF, Ruhayel Y, Skolarikos A, MacLennan S. Treatment of bladder stones in adults and children: a systematic review and meta-analysis on behalf of the European Association of Urology Urolithiasis Guideline Panel. Eur Urol. 2019;76(3):352-67. doi: 10.1016/j.eururo.2019.06.018.
2. Rehman MU, Rehman IU, Hayat N, Khalil J, Muhammad S, Ali S. Assessing the Efficacy and safety of minimally invasive versus open bladder stone removal in pediatric patients. J Saidu Med Coll. 2025;15(3):428-34. DOI: https://doi.org/10.52206/jsmc.2025.15.3.1203.
3. Davis NF, Donaldson JF, Shepherd R, Neisius A, Petrik A, Seitz C. Treatment outcomes of bladder stones in children with intact bladders in developing countries: A systematic review of >1000 cases on behalf of the European Association of Urology Bladder Stones Guideline panel. J Pediatr Urol. 2022;18(2):132-40. doi: 10.1016/j.jpurol.2022.01.007.
4. Ahmad T, Shabbir S, Ahmad M, Ammar MA. Safety and efficacy of transurethral cystolithotripsy in pediatric population: a single center study. Pak J Med Health Sci. 2022;16(10):766-9. DOI: https://doi.org/10.53350/pjmhs221610766.
5. Hussain I, Qureshi MF, Kanjoo SR, Rashid A. Comparison of percutaneous cystolitholepexy with vesicolithotomy in peadiatric age group for safety and efficacy. Professional Med J. 2020; 27(8):1742-46. https://doi.org/10.29309/TPMJ/2020.27.08.4130.
6. Fonseka T, Melchionna A, De Luyk N, Arumuham V, Noah AO, Choong S. 14f super-mini percutaneous cystolitholapaxy: a novel technique in the treatment of bladder stones. J Endourol. 2023;37(4):422-7. doi: 10.1089/end.2022.0697.
7. Yıldız A, Anıl H, Erol İ, Karamık K, Erçil H. Comparison of three different modalities for the treatment of bladder calculi by size. Urologia. 2022-89:413–7. doi: 10.1177/03915603211020469.
8. Carmen Tong CM, Ellison JS, Tasian GE. Pediatric stone disease: current trends and future directions. Urologic Clin North Am. 2023-50:465–47. doi: 10.1016/j.ucl.2023.04.009.
9. Isik G, Bozdag PG. Why is childhood urolithiasis increasing? Etiology, diagnosis and management: a single-center experience. J Nephrol. 2023-36:1599–604. doi: 10.1007/s40620-023-01638-4.
10. Piskin MM, Ozkent MS, Kilinc MT, Goger YE, Sonmez MG, Balasar M. Which endoscopic methods in prepubertal patients with 10–20 mm bladder stones: transurethral cystolithotripsy or percutaneous cystolithotripsy? J Endourology/Endourological Soc. 2021-35:1818–23. doi: 10.1089/end.2021.0269.
11. 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;16(6):782-5. doi: 10.1016/j.jpurol.2020.09.021.
12. Aron M, Agarwal MS, Goel A. Comparison of percutaneous with transurethral cystolithotripsy in patients with large prostates and large vesical calculi undergoing simultaneous transurethral prostatectomy. BJU Int. 2003;91(3):293-95. doi: 10.1046/j.1464-410x.2003.04065.x.
13. Camacho-Trejo VF, Aragón-Tovar AR, Sánchez-Puente JC, Castillo-González JM, Vargas-Valtierra P. Percutaneous treatment of bladder lithiasis: Comparison of two surgical techniques. Rev Mex Urol. 2008;68:318-23.
14. Deliktas H, Sahin H, Cullu N, Erdogan O. A modified technique for performing transurethral resection of the prostate combined with percutaneous cystolithotripsy. Urol Int. 2015;95(3):276-80. doi: 10.1159/000437213.
15. Tzortzis V, Aravantinos E, Karatzas A, Mitsogiannis IC, Moutzouris G, Melekos MD. Percutaneous suprapubic cystolithotripsy under local anesthesia. Urol. 2006;68(1):38-41. doi: 10.1016/j.urology.2006.01.073.
16. Torricelli FC, Mazzucchi E, Danilovic A, Coelho RF, Srougi M. Surgical management of bladder stones: Literature review. Rev Col Bras Cir. 2013;40(3):227-33. doi: 10.1590/s0100-69912013000300011.
17. Demirel F, Cakan M, Yalçinkaya F, Demirel AC, Aygün A, Altug˘ UU. Percutaneous suprapubic cystolithotripsy approach: For whom? Why? J Endourol. 2006;20(6):429-31. doi: 10.1089/end.2006.20.429.
18. Akmal M, Munir M, Jafari A, Subhani G, Javed S. Percutaneous cystolithotripsy; is it safe and successful in all age groups? Annals Punjab Med Coll. 2017;11(1):25-27. DOI: https://doi.org/10.29054/apmc/2017.240.
19. Bhatti MS, Khuhro AQ, Brohi IB. Vesical stone management by percutaneous cystolitholapexy versus open vesicolithotomy among children. Professional Med J. 2021; 28(12):1742-46. https://doi.org/10.29309/TPMJ/2021.28.12.6419.
20. Karkee RJ, Chaudhary S, Kafle A, Sarraf DP. An institutional review of endoscopic and open technique in the management of vesical calculus: A retrospective study. Int Surg J. 2022;9(11):1780-83. DOI: https://doi.org/10.18203/2349-2902.isj20222645.
21. 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;10(Suppl 1):S54-S58. doi: 10.15171/jlms.2019.S10.

22. Abd ZH, Muter SA. Comparison of the safety and efficacy of laser versus pneumatic intracorporeal lithotripsy for treatment of bladder stones in children. J Clin Med. 2022-11:513. doi: 10.3390/jcm11030513.

23. Yağmur İ, Demir M, Katı B, Pelit ES, Ördek E, Çiftçi H. Comparison of two different minimally invasive techniques used in bladder stone surgery for preschool-aged children. Turkish J Med Sci. 2022-52:1274–80. doi: 10.55730/1300-0144.5433.

24. Shahat AA, Kamel AA, Taha TM, Abonnoor AEI, Reda A, Faddan AA, et al. A randomised trial comparing transurethral to percutaneous cystolithotripsy in boys. BJU Int. 2022-130:254–61. doi: 10.1111/bju.15693.

CONFLICT OF INTEREST: Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE: NIL

Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Ullah I	✓	✓	×	×	✓	×
Ahmad T	✓	×	✓	✓	✓	×
Ali M	✓	✓	×	×	×	✓
Muhammad S	✓	×	✓	✓	✓	×
Ali S	✓	✓	×	×	×	✓
Ullah E	✓	×	✓	✓	✓	×

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.

Ethical Approval:

This Manuscript was approved by the Ethical Review Board of Khyber Teaching Hospital, Peshawar Vide No. 429/DME/KMC Dated: 30/05/2024