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A retrospective study of neuromuscular electrical stimulation for treating women with post-stroke incontinence

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Abstract

This retrospective study evaluated the effect of using neuromuscular electrical stimulation (NMES) for the treatment of post-stroke urinary incontinence (PSUI) among female population in China.

A total of 163 eligible patients with PSUI were included in this study. Of these, 103 patients were assigned to a treatment group, and 60 subjects were assigned to a control group. All patients in both groups received bladder training. In addition, patients in the treatment group also received NMES. All patients were treated for a total of 8 weeks. The outcome measurements included the amount of urine leakage, urinary symptoms and quality of life. The urinary symptoms were measured by the Bristol Female Urinary Symptoms Questionnaire (BFUSQ) score, and the quality of life was assessed by the International Consultation on Incontinence Questionnaire-Short Form (ICIQ-SF) score. In addition, adverse events were also documented in this study.

After 4-week treatment, patients who received NMES did not exert better outcomes in the amount of urine leakage, urinary symptoms, measured by BFUSQ scale, and the quality of life, assessed by ICIQ-SF scale. However, after 8-week treatment, patients in the treatment group showed greater effect in reducing the amount of urine leakage ($P < .01$), enhancing urinary symptoms, as measured by BFUSQ scale ($P < .01$), and improving the quality of life, as assessed by ICIQ-SF scale ($P < .01$), compared with patients in the control group. In addition, no adverse event was recorded during the period of 8-week treatment in this study.

The results of this study indicated that NMES may benefit for patients with PSUI after 8-week treatment. Future studies should focus on warranting the results of this study.

Abbreviations: BFUSQ = Bristol Female Urinary Symptoms Questionnaire, ICIQ-SF = International Consultation on Incontinence Questionnaire-Short Form, NMES = neuromuscular electrical stimulation, PSUI = post-stroke urinary incontinence, UI = urinary incontinence.

Keywords: effect, neuromuscular electrical stimulation, post stroke, urinary incontinence

1. Introduction

Urinary incontinence (UI) is one of the most common complications after stroke.[1–4] It often presents as the involuntary leakage of urine.[5–7] One study reported that about 40% to 60% of patients after stroke experienced UI condition.[8] The other studies also reported that the prevalence of post-stroke UI (PSUI) ranges between 32% to 79% at admission and 25% at hospital discharge.[9–11] Additionally, it still increases to 15% one year later.[11] This condition can result in the physical and psychological issues for patients with PSUI.[12] It is estimated that the daily cost for the treatment of such condition is about $185.60 for each patient with PSUI.[13] Most importantly, it can also lead to moderate or severe disability and high mortality.[14] It has been reported that such patients often experience 52% death by discharge, and 60% within 6 months after stroke.[14]

Several management options have been reported to treat this condition, including behavioral therapy, supportive device, pharmacological intervention, and surgical treatment.[15–18] Behavioral therapies mainly consist of healthy bladder habits and training techniques.[19] It helps patients to change their lifestyle, and to teach them to control and enhance continence ability. Supportive devices are often used as the first-line intervention for patients, who have difficulties in moving or using pads or catheters.[20] Additionally, pharmacological therapies usually result in a variety of side effects.[21] As for surgical treatment, most patients rarely received it, especially in neurological injury patients.[22] Thus, more safe and efficacious interventions are urgently needed to treat PSUI.

It has been reported that alternative treatments, such as herbal medicine, acupuncture, moxibustion, and neuromuscular electrical stimulation (NMES) are used to treat this condition.[23–26] However, no data on the effect of NMES for treating patients with PSUI are available among Chinese female population. Therefore, this retrospective study assessed the effect of NMES for PSUI.

2. Patients and methods

2.1. Ethics

This retrospective study was approved by the ethics medical committee of Yulin No.2 Hospital. It was conducted at this

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The authors declare no conflicts of interest.

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hospital between June 2014 and July 2017. All subjects provided the written informed consent.

2.2. Design

Two investigators independently selected the patient cases from Yulin No.2 Hospital. A total of 163 eligible adult female patients with PSUI were included in this retrospective study. All these included patients were divided into a treatment group (n = 103), and a control group (n = 60). All patients in both groups administered bladder training. In addition, patients in the treatment group also underwent NMES. Both groups received a total of 8 weeks intervention. The outcomes consisted of the amount of urine leakage, urinary symptoms, and quality of life. All the outcomes were evaluated before and after 4-week and 8-week treatment respectively. The data analyst was blinded in this study.

2.3. Patients

All patients were confirmed diagnosed with PSUI by the diagnosis criteria of the American Stroke Association and the International Continence Society. However, this study excluded patients if they were pregnancy, unconsciousness, psychiatric problems, severe organ diseases, having a cardiac pacemaker, or failed to have normal communication ability and recognition. In addition, the cases were also excluded if the patients were administered electrical stimulation therapy, including electroacupuncture 1 month before the study. Furthermore, the cases with incomplete information were also excluded.

2.4. Treatment schedule

All patients in both groups administered bladder training by pelvic muscle exercises, which is a very important form of behavior therapy. It may help patients manage urinary incontinence, and change their urination habits. Each patient was asked to practice this exercise for 5 minutes each session, 1 session daily for a total of 8 weeks.

In addition, patients in the treatment group also underwent NMES therapy at bilateral acupoints Baliao (BL31, over the first sacral foramen; BL32, over the second sacral foramen; BL33, over the third sacral foramen; BL34, over the fourth sacral foramen) and Huiyang (BL35, 0.5 cun lateral to the posterior midline, on the level of the tip of the coccyx) for 30 minutes daily, each pair of points 6 minutes, 3 times weekly for a total of 8 weeks. The NMES device (HANS-100, Nanjing Jisheng Medical Technology Co., Ltd) was applied at a frequency of 2 to 100 Hz. The current intensity of NMES was gradually increased to the maximum tolerance according to each patient. Each device had 2 gel pads attached to a silicon patch. The patches were attached to the local selected acupoint area.

2.5. Outcome measurements

The amount of urine leakage, urinary symptoms and quality of life were utilized to assess the effect of NMES therapy. The amount of urine leakage was measured by the 1 hour pad test. Urinary symptoms were measured by the Bristol Female Urinary Symptoms Questionnaire (BFUSQ) score, with a higher score meaning poorer condition or quality of life,[27] and quality of life was measured by the International Consultation on Incontinence Questionnaire-Short Form (ICIQ-SF) score.[28] It ranges from 0 to 21, with a higher score indicating greater severity. Both scales of BFUSQ and ICIQ-SF were validated before they were utilized in this study. In addition, adverse events were also recorded during the treatment period.

Table 1

General characteristic of the included patients.

Characteristics	Treatment group (n = 103)	Control group (n = 60)	*P*
Age, ys	58.6 (10.2)	56.4 (11.3)	.21
Race (Chinese Han)	103 (100.0)	60 (100.0)	–
BMI, kg/m^2	23.5 (2.7)	22.9 (2.4)	.14
Duration of post stroke, mo	10.8 (3.6)	10.3 (4.1)	.43
Duration of PSUI, mo	5.3 (2.4)	5.5 (2.2)	.59
Co-morbidities			
Cardiovascular diseases	10 (9.7)	7 (11.7)	.69
Respiratory diseases	4 (3.9)	3 (5.0)	.74
Osteoarthritis diseases	4 (3.9)	1 (1.7)	.44
Other	7 (6.8)	4 (6.7)	.97

Data are present as mean ± standard deviation or number (%).
BMI = body mass index, PSUI = post-stroke urinary incontinence.

2.6. Statistical analysis

The outcome data was analyzed by the SAS package (Version 9.1; SAS Institute Inc., Cary, NC). Mann–Whitney *U* test or *t* test were applied to analyze the continuous data, while χ^2 test was used to analyze the categorical data. The statistical significance level was set at $P < .05$.

3. Results

The general characteristics of patients in both groups are listed in Table 1. The comparison did not show significant differences in all characteristics, as well as the outcome measurements before the study (Table 2) between 2 groups. Those characteristics consisted of age, race, and body mass index, duration of post stroke, duration of PSUI, and comorbidities (Table 1).

After 4-week treatment, all outcomes in the treatment group did not demonstrate better promising effect in decreasing the amount of urine leakage decrease ($P = .82$), enhancing the urinary symptoms, as measured by the BFUSQ scale (inconvenience in activities of daily life, $P = .17$; urinary symptoms, $P = .63$), and improving the quality of life, as assessed by the ICIQ-SF scale ($P = .72$), compared to the control group (Table 3).

After 8-week treatment, NMES exerted greater outcomes in the amount of urine leakage ($P < .01$), symptoms decrease, as

Table 2

Comparison of outcomes measurements before the treatment.

Outcomes	Treatment group (n = 103)	Control group (n = 60)	*P*
Urine leakage, mL	20.1 (15.6)	19.5 (16.1)	.82
BFUSQ score			
Inconvenience in activities of daily life	41.3 (7.8)	39.5 (8.2)	.17
Urinary symptoms	12.4 (4.0)	12.1 (3.7)	.63
ICIQ-SF score	9.7 (3.5)	9.5 (3.3)	.72

Data are present as mean ± standard deviation.
BFUSQ = Bristol Female Urinary Symptoms Questionnaire, ICIQ-SF = International Consultation on Incontinence Questionnaire-Short Form.

Table 3

Comparison of outcome measurements after 4-week treatment (change from before treatment).

Outcomes	Treatment group (n = 103)	Control group (n = 60)	Difference	P
Urine leakage, mL	−6.5 (−9.1, −4.2)	−4.5 (−7.3, −2.0)	−2.0 (−3.5, −0.9)	.07
BFUSQ score				
Inconvenience in activities of daily life	−9.3 (−12.6, −7.5)	−7.1 (−9.2, −5.9)	−2.2 (−3.7, −1.0)	.10
Urinary symptoms	−3.0 (−5.0, −2.2)	−1.9 (−3.4, −0.8)	−1.0 (−1.8, −0.4)	.25
ICIQ−SF score	−1.8 (−2.7, −1.0)	−0.9 (−1.7, −0.3)	−0.8 (−1.3, −0.3)	.19

Data are present as mean (range).
BFUSQ = Bristol Female Urinary Symptoms Questionnaire, ICIQ-SF = International Consultation on Incontinence Questionnaire-Short Form.

Table 4

Comparison of outcome measurements after 8-week treatment (change from before treatment).

Outcomes	Treatment group (n = 103)	Control group (n = 60)	Difference	P
Urine leakage, mL	−10.9 (−13.4, −7.2)	−5.0 (−7.9, −2.6)	−6.0 (−8.1, −4.3)	<.01
BFUSQ score				
Inconvenience in activities of daily life	−21.7 (−24.9, −17.7)	−8.6 (−10.5, −6.4)	−13.1 (−16.2, −9.9)	<.01
Urinary symptoms	−7.3 (−10.1, −4.9)	−2.5 (−4.2, −1.1)	−4.8 (−6.3, −3.3)	<.01
ICIQ-SF score	−4.2 (−6.6, −2.5)	−1.3 (−2.4, −0.6)	−2.9 (−4.1, −1.6)	<.01

Data are present as mean ± standard deviation.
BFUSQ = Bristol Female Urinary Symptoms Questionnaire, ICIQ-SF = International Consultation on Incontinence Questionnaire-Short Form.

conducted by the BFUSQ score ($P < .01$), and quality of life, as evaluated by the ICIQ-SF ($P < .01$), compared with these outcomes in the control group (Table 4). No adverse event was recorded in both groups during the 8-week treatment period in this study.

4. Discussion

This retrospective study showed encouraging outcomes after 8-week NMES treatment in patients with PSUI. To our knowledge, no data are available regarding the NMES therapy for treating PSUI in individuals in China presently. In this study, we first utilized NMES intervention for the treatment of PSUI. The findings indicated promising effects of NMES in treating women with PSUI.

Previous related studies have reported promising effects of electroacupuncture for the treatment of patients with PSUI.[4,25] One pilot study found that electroacupuncture may effectively and safely relieve the symptoms and enhance quality of life in women with pure PSUI.[4] The other study reported that acupuncture treatment can contribute to the less urine leakage after 6 weeks in women with stress urinary incontinence.[25]

In this study, our results showed that NMES can significantly reduce the amount of urine leakage; enhance the urinary symptoms, assessed by the BFUSQ scale; and improve the quality of life, measured by the ICIQ-SF scale. Moreover, no adverse event was documented during the period of the treatment. It indicated that NEMS may be safe and efficacious for women with PSUI in China.

This study has several limitations. First, this study had an intrinsic limitation because of the retrospective study. Second, this study only evaluated the effect and safety of NMES for 8-weeks treatment period. Third, this study did not include follow-up assessment after 8-week treatment cessation. All those limitations may impact the results of this study.

5. Conclusion

The results of this study demonstrated that NMES therapy may be efficacious and safety for treating patients with PSUI. Further studies are still needed to warrant the results of this study.

Author contributions

Conceptualization: Shu-Xia Shen, Yun Liu.
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Investigation: Yun Liu.
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Validation: Yun Liu.
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