Chapter

Introductory Chapter: Lower Urinary Tract Dysfunction at a Glance

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1. Introduction

Lower urinary tract symptoms (LUTS) refer to a series of symptoms due to bladder or urethral dysfunction and are basically divided into three groups: storage, voiding, and post-micturition symptoms [1]. Of those, storage symptoms include urinary urgency, increased daytime frequency, nocturia, and different types of urinary incontinence. Voiding symptoms include slow stream, splitting or spraying of the urine stream, intermittency, hesitancy, straining to void, and terminal dribble. Post-micturition symptoms include feeling of incomplete emptying and post-micturition dribble. A number of epidemiological studies reported the prevalence of LUTS that varies from country to country. EPIC study performed a population-based, cross-sectional survey in Canada, Germany, Italy, Sweden, and the United Kingdom using computer-assisted telephone interview and showed the overall prevalence of LUTS was approximate 64.3% [2]. The EpiLUTS study investigated the prevalence of LUTS in the USA, United Kingdom, and Sweden according to an Internet-based survey. The results revealed that the prevalence of at least one LUTS in male and female population was 72.3 and 76.3%, respectively [3]. Another study demonstrated that the prevalence in South Korea was 68.5%, which is higher than 59% in Mainland China and 58.5% in Taiwan [4]. The heterogeneity in LUTS prevalence may derive from the difference in genetic, diet, and lifestyle factors for people in different countries. In terms of the gender difference, some studies showed that storage LUTS were more common in women than in men, while voiding and post-micturition LUTS were more common in men than in women [3, 4]. Furthermore, women have a higher proportion to experience storage and voiding LUTS simultaneously in comparison with men. The difference in LUTS between male and female may result from the different anatomy of urethra. Men have an additional organ, prostate, and a longer urethra compared to women, which means men are more likely to experience bladder outlet obstruction than women. Due to the gender difference, it appears to be reasonable to only focus on single-gender population when designing a clinical trial or research about LUTS. Recently a number of clinical trials and research studies have emerged in the assessment and management of LUTS. With the evidence increasing, it is worth considering how to apply these findings to clinical practice. We try to introduce the emerged evidence based on clinical practice from different aspects.

2. Clinical assessment for LUTS

It remains a challenge how to make an accurate assessment for LUTS and identify the potential causes since the etiology of LUTS is diverse. According to EAU

guideline, a number of conditions, including detrusor overactivity, underactive bladder, nocturnal polyuria, urethral stricture, etc., may contribute to male LUTS besides benign prostatic obstruction [5]. For female LUTS, increasing evidence shows that bladder outlet obstruction may play an important role in addition to pelvic floor dysfunction [6].

In general, physical examination can provide the helpful information for the etiological diagnosis of LUTS. Besides regular ones, bulbocavernosus reflex test is really useful to check the intactness of S2–S4 spinal reflex arc. Because sacral micturition center is located in S2–S4, this test is helpful to recognize the LUTS secondary to sacral or pudendal neuropathy. Additionally, the evaluation for pelvic floor function is essential for women with LUTS since it can identify the pelvic floor muscle tone, as well as the pelvic organ prolapse.

Traditionally, urodynamic study has been considered as a standard diagnostic tool for lower urinary tract dysfunction. Basically, urodynamic test contains filling cystometry (CMG) and pressure-flow studies (PFSs). The former is used to assess the storage function of the lower urinary tract, whereas the latter is used to evaluate the voiding function. Besides detecting bladder sensitivity, compliance, and detrusor overactivity, CMG can distinguish stress and urgency urinary incontinence. PFSs are normally used to diagnose bladder outlet obstruction. Furthermore, PFSs can also evaluate detrusor contraction, which is useful to find underactive bladder, a common cause of LUTS.

Despite advantages of urodynamic study, majority of patients tend to accept a noninvasive assessment compared to invasive urodynamic test. With the emergence of innovative imaging techniques, both anatomy and function of lower urinary tract can be assessed by noninvasive imaging approaches. In general, ultrasound is the most common technique to diagnose the lower urinary tract dysfunction. Some studies have shown that increased resistance of bladder contraction during the voiding phase in patients with bladder outlet obstruction (BOO) can result in an increase of bladder wall thickness (BWT), so can frequent detrusor overactive (DO) during the storage phase in patients with overactive bladder (OAB) [7, 8]. Based on this finding, a series of ultrasonographic parameters, including BWT, detrusor wall thickness (DWT), and ultrasound-estimated bladder weight (UEBW), have been used to diagnose BOO and DO. Furthermore, ultrasound strain imaging is also a successful method to evaluate LUTS since it can monitor the change in the BWT during micturition in real time. In addition, near-infrared spectroscopy is a functional imaging technique which can detect changes in the concentration of oxygenated hemoglobin and deoxygenated hemoglobin in the bladder wall and consequently identify the DO and BOO. In comparison with ultrasound, MRI may provide additional important clue for the diagnosis of lower urinary tract dysfunction. Brain functional MRI is helpful to detect the neurologic lesions demerging bladder control. Dynamic MRI is able to detect the pelvic organ prolapse, as well as the urethral hypermobility, which cannot be found by physical examination or static MRI.

3. Management of LUTS

Successful management for LUTS is based on the deep understanding on specific symptoms and accurate diagnosis on potential cause of LUTS. For patients with predominant voiding LUTS, it is essential to distinguish between BOO and underactive bladder (UAB). Once BOO is diagnosed clearly, α-blockers could be considered as the initial treatment. For male patients, if the BOO is secondary to significant enlarged prostate (>40 ml), 5α-reductase inhibitor is recommended to be added to shrink the prostate volume [5]. Moreover, there is increasing evidence to suggest

phosphodiesterase type 5 inhibitors (PDE5-Is) can relieve LUTS secondary to benign prostatic obstruction effectively though nitric oxide/cyclic guanosine monophosphate pathway (NO/cGMP). For patients who fail to respond to pharmacotherapy, minimal invasive surgical intervention, such as transurethral resection, could be an optional treatment. It is worth mentioning that urethral stricture is also a common cause of BOO and can be treated by urethral dilatation, internal urethrotomy, or urethroplasty depending on the characteristics of the stricture. The management of UAB, by contrast, is controversial because no regulatory approved specific therapy is available so far. Currently, the potential optional treatments for UAB include muscarinic agonists, regenerative therapy with mesenchymal stem cells or autologous muscle derived cells, gene therapy with myoblast injection, and neuromodulation [9].

In terms of patients with predominant storage LUTS, OAB is the most common condition. Although behavioral interventions are recommended to be first-line treatment for OAB by guidelines, muscarinic antagonists and β3 agonists are normally used as the initial treatment in clinical practice. Once pharmacotherapy is unable to improve LUTS effectively, some invasive approaches including sacral neuromodulation, botulinum toxin type A intradetrusor injection, and posterior tibial nerve stimulation can be considered as the advanced therapeutic strategy. Urinary incontinence (UI) is another condition related to storage LUTS, and successful management mainly relies on the precise identification for different types. Urgency UI can be managed by the approaches similar with the ones for OAB. Mid-urethral sling has been mainstream intervention for stress UI since the consolidated theory was proposed by Dr. DeLancey in 1996. Compared to pure stress or urgency UI, mixed UI is more difficult to treat since its complex etiology. Today, the treatment only focuses on the main component of mixed UI. Besides conventional therapy, increasing high-level evidence demonstrates the effectiveness of complementary and alternative medicine on different types of UI [10, 11]. Nocturia is also a bothersome storage LUTS which not only can weaken patients' quality of life but also may increase the risk of mortality. Management of nocturia had been a controversial issue until the classification of nocturia was proposed, which allows clinicians to provide precision treatment for patients. It is reported that the main factors contributing to nocturia include nocturnal polyuria and bladder capacity decline during nighttime. The former can be managed by desmopressin or diuretics, whereas the latter can be treated by muscarinic antagonists and β3 agonists. It is important to differentiate nocturnal enuresis from nocturia in clinical practice, because both of them occur during the nighttime. The main difference between the two symptoms is whether the patient is accompanied by sleep arousal. Nocturnal enuresis occurs during sleep, while nocturia is presented in arousal. Moreover, nocturnal enuresis, also known as bed-wetting, is more likely to present in children, while nocturia is common in adults. Similar to the pathogenesis of nocturia, nocturnal polyuria, and bladder capacity decline during nighttime are the potential pathogenesis of nocturnal enuresis too. Besides, arousal disorder also plays an important role for the occurrence of nocturnal enuresis. For this factor, alarm therapy could be helpful in waking the children up.

In summary, accurate clinical assessment is the prerequisite to manage LUTS successfully. Only with the sufficient understanding in characteristics and potential causes of LUTS can an individual management strategy be developed, which may optimize the treatment effect.

Acknowledgements

This work was supported by Beijing Municipal Science and Technology Commission No. Z161100000516156 and grant 2014S292 from Guang'anmen Hospital, China Academy of Chinese Medical Sciences.

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