World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(CASE REPORT)

Diagnosis and Management of a Calculous Female Urethral Diverticulum: A Case Report with a Review of the Literature

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World Journal of Advanced Research and Reviews, 2026, 30(03), 1257-1263

Publication history: Received on 06 May 2026; revised on 12 June 2026; accepted on 15 June 2026

Article DOI: https://doi.org/10.30574/wjarr.2026.30.3.1680

Abstract

Background: Female urethral diverticulum (FUD) is a rare condition with an estimated prevalence of 1–6% in adult women. Intraluminal calculus formation is an uncommon but well-recognised complication, occurring in 1.5–10% of FUD cases, resulting from chronic urinary stasis within the diverticular sac.

Case Report: We report the case of a 43-year-old multiparous woman (G4P4) presenting with a two-year history of an anterior vaginal mass. Pelvic MRI confirmed an inter-urethrovaginal cystic lesion communicating with the urethra and containing a 15 × 11 mm hypointense calculus. The patient underwent transvaginal diverticulectomy with simultaneous stone extraction and a tension-free three-layer repair. The postoperative course was uneventful.

Conclusion: This case highlights the importance of considering FUD with calculus in any patient presenting with an anterior vaginal mass. Pelvic MRI is the gold-standard investigation. Transvaginal diverticulectomy with multilayer closure remains the surgical treatment of choice.

Keywords: Female urethral diverticulum; Intraluminal calculus; Pelvic MRI; Transvaginal diverticulectomy; Anterior vaginal mass

1. Introduction

Female urethral diverticulum (FUD) is a rare condition defined as an outpouching of the urethral mucosa into the periurethral tissues, communicating with the urethral lumen through one or more ostia. Its prevalence has been estimated at 1–6% in adult women [1, 2]. FUD is most commonly acquired, typically arising between the third and sixth decades of life, and results from recurrent infection and obstruction of the periurethral Skene's glands, leading to the formation of periurethral pseudo-abscesses that subsequently drain into the urethral lumen [3, 4].

The clinical presentation is heterogeneous and frequently non-specific. The classic triad of dysuria, dyspareunia, and post-void dribbling is encountered in only a minority of cases. Patients more commonly present with recurrent urinary tract infections, chronic pelvic discomfort, or an anterior vaginal mass, which accounts for the prolonged diagnostic delay of several years frequently reported in the literature [2, 5].

Intraluminal calculus formation is a rare but well-described complication, occurring in 1.5–10% of FUD cases across published series. It results from chronic urinary stasis, recurrent infections, and the accumulation of cellular debris

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within the diverticular sac, which promote precipitation and crystallisation of urinary solutes, most commonly calcium phosphates or oxalates [4, 6].

Pelvic magnetic resonance imaging (MRI) is currently considered the gold-standard investigation, providing precise mapping of the diverticulum, identification of its urethral communication, and detection of associated complications [7]. Management is primarily surgical and relies on transvaginal diverticulectomy with multilayer closure [2, 3].

Herein, we report a case of FUD complicated by intraluminal calculus formation managed in our department, and we propose an updated literature review to clarify the diagnostic and therapeutic features of this rare entity.

2. Case Report

2.1. Clinical Presentation

A 43-year-old multiparous woman (G4P4) with no significant past medical or surgical history presented with a two-year history of an intravaginal mass sensation associated with progressive pelvic discomfort. She denied urinary incontinence, irritative or obstructive lower urinary tract symptoms, and dyspareunia.

Physical examination revealed a patient in satisfactory general condition (ECOG performance status 0), with an unremarkable abdominal examination. Gynaecological examination showed a clean perineum with no visible genital prolapse. Palpation of the anterior vaginal wall demonstrated a firm, mildly tender paraurethral mass, suggestive of a urethral diverticulum containing a hard structure consistent with an intraluminal calculus.

2.2. Diagnostic Work-Up

Abdominopelvic ultrasound performed as a first-line investigation identified a paraurethral cystic formation containing a hyperechoic focus with posterior acoustic shadowing, consistent with an intraluminal calculus.

Pelvic MRI confirmed the presence of an inter-urethrovaginal cystic lesion communicating with the urethra via a well-defined fistulous tract, and containing a hypointense formation on all sequences measuring 15 × 11 mm, consistent with an intraluminal calculus. No intraluminal soft-tissue lesion or pelvic lymphadenopathy was identified.

Standard laboratory investigations (complete blood count, C-reactive protein, serum electrolytes, renal function, mid-stream urine culture) revealed no significant abnormality.

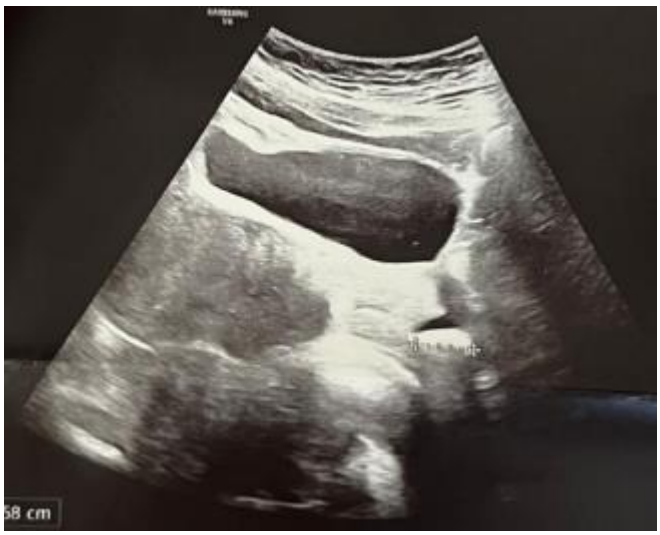

Figure 1 Pelvic ultrasound demonstrating a urethral diverticulum complicated by an intraluminal calculus

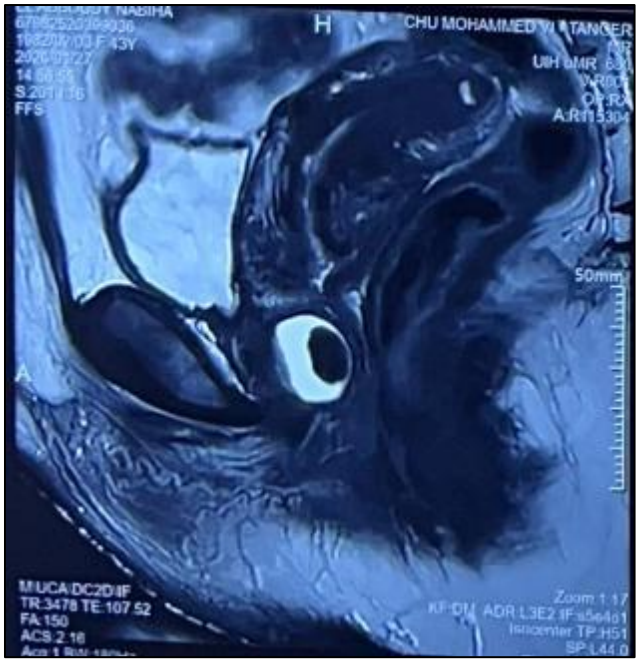

Figure 2 Pelvic MRI demonstrating a urethral diverticulum complicated by an intraluminal calculus

2.3. Surgical Management

Following confirmation of the diagnosis of FUD complicated by an intraluminal calculus, surgical intervention was indicated. The procedure was performed under general anaesthesia in the lithotomy position.

Transvaginal diverticulectomy was performed. A longitudinal incision of the anterior vaginal wall was made, followed by careful dissection in the plane of the vesicovaginal fascia to the periurethral fascia. Transverse incision of the periurethral fascia provided complete exposure of the diverticulum. The diverticular sac was opened transversely, allowing extraction of the intraluminal calculus. The diverticulum and its neck were then widely excised to minimise the risk of recurrence.

Closure was performed in three distinct anatomical layers to ensure satisfactory reconstruction and reduce the risk of urethrovaginal fistula: the urethral wall was closed with 4-0 absorbable suture, the periurethral fascia with 3-0 absorbable suture, and the anterior vaginal wall with 3-0 absorbable suture.

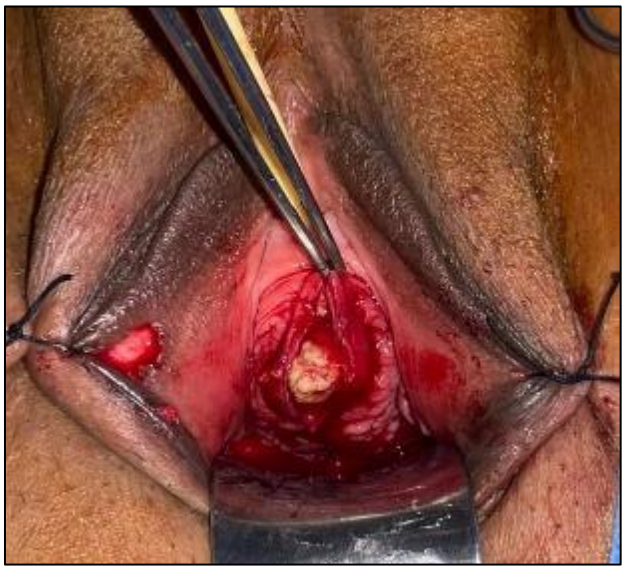

Figure 3 Intraoperative image during calculus extraction

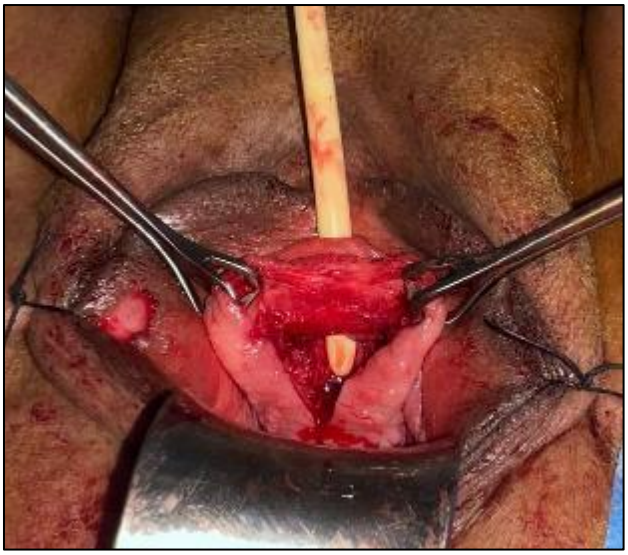

Figure 4 Wide excision of the diverticular neck to prevent recurrence

Figure 5 Immediate postoperative appearance

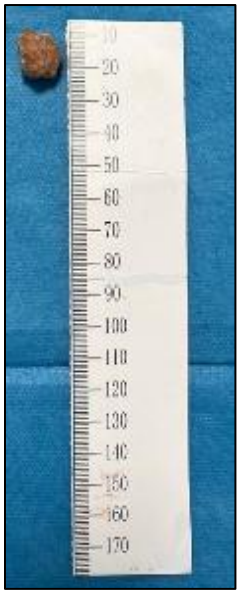

Figure 6 The extracted intraluminal calculus

2.4. Postoperative Course and Follow-Up

The immediate postoperative course was uneventful. The urethral catheter was maintained for seven days. The patient was reviewed at one and three months postoperatively and reported no residual symptoms. Follow-up gynaecological examination showed no signs of infection, fistula formation, or clinical recurrence.

3. Discussion

3.1. Epidemiology and Pathogenesis

Female urethral diverticulum is a rare condition whose true prevalence is likely underestimated given the frequently asymptomatic or non-specific nature of its presentation. El-Nashar et al. estimated its incidence at approximately 4.7 per 10,000 women in a population-based study [1]. Certain series have reported a higher incidence among African-American women, suggesting a possible genetic predisposition [2].

The most widely accepted pathogenetic theory is that of recurrent infection and obstruction of the periurethral glands, initially described by Huffman in 1948 [3]. Recurrent episodes of urethritis or urethral trauma lead to infection, obstruction, and subsequent dilatation of these glands, culminating in the formation of periurethral abscesses that drain into the urethral lumen, thereby establishing a diverticulum [4]. Alternative theories involving obstetric trauma, congenital origin, or iatrogenic causes have also been proposed but remain marginal [5].

3.2. Intraluminal Calculus Formation

Calculus formation within a female urethral diverticulum is a rare complication, with a reported frequency of 1.5–10% across published series [4, 6]. Chronic urinary stasis, recurrent infections, and the accumulation of cellular debris within the diverticular cavity are the principal predisposing mechanisms. Calculi are most commonly composed of calcium phosphates or oxalates, and occasionally of uric acid. Their presence may exacerbate local symptoms, perpetuate the cycle of infection, and increase surgical complexity [6, 8].

In the present case, the calculus measured 15 × 11 mm, representing an intermediate size. Reports of giant calculi have been published in the literature, notably by Beatrice and Strebel [8], underscoring the expansile capacity of the diverticular sac in the absence of timely intervention.

3.3. Clinical Presentation and Diagnostic Delay

FUD presents insidiously. In the series of Statoua et al. comprising 18 cases, the mean time to diagnosis ranged from several months to several years [5]. The classic "3D" triad of dysuria, dyspareunia, and post-void dribbling is present in

only a minority of patients. An anterior vaginal mass, the most clinically significant finding on examination, is the most suggestive feature, particularly when it contains a palpably hard structure indicative of intraluminal calculus.

In our patient, the absence of overt urinary symptoms and the slow progression over two years illustrate the characteristically insidious course of this condition. It was the careful palpation of a hard anterior vaginal mass that directed the clinical assessment toward the correct diagnosis.

3.4. Role of Imaging

Imaging plays a pivotal role in the diagnosis of calculous female urethral diverticulum. Ultrasound is frequently requested as a first-line investigation. It can identify the diverticular sac and detect the calculus by its characteristic posterior acoustic shadowing, yet remains limited in the accurate assessment of anatomical relationships.

Pelvic MRI is currently the reference standard [7]. T2-weighted sequences enable precise localisation of the diverticulum, typically appearing as a horseshoe-shaped hyperintense lesion on axial views, with clear demonstration of its urethral communication, identification of internal septa, and detection of complications (hypointense calculi, soft-tissue nodules suspicious for malignancy). MRI optimises surgical planning by delineating the relationship of the diverticulum to the sphincter mechanism and the bladder neck [7].

Voiding cystourethrography (VCUG), although less widely used since the advent of MRI, retains utility in visualising the diverticular neck and ostium. Cystourethroscopy completes the work-up by allowing direct visualisation of the urethral communication; however, this is identified in only approximately 30% of cases due to periostial inflammation [4].

3.5. Surgical Management

Surgical intervention is indicated for symptomatic FUD. Transvaginal diverticulectomy is the reference technique, aiming at complete excision of the diverticular sac while preserving the sphincter mechanism [2, 3]. In cases of associated calculus, stone extraction is performed as a preliminary step or concomitantly with diverticulum excision.

Multilayer closure in three distinct anatomical planes — urethral repair, periurethral fascia closure, and anterior vaginal wall closure — is the recommended strategy to minimise the risk of urethrovaginal fistula and diverticulum recurrence, with cure rates exceeding 90% in major published series [2, 3]. Wide excision of the diverticular neck is a critical technical element for reducing recurrence risk.

In our patient, this technique was followed, yielding an uneventful postoperative course with no residual symptoms at three months of follow-up, confirming its efficacy. Closure using 4-0 absorbable suture for the urethra and 3-0 absorbable suture for the overlying layers is consistent with current literature recommendations [2].

4. Conclusion

Female urethral diverticulum complicated by intraluminal calculus formation is a rare entity whose diagnosis relies on careful clinical examination, notably the palpation of a hard anterior vaginal mass, and on imaging, with pelvic MRI as the cornerstone investigation. This case underscores the importance of considering this diagnosis in any woman presenting with a persistent anterior pelvic mass so as to avoid a potentially harmful diagnostic delay.

Transvaginal diverticulectomy with simultaneous calculus extraction and anatomical three-layer closure constitutes the reference surgical treatment, allowing complete resolution of symptoms with a low complication rate. Rigorous preoperative planning guided by MRI and meticulous excision, including the diverticular neck, are essential prerequisites for a satisfactory long-term functional outcome.

Compliance with ethical standards

Acknowledgments

The authors thank the Department of Urology of Tangier University Hospital for their support in patient management.

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

The authors confirm that this study does not require formal ethical approval as it involves the retrospective reporting of a single clinical case in routine practice.

Statement of informed consent

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

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