

Acupuncture on Clinical Symptoms and Urodynamic Measurements in Spinal-Cord-Injured Patients with Detrusor Hyperreflexia

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Key Words

Acupuncture · Spinal cord injury · Incontinence · Neurogenic bladder

Abstract

Objectives: We investigated the possible use of acupuncture for the treatment of urinary incontinence caused by detrusor hyperreflexia in patients with chronic spinal cord injuries. **Methods:** A total of 13 patients (11 males, 2 females) suffering from urinary incontinence due to spinal cord injuries were treated by acupuncture, which was carried out with disposable stainless steel needles inserted into the bilateral BL-33 (Zhongliao) points on the skin of the third posterior sacral foramina. Urodynamic studies were also performed before acupuncture, immediately after the 1st acupuncture and 1 week after the 4th acupuncture. In 6 patients, these urodynamic studies were performed again 1 month after the 4th acupuncture. **Results:** No side effects were recognized throughout the treatment period. Of the 13 patients, incontinence disappeared in 2 (15%) and decreased to 50% or less compared to baseline in a further 6 (46%). Maximum cystometric bladder capacity increased significantly from 76.2 ± 62.3 to 148.1 ± 81.5 ml 1 week after the 4th ac-

puncture ($p < 0.01$). In the 6 patients in whom cystometry was repeated 1 month after the 4th acupuncture, bladder capacity decreased from 187.5 ± 90.4 ml 1 week after the 4th acupuncture to 128.3 ± 93.4 ml. **Conclusion:** In spinal cord injury patients acupuncture could represent another valuable therapeutic alternative to the treatment of urinary incontinence caused by detrusor hyperreflexia.

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Introduction

Acupuncture is a traditional Chinese medicine and has been used widely for the treatment of urinary disturbances. Clinical data are, however, limited as to their validity in treating neurogenic bladder dysfunctions in relationship to urodynamics and symptoms. In our previous study, acupuncture has been shown to relieve urinary incontinence and urgency caused by overactive or unstable bladder along with improvement in urodynamic measurements such as bladder capacity [1]. These promising results have prompted us to apply acupuncture to the treatment of urinary incontinence in spinal-cord-injured patients with detrusor hyperreflexia.

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Table 1. Patients profiles and clinical response

Case No.	Age years	Sex	Level	Lesion	Oral oxybutinin mg/day	Response in incontinence ¹ , %
1	40	M	C4	complete	-	14
2	61	M	C4	complete	-	82
3	64	M	C5	complete	-	128
4	20	M	C6	complete	12	18
5	21	M	C6	complete	-	0
6	30	M	C6	incomplete	2	11
7	31	M	C6	complete	6	0
8	28	M	Th2	complete	-	109
9	20	M	Th5	complete	8	20
10	31	M	Th11	complete	-	75
11	33	M	Th11	complete	-	35
12	27	F	Th12	complete	-	78
13	49	F	Th12	incomplete	-	20

¹ Average volume of incontinence after treatment/average volume of incontinence before treatment × 100.

Materials and Methods

Acupuncture was performed on a total of 13 patients (11 males, 2 females) suffering from urinary incontinence due to spinal cord injuries. Patients' characteristics including age and spinal cord levels of lesion are detailed in table 1. The time interval between the onset of spinal cord injury and the treatment by acupuncture ranged from 4 to 206 months (58.7 ± 70.9 months). Before treatment by acupuncture all patients had been managed with clean intermittent catheterization. Bladder diary, including voiding volume, voiding hour and pad weight, was recorded in all patients.

Acupuncture was performed as the first-line treatment for incontinence in 4 cases. The remaining 9 cases had been treated with pharmacotherapy, though control of incontinence had proved unsatisfactory. Of these patients 5 stopped medication for incontinence before acupuncture and 4 patients continued oral oxybutinin chloride (2–12 mg) with no change in dose during the acupuncture treatment. Autonomic hyperreflexia was present in 4 patients. In all patients, informed consent was obtained in written form following an explanation not only of treatment effects but also side effects possibly accompanying acupuncture.

Acupuncture

Acupuncture was performed using a disposable stainless steel needle (0.3 mm in diameter, 60 mm in length, SEIRIN Kasei, Shimizu, Japan) with the patient in the prone position. Acupuncture needles were inserted into the bilateral BL-33 (Zhongliao) points (fig. 1), as standardized by the World Health Organization, on the skin of the third posterior sacral foramina toward the cranial direction. The needle was inserted into each side of the foramina sufficiently deeply for its tip to be placed close to the sacral periosteum (50–60 mm) (fig. 2), and then the bilateral needles were rotated reciprocally with manual change of rotary directions for 10 min. The treatment was repeated once a week for 4 weeks.

Urodynamic Studies

Cystometry and simultaneous monitoring by external urethral sphincter electromyography were performed with the patient in the supine position before treatment, immediately after the 1st acupuncture, and one week after the 4th acupuncture, respectively. Cystometry was performed with a catheter (14F) inserted through the urethra, using CO₂ gas at a filling rate of 50 ml/min (OM-3MAX, Medical Engineering Corporation, Racine, Wisc., USA). Bladder capacity was defined as the infused CO₂ gas volume until uninhibited contraction (15 cm H₂O or more in intravesical pressure) was recognized. Electromyography was recorded with a bipolar needle electrode (MEM-4104, Nihon Koden, Tokyo, Japan) inserted into the external urethral sphincter [2]. In 6 patients, these urodynamic studies were performed again 1 month after the 4th acupuncture.

Urinary Symptoms

All patients recorded a bladder diary for 1 week before treatment as a baseline, and again after the 4th acupuncture. The therapeutic effect of the acupuncture was evaluated based on changes in volume of urinary incontinence recorded in the bladder diary. Urodynamic parameters as well as urinary symptoms were compared before and after treatment.

Statistical Analysis

Values were expressed as the mean plus or minus standard deviation. A Wilcoxon signed rank test was used for statistical analyses. $p < 0.05$ was defined as statistically significant.

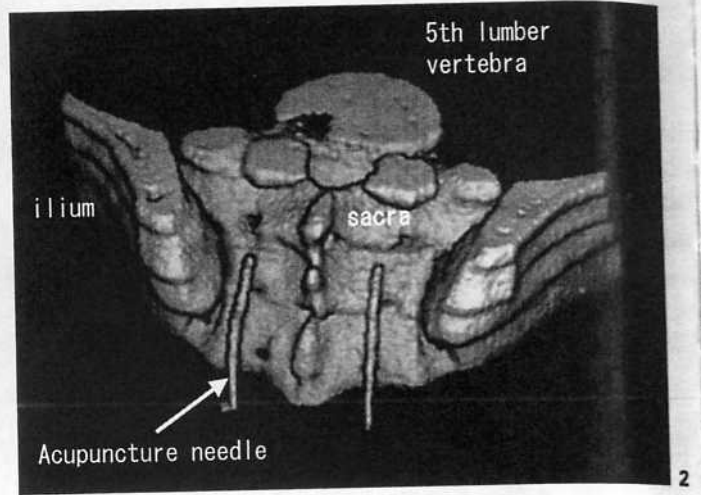
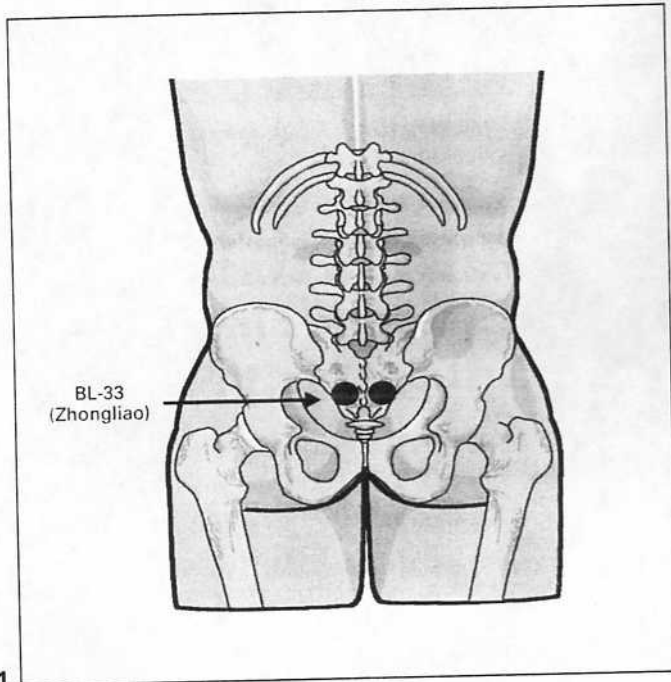
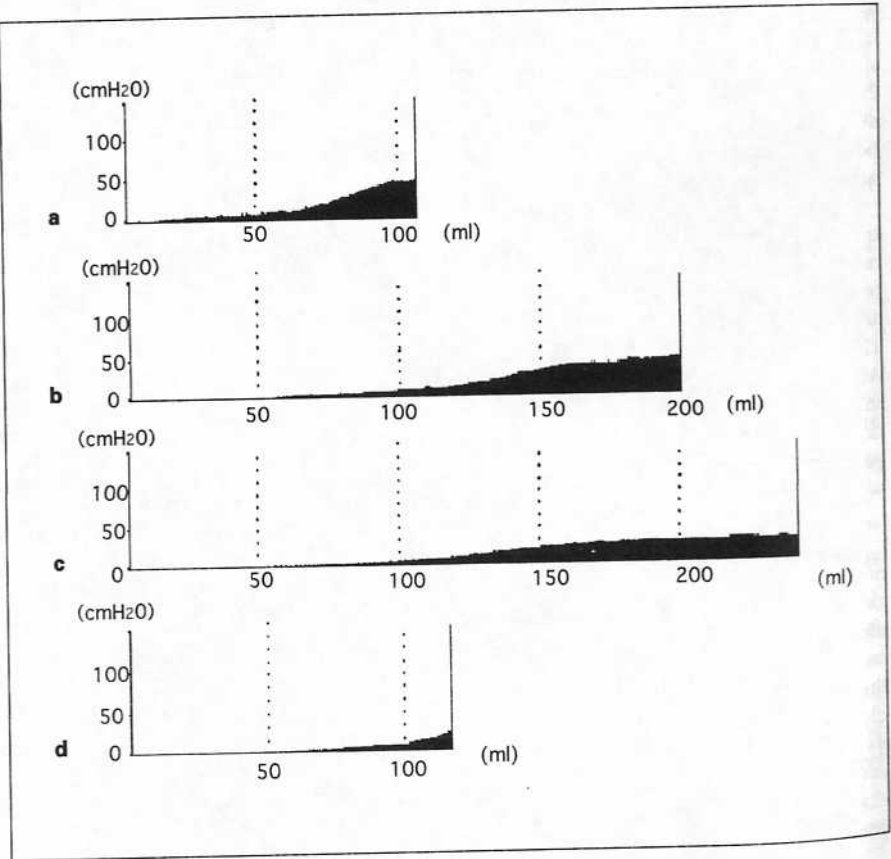


Fig. 1. Schematic diagram showing acupuncture points of BL-33 (Zhongliao).

Fig. 2. Helical CT reveals acupuncture needles are inserted into bilateral BL-33 points.

Fig. 3. Cystometrograms of case 7. **a** Before treatment. Autonomic hyperreflexia occurred when the bladder was filled with 90 ml of CO₂ gas. **b** Immediately after the 1st acupuncture. Autonomic hyperreflexia occurred when the bladder was filled with 190 ml of CO₂ gas. **c** One week after the 4th treatment. The patient had a bladder-filling sensation without autonomic hyperreflexia when the bladder was filled with 240 ml of CO₂ gas. **d** One month after the 4th treatment. Bladder capacity was 110 ml without autonomic hyperreflexia.



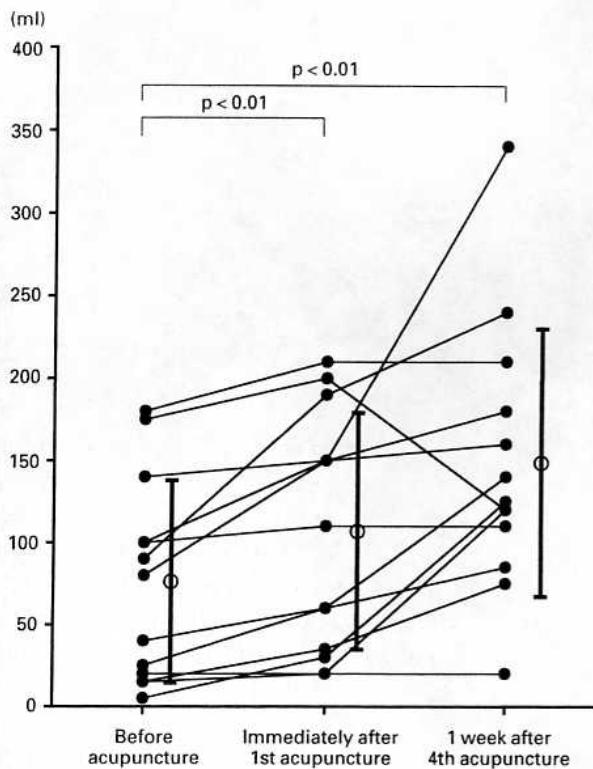


Fig. 4. Changes in maximum cystometric bladder capacity.

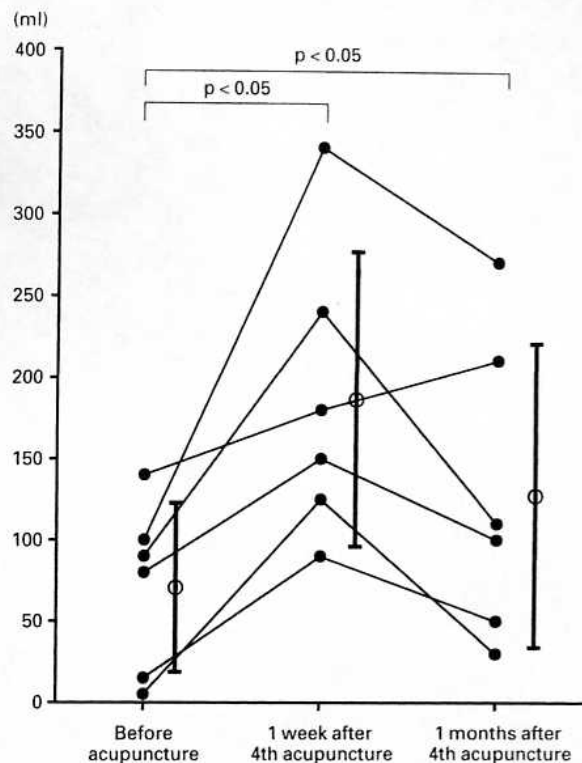


Fig. 5. Changes in maximum cystometric bladder capacity up to 1 month after the 4th acupuncture in 6 patients.

Results

Patients were all confirmed urodynamically to have detrusor hyperreflexia with uninhibited contraction. Of 13 patients, 10 (77%) displayed detrusor external urethral sphincter dyssynergia (DSD).

There were no side effects accompanying the acupuncture and all patients completed the protocol. Response in volume of urine incontinence in each patient is shown in table 1. With acupuncture treatment, incontinence disappeared in 2 (15%) patients and decreased to 50% or less in volume as compared to the baseline in a further 6 (46%), resulting in satisfactory results obtained in 62% (8/13) of the patients. In the remaining 5 patients (38%), however, incontinence did not decrease to 50% or less in volume as compared to the baseline. Of 4 patients suffering from autonomic hyperreflexia, symptoms disappeared in 3 almost completely after acupuncture (fig. 3).

Favorable responses to acupuncture were also recognized in urodynamic measurements, in particular in blad-

der capacity changes. Bladder capacity increased significantly from 76.2 ± 62.3 to 107.3 ± 73.2 ml immediately after the 1st acupuncture ($p < 0.01$) and up to 148.1 ± 81.5 ml 1 week after the 4th acupuncture ($p < 0.01$; fig. 4). In the 6 patients in whom cystometry was repeated 1 month after the 4th acupuncture, bladder capacity decreased from 187.5 ± 90.4 ml 1 week after the 4th acupuncture to 128.3 ± 93.4 ml (fig. 5), which was still higher than before treatment ($p < 0.05$). In contrast, there was little change noted in maximum intravesical pressure, being 47.4 ± 27.4 , 55.2 ± 28.8 and 52.2 ± 28.8 cm H₂O before treatment, immediately after the 1st acupuncture and 1 week after the 4th acupuncture, respectively (fig. 6). In 5 of the 10 patients with DSD, dyssynergia was improved.

Interestingly, there was a significant relationship between changes in bladder capacity and the therapeutic effects of acupuncture. In all 3 patients in whom bladder capacity increased by more than 50 ml immediately after the 1st acupuncture, incontinence disappeared (cases 5, 7)

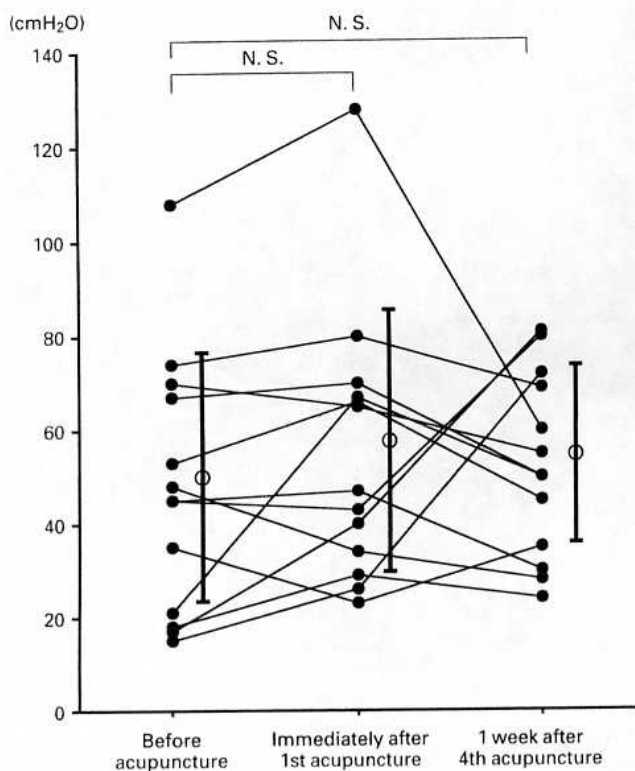


Fig. 6. Changes in maximum intravesical pressure.

or decreased to 11% of baseline (case 6). In contrast, incontinence decreased to 50% or less of baseline in only 4 of 10 patients in whom the change in bladder capacity at the 1st acupuncture was less than 50 ml.

Discussion

Still today, pharmacotherapy plays an important role in the treatment of urinary incontinence caused by detrusor hyperreflexia in spinal-cord-injured patients [3]. Potent anticholinergic agents such as oxybutinin have been reportedly of clinical use for the treatment of urgent incontinence in patients with neurogenic bladder dysfunction. However, side effects often limited its validity. Electrostimulation therapy has also been applied to control detrusor hyperreflexia through the suppression of micturition contraction and the increase of pelvic floor muscle tonus [4–6]. A recently developed electrode buried in the skin was reported to improve incontinence in spi-

nal-cord-injured patients [6]. Its use is, however, also limited due to difficulties in the management of the electrode and possible infection. A more effective treatment of incontinence in spinal-cord-injured patients and one with a few less side effects still remains to be developed.

Acupuncture is a traditional Chinese medicine, which is characterized by having no or few side effects. Currently, acupuncture is used worldwide for the treatment of many kinds of disorder including urinary disturbances [7–9]. Chang [7] applied acupuncture to women with urinary frequency, urgency and dysuria, reporting a significant increase in cystometric bladder capacity along with the relief of these symptoms. Similar improvements were also reported in patients with bladder instability or sensory urgency [8]. In our previous study, acupuncture has been shown to relieve urinary incontinence and urgency caused by overactive or unstable bladder, along with improvement in urodynamic measurements such as bladder capacity [1]. These studies have encouraged us to apply acupuncture to the treatment of urinary disturbances caused by neurogenic bladder dysfunction.

This study is the first to report the results of acupuncture in spinal cord injury patients with urinary incontinence caused by detrusor hyperreflexia. In the majority of patients acupuncture on the bilateral BL-33 points improved symptoms and increased bladder capacity significantly. Acupuncture was well tolerated throughout the treatment. Although the long-term effects of acupuncture remain to be assessed, it looks like a possible therapeutic alternative in the treatment of incontinence in spinal-cord-injured-patients. In this study, when acupuncture was performed every week for 4 weeks, bladder capacity reversed to baseline level within 1 month after the end of the treatment. It might be that acupuncture should be repeated every 1–3 weeks in order to maintain its therapeutic effects.

It was of interest to observe that the changes in bladder capacity correlated significantly with the therapeutic effects on incontinence. In the 3 cases in whom bladder capacity increased by more than 50 ml immediately after the 1st acupuncture, incontinence was well controlled. It is suggested that cystometry immediately after the 1st acupuncture could help predict the outcome of subsequent acupuncture.

The mechanism by which acupuncture inhibits detrusor hyperreflexia remains to be elucidated. In an experimental study on anesthetized rats, Sato et al. [10] reported that acupuncture-like stimulation of the perineal skin and muscles inhibited bladder contraction. Since its inhibitory effects were blocked by the severance of the perineal

nerve and efferent branches of the pelvic nerve, the authors suggested that acupuncture-like stimulation passed centripetally into the spinal cord and inhibited pelvic nerve activities. Kashiwagi et al. [11] also found acupuncture on the rat perineum to prolong the latent time of micturition contraction. These results suggest a mechanism of spinal segmental inhibition through which bladder contraction is suppressed by acupuncture. Kuru [12] has demonstrated nervous control of micturition reflex via the pontine micturition center in an experimental study. In addition, as proposed by Kitakoji et al. [13], there might be another inhibitory mechanism by acupuncture via the pontine micturition center. As in the spinal-cord-injured patients, the inhibitory mechanisms by acupuncture might be different between patients with complete and incomplete lesions. In this study, however, differences in response to acupuncture between patients with complete and incomplete lesions were difficult to elucidate due to the limited number of subjects. Further stud-

ies are needed to elucidate the mechanism through which acupuncture inhibits detrusor hyperreflexia.

Finally, it is to be noted that the number of patients in the present study is small and that statistics might be debatable under such conditions. Further studies are therefore needed with a greater number of patients to corroborate the findings obtained in this study.

Conclusion

Of 13 patients suffering from urinary incontinence due to spinal cord injuries, satisfactory therapeutic effects were obtained by acupuncture in 8 (62%). These results suggest that acupuncture could represent another valuable alternative in the treatment of urinary incontinence caused by detrusor hyperreflexia in patients with spinal cord injuries.

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