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Percutaneous Electrical Stimulation for Management of Monosympatomatic Nocturnal Enuresis

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Abstract: The purpose of this study was to examine the effect of Percutaneous electrical stimulation therapy on children suffering from monosympatomatic nocturnal enuresis **Subject:** Thirty children ranging in age from 7 to 17 years. They received Percutaneous electrical stimulation on the sacral roots for 12weeks **Methods:** The wet nights were evaluated by bladder diary performed pre and post treatment. Patients were reevaluated one, three and six months after the last session. To evaluate the effectiveness of the method, the treatment response was scored according to the ICCS guidelines **Results**: After 6 months follow-up, 7 (23.3 %) patients presented 100% improvement of wet nights, 12 (40%) patients showed 90-99 % improvement, 3 (10%) patients showed partial improvement (50-89 %), and 8 (26.6 %) patients showed none response (0-49 %). **Conclusion:** Percutaneous electrical stimulation therapy has got clear effect in treatment of monosympatomatic nocturnal enuresis.
Key Words: nocturnal enuresis, electrical stimulation.

Introduction

Nocturnal enuresis (NE) is a worldwide health problem frequently encountered in childhood and is defined as an involuntary voiding of urine during sleep with a frequency of at least twice a week in children, in the absence of congenital or acquired defects of the central nervous system[1]. Nocturnal enuresis includes monosymptomatic nocturnal enuresis (MNE) with no daytime urinary symptoms and non monosymptomatic nocturnal enuresis (NMNE) that is accompanied by daytime urinary symptoms. Nocturnal enuresis affects 5%–10% of younger school-age children[2].

Enuretic children have a higher risk for psychosocial co morbidity and loss of self-esteem. Such feelings of humiliation, guilt, and shame are also a reasonable source of heartache to the children and their parents[3]**.** Enuresis is called primary nocturnal enuresis when nighttime urinary control has never been gained and secondary nocturnal enuresis is defined as relapse after a dry period of at least 6 months. Although several etiologic factors have been described, the etiology of MNE is not clear now. These factors are reduced functional bladder capacity or large overnight urine production and the inability to awake when this occurs[4].

The abnormally large amounts of urine produced during sleep exceed the functional nocturnal bladder capacity. In addition, abnormalities in the arousal response to the full bladder have been observed, although the sleep patterns appear to be normal in children with nocturnal enuresis[5].

Typical symptoms of monosymptomatic enuresis are: deep sleep and difficult arousal, increased urine volume at night (polyuria) with large wetted volumes. The typical presentation is a child who is extremely difficult to wake and who wets the bed with large amounts of urine. In contrast, bladder function during the day is completely normal[6].

Delayed maturation in one or more of the following systems results in NE: a lack of stability in bladder function, a lack of arginine vasopressin (AVP) release or response, or relative increased solute excretion during the night, or an inability to wake from sleep to full bladder sensations. Combinations of all three problems may be present[7].

In normal children, the circadian rhythm of urine production results in a nocturnal reduction in dieresis to approximately 50% of daytime levels. Inchildren this is the result of nocturnal release of hormones that regulate free water excretion (arginine vasopressin, (AVP) or solute excretion (angiotensin II and aldosterone) and may result from circadian changes in glomerular filtration[8]. These children make more urine at night, and often overcome their bladder capacity and wet early in the night. Abnormalities can also be intrinsic, related to reduced nocturnal circadian changes in glomerular filtration rate (GFR) or in sodium and calcium excretion. Detection of low plasma vasopressin levels, GFR assessments or specific sodium and calcium excretion are difficult to measure[9].

The detrusor, in order to function appropriately, needs to be relaxed during filling and allow an appropriate functional capacity. Detrusor over activity usually causes small voided volumes resulting in a decreased functional bladder capacity[10]. These children had smaller functional bladder capacities at the point of wetting, than children with enuresis who did not have detrusor overactivity. Functional bladder capacity – defined as the largest daytime void on a frequency- volume (F/V) chart, after excluding the first morning void, may give a reasonably accurate assessment of daytime functional bladder capacity (FBC)[11]. The fundamental mechanism resulting in nocturia or NE is that the bladder fills to its capacity during sleep and needs to empty. Bladder fullness is due to nocturnal polyuria and/or a reduction of the bladder capacity due to detrusor over activity during sleep[12]. The low nocturnal antidiuretic hormone levels help to explain the failure in arousal in response to a full bladder, since there is impaired vasopressin production[13]. Primary therapeutic methods include behavioral therapy, conditioning with an alarm, medical therapies, hypnosis,pelvic floor muscle exercises, electrical stimulation, and acupuncture[14].

Methods

Thirty participants complaining from primary monosymptomatic nocturnal enuresis participated in this study. They were selected from outpatient clinic of urology, Ein Shams specialized hospital, Ein Shams University, Cairo, Egypt. The course of treatment extended up to 12 weeks during the period of April 2014 to February 2016. Their ages ranged from 7 to 19 years. All participants were diagnosed by special physician to exclude the presence of Lower Urinary Tract Symptoms (LUTS), physical examination, urinalysis, and lumbo-sacral spine x-ray. The stimulation was conducted by a generator accurate pulse 195 LAUTZ. Two superficial 3 cm electrodes were placed on each side of S3 and S2. The session was performed three times/ week up to 12 weeks, for 30 min each and at a frequency of 30 Hz. The intensity was gradually increased to the maximum tolerable level; biphasic continuous waveform was used, with a pulse width of 250 microseconds. The wet nights were evaluated by bladder diary performed pre and post treatment. Patients were reevaluated one, three and six months after the last session. To evaluate the effectiveness of the method, the treatment response was scored according to the International Children Continence Society (ICCS) guidelines: Non response is defined as a 0% to 49% decrease of wet bed, partial response is defined as a 50% to 89% decrease, response is defined as a 90% or greater decrease and full response is defined as a 100% decrease of symptoms.

Inclusion Criteria:

1. Children ages 7 to 17 years old without any specific neurological disorder (e.g spina bifida) or urinary tract infection.
2. Currently having no daytime overactive bladder symptoms, i.e. urinary frequency, urgency, or daytime incontinence
3. No behavioral etiologies of nocturnal enuresis (e.g drinking excess fluids or specific bladder irritants)
4. Don’t suffer from constipation

Exclusion Criteria:

1. Known neurological disorders.
2. Significant behavioral causes of enuresis.
3. Chronic constipation.
4. Not adequately potty trained
5. Significant daytime symptoms of overactive bladder including frequency, urgency.
6. Who do not tolerate initial stimulation training session.
7. Any implantable medical devices such as a pacemaker.

Results

The wet nights were evaluated by bladder diary performed pre and post treatment. Patients were reevaluated one, three and six months after the last session. To evaluate the effectiveness of the method, the treatment response was scored according to the ICCS guidelines: Non response is defined as a 0% to 49% decrease of wet bed, partial response is defined as a 50% to 89% decrease, response is defined as a 90% or greater decrease and full response is defined as a 100% decrease of symptoms. Before treatment, 10 participants had wet nights every day, 8 participants had 16 wet nights per month, 7 participants had 12wet nights per month, and 5 participants had 8wet nights per month (Table 1).

Table 1. Number of wet nights per month and the response to treatment in percentage according to the ICCS guidelines.

No./ month	Pre	After 1 month				After 3month				After 6 month			
		I	II	III	IV	I	II	III	IV	I	II	III	IV
30	10	8	1	1	0	7	2	1	0	5	2	2	1
16	8	4	2	2	0	2	1	3	2	1	0	4	3
12	7	3	0	2	2	2	1	2	2	1	1	3	2
8	5	1	0	3	1	1	1	2	1	1	0	3	1

I: 0-49% II: 50-89% III: 90-99% IV: 100%

After 6 months follow-up, 7 (23.3 %) patients presented 100% improvement of wet nights, 12 (40%) patients showed 90-99 % improvement, 3 (10%) patients showed partial improvement (50-89 %), and 8 (26.6 %) patients showed none response (0-49 %). (Table 2).

Table 2. Number and percentage of patients regarding to their response to treatment after 1, 3 and 6 months.

	After 1 month	After 3 month	After 6 month
Full response	3 (10%)	5 (16.6%)	7 (23.3 %)
Response	8 (26.6%)	8 (26.6 %)	12 (40 %)
Partial response	3 (10 %)	5 (16.6 %)	3 (10%)
None response	16 (53.3 %)	12 (40 %)	8 (26.6 %)

Discussion

Enuresis is a common condition which can cause severe psychological and social distress to children and their families[15]. The currently recommended treatment such as alarms, antidiuretic hormone, and anticholinergics are not effective in all patients, with significant relapse rate[16,17]. Electrical neural stimulation (ENS) has been used for OAB with good results in adults and in children[18,19]. Although the mechanisms of action of ENS are not fully elucidated, clinically there is improvement in urinary symptoms, in addition to modifications in the urodynamic pattern such increasing of cystometric bladder capacity and decreasing unstable contractions [20,21].

The mechanism of ES has not yet been proved; however, most studies report that afferent sacral nerve stimulation causes an interneuronal change of the spinal reflex, which induces an inhibitory stimuli in the bladder efferent nerve[22]. However, consensus has not been reached concerning the precise mechanisms, and despite multiple efforts to examine the efficacy of such salvage treatment methods using ES, no gold standard method has been established, which causes frustration to the physician and patients and family members[23]**.**

In the current study Electrical stimulation was well tolerated by all children, with no complaints such as pain or tenderness. Electrical stimulation was well tolerated by all children, with no complaints such as pain or tenderness. After 6 months follow-up, 7 (23.3 %) patients presented 100% improvement of wet nights, 12 (40%) patients showed 90-99 % improvement, 3 (10%) patients showed partial improvement (50-89 %), and 8 (26.6 %) patients showed none response (0-49 %).

This were supported by the work of [24] who mentioned that; surface stimulation of sacral roots has a great effect in decreasing wet nights in children suffering from primary nocturnal enuresis. In our study, there was improvement in enuresis after ES. Decreased urinated volume in bed was observed in most patients, which may explain the high level of satisfaction with treatment even in those patients who remained daily wet nights.

Conclusion

ES seems to be a feasible option for treatment of monosymptomatic nocturnal enuresis with a decrease in the number of wet nights monthly.

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