

Percutaneous Tibial Nerve Stimulation with Modified Electrical Stimulator as Therapy for Overactive Bladder Syndrome: A Serial Case Report

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Abstract: Overactive Bladder Syndrome (OAB) is a syndrome of increased urinary frequency and nocturia with or without incontinence in the absence of obvious pathology. Percutaneous Tibial Nerve Stimulation (PTNS) is one of the neuromodulations used to treat OAB. A modified electrical stimulator was used for PTNS with the same parameters as Urgent®PC. This study aims to determine whether PTNS with a modified electrical stimulator will give improvement in OAB and if there are any complications. In this case series, six patients (three males and three females) diagnosed with OAB were treated with PTNS using a modified electrical stimulator device (Everyway EV-807P NMES). Electrical stimulations were applied once a week for 12 weeks and each treatment was done for 30 minutes. Reduced urinary frequency is determined as improvement and assessed at 6th and 12th weeks. Four patients reported improvement. No complications have been reported. In this case series, PTNS with a modified electrical stimulator may reduce urinary frequency and maybe a safe option to treat patients with symptoms from OAB. Need further research to know the definitive result.

1 INTRODUCTION

Overactive Bladder Syndrome (OAB) is a syndrome of increased urinary frequency and nocturia with or without incontinence in the absence of obvious pathology (Wibisono and Rahardjo, 2016; Wall and Heesakkers, 2017). It is estimated that there are around 455 million people (11% of the world population ranging from 1,5% to 36,4%) having experienced OAB symptoms during their life and resulting in a substantial economic, psychological burden and negatively impacted their quality of life (Wibisono and Rahardjo, 2016; Wall and Heesakkers, 2017). A study (Sumardi et al., 2014) reported that the prevalence in Indonesia for wet OAB is 4.1% and dry OAB is 1.6%.

The treatments of OAB consist of four classes: conservative treatment, pharmacotherapy, surgical therapy, and additional therapy for intractable OAB. The first line treatments are conservative treatment and pharmacotherapy and for second line treatment

available are surgical therapy, electrical stimulation (sacral nerve stimulation, percutaneous tibial nerve stimulation), and botulinum toxin injection (Wibisono and Rahardjo, 2016).

Percutaneous tibial nerve stimulation (PTNS) is one of the neuromodulations therapies for OAB that is minimally invasive and could stimulate posterior tibial nerve and deliver electrical stimulation to sacral nerve plexus (Wibisono and Rahardjo, 2016; Wall and Heesakkers, 2017; Tutolo et al., 2018). The regulation of the bladder is controlled by sacral plexus originating from L2-S4. The nerves converge toward and descend as the sciatic nerve and one of its distal branches is the posterior tibial nerve (Wall and Heesakkers, 2017).

PTNS in various studies is done by using Urgent®PC (Uroplasty, Minnetonka, MN, USA) as the stimulator (Gaziev et al., 2013; Peters et al., 2013; Wall and Heesakkers, 2017; Tudor et al., 2018). In this case series, due to the unavailability of Urgent®PC, modified electrical stimulator was used for PTNS with the same parameters as Urgent®PC.

This study aims to determine whether PTNS with a modified electrical stimulator will give improvement in OAB and if there are any major complications.

2 CASE DESCRIPTION

Six patients (three males and three females) with OAB that have been treated with Vesicare® from Urology Department were consulted to Medical Rehabilitation Department in RSUPN Dr. Cipto Mangunkusumo. All of the patients complained about increased urinary frequency in 24 hours. The urinary frequency ranged from 17 – 30 times per 24 hours. All of the patients were treated with PTNS as management of OAB. PTNS was done by using a modified electrical stimulation device (Everyway EV-807P NMES) with low voltage (9V) and the setting for pulse width of 200 microseconds and frequency of 20 Hz (Figure 1).



Figure 1: A modified electrical stimulation device (Everyway EV-807P NMES).

For the procedure (Figure 2), patients were asked to sit comfortably in a chair with the leg that would be treated was elevated. A small and slim needle (acupuncture needle 0.25x25 mm) as stimulator electrode (needle electrode) was inserted percutaneously to the posterior edge of the tibia and about 5 cm cephalad from the medial malleolus (about four fingers above medial malleolus). The other electrode (pad electrode) as grounding was placed on the medial surface of the calcaneus (same side with the stimulator electrode). The electric current was increased until the patient feels a radiation tingling sensation of the foot sole or flexion of the great toe. Then the current was set at

the highest level that can be tolerated by the patient and continued for 30 minutes. Each treatment was done for 30 minutes, and the electrical stimulations were applied once a week for 12 weeks.



Figure 2: Electrode placement

Urinary frequency per day was reported as a measurement of improvement of OAB and assessed at 6th and 12th weeks (Table 1). Improvement of OAB was defined as patients who had at least a 25% reduction in urinary frequency. In 6th weeks, three patients reported improvement and three patients reported no improvement in urinary frequency. In 12th weeks, four patients reported improvement and two patients reported no improvement in urinary frequency. No major complications have been reported during treatment and all of the patients complied for PTNS.

Table 1: Patients profile and results after PTNS.

No	Patient	Age (years)	Gender	Frequency (times per day)		
				1 st	6 th	12 th
1	D	41	Female	17	14	16
2	M	44	Female	25	15	13
3	N	45	Female	20	20	15
4	AF	28	Male	30	30	30
5	D	41	Male	20	10	8
6	SL	76	Male	25	15	14

3 DISCUSSION

PTNS is a neuromodulation treatment that stimulates lumbosacral nerves (L4- S4) which control bladder detrusor and perineal floor via the posterior tibial nerve located near the ankle. The mechanism of neuromodulation is still unclear, but it is believed that stimulation of the lumbosacral nerves via the posterior tibial nerve located will altered the afferent

and efferent pathways between the brain, brain stem, and pelvic organs and eventually modulate the voiding reflex and facilitate storage (Wall and Heesakkers, 2017).

Neuromodulation utilizes electrical stimulation to target specific nerves that control bladder function (Burton, Sajja and Latthe, 2012). In various studies, PTNS was done by using Urgent®PC (Uroplasty, Minnetonka, MN, USA). In this study, electrical stimulation was done by using a modified device with the same parameters with Urgent®PC as a stimulator due to unavailability of Urgent®PC. We modified an electrical stimulation device (Everyway EV-807P NMES) as a substitute for Urgent®PC. The modifications were made for the needle electrode and power source. For the needle electrode, a modification was made by changing the pad electrode with a crocodile clip. As for the power source, modification was made by changing the power source from batteries to direct electricity through an adapter. The voltage of the adapter was set at 9V as described in a study (Burton, Sajja and Latthe, 2012). The setting for pulse width and frequency were set in 200 microseconds, 20 Hz as the standard settings of the device (Peters *et al.*, 2012).

In this study, the protocol of treatment was done following standard protocol as mention in many studies (Burton, Sajja and Latthe, 2012; Peters *et al.*, 2012; Gaziev *et al.*, 2013; Wall and Heesakkers, 2017). Each treatment was done for 30 minutes, and the electrical stimulations were applied once a week for 12 weeks. The placement of the needle electrode at the posterior edge of the tibia and superior to medial malleolus and grounding electrode at the medial surface of the calcaneus.

In some systematic reviews the range of successful treatment was 37-82% (Burton, Sajja and Latthe, 2012), 54.5-79.5% (Gaziev *et al.*, 2013), 37.3-81.8% (Wibisono and Rahardjo, 2015). The success rate was varied depending on the criteria determined by each author as mentioned in a systematic review (Burton, Sajja and Latthe, 2012). The criteria were 50% reduction in symptoms (frequency or urgency incontinence episodes); 25% reduction in daytime and/or night time frequency; < 8 voids/24 hr, 0-1 urgency episode in 24 hr, no urgency incontinence; < 8 voids, < 2 nocturia episodes and 0-1 g on pad test. In this case series, the success treatment criteria was defined as patients who had at least a 25% reduction in daytime and/or nighttime frequency as in a study by Govier *et al.*, 2001. From the study, 71% of patients were classified as

successfully treated after 12 weeks. In this case series, four patients (66.6%) from six patients were classified as successfully treated.

From the studies reported in a meta-analysis (Wibisono and Rahardjo, 2015), PTNS had no serious adverse event. The rare complications found in PTNS treatment were ankle bruising, discomfort/pain at the needle site, bleeding at the needle site, tingling in leg, generalized swelling, worsening incontinence, headache, hematuria, inability to tolerate stimulation, intermittent foot/toe pain and foot cramp. In this case series, there were no major complications had been reported.

4 CONCLUSIONS

PTNS with a modified electrical stimulator may reduce urinary frequency and maybe a safe option to treat patients with symptoms from OAB. Need further research to know the definitive result.

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