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LOWER URINARY TRACT DYSFUNCTION IN CHILDREN: FOCUS ON OVERACTIVE BLADDER

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ABSTRACT | Lower urinary tract (LUT) dysfunction in childhood presents a high prevalence, which can lead to urinary urgency, urinary incontinence, urinary tract infection, vesicoureteral reflux, renal damage, and psychological and emotional impacts. The overactive bladder (OAB) is the most common kind of LUT dysfunction. It is characterized as a change in the bladder storage phase, combined with urinary symptoms typical of this phase, but with a normal urinary flow pattern and without post-void residual. Its pathophysiology is still controversial, and includes possibilities of alterations of central origin, of triggering uncontrolled detrusor contractions due to constipation, or the possibility of being caused by the urinary tract infection. There are three main treatments available for children with OAB: drugs, urotherapy and electrical stimulation. Of these, drug therapy is still the most widespread in the world, despite having several side effects and low cure rate. Urotherapy is based on micturition and food guidelines and should be indicated as the first therapeutic line. Electrical stimulation still presents diversity in relation to the position of the electrode, time and frequency of the application and different parameters in relation to the therapeutic current. Despite this variability, the combined therapies of urotherapy with electrostimulation have better clinical results according to literature.

Key words: Children, Urinary Incontinence, Overactive bladder, Treatments.

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INTRODUCTION

The Lower Urinary Tract (LUT) Dysfunction regards a voiding alteration in neurologically normal children and may occur during the phase of deflation and/or during the bladder filling (1). When the alteration is only present during the bladder-filling phase, it is denominated as overactive bladder (OAB) which has as main characteristic, a urinary urgency with or without the association of urinary incontinence, nocturnal enuresis, urinary tract infections of repetition, and constipation. Daytime urinary incontinence affects seven year olds in which 3,5% are boys and 6% are girls. The voiding urgency symptom occurs around 20% in this same age group[2].

These symptoms described above are caused by involuntary contractions of the detrusor, usually in an early phase of the bladder filling. In an attempt to hold urine in the bladder and prevent urine loss, the child tends to contract the pelvic muscles purposely taking, not infrequently, classic postures that avoid the loss, such as squatting on the heel, crossing their legs or holding the genital region[3]. When the child does not reach a sufficient urethral pressure during the involuntary contraction of the detrusor, then a urinary loss occurs. Other times, the urgency occurs due to an increased bladder sensitivity, which, in this case, it is commonly associated with frequency[1].

In cases of OAB, the voiding pattern is normal. In the uroflowmetry, the urine stream assumes a bell-shaped uroflowmetry curves and there is no post-voiding residual urine. Because of involuntary contractions of the bladder, opposed by a voluntary contraction of the sphincter, there may be elevated pressure within the bladder, therefore the detrusor can be found hypertrophied and with diverticulum, which can be frequently observed by means of a bladder ultrasound (USG). In theory, the increase of the bladder pressure can decompensate the valve mechanism of the urethrovesical tunnel, particularly those with a lower limit of normalcy length, which generates vesicoureteral reflux (VUR). It is also strongly associated with urinary tract infection (UTI)[4], which justifies the constant search for effective and low costs treatments.

2. Etiology and/or Pathophysiology

Understanding OAB's pathophysiological process is necessary for choosing the most appropriate therapy. OAB's etiology in LUT dysfunction is unclear and its physical therapy is based on the pathophysiology of LUT dysfunction. One theory of voiding dysfunction (VD) during childhood is that the efforts to maintain urinary continence induce the child to, simultaneously, contract the urethral and anal sphincter muscles, which results in an increase in the tonicity of the pelvic floor muscles. This can lead to an unsatisfactory urination as well as constipation. Koff et al. (1998) introduced the term Elimination of Dysfunction Syndrome to describe the association between these two abnormalities[5]. However, this association's pathophysiological mechanism is unclear. The anatomic proximity of the bladder and urethra with the rectum – between S2 and S4 – probably causes an alteration that involves these segments[6].

A proposed theory is that in OAB, the uninhibited contractions of the detrusor lead to episodes of urgency and/or urinary incontinence. In an attempt to prevent these occurrences, exacerbated contractions are generated at the pelvic floor muscles[7], which can lead to the simultaneous contraction of the anal sphincter, inhibiting defecation activity. However, it is possible that the retention of feces in the rectum compresses the bladder and induces bladder contraction[8]. Some authors try to justify the appearance of OAB in children following episodes of UTI. Main studies were carried out on animals and they show that, when the infection is severe enough to cause disruption of the epithelium, there is an afferent stimulation in response to bladder distension (9), with rapid onset of detrusor contractions[10]. On the other hand, the theory of urinary tract infection, which generates OAB, does not justify the appearance of this pattern bladder in children who never had ITU, neither explains why children with ITU never had OAB.

In newborns, as there is no effective cortical participation, conscious and voluntary of the voiding act, the bladder deflation occurs by activation of the voiding reflex arc. By the age of two, children begin to show awareness of bladder filling and are able to store a larger amount of urine in the bladder (higher urinary volume). From two to four years of age, the child is able to start and stop urination voluntarily. Around four years old, they develop bladder control

as an adult.

Koff et al. (1979) reported that the LUT dysfunction resulted from a delay in the maturation of the nervous system responsible for bladder control. In this sense, there would be a failure on the voiding control and a relative persistence of voiding reflex arc[11].

De Groat (2002) believes that OAB and urinary incontinence occurs due to a loss of voluntary voiding control and early recurrence of voiding reflex. Two theories of bladder storage disorder are proposed by this author, the first being that there would be a return of voiding reflex found in newborns, which was repressed during normal voiding development, confirming the theory described above, and the other would happen by forming new circuits reflexes mediated by afferent C fibers[12].

Under normal conditions, it is believed that C fibers are mechanically insensitive to bladder distension, so there is no response to detrusor distention. In OAB, new circuits reflexes would be formed mediated by these fibers, which would stimulate the bladder contraction in filling phase. Being a true premise, this kind of detrusor contraction could be suppressed by blocking the activity of afferent C fibers or by interrupting the reflex pathways in the spinal cord by means of electro stimulation.

Franco (2007) describes the central origin's OAB, explained by the inability to activate brain areas, cingulate gyrus and frontal lobe, responsible for suppressing the autonomic activities[13]. The inactivity of these brain areas may be a good explanation for the family history of OAB. The decrease in the frontal lobe and cingulate gyrus activity may also explain the strong association of voiding dysfunction in patients with attention deficit constipation[14].

3. Treatment options

3.1 Urotherapy

Urotherapy involves behavioral measures for the treatment of OAB. It is considered the first choice and consists of a timed voiding, based on a voiding diary, and is associated with positive reinforcement[15]. An adequate hydration and a restriction of irritant substances to the bladder must be conjugated to a better therapeutic response.

This behavioral technique can be performed without the need to face consultations. EduMicc® was developed by our group, through the association between the main information of a voiding diary and important educational guidelines for the patient. Moreover, there is a web platform that allows the healthcare professional to access the patients' records in real time. Through this platform and the information generated by the patients and sent to the therapist, the professional can set alarms that go straight into the patient's app so that it reminds him to urinate or drink fluids during the day enabling a therapeutic program at a distance[16].

Thus, the EduMicc is a mobile app that brings the possibility of therapist-patient interaction via web from an individual and personalized manner, helping the assessment processes and treatment of individuals with urinary alterations remotely, facilitating access to the health care professional and contributing to the issues of urban mobility and time optimization.

In patients who did not respond to simple urotherapy and has not vesico-sphincter incoordination problems, confirmed by post-void residual presence of and / or uroflowmetry with standard presentation of interrupted flow or staccato, other non-pharmacological option can be electrical stimulation. There is no indication of biofeedback use in patients with OAB without DV. Kegel exercises have been shown to be of no value in children with OAB and in long term it can be detrimental to the bladder by increasing urethral resistance and consequently increasing the bladder pressure, with a risk of upper urinary tract.

3.2 Drugs for overactive bladder

Anticholinergic medication is the most widely used treatment option for OAB. Koff and Murtagh (1983) reported that the treatment of OAB in children using anticholinergic agents showed an improvement rate or cure of the symptoms in approximately 60% of the cases[17]. Drugs commonly used are antimuscarinic, including oxybutynin chloride and tolterodine, and among its effects are suppression of involuntary detrusor contractions, decreased bladder tone and reduction in voiding frequency.

A systematic review of randomized trials showed that no treatment was effective in the OAB therapy[18]. In addition, side effects such as dry mouth, constipation, hyperemia and hyperthermia occur in up to 50% of the cases and in 10% of the cases, the drug had to be discontinued due to adverse effects[19].

3.3. Electrical Stimulation on OAB

Electricity is one of the basic forms of physical energy and can produce significant effects on biological tissues. Electrical stimulation gathers a set of procedures through which circulates an electric current, in order to obtain a particular physiological response, which will depend on the intensity, frequency and pulse width used[20].

Caldwell et al. described the first work with electrical therapy in the treatment of urinary disorders in children in 1969, however these patients had neurogenic bladder dysfunction[21]. Another study, also for the treatment of children with neurogenic bladder, evaluated the results of electrical stimulation using intravesical electrode[22]. From there, other accounts with similar technique, but with mixed results have been published.

In a systematic review, we showed that there is no consensus on the parameters or on the application sites of the electrical stimulation in the treatment of OAB[23]. The parameters reported with best results are: biphasic current, alternated with pulse width of 700 μS, frequency of 10 Hz and intensity in the sensitive threshold applied in sacral roots. The protocol varies and it may be 20 minutes, three times a week, up to 2 hours daily for up to 6 months.

CONCLUSION

Understanding the etiology of OAB and an appropriate patient selection may facilitate the choice to an appropriate therapy. There is a shortage in literature when it refers to non-pharmacological treatment options of OAB in childhood, moreover the parameters not reported and the use of a non-standardized nomenclature complicates the comparison across studies and, consequently, the choice of intervention becomes slightly grounded in scientific evidence. But despite these limitations It seems to be appropriate the use of urotherapy and electrical stimulation with low frequency currents in patients with OAB.

AUTHOR CONTRIBUTIONS

Lordelo P was responsible for the study design, literature review and writing. Teles A was responsible for the critical review of the final draft of the manuscript.

COMPETING INTERESTS

The author Lordelo P reports personal fees from FUNADESP (National Foundation for the Development of Private Higher Education in the Brazilian Portuguese acronym), during the study. No other financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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