Female Urethral Diverticula

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1. Introduction

A urethral diverticulum (UD)[1] is an epithelialized cavity arising from a defect in the fascial layers of the urethropelvic ligament resulting in an outpouching of **urethral mucosa**. UD can vary in size, shape and location, ranging from a simple cyst-like structure with a single opening in the urethral lumen to a complex saddle configuration with multiple septations that can occur along the length of the urethra. For the purposes of this chapter of the Core Curriculum, we will be reviewing female urethral diverticula. While the male urethra can also develop diverticula, such as after **hypospadias repair**, the underlying pathophysiology, diagnosis, and surgical treatment differ from female UD.

2. Risk Factors and Pathophysiology

Most urethral diverticula are acquired and occur in women, most likely from infection and obstruction of periurethral glands located posterolaterally in the mid to distal urethra. Repeated infection of the periurethral glands leads to an enlarging suburethral abscess cavity that expands and dissects within the periurethral fascia and eventually ruptures into the urethral lumen. [2,3]

Risk factors associated with UD include chronic infection,[2] African American descent,[4] trauma with forceps delivery,[5] and endoscopic injections.[6]

3. Epidemiology

The true prevalence is unknown but estimated to be between 1 to 6% of the female population,[7,8] occurring most commonly in the 3rd to 7th decades of life.[9,10,11,12,13] Some historical series have reported an incidence of UD as high as 10 to 40% in patients with lower urinary tract symptoms (LUTS) (depending upon the selected imaging and the population assessed).[14,15]

4. Presentation

Although UD has been associated with a classic triad of dysuria, dyspareunia, and dribbling, UD often presents with diverse signs and symptoms (see **Table 1**), with irritative LUTS, pain,

and infection being most common.[4,16,17,18] If the UD is large, women may note a palpable vaginal mass. The presence of LUTS combined with post-micturition dribbling and UTI symptoms has a significantly higher positive predictive value of finding a UD compared to individual symptoms alone (odds ratio > 13).[19] Since these symptoms can be nonspecific, however, and some patients are even asymptomatic, patients with UD are often misdiagnosed and see an average of nine physicians before the correct diagnosis is made.[20]

Table 1: Presenting Signs and Symptoms of Urethral Diverticula

Symptoms	Signs
Dysuria	Bacteriuria
Urethral or pelvic pain	Hematuria
Urinary frequency	Urethral or vaginal discharge
Urinary urgency	Urethral or anterior vaginal wall tenderness
Vaginal or pelvic mass	Pyuria
Postvoid dribbling	Vaginal wall mass
Dyspareunia	Elevated post void residual
Incontinence	
Urinary hesitancy	
Urethral or vaginal discharge	

5. Diagnosis and Evaluation

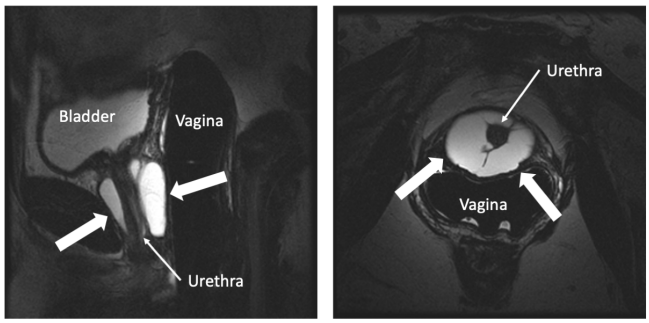


Figure 1: T2 weighted MRI images demonstrating sagittal (a) and axial (b) views of a circumferential urethral diverticulum. On T2 weighted images, the diverticulum will appear white (indicated by the white block arrows)

The evaluation of all patients with suspected UD should include a complete history, physical exam, urinalysis with culture, cystoscopy, and imaging. In select patients with urinary symptoms such as incontinence, urodynamic testing may be useful for surgical planning. During physical exam, the anterior vaginal wall should be palpated for a cystic mass making note of its size, consistency, and location relative to the urethra, which can help differentiate UD from other periurethral masses[21] (see **Table 2**). Discharge from the urethral meatus when applying pressure on the cystic lesion may assist in diagnosis and further suggest a UD. Presence of stress incontinence and vaginal prolapse should be evaluated along with vaginal tissue integrity before surgical treatment, since concomitant reconstruction as well as flap interposition may be needed at the time of repair.

Cystoscopy is performed to identify the opening(s) to the urethra, often referred to as the ostium (os), of the UD and to rule out other causes for irritative symptoms. The UD ostium is usually found posterolaterally in the mid urethra, but may be difficult to visualize with success rates between 15% to 89%.[4,10,22]

A **Urodynamic study** (UDS) is recommended in patients with significant voiding dysfunction. Adding the video component to UDS may improve diagnostic evaluation. About 50% of patients with UD have **stress incontinence** and concomitant anti-incontinence procedure may be performed at the time of UD excision.[10,23,24,25] However, it is important to note that the AUA/SUFU Stress Urinary Incontinence Guideline advises against the placement of a synthetic mesh midurethral sling at the time of diverticulectomy.[26]

Imaging is indispensable in diagnosing and characterizing UD prior to surgical management. There are several imaging modalities utilized based on availability, cost, and experience (of the radiologist

and technician).

Historically, **VCUG** has been the radiographic study of choice for years, but has been shown to miss 7 to 27% of UD diagnoses.[5,10,27,28] Positive pressure urethrography (PPU), which utilizes a double-balloon catheter (e.g. Trattner catheter) to assess the urethra is better at detecting UD, [27,28,29,30,31] but may still miss a UD that is non-communicating with the urethral lumen. A transvaginal ultrasonography (US) can also note the presence of a cystic structure seen as hypoechoic or anechoic lesion. Limitations to US technology include that it is operator-dependent and may not give adequate information to distinguish urethral diverticulum from other cystic masses. **A UD is currently best visualized with pelvic MRI** with and without contrast.[32,33] MRI protocol of UD comprises of T1 pre and post gadolinium views which will demonstrate UD as decreased signal intensity (dark) and T2 weighted fast spin echo sequences, which will show UD as high signal intensity (bright white).

Table 2: Differential Diagnoses of Periurethral Masses

Diagnosis	Location	Characteristic	Treatment
Urethral Diverticulum	Mid or proximal urethra	Connects with urethral lumen (diverticular os)	Excision and reconstruction for most
Skene's Gland Cyst or abscess	Distal urethra; distorts meatus	No connection with urethral lumen; dysuria, dyspareunia, obstruction, pain	Aspiration; Incision and drainage; marsupialization; Excision
Vaginal Wall Cysts	Mid anterior vaginal wall	Freely mobile, soft, usually asymptomatic; associated with trauma	Conservative; simple excision if symptomatic
Vaginal Leiomyoma	Anterior vaginal wall	Freely mobile, firm, nontender; may cause obstructive symptoms if large; estrogen dependent	Excision and enucleation to rule out malignant histology
Gartner's Duct Cysts	Anterolateral vaginal wall from cervix to introitus	May be associated with ectopic ureter in duplicated system; need upper tract evaluation	Depends on symptoms and renal moiety function; observation for nonfunctioning unit; excision and marsupialization of cyst
Urethral Mucosal Prolapse	Circumferential herniation of mucosal tissue at meatus	Beefy red, doughnut-shaped lesion surrounding urethral meatus; asymptomatic or cause bleeding, spotting, pain, or urinary symptoms	Topical estrogen or anti-inflammatory ointment, sitz baths; Circumferential excision (best outcome), cauterization, ligation around Foley catheter

Urethral Caruncle	Meatus	Reddish exophytic lesion related to urethral prolapse, common in postmenopausal women	Topical estrogen or anti-inflammatory ointment, sitz baths; Circumferential excision for larger lesions

6. Management

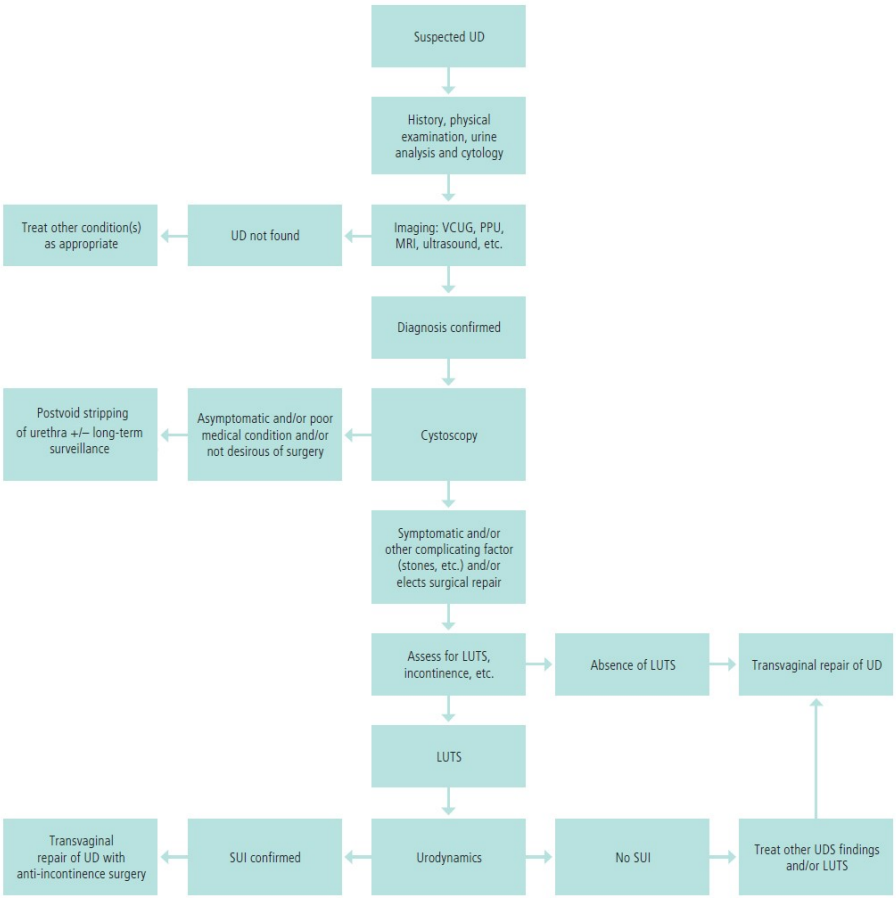


Figure 2: Algorithm for UD Management

Little is known about the natural course of UD, and there is no standard algorithm to guide patients through observation or surgical management. Treatment should be based on degree of bothersome symptoms, although many patients with UD will eventually require definitive removal and reconstruction in a layered and structured approach (**Figure 2**).

Non-surgical

Conservative treatment is based on symptoms and can include antibiotics for **acute infections**, anticholinergics for irritative LUTS, and/or analgesics. For those who are acutely ill or pregnant and cannot undergo surgery, UD can be aspirated or incised and drained in the office. It is important to carefully counsel and monitor those who opt for non-surgical management because there have been cases of **carcinomas** arising in urethral diverticula [29-38]. Please see the below section on Malignancy under Special Considerations for further discussion.

Surgical

Operative intervention should be offered to those with acute symptoms or refractory to medical therapy. Of the various surgical approaches described in the literature, including marsupialization

(Spence procedure), endoscopic unroofing, fulguration, coagulation, and excision with reconstruction, the most commonly performed procedure is excision with reconstruction. A marsupialization procedure is best reserved for distal lesions or poor surgical candidates. The goal of surgical excision is complete resection of the diverticulum. This is achieved through a transvaginal surgical approach.

General principles of UD repair include: complete resection of the diverticulum, meticulous tissue handling and dissection, periurethral tissue and urethral reconstruction with non-overlapping suture lines and tension-free closures. For those complex cases where the tissue quality is poor, such as in cases where there has been prior radiation, chronic infection, reoperation, and/or an immunosuppressive environment (i.e. diabetes mellitus), it is advisable to augment the repair with tissue interposition such as a labial fat pad (i.e. Martius flap). A concomitant autologous fascial pubovaginal sling can treat concurrent SUI and serve as an interposition layer to the urethral closure. Consider suprapubic tube placement if autologous sling placement is performed at the time of the UD excision as a large retrospective study reported peri-operative (<6 weeks) and long-term (>6 weeks) urinary retention rate of 11% and 8%, respectively. [34]

Postoperative Management

All patients will have an indwelling foley and/or suprapubic tube to gravity drainage for 2-3 weeks. There is no consensus on antibiotic prophylaxis during the postoperative period. Urologists may obtain a VCUG study on the day of the voiding trial to rule out extravasation. **Pain** should be managed with a special effort to avoid narcotic use.

7. Complications & Special Considerations

Table 3: Complications of Transvaginal Urethral Diverticulectomy (UD)
Complication (% Range of Reported Incidence)
Urinary incontinence (1.7%-16.1%)
Urethrovaginal fistula (0.9%-8.3%)
Urethral stricture (0%-5.2%)
Recurrent UD (1%-25%)
Recurrent urinary tract infection (0%-31.3%)
Other: • Hypospadias/distal urethral necrosis • Bladder or ureteral injury • Vaginal scarring or narrowing: dyspareunia, etc.
Adapted from Dmochowski R. Surgery for vesicovaginal fistula, urethrovaginal fistula, and urethral diverticulum. In: Walsh PC, Retik AB, Vaughan ED Jr, et al, editors. Campbell's urology. 8th ed. Philadelphia: WB Saunders; 2002.

Complications from urethral diverticulectomy can be minimized by careful dissection and preservation of periurethral fascia, multi-layered closure with well-vascularized tissues, and complete excision of the UD. Complications of transvaginal urethral diverticulectomy are listed in **Table 3,** with the most common being recurrent UTI, urinary incontinence, and recurrent UD.

Post Operative Stress Urinary Incontinence

De novo stress urinary incontinence (SUI) may occur in 16-49% of UD patients after surgery.[35,36,37,38] UD greater than 3 cm in size and in a proximal location appear to be risk factors for post-operative SUI.[37] Evidence suggests that concomitant anti-incontinence procedures can be performed safely during diverticulectomy.[24] Synthetic mesh sling placement at the time of UD excision should not be performed due to the risk of urethral perforation and fistula formation. A staged approach would be safest if a mesh sling is chosen to be placed. However, the use of a concomitant autologous pubovaginal sling at the time of UD repair is appropriate in well-selected patients.[39]

Recurrent UD

Recurrence rates are reported to be between 8-10%.[40,41] Reappearance of UD may occur due to technical factors, such as incomplete excision, remaining dead space, or insufficient closure of the urethra. Management of recurrent UD can be especially challenging due to scarred tissue planes, which may be difficult to dissect.

Urethrovaginal Fistula

Management of urethrovaginal **fistula** resulting from urethral diverticulectomy can differ based on its location. Mid to proximal urethral fistulae can cause significant incontinence and should be repaired with tissue interposition with healthy adjuvant tissue such as a Martius flap. Distal urethral fistula may not need surgical intervention since they are distal to the sphincteric mechanism and therefore are generally only minimally symptomatic.

Malignancy

Although very uncommon, there is risk of **carcinoma** associated with UD, with adenocarcinoma being most frequently type of malignancy reported.[42,43,44,45,46,47,48,49,50] Transitional cell carcinoma is second most common, followed by squamous cell carcinoma.[46] These tumors are often detected incidentally on surgical pathology after excision, but may also be suggested on MRI. It is important to keep malignancy in the differential diagnosis when patients are older, have atypical presentation, gross hematuria, or obstructive voiding complaints.[51] In patients with malignancy within the UD, most advocate local excision followed by radiotherapy or extensive resection with cystourethrectomy with or without adjuvant external beam radiotherapy due to high recurrence rates.

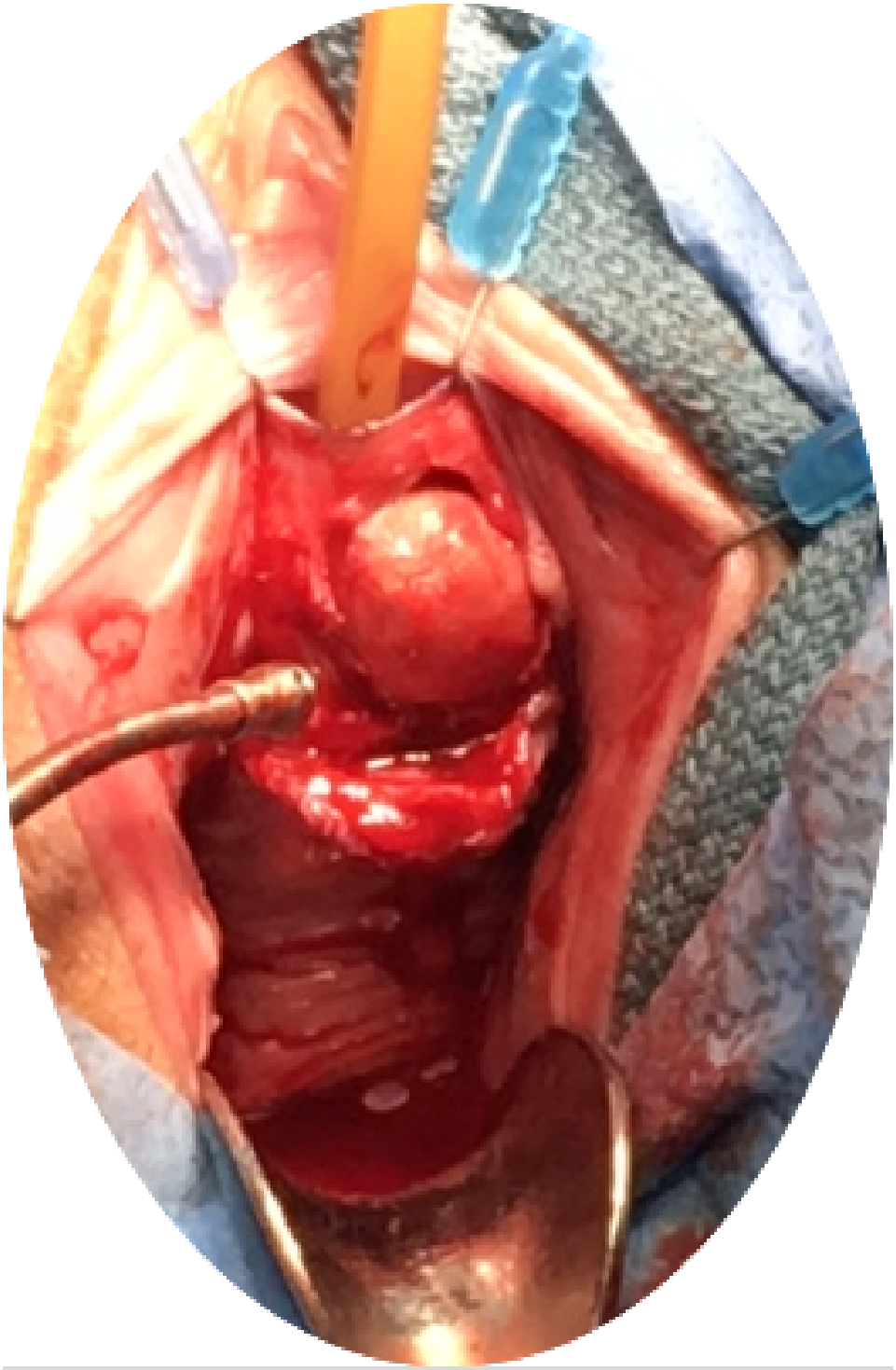
8. Clinical Care Pathway

Algorithm for UD management can be found in **Figure 2**.

9. Abbreviations

- **LUTS**: lower urinary tract symptoms
- **MRI**: Magnetic Resonance Imaging
- **PPUG**: Positive Pressure Urethrography
- **SUI**: stress urinary incontinence
- **UTI**: urinary tract infection
- **UDS**: Urodynamic study
- **VCUG**: Voiding Cystourethrogram
- **UD**: Urethral Diverticulum
- **US**: Ultrasonography

10. Images



Skene gland cyst excision

Videos

Skene's gland cyst excision

Guide for a 6-Step Excision of Complex/Horseshoe Urethral Diverticula

Excision of urethral diverticulum with rectus fascia sling

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