

Fu's subcutaneous needling and constraint-induced movement therapy for a patient with chronic stroke

One-year follow-up case report

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Abstract

Rationale: Spasticity is a common issue in chronic stroke. To date, no study has reported the long-term (up to 1 year) outcomes of Fu's subcutaneous needling in combination with constraint-induced movement therapy in 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: The patient suffered an infarction in the right posterior limb of the internal capsule 1 year ago, which resulted in hemiparesis in his left (nondominant) hand and arm. The only limitation for constraint-induced movement therapy was insufficient finger extension. The patient was unable to voluntarily extend his interphalangeal or metacarpophalangeal joints beyond the 10 degrees required for constraint-induced movement therapy. However, his muscle tension did not change after the BTX type A injection.

Diagnoses: A 35-year-old male experienced arm paresis after an infarction in the right posterior limb of the internal capsule 1 year before the intervention.

Interventions: The BTX type A injection did not work, so the patient received Fu's subcutaneous needling as an alternative therapy before 5 h of constraint-induced movement therapy for 12 weekdays.

Outcomes: All outcome measures (Modified Ashworth Scale, Fugl-Meyer Assessment, Action Research Arm Test, and 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 cannot 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, FSN = Fu's subcutaneous needling, MAL = Motor Activity Log, MAS = Modified Ashworth Scale.

Keywords: chronic stroke, constraint-induced movement therapy, Fu's subcutaneous needling, one-year follow-up, spasticity

Editor: N/A.

Funding: This work was supported by Zhejiang Medical Science and Technology Project (2016ZDB001, 2018ZH001).

The author(s) of this work have nothing to disclose.

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Medicine (2019) 98:8(e13918)

Received: 2 October 2018 / Received in final form: 5 December 2018 /

Accepted: 10 December 2018

<http://dx.doi.org/10.1097/MD.0000000000013918>

1. Introduction

Spasticity, which has been 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 issue as the prevalence at 1 year after stroke was 38%.^[2] BTX is the most widely used therapy, and the duration of efficacy of BTX is 3 to 6 months.^[3] But the higher cost and its limitations (especially severe allergic reaction and inefficiency) cannot be ignored.^[4] The Fu's subcutaneous needling (FSN) is one of the new acupuncture therapies developed from Ashi point therapy and wrist-ankle acupuncture therapy.^[5] Evidence has indicated that FSN could rapidly relieve the pain and obviously improve the spasm of soft tissues in treating the soft tissues injuries in clinical practice.^[6] Therefore, we supposed FSN combined with conventional routine care has the potential of reducing spasticity in upper and lower limb and improving extremity motor function and activity of daily living (ADL) for spasticity patients within 6

months post stroke. Recently, the short-term effect (up to 6 months) of FSN or intensive task training in constraint-induced movement therapy (CIMT) had been reported.^[7,8] To date, however, no study has reported the long term improvements (up to 1 year) in functional outcomes in combination with FSN and CIMT in patients with chronic stroke.

In addition, evidence from multiple randomized controlled trials has indicated that almost all treatments (BTX, FSN, and CIMT) are efficacious for rehabilitating arm function in adults who cannot use the paretic arm after stroke.^[6,8,9] 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 35-year-old male without remarkable cognitive and psychosocial history was admitted to hospital for an infarction in the right posterior limb of the internal capsule 1 year ago, which resulted in hemiparesis in his left (nondominant) hand and arm. The patient received standard inpatient rehabilitation (2–3 h per day) immediately after the stroke for 6 months and standard outpatient rehabilitation (0.5–1 h per day) in a clinic after being discharged from the hospital. This rehabilitation continued until the day before the intervention as his spasticity and arm function had not improved, and his condition had remained the same since onset. We confirmed that the patient had not received any prolonged therapy in the past.

At screening, he exhibited arm spasticity and showed difficulty with voluntarily extension of the metacarpophalangeal or interphalangeal joints beyond 10 degrees, which made many ADL difficult. Screening also revealed that few attempts were being made to use the affected arm for ADL. The goals set by him were to hold a bowl with the affected arm while eating rice with chopsticks, and to push and pull a lever in his car with the affected arm.

3. Clinical impression #1

The primary problem was arm spasticity as the definite diagnosis. The patient was able to extend his wrist to 30 degrees, and the only limitation for CIMT was insufficient finger extension. We choose FSN as an alternate therapy after the treatment of the BTX type A injection. We informed patient that he could not receive any oral medication for spasticity for 1 year after the intervention unless he received specific permission, and the patient agreed to these terms.

4. Examination

The outcome measure included the Modified Ashworth Scale (MAS)^[10] for evaluating muscular tone, the Fugl-Meyer Assessment (FMA)^[11] for evaluating arm impairment, the Action Research Arm Test (ARAT)^[11] for evaluating paretic arm performance, and the amount of use scale of the Motor Activity Log (MAL)^[12] 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 45 (of 66), the initial ARAT score was 33 (of 57), and the average score on the amount of use scale of the MAL was 1.83.

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 FSN 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 FSN 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 FSN and CIMT for 3 consecutive months.

Finding out the positive reaction points (most significant tenderness points) at hyperkinesias shoulder, wrist, and elbow, we chose 2–3 cun above or inferior to the points as entry points. After local routine disinfection, we used a No. 6 disposable Fu's needle to puncture subcutaneously at entry point. The needle tip was aligned to the positive reaction point and penetrated through skin quickly to keep the needle body attaching subcutaneous. We pressed the positive reaction point, and the tenderness would often reduce or disappear immediately. If the tenderness did not relieve, we should check whether the needle tip aligned to the positive reaction point was straight; if not, we should correct it again. After the needles have been inserted, we asked the patient to exercise the involved joints. If it did not make trouble with the movement, we fixed the needle stalk. The needles were retained for 8 to 12 h. The patients were treated every other day, and 15 treatments constituted 1 course and 3 treatment courses in total. In the afternoon, the patient received 5 h of CIMT, which involved three main elements^[13]:

- (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;
- (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 therapists.

7. Outcomes

The intervention (training and follow-up) was conducted from October 2016 to October 2017 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 he thought he had accomplished all the goals that he set before the intervention, and he answered "yes" for each goal. During the intervention, the patient did not receive ambulatory rehabilitation from any other clinics or hospitals.

Table 1
Outcome measures for the paretic arm.

Outcome measure*	Score at†			
	F + CI-pre	F + CI-post	6 mo	1y
Modified Ashworth Scale				
Elbow	1	1	1	1
Wrist	2	1	1	1
Fingers	3	2	1+	1+
Fugl-Meyer Assessment	46	50	54	55
Shoulder/elbow/forearm	27	27	30	31
Wrist	7	8	8	8
Hand	10	12	12	12
Coordination/speed	2	3	4	4
Action Research Arm Test	33	37	43	43
Motor Activity Log: amount of use	1.83	2.45	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).

† F + CI-pre = before Fu's subcutaneous needling and constraint-induced movement therapy, F + CI-post = 1 day after the end of Fu's subcutaneous needling and constraint-induced movement therapy, 6 mo = 6 months after Fu's subcutaneous needling and constraint-induced movement therapy, 1y = 1 year after Fu's subcutaneous needling and constraint-induced movement therapy.

8. Discussion

As far as we are aware, this is the first case report describing the long-term follow-up (up to years) of a patient with chronic stroke and arm spasticity after the combined application of FSN and CIMT. Our goals were to determine whether spasticity and arm function improved after 3 months of CIMT delivered after FSN 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 his 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."^[14] Therefore, we anticipated that the benefits would be long-lasting if appropriate management was applied.

In the present 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^[15-17]; therefore, the treatment can be considered clinically effective. It is noteworthy that the patient continued to show improvements at 1 year, even though he 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 FSN 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.^[18] Many patients find difficult to pay rehabilitation charge within health insurance;

meanwhile a lot of patients are without health insurance in China. The combined treatment costs is about \$1834.5 (¥12,600), whereas the cost of repeated BTX treatments four 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, Fu's subcutaneous needling in combination with constraint-induced movement therapy is a relevant approach to the management of arm spasticity after stroke.

Acknowledgments

The authors thank Dr. Shanshan Shen for her help with the financial support.

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