Review

The treatment of complex female urethral pathology

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Abstract Lower urinary tract symptoms (LUTS) in women produce significant bother. Common conditions causing LUTS in women include urinary tract infections, overactive bladder, and stress incontinence. Urethral diverticulae and female urethral strictures are rare pathologies. They can cause symptoms, which can mimic commoner conditions, leading to delay in diagnosis and unnecessary delay in treatment. In this article, we discuss in detail the definition, symptoms, epidemiology, pathogenesis, diagnosis, and treatment option for these two conditions. Further understanding of these conditions will aid in the proper diagnosis and prevent delay in management.

1. Introduction

Lower urinary tract symptoms (LUTS) including weak stream, dysuria, frequency, urgency, feeling of incomplete evacuation, and incontinence, are a common source of bother in women. Historically female urethral pathologies were often overlooked as a cause of LUTS in women. In a study of 1000 female patients presenting with frequency, lesions of the urethra were present in 690 patients [1]. In another study of 650 female patients complaining of various LUTS, the urethra was the cause of symptoms in 123 patients (18%), and it was a factor contributing to LUTS in 501 patients (72%) [2]. Urethral conditions may have been under-diagnosed particularly before local anesthetic endoscopy and magnetic resonance imaging (MRI) scans were easily available. A high level of suspicion is needed in the clinical evaluation of LUTS to reach a proper diagnosis. Mistaken diagnosis may lead to unnecessary procedures or neglect of treatment with consequent development of unexplained or atypical complications. Therefore it is important to consider urethral pathologies as a possible cause in any case of LUTS in women. The most common pathologies of the female urethra requiring surgical treatment are

urethral strictures and urethral diverticulae (UD). Increasing recognition of these conditions has led to the development of more refined diagnostic techniques and treatments. In addition, the development of specialist referral centers has led to publish reports of larger case series leading to a wider evidence base to guide diagnosis and treatment.

2. UD

2.1. Definition

UD are abnormal, periurethral, urine filled cystic structures that are connected to the urethra via an ostium. Differential diagnoses include periurethral cysts, and benign and malignant tumors of the periurethral tissues.

2.2. Symptoms

UD classically present with dysuria, urethral discharge, and dyspareunia, commonly with anterior vaginal wall mass and insensible post micturition incontinence [3]. Symptoms of urinary or local infection occur in 33%, which together with LUTS are the presenting complaint in 91% of patients [4]. Occasionally, symptoms are due to rare complications such as stones or tumor, which have developed in a diverticulum. These complications may present with increasing discomfort or pain, urinary tract infections or hematuria. However about 10% of UD are completely asymptomatic, and incidentally encountered on physical examination, imaging or perioperatively during vaginal surgery [4].

The non specific presenting symptoms often lead to delay in diagnosis, which was estimated to be between 11 and 72 months in one study [5]. A high index of suspicion is required to avoid this. When atypical incontinence (post micturition and often insensible), persistent urethral discomfort, or atypical symptoms and LUTS occur, appropriate investigations are needed to exclude UD if diagnosis was not apparent on examination.

2.3. Epidemiology

In 1805, Hey [6] first described UD which were rarely diagnosed until the 1950s when positive pressure urethrography was developed. Increasing awareness of UD together with better imaging techniques particularly MRI has made the diagnosis of UD increasingly common. Moreover, symptomatic UD are still rare affecting 1%–6% of adult women [7]. A total of 40% of women investigated for LUTS have been noted to have UD [8]. UD are found in 80% of patients presenting with periurethral masses [4].

2.4. Pathogenesis

UD are thought to be acquired conditions and there are two main theories regarding the pathogenesis. UD are thought to develop due to obstruction, inflammation, and infection of the periurethral glands causing dilatation [9]. The location of UD mimics the distribution of periurethral glands and the rare association of adenocarcinoma in UD supports

the glandular origin. UD often present after childbirth suggesting that trauma from vaginal childbirth may be important, yet 20%–30% of patients in some series are nulliparous, suggesting that trauma may predispose to UD but is not necessary [10].

UD are most commonly situated dorsally and in the midurethra. In the largest series of UD, location was midurethral (52%), followed by distal (27%), proximal (19%), and full length (2%) [11]. Most were single (81%), followed by multiloculated (13%) and then saddle shaped (6%) [11]. UD vary in size from 8 mm to 48 mm [11].

2.5. Diagnosis

To make a diagnosis of UD requires a combination of a thorough history and physical examination, correct laboratory studies, endoscopic examination of the bladder and urethra, and imaging. It is important to have a high index of suspicion for UD in women presenting with atypical or persistent LUTS to avoid missing the diagnosis. During physical examination, the anterior vaginal wall should be palpated for the telltale swelling and tenderness of UD. Expressing pus or urine manually from the urethra during pelvic examination is highly suggestive of UD, particularly if the swelling subsequently disappears, although this sign is not present in the majority of patients [12].

Cystourethroscopy, which can be performed under local anesthesia, can detect an ostium to the diverticulum in 42% patients and rules out any coexisting urethral or vesical pathology [13]. Urodynamic studies may be helpful in ruling out coexisting voiding dysfunction or stress urinary incontinence, and the UD may be detected during a post voiding X-ray in 25% [11]. Pelvic ultrasound is a noninvasive method for detecting UD and has detected 38% of UD in one study, but is operator dependent and may miss small UD [11]. Previously, a range of other radiological investigations has been described to diagnose UD, including voiding cystourethrogram and double balloon urethrography. Currently MRI represents the most accurate and informative imaging modality. Postvoiding sagittal pelvic MRI was able to diagnose UD in 100% of patients, with 100% sensitivity in detecting UD [14]. MRI offers excellent anatomical detail, allowing characterization of the configuration of the UD and its relationship to the urethra, which helps to plan the approach for surgery. Post voiding sagittal MRI has become the gold standard for diagnosis of UD and is recommended in all patients in whom UD needs excluding or to confirm clinical findings and plan surgery.

2.6. Treatment options

Asymptomatic UD may require no intervention, although if encountered inadvertently during vaginal surgery may be treated on their merits. If detected during surgery for stress incontinence it may be better to deal with the diverticulum and leave the incontinence surgery for another occasion.

Symptomatic UD may be managed with minimally invasive methods such as endoscopic coagulation, marsupialization, fulguration or endoscopic or open incision and drainage.

These may be considered for small, distal UD which do not involve the main body of the sphincter, although the majority of UD would not be suitable for this approach due to high recurrence rates [15]. For the majority of UD that are situated predominantly on the dorsal side of the urethra, trans vaginal surgical excision of the diverticulum is the treatment of choice and provides excellent cure rates [11,16]. Placing the patient in the jackknife position facilitates the surgical approach. Surgery is undertaken after inserting ureteric catheters and a suprapubic catheter, which is left postoperatively. After reflecting a U-shaped vaginal flap, the UD is excised, and the ostium closed with dissolvable sutures, avoiding tension on the suture lines. Further fascial closure, avoiding overlapping the sutures if possible, and the use of an interposition Martius flap, can be used when tissues are attenuated or scarred. This decreases the incidence of developing fistula, and may also potentially assists in further surgery if a stress incontinence procedure is required [11,17]. In a study, with these indications a Martius flap was used in 35% of patients, although others have used flaps more routinely [11]. In patients with recurrent diverticulae and those which are predominantly anterior to the urethra, a supra urethral incision can be used. This allows easier access to the anterior surface of the urethra, which may not be accessible via the vaginal approach.

2.7. Results of surgery

Complications of surgical excision include immediate complications such as bleeding, hematoma, and infection, and longer-term complications such as recurrence, incontinence, continuing symptoms and urethrovaginal fistulae.

3. Female urethral stricture (FUS)

3.1. Definition

FUS was described by Brannan in 1951, and first reported in 1828 [18]. The term urethral stricture refers to scarring of the urethral epithelium with or without spongiofibrosis. The result is narrowing of the urethral lumen. Smith et al. [19] defined FUS as "a fixed anatomical narrowing of the urethra such that the lumen will not accommodate instrumentation without disruption of the urethral mucosal lining".

However, there is currently no internationally accepted definition of or diagnostic criteria for FUS [20]. This has led to difficulty in comparing reported treatments as definition of the condition, successful treatment and length of follow-up are defined differently in case series.

3.2. Symptoms

Women with FUS typically present with LUTS in the form of poor urinary flow, frequency, urgency, hesitancy, and incontinence. Recurrent urinary tract infections may occur, and on rare occasions retention of urine [21].

3.3. Epidemiology

The true incidence of FUS is not known. Bladder outlet obstruction (BOO) in women is rare, and it was reported to be in less than 8% [22]. In a study of women with signs and symptoms of BOO that underwent videourodynamic studies, FUS represented only 7% of the causes of BOO [23].

3.4. Pathogenesis

Urethral strictures result from any process that cause injury in the urethral epithelium, and that result in scarring after the healing process of the injury and subsequently formation of a stricture [24,25]. Blunt trauma, infection, chronic irritation, prior dilatation, difficult catheterization, urethral surgery, urethral diverticulae, and iatrogenic injury are the main pathogenic causes for developing FUS disease. Radiation for gynecological malignancies may be an additional cause that leads to urethral stricture formation.

3.5. Diagnosis

In order to increase the chances of accurately diagnosing FUS, it is common for the physician to use more than one diagnostic test. The diagnosis of FUS is suggested when difficulty in catheterization or in passing a flexible cystoscopy is encountered. Uroflowmetry and postvoid residual urine measurement (PVR) are non-invasive simple investigations, which may record low urinary maximum flow rate and high PVR. This could indicate BOO, possibly due to FUS, but could also indicate detrusor underactivity muscle (DUA) or another cause of BOO. Videourodynamics may be used to rule out the inability to empty the bladder due to a functional cause (e.g. DUA), which should be excluded before surgical intervention, but cannot accurately diagnose urethral stricture. Urethrography may be a deceiving test as the urethra could show segmental physiological narrowing that may be present in patients with detrusor sphincter dyssynergia or dysfunctional voiding [19]. Urethral pathologies such as urethral stricture or periurethral fibrosis are non-mass-like pathologies, although possible, it is difficult to diagnose using pelvic MRI [26,27]. Often, the diagnosis is confirmed after attempted catheterization followed by urethral dilatation and subsequent cystoscopy, which can identify the scarred urethral segment.

3.6. Treatment options

Minimally invasive procedures such as urethral dilatation and intermittent self-catheterization for treatment of FUS have been described curative in some studies. In a study, 57% of patients did not require any further dilatation after a follow-up of 21 months [19]. On the other hand, the treatment of FUS with urethral dilatation in other studies was found to cause bleeding and urinary extravasation, which worsens the periurethral spongiofibrosis [28]. Many women treated with urethral dilatation and internal urethrotomies were found to have high recurrences and increased scarring and fibrosis [29,30]. In a study comparing urethroplasty to urethral dilatation, urethroplasty (using vaginal flap or buccal mucosa graft) had a success rate of 100% at 1 year and 78% at 5 years, compared to only 6% success rate for urethral dilatation [31]. The techniques of urethroplasty all have a higher mean success rate (80%−94%) than urethral dilatation (<50%) [20].

Many approaches and procedures for urethral reconstruction have been reported. However, the best approach for urethroplasty is not well defined [32]. The approaches described included the use of either grafts or flaps to augment the urethra. Grafts used were vaginal, buccal, labial, and lingual mucosa [33,34]. Pedicle vaginal flaps have also been described. Success rates are variable ranging from 60% to 100%. Urethroplasty is the treatment of choice in patients whom strictures recur after two urethral dilatations. In patients who are unfit to undergo surgical intervention or patients who decline treatment, palliative urethral dilatation is a valid option. Selection of the surgical approach should be based on the stricture site, fibrosis severity, vaginal anatomy and the presence of coexisting urethral fistulae. There is no strong evidence that support a specific technique over the other; Certainly a surgeon's experience plays an important role.

4. Conclusion

Although often forgotten, FUS and UD are important causes of LUTS in females. Careful patient evaluation is needed when LUTS do not resolve with conservative treatment. High suspicion of the condition and thorough investigation are necessary to reach a diagnosis. Once a diagnosis is made, although techniques may vary, surgical correction is the best treatment of choice. Excision of the diverticulum and urethroplasty for urethral stricture are the treatments of choice. Choosing the specific procedure depends on surgeon's preference and experience, as there is no compelling evidence that favors one technique over the other.

Conflicts of interest

The authors declare no conflict of interest.

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