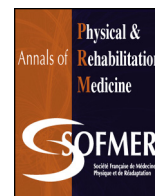




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Update article

Intermittent catheterization in neurologic patients: Update on genitourinary tract infection and urethral trauma



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ABSTRACT

Intermittent catheterization is considered the standard of care in most neurologic patients with lower urinary tract disorders. However, in this context, genitourinary tract infection and urethral trauma represent specific challenges. Such conditions have been found to significantly deteriorate quality of life and complicate subsequent treatments. Only optimal prevention associated with appropriate treatment allows for the long-term continuation of such bladder management. Here, we discuss the diagnosis and therapeutic and preventive approaches associated with genitourinary tract infection and urethral trauma in this specific population. This “state-of-the-art” article results from a literature review (MEDLINE articles and scientific society guidelines) and the authors’ experience. It was structured in a didactic way to facilitate comprehension and promote the implementation of advice and recommendations in daily practice. Genitourinary tract infection and urethral trauma associated with intermittent catheterization in neurologic patients should be managed with a global approach, including patient and caregiver education, optimal catheterization with hydrophilic-coated or pre-lubricated catheters and adequate use of antibiotic therapy.

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1. Introduction

Intermittent catheterization, especially self-intermittent catheterization, introduced in the second part of the 20th century [1,2], is now considered the standard of care for most neurologic patients with lower urinary tract disorders [3]. As compared with indwelling catheterization, supra-pubic tube insertion, the Crede manoeuvre or reflex micturition, intermittent catheterization has repeatedly been reported to improve quality of life and decrease mid- and long-term urinary tract complications [4–6]. Such bladder management aims to protect the upper urinary tract, improve urinary incontinence and decrease urinary tract infection. However, in neurologic patients, the bacteriuria rate is high and repeated urethral manipulations has been associated with urethral trauma and strictures [7]. In this specific population, genitourinary tract infection and urethral trauma constitute challenges because they can affect quality of life [8] and significantly complicate subsequent treatments [9].

This “state-of-the-art” article provides updates regarding the diagnosis, treatment and prevention of genitourinary tract

infection and urethral trauma associated with self-intermittent catheterization in neurologic patients. An extensive search of MEDLINE via PubMed and the authors’ experience constituted the basis of the present recommendations.

2. Genitourinary tract infections: diagnosis, treatment and prevention

2.1. Epidemiology–genitourinary tract infection

When talking about genitourinary tract infection, one must clearly distinguish between urinary tract colonization and infection [10]. Urinary tract colonization is defined by the presence of one (or more) microorganism(s) in the urinary tract, without any clinical manifestation. The much-abused term “asymptomatic bacteriuria” refers to the same entity but is not related to any threshold value. For patients undergoing intermittent catheterization, urinary tract colonization corresponds to asymptomatic bacteriuria $\geq 10^2$ colony-forming units/ml [11]. Urinary tract infection refers to the infestation of a tissue by one (or more) microorganism(s) generating an inflammatory response with different types of symptoms varying in type and severity. Therefore, the infection is defined in the general population by the presence of a positive urine culture associated

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with at least one of the following symptoms: fever ($> 38^{\circ}\text{C}$), urgency, frequency, supra-pubic or lumbar pain.

Urinary tract colonization is a frequent problem in patients undergoing intermittent catheterization. Classically, males and females do not differ in prevalence [12]. Colonization should be considered a risk factor for genitourinary tract infection [13], among which we can distinguish afebrile infection (cystitis, urethritis) and febrile infection (epididymo-orchitis, pyelonephritis, prostatitis). The incidence of epididymo-orchitis has been estimated at about 0.03/100 patient-days [14] and would be higher with urethral stricture [15]. Of note, recurrent epididymo-orchitis episodes could greatly affect male fertility by increasing the risk of azoospermia [16]. Urinary tract infection is more frequent and the incidence has been estimated as high as 0.41–1.46/100 patient-days [17]. The most frequently isolated microorganisms are *E. coli*, *Proteus*, *Citrobacter*, *Pseudomonas*, *Klebsiella*, *Staphylococcus aureus* and *Staphylococcus fecalis*. Among patients undergoing long-term intermittent catheterization, some specific microorganisms can also be found: *Acinetobacter* and *Streptococcus fecalis* [17]. However, as compared with other bladder management, self-intermittent catheterization in neurologic patients aims in particular to decrease the urinary tract infection rate [18,19].

2.2. Diagnosis - genitourinary tract infection

2.2.1. Physical examination

In neurologic patients undergoing intermittent catheterization, the diagnosis of urinary tract infection is challenging. Indeed, this diagnosis is particularly difficult because of the quasi-constant urinary tract colonization as well as the atypical clinical presentation. Typical symptoms such as urgency, frequency and dysuria are sometimes not present in this specific population—especially those with spinal cord injury (SCI)—and urinary tract infection should be suspected with the following clinical signs: fever, discomfort or pain over the kidney or bladder or during urination, onset of urinary incontinence, malaise, lethargy or sense of unease, increased spasticity and/or autonomic dysreflexia in patients with SCI (upper lesion $> \text{T6}$) and persistent urethral bleeding with long-term intermittent catheterization [20–22]. The presence of odorous or cloudy urine is not specific and should not be used alone to diagnose urinary tract infection [20]. However, epididymo-orchitis is easier to diagnose and should be suspected at the onset of an inflammatory and/or painful scrotum.

2.2.2. Laboratory tests

A urine analysis associated with urine culture and antibiogram should be systematically performed when a urinary tract infection is suspected and a urine sample should be obtained by catheterization before any antibiotic treatment [23]. This process will allow for identifying the microorganism(s) and then adapting the antibiotic therapy. Because leucocyturia mainly reflects inflammation at the urinary tract level, it should not be taken into account to confirm infection, especially in this neurologic population [24]. However, when leucocyturia is not found on urine analysis, another diagnosis, other than urinary tract infection, should be considered. Blood culture should be systematically performed with fever $\geq 38.5^{\circ}\text{C}$. Although positive blood culture findings will not affect the length of antibiotic therapy prescribed, they could provide evidence for a urinary tract infection and guide antibiotic therapy—by identifying a specific bacteria. White blood cell count and C-reactive protein measurement will be of interest only to monitor infection. Epididymo-orchitis should be considered here and treated as a urinary tract infection, not as a sexually transmitted infection. Tetraparaplegic patients with no sensory function below the neurological level should undergo a urinary tract imaging to eliminate obstructive pyelonephritis.

2.3. Treatment—genitourinary tract infection

2.3.1. Urinary tract colonization

With certain minor exceptions, urinary tract colonization should never be treated in patients under intermittent catheterization [25]. Indeed, even if the antibiotic therapy is considered effective against the microorganism(s) present in urine, bacterial infection will often not be eradicated or will return rapidly [26] and antimicrobial therapy will contribute to the selection of resistant microorganisms [27,28]. Particular cases for which an antibiotic treatment should be initiated are patients undergoing urologic surgery or implantation of prostheses, immunosuppressed patients, pregnant women or for control of nosocomial infection due to a virulent organism prevailing in a treatment unit or an organism causing a high incidence of bacteremia (e.g., *Serratia marsces*) [25].

2.3.2. Genitourinary tract infection

Genitourinary tract infection should be treated with an empirical broad-spectrum antibiotic based on the patient's history and local susceptibility pattern and introduced just after urine and blood sample collection. For patients with increased risk of antibiotic resistance (history of multi-drug-resistant bacteria, recent hospitalization and/or recent antimicrobial therapy), an infectiologist should be consulted. This empirical antibiotic therapy should be secondarily adjusted to urine culture results and maintained for 14 to 21 days. To date, no clinical studies have clearly assessed the optimal length of treatment in this specific population [25]. Therefore, antibiotic therapy should be continued depending on the suspected localization, microorganism(s), comorbidities and patient response. In case of no localizing features, alternative diagnoses must be considered. Furthermore, observation rather than immediate antimicrobial therapy should be considered when the patient is clinically stable and the fever is low grade [25].

2.3.3. Recurrent genitourinary tract infection

Recurrent genitourinary tract infection has been arbitrarily defined by the occurrence of 3 episodes/year or 2 episodes/6 months or 1 episode in the previous 3 months [10]. With recurrent infection, the catheterization technique should be systematically revised and a persistent underlying cause should be sought by a bladder diary and a urodynamic study (to search for detrusor overactivity or impaired bladder compliance) and urinary tract imaging (to search for urinary lithiasis and urinary tract abnormalities). These approaches may involve a physician as well as a dedicated stoma nurse, and a multichannel urodynamic study should be considered. Furthermore, with recurrent epididymo-orchitis, urethroscopy or micturating cysto-urethrography should be performed to search for an urethral stricture [15].

2.4. Prevention—genitourinary tract infection

2.4.1. Technique: frequency

High micturition volumes have been repeatedly reported as risk factors for urinary tract infection [29,30]. Therefore, catheterization frequency will play a major role in the occurrence of urinary tract complications and should be customized and adapted to each patient. Success will undoubtedly lie in the determination of the most appropriate balance. Catheterization should be performed often enough to limit bladder distension ($> 400\text{ cm}^3$) and infrequently enough to limit the negative impact on social life and quality of life. Between 4 and 6 catheterizations per day are advocated [22,31].

2.4.2. Technique: clean intermittent catheterization

It is currently recommended to use a “clean” technique, consisting of introducing the catheter with an atraumatic and non-infecting manner. This technique implies hand washing and

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