

Diagnostic challenges in urethral calculi; an initial tertiary care study

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ABSTRACT



Background. Kidney stone disease possesses a significant health burden not only to the family but also to the society. Sometimes, urethral stones are not expressed by typical manifestations, which can mislead clinicians in making the diagnosis. **Materials and Methods.** The investigation covers a period of 1 year and 6 months (Oct. 2020-Jan. 2022), carried out after obtaining the written informed consent of 22 symptomatic patients. KUB and pelvis X-ray (with or without perineal ultrasound) were performed after ethical clearance in a single center tertiary care hospital. **Results.** This study reveals male preponderance with no female patients, mostly in the age groups of 35-50 years (all being symptomatic). 54.54% have retention of urine and 45.45% with features of voiding lower urinary tract symptoms (LUTS); in 20% of cases, additional perineal ultrasound was performed to confirm the diagnosis. It is found that 63.63% of the stones were in the anterior part and 36.36% of the stones are in the posterior part of the urethra, 4.5% of the stones being radiolucent. Two patients were treated by meatotomy and 20 patients were treated by retrograde manipulation and fragmentation of stone by pneumatic lithoclast. **Conclusions.** In an extremely clinically suspicious case, an effective investigation, such as an X-ray of the pelvis and pelvis and/ or perineal ultrasound, can be used as the best diagnostic tools for urethral stones.

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Introduction

In India, the prevalence of urolithiasis varies between 5.7% -10.8%, predominantly male [1]. In the nuclear stages, the formation of urolithiasis takes place through supersaturation and crystalline agglomeration. It depends on age, gender, diet and drinking water quality, quality of life dependent on fast food, genetic factors and metabolic disorders [2,3]. The most common type of stone is calcium oxalate among struvite, uric acid, calcium phosphate and mixed stones. The pathological basis behind the formation of stones is therefore primary and secondary. The primary stone is formed secondary to strictures, foreign bodies and neurogenic bladder, etc.; while the secondary stone is due to the migration of stones formed in the upper urinary tract [4,5]. Most of the secondary stones are those found in the urethra. Its symptoms range from mild to severe, from penis pain, urinary retention, pelvic pressure, bladder

distension to nonspecific symptoms. Due to non-specific symptoms, small stones, little faint radio-opaque stone, stone lodged below and behind the pubic symphysis get usually missed on X-ray KUB. For the missed stones, computed tomography of KUB is prescribed which, on the other hand, is expensive and has a higher radiation exposure [6,7].

After the diagnosis, the treatment of the urethral calculi is planned, which depends on the size, location, number, associated anomalies and available facilities. 90% of stones with a size of <10mm pass spontaneously through the maintenance of hydration, being <10% chances to pass stones if their size increases to > 10mm. For calculi >1cm, surgical intervention is required. Anteriorly lodged stone requires manipulation with or without meatotomy, whereas for the posteriorly placed stone the retrograde manipulation with cystolithotripsy/ cystolitholapaxy is usually preferred [8-10].

Urethral stones are the rarest presentation of urolithiasis, with a limited number of reviews in the literature [11,12]. During this pandemic period, the patient should also report to the emergency and outpatient department with urinary retention, dribbling of urine, hematuria and suprapubic pain [13,14]. This study will investigate the predominance of age and sex, clinical presentation, diagnostic challenges, management and follow-up of patients in whom KUB X-ray could not give the necessary result to address the diagnosis of urethral stones.

Materials and Methods

After obtaining the ethical approval of the Ethics Committee of the Institution, the study was performed on 22 patients, after obtaining the informed consent in writing, within a period of 1 year and 6 months (Oct. 2020-Jan. 2022). X Ray KUB and X-ray pelvis with or without perineal ultrasound was performed and studied. In case of anterior urethral calculi, the removal was done by ventral meatotomy under local anaesthesia, where others were managed by retrograde manipulation of stone into urinary bladder followed by pneumatic lithoclast.

Inclusion criteria:

- Age group > 17years and < 70years.
- Symptomatic patients with voiding LUTS, retention of urine and with history of lithouria.
- Patient with history of urethroplasty, urethral stricture, meatal stenosis, bladder neck contracture, ureterocele and neurogenic bladder.

Exclusion criteria:

- Patient not willing to participate

Results

Age and sex. A total of 22 patients were analyzed, mostly male without female patients, the maximum number of patients being in the age groups 35-50 years (Figure 1).

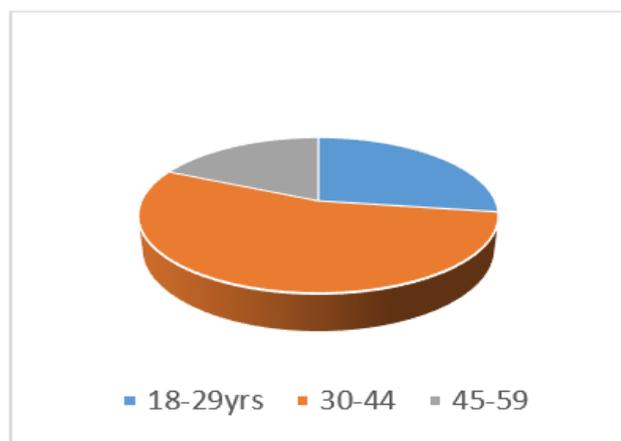


Figure 1. Distribution by age and sex

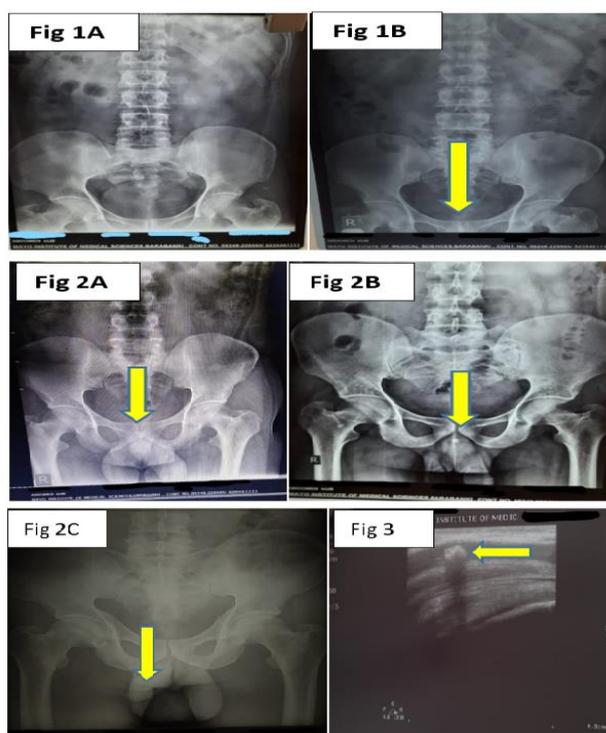
Symptoms. All patients were symptomatic; 54.54% have retention of urine and 45.45% with features of voiding

LUTS, such as dribbling of urine, stranguary and decrease in flow of urine, as described in the Table-1. The duration of symptoms varies from months to days in 21 patients and only 1 patient persisted for 2 years.

Table 1. Distribution by symptoms

Age (years)	Total number of patients	Chief complaints	Associated symptoms
18-29	6	Suprapubic pain, incomplete evacuation.	Increase in frequency of micturition
30-44	12	Retention of urine	Dribbling of urine, pain radiating from suprapubic to the tip of the penis and burning micturition.
45-59	4	Stranguary and decrease in stream of urinary flow	Suprapubic pain

Associated complaints. One patient presented with Fournier's gangrene with penile urethral stricture with two stone in bulbar urethra, who was managed by permanent perineal urethrostomy with retrograde stone fragmentation. None of them have history of urethroplasty, meatal stenosis, bladder neck contracture, ureterocele and neurogenic bladder.



Figures 1-3. KUB and Pelvis X-ray (1,2), perineal ultrasound (3).

Investigation. In 100% cases X-ray KUB (Figures 1A, 1B) and X-ray Pelvis (Figures 2A, 2B & 2C) was required,

and in 20% of cases additional perineal ultrasound (Figure 3) was performed to confirm the diagnosis. Perineal ultrasound has been shown to be useful in identifying radiolucent stones and stones behind the pubic symphysis.

Location of stone (Figure 4). It is found that 63.63% of the stones were in the anterior part and 36.36% of the stones in the posterior part of the urethra.

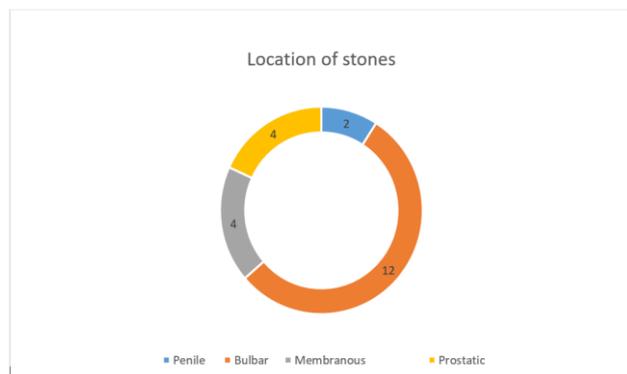


Figure 4. Location of stones

Urine culture. Only 1 patient had a positive culture and an increase in *E. coli*, which was managed by preoperative antibiotics.

Management. The stones of 2 patients were expelled by manipulation and ventral meatotomy under local anaesthesia, while the rest of 20 patients have been operated by retrograde manipulation under spinal anaesthesia with pneumatic lithoclast. The intraoperative period was uneventful; no complications were observed in the postoperative period. Patients were followed up for the following month; they urinated normally without any complaints.

Discussion

Urethra is a tubular structure (M-22.3cm; F-4cm) lined by the mucous membrane, connecting urinary bladder to the external urinary meatus for the passage of the fluid (male urine and semen, and female urine) [15-17]. It has two parts: anterior and posterior. The anterior part constitutes the bulbar and penile regions, while the posterior part constitutes the prostatic and membranous regions. The most dilatable and least dilatable part is prostatic and membranous part of the urethra, respectively. Migratory urethral calculi are mainly unique in location, and are found in posterior urethra > bulbous and penile > fossa navicularis (32-88%, 8-58%, 4-11% respectively) [18,19]. Because the size of the spontaneous passage of stones should be <10 mm, they are ideal candidates for conservative treatment, i.e., hydration and analgesics. The inability of the stones (> 10 mm) to pass leads to symptoms such as stranguary, increase frequency of micturition, dribbling of urine, retention of urine, gross hematuria, dysuria, dyspareunia and chronic pelvic pain, perfectly suited for endoscopic surgery once the diagnosis is

confirmed. To diagnose the cause, a plain X-Ray KUB is usually advised as the first line of investigation, where the exposure is given in supine position, centering towards the midsagittal plane at the level of the iliac crest [20,21]. The mean size of radiopaque stones detected by it is 4.2mm [22-24].

In this study, all 22 symptomatic patients having voiding and obstructive symptoms of lower urinary tract symptoms are evaluated thoroughly and are sent for routine urine investigation along with radiological investigations (i.e., X-ray KUB). Urine culture of one patient has shown the growth of *E. coli*, while the rest of the patients' urine comes out to be sterile. It is observed that either in most of the X-ray KUB calculi is not visualized (Figure 1A) or only upper border of calculi is seen (Figure 1B). This is due to the fact that exposure is limited to the lower edge of the pubic symphysis, therefore the stones that have been omitted are placed under and/ or behind the pubic symphysis and, as a result, the patients' symptoms persist. Therefore, to overcome this diagnostic challenge X-ray Pelvis (Figures 2A,2B & 2C) is added along with X-ray KUB, and for radiolucent stone the perineal ultrasound is recommended, as a noninvasive, cheap, easily available and very handy tool. Perineal ultrasound (Figure 3) helps in finding calculi which are lodged in the urethra and of radiolucent type (4.5%). After evaluating and diagnosing, in 2 patient manipulation of stone with copious amount of xylocaine jelly is done which is compounded with meatotomy under aseptic condition under local anaesthesia. The rest of 20 patients are planned for pneumatic lithoclast and performed under spinal anaesthesia, without any intraoperative complications. In Fournier's gangrene, a patient permanent perineal urethrostomy was performed after fragmentation of stone. All of them have been discharged in an ambulatory condition, ECOG performance score 0 with self-passage of clear urine without any complaints. Follow up advice is given to prevent further calculi formation such as to avoid fast food (French fries, burger and pizza), tin and processed foods (tinned meats, smoked fish), high oxalate content (chocolates, nuts, tea), extra calcium supplementation and carbonated beverages; to consume plenty of water, fruit juices, vegetable soups and low salt diet, low fat diet and moderate amount of protein [25,26]. Patients have been followed up for 1 month and none of them have any difficulty in urination, narrowing of urinary stream, hematuria, and retention of urine.

Judicious use of the clinical and diagnostic skills of a clinicians will save the out-of-pocket expenditure of the patient and will help in reducing the family burden too. X-ray KUB with X-ray Pelvis with or without perineal ultrasound should be the first approach of a practitioner, rather than moving towards the fancy tool like computed tomography.

Conclusions

Every patient having lower urinary tract symptoms (obstructive or voiding) need to be evaluated thoroughly. If there is a possibility that the stones may get lodged behind and/ or under the pubic symphysis or other part of the urethra, along with X-Ray KUB, X-ray Pelvis and/or perineal ultrasound should be investigations of choice to confirm the diagnosis.

Conflict of interest disclosure

There are no known conflicts of interest in the publication of this article. The manuscript was read and approved by all authors.

Compliance with ethical standards

Any aspect of the work covered in this manuscript has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

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Abbreviations used

KUB- Kidney Ureter and Bladder
LUTS- Lower Urinary Tract Symptoms
CT- Computed Tomography

References

- Faridi MS, Singh KS. Preliminary study of prevalence of urolithiasis in North-Eastern city of India. *J Family Med Prim Care*. 2020 Dec 31;9(12):5939-5943. doi: 10.4103/jfmpc.jfmpc_1522_20
- Singh VK, Jaswal BS, Sharma J, Rai PK. Analysis of stones formed in the human gall bladder and kidney using advanced spectroscopic techniques. *Biophys Rev*. 2020 Jun;12(3):647-668. doi: 10.1007/s12551-020-00697-2
- Bosio A, Alessandria E, Dalmaso E, Agosti S, Vitiello F, Vercelli E, Bisconti A, Gontero P. Flexible Ureterorenoscopy Versus Shockwave Lithotripsy for Kidney Stones ≤ 2 cm: A Randomized Controlled Trial. *Eur Urol Focus*. 2022 Apr 21:S2405-4569(22)00081-5. doi: 10.1016/j.euf.2022.04.004
- Lee P, Haber J. Urethral Calculi. *Clin Pract Cases Emerg Med*. 2020 Feb 24;4(2):134-136. doi: 10.5811/cpcem.2019.5.43182
- Pietrow PK, Karellas ME. Medical management of common urinary calculi. *Am Fam Physician*. 2006 Jul 1;74(1):86-94.
- Hamza BK, Bello A, Tolani MA, et al. An impacted urethral stone: a rare cause of acute urinary retention in women—case report. *Afr J Urol*. 2021;27:138. doi: 10.1186/s12301-021-00225-y
- Mukesh CA, Gandhi A, Singhal A, Sonwal M, Maan R. Urethral Calculi: Presentation, Evaluation and Management. *Annal Urol & Nephrol*. 2020;2(2): AUN. MS.ID.000532. doi: 10.33552/AUN.2020.02.000532
- Sungur M, Baykam M, Calışkan S, Lokman U. Urethral calculi: A rare cause of acute urinary retention in women. *Turk J Emerg Med*. 2018 Feb 23;18(4):170-171. doi: 10.1016/j.tjem.2018.02.002
- Jung J, Ahn HK, Huh Y. Clinical and functional anatomy of the urethral sphincter. *Int Neurourol J*. 2012 Sep;16(3):102-6. doi: 10.5213/inj.2012.16.3.102
- Shanmugam TV, Dhanapal V, Rajaraman T, Chandrasekar CP, Balashanmugam KP. Giant urethral calculi. *Hosp Med*. 2000 Aug;61(8):582. doi: 10.12968/hosp.2000.61.8.1407
- Coll DM, Varanelli MJ, Smith RC. Relationship of spontaneous passage of ureteral calculi to stone size and location as revealed by unenhanced helical CT. *AJR Am J Roentgenol*. 2002 Jan;178(1):101-3. doi: 10.2214/ajr.178.1.1780101
- Yen P, Baerlocher MO. Five things to know about...Imaging in urolithiasis. *CMAJ*. 2011 Dec 13;183(18):2133. doi: 10.1503/cmaj.101638
- Mukherjee S, Sinha RK, Hamdoon M, Abbaraju J. Obstructive uropathy from a giant urinary bladder stone: a rare urological emergency. *BMJ Case Rep*. 2021 Jan 19;14(1):e234339. doi: 10.1136/bcr-2020-234339
- Krambeck AE, Lieske JC, Li X, Bergstralh EJ, Melton LJ 3rd, Rule AD. Effect of age on the clinical presentation of incident symptomatic urolithiasis in the general population. *J Urol*. 2013 Jan;189(1):158-64. doi: 10.1016/j.juro.2012.09.023
- Kamal BA, Anikwe RM, Darawani H, Hashish M, Taha SA. Urethral calculi: presentation and management. *BJU Int*. 2004 Mar;93(4):549-52. doi: 10.1111/j.1464-410x.2003.04660.x
- Han H, Segal AM, Seifter JL, Dwyer JT. Nutritional Management of Kidney Stones (Nephrolithiasis). *Clin Nutr Res*. 2015 Jul;4(3):137-52. doi: 10.7762/cnr.2015.4.3.137
- Keskin A, Karslioglu B. Did Covid-19 pandemic narrow the spectrum of surgical indications? *J Clin Investig Surg*. 2021;6(1):58-63. doi: 10.25083/2559.5555/6.1.11
- Dan SA, Bratu OG, Marcu DR, Stanciu AE, Gherghiceanu F, Ionita-Radu F, Bungau S, Stanescu AM, Mischianu D. Underactive bladder - an underestimated entity. *J Mind Med Sci*. 2020;7(1):23-28. doi: 10.22543/7674.71.P2328
- Elbatanouny AM, Ragheb AM, Abdelbary AM, Fathy H, Massoud AM, Abd El Latif A, Moussa AS, Ibrahim

- RM. Percutaneous nephrostomy versus JJ ureteric stent as the initial drainage method in kidney stone patients presenting with acute kidney injury: A prospective randomized study. *Int J Urol.* 2020 Oct;27(10):916-921. doi: 10.1111/iju.14331
20. Ma J, Zhang X, Wang J, Zhou Z, Lin C. Treatment of a patient with total urinary calculi: a case report. *Transl Androl Urol.* 2019 Dec;8(6):764-769. doi: 10.21037/tau.2019.11.23
21. Pai A, Kadhim H, Mackie S, Watson G. Local Anesthetic Flexible Ureterorenoscopy in the Management of Urolithiasis. *J Endourol.* 2019 Sep; 33(9):696-698. doi: 10.1089/end.2019.0107
22. Tan LRL, Tiong HY. Ureteric implantation into the bowel portion of augmented bladders during kidney transplantation: a review of urological complications and outcomes. *ANZ J Surg.* 2019 Jul;89(7-8):930-934. doi: 10.1111/ans.14828
23. Abidin ZAZ, Hayati F, Tan GH, Goh EH, Hafidzul J, Zulkifli MZ. Giant Urethral Calculus without Acute Urinary Retention. *J Coll Physicians Surg Pak.* 2018 Mar;28(3):S69-S70. doi: 10.29271/jcsp.2018.03.S69
24. Hajji F, Lmezguidi K, Janane A, Ameer A. Large prostatic stones with staghorn renal calculus in a 61-year-old man: an unusual presentation of uncommon disease. *BMJ Case Rep.* 2017 Jun 29;2017: bcr2017219778. doi: 10.1136/bcr-2017-219778
25. Kum F, Mahmalji W, Hale J, Thomas K, Bultitude M, Glass J. Do stones still kill? An analysis of death from stone disease 1999-2013 in England and Wales. *BJU Int.* 2016 Jul;118(1):140-4. doi: 10.1111/bju.13409
26. Komeya M, Sahoda T, Sugiura S, et al. A huge bladder calculus causing acute renal failure. *Urolithiasis.* 2013 Feb;41(1):85-7. doi: 10.1007/s00240-012-0517-8