

Case Report

Effectiveness of Combined Korean Medicine on Traumatic Spinal Cord Injury: A Case Report

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Objectives: This study aims to evaluate the clinical effectiveness of a Korean medicine treatment on a traumatic spinal cord injury.

Methods: A 44-year-old male patient who had suffered a traumatic spinal cord injury was treated for two months. The effectiveness of complex Korean medicine treatments was measured using the Numeric Rating Scale (NRS) and the Manual Muscle Test (MMT).

Result: We found that the NRS of pain caused by numbness was decreased from 7 to 0-1, and the overall motor measured by the MMT was also improved. The patient's walking state was changed from wheelchair ambulation to walker ambulation.

Conclusion: Based on this finding, complex Korean medicine treatments may be effective in treating patients' pain, controlling paresthesia, and aiding the recovery function of activities in daily living. However, because of the limitation of our study, further high-quality research should be conducted.

Key Words: Korean medicine, Traumatic spinal cord injury, Acupuncture

Introduction

Traumatic spinal cord injury (SCI) occurs frequently in young men. Despite aggressive initial treatment, SCI patients are accompanied by secondary impairments, which results in dysesthesia or chronic pain, hypoesthesia, limb weakness or paralysis, bladder and bowel dysfunction, and dyspnea¹⁾. In Particular, hypoesthesia, chronic pain and dysesthesia due to nerve injury significantly lower the ability of SCI patients to function in daily life. In clinical practice, medications such as analgesics, muscle relaxants, and anticonvulsants for neurological symptoms are prescribed after the initial surgery, and spinal

nerve block may cause temporary effects²⁾. However, at present, a fundamental treatment for the restoration and regeneration of injured nerve does not exist. Consequently, there is a growing interest in Korean medicine for the improved treatment of the symptoms of SCI patients.

In this paper, we report significant results in one patient with traumatic SCI who was treated with combined Korean medicine modalities, including acupuncture, herbal therapy and physical therapy, at Pusan National University Korean Medicine Hospital.

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Case Presentation

1. Patient

Ko.O.O., M/44

2. Symptoms

Numbness and muscle weakness in arms and legs

3. Onset

September 25, 2016

4. Past Medical History/Family History

None

5. Present History

The patient fell headfirst from a height of 15 meters while hang-gliding on September 25, 2016. He was taken to the Emergency Room of Jinju Gyeongsang National University Hospital. A cervical spine X-ray and MRI were taken, and the patient was diagnosed with a C6 lateral mass fracture and a C5-7 spinal cord injury and was then treated. The patient was then transferred to the Neurology Department of Pusan National University where he received a C6-7 laminectomy and a C4-T1 posterior fusion during the period from September 25 to September 30. From September 30 to December 5, the patient was in the Rehabilitation Department of Yangsan Pusan National University Hospital, where he continued to receive inpatient treatment. The patient continued rehabilitation but felt no improvement in gait disturbance or dysesthesia. On December 5, 2016, he came to our center at the Pusan National University Acupuncture and Moxibustion Medicine Department in the Pain Clinic to receive treatment with Korean medicine.

6. Examination

1) Baseline evaluation

(1) Modified MRC Grade of Manual Muscle Test

(Rt/Lt)

Elbow flexion : 4/4

Wrist, elbow extension : 3/4

Finger flexion, abduction : 1/4

Hip flexion, knee extension : 2/4

Ankle dorsiflexion, Gr. toe dorsiflexion, Ankle plantar flexion : 1/4

(2) Sensory

The C6-T1 and T5-T12 dermatomes showed hypoesthesia. Other dermatomes were in the normal range. In the case of persistent decreased temperature, numbness in the right upper and lower limbs worsened, which the patient rated 7 on the Numerical Rating Scale.

(3) Spasticity (Modified Ashworth Scale[MAS])

There was mild stiffness(MAS Gr.1) in the right fingers but no stiffness in the other areas.

(4) Walking state

Because the patient used a wheelchair at the time of admission, the six-minute walking test (6MWT) was not performed.

(5) The International Standard for the Neurological Classification of Spinal Cord Injury (ISNCSCI)

Neurological level of Injury = C4; incomplete, ASIA scale D

2) Imaging

On September 25, 2016, the patient's cervical

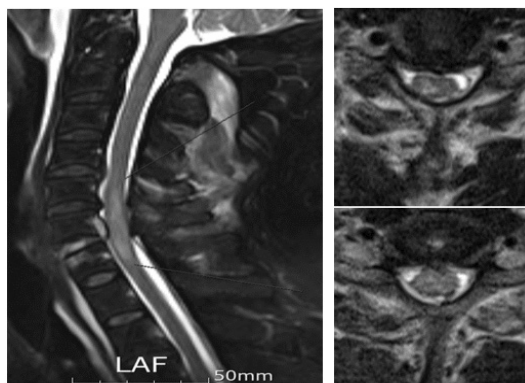


Fig. 1. C-spine MRI (Sagittal, Axial(C5-6, C6-7))

spine was scanned using a CT and an MRI. The radiologist diagnosed a C6-level compression fracture (Rt. Lamina and transverse process fracture) and a C5-7 vertebra-level SCI (Fig. 1).

7. Intervention

- 1) Acupuncture (Table 1)
- 2) Herbal medicine (Table 2)

The prescribed formula had the following composition. During the hospitalization period, the

Table 1. Standards for Reporting Intervention in Clinical Trials of Acupuncture (STRICTA)

		Contents
1. Acupuncture rationale	1a) Style of acupuncture	Classic acupuncture theory and Master Tung's acupuncture theory
	1b) Reasoning for treatment provided	Based on historical context and literature sources (e.g., The Textbook of Acupuncture and Moxibustion Medicine)
	1c) Extent to which treatment was varied	Semi-fixed formula; individualized acupuncture regimen according to the patient's symptoms and conditions
2. Details of needling	2a) Number of needle insertions per subject per session	10 ~ 30 points; practitioner adjusted the number of needle insertions according to patient's symptoms and conditions
	2b) Names of points	A.M : LI4(合谷), TE5(外關), LI11(曲池), LR3(太衝), GB41(足臨泣), ST36(足三里) P.M : EX-B2(夾脊), BL40(委中), BL57(承山), BL60(崑崙)
	2c) Depth of insertion	30-50mm (according to the expected tissue depth on acupuncture points)
	2d) Response sought	Subjective De-qi sensation
	2e) Needle stimulation	Manual stimulation of rotation, lifting and thrusting
	2f) Needle retention time	0 ~ 20 minutes
	2g) Needle type	Dong-bang stainless steel disposable acupuncture needle 0.25(diameter)×40(length) mm, 0.35×50 mm, 0.30×60 mm, 0.50×60 mm
	3. Treatment regimen	3a) Number of treatment sessions
	3b) Frequency and duration of treatment sessions	Twice daily until discharge (excluding the admission day)
4. Other components of treatment	4a) Details of other interventions administered to the acupuncture group	Dry-cupping, herbal steam therapy on low back, herbal medicine, self exercise
5. Practitioner background	Description of participating acupuncturists	Two Korean medicine doctors. 1) Resident trainee in acupuncture and moxibustion medicine with 3 years of experience 2) Specialist of acupuncture and moxibustion medicine with more than 10 years of experience
6. Control or comparator interventions	6) No applicable	No applicable

Table 2. Herbal Medicine Treatment

Date	Herbal Medicine
2016.12.05-2017.02.01	Bo-jung-ik-gi-tang(補中益氣湯) 40g (<i>Astragalus membranaceus</i> (黃芪) 8g, <i>Atractylodes macrocephala</i> (白朮) 6g, <i>Glycyrrhiza uralensis</i> (甘草) 6g, <i>Angelica gigas</i> (當歸) 3g, <i>Citrus unshiu</i> (陳皮) 3g, <i>Cimicifuga heracleifolia</i> (升麻) 2g, <i>Bupleurum falcatum</i> (柴胡) 2g, <i>Salvia miltiorrhiza</i> (丹參) 8g, <i>Ostericum koraenum</i> (羌活) 6g, <i>Aralia continentalis</i> (獨活) 6g, <i>Schizonepeta tenuifolia</i> (荊芥) 6g, <i>Mentha arvensis</i> (薄荷) 6g, <i>Perillae Folium</i> (紫蘇葉) 6g, <i>Pueraria lobata</i> (葛根) 6g, <i>Paeoniae Radix</i> (芍藥) 6g, <i>Ledebouriella seseloides</i> (防風) 6g, <i>Cervi Parvum</i> (鹿茸) 4g)

patient was administered 120 cc, three times a day. The dosage was two doses daily.

3) Herbal steam

Steam was applied to the low back for 20 minutes twice daily. The steam consisted of *Agastachis herba*, *Artemisiae Vulgaridis Folium*, and *Menthae Herba*.

4) Physical therapy

To help the recovery of muscle strength, the patient participated in tilting table and bicycle exercises within the range of no pain.

8. Evaluation method

1) Numeric Rating Scale

The Numeric Rating Scale (NRS) is a measurement that is used to quantify the level of subjective pain from 0 to 10 or 0 to 100. In this study, the patient used the NRS every day to rate numbness, which was the patient's major complaint, from 0 for no discomfort to 10 for the most severe pain.

2) Manual Muscle Test

To evaluate the weakness of the arms and legs caused by nerve injury, the Manual Muscle Test (MMT) was conducted on the patient's main muscles. Each movement of joint flexion, extension,

abduction, and adduction was evaluated according to the degree of resistance movement. The Modified Medical research council of Great Britain Grade (MRC) was used as the rating system³⁾. (Table 3)

3) Activities of Daily Living; ADL

To determine the degree of improvement in the patient's daily activity performance, we tested several performance abilities daily. We checked the degree to which the patient could perform the activities, the time of posture maintenance, and the presence of pain and discomfort when performing. The tested performances were as follows: rolling over in bed, transferring from lying to sitting, transferring from sitting to standing, maintaining a standing position, and walking.

4) Adverse events

Immediately after the acupuncture treatment, a resident, not the practitioner, checked adverse reactions through an open-ended questionnaire at 6:00 a.m. every day.

9. Treatment Period

1) Treatment 1 (December 6-15, 2016)

At the time of admission, the patient had C8 dermatomes on the arms and numbness in the legs.

Table 3. Modified MRC Grade of Manual Muscle Test

Modified MRC grade	Degree of Strength
5	Normal power
5-	Equivocal, barely detectable weakness
4+	Definite but slight weakness
4	Able to move the joint against combination of gravity and some resistance
4-	Capable of minimal resistance
3+	Capable of transient resistance but collapses abruptly
3	Active movement against gravity
3-	Able to move against gravity but not through full range
2	Able to move with gravity eliminated
1	Trace contraction
0	No contraction

The numbness worsened when the temperature dropped and the patient rated himself at NRS 7. In the case of the motor function, the right side was lower than the left side, and the fingers and ankle did not move. The patient mainly used the wheelchair because he could not walk independently. He could walk for 10 minutes using a walker at 25–50% of his performance ability, which indicated his need for help from the people around him.

The patient actively participated in the rehabilitation process, including the combined Korean medicine treatment offered at our center, standing exercises on the tilting table, and cycling exercises for the legs. The patient's numbness improved consistently. The numbness in his upper limbs and lower limbs was alleviated by 60% and 70% respectively, compared to the admission period. Moreover, the patient could maintain a standing position for 10 minutes without help, and he could walk for about 15 minutes using a walker, which indicated that his performance had increased by at least 75%.

2) Treatment 2 (December 16–31, 2016)

The symptom of numbness remained at about 20% in both upper and lower limbs compared to the admission period. Thus, the patient did not feel great discomfort in his daily life. Regarding muscle strength, the patient's condition increased to Gr. 2 in the ability to flex his right ankle and hellux. This improvement was significant compared to the absence of movement at the time of admission.

3) Treatment 3 (January 1–15, 2017)

Numbness remained at about 10% compared to the admission period. The patient had intermittent symptoms of numbness at night or at rest.

Using the parallel bars at the center, the patient practiced walking for 30 minutes three times a day. Because of the patient's overall improvement in muscle strength, the MMT of the right ankle flexion increased to Gr. 3, which restored the full range of

motion. The MMT of the movement in the left limbs increased to Gr.4+. The patient could walk for 20 minutes with the support of a walker. In the six-minute walk test, the patient walked a distance of 85 m for six minutes.

4) Treatment 4 (January 16–February 1, 2017)

The patient could hold large and light objects. Although he had not been able to move before the treatment, his finger flexion was recovered to Gr. 2. The plantar flexion on the right side was improved to Gr.4+, and his walking became more natural. At the time of discharge, numbness, which was the patient's chief complaint, had improved and both the recovery of muscle strength and daily activity performance had improved. Furthermore, the Patient Global Assessment (PGA) was “very much improved” in addition to other ratings.

10. Results

- 1) Daily NRS evaluation (Fig. 2)
- 2) Walking state and Patient Global Assessment(PGA) (Table 4.)
- 3) Muscle strength changes (Table. 5.)
- 4) Adverse events

No adverse reactions associated with the Korean medicine treatment were reported during hospitalization.

Discussion and Conclusion

Chronic pain is a major complication in SCI patients. Approximately 90% of these patients complain of chronic pain, and 30-40% feel severe pain⁴⁾. Severe pain interferes with the patient's will to rehabilitate and quality of life, and it can lead to depression and even suicide⁵⁾.

Currently, oral antidepressants, anticonvulsants, analgesics and other oral medications are used to treat neuropathic pain. However, to date, randomized studies have not shown the effectiveness of these

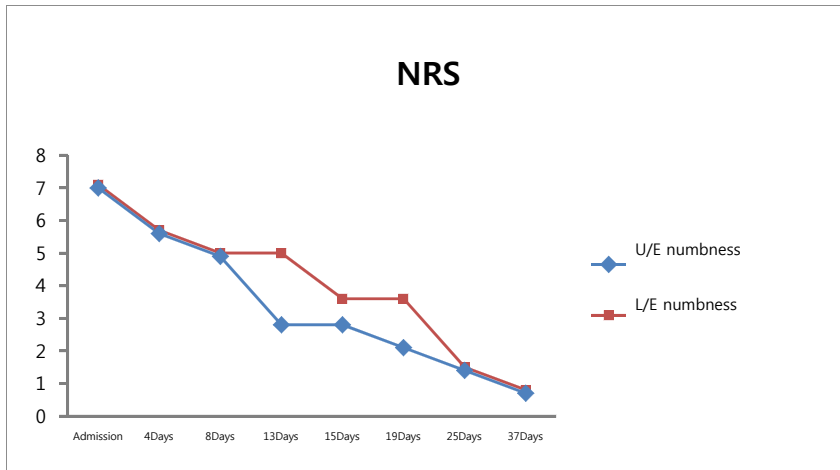


Fig. 2. Daily Numeric Rating Scale(NRS) evaluation

Table 4. Walking state, Patient Global Assessment(PGA)

	Admission (2016-12-05)	Discharge (2017-02-01)
Walking state	Wheelchair ambulation	Walker ambulation
PGA	-	very much improved

Table 5. Muscle strength changes

	Admission (Rt/Lt)	Discharge (Rt/Lt)
shoulder abduction	4/4	4+/4+
elbow flexion	3/4	4+/4+
elbow extension	3/4	4+/4+
finger flexion	1/4	2/4+
finger abduction	1/4	2/4+
hip flexion	2/4	3/4+
knee extension	2/4	3/4+
Ankle Dorsiflexion	1/4	2/4+
Gr. toe dorsiflexion	1/4	4/4+
Ankle plantarflexion	1/4	4+/4+

medications⁶⁾. Furthermore, the long-term treatment with these medications can cause side effects, such as constipation and digestive problems⁷⁾.

The effect of acupuncture on SCI has not been elucidated. Dorsher et al. carried out an animal

experiment and reported that electroacupuncture therapy inhibited spinal cord atrophy and increased the protective effect of spinal cord neurons in promoting neurological recovery⁸⁾. In addition, Cecilia et al. reported that acupuncture treatment had a significant effect on pain caused by spinal injuries⁹⁾.

Most of the papers that have treated spinal cord injury in Korean medicine are related to urination disorder. There are few reports on the improvement of neurological symptoms of spinal cord injury, using bee venom treatment, and functional electrical stimulation therapy^{10),11)}. There is a great need to carry out clinical studies continuously.

In this case report, the male patient presented with SCI. His condition was rated D on the ASIA scale with the partial impairment of motor and sensory functions below the injury. Because of the appropriate surgery and the initial treatment, there was no problem in the patient's basic physiological functions, including urination, defecation, and digestion. However, because of the patient's symptoms of continuous paresthesia, such as numbness and chilling, he entered our center for treatment.

The patient's NRS decreased from 7 to 0-1, and

his symptoms became intermittent at nighttime and while resting. At the time of admission, the patient was unable to flex his fingers, and he used a wheelchair. In addition, the patients' overall muscle strength improved. He was able to move his fingers, and his dorsiflexion and plantar flexion improved such that he was able to walk a distance of 170 m with support during the six-minute walking test. In addition, the PGA score showed that the patient's subjective satisfaction level was "very much improved."

However, this study has the following limitations. First, this study involves the case report of a single traumatic SCI patient, so it does not represent a comprehensive Korean medicine treatment for SCI. Therefore, the outcome of this case cannot be generalized to other cases of SCI. Second, the patient in this case did not receive continuous outpatient treatment after hospitalization because of the distance of his residence from the center; hence, the follow-up was not performed regularly. Therefore, it was difficult to evaluate the recovery rate and treatment objectively. Third, no evaluation scale, such as the Spinal Cord Independence Measure (SCIM)¹²⁾ and the Functional Independence Measure (FIM)¹³⁾, can be compared in previous studies on SCI patients at home and abroad. Thus, it is difficult to make a relative assessment of the effectiveness of this paper.

There is a lack of research on Korean medicine treatment for SCI patients. Consequently, this study provides an initial background for determining the effectiveness of Korean medicine treatment and for conducting extended studies in the future. Furthermore, many case reports and advanced studies under controlled conditions are required to further the research in this area.

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