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Pediatric Urethral Calculus Management in a Resource-Limited Setting: A Case Report and Review of the Literature

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ABSTRACT

Urethral calculi are an uncommon cause of acute urinary retention in children, particularly in low-resource settings where delays in presentation and limited technology complicate management. We report the case of a 5-year-old boy who presented to a rural district hospital in Chad with four days of complete urinary retention and progressive abdominal distention. Examination revealed a palpable mass at the penoscrotal junction, consistent with distal urethral obstruction. Point-of-care ultrasound demonstrated a markedly distended bladder but did not visualize a urethral stone. Initial suprapubic diversion was performed using an intravenous catheter. Under anesthesia the following day, gentle instillation of lubricating gel into the urethral meatus displaced the stone into the bladder, confirmed on repeat ultrasound. Definitive management was achieved with open suprapubic cystolithotomy, and the patient recovered uneventfully, regaining normal voiding function. He was also treated with Praziquantel for presumptive schistosomiasis, a common regional risk factor for stone formation. This case highlights the importance of adaptable, resource-appropriate strategies for pediatric urethral calculi. Simple maneuvers such as retrograde displacement with lubricating gel, combined with open cystolithotomy when minimally invasive options are unavailable, can provide safe and effective treatment. Recognition and treatment of underlying contributors remain essential to preventing recurrence.

Key Words: Urethral calculi, Acute urinary retention, Pediatric urolithiasis, Resource-limited setting

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Introduction

Pediatric urolithiasis, though less common than in adults, represents an emerging global health concern. In 2021, there were an estimated 1.56 million new cases worldwide, reflecting a 15% increase compared with 1990, with boys comprising 58% (920,000 cases) and girls 41% (640,000 cases). The increase in both incidence and prevalence was particularly noted in regions with a lower Socio-Demographic Index, thereby widening disparities in disease burden. By 2040, incidence is projected to exceed 1.53 million cases [1].

The etiology of pediatric urolithiasis is diverse. Approximately 55% of cases are idiopathic, while 25% are attributed to metabolic disorders, 7% to infections, and 12% to anatomical abnormalities. Environmental and socioeconomic factors also contribute, with hot climates, poor nutrition, and diarrheal diseases

recognized as major risk factors in endemic regions [2]. Clinically, urolithiasis can present anywhere along the urinary tract. Urethral calculi, while less frequent, most often manifest with penile pain in male patients. Additionally, anterior urethral stones commonly present with acute urinary retention, whereas posterior urethral stones may cause continuous dribbling of urine [3].

Children with acute urethral obstructions represent a challenge for providers, and early recognition and intervention are essential to prevent complications such as infection, renal impairment, and bladder dysfunction. We report the case of a 5-year-old male who presented emergently to a district hospital in rural Chad with acute urinary retention secondary to a urethral calculus. This case highlights a unique management strategy adapted to the constraints of a low-resource setting.

Case presentation

A 5-year-old male presented to a district hospital in rural Chad with a four-day history of complete urinary retention and progressive lower abdominal distension. On examination, the child was afebrile but in significant distress, with a tense, distended bladder palpable on abdominal examination and suprapubic tenderness. A firm mass was appreciated at the junction of the penile shaft and scrotum, raising suspicion for a distal urethral obstruction. Attempts to place a Foley catheter were unsuccessful.

Point-of-care ultrasound revealed a markedly distended bladder, but no definite calculus was visualized in the bladder or renal pelvis. A common limitation of ultrasonography is difficulty detecting small or distal urethral stones. In keeping with standard practice in this setting, a suprapubic 18-gauge intravenous catheter was inserted to decompress the bladder and provide temporary urinary diversion.

The following day, the patient was taken to the operating room for further evaluation and management under anesthesia. The temporary suprapubic catheter was removed. A small amount of water-soluble lubricating gel (approximately 5 mL) was gently injected into the urethral meatus using a syringe. Immediately after this, the previously palpable mass at the penoscrotal junction could no longer be felt, suggesting that the calculus had been displaced proximally into the bladder.

Ultrasonography was repeated and this time identified a small bladder calculus. In this limited-resource setting there are no endourological options for management of urinary calculi and the decision was made to perform an open procedure. A urethral Foley catheter was then inserted and the bladder filled with lactated Ringer's solution. The Foley was clamped to maintain a distended bladder and an open suprapubic cystolithotomy was performed through a 3 cm incision and the bladder closed in two layers with 2-0 Monocryl suture. A Foley catheter was left in place postoperatively (Figure 1).

Fig. 1. An approximately one centimeter calculus was lodged in the patient's anterior urethra, surgical removal was performed after retrograde expulsion.

The patient received daily intravenous lactated Ringer's solution (500 mL each afternoon) to encourage diuresis and reduce the risk of debris obstructing the Foley catheter. He was also treated with praziquantel for presumptive schistosomiasis, a common contributor to urogenital calculi in the region. The Foley catheter was removed one week postoperatively, and the patient was able to void spontaneously without difficulty. He was discharged home the following day in stable condition with normal urinary function.

Discussion

Urethral calculi are a rare cause of acute urinary retention in children, particularly in developed countries, but represent a significant clinical challenge

in low-resource settings [2,4]. Globally, the incidence of pediatric urolithiasis has risen markedly in recent decades, with one long term cohort reporting a sustained 4% annual increase in children under 18 years of age [5]. Similar trends have been confirmed across diverse populations [6,7] and the 2021 Global Burden of Disease study further documents rising pediatric stone cases worldwide, even as associated mortality and disability-adjusted life years have declined [8].

The epidemiology of pediatric stone disease in low-resource settings is shaped by hot climates, poor nutrition, recurrent diarrheal illness, and endemic infections such as schistosomiasis, all of which predispose to the formation of ammonium acid urate and calcium oxalate stones [2,4]. In contrast, urethral stones are rarely reported from high-income countries, where early diagnosis and minimally invasive interventions predominate [9]. This rising epidemiological trend underscores the growing relevance of stone disease in pediatric populations across both developed and emerging settings.

The clinical presentation of pediatric urethral calculi depends largely on stone size and location. Distal stones typically cause acute urinary retention, as in our case, while proximal stones may present with urinary dribbling [3]. Our patient's presentation of complete retention due to a distal urethral stone is consistent with prior reports that smaller calculi more often obstruct the anterior urethra. Palpable masses may guide diagnosis, however, imaging such as ultrasonography is often limited in detecting small or distal urethral stones [3,10].

Management strategies must adapt to resource availability. In high-resource settings, minimally invasive approaches such as transurethral or percutaneous cystolithotripsy predominate, offering high stone-free rates with low morbidity [4]. In contrast, open cystolithotomy remains the most practical option in many low-resource environments, where socioeconomic constraints, delayed presentation, and lack of endoscopic equipment limit access to minimally invasive surgery [2,4,9,11]. For example, up to 30% of pediatric cases in Pakistan still require open procedures, and in rural Chad, cystolithotomy remains the standard of care [9]. Despite being largely abandoned in high-income countries, open surgery continues to play a critical role in these settings [5,8].

In selected cases, however, simple bedside maneuvers may be sufficient. At our center, milking a distal urethral stone out of the urethra with digital pressure along the penile shaft has relieved obstruction effectively, with children subsequently voiding well and showing no evidence of stricture. Care must be taken to avoid exacerbating urethral trauma, but this approach can relieve obstruction without surgical intervention. This method, however, is not applicable to chronic cases complicated by urethral fistulae, where suprapubic diversion is often already in place.

Our case highlights a pragmatic stepwise approach: initial suprapubic catheter diversion for acute decompression, retrograde displacement of the urethral stone *via* lubricating gel injection, and open cystolithotomy for definitive removal. This sequence minimized urethral injury and achieved a successful outcome. Recognizing and treating underlying contributors such as endemic infections (e.g., schistosomiasis), dehydration, and malnutrition is essential to prevent recurrence [2,4].

Although relatively few reports describe acute urethral obstruction from calculi in pediatric populations, our experience suggests it may be more common in certain low-resource regions [2]. Sharing such strategies contributes to the global conversation on pediatric stone disease and underscores the need for adaptable management approaches where minimally invasive urology cannot be reliably accessed.

Conclusion

Pediatric urethral calculi are a rare but important cause of acute urinary retention, particularly in resource-limited settings, where delayed presentation and limited technology complicate management. This case demonstrates that simple, low-cost maneuvers such as lubricating gel injection to dislodge a distal urethral stone combined with open cystolithotomy can provide safe and effective treatment when endourological options are unavailable.

Greater awareness of these pragmatic approaches, alongside efforts to address underlying risk factors such as schistosomiasis, dehydration, and malnutrition, is essential to improving outcomes for children with stone disease in low-resource regions.

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