Conservative Bladder Management and Medical Treatment

Subjects: Urology & Nephrology

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To review the available data on non-surgical management for neurogenic lower urinary tract dysfunction (NLUTD) in patients with chronic spinal cord injury (SCI) and provide the most updated knowledge for readers. Researchers categorized the bladder management approaches into storage and voiding dysfunction separately; both are minimally invasive, safe, and efficacious procedures. The main goals for NLUTD management are to achieve urinary continence; improve quality of life; prevent urinary tract infections and, last but not least, preserve upper urinary tract function. Annual renal sonography workups and regular video urodynamics examinations are crucial for early detection and further urological management.

Keywords: spinal cord injury ; neurogenic bladder ; neuromodulation

1. Introduction

Lower urinary tract (LUT) dysfunction is a common sequela to spinal cord injury (SCI) patients. It might be presented with a wide range of LUT symptoms depending on the level of SCI, and the symptoms vary as time goes by [1]. Its heterogenous presentation and the individualized treatment needed for each SCI patient becomes extremely arduous as the standard treatment modalities often have limitations. Moreover, pelvic organ dysfunction encompasses LUT, sexual and bowel dysfunction and their complex interrelationship is crucial for a comprehensive approach for management in SCI patients [2]. LUT dysfunction in SCI patients can be life threatening or a sequela to upper urinary tract complications in the chronic phase. The negative effects of LUT dysfunction on patients' health and quality of life are extremely severe and have been of great interest for researchers and clinicians for several decades [3]. Goals of management are none other than to achieve urinary continence, improve quality of life (QoL), prevent urinary tract infections (UTI), and preserve upper urinary tract function [4].

Lesions of the nervous systems, either peripheral or central and the level of lesion in the spinal cords can result in different patterns of neurogenic LUT dysfunction (NLUTD). The lesions of suprapontine or spinal pathways regulating LUT functions affect the storage phase, causing reduced bladder capacity and detrusor overactivity (DO), leading to involuntary contraction of the detrusor muscle during the storage phase [5]. Patients might present with urinary urgency, frequency, nocturia, and urge urinary incontinence. Injury to infrapontine-suprasacral spinal pathways can result in loss of coordination between detrusor contraction and urethral sphincter relaxation during the voiding phase, which is known as detrusor sphincter dyssynergia (DSD) [6]. Patients might also present with voiding difficulty and incomplete bladder emptying, which can result from high intravesical pressure and DSD. DO in combination with DSD can cause high intravesical pressure during the voiding phase, which then leads to morphological changes of the bladder wall [7]. Long-term morphological changes of the bladder wall due to neuropathy and outlet obstruction can reduce bladder compliance and bladder capacity, and consequently increase the risk of upper urinary tract complications such as vesico-uretero-renal reflux, hydronephrosis, upper urinary tract UTI, renal impairment and eventually end-stage renal disease [8]. Lesions of the sacral cord or infrasacral pathways can result in voiding dysfunction, detrusor underactivity (DU) or acontractile detrusor associated with a loose or non-relaxing sphincter [9].

2. Goal of Bladder Management

To achieve urinary continence, improved QoL, and preserve the upper urinary tract function, the management of NLUTD should address both storage and voiding dysfunction. Urinary incontinence is a prevalent problem in patients with chronic SCI, especially in women, affecting about half of the patients and is associated with impaired mobility and reduced quality of life [10]. Patients with storage dysfunction are presented with overactive bladder symptoms such as urgency, frequency,

nocturia, with or without urge urinary incontinence. Moreover, some patients present with stress urinary incontinence due to urethral sphincter or bladder neck incompetence. However, untreated voiding dysfunction eventually has an impact on renal function [8].

3. Management of Voiding Dysfunction

3.1. Catheterization

CIC remains the mainstay and minimally invasive treatment for neurogenic bladder. CIC for SCI patients with hydronephrosis, recurrent UTI and large PVR remains the gold standard rather than free micturition [11]. The frequency of CIC depends on the fluid intake and patient's safe bladder capacity. There is no definite number of CIC per day in the current guidelines of NLUTD; however, CIC every 4–6 h is usually recommended for patients with complete urinary retention. Amongst patients with SCI and NLUTD requiring catheter-based drainage, the use of CIC is associated with lower rates of UTI than indwelling urethral catheter (IUC). Comparisons of IUC versus suprapubic catheter (SPC) and SPC vs. CIS gave mixed results [12]. Previous studies showed clean CIC as non-inferior to sterile CIC as it is more cost-effective and convenient for the patient [13]. In selected patients who demand a continent catheterizable cystostomy, constructing a continence channel using appendix, terminal ileum, or a nipple valve is feasible and the patient usually has a high satisfaction rate [14]; however, the long-term complications should be cautiously monitored [15].

An indwelling catheter can also be considered when patients have troublesome motor dexterity, spasticity, or lack of reliable caregiver for CIC support. Suprapubic catheters are considered to prevent urethral trauma and permit sexual function, and have been recommended when CIC is not feasible for patients with chronic SCI without available hand function [16]. Krebs et al. performed a retrospective investigation on the association between bladder management and occurrence of symptomatic UTI in 1104 chronic neurogenic LUTD patients, with a mean duration of 20.3 ± 11.6 years [17]. The study revealed that indwelling catheters caused the highest occurrence of UTI and recurrent UTI, 10- and 4-fold, respectively. The occurrence rate of symptomatic UTI in indwelling catheter was 83.3%, CIC 39%, suprapubic catheter 11%, triggered reflex voiding 27%. Therefore, suprapubic catheterization is more recommended for SCI patients rather than CIC and the least recommended are chronic indwelling catheters.

3.2. Triggered Voiding

Triggered reflex voiding can be performed by stimulation of sacral and lumbar dermatomes (such as thigh scratching and suprapubic tapping), resulting in provocation of bladder contractions. Bladder expression by Valsalva or Credé maneuvers (straining/external compression) is not recommended as it is associated with a rise of intravesical pressures. Both management procedures are only recommended in patients with a urodynamically safe bladder [18].

3.3. Alpha-Adrenoceptor Blockers

α-adrenoceptor blockers are a mainstay treatment for male benign prostate obstruction. α-blockers are believed to relax the internal urethral sphincter and smooth muscle component of prostate, urethral and bladder neck in men, resulting in reduced bladder outlet obstruction and facilitating voiding in a selected population that maintain the ability to void [19]. In a small group study on 12 SCI patients with high intravesical pressure and poor compliance, terazosin 5 mg daily was administered for 4 weeks. Urodynamic detrusor pressure at maximum capacity decreased by a mean of 36 cm H_2O ($p < 0.001$) for a 73% improvement in compliance compared to baseline. This effect was reversible with cessation of the medication [20]. α-blockers improve autonomic dysreflexia (AD) symptoms in SCI patients. Terazosin reduces the frequency of AD episodes and the severity of AD symptoms and has no impact on erective function in a prospective trial [21]. A randomized controlled trial reported patients with injuries above T6 had 44% becoming AD symptom free after taking Tamsulosin [22].

3.4. Botox Injection into Urethral Sphincter Muscle

Urethral sphincter Botox injection results in the relaxation of the urethral sphincter muscle during the voiding phase. SCI patients with suprasacral lesions frequently presented with NDO and DSD. Shokhl et al. performed a systematic review to examine the efficacy and outcome of urethral sphincter Botox injection. The review included 11 studies and 353 patients. Botox was effective in 60–78% of patients in reducing PVR, mean detrusor pressure, detrusor leak point pressure, and mean urethral pressure 1 month after injection, and most of the patients needed reinjection after an average 4 to 9 months [23]. The previous study included 33 SCI patients with DSD treated with transurethral sphincter injection of 100U of Botox. The overall satisfaction was 60.6%; however, the frequent occurrence of incontinence became the major dissatisfaction among the patients. Patient selection is crucial for a better outcome [24]. In another previous study,

researchers investigated 118 SCI patients with dysuria [25]. Patients with cervical SCI, DO with DSD, partial hand function and incomplete SCI had a better improvement rate. Only 35.6% of the urge urinary incontinence patients received repeated urethral sphincter Botox injections while more than 60% of patients converted to augmentation enterocytoplasty, bladder outlet surgery, intradetrusor Botox injection or medication, and eventually had moderate to marked voiding improvement. Only certain SCI patients benefitted from urethral sphincter Botox injection, and other bladder management might have had a better clinical outcome.

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