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Original Article

Urology Section

Transurethral Pneumatic Cystolithotripsy under Local Anaesthesia as a Day-care Procedure: A Retrospective Descriptive Study from North-east India

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ABSTRACT

Introduction: Urinary bladder stones comprise only 5% of all urinary stones but are responsible for 14% of hospital admissions. Various types of treatment for bladder stones include open cystolithotomy, extracorporeal shock wave lithotripsy, cystolitholapaxy, and percutaneous suprapubic or transurethral cystolithotripsy.

Aim: To report the safety and intensity of pain associated with transurethral pneumatic cystolithotripsy under local anaesthesia in adult patients as a day-care procedure.

Materials and Methods: This retrospective hospital-based descriptive study was conducted in the Department of Urology at the North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS), Shillong, India, from June 2022 to January 2024, 34 patients (33 men and 1 woman) with symptomatic urinary bladder stones underwent transurethral pneumatic cystolithotripsy under local anaesthesia as a day-care procedure. Patient's sex, age, symptoms, complete blood count, kidney function tests, random blood sugar, glycated haemoglobin (HbA1c), coagulation profile and urine analysis were collected from hospital records. Stone size and number were collected from kidney, ureter and bladder (KUB) X-ray, ultrasonography and in some cases, intravenous urography and CT scan (non-contrast) reports. Ten minutes after the instillation of 10 mL of 2% lignocaine jelly into the urethra, pneumatic energy was delivered using a 9.5 F semi-rigid ureteroscope (Karl Storz, Germany). Pain during the procedure was assessed using the Visual Analogue Scale (VAS). The operating time and status of fragmentation and clearance of the stone were also recorded. These data were entered and analysed using Microsoft Excel Software version 2019. Continuous variables were presented as mean and standard deviation or range, while categorical variables were expressed as frequencies and percentages.

Results: The mean patient age was 38 years, and the mean stone size was 13.9 mm. The mean operating time was 15.4 minutes. Complete stone fragmentation and clearance were achieved in 30 out of 34 patients (88.2%), with a mean VAS score of 2.5. All patients who had a successful procedure had stones ≤20 mm. Mild haematuria was observed in 25 patients (73.5%). There were no bladder perforations and no mortality. The procedure failed in four patients, who subsequently underwent cystolithotripsy under spinal anaesthesia.

Conclusion: Transurethral pneumatic cystolithotripsy under local anaesthesia as a day-care procedure was safe and effective. Adult patients tolerated the procedure well. Therefore, it is a viable treatment option for urinary bladder stones of size up to 20 mm in adult patients.

Keywords: Ultrasonography, Urinary bladder stone, Visual analogue scale

INTRODUCTION

Urinary bladder stones, although they comprise only 5% of all urinary stones, are responsible for 14% of hospital admissions [1,2]. Most bladder stones are symptomatic and lead to lower urinary tract symptoms, infections, pain, haematuria, and, rarely, bladder cancer and renal failure [3-6]. Bladder stones can be treated using open cystolithotomy, cystolitholapaxy, Extracorporeal Shock Wave Lithotripsy (ESWL), suprapubic percutaneous cystolithotripsy, and transurethral cystolithotripsy [7]. Open cystolithotomy, the traditional method of bladder stone removal, is associated with increased morbidity and prolonged hospital stays and is rarely performed nowadays, except in cases of giant bladder stones [5,6,8]. Cystolitholapaxy, where bladder stones are crushed using mechanical lithotrites, has significant side effects such as bladder perforation and gross haematuria [9]. Shock wave lithotripsy for bladder stones is not satisfactory due to its variable success rate, poor evacuation, and high recurrence [9].

Conventionally, in percutaneous suprapubic cystolithotripsy and transurethral cystolithotripsy, a 30 F Amplatz sheath and a 24 F nephroscope are used, respectively, to deliver ultrasound or pneumatic energy to break the stones [10,11]. Both procedures are usually performed under regional or general anaesthesia and may be associated with significant morbidities. Holmium laser has transformed the treatment of bladder stones since the energy can be delivered through a small endoscope. This procedure is associated with limited pain and may be performed as a day-care procedure [12-15].

At our center, small bladder stones were treated with transurethral holmium laser cystolithotripsy under local anaesthesia [16]. However, during the COVID-19 pandemic in our area, patients could not be admitted due to administrative reasons. As a result, these patients underwent transurethral pneumatic cystolithotripsy under local anaesthesia as a day-care procedure. This study was conducted to assess the safety and intensity of pain associated with transurethral pneumatic cystolithotripsy under local anaesthesia as a day-care procedure.

MATERIALS AND METHODS

This retrospective hospital-based descriptive study was conducted in the Department of Urology at the North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS), Shillong, India, from June 2022 to January 2024. Sampling was done using

convenience sampling, and all patients who attended the department during the study period were included. Ethical approval for the study was obtained from the Institutional Ethics Committee, with approval number: NEIGR/IEC/M14/F35/2024 dated 19th February 2024.

Inclusion criteria: Adult patients (age >18 years, both males and females) with urinary bladder stones who underwent transurethral pneumatic cystolithotripsy under local anaesthesia as a day-care procedure and who consented to be included in the study were included.

Exclusion criteria: Children, stones >4 cm, paraplegia, stricture urethra, coexisting ureteric or renal stones, and benign prostatic hyperplasia were excluded.

Study Procedure

A detailed medical history was taken, and patients underwent a complete physical examination. The patients then had a complete haemogram, renal function tests, electrolyte tests, random blood sugar, glycated haemoglobin (HbA1c) estimation, coagulation profile studies (PT, PTT, INR), urinalysis, and urine culture. In some cases, a Prostate Specific Antigen (PSA) test was performed. A Kidney, Ureter, and Bladder (KUB) X-ray was done in all cases, and renal and bladder ultrasonography, intravenous urogram, and non-contrast CT scans were performed as indicated. The stone size was recorded as the largest dimension measured by KUB X-ray. Based on the urine culture report, appropriate antibiotics were given thirty minutes before the procedure. Injection Ceftriaxone (1 gm, intravenous) was administered to patients with a sterile urine culture.

The operation was carried out in the outpatient minor operating room. The patients were positioned in the semi-lithotomy position with continuous monitoring of pulse, blood pressure, and oxygen saturation. Ten minutes after instilling 10 mL of 2% lignocaine jelly into the urethra, an 8 F infant feeding tube was inserted into the bladder for urine drainage and optimal bladder distension during the procedure. A 9.5 F semi-rigid ureteroscope (Karl Storz, Germany) was inserted into the bladder. The bladder stone was fragmented using pneumatic energy (Swiss Lithoclast) with a 0.8 mm lithoclast probe. Stone fragmentation continued until all fragments were small enough to be passed via the urethra. The operation time was calculated from the insertion of the infant feeding tube to the removal of the ureteroscope. Pain during the procedure was assessed using the Visual Analog Scale (VAS). Analgesic injection (Diclofenac Sodium 75 mg, intramuscular, or Paracetamol 1 gm, intravenous) was given upon request. At the end of the procedure, the bladder was kept distended, and no Foley catheter was placed. The patients then passed the stone fragments along with urine.

Tablet Tamsulosin 0.4 mg was prescribed to be taken at night for ten days, Tablet Flavoxate 200 mg three times a day for five days, and Tablet Aceclofenac 100 mg to be taken as needed. Complete stone clearance was defined as the absence of residual stones on KUB X-ray done on the 10th postoperative day. Patients were followed up at 1, 2, 3, 6, and 12 months. At each follow-up, KUB X-ray was performed in all cases, and post-void residual urine and uroflowmetry were conducted if the patients complained of a poor urinary stream.

STATISTICAL ANALYSIS

Data were entered and analysed using Microsoft Excel software version 2019. Continuous variables were presented as mean (standard deviation or range), while categorical variables were expressed as frequencies or percentages.

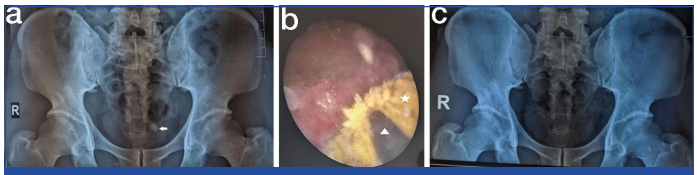
RESULTS

Between June 2022 and January 2024, 38 adult patients presented with symptomatic bladder stones [Table/Fig-1]. The most common symptoms were acute urinary retention (52.6%), dysuria (36.8%), suprapubic pain (36.8%), and haematuria (10.5%). Out of these 38 patients, five had positive urine cultures (*E. Coli*-3, *Enterococcus faecalis*-1, *Acinetobacter baumannii*-1). Four patients were excluded from the total cohort (stone >4 cm-1, patient not willing for the procedure-1, paraplegia-1, benign prostatic hyperplasia-1). Therefore, 34 patients (33 men and 1 woman) underwent transurethral pneumatic cystolithotripsy under local anaesthesia as a day-care procedure and were included in the analysis.

Variables	Values
Total patients in the study	38
Total patients excluded	4
Total patients recruited	34 (33 men, 1 woman)
Mean age (SD)	38 years (12.3 years)
Presenting symptoms	Acute urinary retention-20 (52.6%); dysuria-14 (36.8%); suprapubic pain-14 (36.8%); haematuria-4 (10.5%)
Mean stone size (SD)	13.9 mm (5.7 mm)
Mean pain score (VAS)	2.5 (1.1)
Mean operating time (SD)	15.4 min (10.7 min)
Complete stone clearance	30 patients (88.2%)
Postoperative complications	Haematuria-25, fever-1

[Table/Fig-1]: Patients and treatment characteristics.

The mean age of the patients was 38 years (range 20 to 70). The mean stone size was 13.9 mm (SD, 5.7 mm; range 5 to 30 mm). The mean operating time was 15.4 minutes (range 5 to 60). The mean VAS score was 2.5 (SD, 1.1; range 1 to 6). Complete stone fragmentation and clearance were achieved in 30 patients (88.2%) [Table/Fig-1]. Thirty patients (88.2%) received analgesic injections (Paracetamol or Diclofenac). Twenty-five patients (73.5%) developed mild haematuria, which subsided with hydration within 24 hours. One patient developed a fever, which resolved with intravenous antibiotics. Patients who had a successful procedure had stones ≤20 mm. There were no major complications, such as bladder perforation or gross haematuria requiring bladder irrigation. The stones were not sent for analysis. In our series, the procedure could not be completed in four patients. Their mean stone size was 21.8 mm, and the mean VAS score was 3.3. These patients underwent transurethral cystolithotripsy under spinal anaesthesia on the next operational day. After a mean follow-up of 2.4 months (range 1 to 6 months), no recurrent stones or urethral strictures were detected. [Table/Fig-2] shows a case of a bladder stone presenting with acute urinary retention.



[Table/Fig-2]: a) A 36-year-old man with bladder stone (arrow) presenting with acute urinary retention; b) The stone (star) was crushed using lithoclast probe (triangle); c) Postoperative radiograph showed complete clearance of the stone.

DISCUSSION

In our study, 34 adult patients underwent transurethral pneumatic cystolithotripsy under local anaesthesia. All procedures were performed in the minor operation theater of the outpatient department. The procedure was highly successful, with complete stone fragmentation and clearance achieved in 88.2% of patients. The patients tolerated the procedure well, with a mean pain VAS score of 2.5. The procedure was relatively safe, with no significant morbidity. To the best of our knowledge, this is the first report of patients with bladder stones who underwent transurethral cystolithotripsy under local anaesthesia as a day-care procedure.

Bladder stones can also be treated with either Holmium or Thulium laser under local anaesthesia as an outpatient procedure [14,15, 17]. However, Holmium or Thulium laser machines and fibers are expensive and not available in many developing countries. On the other hand, pneumatic lithotripters and probes are relatively inexpensive, and the energy generators are easy to maintain. Therefore, in developing countries where laser equipment is not available for the treatment of bladder stones, pneumatic energy is a viable alternative to Holmium laser for treating bladder stones [18].

At our center, Holmium laser was used to fragment bladder stones up to 2 cm in adults under local anaesthesia in the main operating theater [16]. The patients were admitted the day before the operation and discharged one day after the procedure. However, during the COVID-19 epidemic in our area, patients could not be admitted due to administrative reasons. Consequently, patients with bladder stones and urinary retention were catheterised and sent home with a Foley catheter. Many patients, however, were unwilling to leave the hospital with a Foley catheter. Since the electrical plug point was installed in the main operating theater and the Holmium laser machine (Lumenis) is heavy and not suitable for transportation to the outpatient department, patients were offered transurethral pneumatic cystolithotripsy (Swiss Lithoclast) under local anaesthesia as a day-care procedure. This procedure appeared to work satisfactorily, and patients tolerated it reasonably well. As a result, we continued this treatment even after the COVID-19 epidemic was over.

Tzortzis et al., performed suprapubic percutaneous cystolithotripsy under local anaesthesia in 31 adult patients. Complete stone clearance was achieved in 96.78% of patients, and the pain score was similar to that of rigid cystoscopy [19]. In our series, all patients who had successful procedures had stones ≤20 mm. Therefore, we propose that this procedure can be used for patients with bladder stones smaller than 20 mm in size and with a normal bladder outlet anatomy. Larger bladder stones, hard stones, and patients with Benign Prostatic Hyperplasia (BPH) can be treated with either percutaneous or transurethral cystolithotripsy under regional anaesthesia [10,20-22]. We found the procedure to be relatively safe. Mild haematuria was observed in 73.5% of patients, and all cases of haematuria subsided with hydration within 24 hours. One patient developed a fever, which resolved with intravenous antibiotics. Complications such as mild haematuria, gross haematuria requiring bladder irrigation, fever, urinary tract infection, and epididymitis have been reported in similar published studies [18-20,23].

In our study, a 9.5 F semi-rigid ureteroscope was used, and there was no need for urethral dilation, unlike traditional transurethral cystolithotripsy procedures, which typically require urethral dilation to accommodate a 24 F nephroscope [10,21,24]. No Foley catheter was placed at the end of the procedure, and the patient passed the fragmented stones spontaneously. Thus, the chance of developing urethral injury and subsequent urethral stricture is likely to be low after pneumatic transurethral cystolithotripsy under local anaesthesia.

One main disadvantage of using pneumatic energy to break stones is stone migration. This can be mitigated to a certain extent by holding the stone against the bladder wall and keeping the bladder optimally distended during the operation.

The use of local anaesthesia for the removal of bladder stones avoids the complications associated with regional or general anaesthesia and makes the treatment more cost-effective [19]. Conducting the procedure as a day-care treatment avoids hospital admission, reducing the cost of treatment and the risk of nosocomial infections [25].

Limitation(s)

The study was retrospective with a small sample size. The type of stones was not known, as stone analysis was not conducted. Follow-up was inadequate. Prospective, multicenter, well-designed studies with larger sample sizes are needed to verify and expand the conclusions of this study.

CONCLUSION(S)

Transurethral pneumatic cystolithotripsy under local anaesthesia as a day-care procedure was well tolerated by adult patients. Thus, it is a viable alternative treatment for urinary bladder stones up to 20 mm in size in adult patients.

REFERENCES

[1] Schwartz BF, Stoller ML. The vesical calculus. Urol Clin North Am. 2000;27(2):333-46. Doi: 10.1016/s0094-0143(05)70262-7.

[2] Allwright SP. Hospital admissions for renal and bladder stone in Ireland. Ir Med J. 1978;71(4):112-16.

[3] Papatsoris AG, Varkarakis I, Dellis A, Deliveliotis C. Bladder lithiasis: From open surgery to lithotripsy. Urol Res. 2006;34(3):163-67.

[4] Demirel F, Cakan M, Yalçinkaya F, Demirel AC, Aygün A, Altuğ UU. Percutaneous suprapubic cystolithotripsy approach: For whom? Why? J Endourol. 2006;20(6):429-31.

[5] Bestari MG, Oktarina AL, Karim MI, Aryanti, Melati R, Octavian I. Giant bladder stone resulting in renal failure and concurrent bladder cancer: A case report. Int J Surg Case Rep. 2022;94:107170. Doi: 10.1016/j.ijscr.2022.107170.

[6] Mukherjee S, Sinha RK, Hamdoon M, Abbaraju J. Obstructive uropathy from a giant urinary bladder stone: A rare urological emergency. BMJ Case Rep. 2021;14(1):e234339. Doi: 10.1136/bcr-2020-234339.

[7] Cicione A, De Nunzio C, Manno S, Damiano R, Posti A, Lima E, et al. Bladder stone management: An update. Minerva Urol Nefrol. 2018;70(1):53-65. Doi: 10.23736/S0393-2249.17.02972-1.

[8] Donaldson JF, Ruhayel Y, Skolarikos A, MacLennan S, Yuan Y, Shepherd R, et al. 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.

[9] Philippou P, Moraitis K, Masood J, Junaid I, Buchholz N. The management of bladder lithiasis in the modern era of endourology. Urology. 2012;79(5):980-86. Doi: 10.1016/j.urology.2011.09.014.

[10] Ener K, Agras K, Aldemir M, Okulu E, Kayigil O. The randomized comparison of two different endoscopic techniques in the management of large bladder stones: Transurethral use of nephroscope or cystoscope? J Endourol. 2009;23(7):1151-55. Doi: 10.1089/end.2008.0647.

[11] Tugcu V, Polat H, Ozbay B, Gurbuz N, Eren GA, Tasci AI. Percutaneous versus transurethral cystolithotripsy. J Endourol. 2009;23(2):237-41. Doi: 10.1089/end.2008.0455.

[12] Gould DL. Holmium:Yag laser and its use in the treatment of urolithiasis. Our first 160 cases. J Endourol. 1998;12(1):23-26.

[13] Teichman JM, Rogenes VJ, McIver BJ, Harris JM. Holmium: Yttrium-aluminum-garnet laser cystolithotripsy of large bladder calculi. Urology. 1997;50:44-48.

[14] Karami H, Razaghi MR, Javanmard B, Yaghoob M, Hasanzadeh Hadad A, Amani M, et al. Outpatient transurethral cystolithotripsy of large bladder stones by Holmium laser. J Lasers Med Sci. 2016;7:12-15.

[15] Nameirakpam S, Naorem S, Faridi MS, Akoijam KS, Sinam RS. Transurethral cystolithotripsy of large bladder stones by holmium laser as a day care procedure. J Clin Diagn Res. 2016;10:PC01-PC02.

[16] Sailo SL, Sailo L, Wann C. Transurethral holmium laser cystolithotripsy under local anaesthesia in adult patients: A prospective observational study at a tertiary care centre in north-east India. J Clin Diagn Res. 2022;16:PC05-PC08.

[17] Gupta R, Rahman Y, Mahajan A, Mehta A. Thulium fiber laser cystolithotripsy under local anaesthesia: A day care procedure. Urologia. 2024;91(1):112-16. Doi: 10.1177/03915603231186286.

[18] Shalaby EA. Assess the safety and effectiveness of a novel approach during transurethral pneumatic cystolithotripsy in large urinary bladder stone: Quasi-clinical trial. Urolithiasis. 2022;50(2):189-97. Doi: 10.1007/s00240-021-01294-y.

[19] Tzortzis V, Aravantinos E, Karatzas A, Mitsogiannis IC, Moutzouris G, Melekos MD. Percutaneous suprapubic cystolithotripsy under local anaesthesia. Urology. 2006;68(1):38-41. Doi: 10.1016/j.urology.2006.01.073.

[20] Ali AI, Fathelbab TK, Abdelhamid AM, Elbadry M, Alshara L, Anwar AZ, et al. Transurethral pneumatic cystolithotripsy: A novel approach. J Endourol. 2016;30(6):671-73.

[21] Singh KJ, Kaur J. Comparison of three different endoscopic techniques in management of bladder calculi. Indian J Urol. 2011;27(1):10-13. Doi: 10.4103/0970-1591.78402.

[22] Mekke S, Roshani H, van Zanten P, Palacios LG, Egberts J, Hendriks N, et al. Simultaneous transurethral resection of the prostate and cystolithotripsy: A urological dilemma examined. Can Urol Assoc J. 2021;15(7):E361-E365. Doi: 10.5489/cuaj.6743.

[23] Gupta R, Gupta S, Das RK, Basu S, Agrawal V. Comparative study of a new technique using nephroscope and resectoscope sheath and the percutaneous cystolithotripsy for the treatment of bladder calculus. Cent European J Urol. 2017;70(4):400-04. Doi: 10.5173/ceju.2017.1379.
[24] Okeke Z, Shabsigh A, Gupta M. Use of Amplatz sheath in male urethra during cystolitholapaxy of large bladder calculi. Urology. 2004;64(5):1026-27. Doi: 10.1016/j.urology.2004.07.022.
[25] Hong A, Hemmingway S, Wetherell D, Dias B, Zargar H. Outpatient transperineal prostate biopsy under local anaesthesia is safe, well tolerated and feasible. ANZ J Surg. 2022;92(6):1480-85. Doi: 10.1111/ans.17593.

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