



## Intracavitary electrical stimulation as treatment for overactive bladder: systematic review

### *Eletroestimulação intracavitária como tratamento para bexiga hiperativa: revisão sistemática*

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#### Abstract

**Introduction:** Overactive bladder (OAB) is a clinical diagnosis of irritating urinary symptoms that influence on sufferers' life quality. There are effective treatments described in literature, but most of them present adverse effects. One way of treatment is the use of electrical stimulation, which has been widely used, but studies show varying results. **Objective:** To verify if intracavitary electrical stimulation can be effective in patients with OAB. **Methods:** online databases were searched with specific descriptors to find randomized clinical trials on overactive bladder treated with intracavitary electrical stimulation. Only articles with score equal or higher than 5 in methodological PEDro scale were used and those that described intra and / or inter-group P-value. **Results:** 217 articles were found, but only 6 were analyzed by the selection criteria. The studies show that electrical stimulation promotes the reduction of urinary frequency, urinary incontinence, nocturia, urgency and the number of protectors used, and improvements in maximum cystometric bladder capacity, symptoms of OAB and quality of life. **Conclusion:** Electrical stimulation was effective in patients with OAB and can be used before any invasive treatment due to none side effects.

**Keywords:** Overactive Bladder. Bladder Overactivity. Urge Urinary Incontinence. Detrusor Instability. Electrical Stimulation.

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## Resumo

**Introdução:** A bexiga hiperativa (BH) é um diagnóstico clínico de sintomas urinários irritantes que influenciam na qualidade de vida de seus portadores. Existem tratamentos eficazes descritos na literatura, porém a maioria deles apresenta efeitos adversos. Uma das formas de tratar é utilizando a eletroestimulação, a qual vem sendo muito utilizada, porém os estudos publicados apresentam resultados variados. **Objetivo:** Verificar se a eletroestimulação intracavitária pode ser eficaz nos distúrbios urinários de pacientes com BH. **Métodos:** Foram utilizadas bases de dados online com descritores específicos para busca de experimentos controlados randomizados, com pacientes portadores de BH tratados com eletroestimulação intracavitária. Foram selecionados apenas artigos com pontuação maior/igual a 5 na escala metodológica PEDro e que descrevessem P-valor intra e/ou intergrupos. **Resultados:** Foram encontrados 217 artigos, porém somente 6 atenderam aos critérios de seleção. A eletroestimulação promoveu a redução da frequência urinária, perda urinária, noctúria, urgência e do número de protetores utilizados diariamente, além de aumentar a capacidade cistométrica máxima da bexiga, melhorar os sintomas da BH e a qualidade de vida. **Conclusão:** A eletroestimulação mostrou-se eficaz em pacientes com BH, e por não apresentar efeitos colaterais, pode ser utilizada antes de qualquer tratamento invasivo.

**Palavras-chave:** Bexiga Hiperativa. Incontinência Urinária de Urgência. Hiperatividade do Detrusor. Eletroestimulação. Estimulação Elétrica.

## Introduction

The overactive bladder (OAB) is classified by the International Continence Society (ICS) as “urinary urgency, usually accompanied by frequency and nocturia, with or without urgency urinary incontinence, in the absence of urinary tract infection (UTI) or other obvious pathology” (1, 2). Urinary urgency is a sudden and compelling desire to urinate, which is difficult to postpone. Frequency is when urination occurs more frequently during waking hours than what would be considered normal. Nocturia is the interruption of sleep one or more times because of an urge to micturate, each void is preceded and followed by sleep. However, the symptom that most limits patients with OAB is the urgency urinary incontinence (UUI) (3). Thus, the OAB is a clinical diagnosis characterized by the presence of irritating urinary symptoms (2) that influences the quality of life of the patients. It compromises 15 - 30% of women of all ages in relation to social, professional and sexual life (4), sometimes modify their social and work lives to accommodate their symptoms (5).

The most common risk factors for UUI in women are age, birth numbers, obesity, neurological disorders and chronic constipation (6). The prevalence of OAB is 7% to 27% in men and 9% to 43% in women (2). Such rates and symptoms tend to increase with advancing age (2, 7). Irwin and colleagues (8)

suggested in their study that the prevalence of OAB symptoms in women is higher than in men before age 60, afterwards this rate is reversed, becoming higher in men.

“The pathophysiology of OAB syndrome is overactivity of the detrusor muscle. The tone of the detrusor muscle during filling and voiding relies on the counterbalance of the autonomic (sympathetic and parasympathetic) nervous system” (3).

The literature describes many treatments for patients with OAB symptoms such as medications (3, 9, 10, 11), behavioral therapies, pelvic floor exercises (9), electrical stimulation (12, 13), biofeedback (14), catheterization (10), intravesical botulinum toxin (15) and surgical treatment, usually indicated when conservative treatments are not effective (10). However, drugs may have some adverse effects (16) and lead patients to quit treatment, although they have been proven to be effective in reducing symptoms and they still are the first choice for physicians. Catheterization, botulinum toxin and surgeries are invasive procedures that may cause infections and other complications, more indicated in specific cases. Physiotherapy techniques have few contraindications and do not exclude other future options of treatment. These techniques can improve and eventually restore pelvic floor function as bladder control (17).

Behavioral therapy (including bladder training, physiotherapy, bladder control strategies) is one of the

therapy's modalities that should be considered as a first-line treatment for OAB (2, 9, 18, 19). In literature, it is shown symptoms improvements with physiotherapy (20), especially with pelvic floor exercises for muscle strengthening (19, 21), but few researchers attribute the same use and effects to electrical stimulation technique.

Electrical stimulation is widely used by physiotherapy to treat patients with overactive bladder syndrome because it inhibit detrusor involuntary contractions (22). The precise mechanism is not well understood yet, but researchers believe that the mechanism of action of this therapy is associated with reorganization of spinal reflex and regulation of cortex activity (23). Usually, the pontine micturition center is responsible for the central control of micturition and its peripheral control is given by neurotransmitters and nerve fibers that regulate the bladder, urethra and periurethral region (6). The effect of electrical stimulation in afferent pathways provides a preganglionic central inhibition of bladder's motor neuron influencing the detrusor activity, but the effects of this therapy in the sacral region are better known. In animal models it has been observed bladder relaxation by the inhibition of parasympathetic motor neurons (23). Berghmans et al. (17) report that electrical stimulation can induce a reflex contraction of the urethral striated muscle, combined with an inhibition of the nerve impulse that promotes detrusor muscle contraction.

Besides involuntary detrusor contractions, OAB usually occurs with weakness of the pelvic floor muscles causing UUI (6). Electrical stimulation also leads to the strengthening of these muscles (24) and can send afferent stimuli by pelvic organs to inhibit preganglionic bladder innervation, as well as increase the urethral pressure by guardian reflex (6).

This systematic review, only including randomized controlled trials in its analysis, aimed to verify if intracavitary electrical stimulation is effective in patients with OAB.

## Methods

This systematic review was drafted in accordance with PRISMA Statement recommendations and properly registered with the PROSPERO International prospective register of systematic reviews under no CRD42014010766 accessed at <http://www.crd.york.ac.uk/PROSPERO/>.

## Inclusion criteria

The inclusion criteria considered the following cases: 1) studies with patients diagnosed with OAB; 2) studies that used intracavitary electrical stimulation as treatment; 3) studies comparing electrical stimulation treatment with those groups that used drugs, placebo or another intervention; 4) studies that present bladder activity as a result of the measurement; and 5) the ones that adopted randomized controlled trials design.

## Search strategy

The Databases used were: Physiotherapy Evidence Database (PEDro), PubMed and although MEDLINE and SciELO are integrated into the Health Virtual Library, these two were also consulted with the combination of the following keywords searched in Portuguese and English: bladder overactive, overactive urinary bladder, bladder overactivity, detrusor overactive, overactive detrusor function, urinary urge incontinence, detrusor instability, urge incontinence, electric stimulation, electrical stimulation. The descriptors were searched on two databases: Descriptors in Health Sciences (DeCS) and the Medical Subject Headings (MeSH).

## Study selection

Studies with a score equal to or above 5 on methodological PEDro scale (<http://www.pedro.org.au/portuguese/downloads/pedro-scale/>) were selected. The score 5 was chosen because the highest number of studies evaluated by the PEDro base has this score (25). In addition to this criteria, the studies that showed P-value intra- and / or inter-group were also selected.

## Results

The survey was conducted between November 20 and December 6 of 2013 with 217 articles identified from the criteria described above. The screening of the articles was performed only by the author, that removed the duplicated and those who did not meet the inclusion criteria. Only one study had no evaluation in PEDro base and was evaluated by the author in accordance with the criteria described in

scale. Six studies published between 1996 and 2010 remained in this review for analysis. Figure 1 shows the flowchart with the screening process used, the number of items excluded with their justification and the number of selected items.

The results of the six selected articles that show the effect of intracavitary electrical stimulation in people suffering from OAB syndrome are described in the table below, as well as the parameters used, and P-value.

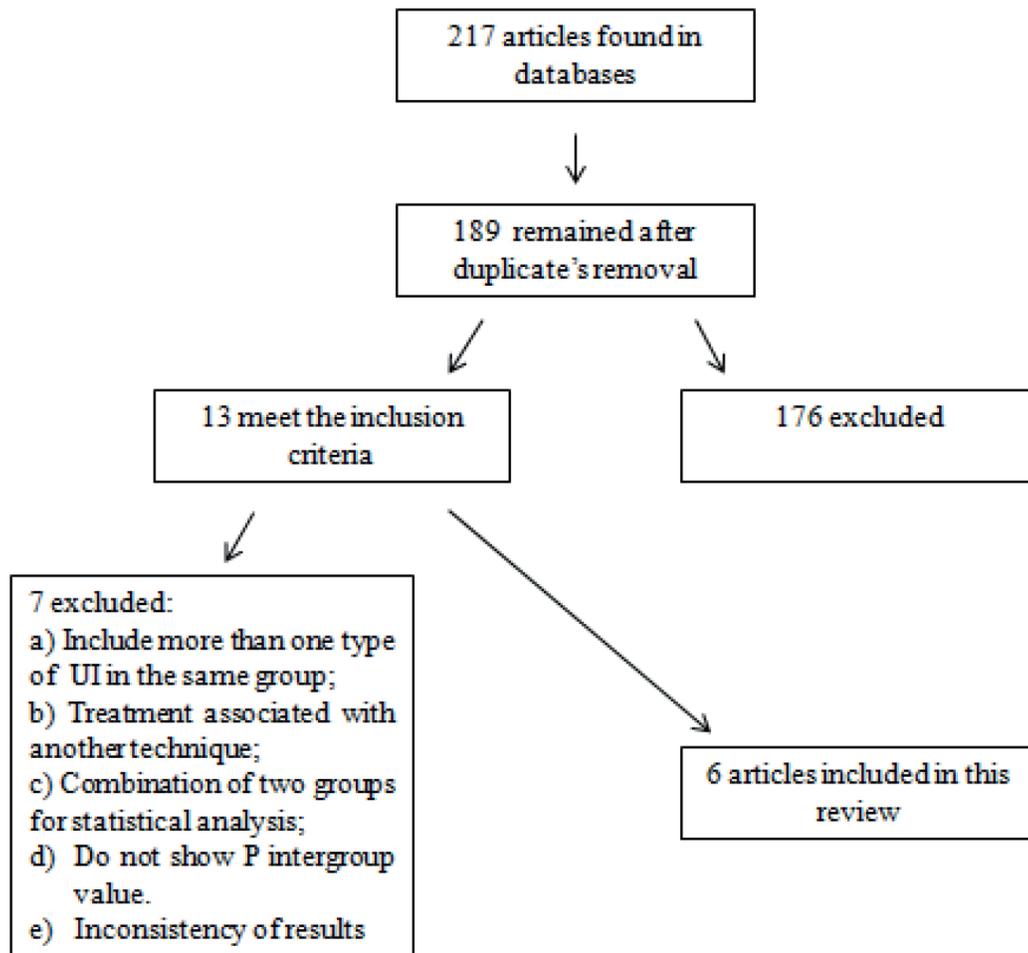


Figure 1 - Flowchart information.

**Table 1** - Results from studies with electrical stimulation in patients with OAB syndrome

Author/Year	Sample	Freq ES	Pulse Width	Intensity	Duration	Freq DW	Weeks	Groups	Answers measured	P intra	P inter
Yamanish/2000 (26)	60 39 women 29 men	10 Hz	1 ms	max 60 mA	15 min	2\7	4	ES x Sham	Number of pads, urinary freq <sup>a</sup> Urinary incontinence, nocturia MCC <sup>b</sup> Urgency improvement OAB symptoms QoL <sup>c</sup>	P < 0,05 P < 0,05 P < 0,05 P < 0,05 NM P < 0,05	P > 0,05 P < 0,05 P < 0,05 NM P < 0,05
Wang/2004 (14)	103 women	10 Hz	400 µs	max 72 mA	20 min	1\2	12	ES x exerc x biofeedback + exerc	Urinary incontinence OAB symptoms QoL (KHQ) <sup>e</sup>	NM NM NM	P < 0,05 P < 0,05 P < 0,05
Wang/2006 (27)	68 women	10 Hz	400 µs	max 72 mA	20 min	1\2	12	ES x oxybutynin x placebo	Number of pads, urinary freq Urinary incontinence Nocturia Urgency improvement QoL (KHQ)	P < 0,05 P > 0,05 P < 0,05 P < 0,05 P < 0,05	P > 0,05 P > 0,05 P < 0,05 P < 0,05 P < 0,05
Arruda/2007 (28)	64 women	10 Hz	1 ms	max 100 mA	20 min	1\2	12	ES x oxybutynin x exerc	Number of pads, urinary freq Urinary incontinence, nocturia Urinary freq, Urinary incontinence MCC Urgency improvement QoL (IIQ-7) <sup>f</sup>	P < 0,05 P > 0,05 P < 0,05	P > 0,05 P > 0,05 P > 0,05
Ozdedeli/2010 (29)	35 women	5 Hz	100 µs	max 80 mA	20 min	1\3	6	ES x trospium hydrochloride	Urinary freq, Urinary incontinence MCC Urgency improvement QoL (IIQ-7) <sup>f</sup>	P < 0,05 P > 0,05 P < 0,05 P < 0,05	P > 0,05 P > 0,05 P > 0,05 P > 0,05
Berghmans/2002 (30)	68 women	4 – 10 Hz	200 µs	max 100 mA	NI	1\1	9	ES x exerc <sup>d</sup> x ES + exerc x Sham	OAB symptoms	NM	P < 0,05

## Discussion

In Table 1 it can be noted that all studies used low frequency electrical stimulation (4 and 10 Hz) to inhibit involuntary detrusor contractions. However, the pulse width presented great variability between studies. Great variability also occurred in duration and weekly frequency of treatment. Table 1 results showed that electrical stimulation can promote benefits for patients with overactive bladder, significantly reducing urinary incontinence, nocturia, urinary frequency and number of pads used, increasing the maximum cystometric capacity (MCC), bladder and improving the quality of life when compared before and after treatment ( $P < 0.05$ ).

In Yamanishi's study (26) the electrical stimulation when compared with untreated group (control) proved to be an important strategy of improvement to overactive bladder (Table 1), and this result is reinforced by other researchers (12, 31, 32). When confronted with other forms of treatment such as medication (27, 28, 29) or pelvic floor exercises (14, 28, 30), electrical stimulation showed similar efficacy ( $P \leq 0.05$ ) results which were also supported by other studies (9, 13, 33, 34, 35, 36). Reduction of frequency, urinary incontinence and number of pads used also occurred, besides the improvement in urodynamic data. Such reductions and improvements were also found in other studies (4, 12, 13, 20, 23, 31, 33, 34). Brubacker (24) reports that "There is good evidence that the use of vaginal electrical stimulators can reduce the occurrence of symptoms of overactive bladder in about half of the patients treated". Abdelbary (37) showed that vaginal electrical stimulation and estrogen found to be effective in treating OAB symptoms.

Quality of life was assessed by different questionnaires: own Questionnaire (26), King's Health Questionnaire (14, 27) and Incontinence Impact Questionnaire Short Form (29) (Table 1). All showed benefits from treatment with electrical stimulation, improving the quality of life. These results were also confirmed by other researchers (4, 35).

The percentage of patients satisfied with electrical stimulation treatment was greater than 50%, reaching 59.40% as shown by Yamanishi (26), 52.4% by Arruda (28) and 87.60% by Ozdedeli (29). These percentages of patient's satisfaction were also replicated in other studies (20, 33, 34, 32).

The effectiveness of electrical stimulation shown in this review can be explained by the reactivation

of the inhibitory reflex of the detrusor, with consequent bladder relaxation (12). The inhibition occurs by reflex contraction of para and peri urethral striated muscles (17) or by afferent stimulation of the pudendal nerve (17), since that afferent stimulation promotes the contraction of the bladder (38).

Although electrical stimulation has been shown to be effective in treating the symptoms of OAB, this effect can not occur so markedly in older population. Spruijt (39) showed low efficacy of electrical stimulation and perineal exercises, when applied to the elderly, correlating these findings about aging to hormonal changes and great emotional impact. The UI in elderly is considered multifactorial, including changes in body tissues, anatomy, lifestyle and personal characteristics. Furthermore, there is a reduction in bladder muscarinic receptors and innervation may influence recovery (40).

Therapy with electrical stimulation become a promissory possibility of intervention in patients with OAB, as they do not have adverse effects such as medications, shown by Smith (32) and Franzen (35) and is not characterized as a so-invasive and harmful procedure as surgical corrections, which are indicated only when there is no satisfactory results with conservative therapies (10). Note that electrical stimulation only need an initial adaptation of the patient to electrical current since it can cause discomfort, but along the therapy occurs an accommodation of the magnitude of the fibers, becoming more comfortable.

## Conclusion

According to results of this review, the intracavitary electrical stimulation is effective in patients with OAB syndrome as well as other therapies already described, such as medications, pelvic floor exercises and surgery, but the former is less invasive and presents no side effects. Therefore, electrical stimulation becomes an important strategy to be considered in the treatment of OAB symptoms.

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