

Acupuncture and constraint-induced movement therapy for a patient with chronic stroke

One-year follow-up case report

Yuanyuan Jin, MD*, Xiaoqing Jin, MD, Yidan Chen, MD, Jianfang Zhu, MD

Abstract

Rationale: Spasticity is a widespread problem in chronic stroke. To date, no study has reported the long-term (up to 1 year) outcomes of acupuncture in combination with constraint-induced movement therapy in patients with chronic stroke. This report describes the successful addition of acupuncture on spasticity and arm function in a patient with chronic stroke and arm paresis.

Patient concerns: At screening, the patient was unable to voluntarily extend her interphalangeal or metacarpophalangeal joints beyond the 10 degrees required for constraint-induced movement therapy. However, the BTX type A injection couldn't be used as she had ever suffered a severe allergic reaction in the injection of BTX type A for facial anti-wrinkle.

Diagnoses: A 40-year-old female experienced arm paresis after an infarction in the right posterior limb of the internal capsule 2 years before the intervention.

Interventions: The BTX type A injection couldn't be used as she had ever suffered a severe allergic reaction in the injection of BTX type A for facial anti-wrinkle, so the patient received 1 hour of acupuncture as an alternative therapy before 5 hours of constraint-induced movement therapy for 12 weekdays.

Outcomes: All outcome measures (Modified Ashworth Scale, Fugl-Meyer Assessment, Action Research Arm Test, Motor Activity Log) substantially improved over the 1-year period. Moreover, during the observation period, the patient's muscle tone and arm function did not worsen.

Lessons: As a result of a reduction in spasticity, a reduction of learned nonuse behaviors, or use-dependent plasticity after the combined therapy, the arm functions include volitional movements and coordination or speed of movements in the paretic arm have been improved. However, we can not rule out the possibility of an influence of the passage of time or the Hawthorne effect. The costs of the treatment of stroke may be reduced, if this combined therapy proved useful in future controlled studies.

Abbreviations: ADL = activity of daily living, ARAT = Action Research Arm Test, BTX = botulinum toxin, CIMT = Constraint-induced Movement Therapy, FMA = Fugl-Meyer Assessment, MAL = motor activity log, MAS = Modified Ashworth Scale.

Keywords: acupuncture, chronic stroke, constraint-induced movement therapy, one-year follow-up, spasticity

1. Introduction

Spasticity is defined as a hypertonic postural attitude characterized by a velocity-dependent increase in tonic stretch reflexes with exaggerated tendon jerks resulting in hyperexcitability of the stretch reflex, is a component of upper motor neuron syndrome.^[1] Spasticity assumed to be a thorny issues as the prevalence at 1 year after stroke was 38%.^[2] Botulinum toxin (BTX) as a common used therapy, the duration of efficacy of BTX is 3 to 5 months.^[3] But the higher cost and its limitations

(especially severe allergic reaction) cannot be ignored.^[4] Evidence from a systematic review and meta-analysis has indicated that acupuncture combined with conventional routine care has the potential of reducing spasticity in upper and lower limbs and improving extremity motor function and activity of daily living (ADL) for spasticity patients within 6 months post stroke.^[5] Recently, the short-term effect (up to 6 months) of acupuncture or intensive task training in constraint-induced movement therapy (CIMT) had been reported.^[5,6] To date, however, no study has reported the long-term improvements (up to 1 year) in functional outcomes in combination with acupuncture and CIMT in patients with chronic stroke.

In addition, evidence from multiple randomized controlled trials has indicated that almost all treatments (BTX, acupuncture, CIMT) are efficacious for rehabilitating arm function in adults who cannot use the paretic arm after stroke.^[5,7] Therefore, our goal was to determine whether the combined therapy is a viable therapeutic option. In this case report, the long-term (1 year) improvements in spasticity and arm function after treatment with the combined therapy in a patient with chronic stroke and arm spasticity are described. The cost of the treatment was also considered.

2. Case description

A 40-year-old female without remarkable cognitive and psychosocial history was admitted to hospital for hemiparesis

Editor: N/A.

The authors have no conflicts of interest to disclose.

Department of Acupuncture and Moxibustion, Zhejiang Hospital, Hangzhou, China.

* Correspondence: Yuanyuan Jin, Zhejiang Hospital, Hangzhou, Zhejiang 310013, China (e-mail: jinghuo1606@126.com)

Copyright © 2017 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Medicine (2017) 96:46(e8737)

Received: 26 September 2017 / Received in final form: 19 October 2017 /

Accepted: 23 October 2017

<http://dx.doi.org/10.1097/MD.00000000000008737>

in her left (nondominant) hand and arm after an infarction in the right posterior limb of the internal capsule 2 years ago. The patient received 2 to 3 hours of standard inpatient rehabilitation every day immediately after the stroke for 6 months. After being discharged from the hospital, she received 0.5 to 1 hour of standard outpatient rehabilitation every day in a clinic. This rehabilitation continued until the day before the intervention as her spasticity and arm function had not improved, and her condition had remained the same since onset. We confirmed that the patient had not received any prolonged therapy in the past.

At screening, she exhibited arm spasticity and showed difficulty with voluntarily extension of the metacarpophalangeal or interphalangeal joints beyond 10°, which made many ADL difficult. Screening also revealed that few attempts were being made by using her affected arm for ADL. The goals set by her were to eat rice with chopsticks while holding a bowl with the affected arm, to push and pull a lever in her car with the affected arm.

3. Clinical impression #1

The patient had no obvious differential diagnosis. The primary problems were arm spasticity. The patient was able to extend her wrist to 25°, and the only limitation for CIMT was insufficient finger extension. She had ever suffered a severe allergic reaction in the injection of BTX for facial anti-wrinkle, so she could not receive BTX type A injection. Thus we choose acupuncture as an alternate therapy. We informed the patient that she could not receive any oral medication for spasticity for 1 year after the intervention unless she received specific permission, and the patient agreed to these terms.

4. Examination

The outcome measure included the Modified Ashworth Scale (MAS)^[8] for evaluating muscular tone, the Fugl–Meyer Assessment (FMA)^[9] for evaluating arm impairment, the Action Research Arm Test (ARAT)^[9] for evaluating paretic arm performance, and the amount of use scale of the Motor Activity Log (MAL)^[10] which was used to evaluate the amount of paretic arm use. All assessments were made by trained therapists.

The patient's initial rating on the MAS was 3 for fingers, 2 for wrist, and 1+ for elbow. The initial FMA score was 43 (of 66), the initial ARAT score was 30 (of 57), and the average score on the amount of use scale of the MAL was 1.73.

5. Clinical impression #2

The MAS score confirmed that the patient had a high resistance to passive muscle stretch at the wrist and finger joints, which did not meet the criteria for constraint-induced movement therapy. The stimulation of acupuncture could temporarily improve the wrist and finger extension and made the finger and wrist flexor muscles stretched possibly. Therefore, we believed that the combined application of acupuncture and CIMT was a viable therapeutic option.

6. Intervention

This study was approved by the Research Ethics Review Board of Zhejiang Hospital. The study procedures were explained to the patient. Informed consent was obtained from the patient. The

planned intervention was a combination of acupuncture and CIMT for 3 consecutive months.

The acupuncture points selected for her were Classical Chinese points. The acupuncture points we used were DU20 (Baihui), PC7 (Daling), SI3 (Houxi), EX-UE9 (Baxie), with reducing and slightly heavy manipulation. Needles were left 10 mm for 1 hour per day in the morning. Manual stimulation was done every 10 minutes to allow the patient to actively extend her wrist, and fingers.

In the afternoon, the patient received 5 hours of CIMT, which involved 3 main elements^[11]:

1. repetitive, task-oriented training of the affected arm, which was approached in small steps of progressively increasing difficulty to suit the arm function and physical condition of the patient;
2. the transfer package, which was designed to facilitate the transfer of therapeutic gains made in the clinical setting to the patient's real-world activities; and
3. restraining of the unaffected arm to enforce use of the affected arm. The patient was restrained by verbal instruction for safety purposes. The training was provided by an experienced therapist.

7. Outcomes

The intervention (training and follow-up) was conducted from October 2015 to October 2016 in Zhejiang Hospital. Outcome measures were assessed the day before intervention and 1 day, 6 months, and 1 year after acupuncture and constraint-induced movement therapy. All outcome measures improved substantially over the 1-year period (before intervention to 1 year after intervention) (Table 1). After the intervention, the patient was able to hold (pinch) and release objects using the affected fingers. After the 1-month intervention, the patient was asked to answer “yes” or “no” to questions about whether she thought she had accomplished all the goals that she set before the intervention, and she answered “yes” for each goal. During the intervention, the patient did not receive ambulatory rehabilitation from any other clinics or hospitals.

8. Discussion

As far as we are aware, this is the first case report that describes the long-term follow-up (up to years) of a patient with chronic stroke and arm spasticity after the combined application of acupuncture and CIMT. Our goals were to determine whether spasticity and arm function improved after 3 months of CIMT delivered after acupuncture and whether any improvements were maintained in 1 year after the intervention. Our clinical results indicated that spasticity and arm function improve over the 1-year period (before intervention to 1 year after intervention) and her muscle tone and arm function do not worsen during the observation period.

We expected that the gains achieved during the intervention would be maintained for more than 3 months. This assumption was based on the guidelines for the use of BTX in the management of spasticity in adults, which state that, “If the muscle can be stretched or active function regained during this window, continued physical management may then be sufficient to manage spasticity, so the benefits can be long-lasting.”^[12] Therefore, we anticipated that the benefits would be long-lasting if appropriate management was applied.

Table 1
Outcome measures for the paretic arm.

Outcome measure*	Score at†:			
	A+CI-pre	A+CI-post	6 mo	1 y
Modified Ashworth Scale				
Elbow	1+	1	1	1
Wrist	2	1	1	1
Fingers	3	2	1+	1+
Fugl-Meyer Assessment	43	50	55	55
Shoulder/elbow/forearm	24	27	31	31
Wrist	7	8	8	8
Hand	10	12	12	12
Coordination/speed	2	3	4	4
Action Research arm test	30	34	43	43
Motor activity log: amount of use	1.73	2.55	3.82	4

* The Modified Ashworth Scale is scored with a 6-point scale (0, 1, 1+, 2, 3, and 4, where 0 indicates no increase in muscle tone and 4 indicates that the affected part is rigid in both flexion and extension). Scores for the arm component of the Fugl-Meyer Assessment can range from 0 (severe paresis) to 66 (normal). The ordinal scale score for each item of the Action Research Arm Test ranges from 0 to 3, and the total score for this test can range from 0 to 57. Scores for the Motor Activity Log can range from 0 (no use) to 5 (normal use).

† A+CI-pre=before acupuncture and constraint-induced movement therapy, A+CI-post=1 day after the end of acupuncture and constraint-induced movement therapy, 6 mo=6 months after acupuncture and constraint-induced movement therapy, 1 y=1 year after acupuncture and constraint-induced movement therapy.

In the case, our intervention improved spasticity (MAS score), function (FMA and ARAT scores), and the use of the affected arm for ADLs (MAL amount of use scale score). The improvements in the MAS, FMA, ARAT, and MAL (amount of use scale) scores in this case were greater than the thresholds for clinically meaningful change;^[13–15] therefore, the treatment can be considered clinically effective. It is noteworthy that the patient continued to show improvements at 1 year, even though she received no further rehabilitation or medication after the completion of the intervention.

The observed changes in outcome measures may be attributed to several factors. It is possible that either acupuncture or constraint-induced movement therapy alone was the critical factor underlying the observed improvements. In addition, we cannot ignore the possibility of an influence of the passage of time or the Hawthorne effect. The Hawthorne effect has long been known as a possible explanation for positive results in intervention studies.

We believe that the long-term effects of the combined treatment have the potential to reduce the rising medical costs of stroke rehabilitation. There has been a marked increase in the number of publications on the economic aspects of stroke.^[16] Many patients are difficult to pay rehabilitation charge within health insurance, meanwhile a lot of patients without health insurance in China. The combined treatment cost about \$2582 (¥16,860), which the cost of repeated BTX treatments 4 times over a 1 year is \$3735 (¥24,400) in our hospital. Therefore, the combined treatment is less expensive than repeated BTX treatments.

This case report has a few limitations. First, we were unable to prove the efficacy of the combined treatment alone only by a single case. Multicenter studies and a long follow-up with large samples are needed to confirm our observations. Second, there was no control group as the case report was prospective. Future studies should require a more rigorous design, such as a randomized controlled trial. Third, the lack of patient-reported outcomes during the follow-up period and the lack of more frequent follow-up assessments may mean that other possible relevant factors were overlooked.

Considering the promising outcomes seen in this case report, we believe that the combined approach offers promise for

effectively improving spasticity and arm function in patients with stroke and spastic hemiparesis. In conclusion, acupuncture in combination with constraint-induced movement therapy is a relevant approach to the management of arm spasticity after stroke.

References

- [1] Lance JW. The Control of Muscle Tone, Reflexes, and Movement: Robert Wartenberg Lecture. 1980;University of London Press, London:1303–1313.
- [2] Watkins CL, Leathley MJ, Gregson JM, et al. Prevalence of spasticity post stroke. *Clin Rehabil* 2002;16:515–22.
- [3] Van den Bergh P, Francart J, Mourin S, et al. Five-year experience in the treatment of focal movement disorders with low-dose Dysport botulinum toxin. *Muscle Nerve* 1995;18:720–9.
- [4] Balash Y, Giladi N. Efficacy of pharmacological treatment of dystonia: evidence-based review including meta-analysis of the effect of botulinum toxin and other cure options. *Eur J Neurol* 2004;11:361–70.
- [5] Cai Y, Zhang CS, Liu S, et al. Electroacupuncture for poststroke spasticity: a systematic review and meta-analysis. *Arch Phys Med Rehabil* 2017;[Epub ahead of print].
- [6] Sun SF, Hsu CW, Sun HP, et al. Combined botulinum toxin type A with modified constraint-induced movement therapy for chronic stroke patients with upper extremity spasticity: a randomized controlled study. *Neurorehabil Neural Repair* 2010;24:34–41.
- [7] Coupar F, Pollock A, Rowe P, et al. Predictors of upper limb recovery after stroke: a systematic review and meta-analysis. *Clin Rehabil* 2012;26:291–313.
- [8] Pandyan AD, Johnson GR, Price CI, et al. A review of the properties and limitations of the Ashworth and modified Ashworth Scales as measures of spasticity. *Clin Rehabil* 1999;13:373–83.
- [9] Platz T, Pinkowski C, van Wijck F, et al. Reliability and validity of arm function assessment with standardized guidelines for the Fugl-Meyer Test, Action Research Arm Test and Box and Block Test: a multicentre study. *Clin Rehabil* 2005;19:404–11.
- [10] Uswatte G, Taub E, Morris D, et al. Reliability and validity of the upper-extremity Motor Activity Log-14 for measuring real-world arm use. *Stroke* 2005;36:2493–6.
- [11] Amano S, Takebayashi T, Hanada K, et al. Constraint-induced movement therapy after injection of botulinum toxin type a for a patient with chronic stroke: one-year follow-up case report. *Phys Ther* 2015;95:1039–45.
- [12] Turner-Stokes L, Ward AB. Guidelines on the use of botulinum toxin (BTX) in the management of spasticity in adults. *Algerie Medicale* 2007;63:7–14.

- [13] Simpson DM, Alexander DN, O'Brien CF, et al. Botulinum toxin type A in the treatment of upper extremity spasticity: a randomized, double-blind, placebo-controlled trial. *Neurology* 1996;46:1306–10.
- [14] Wei XJ, Tong KY, Hu XL. The responsiveness and correlation between Fugl-Meyer Assessment, Motor Status Scale, and the Action Research Arm Test in chronic stroke with upper-extremity rehabilitation robotic training. *Int J Rehabil Res* 2011;34:349–56.
- [15] Van der Lee JH, De Groot V, Beckerman H, et al. The intra- and interrater reliability of the action research arm test: a practical test of upper extremity function in patients with stroke. *Arch Phys Med Rehabil* 2001;82:14–9.
- [16] Evers SM, Struijs JN, Ament AJ, et al. International comparison of stroke cost studies. *Stroke* 2004;35:1209.