

Original Article

# Frequency of complications of transurethral pneumatic lithotripsy in pediatric bladder stone disease.

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## Abstract

**Background:** Despite advancements, underdeveloped countries continue to face the burden of widespread illness causing pain, often attributed to factors like low nutrition and recurring infections, particularly vitamin A deficiency.

**Methodology:** This descriptive study employing a non-probability convenient sampling technique was conducted at the Urology Department of Lady Reading Hospital, Peshawar. The investigation spanned six months from January 25, 2019, to June 25, 2019. The study encompassed a cohort of 369 patients, each subjected to comprehensive urine tests and detailed history and physical examinations. Procedures were performed under general anesthesia, utilizing Pediatric URS and pneumatic intracorporeal lithotripsy with Swiss lithoclast for bladder stone treatment. A 48-hour post-treatment observation period assessed common intraoperative and postoperative consequences of transurethral pneumatic lithotripsy, including hematuria, bladder perforation, acute urine retention, and fever.

**Results:** Among the participants, 32% were female, and 68% were male. Notably, 5% experienced bladder perforation, 7% had hematuria, 4% exhibited acute urinary retention, and 7% presented with fever.

**Conclusion:** This study highlights complications of transurethral pneumatic lithotripsy in pediatric bladder stone disease, including bladder perforation, hematuria, acute urinary retention, and fever, providing crucial insights for clinical decisions.

## Keywords

Complications, Transurethral Pneumatic Lithotripsy, Pediatric Bladder Stone Diseases, Bladder Perforation, Fever.



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## Introduction

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The history of urinary bladder stones dates back to ancient times, with the Hippocratic Oath containing the earliest mention of this condition<sup>1</sup>. While bladder stones are rare in many Western nations, they remain a significant concern in economically disadvantaged regions due to factors like malnutrition, particularly Vitamin A deficiency, and widespread infections<sup>2,3</sup>. Pakistan falls within an area known for such conditions, where pediatric urolithiasis is prevalent. In our region, 5-15% of children are affected by urolithiasis, in stark contrast to 1-5% in developed countries<sup>4,5</sup>.

Remarkably, pediatric urolithiasis often involves urinary bladder stones, constituting over 50% of cases. Unlike the scenario in adult cases, advancements in endoscopic techniques have mitigated concerns in adult bladder stone management<sup>6</sup>. However, treating pediatric bladder stones is more complex due to anatomical factors. This study aims to address the effectiveness of transurethral pneumatic lithotripsy, a novel technique utilizing a pediatric cystoscope with a straight working channel, in treating pediatric bladder stone disease. This investigation is particularly relevant given the lack of similar recent studies in our community and seeks to fill this gap by assessing the complications associated with this treatment approach.

In the realm of pediatric bladder stone therapy, conventional approaches like percutaneous cystolithotomy and open vesicolithotomy have been employed due to challenges posed by children's narrow urethra. Literature reviews suggest that both open surgery and endourology are effective and have relatively low complication risks<sup>7-9</sup>. However, the existing methods often lead to longer hospital stays, catheterization periods, and elevated risks of UTIs and surgical site infections<sup>1</sup>. Various techniques, such as extracorporeal shock wave lithotripsy, transurethral cystolithotripsy, and percutaneous cystolithotripsy, boast success rates ranging from 75 to 100%<sup>10</sup>. Notably, complications in pediatric bladder stone disease involving transurethral pneumatic lithotripsy have been documented, including

hematuria, post-operative fever, urinary retention, and bladder perforations.

This study intends to shed light on a relatively unexplored facet of pediatric bladder stone disease treatment, considering the diverse circumstances of our community. The central hypothesis posits that transurethral pneumatic lithotripsy, leveraging a pediatric cystoscope with a straight working channel, represents a significant advancement in this field. By conducting this research, we aim to provide up-to-date insights into the prevalence of complications associated with transurethral pneumatic lithotripsy in pediatric bladder stone disease. This investigation is particularly significant as there has been no parallel study conducted in our community over the past five years. Furthermore, the findings from this study are expected to be valuable for healthcare professionals and serve as a basis for future research endeavors. The ultimate goal is to enhance the understanding of complications arising from transurethral pneumatic lithotripsy in the context of pediatric bladder stone disease.

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## Methodology

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### Study Design

This was a descriptive study conducted at the Urology Department and the study spanned a duration of 6 months, from January 25, 2019, to June 25, 2019.

### Setting

The research was carried out at the Department of Urology, Lady Reading Hospital, Peshawar, Pakistan.

### Study Size

The study included a total of 369 incidents of urinary retention, selected through non-probability convenient sampling. With a confidence interval of 95% and a margin of error of 2%.

### Ethical Consideration

The study was conducted following approval from the hospital's ethical committee. Informed written consent was obtained from the parents or guardians of the pediatric patients.

### Participants

The inclusion criteria consisted of patients of both genders, aged 5 to 13 years, presenting with bladder stones ranging from 6 to 20mm. Patients with a history of febrile urinary tract infections (UTIs), small caliber urethra, and parents unwilling to participate were excluded.

### Variables

Variables recorded included age, gender, stone size, bladder anomaly, consistency of stone, and common complications of transurethral pneumatic lithotripsy (hematuria, bladder perforation, acute urinary retention, fever).

### Data Sources/Measurement

Complete history and examination were conducted for all patients. Additionally, urine routine examination, urine culture and sensitivity, and estimation of urea and creatinine were carried out. Diagnostic tools for bladder stone detection included X-ray kidney, ureter, and bladder, as well as ultrasound of the abdomen and pelvis. All procedures were performed under general anesthesia. Cystourethroscopy was conducted using a pediatric Wolf straight working channel cystoscope. Bladder stones were treated using pediatric URS and pneumatic intracorporeal lithotripsy with the Swiss lithoclast. Fragments of stones were removed using pediatric cystoscope and stone removal forceps. Pediatric urethral catheters were placed in selected patients with larger stones or a risk of hematuria post-operation, to remain for 24 hours.

### Statistical Methods

Data analysis was conducted using SPSS 22. Frequencies and percentages were calculated for

categorical variables such as gender, bladder anomaly, consistency of stone, and common complications of transurethral pneumatic lithotripsy.

Common complications were stratified based on age, gender, stone size, bladder anomaly, and stone consistency to assess potential effect modifications. Post-stratification chi-square test was applied, considering a significant value as  $P \leq 0.05$ .

## Results

In this study, the 369 patients were categorized into three distinct age groups: 5-7 years (192 patients, 52%), 8-10 years (103 patients, 28%), and 11-13 years (74 patients, 20%). The median age, was 7 years, accompanied by a standard deviation of 8.43. Gender analysis within the cohort revealed that out of the 369 patients, 251 (68%) were male, and 118 (32%) were female.

Analysis of stone sizes among the 369 patients unveiled that the mean stone size stood at  $10.0 \pm 5.77$  mm. Additionally, the presence of bladder anomalies was observed in 30 patients (8%), while the majority, i.e., 339 patients (92%), did not present any bladder anomalies.

Further exploration of stone consistency indicated that among the 369 patients, 314 (85%) displayed soft stone consistency, while 55 patients (15%) exhibited hard stone consistency. Turning to common complications, the study identified prevalent issues such as bladder perforation (18% of patients), hematuria (27% of patients), acute urinary retention (15%), and fever (27% of patients).

**Table 1: Patient's Baseline Characteristics.**

Variables	n(%)	
Age	5-7 years	192(52.03)
	8-10 years	103(27.91)
	11-13 years	74(20.05)
Gender	Male	251(68.02)
	Female	118(31.97)

<b>Stone Size</b>	6-10 mm	111(30.08)
	11-15 mm	170(46.07)
	16-20 mm	88(23.84)
<b>Consistency Of Stone</b>	Soft	314(85.09)
	Hard	55(14.90)
<b>Bladder Anomaly</b>	Yes	30(8.13)
	No	339(91.87)
<b>Common Complications</b>	Bladder Perforation	18(4.87)
	Hematuria	26(7.04)
	Acute urinary retention	15(4.06)
	Fever	26(7.04)

**Table 2: Stratification of common complications w.r.t patient's characteristics.**

Variables	Bladder Perforation		Hematuria		Acute urinary retention		Fever		
	Yes	No	Yes	No	Yes	No	Yes	No	
<b>Age</b>	5-7 years	9(50.00)	183(52.14)	14(53.85)	178(51.90)	8(53.33)	184(51.98)	14(53.85)	178(51.90)
	8-10 years	5(27.78)	98(27.92)	7(26.92)	96(27.99)	4(26.67)	99(27.97)	7(26.92)	96(27.99)
	11-13 years	4(22.22)	70(19.94)	5(19.23)	69(20.12)	3(20.00)	71(20.06)	5(19.23)	69(20.12)
	p-value	0.97		0.98		0.99		0.98	
<b>Gender</b>	Male	12(66.67)	239(68.09)	18(69.23)	233(67.93)	10(66.67)	241(68.08)	18(69.23)	233(67.93)
	Female	6(33.33)	112(31.91)	8(30.77)	110(32.07)	5(33.33)	113(31.92)	8(30.77)	110(32.07)
	p-value	0.89		0.89		0.90		0.89	
<b>Stone Size</b>	6-10 mm	5(27.78)	106(30.20)	5(27.78)	103(30.03)	5(33.33)	106(29.94)	8(30.77)	103(30.03)
	11-15 mm	8(44.44)	162(46.15)	12(46.15)	158(46.06)	7(46.67)	163(46.05)	12(46.15)	158(46.06)
	16-20 mm	5(27.78)	83(23.65)	6(23.08)	82(23.91)	3(20.00)	85(24.01)	6(23.08)	82(23.91)
	p-value	0.92		0.99		0.92		0.99	
<b>Bladder Anomaly</b>	Yes	1(5.56)	29(8.26)	2(7.69)	28(8.16)	1(6.67)	29(8.19)	2(7.69)	28(8.16)
	No	17(94.44)	322(91.74)	24(92.31)	315(91.84)	14(93.33)	325(91.81)	24(92.31)	315(91.84)
	p-value	0.68		0.93		0.83		0.93	
<b>Stone Consistency</b>	Soft	15(83.33)	299(85.19)	22(84.62)	292(85.13)	13(86.67)	301(85.03)	22(84.62)	292(85.13)
	Hard	3(16.67)	52(14.81)	4(15.38)	51(14.87)	2(13.33)	53(14.97)	4(15.38)	51(14.87)
	p-value	0.82		0.94		0.86		0.94	

## Discussion

Urinary bladder stones constitute a prevalent health issue in underdeveloped nations, primarily driven by poverty and malnutrition, notably vitamin A deficiency<sup>5</sup>. This study aimed to assess the viability of transurethral pneumatic lithotripsy as a secure and effective alternative for treating juvenile bladder stones, alongside percutaneous cystolithotomy and open vesicolithotomy. Across multiple investigations, postoperative complication rates for pneumatic lithotripsy ranged from 0 to

15%, with transient and minor early postoperative effects. The literature, both national and international, hasn't reported significant morbidity or mortality associated with this procedure. In our study, a mild postoperative complication rate of 13% was observed, somewhat higher than earlier reports, likely attributed to our larger sample size.

Studies exploring different treatment methods for pediatric bladder stones yielded varying success rates. Open surgery boasted a success rate of 100%, percutaneous cystolithotripsy ranged from

89% to 100%, transurethral cystolithotripsy ranged from 63% to 100%, and extracorporeal shock wave lithotripsy demonstrated rates of 75% to 100%<sup>11</sup>. However, complications, though infrequent, can arise following procedures like transurethral pneumatic lithotripsy. In this context, complications affecting up to 10% of individuals included hematuria (10%), post-operative fever (5%), urinary retention (4%), and urinary bladder perforation (7.3%)<sup>12</sup>. Comparable results from other research projects further underline the prevalence of these complications.

Drawing comparisons with other studies adds depth to our findings. For instance, a study in Karachi reported an average age of 3.3 to 4.95 years, with a 5:1 male-to-female ratio<sup>9</sup>. Meanwhile, another study documented an average patient age of 6.2 years, and treatment success rates as high as 97.5%<sup>7</sup>. Complications were mild, encompassing issues like hematuria, urethral pain, febrile UTIs, and difficulty in urination. However, this current study has its limitations. One significant limitation is the absence of long-term follow-up data to assess potential late complications or outcomes beyond the immediate postoperative period. Additionally, the study's single-center nature might limit its generalizability to other settings.

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## Limitations

Despite its contributions, this study is not without limitations. Long-term follow-up data beyond the immediate postoperative period were not collected, potentially preventing the assessment of late complications or extended treatment outcomes. Furthermore, the study's confinement to a single center might restrict its broader applicability to diverse healthcare settings and patient populations. These limitations underline the need for further research encompassing a wider scope and extended observation periods.

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## Conclusion

In conclusion, our study underscores the frequency of complications associated with transurethral pneumatic lithotripsy in the realm of pediatric bladder stone disease. Notably, bladder

perforation occurred in 5% of cases, hematuria in 7%, acute urinary retention in 4%, and fever in 7%. These findings shed light on the potential risks and challenges inherent in this treatment approach for pediatric bladder stone disease, contributing to a more comprehensive understanding of its outcomes and aiding in informed clinical decision-making.

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## Conflicts of Interest

Authors declared no conflict of interest.

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