

Electroacupuncture and “Duhuojisheng-tang” Administration for Postoperative Treatment in 3 dogs with Traumatic Spinal Cord Injury

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Abstract : Three dogs with severe traumatic spinal cord injury (TSCI) due to falling wound were admitted to the Veterinary Medical Center, Chonbuk National University for evaluation of severe pelvic limbs paralysis without deep pain, normal defecation and urination. Based on physical examination, neurological assessment and computed tomogram (CT), the diagnosis was made as subluxation and compressed fracture. All the cases were surgically treated with dorsal laminectomy and a spondylosyndesis using pin and bone cements. For 2 weeks, the dogs didn't show any improvement. Consequently, the dogs were treated with electroacupuncture (EA) and Duhuojisheng-tang (DHJST). All the dogs got back the deep pain and presented wagged tail on 14-35 days after starting EA with DHJST. Especially, two of 3 dogs recovered almost normal ambulation and capacities of urination and defecation. But, one dog failed to regain normal ambulation due to inflammation of operative site which is thought to be caused by the bone cement. From these cases, it was thought that the combination of EA and DHJST might be one of the suitable therapies in dogs with no neurological improvement.

Key words : Electroacupuncture, Duhuojisheng-tang, traumatic spinal cord injuries, dog.

Introduction

Traumatic spinal cord injury (TSCI) caused by a vertebral fracture and luxation mainly occurred as primarily and secondarily. TSCI is taken place by direct injured forces including impact with persistent compression, impact alone, distraction, shearing, laceration, or stretching to the parenchyma and vessel in the spinal cord (6,12,20,23). The series of pathophysiological changes is occurred in the spinal cord following initial injury (6,15). Activation of nuclear factor- κ B (2) was followed by secondary compression and modified vessels (12) as well. The recovery of patient was judged by three factors that are velocity against the spinal cord, forced energy and compressed duration when the spinal cord was impacted (23).

In this condition, the treatments of injuries focused on rearrangement of the affected vertebrae, decompression of spinal cords and stabilization of the damaged vertebrae (23). The prevention from instability, malarticulation in short-term, degeneration of joint by hypertrophy of soft tissue and exostoses in long-term could improve neurological disorders and stop from the additional progression of disease (23).

TSCI including a spinal fractures or luxation with lack of deep pain generally have a prognosis from poor to grave for recovery (16). Although the vertebrae can be corrected through surgery in most of patients with TSCI, prognosis was not good

(3,22). Especially, it was reported that ambulatory rate was between 43.8 and 56.0 percent (3,22).

Traditional medicine such as acupuncture and herbal medicine is an important part of alternative medicines that is informed to recover the neurological disease as intervertebral disk disease (IVDD) (4,8-10). The previous studies, on the mechanism of action of acupuncture, reported that endogenous opioids such as β -endorphins and neurotransmitter were secreted from the brain (24,27). Pain inhibitory pathway and immune system were facilitated what derive the physiological change in the body (24-25). The acupuncture also activates regrowth and regeneration of the affected axon, decreases an inflammation, a swelling and secretion of chemokines such as histamine and kinin as anti-inflammatory reactions and reduces the formation of the scar, hypoxia and pain (9,28).

Among the acupuncture techniques, electroacupuncture (EA) is stronger and more effective to control pain than other acupuncture method especially in neuro-musculoskeletal disease including thoracolumbar IVDD (27). Duhuojisheng-tang (DHJST) in herbal medicine has been used as alternative therapy with acupuncture in several diseases (8). According to traditional veterinary medicine (TCM), the vertebral column diseases could be diagnosed kidney yin deficiency, kidney yang deficiency or both (8). According to a therapeutic medicine, DHJST can be used to remove a wind and damp, to strengthen the energy (Qi) of liver and kidney, to promote the circulation of Qi & blood and to make the pain easier (8,26).

The aim of this study is to evaluate a prognosis of postoperative therapy using EA and DHJST in patients with TSCI.

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Cases

Case 1

A 7-year intact female Maltese was presented with pelvic limbs paralysis and severe back pain caused by falling trauma. Upper motor neuron (UMN) sign and a loss of deep pain were observed on neurological examination. The spinal cord at the thoracic (T)₁₁₋₁₂ vertebrae was severely compressed. The T₁₂ vertebra was displaced and fractured on a radiograph and CT (Fig 1). Initially, high dose of methylprednisolone sodium succinate (Methysol, Kunwha, Korea, 30 mg/kg, IV) was administered (15). After approach to the spine through dorsal laminectomy, fragmented bone particles were removed. Spondylodesis using polymethylmethacrylate (PMMA) and Steinmann pins was performed within 12 hours from injury. A patient positioned dorsoventrally. The Steinmann pins were placed cranioventrally in the vertebral bodies. After the liquid monomer was mixed with polymer powder, it was packed around the Steinmann pins over all surfaces of each pin and the dorsal aspects. The lumbodorsal fascia was closed to the dorsal midline with nonabsorbable monofilament suture material by a simple interrupted pattern (Fig 1). After 2 weeks from surgery no neurological improvement was found.

High dose of methylprednisolone sodium succinate (MPSS) was administered initially as a free radical scavenger in all patients. Diuretics (furosemide 1 mg/kg and spirolactone 1 mg/kg), hepatic protector (ursodeoxycholic acid 10 mg/kg), H₂-blocker (famotidine 0.5 mg/kg) and vitamin B complex were used orally, twice a day for 2 weeks as postoperative care.

The combined EA with DHJST therapy was performed with consent of owner for the 3 patients. EA performed twice a

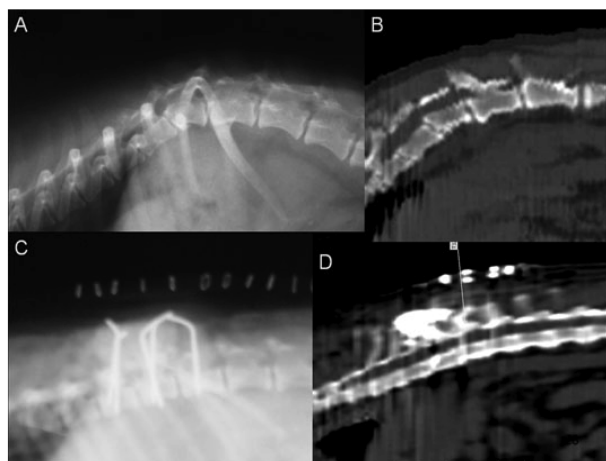


Fig 1. These (A and C) were the radiograph on the lateral view before (A) and after surgery (B). The CT images on sagittal view showed before (B) and after surgery (D). Narrowed spinal canal and loss of continuity of T₁₂ body were on the radiograph (A) and CT (B). Fixation of the vertebrae body using a bone cement and Steinmann pin was observed on the radiograph (C). A good alignment of T₁₂ and a decompressed T₁₂ region were observed on the CT (D).

Table 1. The DHJST consists of 16 herbs including Radix Araliae, Radix Contortilis and Loranthis Ramulus

Duhuoji Sheng-tang (DHJST)	
Cortex Cinnamini (肉桂)	4 g
Cortex Ecommieae (杜冲)	4 g
Herba Asari (细辛)	4 g
Poria (白茯苓)	4 g
Radix Achyranthis (牛膝)	4 g
Radix Angelicae Gigantis (当归)	6 g
Radix Araliacordatae (独活)	6 g
Radix Gentianae Macrophyllae (秦艽)	4 g
Radix Ginseng (人参)	4 g
Radix Glycyrrhizae (甘草)	3 g
Radix Paeoniae Lactiflorae (白芍药)	6 g
Radix Saposhnikoviae (防风)	4 g
Ramulus Loranthis (桑寄生)	6 g
Rhizoma Cnidii (川芎)	4 g
Rhizoma Rehmanniae (熟地黄)	4 g

week. Urinary bladder (BL) -18, BL-22, BL-23, BL-25, BL-26, BL-27, BL-28, BL-37, BL-60, gallbladder (GB) 30, GB-31, GB-34, governing vessels (GV) -14, GV-1, stomach (ST) -36 and kidney (KI)-1 were selected as acupoints. The EA was applied for 10 minutes on 30 Hz and then for 10 minutes on 80-120 Hz in sternal recumbency posture. Each electrode was paired both-sided totally 6 pairs: transfixed GV-14 with GV-2-1, transfixed BL-18 with KI-1 and transfixed BL-23 with ST-36. In addition, DHJST was administered twice a day (Table 1).

The dog could walk with assistant of owner on 38th day after EA and DHJST therapy. After 2 months voluntary walking without assistant was possible. These neurological symptoms improved correspond to grade II from IV.

Case 2

A 2-year castrated male Maltese was admitted with the hind-limb paralysis and severe back pain caused by falling wound. On the neurological examinations, UMN signs and the loss of deep pain were observed. A fractured vertebral fragment compressed the spinal cord at the T₄ region on radiographs and CT (Fig 2). High dose of MPSS administered in this case and then dorsal laminectomy was performed (Fig 2) within 12 hours. Postoperatively, the improvement of neurological signs including UMN signs and loss of deep pain delayed.

The combined EA with DHJST therapy was performed on same method as case 1. After treatment of DHJST and EA, the case stood up himself at 35th day after combined therapy EA with DHJST. An incomplete walking appeared at 90th day. This patient also improved to grade II from grade V as like case 1.

The deep pain response appeared between 2 and 5 weeks. Case 2 showed voluntary walking in 44th day and 90th starting from combined therapy EA and DHJST after 2 weeks from surgery, respectively.



Fig 2. These were the transverse view on the CT before (A) and after surgery (B). Narrowed spinal space and compressed vertebral body were observed (A). After surgery (dorsal laminectomy), on the CT image (B) at T₄ show decompressed spinal space by removal of a bone fragment.

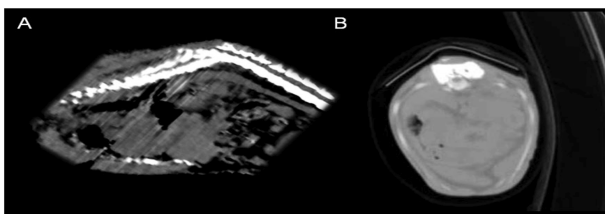


Fig 3. These were the CT images on sagittal view before (A) and transverse view after surgery (B). On the CT sagittal image (A) of vertebral canal, the vertebral fracture and luxation at T₁₁ and T₁₂ was observed. On the transverse CT image after surgery (B), decompressed spinal space and stabilized vertebrae using bone cements and Steinmann pins was confirmed.

Case 3

A 6-year castrated male miniature Pincher was presented after falling trauma from height of 3rd floor. Radiographs and CT revealed dislocation and dorsal displacement of the T₁₁ and T₁₂ vertebrae (Fig 3). After high dose of MPSS (30 mg/kg) was administered, spondylosis using PMMA and Steinmann pins was carried out as like case 1 (Fig 3). Postoperatively, the improvement of neurological signs including UMN sign and loss of deep pain did not observed. The combined EA with DHJST therapy was performed on same method as case 1. The case 3 recovered the deep pain within 2 weeks after EA and DHJST therapy. However, EA and DHJST therapy was postponed for 5 weeks due to infection and dehiscence on surgical site. When the therapies restarted for 1 month, the dog regained voluntary defecation and urination. The sign of improvement however delayed and it was judged as grade IV. The deep pain response appeared between 2 and 5 weeks. But, this case was no observed more improvement and this case decided to be taken on canine cart.

Discussion

A nerve fiber belongs to small sized fiber (13). When it compressed, the function loses along with the neurological responses such as conscious proprioception, voluntary motor,

superficial pain, and deep pain (13). Especially, to recover the deep pain response is an important thing for prognosis of patients with neurological disorders. In the cases, grading system was used to base of function for neurological responses objectively.

A grading system is used to assort in thoracolumbar vertebrae disease including IVDD and spinal cord injury what is being important factor to decide a prognosis of treatment (1,8,17,21). The all three patients were admitted with direct TSCI without deep pain. Urination and defecation was not able to control themselves. On the grading system based upon clinical signs, the cases were a grade V.

Suspected patients as TSCI caused by vertebral luxation, subluxation or compressed fracture often need surgery to reestablish anatomic continuity of the vertebral column and to prevent further damage to the spinal cord and nerve roots (6). Spondylosis using Steinmann pin and PMMA was performed in 2 of 3 cases and dorsal laminectomy was performed in one case. Spinal fixation with Steinmann pin and PMMA was used to stabilize vertebral fractures or luxations (3,14,19). Performing the dorsal laminectomy also was used to remove fragments for decompressed effect in the spinal cord (11). The surgical treatment was proper on these cases. In these cases, a good adhesion of the surgical wound and improvement of the inflammation were noticed by two weeks postoperatively. However these were little or no improvement of the neurological disorders such as loss of deep pain, UMN sign and dysuria after surgical intervention. At that time, the medical therapy seemed to do not work toward patients.

It has been reported that deep pain can be recovered within 2 weeks in 58% of dogs if the surgery was performed within 48 hours (21). In all of these cases, 2 week after surgery, the prognosis of the surgery was poor than in previous reported cases. It made a reason for necessity of stronger postoperative care.

Generally, supporting care and rehabilitation was needed to the majority of dogs with vertebrae surgery as postoperative care including bladder and bowel management, range of motion, massage and swimming (19). To the patient with bad prognosis was thought to be needed more active methods like traditional veterinary medicine (TVM) including acupuncture and herbal medicine.

TVM has been thought to be proper alternative therapy on postoperative care relating the spinal injury or IVDD (5,8,10-11,28). In the TVM, TSCI is diagnosed on painful Bi syndrome which is characterized by severe pain. It is called cold bi syndrome why primary pathogen of the pain is the cold (5). Therefore painful bi syndrome was diagnosed to these cases as TVM diagnosis.

The TVM treatment consists of acupuncture and herbal medicine that they are effective in neurological problem (4). In the many types of acupuncture, EA is popular and stronger therapy in various conditions (7-8). Although acupoints are selected depending experience of clinician and condition of patient, several reports indicated that some specific acupoints are used in IVDD or experimental spinal cord injury (10,

11,28). The acupoints are BL-40, BL-60, GB-30, GB-34 and ST-36 (7,9-11,28). In these cases, BL and GV acupoints were also selected as major acupoints.

DHJST has been used as energy supplement of yangin case of kidney-yang-deficiency (8). It consists of 16 herbs including Radix Aralia Contientalis and LoranthiRamulus (18). It can be used when the symptoms of musculoskeletal disease from arthritis, degenerative disease and knee joint pain by disorder of circulation for nourishing of the blood. It has a function on strengthen the body and muscle, relief the pain and anti-inflammation especially case of painful Bi syndrome (8,18).

In the patients, comparing with other reports (3,5,16), the application of EA and DHJST showed the better and faster progression on neurological improvement.

In an experimental model of spinal cord injury, the conscious proprioception and thrust extensor responses could be elicited within 20th day and 14th after EA treatment the experimental animals were recovered from deep pain loss. In these cases, deep pain response appeared between 2 and 5 weeks after an application of EA and DHJST. Previous study also reported similar period to take ambulatory response between 7 days and 15 days (7-8,10-11). Normal urination and defecation recovered completely 30th, 32th and 74th day from application EA and DHJST in case 1, 2 and 3. Two cases were able to stand between 35th and 38th day after the treatments. They also could walk voluntarily between 44th and 90th day. In view of degree and prognosis on other previous TSCI cases (3,16,22). It is thought that application of EA combined with DHJST treatment was good for these TSCI cases.

The application of EA in combination with DHJST should be a good therapeutic approach for the postsurgical management on the patients with traumatic spinal cord injury.

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외상성 척수 손상에 대한 척추 수술을 한 3마리의 개에서, 술 후 처치로써 전침과 독활기생탕을 적용한 증례

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요 약 : 심한 낙상으로 척수 손상을 입은 개 3 마리가 전북대학교 동물의료센터에 내원을 하였다. 내원을 할 당시 환자는 심부통, 정상적 배변 배뇨 반사가 관찰되지 않았다. 신체 검사, 신경계 검사, 컴퓨터 단층 촬영을 실시한 결과, 흉추의 아탈구와 골절로 진단 되었다. 각각의 증례는 등쪽 척추 후궁 절제술과 척추 고정술을 뼈 시멘트와 스테인만 핀을 이용하여 실시 하였다. 술 후 처치는 약 2 주간 실시하였지만 세 증례에서 신경 증상의 개선이 지연되어 나타났다. 전침과 독활기생탕을 이용하여 환자를 치료하였다. 전침 자극과 독활기생탕 투여 14~45일 후에 세 증례에서 운동성, 고유자세반응, 척추 자세 등이 개선되었으며 심부통이 회복되고 꼬리를 흔들었다. 특히 세 마리 중 두 마리는 거의 정상적인 보행과 배변 배뇨 반사를 나타냈지만 뼈 시멘트로 인한 슬부의 염증으로 인하여 치료를 중간에 지연한 1 예에서 경과가 좋지 않았다. 이 증례를 바탕으로 술 후 2 주 이후에도 신경 증상의 개선이 없는 환자에서 전침과 독활기생탕의 적용은 환자의 상태를 개선시킬 수 있는 적당한 치료라 생각된다.

주요어 : 전침, 독활기생탕, 외상성척수손상, 개