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Case Report

A 68-Year-Old Male with Giant Urethral Diverticulum Stone

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ABSTRACT

Introduction: Urolithiasis primarily affects the kidneys, ureters, or bladder, but urethral stones are rare, making up less than 1% of all urinary tract stones. Their prevalence is 0.3% to 2%, with a higher incidence in men due to the longer male urethra. Symptoms range from asymptomatic to severe pain, dysuria, and urinary retention, often complicated by fever or renal failure. Urethral diverticulum, a rare malformation, can cause recurrent infections and stone formation. Diagnosis involves imaging, urethrography, and cystourethroscopy, while treatment depends on stone size and location. Delayed diagnosis can lead to significant morbidity.

Case Presentation: A 68-year-old male presented to the clinic with a painful lump in the left scrotum, which had progressively enlarged and hardened. He reported experiencing painful, incomplete urination along with right-sided back pain. The patient had a history of similar lumps that had been surgically removed. Upon examination, a tender, hard mass measuring 4x3 cm was found in the left scrotum. Urethrography revealed a solitary opaque stone in the posterior urethra, while post-contrast imaging confirmed diverticulolithiasis in the bulbo-cavernous urethra, leading to stenosis and partial obstruction, confirming urethral obstruction due to stones. Laboratory tests returned normal results.

Conclusion: Urethral stones are rare, constituting less than 1% of urinary tract stones, mainly affecting men. Symptoms range from asymptomatic to severe pain, with potential complications like fever and kidney failure. Diagnosis involves imaging, and timely management is crucial to prevent morbidity.

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INTRODUCTION

Urolithiasis is a condition where stones are commonly found in the kidneys, ureters, or bladder. The urethra is a very rare location for urolithiasis. Urethral stones are rare and represent less than 1% of all urinary tract stones [1]. In the general population, around 0.3% to 2% of all urinary tract stones are localized in the urethra. This incidence is higher in men than in women, due to the longer and more complex anatomy of the male urethra [2]. The clinical manifestations that arise vary from no complaints; mild to severe back pain (colic); dysuria; hematuria; urinary retention and anuria. These complaints can be accompanied by complications such as fever; signs of kidney failure; suprasymphyseal tenderness; pain in the costovertebral angle and palpable stones in the urethra [3].

Urethral diverticulum is a rare urinary malformation that can often cause urinary complications. These diverticulum can be congenital or acquired and can be caused by stenosis of the urethra or urethral meatus [4]. Urethral diverticulum can cause stone formation, incomplete voiding, infection, post-urethral dribbling, hematuria, and other complications [5]. Diagnosis begins with simple imaging followed by selective use of urethrography and cystourethroscopy to confirm the

diagnosis and determine the underlying urethral abnormality. Ultrasonography can be helpful if radiolucent stones are suspected and to evaluate the upper urinary tract due to the high incidence of associated bladder and upper urinary tract stones [6].

Management of urethral stones varies depending on size, position, and clinical (urinary retention and sepsis) and institutional (available technology) factors. Delay in diagnosis can result in significant morbidity, including post-obstructive renal failure; urethral injury; urethrocutaneous fistula; incontinence, and impotence [7].

CASE PRESENTATION

A 68-year-old male patient came to the urology clinic of dr. Soedomo Hospital with a primary complaint of a lump in the left scrotum. The lump was painful. The lump initially felt small but gradually enlarged and hardened. The patient admitted that he could still urinate, but it was painful. The patient also complained of incomplete urination and pain in the right side of his back that had become increasingly painful in the last few days. The patient said that he previously had a history of 2 similar lumps in his left scrotum which had been removed through surgery but now a lump has reappeared on the left side. On general physical examination, the general condition was found to be moderately ill, compos mentis consciousness, blood pressure 173/65 mmHg, pulse 68 times/minute, respiratory rate 19 times/minute, temperature 37°C. On urological status examination, no masses, tenderness, or percussion pain were found in the flank region.

In the suprapubic region, an empty VU impression was found and no tenderness was found. The patient did not have a catheter, and the urine was found to be reddish-yellow. In the external genitalia, no injuries, deformities, or edema were found on the penis. In the scrotum area, a mass was found in the left scrotum measuring approximately 4,3 cm x 3,4 cm with tenderness and a hard, solid consistency. Complete blood count and coagulation function laboratory examinations showed results within normal limits. ECG examination showed left ventricular enlargement (LVH). On the urethrography examination, there was a suspected solitary opaque stone in the posterior urethra during pre-contrast conditions (**Fig.1**). Furthermore, post-contrast urethrography resulted in a conclusion reading in the form of diverticulum urethral stone in the bulbo-cavernous urethra which resulted in stenosis with partial obstruction, thus confirming the diagnosis (**Fig.2**).

Treatment

The patient was then planned for surgical stone evacuation therapy in the form of Urethrectomy. The patient was categorized as low risk for MACE so that the surgical plan by urology could be continued.

As a surgical procedure, the patient was placed on his back in a countertrendelenburg position and given Subarachnoid Block anesthesia. Furthermore, disinfection with 10% betadine was performed on the

Figure 1. Right Oblique Pelvic Plain X-ray. Two relatively square calcifications are visible in the symphysis pubis region and a large relatively oval calcification measuring approximately 4.3 x 3.4 cm in the soft tissue of the scrotal region. The pelvic bones appear fine. A 1 cm marker is attached to the soft tissue of the right proximal femur.

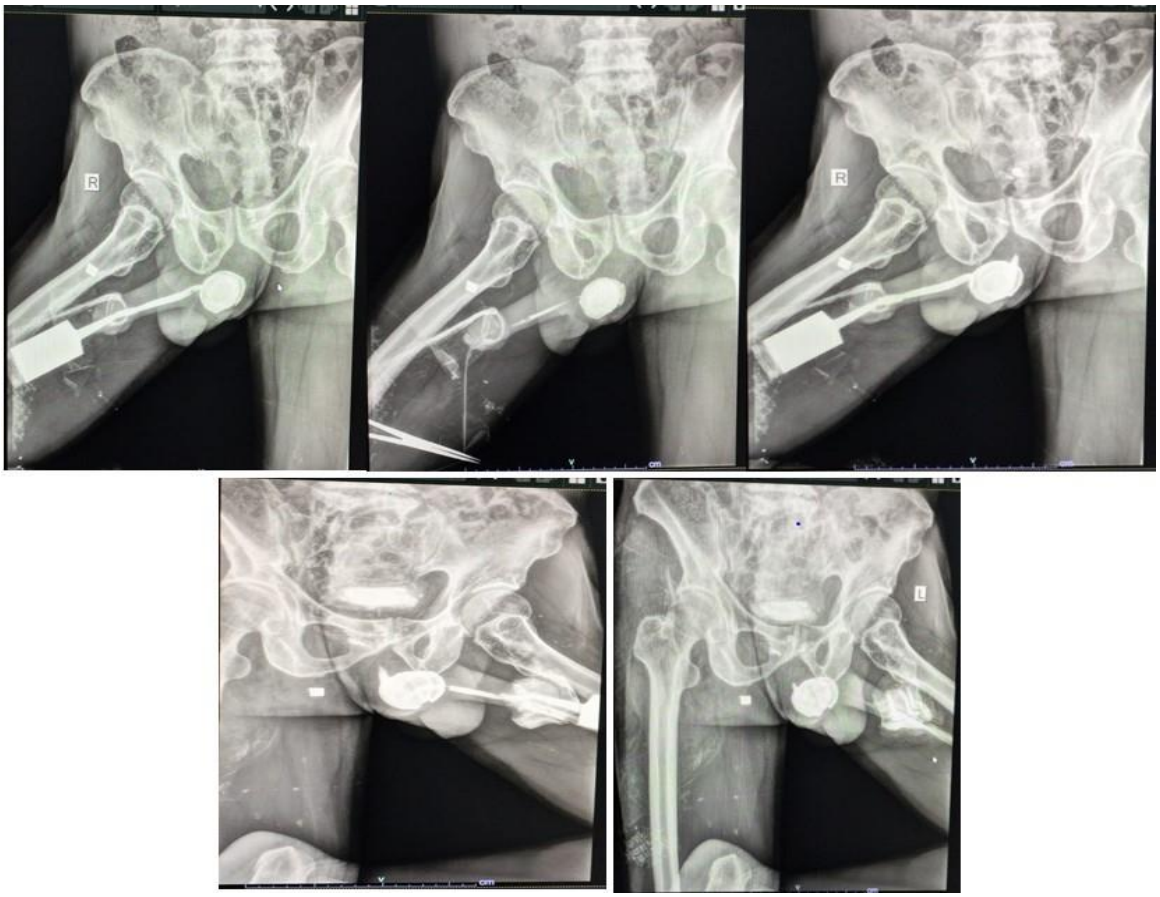

Figure 2. Post Contrast Urethrography Photo. Non-ionic contrast that has been diluted with sterile water in a ratio of 1:1 as much as about 25 cc is inserted into the urethra through a 50 cc syringe with a middle hole, the contrast appears to flow smoothly filling the urethra cavernosa to part of the bulbosa then backflow occurs, With the same technique, the contrast is slowly refilled, the contrast appears to fill the urethra bulbosa, membranasea, and prostatica then fills the bladder. Contrast filling is seen in the peri calcification of the soft tissue peri penile inferior accompanied by narrowing in the urethra bulbo-cavernosa by the calcification lesion which causes partial obstruction. No filling defect is seen. No contrast extravasation is seen.

surgical area which was narrowed with a sterile drape. The patient was positioned in a lithotomy position, then a perineal incision was made up to the urethra, and adhesions were found. The urethra was opened and a 4 cm x 4 cm stone was evacuated, then a 14-gauge Silicone Dower Catheter was installed, the urethra was sutured with Vicryl 2.0 simple suture, then closed layer by layer.

DISCUSSION

Age, gender, ethnic group, local climate, dietary habits, physical activity, and occupation are risk factors that can contribute to the development of urolithiasis. The presence of comorbid medical conditions such as diabetes; hypertension; and obesity are other risk factors [8]. In general, males are more likely to experience urethral stones compared to females due to anatomical differences in the urethra. In females, the incidence of urethral stones is lower due to the shorter urethra. However, frequent urinary tract infections in females can increase the risk of urethral stone formation. In rare cases, trauma or medical procedures involving the urethra can also lead to stone formation [8]. Urethral diverticula can be caused by urethral or meatal stenosis.

Infection and injury from medical procedures, especially catheterization, are two common causes of acquired urethral diverticula in males. Urethral diverticula can lead to stone formation, incomplete urination, infection, post-void dribbling, hematuria, and other complications[19]. Another study showed that there are several risk factors associated with urolithiasis, including family history; male gender; Diabetes Mellitus, and smokers. In addition, patients with a higher body mass index are also at risk for increased stone formation [9]. The causes of primary urethral stones are anatomical abnormalities such as urethral stricture, diverticulum, hypospadias, and meatal stenosis. These pathological conditions cause urinary stasis or stagnation and predispose to urinary tract infections [10].

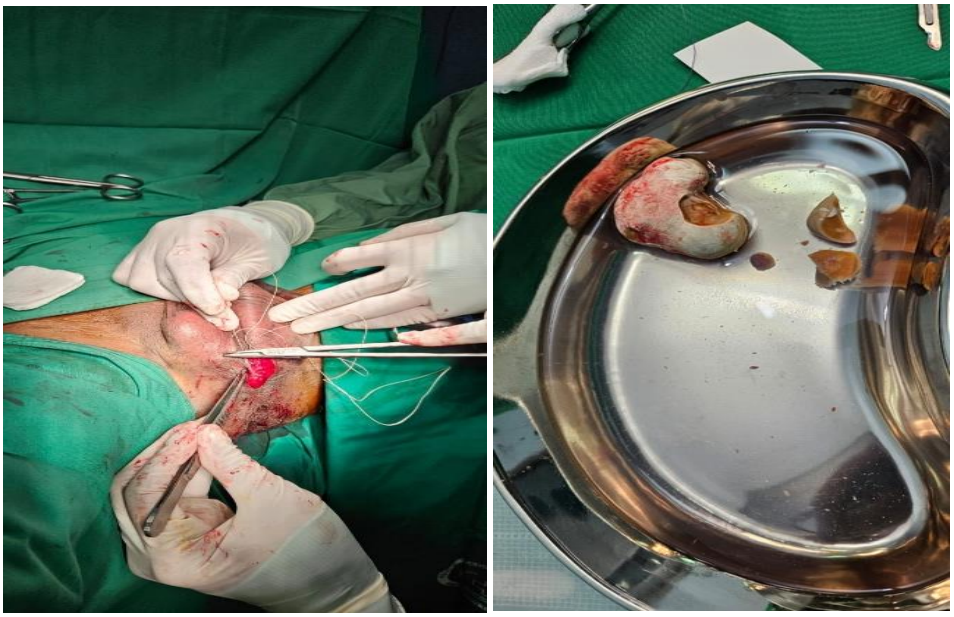

Figure 3. **Urethrectomy for Urethral Diverticulum Stone Evacuation**

Most urethral stones typically appear secondarily, originating from kidney or ureteral stones that descend to the bladder and subsequently enter the urethra. However, there are cases of primary urethral stones reported, arising directly in the urethra due to anatomical abnormalities such as urethral stricture, diverticulum, hypospadias, and meatal stenosis. These pathological conditions cause urinary stasis or stagnation, predisposing the patient to urinary tract infections [10]. A urethral diverticulum is a protrusion of the urethra through the periurethral fascia, typically presenting as a cystic lesion arising from the mid/distal posterolateral urethra. It often encases the urethra and may be multilocular. Approximately 10% of patients with a urethral diverticulum eventually develop stones within the diverticulum. Recurrent infections and irritation predispose to malignant transformation of the urothelial lining [7,12].

In this case, the patient was admitted to a similar condition two years ago, presenting with two lumps in the scrotal area, for which surgery was performed. The urethral diverticulum in this case can be assumed to result from the patient's previous surgical history and/or was exacerbated by a persistent stone, leading to local fibrotic necrosis, subsequent diverticulum formation, and recurring inflammation. Patients with underlying urethral abnormalities are more frequently found to have urethral stones in the penile or bulbar urethra (76.3% vs. 32.5%), whereas patients with normal urethras more commonly have stones in the posterior urethra (45.0% vs. 10.5%; $p<0.001$). Some patients also had a history of previous urethral surgery (14.7%) or were experiencing bladder or upper urinary tract stones (16.8%) [7].

Urethral obstruction by stones is often caused by the movement of upper urinary tract stones, namely bladder stones, ureteral stones, or kidney stones. Kidney or ureteral stones that descend spontaneously into the bladder will usually easily block the urethra. Stones that migrate from the bladder are usually solitary. Small stones (diameter <1 cm) can sometimes come out spontaneously. However, stones in the upper urinary tract that are already large before descending will block the urethra. Late detection can cause urethral stones to only be discovered when they are already in the anterior part. Friction of stones with the urethral epithelium will increase spasm of the external urethral sphincter or edema of the urethral epithelium, thereby increasing the possibility of obstruction. This stone obstruction is usually located in the prostatic or bulbous urethra [10].

Patients with urethral stones usually come with acute lower urinary tract complaints due to sudden impaction, which can be irritative or obstructive complaints. Obstructive complaints in the form of acute urinary retention are the most common main complaints found, with other obstructive complaints in the form of a weakened urine stream or dripping urine. Irritant complaints can be stranguria, macrohematuria, and dysuria [10]. Anamnesis, physical examination, and also supporting examinations are very necessary for establishing a diagnosis of stones.

The primary indication for retrograde urethrography is the detection of urethral strictures, which are narrowings of the urethra that obstruct urine flow. According to a study by Raj et al. (2022), retrograde

Table 1. Analysis of Urethral Diverticulum Stone Theory and Choice of Imaging Modalities

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Etiology	• Urethral diverticula in men is an uncommon condition, frequently developing following urethral instrumentation [14]. • The penile portion of the urethra is most often involved [14]. • Complications arise in approximately 10% of cases, with stone formation being the primary complication [15]. • Diverticula in the front or underside of the urethra are often due to birth defects [12]. • Urethral calculi may arise from kidney or bladder stones that have migrated and become impacted in the urethra. Nevertheless, cases have been documented where urethral calculi form primarily within urethral strictures, around foreign bodies, or within urethral diverticula [4].
Modality	• Voiding cystourethrography is the main test used to identify urethral diverticula and distinguish them from other nearby cysts [14]. • It is more accurate in women (up to 80-90%) than in men (60%) because it's easier to insert a catheter into a woman's urethra [14].
	• Ultrasonography is the initial modality of choice in cases of stones and diverticula [16]. • While being a highly accessible imaging test, ultrasound has demonstrated low sensitivity and specificity in detecting urethral diverticula [14]. • It can detect the presence of diverticula, as well as stones or tumors [4], with a sensitivity of 30-40% for posterior diverticula or to differentiate between solid and fluid-filled paraurethral masses [14]. • Ultrasound can also assess the impact of stones on surrounding urethral tissues and any dilation of the urinary tract above the stone [17].
	• CT can identify periurethral cystic lesions or calculi. Its sensitivity and specificity in detection are very high, however, it has low accuracy in determining the etiology [12,14].
	• MRI should be reserved for more complex cases when the status and relationship of the diverticulum to surrounding tissues need to be determined. In women, its sensitivity reaches 70% [4,12,14].
Therapy	• The treatment of choice is diverticulectomy and urethroplasty. Patients have been treated with pneumatic lithotripsy combined with ultrasonic lithotripsy [12]. • Endoscopic treatment has been performed for small diverticula with intact corpus spongiosum and supporting tissues [12]. • Surgical abstention can only be indicated for asymptomatic diverticula with a very small volume [12].
Follow up	• Ultrasound and ureteroscopy every 6 months may be recommended to monitor for residual stones [12].

urethrography has been shown to be highly effective in detecting anterior urethral strictures, which are common in men [2]. Additionally, urethrography is used to evaluate urethral trauma, particularly after accidents or injuries. In a study by Lee et al. (2021), urethrography demonstrated high sensitivity in diagnosing urethral trauma caused by blunt force injury, which is frequently associated with motor vehicle accidents [13].

The advantage of urethrography lies in its ability to directly visualize the urethral anatomy, facilitating physicians in planning subsequent interventions, such as surgery or non-invasive treatments. A study by Martinez et al. (2020) suggested that a combination of retrograde urethrography and voiding cystourethrography provides better diagnostic accuracy compared to either modality alone. This examination is recommended for patients with symptoms suggestive of strictures or other urethral abnormalities to obtain a comprehensive evaluation and appropriate management [20]. In the Urethrography examination, imaging begins with a plain pelvic X-ray in the Right Posterior Oblique (RPO) projection, revealing a suspected posterior urethral stone approximately 4.3 cm x 3.4 cm in size.

The purpose of the RPO projection is to prevent superimposition with other pelvic bone structures, except for the lower pelvis and proximal femur. A contrast X-ray is then performed by injecting a contrast medium into the urethra through a specialized instrument inserted into the external urethral orifice (OUE). The contrast medium used is iodine-based and water-soluble, with a volume of 20-30 mL. The injection of the contrast medium may also utilize a special tool, such as the Brodney Clamp. Next, serial post-contrast images in the RPO projection are taken, revealing diverticulolithiasis in the bulbo-cavernous urethra, resulting in urethral stenosis with partial obstruction.

The management of this patient involved a urethrotomy surgical procedure with the patient in the lithotomy position. Adhesions were found, and the urethra was opened to evacuate a urethral stone measuring 4 cm x 4 cm. A silicone Dower Catheter size 14 was placed, the urethra was sutured with Vicryl 2.0 using a simple suture, and the closure was done layer by layer. Post-operatively, the patient was admitted to the general ward class III and was administered Ceftriaxone 2x1g IV, Tranexamic acid 3x500mg IV, and Metamizole

3x500mg IV. Treatment options for urethral stones are still not fully codified, as they depend on the size, number, location of the calculus, the presence of underlying urethral pathology, and the presence or absence of complications that might modify the surgical approach [7,10].

A minimally invasive endoscopic approach using urethroscopy is preferred for small proximal stones, with the possibility of extraction in situ or fragmenting them or pushing them back to the bladder for laser fragmentation or lithotripsy, with a success rate approaching 80% [7,10,13]. For large, multiple, distal, and embedded urethral stones, conventional open surgery with meatotomy or sometimes urethrotomy, with or without urethroplasty, is an excellent therapeutic option [3,10]. Meanwhile, for large anterior urethral diverticula with urethral calculus, as in this case, open surgery (i.e., diverticulum resection and urethrostomy) is the recommended conventional approach and has shown good post-operative clinical outcomes [12].

Recurrence rates vary across different studies. One study showed a urolithiasis recurrence rate of 30% to 50% within 5 to 10 years after the initial stone episode. Similarly, two other studies reported recurrence rates as high as 50% within 10 years after the first stone episode. Asplin and Chandoke estimated an average stone recurrence rate of 30% at 5 years, 50% at 10 years, and 80% at 20 years [13]. Stone recurrence is common following urinary tract stone management. One study reported that 25.8% of patients experienced stone recurrence after endourological management with a median follow-up of 32 months. Furthermore, this study demonstrated that diabetes and smoking were risk factors for recurrence [11].

CONCLUSION

Urethral stones are a rare condition, comprising less than 1% of all urinary tract stones, with higher prevalence in men due to the longer and more complex anatomy of the male urethra. Clinical manifestations range from asymptomatic to symptoms like colic, dysuria, hematuria, urinary retention, and anuria. Urethral stones may cause complications such as fever, kidney failure, and urethral tenderness. Urethral diverticulum, a rare malformation, can also result in stone formation and incomplete voiding. Diagnosis usually starts with imaging, followed by urethrography and cystourethroscopy to confirm stones and assess underlying abnormalities. Ultrasound is useful for detecting radiolucent stones and evaluating the upper urinary tract. Management depends on the stone's size and location, with prompt intervention necessary to prevent complications like renal failure, urethral injury, or incontinence. Delayed diagnosis can lead to significant morbidity and complications, severely impacting the patient's quality of life.

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CONFLICT OF INTEREST

The authors declare that there are no relevant conflicts of interest related to this research. All research and analyses were conducted objectively and without influence from any parties that could affect the results or interpretation of the data. The authors did not receive financial support, sponsorship, or any other incentives that could create potential bias in this research. All information presented in this article is the result of independent research and has been conducted in accordance with applicable ethical principles.

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