


Holmium-YAG Laser Cystolithotripsy for Bladder Stone in Children

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Abstract

Introduction: Bladder stones are endemic in developing countries, transurethral cystolithotripsy, open cystolithotomy and percutaneous suprapubic cystolithotripsy are the modalities of treatment. Ho:YAG lasers are widely used recently for pediatric bladder stones with development of pediatric ureteroscopes and cystoscopes. Hence this study is done to evaluate the efficacy, safety and morbidities of holmium laser lithotripsy for bladder stones in children.

Materials and Methods: This prospective study was conducted in our institute over a period of 5 years. All children under18 years who underwent transurethral laser cystolithotripsy were included in the study. 9.5 Fr cystoscopes were used for transurethral cystolithotripsy. The stone was fragmented to 2-3 mm in size in all with Holmium YAG laser. Demographic data, clinical features, stone size, outcome and complications were recorded.

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Keywords

- Bladder stone
- Children
- Holmium-YAG laser
- Cystolithotripsy

Results: Total of 32 children underwent transurethral laser cystolithotripsy for bladder stone during the period of study. Mean age were 8.7 ± 5.3 years. The most common presenting symptom was difficulty in micturition, which occurred in 15 children (46.9 %). Stone sizes ranged from 5 to 60 mm with mean 20.48 ± 12.9 mm. The operating time was 35 minutes with the range of 15–55 minutes. Complications were seen in 28.1% children among which hematuria was common seen in 18.8% children.

Conclusion: Laser cystolithotripsy is effective and safe with less morbidity for management of bladder stones on children.

Introduction

Bladder stones account for 5% of all urinary calculi. However, offspring of families with low socioeconomic status face higher risk.¹ Bladder calculi are endemic in developing countries such as those in Southeast Asia and India.^{2,3}

The etiology of primary bladder stones in children is either idiopathic or related to late weaning and nutritional deficiency with diet low in animal proteins, which consists mainly of cereals. Other factors include dehydration and a dietary phosphate deficiency. Some patients may have associated secondary causes like urinary tract anomalies, metabolic derangements, neurological diseases, voiding dysfunction, foreign bodies, urethral strictures, posterior urethral valve and vesicoureteral reflux.^{4,5}

Although the best option for managing these patients is surgery and open cystolithotomy is considered as the gold

standard with high stone-free rate.⁶⁻

⁸ During the past decade, minimally invasive techniques have largely replaced open surgeries in management of bladder stones.⁹⁻¹¹

The other types of treatment available for bladder stones in children include extracorporeal shockwave lithotripsy, transurethral cystolithotripsy, open cystolithotomy and percutaneous suprapubic cystolithotripsy. The treatment of pediatric bladder stones has changed radically with the development of pediatric ureteroscopes and cystoscopes and the widespread application of the Ho:YAG laser.¹⁰⁻¹²

We performed this prospective study to evaluate the efficacy, safety and morbidities of holmium laser lithotripsy for bladder stones in children.

Material and Methods

This prospective study was conducted in

our institute over a period of 5 years since June 2016 till May 2021. All children under 18 years who had presented with symptoms of bladder stones with confirmed bladder stone on plain abdominal radiography **Figure 1** or ultrasonogram **Figure 2** and underwent transurethral laser cystolithotripsy, were

included in the study. The indication for transurethral cystolithotripsy was stone size > 5mm. Patients who had bladder stones accompanied with renal stones, meningocele, neurogenic bladder and/or spontaneously passed bladder stones were excluded from the study.



Figure 1: Plain X-ray KUB showing Radio opaque shadow in bladder region suggesting Bladder stone.



Figure 2: Ultrasound showing hyper echoic shadow in Urinary bladder suggesting Calculi.

Plain abdominal radiography, ultrasonography, urine culture, kidney function test and coagulative tests were done for all children before procedure, and if needed, antibiotic therapy was given. Intravenous prophylactic antibiotics were given preoperatively in all children. All patients underwent general anesthesia and placed in lithotomy position. 9.5 Fr cystoscopes were used for transurethral

cystolithotripsy **Figure 3**. The stone was fragmented to 2-3 mm in size with Holmium YAG laser, via 365 μ m fiber at power of 5 to 10 W with frequency of 8-10 Hz. At the end of the procedure, cystourethroscopy was performed for detection of any stone residues. Indwelling catheter was inserted at the end of procedure and patient was discharged after catheter removal 24 hours after

operation. Post-operatively the children were evaluated at 2 week with

ultrasonography for residual stone fragments.

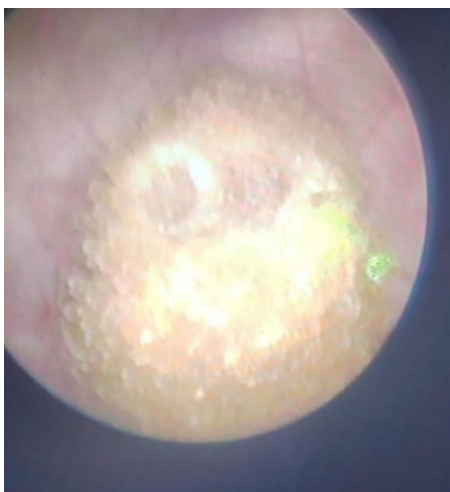


Figure 3: Cystoscopy showing laser cystolithotripsy of Bladder stone.

Demographic data, clinical features, stone size, hospital stay, procedure time, fragmentation of stone, outcome (clearance) and complications were recorded. The stone burden was measured in millimeters.

Qualitative data was expressed in terms of proportions. Quantitative data was expressed in terms of Mean and Standard deviation. All the data collected was analyzed by using SPSS 24.0 version IBM USA.

Results

Total of 32 children underwent transurethral laser cystolithotripsy for bladder stone during the period of study. Among 32 children, 2 girls (6%) and 30 boys (94%), with age ranging from 2 to 18 years with mean age 8.7 ± 5.3 years were evaluated.

The most common presenting symptom was difficulty in micturition, which occurred in 15 children (46.9 %). Other symptoms of presentation were pain in the abdomen (28.1%), hematuria (15.6%), and fever (12.5%) **Table 1**

Table 1: Presenting symptoms of Bladder Stones

Symptoms	Number (n)	Percentage (%)
Difficulty in micturition	15	46.9%
Pain in abdomen	9	28.1%
Hematuria	5	15.6%
Fever	4	12.5%

Associated anomalies were present in 4(12 %) children, in which vesicoureteral reflux were present in 2(6%) children, Associated anomalies were present in 4(12 %) children, in which vesicoureteral reflux were present in 2(6%) children, undescended testis was present in 1(3%) child and mid-penile hypospadias was present in 1(3%) child.

Stone size ranged from 5 to 60 mm with mean of 20.48 ± 12.9 mm. None of our children with bladder stone had accompanied hydronephrosis.

On cystoscopy bladder wall thickening or trabeculation were present in 12 (37%)

children. The operating time was 35 minutes with the range of 15–55 minutes. In two children operations were converted to open procedure because of failed endoscopic methods due to excess amount of stone burden.

Complications were seen in 9 (28.1%) children, among which haematuria (18.8%) was more common. Fever (6%), mucosal laceration of the urethra (3%) was other complications observed **Table 2**. The mean hospitalization time was 3.2 days with range of 2–6 days. All children were free of stone at 2 weeks postoperatively.

Table 2:Complications of procedure

Comlications	Number (n)	Percentage (%)
Haematuria	6	18.8%
Fever	2	6%
Mucosal laceration of the urethra	1	3%

Discussion

Bladder stones are more often found in children from developing countries. Bladder stones in children are much more common in boys than in girls, with ratios ranging from 9: 1 to as high as 33: 1 in areas of India.¹³ In our study also boys to girl ratio was 15:1 with male predominance.

Traditionally, open surgery was considered the treatment of choice for large bladder stones (>4 cm). In recent years with the development of pediatric ureteroscopes and cystoscopes and the widespread application of the Ho:YAG laser the management of pediatric bladder stones has changed radically. However,

some studies revealed that the use Ho:YAG laser was successful in managing the stones with mean diameter of 5.5-6 cm.^{14,15}

Transurethral lithotripsy can be performed by ultrasonic, pneumatic and other types of lithotripters. Laser is also used for lithotripsy. Holmium laser has been a great revolution in the management of urinary lithiasis.^{14,16,17} The smallest stone fragments are achieved by holmium laser, when compared with other tools of lithotripsy.¹⁴ The holmium laser have minimal thermal injury. Therefore, it can be used near to the mucosal surface.¹⁸ Stone composition have little effect on the stone fragmentation.¹⁹

Holmium laser lithotripsy has become the modality of choice, owing to its ability to treat large calculi while incurring a minimum of collateral damage. Most patients undergoing laser lithotripsy will be rendered stone free in one procedure with no major complications.¹³

In our study Ho:YAG laser was successful in managing the stones size ranged from 5 to 60 mm with mean 20.48 ± 12.9 mm which is similar to stone size in other studies.^{14,19,20,21}

The operating time was 35 minutes with range of 15–55 minutes in our study which was similar to operative time in other studies.^{14,19,20,21}

In our study complications were seen in 28.1% children, among which hematuria was seen in 18.8% of children which resolved after 48 hours with catheterization. Fever was seen in 6% of children, which was treated with antibiotics. Mucosal laceration of the urethra was seen in 3% of children, which resolved after 48 hours of catheterization. Complications such as transient hematuria were minor and manageable conservatively. Bladder perforation was not seen and mucosal injuries were limited and acceptable. These findings suggest that transurethral holmium laser lithotripsy was associated with minimal complications and morbidities.

Transurethral cystolithotripsy with holmium laser has been reported to be associated with minimal complication.^{14,17,20,21}

The mean hospital stay was 3.2 days with the range of 2–6 days in our study. However, in other studies by Ramakrishnan PA et. al, it was 2.2 (range 2-3) days and 2.3 days in the study by Kara C et. al,¹⁷ while in a study by Karami H et. al, it was 6.5 ± 1.3 hours.²⁰

All patients were stone-free at 2 weeks postoperatively, which was also comparable with similar studies.^{20,21}

Our study had some limitations. Despite the prospective design of this study, it was not a comparative study. On the other hand, larger population is needed for definitive judgment about safety and efficacy of transurethral holmium laser lithotripsy of large bladder stones.

Conclusion

Laser cystolithotripsy is effective, safe with less morbidity for management of bladder stones in children.

Ethical Consideration

This study was approved by Institutional Ethics Committee of KBN University, Faculty of Medical Sciences at its meeting held on 01/05/2016.

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Conflict of interests

There is no conflict of interest

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