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Clinical Practice, Particular Techniques and Special Issues

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ACUPUNCTURE – CLINICAL PRACTICE, PARTICULAR TECHNIQUES AND SPECIAL ISSUES

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Notice

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Meet the editor

Dr. Marcelo Saad graduated in Medicine at the Federal University of S. Paulo, Brazil, in 1992. At the same University, he achieved the degrees of MSc (1998) and PhD (2001) in Rehabilitation Sciences. As medical specialties, he is Board Certified both in Physiatry and Acupuncture. Currently he is a member of Editorial Boards of the Acta Fisiatrica (ISSN 0104-7795), and the Einstein - Continuous Health Education (ISSN 1981-2825). At the Hospital Israelita Albert Einstein (S. Paulo, Brazil), the Latin America's most advanced private hospital, he is a member of the clinical staff, acting as a Physiatrist and Acupuncturist. In this same Hospital, he is the Coordinator of the Committee of Spirituality-Religiosity in Health. Besides his work as a physician, he has authored several scientific publications, given technical lectures and participated in academic and associative tasks. His main interest areas are Acupuncture, Physical Medicine and Rehabilitation, Spirituality in Health, and Complementary and Alternative Therapies.

Contents

Preface

Acupuncture is growing in popularity world-wide. Since it started to be scientifically studied in the 1970's decade, acupuncture is conquering position as an efficient and safe therapeutic method. The amount of cumulated scientific evidence is already enough to guarantee a highly detached status for acupuncture among other complementary therapies. In many countries, acupuncture is well integrated into the conventional health system. Therefore, the value of acupuncture has been well consolidated. However, there are several factors that affect the perception of acupuncture.

The mechanisms of action of acupuncture are not entirely clear. Although we have many pieces of this puzzle, it is not still complete neither entirely mounted. Another debilitating element is the absence of a convincing model of sham acupuncture for a control group in clinical trials. All this facts, allied to inappropriate prejudice and unfamiliarity, reinforce the false notion that acupuncture works mainly due to placebo effect. Therefore, there is still the issue of the absence of a universal consensus about the degree in which acupuncture can be independent to the traditional chinese medicine.

However, acupuncture can also be sustained by itself. Currently, it is practiced in more than 160 countries and regions. The UNESCO (United Nations Education, Scientific and Cultural Organization) inscribed acupuncture on its List of the Intangible Cultural Heritage of Humanity in 2010. There cannot be larger acclamation than these.

Acupuncture and related techniques are useful tools for treating a spectrum of diseases. But there are still many areas of controversy. We hope this book can contribute to guide the advance of this ancient medical art.

In this book, the reader will find texts wrote by authors from different parts of the world. The chapters cover strategic areas to collaborate with the consolidation of the knowledge in acupuncture. The book doesn't intend to solve all the questions involved in this issue. The main objective is to share elements to make acupuncture more and better offered at health systems worldwide.

The book contents information about Acupuncture Clinical Practice, Particular Technics and Special Issues. I believe reading of this edition will be useful and pleasant.

With Best Regards

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Part 1

Clinical Practice

1

Acupuncture for Disorders of Consciousness - A Case Series and Review

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1. Introduction

The lives of numerous patients in critical condition have been saved since the development of neuro-intensive care medicine in the 1960s. However, an unfortunate outcome of this development is the existence of a pool of surviving patients with unresponsiveness. This previously rare condition has been a new challenge for the medical community. After decades of medical development, a general framework of diagnosis and treatment of unresponsiveness has gradually been established, although the current knowledge is mainly derived from personal experience, and consensus is lacking for well-defined and effective diagnostic and treatment procedures (Liang, 2008). Disorders of consciousness mainly include coma, vegetative states (VSs), and minimally-conscious states (MCSs) (Bernat, 2006). The causes of consciousness disorders are mainly traumatic brain injury and cerebrovascular diseases, but they may also include hypoxia resulting from cardiac arrest and resuscitation, shock, and carbon monoxide (CO) poisoning. The lesions are predominantly found in the cerebral cortex, hypothalamus, and midbrain (Povlishock & Christman, 1995; Kampel et al., 1998). Consciousness emerges from interactions of the reticular activating system between the two cerebral hemispheres and the brain stem. Any factor interfering with these delicate processes may decrease alertness. The cerebral cortex lacks any intrinsic mechanism to promote responsiveness, which instead requires subcortical structures to generate and maintain consciousness. External stimuli are transmitted to the brain stem through the sensory organs, subsequently relayed to the thalamus, and eventually delivered to the cerebral cortex. The hypothalamus also plays a crucial role during this process, especially in controlling periodic rhythms. Different etiological factors of consciousness disorders result in differences in neuropathology. This is exemplified by studies of nerve electrophysiology showing that short-term brain hypoxia mainly affects the cerebral cortex; however, as the duration of hypoxia extends, deeper structures are also compromised (Hoesch et al., 2008). The pathology of VS is divided into three categories: large-scale damage to the cerebral cortex, injury to links (e.g., thalamus)

between the cerebral cortex and the brain stem, and injury to connections (e.g., corpus callosum) within the cerebral cortex. The latter type of injury is also known as severe diffuse axonal injury (DAI). However, thalamus lesions or DAI are rarely found among MCS patients (Jennett et al., 2001).

Over the last decade, we have been applying acupuncture to various unresponsive patients who were receiving traditional Western medical treatment, and we have observed significant results. Similar advanced care protocols using multi-modal therapy have also been applied in some research fields (DeFina et al., 2010). Here, we report our findings using auxiliary acupuncture in addition to Western medicine, which enabled patients to regain consciousness in 6 weeks. Specifically, each of our patients from suffered consciousness disorders ranging from stroke, traumatic brain injury, hypoxic-ischemic encephalopathy, hypoxic encephalopathy, and post-partum eclampsia. Each patient had a Glasgow Coma Scale (GCS) score of 8 or lower.

2. Acupuncture therapy - restoring consciousness

We applied a consistent acupuncture procedure using the acupuncture positions of Eding zone, Dingnie zone, Shuigou (GV26), and Twelve Well on several patients with various consciousness disorders.

2.1 Scalp acupuncture: Eding zone and dingnie zone (Fig. 1)

Eding zone is located from the midline to the top of the forehead. Specifically, it extends from the front hairline to the Baihui (GV20) at the top of the head and has a width of approximately 1 cun. This zone belongs to the Governor Vessel and the Bladder Meridian of Zutaiyang and is divided into four parts, each of which can be used to treat diseases of the head, throat, upper energizer (or chest cavity, including the chest and diaphragm), the middle energizer (upper abdomen, umbilical abdomen), and the lower energizer (lower abdomen) (Zhu et al., 1993). Three stainless steel filiform needles with a diameter of 0.26 mm and length of 40 mm were sequentially inserted at 30 degree into Eding zone using the promotion needling technique in which the needles are twisted, slightly lifted, re-inserted to obtain Qi (de qi, causing the acupuncture needle to elicit the patient's feeling of soreness, numbness, distension, heaviness, or even sensation like an electric shock around the point

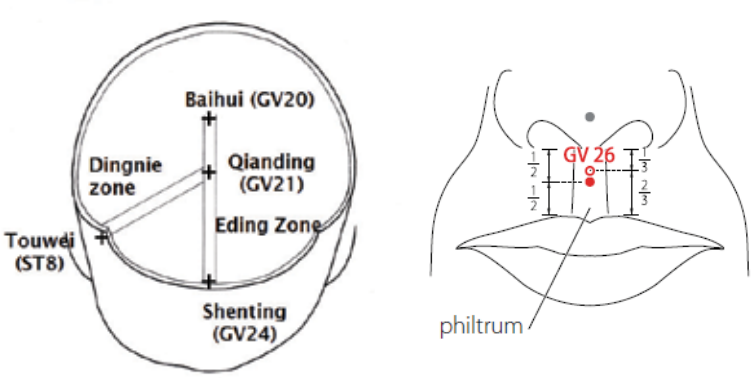

Fig. 1. Eding zone, Dingnie zone & GV26 (WPRO, 2009)

together with the practitioner's feeling of tenseness around the needle) (WPRO, 2007), and kept in place for 1 h. The procedure was applied three times every week. Twenty sessions of this procedure comprised a therapeutic course.

Dingnie zone is a strip between Qianding (GV21) and Touwei (ST8) and has a width of approximately 1 cun. It belongs to the Governor Vessel, the Bladder Meridian of Zutaiyang, and the Gallbladder Meridian of Zushaoyang. This strip is mainly used for treating movement disorders and sensory disturbances, and it has an especially significant effect on central and sensory movement disorders (Zhu et al., 1993). Four stainless steel filiform needles with a diameter of 0.26 mm and length of 40 mm were sequentially inserted at 30 degree into the two sides (two needles/side) using the promotion needling technique in which the needles are twisted, slightly lifted, re-inserted to obtain Qi, and kept in place for 1 h.

2.2 Body acupuncture: GV26 (Fig. 1) and Twelve Well points (Fig. 2)

Shuigou is also known as Renzhong. The Twelve Well points belong to the twelve Meridians. A stainless steel filiform needle with a diameter of 0.26 mm and length of 25 mm is sequentially inserted into individual points with half needling (no retention).

GV26: Shuigou. At the junction of the upper one third and lower two thirds of the philtrum midline. (WPRO, 2009)

LU11: Shaoshang. On the thumb, radial to the distal phalanx, 0.1 F-cun proximal-lateral to the radial corner of the thumb nail, at the intersection of the vertical line of the radial border and the horizontal line of the base of the thumb nail. (WPRO, 2009)

LI1: Shangyang. On the index finger, radial to the distal phalanx, 0.1 F-cun proximal-lateral to the radial corner of the index fingernail, at the intersection of the vertical line of the radial border of the fingernail and the horizontal line of the base of the index fingernail. (WPRO, 2009)

ST45: Lidui. On the second toe, lateral to the distal phalanx, 0.1 F-cun proximal-lateral to the lateral corner of the second toenail, at the intersection of the vertical line of the lateral border and the horizontal line of the base of the second toenail. (WPRO, 2009)

SP1: Yinbai. On the great toe, medial to the distal phalanx, 0.1 F-cun proximal-medial to the medial corner of the toenail, at the intersection of the vertical line of the medial border and horizontal line of the base of the toenail. (WPRO, 2009)

HT9: Shaochong. On the little finger, radial to the distal phalanx, 0.1 F-cun proximal-lateral to the radial corner of the little fingernail, at the intersection of the vertical line of the radial border of the nail and horizontal line of the base of the little fingernail. (WPRO, 2009)

SI1: Shaoze. On the little finger, ulnar to the distal phalanx, 0.1 F-cun proximal-medial to the ulnar corner of the little fingernail, at the intersection of the vertical line of ulnar border of the nail and horizontal line of the base of the little fingernail. (WPRO, 2009)

BL67: Zhiyin. On the little toe, lateral to the distal phalanx, 0.1 F-cun proximal to the lateral corner of the toenail; at the intersection of the vertical line of the lateral side of the nail and the horizontal line of the base of the toenail. (WPRO, 2009)

KI1: Yongquan. On the sole of the foot, in the deepest depression of the sole when the toes are flexed. (WPRO, 2009)

PC9: Zhongchong. On the middle finger, 0.1 F-cun proximal to the radial corner of the middle fingernail, at the intersection of the vertical line of the radial side of the nail and the horizontal line of the base of the fingernail. (WPRO, 2009)

TE1: Guanchong. On the ring finger, ulnar to the distal phalanx, 0.1 F-cun proximal to the ulnar corner of the fingernail, at the intersection of the vertical line of the ulnar side of the nail and the horizontal line of the base of the fingernail. (WPRO, 2009)
GB44: Zuqiaoyin. On the fourth toe, lateral to the distal phalanx, 0.1 F-cun proximal to the lateral corner of the toenail, at the intersection of the vertical line of the lateral side of the nail and the horizontal line of the base of the fourth toenail. (WPRO, 2009)
LR1: Dadun. On the great toe, lateral to the distal phalanx, 0.1 F-cun proximal to the lateral corner of the toenail, at the intersection of the vertical line of the lateral side of the nail and the horizontal line of the base of the toenail. (WPRO, 2009)

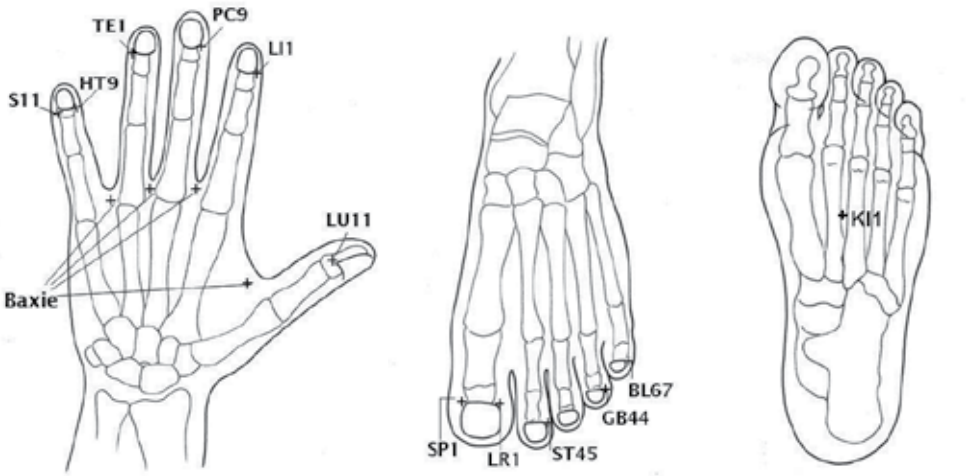

Fig. 2. Twelve Well points & Baxie

3. Case reports

3.1 Stroke

3.1.1 History and examination

An 84-year-old male who had suffered from diabetes and hypertension for more than 10 years had been treated with Western medicine regularly to control his symptoms. On January 21, 2008, he suddenly suffered a general weakness when going up stairs. He subsequently lost consciousness and was sent to the emergency ward of our hospital. Due to respiratory failure, he was placed on support with a ventilator. After admission, neither a brain computerized tomography (CT) scan nor magnetic resonance imaging (MRI) detected any hemorrhage or newly developed infarction. However, it was discovered that the patient had a high level of myocardial enzymes, corroborated by electrocardiography, which showed ST-T elevation in V4-V5. Thus, the patient was assumed to have suffered from acute myocardial infarction and cardiogenic shock and was subsequently transferred to a cardiac intensive care ward. On January 27, the patient was weaned from the ventilator, but still had a GCS score of 8 (E1V2M5). On January 29, because of a persistent consciousness disorder, he again underwent brain MRI, which revealed a partial infarction in the right and middle cerebral arteries. The next day, he was transferred to an intensive care ward in the Department of Neurology for further evaluation and treatment. On the same day, he

suffered gastrointestinal hemorrhage. On February 1, the patient developed intermittent atrial fibrillation associated with a rapid ventricular rate, and he therefore received a consultation and treatment from cardiovascular physicians. On February 5, he repeatedly exhibited ventricular tachycardia, from which he recovered after treatment with an automated external defibrillator (AED). On February 12, brain MRI indicated that infarction and hemorrhagic transformation appeared in both parts of the thalamus, the right cerebral peduncle, the right occipital lobe, and the right temporal-parietal area. On February 18, the patient suffered a urinary tract infection combined with pneumonia and sepsis, but remission was achieved after antibiotic treatment. Afterwards, he showed no apparent improvement in consciousness and exhibited signs of left hemiplegia, which was considered to be caused by hypoxic encephalopathy. On February 27, with a GCS of 8, he underwent a consultation and began acupuncture treatment.

3.1.2 Treatment (Table 1)

After three acupuncture treatments, the patient gradually regained responsiveness such that he could follow simple action commands. He was subsequently transferred to an ordinary ward in the Department of Neurology with a GCS of 11 and left side weakness. After 14 treatments, the patient could answer questions correctly and was therefore transferred to a rehabilitation ward. During this period, he developed angina pectoris and hyponatremia, which were improved after application of sublingual nitroglycerin as well as a diet adjustment to increase his salt intake (facilitated by dietitians). After 17 treatments, he completely regained consciousness and had a GCS of 15. After 20 treatments, the patient showed further improvement and was discharged from the hospital.

Date (sessions)	GCS	Muscle power*	Events
2008.02.27 (1)	E1V2M5	3/ 3/ 2/ 2	Intensive care ward, Dept. of Neurology
0303 (3)	E3V2M6	4/ 4/ 2/ 2	Ordinary ward, Dept. of Neurology
0313 (8)	E3V2M6	4/ 4/ 2/ 2	Hyponatremia
0325 (14)	E3V5M6	4/ 4/ 2/ 2	Rehabilitation ward, angina pectoris and hyponatremia
0403 (17)	**E4V5M6**	**4/ 4/ 3/ 3**	
0409 (20)	E4V5M6	4/ 4/ 3/ 3	Discharged from hospital

Table 1. Acupuncture therapeutic sessions for a patient with stroke (GCS: Glasgow coma scales; *: right upper extremity/right lower extremity/left upper extremity/left lower extremity)

3.2 Traumatic brain injury

3.2.1 History and examination

A 19-year-old female was involved in an automobile accident and was transferred to the emergency ward of our hospital from another medical institution on May 24, 2008. After admission, the patient lost consciousness and had a GCS of 8 (E1V2M5) as well as a dilated right pupil. Examination of the brain CT scan revealed multiple sites of contusion and bleeding in the subarachnoid space, left brain ventricle, and left temporal lobe, along with fracture of the right facial bone. After emergency intubation, the patient was transferred to

an intensive care ward in the Department of Neurosurgery. On May 26, she was extubated, but she remained unconscious and was additionally found to suffer from right hemiplegia. In addition, brain MRI detected a contusion and edema in the left cerebral peduncle and edema in the left optic chiasm. On May 30, with a GCS of 8, she underwent a consultation and began acupuncture treatment.

3.2.2 Treatment (Table 2)

After two acupuncture treatments, the patient could open her eyes. Due to a contusion and bruising, her right eye drooped, but the pupillary light reflex was still present. Overall, her GCS score had improved to 11; therefore, she was transferred to an ordinary ward the same day. After four treatments, she was observed to be making vulgar verbalizations (unconscious), which was indicative of progress. After six treatments, she had a GCS score of 14 and continuous improvement of her overall symptoms; thus, she was transferred to a rehabilitation ward. After nine treatments, she completely regained consciousness and had a GCS score of 15. After 15 treatments, her condition was greatly improved, and she was discharged from the hospital and underwent follow-up therapy as an outpatient. After recovery of responsiveness, she switched to the treatment associated with freeing meridians (Eding zone, Dingnie zone, Fengchi, Taijian, Jianyu, Quchi, Hegu, Baxie, Zusanli, Yanglingquan, and Sanyinjiao) to address her deficit of nerve function. After 45 treatments, the patient completely regained her muscle power and could live independently (Barthel Index score of 100). Eight months after the treatments, she restarted her first year of college study.

Date (sessions)	GCS	Muscle power	Events
2008.05.30 (1)	E1V2M5	1/ 2/ 3 /3	Intensive care ward, Dept. of Neurosurgery
0602 (2)	E4V2M5	1/ 2/ 3/ 3	Ordinary ward, Dept. of Neurosurgery
0611 (6)	E4V4M6	2/ 3/ 4/ 4	Rehabilitation ward
0618 (9)	**E4V5M6**	**2/ 3/ 4/ 4**	
0620 (10)	E4V5M6	4/ 3/ 4/ 4	
0705 (15)	E4V5M6	4/ 3-4/ 4-5/ 4-5	Discharged from hospital
1222 (45)	**E4V5M6**	**5/ 5/ 5/ 5**	Outpatient; Barthel Index: 100

Table 2. Acupuncture therapeutic sessions for a patient with traumatic brain injury

3.2.3 Acupuncture therapy - freeing meridians

We used the same acupuncture treatment for all patients who recovered from consciousness disorders but still displayed neurologic impairments, regardless of the individual etiology of the disorder. The following acupuncture points were used: Eding zone, Dingnie zone, Fengchi, Taijian, Jianyu, Quchi, Hegu, Baxie, Zusanli, Yanglingquan, and Sanyinjiao. The application of needles to Eding and Dingnie zones was the same as described previously except that the retention time was 30 min. Stainless steel filiform needles with a diameter of 0.26 mm and length of 40 mm were inserted into Quchi, Zusanli, Yanglingquan, and Sanyinjiao; stainless steel filiform needles with a diameter of 0.26 mm and length of 25 mm

were inserted into Fengchi points on two sides, as well as Taijian, Jianyu, and Hegu; stainless steel filiform needles with a diameter of 0.26 mm and length of 13 mm were inserted into Baxie. The needles were twisted, slightly lifted, and re-inserted to obtain Qi. In Jianyu, Quchi, Hegu, Yanglingquan, and Zusanli, this needling technique was followed by being connected to an electrical stimulator (Model-05B; Ching-Ming Medical Device Co., Taipei, Taiwan). Electricity was generated as an output of programmed pulse voltage at 1.2 Hz with a regular wave, 390-ms square pulse at a maximal tolerable intensity of 500 Ω (12–18 V; a strong but not painful sensation for the patient). The electroacupuncture was applied for 30 minutes to maintain the therapeutic effect.

GB20: Fengchi. In the anterior region of the neck, inferior to the occipital bone, in the depression between the origins of sternocleidomastoid and the trapezius muscles. (Fig. 3) (WPRO, 2009)

Taijian (Ex-UE23). 1 ½ cun below the tip of the acromion. (Fig. 3) (GMRLWB, 1970)

LI15: Jianyu. On the shoulder girdle, in the depression between the anterior end of lateral border of the acromion and the greater tubercle of the humerus. (Fig. 4) (WPRO, 2009)

LI11: Quchi. On the lateral aspect of the elbow, at the midpoint of the line connecting LU5 with the lateral epicondyle of the humerus. (Fig. 4) (WPRO, 2009)

LI4: Hegu. On the dorsum of the hand, radial to the midpoint of the second metacarpal bone. (Fig. 4) (WPRO, 2009)

Baxie (EX-UE 9). When a loose fist is made, the points are on the dorsum of the hand, proximal to the margins of the webs between all five fingers, at the junction of the red and white skin. Both hands altogether have a total of eight points. (Fig. 2) (Yang, 2000)

ST36: Zusanli. On the anterior aspect of the leg, on the line connecting ST35 with ST41, 3 B-cun inferior to ST35. (Fig. 5) (WPRO, 2009)

GB34: Yanglingquan. On the fibular aspect of the leg, in the depression anterior and distal to the head of the fibula. (Fig. 5) (WPRO, 2009)

SP6: Sanyinjiao. On the tibial aspect of the leg, posterior to the medial border of the tibia, 3 B-cun superior to the prominence of the medial malleolus. (Fig. 5) (WPRO, 2009)

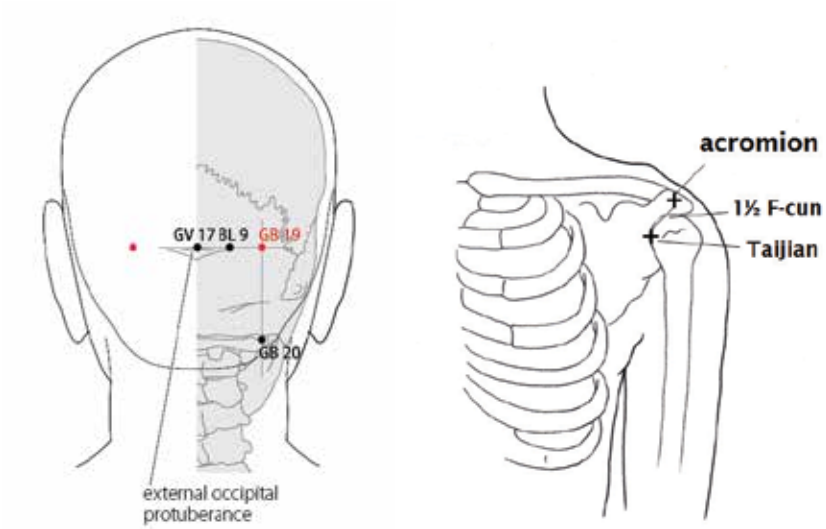

Fig. 3. GV17, GB19, GB20 (WPRO, 2009) & Taijian

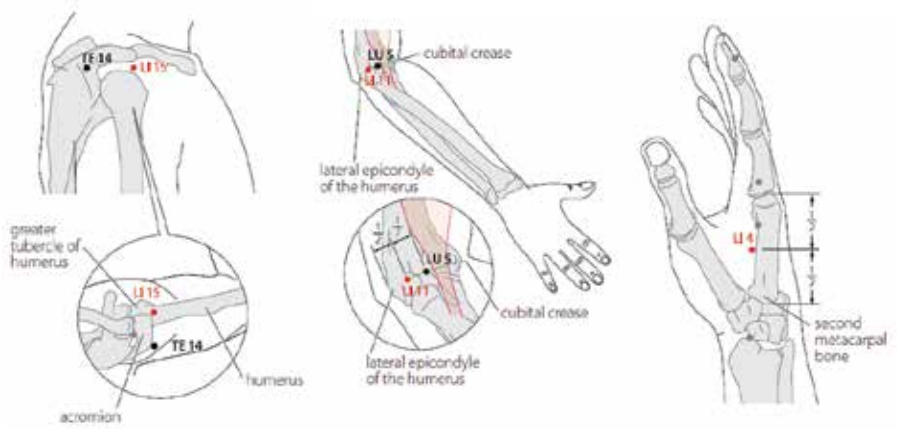

Fig. 4. LI15, LI11 & LI4 (WPRO, 2009)

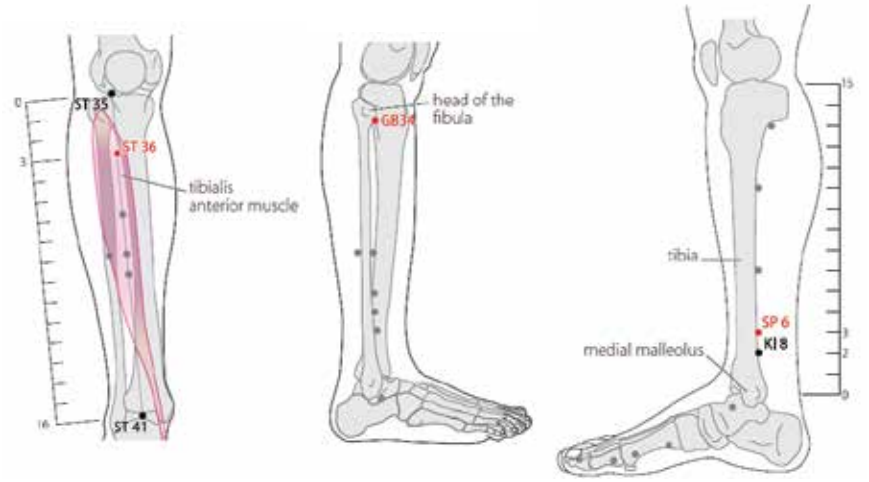

Fig. 5. ST36, GB34 & SP6 (WPRO, 2009)

3.3 Hypoxic-ischemic encephalopathy

3.3.1 History and examination

A 39-year-old female with a history of hyperthyroidism had been regularly undergoing Western medicine treatments to control the symptoms. She had an obstetric history of G5P2A2. On June 16, 2005, after a full-term pregnancy, she gave birth to a baby boy (natural birth). Subsequently, she suffered postpartum hemorrhage (ca. 2500 cc) due to atonic uterus and underwent hysterectomy. During the operation, she developed shock caused by dropped blood pressure and was subjected to cardiopulmonary resuscitation along with transfusion and intubation. After the initial first-aid procedures, the patient was transferred to the emergency ward of our hospital for further treatment. She was then transferred to an intensive care ward in the Department of Neurosugery. The next day, it was discovered that she had developed pulmonary edema and hemopneumothorax; thus, she was subjected to chest intubation and drainage. During this period, the patient received a large number of

transfusions and tapered the administration of the vasopressor, but she remained in a coma and was dependent on a ventilator. Afterwards, the patient developed pneumonia, empyema, and infections in the vagina, urinary tract, and central venous catheter. For these infections, she was treated with antibiotics. Although neither brain CT scan nor brain MRI detected any apparent damage, she remained unconscious. On June 27, the patient was transferred to an intensive care ward in the Department of Internal Medicine. On the next day, she was weaned from the ventilator and extubated. On June 29, with a GCS score of 8, she underwent a consultation and began acupuncture treatment.

3.3.2 Treatment (Table 3)

On June 30, the patient was transferred to a ward in the Department of Gynaecology and Obstetrics. After five acupuncture treatments, she gradually regained consciousness and had a GCS score of 12 but occasionally complained of blindness. The Nao-Sanzhen (Naohu and Naokong; Figure 3, "Jin-Sanzhen" technique) (Yuan et al., 2005) was used for her blindness. After eight treatments, she completely recovered consciousness, and her overall condition was greatly improved. Thus, she was discharged from the hospital and underwent follow-up therapy as an outpatient. After recovery, she switched to the treatment of freeing meridians to resolve her impaired nerve function. After 21 treatments, the patient recovered her visual perception. After 40 treatments, she completely regained her muscle power, could live independently, and had a Barthel Index score of 100.

GV17: Naohu. On the head, in the depression superior to the external occipital protuberance. (Fig. 3) (WPRO, 2009)

GB19: Naokong. On the head, at the same level as the superior border of the external occipital protuberance, directly superior to GB20. (Fig. 3) (WPRO, 2009)

Date (sessions)	GCS	Muscle power	Events
2005.06.29 (1)	E4V2M2	0/ 0/ 0/ 0	Intensive care ward, Dept. of Internal Medicine
0630	E4V2M2	0/ 0/ 0/ 0	Ward in Dept. of Gynaecology and Obstetrics
0708 (5)	E4V2M6	0/ 2/ 0/ 2	Blindness
0718 (8)	**E4V5M6**	**2/ 3/ 2/ 3**	Discharged from hospital
0808 (15)	E4V5M6	3/ 3/ 3/ 3	Outpatient treatment
0826 (21)	**E4V5M6**	**4/ 4/ 4/ 4**	Regained eyesight
2006.01.20 (40)	E4V5M6	5/ 5/ 5/ 5	Barthel Index: 100

Table 3. Acupuncture therapeutic sessions for a patient with hypoxic-ischemic encephalopathy

3.4 Hypoxic encephalopathy

3.4.1 History and examination

We treated a 68-year-old female with a history of various diseases including diabetes, hypertension, chronic renal failure, congestive heart failure, atherosclerosis, and osteoporosis. On April 13, 2006, the patient suffered general weakness, pain in the right

limbs, and dyspnea and was therefore admitted into our hospital. Subsequently, she developed chest pain, which radiated into her back and was suspected to be caused by dissection of an aortic aneurysm. However, no obvious lesion was detected by chest CT scan. The patient also clearly displayed worsening renal function (BUN: 161.6 mg/dl; Cr: 10.24 mg/dl); thus, she was subjected to emergency hemodialysis. During the dialysis, the patient occasionally exhibited delirium, which improved after a short period. Afterwards, she was transferred to a ward in the Department of Nephrology. Around May 5, the patient showed poor glycemic control. Given her leukocytosis symptoms, infection was suspected, and she was given prophylactic antibiotic treatment. Correspondingly, her arteriovenous fistulization operation was postponed. On May 10, she suffered gouty arthritis on the first right toe and was treated with colchicine. On the same day, she underwent the arteriovenous fistulization procedure. The next day, she experienced choking when having her lunch, which developed into acute respiratory failure; she then received emergency intubation and was subsequently placed on a ventilator. A high level of food residue was found in her endotracheal tubes. After a 5-min treatment of cardiopulmonary resuscitation, the patient's heart rate was recovered, but she remained unconscious. Subsequently, she was transferred to an intensive care ward in the Department of Internal Medicine and received antibiotic treatment. At the same time, she received bronchoscopy, which identified rice grains and minor bleeding in her left lung. The brain CT scan did not reveal any apparent lesion. On May 18, ventilator weaning was attempted but was unsuccessful due to respiratory failure. On May 23, with a GCS score of 3, she underwent a consultation and began acupuncture treatment.

3.4.2 Treatment (Table 4)

On June 1, the patient remained in respiratory failure and was transferred to a respiratory intensive care ward. On June 2, she received a tracheotomy and had a GCS score of 3. On June 10, she was weaned from the ventilator and had a GCS score of 7. Three days later (the 10th acupuncture treatment), she regained consciousness (GCS of 11) and was transferred to a ward in the Department of Nephrology. On June 18, the patient developed a sudden dyspnea after hemodialysis, which was identified as respiratory failure resulting from sepsis. She was then re-connected to a ventilator and had a GCS score of 6. On June 22, she was weaned from the ventilator and had a GCS score of 6. On June 29 (the 17th treatment), the patient recovered consciousness (GCS of 11), and she had not developed any symptoms of fever or chill over the previous two weeks. However, she still had leukocytosis and emergence of hypotension during hemodialysis, both of which were indicative of sepsis. Thus, the antibiotic treatment was continued. On July 3, with a GCS score of 11, the patient exhibited upper gastrointestinal bleeding and was transfused with concentrated red blood cells during hemodialysis. On July 6, with a GCS score of 11, she displayed paroxysmal supra-ventricular tachycardia during hemodialysis, after which she occasionally exhibited atrial fibrillation with a rapid ventricular response. On July 8, with a GCS score of 11, the patient again developed a fever, and the blood culture revealed an infection of *Candida albicans*. On July 15, she exhibited dyspnea and tachycardia; the electrocardiography revealed ST elevation and T-wave changes in V2-V6. In addition, she was also found to harbor high levels of myocardial enzymes and develop hypotension and was assumed to have developed an acute myocardial infarction. Thus, she was transferred to a cardiac intensive care ward. Concurrently, she also suffered bronchopneumonia and had a GCS

score of 5. On July 22 (the 27th treatment), with a GCS score of 9-11, she was successfully weaned from the ventilator. Three days later, she was transferred to a ward in the Department of Cardiology. Afterwards, the patient received hemodialysis on Monday, Wednesday, and Friday every week, during which she occasionally exhibited hypotension. In addition, she had poor wound healing in her left leg, which was accompanied by fever. On August 18, with a GCS score of 9-11, she received debridement and antibiotic treatment. On September 2 (the 45th treatment), the patient regained consciousness and her condition was improved. She was therefore discharged from the hospital and transferred to an elderly center for recuperation.

Date (sessions)	GCS	Muscle power	Events
2006.05.23 (1)	E1VeM1	0/ 0/ 0/ 0	Intensive care ward, Dept. of Internal Medicine; on a ventilator
0601 (5)	E1VtM1	0/ 0/ 0/ 0	Respiratory Intensive Care ward, tracheotomy
0608 (8)	E3VtM1	0/ 0/ 0/ 0	
0610 (9)	E3VtM1	0/ 0/ 0/ 0	Ventilator weaning
0613 (10)	**E4VtM6**	**0/ 0/ 3/ 0**	Ward in Dept. of Nephrology
0618 (12)	E3VtM2	0/ 0/ 2/ 0	Sepsis, respiratory failure, on a ventilator
0622 (14)	E3VtM2	0/ 0/ 2/ 0	Ventilator weaning
0629 (17)	**E4VtM6**	**2/ 0/ 3/ 0**	
0715 (24)	E3VtM1	0/ 0/ 0/ 0	Cardiac Intensive Care ward, acute myocardial infarction, on a ventilator
0722 (27)	**E3-4VtM5-6**	**2/ 0/ 3/ 0**	Ventilator weaning, ward in Dept. of Cardiology
0902 (45)	E4VtM6	2/ 0/ 3/ 0	Discharged from hospital

Table 4. Acupuncture therapeutic sessions for a patient with hypoxic encephalopathy

3.5 Post-partum eclampsia

3.5.1 History and examination

We treated a 30-year-old female who had been healthy and had an obstetric history number of G2P0A1. On July 2, 2009, at 39^{+5} weeks of pregnancy, her amniotic sac broke, and she was sent to another hospital via ambulance for delivery. Due to the prolonged labor, a caesarean section was suggested and performed by her gynecologist the next day. During the surgery, spinal anesthesia was performed and a 2600-g baby girl was born. Subsequently, a chocolate cyst on her left side was removed, and the wound was sutured after a drainage tube was placed. Her condition was stable and she was conscious, so she was sent to a ward to rest. However, the patient experienced chest discomfort and palpitations the next morning. At that time, the nurses first gave her oxygen and notified the doctors for treatment. Her blood pressure was 150/100 mmHg, her pulse was 120/min, and her respiration rate was 17/min. When the attending physician arrived, 5% glucose water and magnesium sulfate drips were administered. Afterwards, the doctor suggested to the patient's family members that she should be transferred to our hospital for further treatment. Laboratory examination showed 15400 leukocytes, protein in the urine (+), occult blood (+), and IgE of 129 IU/ml. Before the ambulance arrived, the patient had already exhibited clasped hands, trismus, and mild

convulsions. Doctors from that hospital then gave 1 Amp of valium and 20 ml of 20% G/W by intravenous injection. After the administration, the patient could not speak but was able to nod when questioned. In addition, after an infusion of 500 ml D5W + 2 Amp drips of MgSO4, the patient was subsequently transferred to our hospital for treatment. Upon arrival, the patient showed changes in consciousness, a body temperature of 38.3°C, blood pressure of 158/71 mmHg, a heart rate of 110 bpm, and a GCS score of E2V2M2. Therefore, emergency physicians first had her intubated to establish an airway, followed by a series of imaging examinations, including a brain CT scan and chest X-ray, but nothing notable was detected. ECG showed sinus tachycardia, while EEG indicated widespread cortical dysfunction. Antiepileptic drugs were administrated but were ineffective. Instead, the patient suffered from consistent convulsions. Under status epilepticus along with eclampsia, she was assumed to suffer malignant hyperthermia and was transferred to an intensive care ward for further treatments. On July 6, the patient developed rhabdomyolysis, acute renal failure, systemic edema, and pulmonary edema, and she underwent emergency hemodialysis. Brain MRI showed extensive vasculitis, and she had a GCS score of 3. Two days later, she was found to have hypotension and disseminated intravascular coagulation. Thus, antibiotic treatment was given. Meanwhile, the patient exhibited a drug-related rash, and alternative antiepileptic drugs were provided. On July 13, with a GCS score of 3, she underwent a consultation and began acupuncture treatment.

3.5.2 Treatment (Table 5)

After three acupuncture treatments, the patient could open her eyes naturally. After eight treatments, she was weaned from a ventilator and extubated, and she had a GCS score of 9.

Date (sessions)	GCS	Muscle power	Events
2009.07.13 (1)	E1VeM1	1/ 1/ 1/ 1	Intensive care ward, status epilepticus, acute respiratory failure, acute renal failure, sepsis, on a ventilator
0714	E2VeM1	1/ 1/ 1/ 1	
0718 (3)	E3VeM1	1/ 1/ 1/ 1	
0719	E4VeM2	1/ 1/ 1/ 1	
0720 (4)	E4VeM3	1/ 1/ 1/ 1	
0729 (8)	E4V1M4	1/ 1/ 1/ 1	Ventilator weaning and extubation
0802 (10)	E4V2M5	2-/ 2-/ 2/ 2-	Ward in Dept. of Neurology, pneumonia and urinary tract infection detected the next day
0817 (16)	**E4V2M6**	**2-/ 2-/ 2/ 2-**	
0924 (31)	E4V2M6	2-/ 2-/ 2/ 2-	Rehabilitation ward, urinary tract infection detected after a week
1022 (43)	E4V2M6	3/ 3/ 3/ 3	Discharged from hospital

Table 5. Acupuncture therapeutic sessions for a patient with postpartum eclampsia

On August 2, with conditions continuing to improve and a GCS score of 11, she was sent to a ward in the Department of Neurology. The next day, the patient developed pneumonia and a urinary tract infection, and she had a GCS score of 11; antibiotic treatment was given. Afterwards, her condition continued to improve, except that her limbs were still weak, and her consciousness remained unstable. Her husband claimed that she could recognize acquaintances. Subsequently, because of anemia, transfusion therapy was administrated. Afterwards, she suffered an allergic reaction and hematuria, and hemodialysis was immediately arranged. After hemodialysis, the patient stabilized and her renal function returned to normal. On August 17 (the 16th treatment), the patient regained consciousness, but she could not speak fluently due to vocal cord paralysis and had a GCS score of 12. On September 24, the patient was moved into a rehabilitation ward and had a GCS of score 12. After 1 week, she developed a urinary tract infection; thus, antibiotics were given (a GCS score of 12). On October 22 (the 43rd treatment), her condition had improved and she was therefore discharged.

4. Discussion and conclusion

Brain damage can result in the production of inhibitors, including γ—aminobutyric acid (GABA), which generates a response resembling automatic shutdown. The purpose of this response is probably to conserve energy and promote cell survival. However, this also causes a comatose state (Clauss & Nel, 2006). Therefore, any treatment affecting the reticular activating system may be worth trying, and among the possible treatments, acupuncture has the most potential.

Traditional Chinese medical science suggests that consciousness disorders are caused by a disruption of Yin and Yang, which results in blocking of blood and Qi and causes brain dystrophy. Unconsciousness usually involves syndrome of block or syndrome of collapse. Syndrome of block is characterized by unconsciousness, trismus, clasped hands, red face, rough breathing, and other features. In general, the syndrome of block, such as heat-toxin, phlegm, internal wind, and stasis, leads to an imbalance of Yin and Yang and unconsciousness. Syndrome of collapse has the characteristics of unconsciousness, cold limbs, sweating, closed eyes, opened mouth, snoring, opened hands, and urinary incontinence. Syndrome of collapse includes blood and Qi depletion, Yin and Yang failure, incompatible maintainability, and orifice dystrophies (Wang & Dong, 2007; He et al., 2005). The consciousness strategies in this article use Twelve Well points connecting the meridian Qi of three yins and three yangs. The Governor Vessel is the head of all yang meridians. Eding zone and Renzhong can be used to regulate the Governor Vessel and release the Qi of yang hyperactivity. Liver meridian intersects at the parietal. Eding and Dingnie zones can be used to regulate the meridian Qi of the liver and gall bladder and to extinguish wind and subdue yang. Thus, this strategy can pacify the liver to extinguish wind, regulate Yin and Yang, and promote consciousness (Yang, 1601). In the procedure of freeing meridians, Eding zone, Dingnie zone, and Fengchi pacify the liver and subdue Yang. Quchi and Hegu are the He point and Yuan point of the large intestine meridian, Quchi is not restricted to one place, and Hegu can rise and spread. These two points work together to regulate the meridian Qi and promote blood flow and are therefore able to cure paralyzed upper limb. Zusanli raises Yang and stimulates the stomach to increase Yang. Sanyinjiao strengthens the spleen and Yin blood. Yanglinquan, the point of conjunction of the sinews, relaxes sinews and benefits joints. The combination of three points tonifies Qi and replenishes blood, dispels wind, and

dredges collaterals, thus curing paralyzed lower limb (Dai, 1978). The Nao-sanzhen can provide pulp and stimulate the brain to resolve blindness (Yuan & Luo, 2004).
In studies that have examined the use of acupuncture for the treatment of stroke, body acupuncture accounts for 38.54%, scalp acupuncture accounts for 10.42%, the combination of acupuncture and medical treatment accounts for 12.5%, electroacupuncture accounts for 13.54%, general treatment accounts for 19.79%, moxibustion treatment accounts for 2.08%, and tongue acupuncture accounts for 3.13% (Jin, 2008). Currently, diagnosis and treatment options for cerebral hemorrhage continue to expand, and new treatment strategies continue to emerge, such as minimally invasive treatments for hematoma. However, the recent uses of minimally invasive hematoma treatment or intracerebral hematoma drainage in neurosurgery have not significantly reduced the death or disability rates associated with these diseases. Therefore, the goal is not only to promote the treatment of hematoma, but also to disrupt the process of progressive pathophysiology. Thus, the discussion of treatments for minimizing the death and disability rates of cerebral hemorrhage patients is still one of the most significant topics in neurology (Bai et al., 2010).

4.1 Twelve Well points

The Twelve Well points together comprise one of the Five-Shu points, next to nails. These points are also the origin of Yin and Yang for twelve meridians. The Qi of the meridians intersect at the ends of the extremities, metaphorically like an initial source. The 12 Well points serve the purposes of clearing heat, allaying excitement, prompting Qi, activating blood, and dredging the meridian (Yan & Zang, 2007). Acupuncture on the 12 Well points and exsanguinations can clear the stagnant Qi and blood within the meridians, adjust organs, promote harmony within organs, un-impede meridians, balance blood and Qi, and promote harmony of Yin and Yang, thus serving the purpose of curing the disease. Moreover, this can also greatly regulate the blood system as it promotes human metabolism and increases heart rate, systolic blood pressure, and blood supply to the brain. Through the nerve-body fluid regulation, it improves microcirculation and vascular function, which helps to remove harmful free radicals from the blood. Therefore, for acute cerebral infarction, early intervention of acupuncture on the 12 Well points can significantly ameliorate cerebral ischemia (Teng et al., 2009).
Acupuncture on the 12 Well points in mice with focal cerebral ischemia can reduce the release of tumor necrosis factor-α (TNF-α) and alleviate cerebral ischemic injury caused by TNF-α, and intervention within six hours is the most effective. The mechanism in mice is probably similar to that of early intervention through acupuncture of the 12 Well points in ischemic cerebrovascular disease (Ma et al., 2006). For experimental cerebral ischemic mice, acupuncture on the 12 Well points and exsanguination has been shown to increase blood flow in the ischemic region of the brain. This effectively delays hypoxia in the brain tissues (Ma et al., 2000). When three-edged needles were used on Renzhong, the 12 Well points and Shixuan in mice with experimental cerebral ischemia, an increase of HSP_{70} (heat shock protein in the brain) messenger ribonuclear acid (mRNA) expression in the cortex and hippocampus was observed in the acupuncture group compared to the control group. This indicates that acupuncture can boost HSP_{70} mRNA expression in the brain through regulation of calcium channels by HSP_{70} to achieve nerve protection (Huang, 2008).

Acupuncture on the six Well points of the hands and exsanguination are classical first aid measures in traditional Chinese medicine, and this approach has been used in clinical applications for thousands of years. It has the effects of reducing heat and stasis, increasing blood flow, protecting the brain, and promoting consciousness. Its medical theory is based on Chinese meridian-collateral theory and the qi-blood doctrine. After acupuncture on the six Well points of the hands and exsanguination, the consciousness of stroke patients improves. This is probably due to the effect of acupuncture on the six Well points of the hands and the effect of exsanguination on hemodynamic regulation and biochemical changes in regional cerebral areas. Analysis of GCS changes in patients with cerebral infarction and cerebral hemorrhage who were treated with acupuncture provides clinical evidence for the effectiveness of acupuncture at an early time point following cerebral hemorrhage (Ding & Guo, 2004) (Table 6). Acupuncture on the six Well points of the hands and exsanguination can improve the consciousness of patients with infarct damage of small size and can increase systolic blood pressure, causing the heart rate to accelerate (Guo et al., 2005).

Acupuncture on the six Well points of the hands and exsanguination has shown excellent effects on hemodynamics in rabbits with experimental cerebral ischemia and cerebral hemorrhage. Somatic nerves and autonomic vessel walls are pathways for Well point acupuncture and exsanguination to the center. Receptors of the central adrenaline and choline play important roles (Guo et al., 1997). Acupuncture on the six Well points of the hands and exsanguination can cause an increase in partial O_2 pressure and a decrease in H^+ concentration in regions of cerebral ischemia in mice. It further eases hypoxia and acidosis due to acute cerebral ischemia (He et al., 2002), adjusts homeostasis of K^+ and Na^+ in extracellular fluid, and reduces the development of cytotoxic brain edema (Ma et al., 1997). Acupuncture on the six Well points of the hands and exsanguination provide protection to the brains of patients when applied soon after a stroke. Pricking to draw blood can reduce nitric oxide (NO) concentration, improve nitric oxide synthase (NOS) activity, and reduce damage caused by free radicals on brain tissue (Huang et al., 2006) following cerebral ischemia in mice. Moreover, it can decrease the malondialdehyde (MDA) concentration, increase super oxide dismutase (SOD) activity, clear free radicals, and reduce lipid peroxidation (Huang et al., 2005). It can significantly increase HSP_{70} expression in an ischemic brain cortex, further enhance the protection of brain tissue against anti-ischemic injury, prohibit additional development of ischemic brain damage, and strengthen the ability of brain repair (Wang et al., 2005). In addition, it can improve the responsive ability of nerve cells by elevating c-fos (cellular proto-oncogene fos) protein concentration in the ischemic region, thus improving the brain's ability to repair itself, reducing neuronal apoptosis, and protecting the brain from further ischemic damage (Wang et al., 2004). Finally, it inhibits the entry of extracellular Ca^{2+} into cells, decreases raised excitatory amino acid (EAA) and NO concentrations after cerebral ischemia, reduces neurotoxicity, and improves the prognosis (Ren et al., 2001a; 2001b).

4.2 Scalp acupuncture combined with body acupuncture

Because the four limbs have wide distributions within the cerebral cortex, the Well points can strongly stimulate brain function. If diseases occur in the head, Baihui, or Sishencong, which are closer to the precentral gyrus, acupuncture can directly stimulate the functions of the central motor and sensory nervous systems (Chen et al., 2009). Because Shuigou is the

point of intersection for Shouyangming, Zuyangming, and the Governor Vessel, it is an essential point for first aid. Acupuncture on Shuigou can promote consciousness and restore resuscitation. Mechanical stimulation caused by acupuncture leads to the expedition of systemic blood circulation, affects blood supply to the brain, increases collateral circulation, strengthens oxygen supply capacities in various brain tissues, eliminates edema around the necrotic tissue, saves endangered dysfunctional neurons, promotes proliferation of astrocytes, and increases repair to promote the patient's consciousness and reduce the incidence of complications and mortality (Shan et al., 2002). When the patient's condition stabilizes, acupuncture can improve lesions caused by ischemic hypoxia by the regulation of excitement levels in the brain stem and cerebral cortex through nerve conduction, which gradually returns the excitation and inhibition processes to normal, thus promoting consciousness (Bi, 2004; Wu et al., 2003).

A previous report showed that nine days after an operation for hypertensive intracerebral hemorrhage, the patients in the acupuncture groups were provided with both acupuncture and Western medical treatment. The use of Xingnao Kaiqiao acupuncture at the base and scalp supplemented traditional body acupuncture; the result was significantly better than that of the control group (Li et al., 2006). The application of this combination of acupuncture promotes NO formation in the blood and brain tissues, increases NO concentration, ameliorates microvascular self-improvement movement, improves circulation, elevates SOD activity, and decreases lipid peroxide (LPO) concentration, thereby reducing the oxidative damage to the brain tissue, decreasing the cellular influx of calcium, improving calcium overload in brain tissue, benignly regulating the abnormal metabolism of neurotransmitters in the central nervous system, and reducing necrosis and apoptosis of brain cells (Ding & Shi, 2004). Scalp acupuncture therapy is based on functional areas of the cerebral cortex; it directly stimulates the intersections of all Yangs, "places where meridian passed, treatments thereby can be reached." The anterior oblique line of the parieto-temporal is equivalent to the cerebral cortex on the precentral gyrus's projection of the scalp; therefore, directly stimulating this area can improve cerebral blood circulation and increase oxygen saturation so that the corresponding area of the cerebral blood flow in ischemic disorders can be improved. Brain cells that are hibernating or in shock as a result of hemorrhagic focal constriction or inhibition of excitation can quickly restore their excitability (Zhu, 2000). Scalp acupuncture by Guirong Dong (Dong et al., 1990) first challenged the notion that scalp acupuncture cannot be used for acute hemorrhagic stroke. No matter which types of acupuncture are used, all acupuncture increases the expression of HSP_{70} mRNA to promote the expression of HSP_{70} protein, thus stimulating the protection and repair of neurons (Zhao et al., 2004).

4.3 Xingnao Kaiqiao acupuncture

After many years of study, Xuemin Shi established Xingnao Kaiqiao, or XNKQ (resuscitating), acupuncture using Neiguan as the main point to regulate the spirit of the whole body (Shi, 1998). Neiguan is a luo point on the Jueyin Pericardium meridian. It connects to the Yinwei vessel and is one of the eight intersection points of the vessels. Acupuncture on Neiguan can promote calmness and regulate blood circulation. Shuigou, one of the Governor Vessels, is an important point for consciousness, and it is a combined point of Shouyangming and Zuyangming. The Governor Vessel, the sea of the Yang meridians, begins in the cells and flows upward to the brain, and it has a close relationship

with the brain and other organs. Therefore, Shuigou serves as a gateway. Sanyinjiao is the point of intersection for the three yin meridians. Acupuncture on this point regulates the kidney, liver, and spleen (Ma et al., 2006).

Neiguan and Quze are both critical points on the Jueyin Pericardium meridian of the hands. Electroacupuncture on these points, combined with Western treatments, can help patients to regain consciousness earlier, and it reduces complications for some patients (Fu et al., 2009). Continuous electroacupuncture on Neigun can indirectly excite the median nerve; cause excitements in the brain stem, reticular formation, hypothalamus, and other structures; lift non-specific inhibition of the ascending activation system; and improve the patient's consciousness. Electrical stimulation can also affect autonomic nerves through spinal nerve traffic signals. It increases the oxygen supply by adjusting the cardiac function and respiratory activities. The distal projection is the largest in the cerebral cortex, and it therefore has a greater afferent effect and a greater impact on the cerebral cortex, which may help patients to regain consciousness and neurological functions (Wei et al., 2007). Furthermore, acupuncture on Shuigou and Yintang can also increase the oxygen supply to the brain, improve the nutritional status, and increase the excitability of neurons (Teng, 2000). Electroacupuncture can increase the activity of Na^+, K^+, Mg^{2+}, and Ca^{2+}-ATP enzymes in brain injury patients, reduce calcium overload, prevent secondary damage to nerve cells, improve abnormal blood vessel contraction, reduce spasm and abnormal platelet aggregation, increase the concentrations of dopamine, epinephrine, and norepinephrine, elevate adrenergic nerve activity, and enhance the metabolism of central norepinephrine to promote metabolism in the cerebral cortex. Furthermore, it can inhibit the production of endothelin, reduce MDA content, reduce free radical reactions, reduce reperfusion injury in brain tissue, and it can protect the blood-brain barrier, delay and reduce the formation and development of cerebral edema, and promote functional recovery of the penumbra and brain functions (Zhao et al., 2003; Zhou et al., 1991; Luo et al., 1987; Liu & Zhao, 2003). Neiguan contains cutaneous nerves in the forearms. Beneath it is a palmar cutaneous branch of median nerves. The deepest layer distributes forearm volar interosseous nerves, and Quzhe is passed by the median nerve stem (WPRO, 2009). Electroacupunture median nerve stimulation (MNS) is currently an internationally recognized strategy to treat traumatic coma. The introduction of a low-frequency current in the median nerve distribution area can increase blood circulation in the brain, reduce cerebral edema in the necrotic area, and promote the secretion of neurotrophic substances. Moreover, by restricting the release of β-endorphin in coma patients, it inhibits the increase of intracranial pressure, saves the dying neurons, and promotes consciousness (DeFina et al., 2010; Xu, et al., 2004; Xu & Wang, 2006). The mechanisms of consciousness promotion with electroacupunture of Neiguan are probably related to MNS. The effects of electroacupuncture are more precise in patients with diffuse axonal injury (Peng et al., 2010). This is probably due to the regulation of Bcl-2 (inhibits apoptosis) and Bax (promotes apoptosis) gene expression (Li et al., 2003), which stimulate the occurrence of new collateral axons and establish new axon contacts (Wu et al., 1998).

XNKQ acupuncture can effectively improve the flexibility of the red blood cells during reperfusion. This plays a significant role in maintaining the normal operation of microcirculation, maintaining the levels of material and energy metabolism, and promoting the functional recovery of nerve cells (Hu et al., 1995). Furthermore, it also can regulate glycoside fat concentrations in the ganglion of the brain for protection and promotion of

nerve reconstruction, which facilitates the improvement of consciousness disorders (Wang et al., 2004). XNKQ acupuncture can be used on Baihui, Shuigou, Yongquan, Laogong, and Fengchi, which are traditional treatment points for consciousness. Through acupuncture at the previously mentioned points, light insertion and heavy extraction are the main strategies for strong stimulation. Applying G6805 electrical therapeutic equipment to give a dense wave of electrical stimulation can help improve the metabolism of brain cells, initiate the consciousness-related functions of the reticular formation, significantly reduce the duration of consciousness disorders, and promote consciousness in coma patients (Liu et al., 2010). Acupuncture on the Shuigou point can efficiently reduce the infarction area of MCAO mice after cerebral ischemia, and it has a point-specific advantage. An appropriate acupuncture frequency (180 times/minute) and duration (5 seconds) can significantly reduce the infarction area (Wei et al., 2010).

Acupuncture can mitigate cerebral vasospasm, improve blood flow in damaged areas, promote the establishment of effective collateral circulation to reduce cerebral edema and high intracranial pressure, and promote the creation of brain cell metabolism. Meanwhile, it activates the function of the brain stem reticular system and increases the excitability of nerve cells so that the inhibited brain cells can re-emerge. Acupuncture on Shuigou can improve the oxygen supply to brain tissues and adjust the catecholamine concentration so that the sympathetic nerve can reach a relatively stable state (Zhang & Liu, 2010). Based on the effects of acupuncture on SOD activities in ischemic stroke patients, it appears that acupuncture can improve the activity of SOD, allow the body to eliminate free radicals effectively, strengthen the body against excessive reactive oxygen species attacks, reduce damage to brain tissue, and promote the metabolism of brain tissue to facilitate body recovery (Zhou et al., 1993). Acupuncture on Neiguan can increase cerebral perfusion and improve cerebral circulation (Shi et al, 1998). Through the observation of a transcranial Doppler, it has been shown that acupuncture on Baihui expedites the flow velocity of the middle cerebral artery, decreases vascular resistance, and increases cerebral blood volume (Liu et al., 1996).

XNKQ acupuncture can bidirectionally regulate hemodynamic parameters of acute stroke patients to assist cerebral blood flow, increase SOD activity, reduce LPO concentration, mitigate brain tissue damage, elevate the PGI2/TXA2 (prostacyclin/ thromboxane A2) ratio, and reduce the chance of thrombosis to advance brain tissue recovery (Shi, 2005). XNKQ acupuncture can ameliorate brain cell metabolism in cerebral infarction patients, stimulate the regeneration of brain cells after damage, and enhance the recovery of cerebral function (Shen & Shi, 2010). Acupuncture can notably reduce the difference in oxygen saturation between the arteries and the internal jugular bulb in acute cerebral ischemia patients, decrease the rate of cerebral oxygen uptake, and strengthen the tolerance of brain to ischemia and hypoxia, thus maintaining the balance of oxygen supply and demand and protect the brain in severe brain injury patients (Shen & Shi, 2009). XNKQ acupuncture has had positive regulation on neuropeptide Y and calcitonin gene related protein in patients' plasma. Moreover, it can also be used for treating acute cerebral infarction, and early intervention can yield a better clinical outcome. Proteomics studies have shown that XNKQ acupuncture uses multiple mechanisms, targets, and levels to fully treat cerebral ischemic stroke (Shi, 2006). When XNKQ acupuncture was first developed, it was mainly used to treat strokes involving limb paralysis, urination disorders, stress ulcers, arrhythmia, diabetes, and other complications and comorbidities. Whether XNKQ acupuncture has more

advantages compared to other types of acupuncture with respect to reducing the occurrence of complications will require further studies (Wu et al., 2008).

4.4 Conclusion

An experienced doctor can use acupuncture to augment consciousness disorder treatment. For patients with consciousness disorders from different causes, restoring consciousness acupuncture is used for treatment, and it provides satisfactory results. Our experience shows that several factors affect the recovery of people with consciousness disorders due to brain damage: 1. level of brain tissue damage – acupuncture is not an efficient treatment for patients with severe damage; 2. infections such as pneumonia, urinary tract infections, bedsores, and sepsis lead to poor results; 3. completeness of treatment – the effects are not significant enough for patients with interrupted treatment, regardless of regular Western treatment, therapy, or traditional Chinese treatment; 4. disease duration – patients who have certain diseases for more than three months have poor results or need longer treatments; 5. age – younger patients yield better results; and 6. psychological factors – patients who are optimistic improve faster than patients with who are depressed. Treating consciousness disorders requires care from various people, including neurologists, neurosurgeons, Chinese medicine practitioners, psychologists, dietitians, physiatrists, family members, and friends. Patients benefit from a comprehensive treatment plan that further prevents the occurrence of complications. If Western and Chinese treatments are combined, the best potential outcomes can be achieved, expediting and boosting the efficacy of treatment, which decreases medical costs.

Condition/study	No.	Design	Test group	Control group	Results
Infarction, intracerebral hemorrhage (Ding & Guo, 2004)	99:76	Random control	Add acupuncture on Twelve Well points and exsanguinate	Regular Western treatment	GCS score changes after 80 minutes: test group 0.31± 0.0.7; control group -0.14± 0.05
Ma et al., 2006	46:45	Case control	Add main points: Neiguan, Renzhong, Sanyingjiao; auxiliary points: Jiquan, Weizhong, Chize	Regular Western treatment	Consciousness rate after 10 days of treatments: test group 54.35%; control group 33.33% Consciousness rate after 20 days of treatments: test group 73.91%; control group 53.33%

Condition/study	No.	Design	Test group	Control group	Results
Shi, 2005	9005	Case series	Main Points: Neiguan, Renzhong, Sanyingjiao; auxiliary points: Jiquan, Weizhong, Chize		Recovery：59.27%; valid: 23.15%; Improved: 16.14%; invalid: 0.44%; death: 1.0%
Intracerebral hemorrhage Wang, 2008	30:30	Random control	Add consciousness point, Yongquan, Shuiquou, Taichong, Quchi	Regular Western treatment	Consciousness time and rate after 30 days: test group 33.00± 5.00 days, 80%; control group 80.00± 4.00 days, 60%
Intracerebral hemorrhage postoperative Li et al., 2006	50:50	Random control	Add XNKQ acupuncture (Neiguan, Shuigou, Sanyingjiao, Baihui, Fengchi, etc.); Scalp acupuncture (parieto-temporal anterior and posterior oblique line); Body Acupuncture (Chengjiang、Jiansanzhen, Shousanli, Zusanli, etc.)	Regular Western treatment	Improvement of neurological deficit: test group 86.0%; control group 14.0%
Traumatic brain injury Peng et al., 2010	29:27	Random control	Add Shuigou, Yintang, Electroacupuncture on Neiguan	Regular Western treatment	Consciousness time and rate after 1 month: test group 18.57± 7.14 days, 72.4%; control group 24.60± 5.00 days, 37.0% After 3 months: test group 25.04± 16.68 days, 86.2%; control group 37.90± 16.94 days, 77.8%

Condition/study	No.	Design	Test group	Control group	Results
Fu et al., 2009	16:16	Random control	Add electroacupuncture on Neiguan and Quze	Regular Western treatment	promoting consciousness rate: test group 25.0%(7 times), 81.3% (30 times); control group 0(7 times), 43.8%(30 times)
Liu et al., 2010	15:14	Case control	Add electroacupuncture on Baihui, Shuigou, Yongquan, Laogong, and Fengchi	Regular Western treatment	Consciousness time and rate: test group 40.1 days, 73.3%; control group 51.8 days, 28.6%
Bi, 2004	38:22	Case control	Acupunctures: Baihui, Neigun, Qihai, Guanyuan, Zusanli, Siguan, Shuigou, Zhongchong, Sanyinjiao, Laogong, and Yongquan Moxibustion: Baihui, Shenque, Qihai, Guanyuan, Zusanli, Yongquan	Regular Western treatment	Test group: 31 casees restore consciousness, 5 cases with increasing GCS, 2 cases are invalid; control group data are 13, 5, 4, respectively
Consciousness disorders in brain surgery					
Chen et al., 2009	46:46	Random control	Add acupuncture on Twelve Well points, Shuigou, Baihui, Sishencong, and electroacupuncture on Zhisanzhen	Regular Western treatment	Test group regular recovery rate 80.4%, efficiency 100%, reduces consciousness time; Control group has 32.6%, 91.3%, respectively

Table 6. Summary of acupuncture therapy for consciousness disorders.

5. Acknowledgment

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2

Use of Acupuncture for the Chronic Neck Pain: Application to Adults as Part of Primary Health Care

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1. Introduction

Neck pain (cervical pain) has been described in the literature as a common complaint in the adult population (van der Velde et al., 2010; Mäntyselkä et al., 2010). It is more prevalent in women, both as regards the number of cases and extent of this type of pain (Fejer et al., 2006). Neck pain can occur due to jaw disorders, whose etiology is complex and unresolved (Bretan et al., 2005). These disturbances may trigger other affection, in addition to neck pain, such as: headaches, earaches, popping joints, mandibular locking, and lateral deviation of the mandible (Okeson, 1998; Simma et al, 2009). The onset of these affections may be linked to the close relationship between the cervical spine and temporomandibular joint (Tedeschi-Marzola, 2005), and may also included the equilibrium relationship between the braincase, temporomandibular joint, articulation of the skull and cervical spine (Butler, 2003).

The management of individuals with chronic pain has been a challenge, since various factors may interfere in the development of this type of pain. Outstanding among these factors are emotional situations; interests in obtaining workers' compensation benefits – being laid off work and/or retired due to disability (Kraychete et al. 2003). Moreover, conditions of anxiety and depression tend to make it difficult to apply strategies used for the treatment/control of neck pain (Institute for Clinical Systems Improvement, 2007).

Neck pain and headaches are syndromes that represent a clinical challenge for dentists and physicians (Lu et al., 2001). Furthermore, neck or cervical pain has been recognized as a frequent complaint among adults, a fact that has resulted in a high demand for medical services, in addition to causing absenteeism and incapacity to work (Willich et al, 2006; Matsudaira et al., 2010). Painful disorders that affect the neck area are known as common incapacity affections that involve high cost medical treatment (Haines et al., 2009).

Conventional therapeutic treatments are not always capable of producing chronic pain relief (Simma et al., 2009). The history of acupuncture reveals the existence of an ancient relationship between this therapy and the treatment of pain (Filshie and Cummings, 2001).

The use of acupuncture in public health care systems has been recommended by the World Health Organization – WHO (1999). This Organization has also recommended the use of acupuncture in the treatment of neck pain, in view of the proven effectiveness of this therapy (WHO, 2002).
In some countries the use of acupuncture in addition to conventional medical treatment has shown cost-benefit (Kim et al., 2010). As acupuncture is a non-pharmacologic treatment modality (Wang et al., 2008) and has presented satisfactory results in reducing pain intensity (Lu et al., 2001) it could be more widely used in chronic health situations, especially for primary care in the public health service.
The aim of the present study was to describe the results obtained with acupuncture treatment applied to adult patients with chronic neck pain, assisted by a public service providing primary health attention, located in the south of Spain during the year 2008.

2. Methods

The present work is characterized as clinical study (case series) conducted to verify the possible proportionate benefits to the health of patients with chronic neck pain treated by acupuncture. The study sample was composed of 100 patients diagnosed with chronic cervical pain. Data collection was accomplished in the Pain Treatment Unit - UTD, located at the Doña Mercedes Health Centre (Spain). Patients included in the present study were those who signed the informed consent document, with complaint of chronic cervical pain (pain experience equal to or longer than 03 months) and, who then received two acupuncture sessions during the months from January to December of 2008 (participation in at least 2 sessions).
To measure pain intensity, the Visual Analogue Scale (VAS) from 0 to 100 mm was used (Wewers & Lowe, 1990), and the Likert Scale from 0 to 4 points was used to measure the following variables: frequency, level of incapacity caused by the pain, level of sleep disorders caused by pain, and analgesic consumption (Likert, 1932; Likert, 1967). The studied variables were classified showed in table 1.
The other variables were analyzed through the absolute and relative frequencies (gender, marital status, and time of pain experience) or mean and standard deviation (age). Initially the data were tabulated in spreadsheets (Excel) and later the Software SPSS version 17 was used to perform statistical analysis. The patients were submitted to 1 acupuncture session a week.
The data were analyzed by means of comparing the values obtained in the first and in the last acupuncture consultation. The Wilcoxon test for two dependent samples was used for intensity, frequency and level of incapacity caused by the pain; level of sleep disorders caused by pain; and analgesic consumption. The power of the test was a minimum of 0.80, and Alpha of 5%, according to the pattern most frequently used in the medical literature (Gardner & Altman, 1986; Gong et al., 2000; Lauer, 2006).

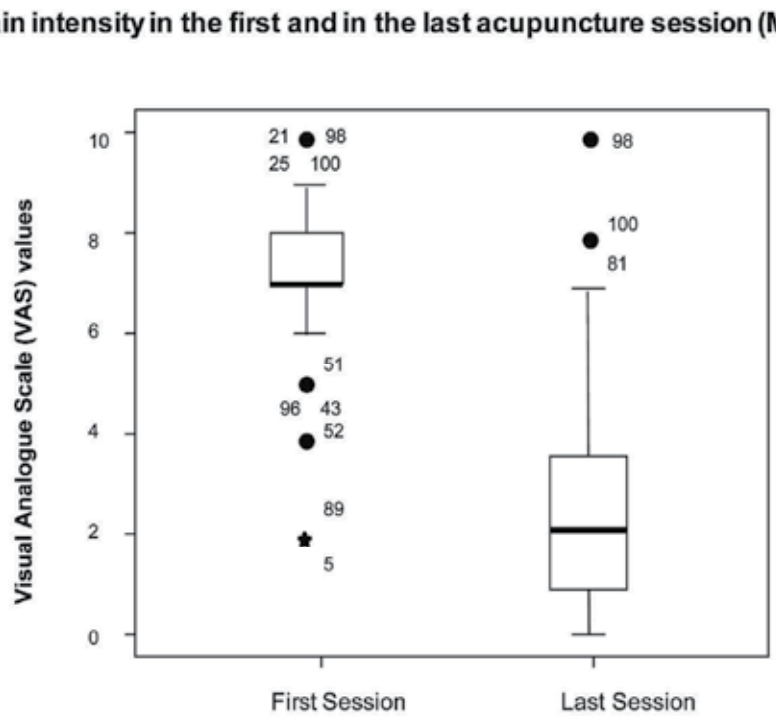
3. Results

The 100 patients participating in this study, received an average of eight acupuncture sessions, and the majority of them were women (84%).
As regards marital status, 78% of the individuals were married; 12% single; 8% widowers and 2% divorced. The average of age and the respective standard deviation were 56 and 13 years.

Studied variables	Levels	Description
Pain Frequency	0	never feels pain
	1	pain that appears sporadically, or with a duration of up to 1 hour a day, every day of the week; or pain that appears on less than 02 days a week, including pain with a duration of 1 hour
	2	presence of persistent pain during a maximum of 6 hours a day
	3	presence of daily pain with a duration of 6 hours and less than 24 hours
	4	presence of constant pain
Analgesic Consumption	0	never consumes analgesic
	1	consumes analgesic sporadically or less than the dose recommended for the illness
	2	consumes analgesic respecting the doses recommended by the medical practice guidelines for the illness
	3	consumes analgesic with a higher dose than that recommended by the medical practice guidelines for the illness
	4	needs to increase the number of analgesics, as well as continual increase in the dose administered.
Level of Incapacity	0	there is no incapacity
	1	there is incapacity for doing heavy work, or work that demand great physical effort
	2	the patient is unable to accomplish daily tasks
	3	the patient needs help to dress or to take bath
	4	complete incapacity
Sleep Disorder	0	the pain does not wake up the patient
	1	the patient wakes up occasionally during the night because of the pain
	2	the patient wakes up 1 time every night because of the pain
	3	the patient wakes up 2 or more times every night, most of the week, because of the pain
	4	the patient does not sleep because of the pain

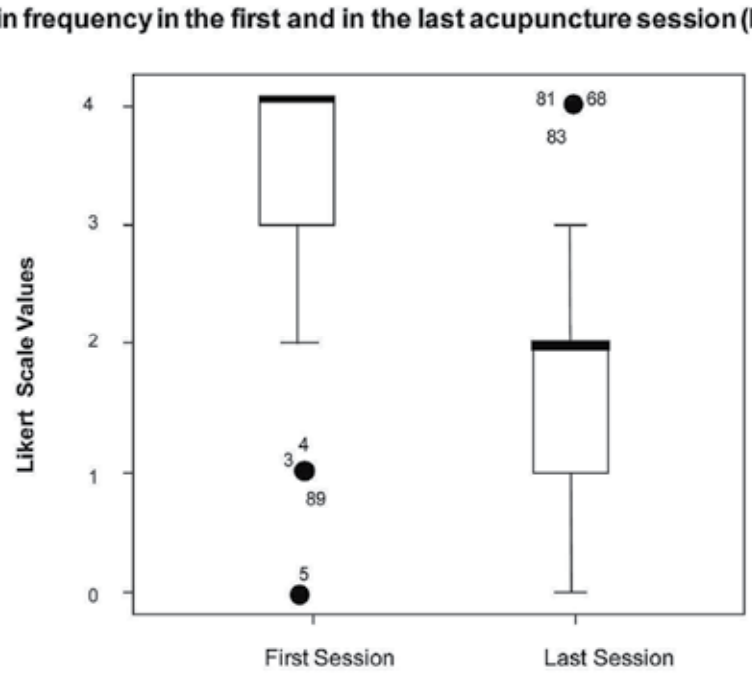
Table 1. Levels of pain, analgesic consumption, incapacity and sleep disorder

The results with regard to pain experience indicated its predominance for a period from 12 to 180 months (71%), which corresponds to a period of 1 to 15 years; followed by pain for a period of less than 12 months (17%); pain for a period of longer than 180 months (12%).
The results of the Wilcoxon test for dependent samples revealed significant changes ($p < 0.0001$) in the: pain intensity, pain frequency, analgesic consumption, incapacity caused by pain and sleep disorders due to pain (Graphs 1, 2, 3, 4 and 5).
The pain intensity was classified in the first acupuncture session and for most of the patients it was close to the maximum value of VAS (median = 7), whereas in the last session, the patients reported pain close to the lowest degree of this scale (median = 2) - Graph 01.

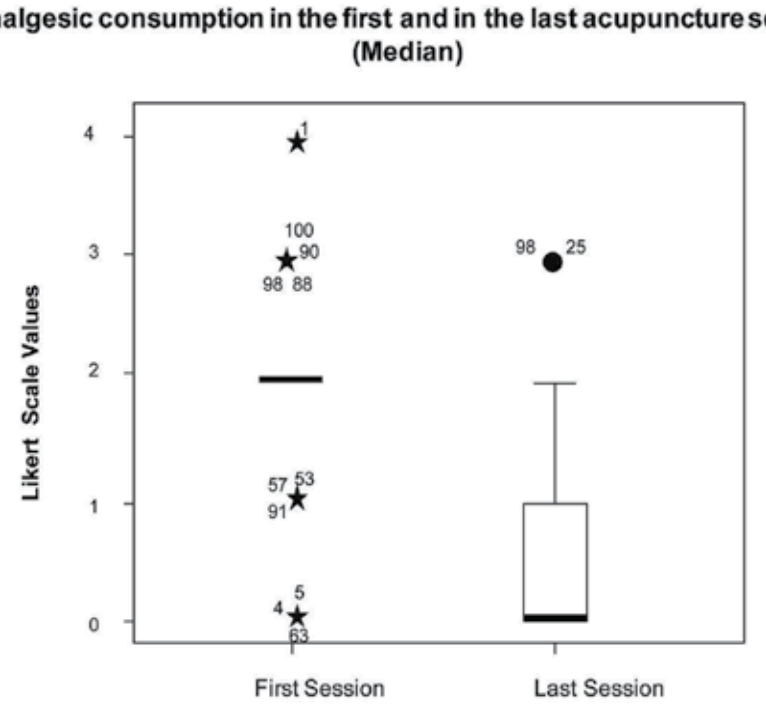


Graph 01. Pain intensity in the first and in the last acupuncture session (Median)

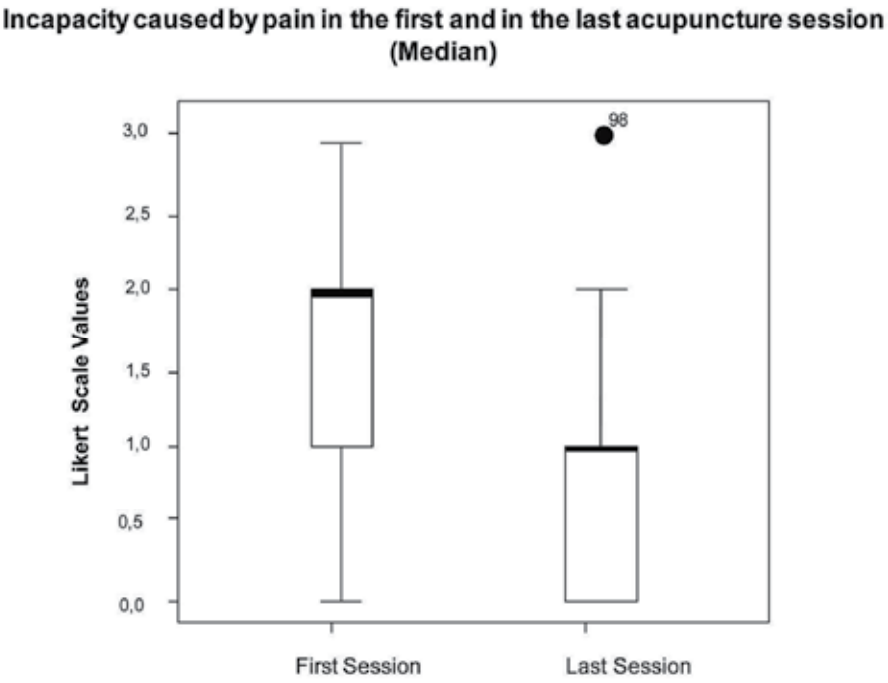
As regards pain frequency (Graph 02) it was observed that in the first session the majority of the patients reported the presence of constant pain (median = 4), and at the end of the session this population reported the presence of persistent pain with duration of at the most 06 hours a day (median = 2).
In the first session, most of the patients reported that they consumed analgesic and respected the doses recommended by the medical practice guidelines for the illness that affected them (median = 2), however, in the last session of the proposed treatment, practically the absence of consumption of these medicines was related (median = 0) - Graph 03.
Data as regards the level of incapacity (Graph 04) demonstrated that in the first acupuncture session, most of the patients reported that they were unable to accomplish daily tasks (median = 2), while in the last session, most of the patients reported no such incapacity (median = 0).



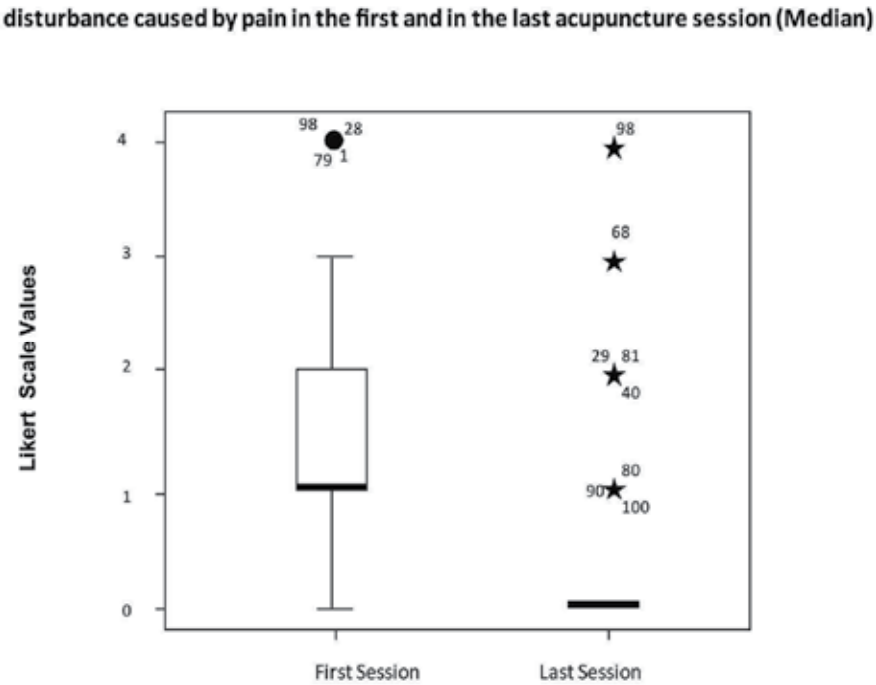
Graph 02. Pain frequency in the first and in the last acupuncture session (Median)



Graph 03. Analgesic consumption in the first and in the last acupuncture session (Median)



Graph 04. Incapacity caused by pain in the first and in the last acupuncture session (Median)



Graph 05. Sleep disorder caused by pain in the first and in the last acupuncture session (Median)

In the first treatment session the patients classified sleep disorders as being of degree 1 (median = 1), which corresponds to the fact of waking up occasionally during the night because of pain, however, in the last session, most of the patients reported that they did not to wake up for this reason (Graph 05).

4. Discussion and conclusion

In the medical literature, the type of study conducted by observing a group of patients group who present common characteristics is called a "case series". Such studies are used to describe some of the clinical, physiopathological or functional aspects of affections, in addition to reporting aspects with regard to the treatment or diagnostic procedure used in this context (Porta, 2008).

Due to the fact of presenting a detailed report of the clinical experience of the studied subject, the publication of case series can indeed contribute to the production of relevant bibliographical material. On the other hand, this methodology presents some limitations that prevent the inference of a causal relationship (Kestenbaum, 2009) and the confirmation of hypotheses (Hennekens & Buring, 1987).

The lack of control groups is an inherent feature and limiting the case series (Porta, 2008). However, this methodology has been widely incorporated in the assessment of health technology, especially when there is no strong evidence on the effectiveness of therapy tested (Dalziel et al, 2005).

Considering the advantages and disadvantages mentioned above, in the present study the design principles called case series it was adopted in order to make a contribution to more detailed scientific knowledge with regard to acupuncture treatment for cases of chronic cervical pain attended by the public service. That was made because decisions about health policies are going to be necessary even in the absence of scientific evidence produced by means of the randomized clinical trials (Dalziel et al., 2005). The importance of conducting this type of study is pointed out insofar as it represents the possibility of helping other researchers that have produced similar observations, aiming to create better conditions for formulating hypotheses (Hennekens & Buring, 1987) and for developing future studies with higher methodological quality.

Chronic pains have been considered as a severe problem in health attendance, not only in terms of human suffering and morbidity, but also in terms of the economic implications for society (Sjogren et al., 2009). Pains that affect the area of the back, among these, the cervical pain represent one of the three most frequent complaints among the affections of the musculoskeletal system (Trinh et al, 2007). They have been considered a frequent and common health problem in the adult population (Wening et al., 2009; Kaaria et al., 2009).

The effect of an appropriate treatment performed by acupuncture can last up to three years after the last session (He et al.; 2004). Ezzo et al. (2000) verified that 06 acupuncture sessions was associated with positive results (benefits) and other authors corroborate these results (Petrie 1983; Petrie 1986; White 2004). In the present case series this association was not verified. However, it was verified that the patients received an average of 08 acupuncture sessions and that the results of these interventions demonstrated significant improvement in all the studied variables.

Cervical pain has been reported in the literature as being a common symptom manifested in the word; and it mainly affects women (Fejer et al., 2006; Trinh et al., 2007). In the present study it was verified that most of the patients treated with acupuncture were women (84%),

finding agrees with Holdcroft et al. (2005) and according to Vas et al. (2007) represents the profile of users of the public health services offered in the studied area.

Married individuals composed the greater part of the sample in the present research (78%). Similar data are in agreement with these results (Niemtzow et al., 2008). However, it is pointed out that marital status has not been evaluated in most of the published studies on chronic cervical pain treated with acupuncture.

The mean age verified in the present study, when compared with researches that evaluated the management of the chronic cervical pain with the above-mentioned therapy, was higher than the value mentioned in the study published by Salter et al. (2006); Zheng et al. (2008) and lower than that mentioned in the study published by Itoh et al. (2007).

In agreement with Sardá Jr. et al. (2009) scientific studies published had recognized that several psychological factors can influence the degree of pain experience, the reaction of the individuals to the perception of pain and impact of pain on their daily activities. Thus, the experience of chronic pain has been defined as being a product of the complex and dynamic interaction of several biological, social, psychological, environmental and family factors which result in a non linear relationship between the beginning of benign chronic pain and their effects on the human body (Shipton, 2008). In the present study the time of experience of the pain felt occured predominantly between 12 and 180 months (71% of the cases) which corresponds to an average of 6.5 years, higher than the value found by Itoh et al (2007); Willich et al. (2006); Salter et al. (2006).

According to He et al. (2004), the establishment of an appropriate treatment with acupuncture was capable of reducing effectively the intensity as well as the frequency of muscular pain located in the cervical area. The findings of the present research agree with data of the above-mentioned study and corroborate the results of other randomized controlled clinical studies conducted by Itoh et al. (2007) and Witt et al. (2006).

It is known that opioid analgesics have been prescribed as fundamental therapy of first choice in the treatment of patients with chronic pain (Reid et al., 2002; Rosenblum et al., 2008; Victor et al., 2009). However, patients who were treated in the long term with this type of medication became more depressive, had poor life quality (Zheng et al. 2008) and presented passive attitudes to chronic pain management (dependence and addiction) (Breivik, 2005). Sleepiness, qualm, vomiting, constipation and possibility of the need for gradual increase in the dose of the medicine are mentioned in the literature as adverse effects of opioid analgesic consumption (Gourlay, 1999).

Borenstein (2007) reported that non pharmaceutical therapies such as acupuncture, for instance, present the potential of reducing chronic cervical pain and represent a therapeutic modality exempt from toxicity. The reduction of the consumption of analgesics due to acupuncture treatment for chronic cervical pain was verified in the present study and this findings ratifies similar results in two other publications by Vas et al. (2007) and Hansson et al. (2008) respectively.

Witt et al. (2006) verified a reduction in the intensity and incapacity caused by the chronic cervical pain in patients treated with acupuncture. Similarly, in a study published by Hansson et al. (2008), adult patients affected by chronic musculoskeletal pain reported an increase in the capacity to perform daily activities, as well as in work activities during a period of up to 06 months after the end of acupuncture treatment. Such findings agree with the results of the present research, which verified a reduction in the incapacity caused by chronic cervical pain in the studied population.

The findings of the present study indicate that the patients treated with acupuncture presented a significant statistic reduction in sleep disorders. However, this condition is a theme that has hardly been explored. In agreement with some authors, the latest evidences on effect of acupuncture in this disorder cannot yet be considered clarified (Chen et al., 2007; Yeung et al., 2009).

The characteristics of the researches on back pain, among these cervical pains, have recently been modified and have gone from a biomedical approach to a biopsychosocial approach (Sieben et al., 2009). Thus it is important to remember that the attitude of patients submitted to treatment with alternative and complementary therapies can be a predictive factor for positive results (Sasagawa et al. 2008), nevertheless, studies conducted by Lewith et al. (2002) and White (2003) suggest the opposite. The present scientific investigation did not explored the above-mentioned characteristic, however, the explanation of the interference of the patient's attitude in acupuncture treatment, is relevant and interesting data to be studied in future works. Other approaches such as: cost effectiveness, variations of acupuncture technique, association of cervical pain with other areas of the spine also constitute interferences that need to be studied to perfect the understanding and planning of future strategies in public service of the population by means of acupuncture and auriculotherapy.

Reports of studies conducted over a period of more than 10 years revealed that the treatment of chronic pains by acupuncture presented acceptable cost-effectiveness when compared with conventional therapies used for treating this type of pain, in addition to demonstrating that this therapy was clinically effective in these circumstances (White & Cummings, 2009). Other publications have reported that the offer of acupuncture therapy in the primary health care service was capable of providing a reduction in routing patients at other levels of attention including reducing costs related to prescriptions (Johnson, 2008).

The use of acupuncture promoted significant economy with regard to expenses originating from conventional pharmacological treatment in individuals affected by migraine who were attended in units of the public service of health in Italy (Liguori et al., 2000). In England in the same treatment mentioned above was verified an additional cost due to the use of acupuncture when it was used as supporting treatment to the conventional therapeutics. Such increment was considered a small expense when compared with the improvement in the patients' quality of life and to the cost-effectiveness of the use of acupuncture in comparison with the number of other interventions performed in the English health system (Wonderling et al., 2004).

With further regard to the expenses incurred with public health systems in agreement with the international threshold of the values of cost-effectiveness in health acupuncture can be considered a valid strategy for the alternative treatment of chronic cervical pain in agreement with the cost-effectiveness relationship published in a multicentric study conducted in the public health service in Germany (Willich et al., 2006).

The present study was conducted in a public service of primary attention and the improvements perceived in the levels of the patients' health aroused the idea that an increase in the offer of this type of therapy is desirable in view of fact that some authors verified clinically pertinent benefits in patients attended by acupuncture, in these services (Valdés et al., 2001; Vickers et al., 2004; Vas et al., 2007; Witt et al., 2008). Furthermore the use of the mentioned therapy constitutes an alternative important to the treatment of patients who do not respond to the conventional medical treatment applied to musculoskeletal pains (Kam et al, 2002).

It was concluded that acupuncture can be considered a treatment option in the cases of chronic cervical pain in adult patients assisted by the public health service in the primary care brought as it important benefits to the health of these individuals.

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3

Molecular Evidence: EA May Inhibit the Muscle Atrophy

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1. Introduction

Aging is of critical interest in the medical, health, and social domains, especially in developed countries and newly industrializing countries. Because muscle atrophy in elderly individuals can cause falls, its prevention is important. Moreover, prevention of aging-related reduced skeletal muscle mass may allow a higher quality of life in the elderly, because reduced muscle function is linked to the occurrence of several chronic diseases (Handschin & Spiegelman, 2008).

High-intensity resistance training effectively maintains muscle mass and strength, but rigorous training is difficult for elderly people (Seynnes et al., 2007).

Acupuncture is a well-known traditional technique in eastern Asia that is used to maintain health and cure many diseases. Major acupuncture techniques utilize penetration of the skin by thin, solid metallic needles, which are manipulated manually or are stimulated electrically. This electrical needle stimulation is called electroacupuncture (EA) (Klein & Trachtenberg, 1997). EA is effective not only for pain but also for muscle problems, such as stiffness, exhaustion, and atrophy, in many patients including elderly people (Zhang, 2003).

Acupuncture studies have reported the nerve routes of acupuncture signal transmission, effects via the spinal reflex, and reactions in the brain (Cho et al., 1998; Murase & Kawakita, 2000; Uchida et al., 2000). Figure 1 is a schematic diagram showing the routes of EA stimuli between treated points and organs. In a previous investigation on acupuncture, only a neural mechanism of pain reduction was clear; endogenous opioid (beta endorphin and enkephalin) is induced under the acupuncture anesthesia (Chung & Dickenson, 1980).

However, the molecular mechanisms of other effects of acupuncture were as yet not defined (Acupuncture, 1997). Scientific evidence of efficacy is an important as for the CAM research, as for research in Western medicine. The enhancement of blood flow in target organs of acupuncture treatment, which is a major reason for the effectiveness of acupuncture (Niimi & Yuwono, 2000), cannot sufficiently explain the recovery of muscle from exhaustion because it is not clear how the supplied oxygen and nutrients would be used during the cellular recovery process. Many cellular and physiological processes are regulated at the transcription level of gene expression. The identification of genes specifically modulated during the process of acupuncture would provide an initial step toward elucidation of the underlying mechanisms of this technique.

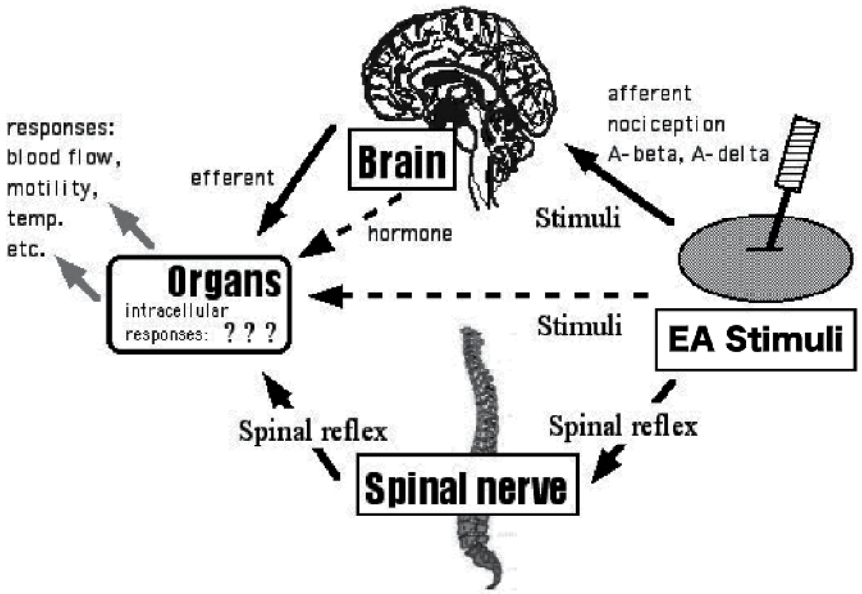

Fig. 1. Schematic diagram of transmission of Electroacupuncture signals. Solid arrows indicate the nervous system; broken arrows, the extraneural system; gray arrows, organ responses. Modified from Takaoka et al.(Takaoka et al., 2007).

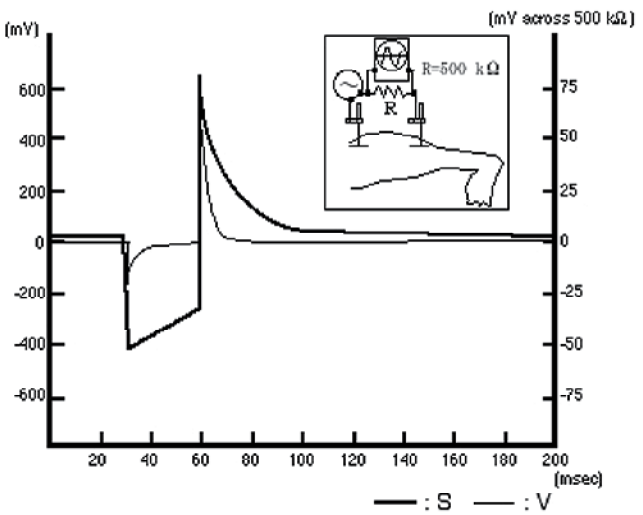

Fig. 2. Electrical voltage and current were measured with a digital oscilloscope (LS140; LeCroy, Chestnut Ridge, NY) connected to circuits as shown. Electrical current was calculated on the basis of voltage across a 500-k resistor.

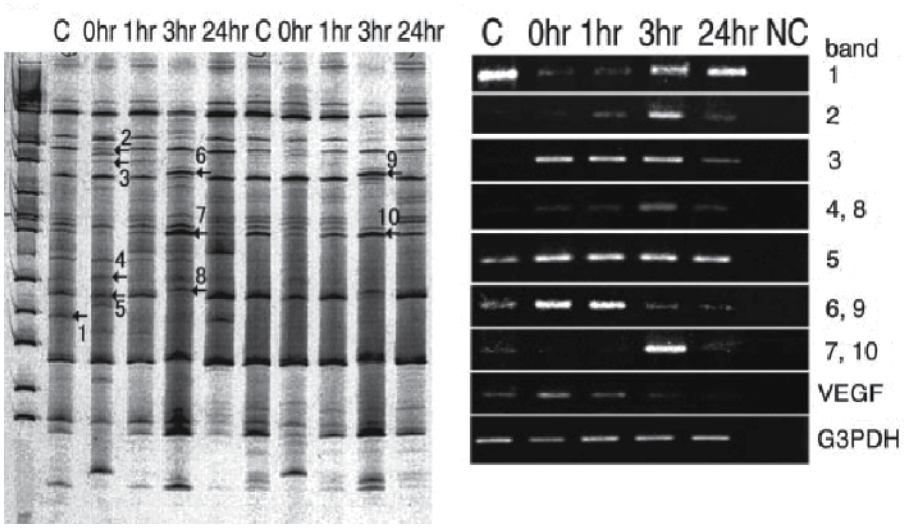

Fig. 3. Example of a typical pattern of gene expression for 10 transcripts identified by mRNA fingerprinting analysis. Total RNA from mouse skeletal muscle without treatment (control) and 0, 1, 3, or 24 h after electroacupuncture (EA) treatment were subjected to mRNA fingerprinting by using an amplified restriction fragment length polymorphism (AFLP)-based method (Left). Arrows indicate ten bands that were selected and sequenced for gene identification. Results of semiquantitative RT-PCR are also shown (Right). Lanes are as follows: lane C, no EA stimulation (control); lane 0hr, EA-treated sample just after stimulation; lane 1hr, EA-treated sample 1 h after stimulation; lane 3hr, EA-treated sample 3 h after stimulation; lane 24hr, EA-treated sample 24 h after stimulation; lane NC, negative PCR control containing no cDNA template in the PCR mixture; VEGF, vascular endothelial growth factor; G3PDH, glyceraldehyde-3-phosphate dehydrogenase (an internal control).

We suggested that EA (Fig. 2) may be an appropriate choice for effective prevention of muscle atrophy, on the basis of our results from a transcriptome study (Fig. 3), which provided molecular evidence obtained from skeletal muscle of wild-type mice: EA suppressed expression of the myostatin gene (Fig. 4), an endogenous inhibitor of muscle growth and satellite cell-related muscle regeneration, and EA induced a proliferative reaction of muscle satellite cells (Fig. 4) (Takaoka et al., 2007). Thus, in view of our previous basic research, EA may be an effective method for retaining muscle mass.

To investigate the effect of EA on muscle atrophy, we used a hindlimb suspension model. Hindlimb-suspended (HS) rodents are a commonly used animal model for pathological studies of the loss of muscle mass, such as disuse muscle atrophy (Däpp et al., 2004; J.F. Desaphy et al., 2001; Dupont-Versteegden et al., 2006; Gallegly et al., 2004; Pisani & Dechesne, 2005; Stelzer & Widrick, 2003). In this model, mainly postural muscles such as the soleus demonstrate reduced mass (Thomason & Booth, 1990). In addition, studies of HS mice suggested that the cross-sectional muscle area was reduced (Nguyen & Tidball, 2003).

The aims of our study were to evaluate the effect of EA according to the measures of muscle mass and myofibre diameter in a murine HS model and in this murine model after repeated EA treatments, and to analyse expression of the myostatin gene and the ubiquitin ligase genes muscle RING finger 1 (MuRF-1), muscle atrophy F-box (MAFbx), and Casitus b-lineage lymphoma-b (Cbl-b) of insulin-like growth factor I (IGF-1)/thymoma viral proto-

oncogene (AKT) pathway, as related to disuse muscle atrophy (Bodine et al., 2001; Centner et al., 2001; Keane et al., 1995; Sandri et al., 2004; Takaoka et al., 2007). This investigation corresponds to a preclinical stage in translational research, that is, preclinical development after basic research that we previously performed. In addition, this study had the potential to acquire direct experimental evidence from an EA-treated animal model.

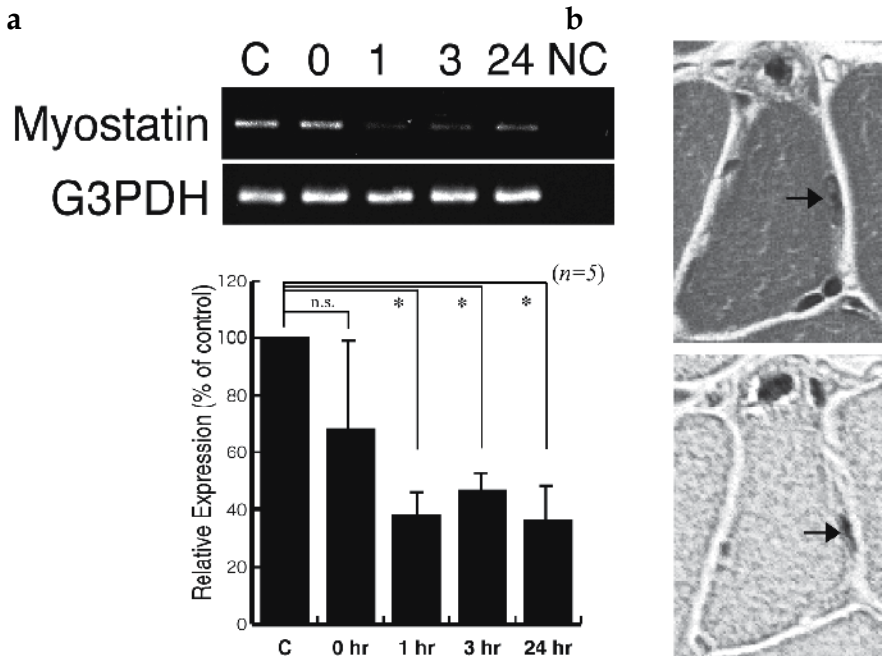

Fig. 4. RT-PCR analysis of myostatin gene expression after the EA (a) and Histochemical and immunohistochemical findings for EA-treated muscle (b). a, Data were obtained from different individual samples (n=5). G3PDH was used as a loading control. See Fig. 3 for lane designations. Relative transcript levels of myostatin are shown (means and SD). *P <0.05; NS, not significant. b, Hematoxylin and eosin (H&E)-stained sample (upper) and immunohistochemical sample stained by PCNA antibody (lower). Arrows indicate positive nuclei and nucleoli in EA-treated muscle.

2. Materials and methods

We first compared the effects of EA, as evidenced by muscle mass and myofibre diameter, in HS mice and HS mice treated with EA (EA/HS). Then we used real-time quantitative RT-PCR to analyse myostatin and ubiquitin ligase gene expression in atrophic muscles of HS mice and in muscles of EA/HS mice. In this research, all mice used were treated according to the Standards Relating to the Care and Management, etc. of Experimental Animals (Ministry of the Environment, Tokyo, Japan). This study was approved by the Institutional Animal Care and Use Committees, at the University of Tsukuba (Permission number 200) and Kobe University (Permission number P080913) and was carried out according to the Animal Experimentation Regulations of these Committees. It was also approved by the Committee for Safe Handling of Living Modified Organisms at Kobe University (Permission number 17-21) and carried out according to the Guidelines of the Committee.

2.1 Murine hindlimb suspension model and EA stimulation

We used 8-week-old Crlj:CD1(ICR) male mice (each weighing 30–35 g; Charles River Japan, Yokohama, Japan) for three groups: control, 7 days of HS, and 7 days of EA/HS. HS mice were prepared by using a modified version of the apparatus of Miyazaki *et al.* (Miyazaki et al., 2006). A sigmoid hook connected to a metal fitting was fastened to the tail with adhesive tape, so that hindlimbs could not touch the floor. The suspension height was adjusted for the forelimbs so that the mice could move. All groups of mice had *ad libitum* access to food and water for the duration of the experiment.

For EA stimulation, EA/HS mice were anesthetized by means of an intraperitoneal injection of pentobarbital sodium (2.5μg/g); control and HS mice were similarly anesthetized. Stainless-steel acupuncture needles (two needles, each 40 mm long and 0.16 mm in diameter; Seirin Co. Ltd., Shizuoka, Japan) were then inserted into the anesthetized EA/HS mice at the origin and insertion of the soleus muscle. The needles were stimulated with an electrical stimulator (Ohm Pulser LFP4000A; Zen-iryoki Co. Ltd., Fukuoka, Japan), as in our previous study (Takaoka et al., 2007). Every other day, on days 1, 3, 5, and 7, mice received EA for 30 min with 10-Hz pulse wave repetitions. After 7 days, animals were evaluated (Fig. 5).

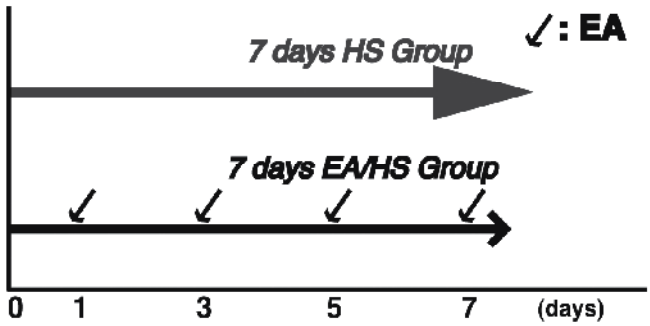

Fig. 5. Experimental design of EA stimulation

2.2 Relative soleus muscle mass and Histochemical analysis

All mice (n = 10, for each time point for each group) were dissected after determination of body weight. For each mouse, both soleus muscles were excised and their wet weights were measured. Then, the relative muscle mass (wet weight per body weight) was calculated to allow groups to be compared.

For histochemical analysis of muscle fibres, soleus cryosections, after having been frozen in 2-methylbutane, were sectioned with a cryostat (CM3050; Leica, Wetzlar, Germany). Frozen sections were stained with hematoxylin and eosin (H&E) according to our previous report (Takaoka et al., 2004). They were then examined with a light microscope (BX51 Research Microscope; Olympus, Tokyo, Japan) equipped with a digital camera (MicroPublisher 5.0; Roper Japan, Tokyo, Japan). To obtain myofibre diameters, an image-based software (MicroAnalyzer; Nihon Poladigital, K.K., Tokyo, Japan) was used. These values are given as means ± S.D. Soleus mass and myofibre diameter for each time point for the three groups are given as percentages of the control at day 0. Student's t test was used for statistical analysis, with P values of <0.05 considered statistically significant.

2.3 Gene expression analysis

To examine myostatin gene expression in three experimental groups (control, HS, and EA/HS; n = 7 for each time point for each group), total RNA was extracted from soleus

muscle. Total RNA (5-μg samples) was reverse-transcribed into cDNA by using SuperScript RT (SuperScript Preamplification System; Gibco/BRL, Gaithersburg, MD), according to the company's instructions. Expression levels were compared by using real-time quantitative RT-PCR analysis with gene-specific primers as follows: myostatin: sense: 5'-GACAAAACACGAGGTACTCC-3'; antisense: 5'-GATTCAGCCCATCTTCTCC-3'; *MuRF-1*: sense: 5'-CTCCTTGTGCAAGGTGTTTG-3'; antisense: 5'-CCAGCATGGAGATGCAGTTA-3'; *MAFbx*: sense: 5'-AGCGCTTCTTGGATGAGAAA-3'; antisense: 5'-ACGTCGTAGTTCAGGCTGCT-3'; and *Cbl-b*: sense: 5'-TCATTCAGAAAGGCATCGTG-3'; antisense: 5'-CGGGAGTGGTTTGTCTTGTT-3'. Real-time quantitative PCR was performed by using Power SYBR Green PCR Master Mix and StepOne (Applied Biosystems, Foster City, CA), according to the manufacturer's instructions. The reaction mixture consisted of 2 μl of SYBR Green, 4 μl of cDNA, and each primer at 5 pmol, plus water to a final volume of 20 μl. The PCR conditions were 95°C for 10 min followed by 50 cycles for 95°C for 15 s, 60°C for 60 s, and then 95°C for 15 s, 60°C for 60 s, and 95°C for 15 s.

Three internal control genes for this research were chosen from six housekeeping genes, β-actin (*Actb*), β_2-microglobulin (*B2m*), glyceraldehyde-3-phosphate dehydrogenase (*GAPDH*), β-glucuronidase (*Gusb*), transferrin receptor (*Tfrc*), and 18S rRNA, by using the method of Vandesompele *et al.* (Vandesompele et al., 2002). Then the relative expression levels were calculated by means of comparison with the geometric mean of the expression of the three internal control genes. These values are given as means ± S.D. Data related to myostatin gene expression are presented as percentages of control. Student's *t* test was used for statistical analysis, with *P* values of <0.05 considered statistically significant.

3. Results

In view of our previous research indicating that EA-induced myostatin gene suppression may help prevent muscle atrophy, we continued our investigations of this effect of EA by using a pathological animal model in a preclinical study: hindlimb-suspended (HS) mice in the disuse muscle atrophy model. We first compared the effects of EA, as evidenced by muscle mass and myofibre diameter, in HS mice and HS mice treated with EA (EA/HS). We found that EA/HS mice maintained a soleus muscle mass that was not significantly different from that of control mice, whereas HS mice had significantly reduced muscle mass. Also, the diameters of myofibres in EA/HS mice, which were not significantly different from control values, were significantly larger than those in HS mice. We then used real-time quantitative RT-PCR to analyse myostatin and ubiquitin ligase gene expression in atrophic muscles of HS mice and in muscles of EA/HS mice. Repeated EA treatment suppressed expression of these genes in skeletal muscle of EA/HS mice but induced expression of them in HS mice.

3.1 Relative wet weight of the soleus muscle

To determine the relative wet weight of the soleus muscle, we measured the wet weight of the soleus muscle and the body weight of each mouse (total $n = 30$; $n = 10$ for each group). The HS group showed a significant reduction in relative wet weight of the soleus muscle when compared with the control mice ($P < 0.005$) (Fig. 2a).

These data suggest that hindlimb suspension led to muscle atrophy. Comparison of EA/HS mice with the control group showed no significant differences in relative soleus muscle wet weight at 7 days. EA/HS mice had a significantly higher relative soleus muscle weight than did HS mice ($P < 0.01$) (Fig. 6a). These results suggest that EA prevented muscle atrophy.

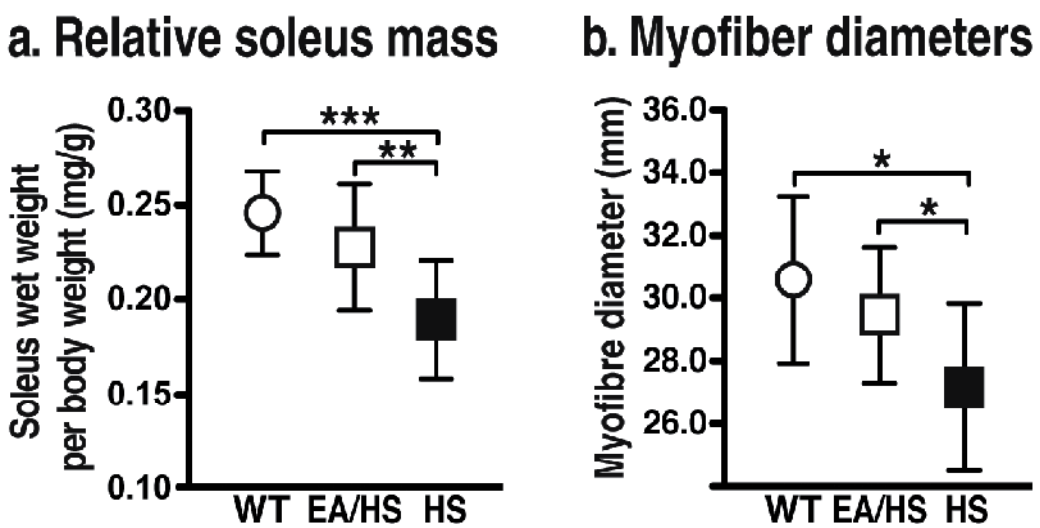

Fig. 6. Changes in relative soleus muscle mass and myofibre diameters after EA. a, The measure of wet weight of the soleus muscle per body weight shows an effect of EA on muscle atrophy. b, Effect of EA on prevention of muscle atrophy as shown by changes in myofibre diameters. Open circle, control mice; closed squares, HS mice; open squares, EA/HS mice; $^{**}P < 0.01$; $^{***}P < 0.005$; NS, not significant; $n = 10$.

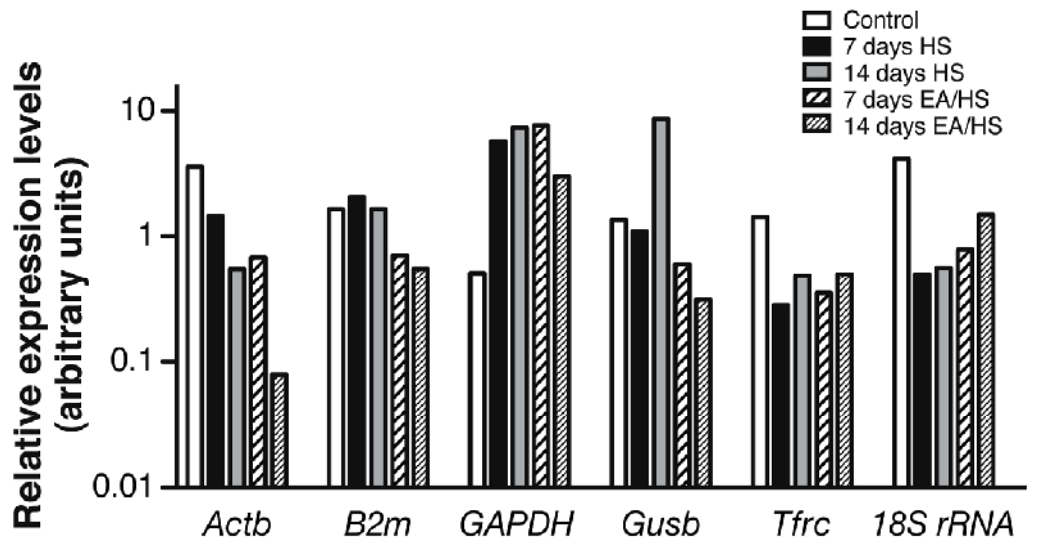

Fig. 7. Logarithmic histogram of expression levels of six housekeeping genes. An approximately 100-fold expression difference is apparent between the most and least abundantly expressed gene, as well as treatment-specific differences in expression levels for particular genes (for example, *Actb*). Genes are as follows: *Actb*, β-actin; *B2m*, β_2-microglobulin; *GAPDH*, glyceraldehyde-3-phosphate dehydrogenase; *Gusb*, β-glucuronidase; *Tfrc*, transferrin receptor; and *18S rRNA*, 18S ribosomal RNA.

3.2 Diameters of muscle fibres in cross section

Soleus muscles from all groups of mice were stained with H&E and muscle fibre diameters were measured. HS mice had significantly reduced cross-sectional muscle fibre diameters when compared with control mice. EA/HS mice had significantly larger muscle fibre diameters than HS mice (Fig. 6b). These findings suggest that EA prevented the muscle atrophy that was caused by hindlimb suspension. EA maintained muscle diameter sizes similar to those of control mice. No abnormality was observed in H&E-stained muscle tissues (data not shown).

3.3 Real-time quantitative RT-PCR analysis

To identify proper internal control genes for real-time quantitative RT-PCR analysis, we analysed the expression of six housekeeping genes according to a previous report (Vandesompele et al., 2002). We first investigated the gene expression level of these housekeeping genes via real-time quantitative RT-PCR in samples prepared from the same amount of RNA for each gene. The result revealed that no gene showed a constant expression level in both HS and EA/HS groups (Fig. 7).

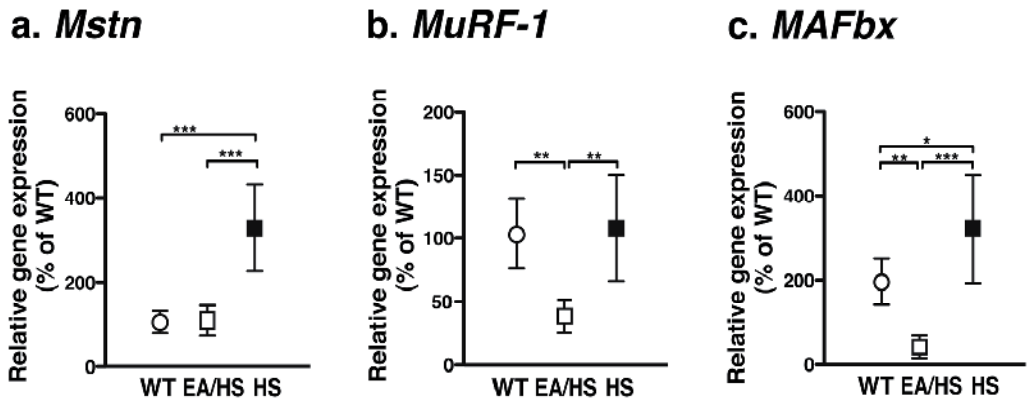

Fig. 8. Gene expression as related to hindlimb suppression and EA effect. Real-time RT-PCR analysis of expression of *Mstn* (myostatin) (a), *MuRF-1* (b), and *MAFbx* (c) genes in control, HS, and EA/HS mice (for each group, $n = 7$). Relative transcript levels are shown (means ± S.D.). Open circle, control mice; closed squares, HS mice; open squares, EA/HS mice; *$P <$ 0.05; **$P < 0.01$; ***$P < 0.005$; NS, not significant.

Because we found no housekeeping gene with expression stability in all groups, we calculated the gene expression stability of these genes by using geNorm (http://medgen.ugent.be/~jvdesomp/genorm/) and found that the geometric mean of the expression levels of three genes—β-actin, GAPDH, and transferrin receptor—was the optimal value for normalization factors. Thus, we used the geometric mean of these three genes to calculate the relative gene expression level.

We next analysed changes in myostatin and ubiquitin ligase gene expression in HS mice to examine the effect of EA in HS mice and compared the expression level with the control. Figure 8a shows that the myostatin gene was induced in HS mice but that its expression was significantly suppressed in EA/HS mice. In addition, the two ubiquitin ligase genes, *MuRF-*

1 and *MAFbx*, were induced in HS mice but their expression was significantly suppressed in EA/HS mice (Fig. 8b and c). Expression of *Cbl-b* was induced at 13 days in HS mice but was significantly reduced in EA/HS mice compared with control and HS mice (data not shown).

4. Discussion

The HS model is characterized by a muscle disorder—disuse muscle atrophy—that was previously established in rabbits (Anzil et al., 1991; Sancesario et al., 1992), rats (Morey-Holton & Globus, 2002; Riley et al., 1990; Thomason & Booth, 1990), and mice (Stelzer & Widrick, 2003; Thomason & Booth, 1990). For the present preclinical study, we confirmed the molecular evidence of the effect of EA by using a pathological murine model of disuse muscle atrophy involving hindlimb suspension. Our previous basic research indicated that EA suppresses myostatin gene expression in skeletal muscle and causes a satellite cell-related proliferative reaction (Takaoka et al., 2007). In this study, the myostatin gene and three ubiquitin ligase genes were evaluated by means of real-time quantitative RT-PCR analysis.

First, to examine the possibility that EA prevented muscle atrophy, we determined relative soleus muscle mass and cross-sectional diameters of soleus myofibres. Relative wet weights of muscles and myofibre diameters in EA/HS mice were significantly larger than those in HS mice (Figs. 6a and b). In addition, values of both relative wet weights and cross-sectional myofibre diameters for EA/HS mice were not significantly different from those of control mice. These results indicate that EA prevented muscle atrophy induced by hindlimb suspension.

Then, to investigate the molecular mechanisms governing the effect of EA in prevention of disuse muscle atrophy, the expression of the myostatin gene and three ubiquitin ligase genes (*MuRF-1*, *MAFbx*, and *Cbl-b*) in these HS models was analysed by using real-time RT-PCR. We chose these genes because they play key roles in hindlimb suspension and are therefore appropriate for investigations of the effect of EA on HS mice. Figure 4a shows that expression of the myostatin gene was induced in HS mice and was significantly greater than that in control mice, but this effect was not observed in EA/HS mice, as in our previous study of EA-treated mice (Takaoka et al., 2007). This induction of myostatin gene expression in HS mice is consistent with the presence of muscle atrophy. Application of EA significantly suppressed myostatin gene expression in EA/HS mice at 13 days (data not shown). This result is consistent with prevention of muscle atrophy by EA. The consequence of this suppressed gene expression is increase in proliferation of satellite cells, that is, skeletal muscle stem cells, and prevention of muscle atrophy.

For microgravity-induced muscle atrophy, the ubiquitin-proteasome pathway plays the most important role in the protein degradation system (Ikemoto et al., 2001). Therefore, this ubiquitin-proteasome-related protein degradation system can be rate-limiting for degradation of proteins in the muscle atrophy found in our HS mice. Indeed, expression of the three ubiquitin ligase genes that we examined in this study was reportedly up-regulated in HS rats (Haddad et al., 2006; Nikawa et al., 2004). In our experiment, these genes except *Cbl-b* showed significant difference in expression at 7 days in HS mice (Fig. 4b and c), and had significantly greater expression at 13 days compared with three genes of control mice (data not shown). In EA/HS mice, expression of *MuRF-1* and expression of *MAFbx* were significantly lower than those of control mice at both 7 and 13 days and were significantly suppressed compared with those of HS mice at both time points. EA/HS mice also had

significantly lower *Cbl-b* gene expression at 13 days compared with control mice and HS mice (data not shown).

Our results from the myostatin and ubiquitin ligase gene expression study were mostly consistent with results from previous reports on HS mice and rats (Haddad et al., 2006; Kawada et al., 2001; Nikawa et al., 2004; Stevenson et al., 2003)), except for the finding for HS mice at 7 days which showed no significant difference from the control. The differences between our findings and those of previous HS studies may result from differences in the kinds of rodents or mouse strains. For example, our previous studies of transgenic mice showed amyloid deposition in C57BL/6 mice (Takaoka et al., 2004) but not in C57BL/6 × C3H F_1 mice (Sasaki et al., 1986). In our HS ICR strain mice with the phenotype of muscle atrophy, ubiquitin ligase genes were expressed at 7 days at the level of controls, whereas myostatin gene expression was significantly greater than that of controls (Fig. 8a). This result suggests that the muscle atrophy was caused because the myostatin gene expression was induced, which led to suppression of satellite cell proliferation and a degree of protein degradation was not changed from that of controls.

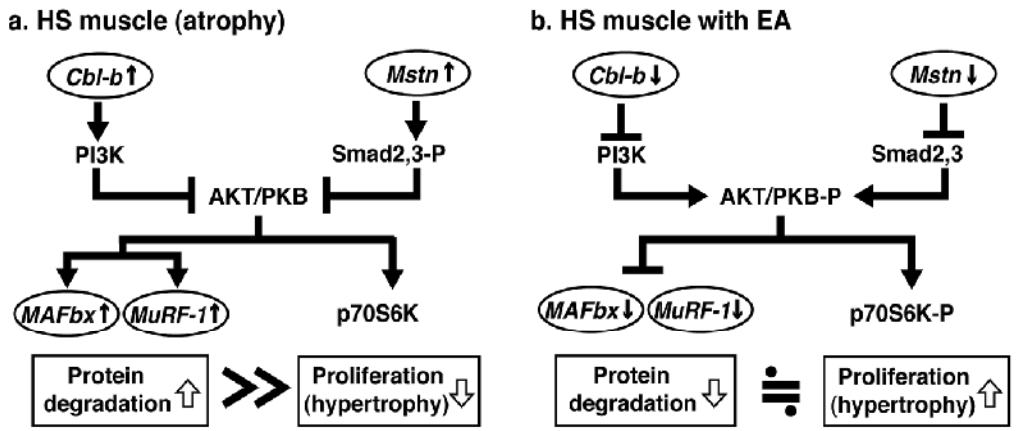

Fig. 9. Molecular mechanisms of EA efficacy in prevention of muscle atrophy. Summary of a model of molecular mechanisms of EA efficacy in prevention of muscle atrophy, including the role in the IGF-1/AKT pathway and myostatin gene expression. a, HS mice. b, EA/HS mice. Our experiment has not yet elucidated the details of the signaling pathway leading from EA to gene suppression.

In this study, the molecular evidence that EA suppressed induction of the expression of the myostatin gene and the three ubiquitin ligase genes in HS mice was consistent with the phenotype, and EA prevented muscle atrophy. Figure 9 provides schematic diagrams of the molecular mechanisms of the effects of EA on inhibition of disuse muscle atrophy, as based on the previous reports (Sandri et al., 2004; Takaoka et al., 2007; Workman et al., 2006) and our data from this study. After the myostatin gene induction in our HS mice, the expression of ubiquitin ligase genes of the IGF-1/AKT pathway was facilitated (Fig. 9a and b).

When HS mice received EA every other day, expression of the myostatin, *MuRF-1*, and *MAFbx* genes was significantly suppressed at 7 days; at 13 days, expression of *Cbl-b* was also

significantly suppressed. With regard to expression of the three ubiquitin ligase genes, our data suggest that EA-induced suppression of *MuRF-1* and *MAFbx* at 7 days did not involve the IGF-1/AKT pathway and that another signaling pathway may exist for regulation of these genes. In addition, the finding that at 7 days the *Cbl-b* gene showed no significant expression after EA suggested that the effect of EA on gene suppression differs for *Cbl-b* and the other two ubiquitin ligase genes. The results for 13-day EA/HS mice suggested that induced satellite cell proliferation via the suppressed myostatin gene and reduced protein degradation via suppression of ubiquitin ligase gene expression neutralized each other because the relative soleus muscle mass and myofibre diameters were not significantly different from control values. This result suggested that a more effective EA method for treatment of muscle atrophy may be developed by analysing the changes in expression of these genes. These molecular findings and muscle phenotype thus support the suggestion that EA may be an effective technique for prevention of muscle atrophy.

In the present study, we used 10-Hz pulses for EA, not 1-Hz pulses as in our previous study, because we determined that in the range of 1–40 Hz, 10 Hz provided the best myostatin gene suppression (Fig. 10). Onuma *et al.* (Onuma et al., 2008) reported on the effect of electrical stimulation applied by using electrodes on the skin (no needles were inserted) to prevent muscle atrophy. They compared electrical pulse sizes and found that 20 and 30 Hz effectively prevented atrophy. Another research group reported, however, that electrical stimulation at 50 Hz caused muscle atrophy (Kanno et al., 1999). These data suggest the existence of other more effective stimulation conditions than 10 Hz, which we chose for our experiment, to prevent muscle atrophy. Understanding the relationship between EA microcurrent pulse conditions and reactions of skeletal muscle is important, and investigations to determine the best stimulation conditions are needed.

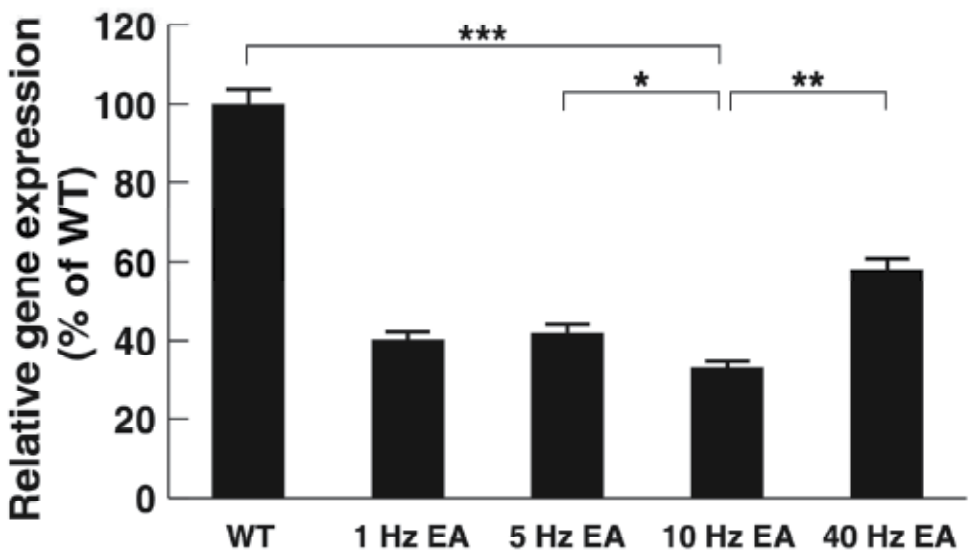

Fig. 10. Mstn gene suppression by various EA stimulations (each n=5). *$P < 0.05$; **$P < 0.01$; ***$P < 0.005$.

Certain physical therapy techniques involve types of pulse stimulation that differ from EA stimulation. In rehabilitation medicine, electrotherapies such as transcutaneous electrical nerve stimulation (TENS) and electrical muscle stimulation (EMS) are used for relief of pain, reduction of inflammation, and improvement of muscle function (Hurley & Bearne, 2008; Maffiuletti et al., 2003). In these electrotherapies, pulses pass from the skin surface through motor nerves to skeletal muscles to cause muscle contractions (Collins et al., 2002). In EA, a stainless-steel needle, which is inserted into a muscle, stimulates and electrifies the muscle directly by means of a pulse wave of a low-frequency microcurrent (−0.14 to +0.30 □A in mouse muscle), the result being muscle contraction (Takaoka et al., 2007). Indeed, unlike TENS and EMS, EA can clearly electrify a targeted muscle that has had an acupuncture needle inserted and can also stimulate tissues distant from the skin (Ishimaru et al., 1995). In addition, the direct microcurrent may induce growth signal transduction in the cell (McCaig et al., 2005). Therefore, EA probably induces cell growth (Takaoka et al., 2007) by direct application of electrical current, which is superior to the electrical stimulation through the skin such as that provided by TENS and EMS. Thus, EA is likely to enhance muscle function during rehabilitation.

Long-term rehabilitation is needed for complete recovery from muscle atrophy. For example, complete recovery after a 2-week hindlimb suspension required 3–4 weeks (J. Desaphy et al., 2005). In view of this finding, preventing muscle atrophy is important, to avoid the need for such rehabilitation. Although the efficacy of resistance training for disuse muscle atrophy has been reported (Kannus et al., 1998; Suetta et al., 2008), development of methods other than exercise to prevent muscle atrophy is important for individuals such as elderly people and patients on long-term bed rest after surgery.

5. Conclusion

In this study, we demonstrated that EA was an effective option to prevent muscle atrophy, as evidenced by molecular data showing suppression of myostatin and ubiquitin ligase gene expression. Additional research is now under way to analyse EA-related differences in functions such as muscle contraction and relaxation.

6. Acknowledgements

This study was supported by a 20th Grant-in-aid of the Nakatomi Foundation and grant-in-aid for Scientific Research (C) from the Japan Society for the Promotion of Science (grant no. 22590653). We also thank Mr. Kenji Miura (Kobe University), Dr. Sachiko Ikemune and Mr. Toshikazu Miyamoto (Tsukuba University) for their technical assistance.

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4

The Treatment of Vascular Dementia in Acupuncture Based on Syndromes Differentiation

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1. Introduction

Vascular dementia (VaD) is a progressive neurodegenerative syndrome that encompasses a wide spectrum of cognitive disorders caused by cerebrovascular diseases (Pennisi et al., 2011; Selnes & Vinters, 2006). VaD and Alzheimers disease (AD) are the most common dementia syndromes in the elderly (Matioli & Caramelli, 2010). However, only a small percentage of elderly patients have 'pure AD' or 'pure VaD' (Fotuhi et al., 2009), both of which are caused by mixed aetiology and pathophysiology. Clinical diagnostic criteria of VaD show moderate sensitivity (50-70%) and variable specificity (64-98%) (Jellinger, 2008). The frequency of specific neuropathologic features of vascular cognitive impairment depends largely on study exclusion criteria (Selnes & Vinters, 2006). Although the use of voxel-based multivariate analysis in ^{18}FDG PET extracted a metabolic pattern could differentiate VaD and AD efficiently (Kerrouche et al., 2006). VaD is in silent epidemic now as global ageing population developing, while its prevalence ranges from 4.5 to 39% with standardized incidence rates between 0.42 and 2.68 per 100,000 world people (Jellinger, 2008), caused by cerebrovascular disorders and vascular risk factors, such as stroke, generalized cerebral atherosclerosis, hypertension, hypercholesterolaemia, especially progressive cerebrovascular atherosclerosis and consecutively stroke in asian and western countries (Konno et al., 1997). There are many subtypes of VaD, such as cortical VaD, subcortical VaD and cortical-subcortical VaD. The mechanisms that lead to VaD are controversial and remain to be elucidated (Schuff et al., 2009). Gene-environment interactions are central to human disease (Traynor & Singleton, 2010), as well as VaD. Virus-gene interactions also should not be ignored (Dobson et al., 2003). Telomere length may be an independent predictor for the risk of VaD (Zglinicki et al., 2000).

The name of VaD is *chidai* in traditional Chinese medicine (TCM). The earliest description of *chidai* ascends to *Pre-Qin* Dynasty in China, such as the book *Zuozhuan* said '*Chidai* is the meaning of not clever.' *Huangdi's Internal Classics* recorded the classic understanding of VaD correlated with age in TCM, as it said 'Heart *qi* begins weakness at sixty years old, the elderly are fond of being anxious and depressed, while blood and *qi* are apt to delinguency, which lead to be keen on decubitus or sleep; Lung *qi* begins weakness at eighty years old, the soul of the elderly are dispersion, which lead to be often mistake on communication.'

Huangdi's Internal Classics also said 'Head is the house of intelligence… Heart is the viscus likened to the monarch in the body which produces the intelligence… Heart is as a major regulator of five *zang*-organs and six *fu*-organs and is also the house of spirit… Heart stores the spirit, lung stores the soul, liver stores the mentality, spleen stores the will, and kidney controls the aspiration.' *Compendium of Materia Medica* proposed definitely that 'Brain is the house of cerebral spirit'. As we know, both the patterns of holism and treatment with syndromes differentiation are the special characteristics of TCM. So the brain is the location of disease of VaD, as well as the heart in TCM. Besides, the disorders of any of five *zang*-organs and six *fu*-organs could lead to cognition impairment and VaD. For example, heart stores the spirit and kidney is the origin of primordial *qi* and *yinyang*, both the two viscera could be as assistance for the brain to manage spirit. As *Syndromes Differetiation Record* said 'The integration of heart and kidneys produce wisdom, while the failure of which lead to wisdom loss'.

2. The primary etiology and pathogenesis of VaD in TCM

The characteristics of disease of VaD in TCM are asthenia in origin and sthenia in superficiality, as well as deficiency syndrome mingling with excess syndrome. There are five highlights on primary etiology and pathogenesis of VaD in TCM while integrating our decades of years for TCM clinical practice. The five primary points on understanding VaD in TCM should be integrated with western medicine to guide for clinical practice (Zhang, 2010).

2.1 Ageing and asthenia of healthy energy accompanying with concurrent diseases of *zang*-organs and *fu*-organs

The functions of *zang*-organs and *fu*-organs are degenerative in the elderly as age growing. *Huangdi's Internal Classics* said 'The male's kidney *qi* begins weakness at forty years old, while liver *qi* begins weakness at fifty-six'. On the one hand, *yin qi* is degenerative with aging, both the essence and blood are deficient, as well as marrow-reservoir, which lead to loss of brain nourish and dysfunction of the mind and psychoactivity. On the other hand, the essence and blood of liver and kidneys are insufficient, hyperactivity of fire caused by deficiency of *yin* that leads to endogenous deficient wind, which induce activities discomforts. Besides, heart and spleen are deficient gradually with aging, heart deficiency leads to dysfunction of the mind while spleen deficiency causes insufficiency of *qi* and blood, which lead to deficiency of essence and marrow and dull of the mind.

2.2 Autolesion of *zang*-organs and *fu*-organs caused by seven emotions disorder

Seven emotions include the joy, rage, anxiety, contemplation, sorrow, fear and surprise in TCM. *Huangdi's Internal Classics* said 'rage drives *qi* upward, overjoy slackens *qi*, excessive sorrow consumes *qi*, fear disorders *qi*, over-strain consume essence, anxiety causes *qi* stagnation.' The disorder of seven emotions could lead to dysfunction of *qi* and blood, lack nourish of heart mind and brain sea, which turn out to be abnormal mind and cognition impairment and dementia.

2.3 Five excessive emotional activities and incoordination of seven emotions

Five emotional activities correlate with functions of five *zang*-organs closely, including joy, rage, anxiety, contemplation, and fear. *Huangdi's Internal Classics* said 'heart associates with

joy, liver connects with rage, spleen associates with contemplation, lungs govern anxiety, and the emotion of the kidneys is fear.' Excess of liver *qi* causes rage, pathogenic fire derives from stagnation of liver *qi*, aberration of heart mind, hyperactivity of both fire of heart and liver, all of which lead to be insufficiency of essence and blood and marrow sea and dysfunction of the mind, then, turn out cognition impairment and dementia.

2.4 Turbid phlegm blocks the clear orifices and clear *yang* fails to distribution

The brain is the house of clear *yang* and upper *qi* in TCM. If the upper *qi* was not enough, the brain sea would be deficient. On one hand, internal stagnation of phlegm would be occurrence caused by kidneys deficiency, or excessive contemplation injuring spleen, then, transformation failure of stomach and intestine and metabolic disorder of body fluid. On the other hand, long addiction to fatty and sweet food and smoking and alcohol abuse lead to stagnation of *qi* due to phlegm and damp. All of which cause turbid phlegm to block the willing, yet, the brain would be deficient and dysfunction of the mind, thus, lead to dementia.

2.5 Blood stasis obstructs the collaterals and deficiency of marrow-reservoir

Blood is one of the most treasurable objects of human body as well as *qi*, both of which enriched in the brain sea are the source of wisdom. 'If inside blood stasis occurred, the patient would turn out morbid forgetfulness and madness' said in *Systematic Compilation of Internal Classic*. Blood stasis or deficiency in brain would lead to abnormal mind. 'Demented syndrome caused by *qi* and blood stagnation' also said in *Errors in Medicine Corrected*. Cognitive impairment is caused by *qi* stagnation and blood stasis in meridians and collaterals, especially after stroke as aging.

3. Treatment of VaD in acupuncture based on syndromes differentiation

The treatment of VaD in acupuncture has thousands of year origin in TCM. *Yulong Classics on Acupuncture and Moxibustion* said '*Shenmen* (HT 7) could treat dementia alone.' *Classified Classics on Acupuncture and Moxibustion* said '*Neiguan* (PC 6) could regulate the impaired cognition.' *Compendium of Acupuncture and Moxibustion* also said '*Baihui* (DU 20) could regulate wind syndrome of head and stroke, pavor and morbid forgetfulness, and syndrome of to be ill at ease and full of dread.' The effect of VaD treatment on acupuncture is definite. And the advantage of acupuncture includes simple and convenient, inexpensive, without any toxicity and side effects way for excellent treatment choice. The TCM clinical effect is the most important leading advantage for clinical practice as well as acupuncture. The effect of acupuncture includes dredging meridians and collaterals, strengthening healthy *qi* to eliminate pathogens, and regulating *yin-yang*.

Doctrine of meridians and collaterals system has a clear understanding on VaD while combining with the above standpoints in TCM, especially to be reflected in twelve meridians and collaterals, and eight extra meridians. Acupuncture also has both TCM characteristics of patterns of holistic thought and syndromes differentiation, especially syndromes differentiation of meridians and collaterals. Therapeutic principle of acupuncture includes curing spirit and maintaining *qi*, reinforcing insufficiency and reducing excessiveness, simultaneous treatment of principal and subordinate symptoms, partial and whole treatment. The VaD treatment with syndromes differentiation in

acupuncture based on the integration guidance reflects TCM characteristics and objectives of regulating *yin-yang*. Usually, there are six syndromes of VaD classified for clinical practice in acupoints selection and manipulation. Acupoints should be modification according to syndromes as well as reinforcing and reducing techniques for needling. While two congregated head points (*Da* and *xiao Sishencong*) are so important to VaD treatment integrated with our decades of years clinical experience. Besides, ear acupuncture therapy, scalp-acupuncture therapy, hydro-acupuncture therapy, warm needling method, and other acupuncture therapy methods will be also flexible modification to obtain personal medical effect.

3.1 Syndrome of deficiency of kidney *qi* and marrow sea

'The deficiency of marrow sea leads to vertigo and tinnitus, sore waist and weak kneed, delinquency and peacefully sleeping' said in *Huangdi's Internal Classics*. Deficiency of kidneys leads to deficiency of marrow, both of which cause deficiency of the brain sea. Primary symptoms of syndrome of deficiency of kidney *qi* and marrow sea contain dizziness, dazzling, cloudiness vision, sore waist and weak kneed, delinquency and peacefully sleeping, daffy and dull expression, dull respondence, decline of memory, morbid forgetfulness, poor judgment ability, disorientation (such as often go wrong direction), discrimination disorder (such as often be unacquainted with familiar people or recognize wrong people), thin and sunken pulse, especially feeble *chi* pulse, thin and rufous tongue with few lingual fur. The therapeutical principle is to tonify kidneys and nourish marrow, ease mental anxiety and regain consciousness. And the primary acupoints for treatment of the syndrome involve *Sishencong* (also named as *Xiao Sishencong*) (EX-HN1), *Da Sishencong* (*Qianding*, *Houding*, *Luoque*) (DU 21, DU 19, BL 8), *Fengfu* (DU 16), *Dazhu* (BL 11), *Quchi* (LI 11), *Hegu* (LI 4), *Taixi* (KI 3), *Taichong* (LR 3). If dizziness and dazzling were severe, *Touwei* (ST 8), *Shenting* (DU 24) and *Fengchi* (GB 20), would be added. If insomnia and anxiousness were conspicuous, *Neiguan* and *Shenmen* would be added. If disorientation and discrimination disorder were severe, *Muchuang* (GB 16) and *Zhengying* (GB 17) would be added.

Sishencong is extraordinary point and surrounds *Baihui*, consisted of four acupoints which locate in DU and BL meridians. The hump of head is *yang* within *yang in* TCM, and *Baihui* which is the house of three *yang* meridians and five convergent collaterals. Foot *taiyang* meridian communicates with kidneys. Besides, the relationship of bladder and kidneys is exterior and interior. Especially, DU meridian also communicates both kidneys and heart. Kidneys essence could produce marrow and tonify the brain sea. So the stimulation of *Sishencong* could tonify kidneys *yang qi* and regulate diseases derived from the house of cerebral spirit. *Da Sishencong* is one of the most effective acupoints and distinguishing features of China national famous veteran teran doctors of TCM of professor *Zhangji*'s experience on VaD treatment in acupuncture. *Da Sishencong* surrounds *Baihui* too. *Da Sishencong* is also consisted of five acupoints which locate in DU and GB meridians, which could combine *Sishencong* to enforce the effect of tonifying kidneys and marrow and repairing impaired cognition. *Fengfu* is convergent point of DU and *yang* link meridians, which could induce resuscitation. *Dazhu* is convergent acupoint of meridians of hand and foot *taiyang*, and one of eight convergent points that said as bone convergence, which could regulate *yang qi* and resuscitate the cognition. *Quchi* is the meeting point of five *shu* points and original point of hand *yangming* meridian, which is one of strengthening points and

could free *yang qi* and eliminate phlegm and promote blood circulation to remove blood stasis. *Hegu* also is in the meridian of hand *yangming*, which could dredge the meridian passage and tranquilize and allay excitement. *Taixi* is the meeting point of five *shu* points and original point of foot *shaoyin* meridian, which nourish kidneys *yin-yang* and remove cardiopyrexia for tranquilization. *Taichong* is the meeting point of five *shu* points and original point of foot *jueyin* meridian, which could calm the liver to stop the wind and disperse stagnated *qi* and blood of liver. All of the points could cooperate to target at the effective treatment of this VaD syndrome.

3.2 Syndrome of liver and kidneys *yin* deficiency, and the essence and marrow start to fade

Kidney stores essence and liver stores blood in TCM. The deficiency of essence and blood could lead to feeble marrow sea. Primary symptoms of this syndrome contain dizziness, dazzling, tinnitus and deaf, poor expression of eyes, dumb as a wooden chicken, reticence, memory decline, suspiciousness, visual hallucination, restlessness, sore waist and weak kneed, bizygomatic aestus, insomnia and night sweat, weak and thin body, squamous and dry skin, thin, wiry and frequent pulse, red tongue with few lingual fur. The therapeutical principle of which is to nourish liver and kidneys, strengthening marrow and spirit. And the primary acupoints for treatment of the syndrome involve *Xiao Sishencong*, *Da Sishencong*, *Touwei*, *Jingming* (BL 1), *Fengchi*, *Fengfu*, *Neiguan*, *Shenmen*, *Quchi*, *Zulinqi* (GB 41). If dizziness and dazzling were severe, *Xuanlu* (GB 5), *Xuanli* (GB 6), *Jingbailao* (EX-HN 15), would be added. If limbs tic occurred, *Baxie* (EX-UE 9), *Bafeng* (EX-LE 10), *Hegu* and *Taichong* would be added. If insomnia was conspicuous, *Anmian* (EX-HN 22), *Neiguan*, *Yinxi* (HT 6), *Taixi*, would be added. If fever with yin asthenia was severe, *Dazhui* (DU 14), *Dingchuan* (EX-B 1), *Fuliu* (KT 7), *Hegu*, would be added.

Touwei is convergent point of meridians of foot *shaoyang*, foot *yangming* and *yang* link, which refresh mental and eyes. *Jingming* is convergent point of meridians of hand and foot *taiyang*, foot *yangming*, *yin* and *yang* heels, which could reduce fever and improve acuity of vision, expel wind and promote the restoration of consciousness. *Fengchi* is convergent point of meridians of hand and foot *shaoyang*, and *yang* link, which could calm the liver to stop the wind, expel wind and promote the restoration of consciousness. *Neiguan* is collateral point of meridian of hand *jueyin*, and one of eight convergent points to communicate with *yin* link meridian, which could quiet down the mind and heart, and regulate *qi* to alleviate mental depression. *Shenmen* is the transport point of five *shu* points and original point of meridian of hand *shaoyin*, which could tranquilize mind and dredge the meridian passage. *Zulinqi* is the meeting point of five *shu* points and lower meeting point of meridian of foot *yangming*, which could invigorate spleen and stomach, strengthen healthy *qi* to eliminate pathogens, dredge the meridian passage. And all of these points could lead to regulate this VaD syndrome well.

3.3 Syndrome of asthenia of both spleen and kidneys, and damage of essence and marrow depletion

Spleen transports the nutritious substance in the stomach, while kidneys generate marrow and dominate bone in TCM. Asthenia of both spleen and kidneys would lead to marrow sea deficiency. Spleen is as *yin zang*-organs, so the symptoms of which are special at characteristics of quiet and autistic type. Thus, the primary symptoms of the syndrome

contain dull expression, reticence, decline of reaction ability, hypomnesis, agnosia, aprophoria, lapsus of reasoning and judgment, weak and thin body, muscular dystrophy, anorexia, short of breath, listless talk, thin, sunken and feeble pulse, light and plump ongue with teeth-marked. The therapeutical principle of which is to strengthen spleen and tonify kidneys. And the primary acupoints for treatment of the syndrome involve *Xiao Sishencong*, *Da Sishencong*, *Shenting*, *Fengfu*, *Dazhui*, *Quchi*, *Hegu*, *Yingu* (KI 10), *Sanyinjiao* (SP 6), *Taixi*. If insomnia was conspicuous, *Neiguan* and *Shenmen* would be added. If *yang* deficiency was conspicuous, *Guanyuan* (RN 4) and *Qihai* (RN 6) would be added. If *yin* deficiency was conspicuous, *Fuliu* and *Taichong* would be added. If the disorders of judgment and orientation were severe, *Shenmen*, *Daling* (PC 7), *Shenshu* (BL 23) would be added.

Shenting is convergent point of meridians of foot *taiyang* and *yangming*, and DU, which could quiet down the mind and activate brain, promote flow of *yang qi*. *Dazhui* is convergent point of three *yang* meridians, and DU, which could supplement *qi* and strengthen *yang*. *Yingu* is the meeting point of five *shu* points of meridian of foot *shaoyin*, which could nourish kidneys and regulate meridians, and regulate *qi* to dissipate blood stasis. *Sanyinjiao* is convergent point of meridians of foot three *yin*, which could invigorate spleen and stomach, nourish liver and kidneys, and dredge the meridian passage. All of the points, especially leaded with *Xiao Sishencong* and *Da Sishencong*, could mend impaired cognition of the syndrome.

3.4 Syndrome of seven emotions stagnation and hyperactivity of fire of heart and liver

Fire syndrome is caused by overreaction of the five emotions, such as flaming up of liver fire due to mental irritation. Both heart and liver are *yang zang*-organs, and the heart controls mental and emotional activities as liver controls dispersion, so hysteria often dues to fire of heart and liver. Primary symptoms of the syndrome involve nervous expression, polylogia, divagation, crankous behavior, visual hallucination, acouasm, restlessness, dizziness, dazzling, conjunctival congestion, constipated, oliguria with reddish urine, wiry, slippery and rapid pulse, red tongue with yellowy fur. The therapeutical principle of which is to clear liver fire and tranquilize by nourishing the heart. And the primary acupoints for treatment of the syndrome involve *Xiao Sishencong*, *Da Sishencong*, *Dazhui*, *Dingchuan*, *Quchi*, *Hegu*, *Anmian* (EX-HN 22), *Zhongwan* (RN 12), *Liangmen* (ST 21), *Fenglong* (ST 40), *Sanyinjiao*. If dizziness and dazzling was conspicuous as well as dry throat with bitter taste, *Touwei*, *Toulinqi* (GB 15), *Taiyang* (EX-HN 5), *Yingu*, would be added. If insomnia was conspicuous, *Neiguan*, *Shenmen*, *Daling*, would be added. If polylogia and paraphasia was conspicuous as well as restlessness, Shenting, *Shendao* (DU 11), *Xingjian* (LR 2), *Shuigou* (DU 26), *Fenglong* (ST 40), would be added.

Anmian is one of extraordinary points that could quiet down the mind and relieve mental train and strengthen kidneys. *Zhongwan* is convergent point of meridians of hand *taiyang* and *shaoyang*, foot *yangming*, and RN, which could invigorate spleen and stomach, calm the adverse-rising energy and disperse stagnated liver *qi*. *Liangmen* is at the meridian of foot *yangming* that could regulate stomach to smooth *qi*, invigorate spleen and soothing liver. *Fenglong* is collateral point of meridian of foot *yangming* that could invigorate spleen to remove phlem, regulate stomach to smooth *qi*, reduce phlegm by resuscitation. Therefore, the key effect of this syndrome is to regulate five emotions for ameliorating VaD.

3.5 Syndrome of damp abundance due to splenic asthenia and stagnation of phlegm in the orifices

For *qi* deficiency of spleen and stomach, transformation failure of spleen and stagnation of phlegm and damp turn out, which lead to turbid phlegm block the orifice of the heart and clear orifices, then, cognition is impaired. Primary symptoms of the syndrome contain dull expression, dementia, emotional instability, mussitation, lassitude and disorders of excessive sleepiness, anorexia, abdominal distention and pain, or oppressive and distending feeling due to stagnation of *qi*, much spittle, heaviness of head, slippery and moisten pulse, light tongue, white and greasy fur on tongue. The therapeutical principle of which is to invigorate spleen to remove phlem and eliminate phlegm for clearing orifices. And the primary acupoints for treatment of the syndrome involve *Xiao Sishencong*, *Da Sishencong*, *Shenting*, *Fengfu*, *Shuigou*, *Hegu*, *Fengchi*, *Zusanli*, *Fenglong*. If insomnia was conspicuous, *Neiguan*, *Shenmen*, *Daling* and *Anmian* would be added. If anorexia and abdominal distention were conspicuous, *Zhongwan*, *Liangqiu*, *Tianshu*, *Taixi*, *Shenmai*, *Zhaohai* and *Yangjiao* would be added. If depression was severe, *Sanyinjiao*, *Yanglingquan* (GB 34) and *Xuanzhong* (GB 39) would be added.

Shuigou is the meeting point of meridians of hand and foot *yangming*, and DU, which could reduce phlegm by resuscitation, and resuscitate by cooling, calm endopathic wind and remove heat. The effect of invigorating spleen to remove phlem and resuscitation with other acupoints show a well match. The integrated with *Xiao Sishencong*, *Da Sishencong*, *Shenting*, *Fengfu*, *Hegu*, *Fengchi*, *Zusanli*, *Fenglong*, would target to this VaD syndrome exactly.

3.6 Syndrome of stagnation of *qi* to block orifices and blood stagnation in the brain

For lacking free flow of *qi* and blood as aging, or rich and fatty diet, which lead to blood stasis, in brain especially that would occur stroke, then, impaired cognition and dementia in the early stage. Primary symptoms of the syndrome contain dull expression, dementia, abnormal thought, eccentric behavior, personality and behaviour disorder, stillness in daytime and dysphoria at night, limbs paralysis, squamous and dry skin, dark eyes, thin and unsmooth pulse, light, purplish and dark tongue with petechiae, thin lingual fur. The therapeutical principle of which is to promote blood circulation to remove blood stasis and induce resuscitation. And the primary acupoints for treatment of the syndrome involve *Xiao Sishencong*, *Da Sishencong*, *Fengfu*, *Fengchi*, *Dazhu*, *Geshu* (BL 17), *Xuehai* (SP 10), *Kongzui* (LU 6). If recognition disorder was severe, *Shenting* and *Xinmen* (DU 22) would be added. If stroke and disorder of consciousness were severe, *Shuigou*, *Daling*, *Zhaohai* would be added. If deadlimb was conspicuous, *Baxie*, *Bafeng*, *Neiguan* and *Fuliu* would be added.

Geshu is one of eight convergent points said as blood convergence that could regulate *qi* to alleviate mental depression, and promote blood circulation to remove meridian obstruction. *Xuehai* is at the meridian of foot *taiyin* that could regulate *qi* and blood, and invigorate spleen to eliminate dampness. *Kongzui* is at the meridian of hand *taiyin* that could clear away heat for hemostasis, moisten lungs and regulate *qi*. All of the points are match with syndrome differentiation and obtain good effect.

4. Treatment of VaD in kinds of acupuncture therapy methods

4.1 Body acupuncture

The body acupuncture is the basic method to regulate VaD with the above syndromes differentiation. And kinds of needle insertion manipulations will be use based on the

selected acupoints. For examples, horizontal needling will be use for *Xiao Sishencong*, *Da Sishencong, Xinmen*, et al. Oblique needling will be use for *Shenting*, *Touwei*, et al. Penetration needling will be use for *Taixi*, *Yanlingquan*, *Neiguan*, et al. Deep needling will be use for *Sanyinjiao*, *Zusanli*, *Fenglong*, et al. Shallow needling will be use for *Jingming*, *Yamen*, et al. Yet, after obtaining acu-esthesia, manipulating needle to promote acu-esthesia will be enhanced, including manipulations of mild reinforcing and attenuating, reinforcing, reduction, et al.

4.2 Electroacupuncture

The electroacupuncture could strengthen acu-esthesia for VaD treatment. The selected acupoints for electroacupuncture are based on the differentiated syndrome. For examples, syndromes of deficiency of kidney *qi* and marrow sea of VaD that *Taixi*, *Dazhu*, *Hegu* will be use. Syndromes of damp abundance due to splenic asthenia and stagnation of phlegm in the orifices of VaD that *Xiao Sishencong*, *Zusanli*, *Fenglong* will be use. Quantity of stimulus electroacupuncture should comply with personal medicine principle.

4.3 Ears acupuncture

Ears contain the information of the whole organism in TCM and acupuncture theory. Therefore, ears acupoints are special in the field of acupuncture treatment as well as VaD. The clinical use of ears acupoints methods in china include massotherapy, magnetotherapy, electroacupuncture, blood-letting therapy, needle-embedding therapy, moulded therapy, plaster therapy, injection therapy, et al.

4.4 Semiconductor laser irradiation therapeutics

The use of semiconductor laser irradiation therapeutics for VaD also is based on syndromes differentiation and body acupuncture. After needle insertion manipulations of body acupuncture, some important acupoints will be integrated with low power or middle power semiconductor laser irradiation therapeutics for enhancing the acu-esthesia.

4.5 Scalp acu-therapy

Scalp acupuncture could be only use for VaD treatment as well as integrated with body acupuncture, such as *Xiao Sishencong*, *Da Sishencong*. Scalp also contains the information of the whole organism in TCM and acupuncture theory as well as ears. Scalp acupoints are special for VaD regulation, not only because of the head are both the house of points and disease location, but also the acupuncture theory and therapy methods are integrated to excellent effect. The manipulations include percussopunctator, horizontal needling, cauterized needling therapy, et al.

4.6 Others

Others acupuncture therapy methods contain acupoints injection, tongue acupuncture, catgut implantation at acupoint, eyes acupuncture, integrated with moxibustion also called warmed acupuncture, TCM herbals, western medicine, et al. So kinds of acupuncture therapy methods could be integrated for VaD treatment effectively in China, especially are based on TCM clinical pattern and personality medicine.

5. Clinical cases of VaD

A 65-year-old man was referred for morbid forgetfulness, dull expression and oligologia for 3 months. After nearly 5 decades of years of smoking, he had quit smoking 3 years. The skull examination in mgnetic resonance imaging (MRI) indicated partial branches of mesencephal vascularities had minimal lesion disease without stroke at local hospital 3 months ago. Although he was summated citicoline sodium and other trophic nerve drugs, the symptoms had been advanced still. So acupuncture was required for regulation by the patient's family. The patient has no other risk factors for heart diseases, such as hypertension, hyperlipoidemia, hyperglycaemia. The patient had dull expression, few speech, tied tongue, slurred speech, poor reactive ability, action retardation, disorder of reasoning and judgment, morbid forgetfulness and insomnia, agnosia, acalculia, sore waist and weak knees, muscular dystrophy of limbs, anorexia, short of breath and fatigue, thin, sunken and feeble pulse, light tongue, plump body of tongue with marked teeth, yellowy lingual fur. MRI was used to confirm the diagnosis of VaD as well as the use of mini-mental state examination (MMSE). While integrated holistic syndrome differentiation pattern to definite the syndrome of asthenia of both spleen and kidneys, and damage of essence and marrow depletion, and the therapeutical principle of which is to strengthen spleen and tonify kidneys. The primary acupoints for treatment of the syndrome involve *Xiao Sishencong*, *Da Sishencong*, *Shenting*, *Fengfu*, *Dazhui*, *Quchi*, *Hegu*, *Yingu*, *Sanyinjiao*, *Taixi*, *Qihai*, *Shenmen*. The use of mild reinforcing and attenuating way to stimulate the acupoints in 1 to 1.5 inch needle maintain half an hour every time, manipulate needles to promote acu-esthesia 2 to 3 times, integrated with scalp acupuncture, electroacupuncture and ears acupuncture therapy, and once-daily therapy for strengthening effect. For half years treatment, the patient's impaired cognition obtained an effective improvement, especially in communication and life of quality. The acupoints and manipulations were changed as the change of patient's VaD situation development and prognosis. After one year's treatment in acupuncture with strengthening TCM daily regulation and rehabilitation, the patient's VaD is cure, and the skull MRI indicated well that matching with this aged.

6. Conclusions

The understanding of VaD in TCM and treatment of that in acupuncture are advantaged on clinical effect which also is as the most leading important topic for acupuncture study. Etiopathogenesises of VaD contain five highlights in TCM, including ageing and asthenia of healthy energy accompanying with concurrent diseases of *zang*-organs and *fu*-organs, autolesion of *zang*-organs due to improper seven emotions, injured by five viscera excessive emotional activities and incoordination of seven emotions, turbid phlegm blocks the clear orifices and clear *yang* fails to distribution, blood stasis obstructs the collaterals and deficiency of marrow-reservoir. The five primary points on understanding VaD in TCM are integrated with western medicine to guide for clinical practice. There are six syndromes of VaD classified for clinical practice in acupoints selection and manipulation, including syndromes of deficiency of kidney *qi* and marrow sea, liver and kidneys *yin* deficiency and the essence and marrow start to fade, asthenia of both spleen and kidneys and damage of essence and marrow depletion, damp abundance due to splenic asthenia and stagnation of phlegm in the orifices, stagnation of qi to block orifices and blood stagnation in the brain. As result that treatment with syndromes differentiation in acupuncture on VaD is clear and

easy for clinical practice, especially to enhance the effect of acupuncture, while integrated with kinds of therapy methods of acupuncture. However, modern science and technology and methodology should be induced to acupuncture for reveal and solve the scientific problems so that the development and use of acupuncture will be widespread and popular, such as randomized controlled trail and meta-analysis of best evidence for guidelines (Fernández et al., 2011; Ho et al., 2011). In conclusion, the use of acupuncture to treat VaD just reflects TCM thinking pattern on regulating diseases effectively which are as partial of thousands years sediments evidence on personal clinical medicine.

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5

An Evidence-Based Review of Acupuncture in Osteoporosis and Fracture-Related Pain

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1. Introduction

After 40 years of extensive studies, compelling evidence has been obtained to support acupuncture as a useful tool for treating a spectrum of diseases. In fact, more than 40 disorders have been endorsed by the World Health Organization (WHO) as conditions that can benefit from acupuncture treatment (Han, 2011). A study on 202 subjects attending an Australian university osteoporosis clinic found that almost one-fifth of those using a complementary medicine modality used acupuncture (*Table 1:* Mak 2010). This chapter begins by looking at the history of documented acupuncture use in osteoporosis. It then utilises an evidence-based approach in appraising relevant clinical trials over the past 10 years of the benefits of acupuncture use in osteoporosis (improvements in bone-mineral density, falls and fracture rates), as well as the efficacy in the treatment of acute fracture-related pain. Finally, it discusses the pathophysiological basis of the efficacy of acupuncture in these conditions. 'Within the next 5-10 years, clinicians could be routinely recommending acupuncture as a first-line treatment for fracture-related pain. The use of acupuncture in this circumstance bypasses the common problem of systemic side-effects from oral and topical analgesic agents'.

2. Basic bone biology and pathophysiology of fractures

2.1 Osteoporosis

"Osteoporosis" is a term that encompasses both a risk factor for fragility (low bone density) and a condition of fragility (fractures) (Heaney, 1998). About a third of new fractures come to medical attention, suggesting that, in reality, most are either asymptomatic or have tolerable symptoms. Bone strength is based on bone density and other factors, such as remodeling frequency (bone turnover), bone size and area, bone microarchitecture and degree of bone mineralization. While there is a strong inverse relationship between BMD and fracture risk, the rate of bone turnover is also a risk factor for fracture. Cancellous/trabecular bone is more sensitive to high bone turnover. Rapid bone turnover can disrupt the underlying microarchitecture of bone thus affecting bone strength. Because new bone synthesis is a slower process than bone resorption, rapid bone turnover can lead to an imbalance in bone renewal and to loss of connectivity within the trabeculae. Loss of connectivity irreversibly weakens the structural integrity of the bone and is a more serious

consequence than mere thinning of the trabeculae. Such a weakening of bone microarchitecture has been found in early postmenopausal women (Martin, 2008).

CAM therapy	n *(%)*
Any CAM therapy, standard CAM definition[a]	104 (51%)
Any CAM therapy, stringent CAM definition[a]	62 (31%)
Multivitamins	25 (24%)
Fish oil	24 (23%)
Acupuncture	20 (19%)
T'ai chi	15 (14%)
Glucosamine	14 (13%)
Yoga	13 (13%)
Chiropractic/osteopathy	12 (12%)
Naturopathy	6 (6%)
Herbal therapy	5 (5%)
Chinese medicine	3 (3%)
Aromatherapy	2 (2%)
Massage therapy	2 (2%)
Homeopathy	1 (1%)
Hypnosis	1 (1%)
Minerals	1 (1%)
Laser therapy	1 (1%)
Reflexology	0 (0%)

Percentage is provided in parentheses and the total is greater than 100% because patients used multiple therapies.
[a]Standard definition includes all therapies listed in table; stringent definition excludes hypnosis, multivitamins, *t'ai-chi*, and yoga.

Table 1. Patterns of Complementary and Alternative Medicine (CAM) Use in Osteoporosis Clinic Patients According to the Standard CAM Definition (N=104) (from Mak 2010)

2.2 Fractures

Osteoporotic fractures are frequently referred to as fragility fractures or low-trauma fractures, since they occur with minimal or no trauma. The development of osteoporosis and osteoporotic fractures is multifactorial, with skeletal strength factors, such as low bone density and impaired bone quality, and nonskeletal factors, such as falls, playing important roles.The likelihood of a fracture depends on the type of fall (Nevitt, 1993). Hip fractures in the elderly tend to occur with backwards or sideways falls in which the person is unable to break the fall and lands directly on an unprotected hip (Greenspan, 1994). Elderly people who are thinner or taller are at greater risk of a hip fracture because there is less soft tissue to absorb the impact or because the hip axis is longer (Fitzpatrick, 2002).

3. Pathophysiology of osteoporosis and fracture-related pain

Bone pain is a debilitating form of pain emanating from the bone tissue. For many years, it has been known that bones are innervated with sensory neurons. Yet, their exact anatomy

remained obscure due to the contrasting physical properties of bone and neural tissue (McCredie, 2007). However, until recently, it was not determined what types of nerves innervated which sections of bone (Mach, 2002). The sensations from bone tissue are carried by sensory nerves, which mainly supply the periosteum (outer covering of a bone) and the peri-articular (adjacent to a joint) portions of a bone. The nerve supply is also extensively present in vertebrae, which is the reason why vertebral bone pain is more common. Mechanically-induced pain is elicited when these somatic nociceptors are triggered during a fracture, e.g. vertebral collapse or a fractured hip.

3.1 Osteomalacia and pain

Osteomalacia is a generalized bone condition in which there is inadequate mineralization of the bone, caused by insufficient calcium or phosphate. Calcium absorption from the intestine may be reduced because of a deficiency of, or rarely resistance to the action of vitamin D, or less commonly due to a severe lack of dietary calcium (Thacher, 2011). In adults, osteomalacia starts insidiously as aches and pains in the lumbar (lower back) region and thighs, spreading later to the arms and ribs. The pain is symmetrical, non-radiating and is accompanied by sensitivity in the involved bones, and is invariably accompanied by proximal muscle weakess leading to a typical 'waddling' gait and difficulty in transfers and stair-climbing. Due to demineralization bones become less rigid. Pathologic fractures due to weight bearing may develop. Most of the time, the only alleged symptom is chronic fatigue, while bone aches are not spontaneous but only revealed by pressure or shocks. (Eisman, 1988).

3.2 Vertebral fractures and pain

Vertebral fractures — deformities of the vertebral bodies identified with imaging of the lateral spine and characterized according to shape — are the most common manifestation of osteoporosis. These fractures are usually identified clinically when a patient presents with back pain, and a spinal radiograph is interpreted as showing a fracture of a vertebral body, most commonly in the thoracolumbar transition zone or mid-thoracic region (Cooper, 1992). However, in contrast with other fracture types, most vertebral fractures do not come to medical attention at the time of their occurrence. Only one quarter to one third of incident radiographically identified vertebral fractures are clinically diagnosed (Fink, 2005). However, clinical vertebral fractures may cause pain severe enough to require hospitalization (Burge, 2002).

In a recent study of 202 patients with vertebral fractures in a randomised-controlled trial of vertebroplasty versus conservative treatment (Vertos II), more than half of the study patients had pain spontaneously decreasing to bearable levels, with a VAS score lower than 5 thereby precluding inclusion, suggesting spontaneous improvement with time. Despite this, the increased pain relief after vertebroplasty remained significant throughout a year of follow-up. This finding is remarkable, since fracture healing in the control group should be completed within several months. However, some patients in the control group developed chronic back pain, possibly because of non-healing of the fracture, and likely inadequate treatment of the initial pain leading to chronic back pain (Klazen, 2010).

3.3 Hip fractures and pain

A recent prospective study by Mak et al (2011) on 415 patients with hip fractures found that multiple variables exist in determining the amount of analgesia used, being a proxy for the

severity of pain, including hip fracture subtype and operative technique. Unstable pertrochanteric fractures (3-4 part intertrochanteric hip fractures) required more analgesia than stable pertrochanteric fractures (2 part) and subcapital fractures in patients with hip fractures at 24 to 36 hours after hip fracture surgery. This is consistent with the theory that the instability of the hip fracture (both the type of hip fracture, SC or trochanteric, and the number of fracture fragments) is a strong determinant for the amount of pain relief required (*Table 2)*.

Postop Analgesia Usage (mg[a])	Subcapital Undisplaced Fracture (n = 39)	Subcapital Displaced Fracture (n = 156)	Basicervical Fracture (n = 42)	Simple Interchanteric Fracture (n = 94)	Complex Interchanteric Fracture (n = 60)	Subtrochanteric Fracture (n = 24)	P Value[b]
0-6 hours	8.3 (24.3)	4.5 (6.3)	4.9 (6.5)	2.3 (5.1)	2.2 (5.7)	4.4 (7.4)	.034
6-12 hours	10.3 (24.8)	4.4 (7.8)	5.4 (6.6)	4.3 (5.2)	3.2 (5.3)	6.3 (8.18)	.02
12-24 hours	8.8 (18.1)	6.6 (10.1)	7.6 (9.2)	5.2 (5.5)	7.3 (8.7)	15.0 (20.2)	.027
24-36 hours	11.3 (17.1)	8.8 (18.1)	12.1 (17.4)	7.6 (5.9)	9.7 (15.8)	24.7 (27.2)	.001
0-36 hours	39.6 (77.6)	24.3 (35.6)	30.0 (32.3)	19.3 (14.7)	22.2 (26.0)	50.5 (39.7)	.006

[a] Denotes mean equivalent of oral morphine in milligrams (standard deviation).
[b] Continuous variables were compared with the use of a Student *t* test.

Table 2. Analgesia Requirements Following Hip Fracture Surgery According to Hip Fracture Subtypes in 415 Patients (from Mak 2011)

Dasch et al (2008) reviewed a large cohort of elderly patients with hip fracture (1541) over a 21 -month period and noted a large fracture-related hip pain prevalence of 13.4%. Patients often focus on the immediate post-operative clinical phase. These studies have revealed shortcomings in the treatment of pain with the consequence that severe pain both at rest and with motion on the first days after the operation delayed early mobilization of the patient, interfered with participation in physical therapy, and led to longer hospital stays (Morrison, 2003). Furthermore, a strong association was found between severe pain in the immediate post-operative phase and higher levels of motor impairment after discharge from hospital, confirmed by other studies (Cree, 2001; Feldt, 2000). The extent to which a previous hip-fracture can be a causal factor in chronic pain in the hip joint area has not been sufficiently studied. Data published to date suggest a high prevalence of hip pain among people with past hip replacement (Herrick, 2004; Linsell, 2006; Morrison, 2003).

Fracture-related pain was reported more frequently in self-rating interviews than in proxy interviews, consistent with the well-known phenomenon that caregivers tend to underestimate the presence of pain in patients (Lungenhausen, 2005). Overall, the severity of the fracture-related hip pain was characterized by 53.4% of the affected patients as moderate (Grades 1 and 2), and by 46.6% as severe to very severe (Grades 3 and 4). This means that after a hip-fracture operation, an unacceptably large proportion of elderly patients suffer from severe pain post-discharge.

4. Evidence for acupuncture and osteoporosis

Acupuncture is a therapeutic intervention characterized by the insertion of fine, solid metallic needles into or through the skin at specific sites (Burge, 2002; Prather, 2007). Internal disharmony among bodily functions and between body and nature is believed to cause blockage of the body's vital energy, known as *qi*, which flows along 12 primary and 8 secondary meridians. Blockage of *qi* is thought to be manifested as tenderness on palpation.

The insertion of acupuncture needles at specific points along the meridians is supposed to restore the proper flow of *qi (*Figure 1).

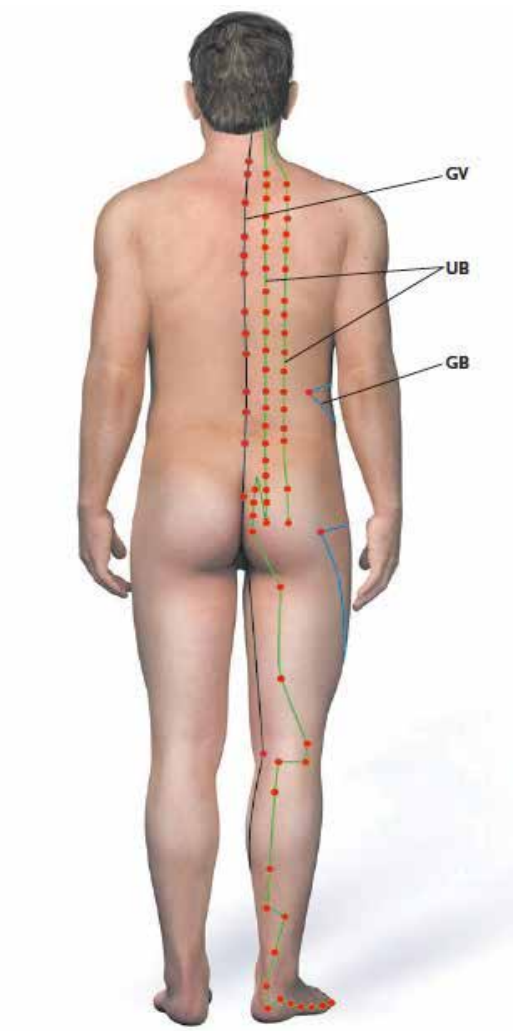

Fig. 1. Acupuncture Meridians. Twelve of the major acupuncture meridians are associated with a specific internal organ e.g. heart, lung or spleen), and an additional eight meridians are considered to be vessels or reservoirs of energy (*qi*) not associated with internal organs. Shown are the governing vessel (GV) meridian, the urinary bladder (UB) meridian, and the gallbladder (GB) meridian (From Berman 2010)

A fundamental concept of Traditional Chinese Medicine (TCM) is qi. This is translated as "intrinsic energy". TCM theory holds that there are invisible channels of energy (Jing Luo) all over the body. These channels conduct the qi to all parts of the body and are connected to vital organs. Qi assists the various organs and fluids of the body to function correctly (Crompton, 1996). Acupuncture treatment regulates qi that further regulates blood to prevent and treat qi and blood problems and maintain a healthy body.

According to the TCM classic "Nei Jing", the kidney system comprises the kidney, marrow, bone and brain. In this holistic theory, the kidney controls bones in the body. The relationship between the physiology and pathology of the kidney, marrow and brain is associated with pathways made up of channels and collaterals. According to the Jing Luo theory (the theory of Channels and Collaterals) and differential diagnosis, 'Foot Shao Yin Kidney' channel, 'Foot Tai Yang Bladder' channel, 'Foot Tai Yin Spleen' channel and 'Foot Jue Yin Liver' channel are all related. A close relationship exists between the 'Foot Shao Yin Kidney' and 'Foot Tai Yang Bladder' channels. This relationship, in combination with the role of the kidney, as governing bone and marrow and the path of the Bladder channel through the back and hip areas associate weakness in the back and hips with a kidney problem. This supports the TCM view that the occurrence of bone loss and osteoporosis in the region of the lower back and hips (and a high rate of fractures) are associated with TCM kidney. If acupuncture can improve kidney function then bone density may be improved. (Xu, 2003)

A recent review of 57 systematic reviews on the evidence for acupuncture found that it was effective in osteoarthritis pain, neck and low back pain (Ernst, 2011). However, it cautioned about serious complications after acupuncture which continue to be reported. Many are not intrinsic to acupuncture, but caused by malpractice of acupuncturists. The most frequent complications included pneumothorax, and bacterial and viral infections. In the next section, we review the evidence for acupuncture in the different facets of osteoporosis, namely in acute fractures (the most common of which are vertebral and hip fractures), and then onto its possible benefits for bone health.

4.1 Search strategies

The author identified randomised controlled trials (RCTs) and meta-analyses of acupuncture 25 interventions for fractures and bone health that were published from January2001 to 26 January 2011 by searching electronic databases (MEDLINE, EMBASE and CINAHL) in the 27 English language. The Cochrane Database of Systematic Reviews was searched up to Issue 2, 2011. Search terms were "osteoporosis", "fractures", "bone health" together with "acupuncture". Searches were limited to RCTs and meta-analyses and participants aged 50 years or older. In the absence of an RCT, *the author* searched for large-scale observational and 31 other relevant studies.

All articles were read independently by two assessors *(JCSM and LM)*. Results and data on 33 study quality were recorded on a proforma developed according to Cochrane Collaboration 34 guidelines for assessment of study quality (Higgins, 2011). Disagreements were resolved by 35 a third, independent ssessor and a consensus meeting.

4.2 Acupuncture and vertebral fractures

Data from randomized, controlled trials evaluating the efficacy of pain medications in patients with acute vertebral fracture are lacking, but in practice, non-steroidal anti-inflammatory drugs, analgesics (including narcotics and tramadol), transdermal lidocaine, and agents used to relieve neuropathic pain (e.g., tricyclic antidepressants) are commonly used. Although the pain of acute vertebral fracture typically subsides over the course of several weeks, narcotics are often required temporarily to facilitate mobility and avoid prolonged bed rest (Ensrud, 2011). The data from the VERTOS II study (Klazen, 2010) found

that with acute osteoporotic vertebral fractures who have persistent severe pain, vertebroplasty done at a mean 5.6 weeks after onset of symptoms resulted in quicker and greater pain relief than did conservative treatment, suggesting that the benefits of early targeted treatment.

There were no relevant articles on the efficacy of acupuncture in acute vertebral fractures. However, an RCT of 55 older patients (age > 60) on the efficacy of acupuncture for chronic lower back pain patients versus control (not sham acupuncture) found a significant decrease in the modified Roland Disability Questionnaire (RDQ) at week 6 and 9 for subjects treated with five biweekly courses of acupuncture versus usual treatment.

Given the sparsity of evidence, further high-quality RCTs are required in this area comparing with sham acupuncture.

4.3 Acupuncture and hip fractures

Again the literature was sparse in this area. However, we found a useful RCT for the use of auricular acupressure following a hip fracture. Auriculotherapy, or auricular therapy, or ear acupuncture is a form of alternative medicine based on the idea that the ear is a microsystem with the entire body represented on the auricle, the outer portion of the ear. Ailments of the entire body are assumed to be treatable by stimulation of the surface of the ear exclusively. Barker (2006) conducted a randomized, double-blind, sham control study to determine whether auricular acupressure can decrease not only the level of anxiety but also the level of pain in a group of elder patients with acute hip fracture. For the 38 study patients, patients in the true intervention groups had less pain ($F = 28$, $p = 0.0001$) and anxiety ($F = 4.3$, $p = 0.018$) and lower heart rate ($F = 18$, $p = 0.0001$) on arrival at the hospital than did patients in the sham control group. As a result, the patients in the true intervention group reported higher satisfaction in the care they received during the ride to the hospital. The authors encourage physicians, health care providers, and emergency rescuers to learn this easy, noninvasive, and inexpensive technique for its effects in decreasing anxiety and pain during emergency transportation.

4.4 Acupuncture and bone health

The literature search revealed no human RCTs but several small animal based and animal research studies on the use of acupuncture in several parameters of bone health.

4.4.1 Animal studies

Zhang (2006) randomised 24 ovariectomised rats into 3 groups (sham: rats were not ovariectomised), model (rats were ovariectomised) and acupuncture groups) and underwent 16 weeks of treatment. Blood and urine were collected to measure serum osteocalcin (OC) and urinary calcium, phosphorus or deoxypyridinoline (Dpd). After 16 weeks of treatment, all the rats were killed and their tibiae and femora were removed. The tibiae were used for analyses of bone histomorphometry and the femora for a three-point bending test. The acupuncture group gave significant protection against ovariectomy-related decline on femoral strength in the mechanical test, increased the trabecular bone volume and thickness, lowered the trabecular separation of tibiae and restricted the excretion of phosphorus and Dpd, while promoting concentrations of serum osteocalcin as compared with model rats. These results indicate that acupuncture on the points of Pishu

(BL20) and Shenshu (BL23) may promote bone formation but also suppressed the bone resorption induced by ovariectomised in osteoporotic rats.
Chen (2010) assessed the effects of acupuncture on the changes in the histomorphometric and mechanical properties of femurs in senescence-accelerated mice strain P6 (SAMP6). Six-month-old male SAMP6 and SAMR1 mice were allocated to 1 of 4 groups: SAMP6 control group (Pc), SAMP6 non-acupoint control group (Pn), SAMP6 acupuncture group (Pa) and SAMR1 control group (Rc). The Pa group was acupunctured at the Shenshu point (BL23) once daily for 8 weeks. After acupuncture treatment, the decreased serum testosterone level in SAMP6 mice increased markedly, whereas the increased OC concentration declined sharply. The bone histomorphometric and mechanical indexes of SAMP6 mice also improved significantly. The values of trabecular thickness, trabecular bone volume, osteoid volume, mineral apposition rate and bone formation rate in Pa mice increased by 20.4, 18.1, 14.1, 9.9 and 14.7%, respectively, compared with Pc mice. The scores for ultimate force, yield force, elastic stress, ultimate stress and energy to yield force for Pa mice were significantly higher than those of Pc and Pn mice. Acupuncture at BL23 was found effective in promoting bone formation, restoring the amount of bone volume, improving bone architecture and reversing osteoporosis in SAMP6 mice to some degree by enhancing the secretion of testosterone and declining bone turnover.

4.4.2 Human studies

Xu (2005) conducted an eight-month paired cross-over study the effects of three traditional Chinese therapeutic strategies (Tai Chi, acupuncture and Chinese herbal medicine) on bone structure and function to prevent bone loss were evaluated. The effects of these modalities were objectively examined through changes in bone material properties and the biomarkers of bone metabolism. Broadband ultrasound attenuation (BUA), a measure of bone structure and density, velocity of sound (VOS), an indicater of the elastic modulus and the breaking forces of bone as provided by ultrasound parameters, were evaluated. The levels of osteocalcin (OSTN) in serum, a biomarker of bone formation and the levels of pyridinoline (PYR) and doxypyridinoline (D-PYR) in urine, which are bone resorption markers were evaluated as parameters of bone metabolism. Traditional Chinese Medicine diagnosis was also used to measure changes in participants' symptoms resulting from Tai Chi exercise, acupuncture and herbal treatment. Forty menopausal women who completed treatment and testing were divided into three sub groups; 12 into the Tai Chi exercise group, 14 into the acupuncture treatment group and 14 into the herbal treatment group. The groups were then further divided into treatment and control groups. The sub-group for each treatment underwent a four month regime while the control group maintained a normal lifestyle. Three main acupuncture points in the lower legs, KID 3, SP 6 and ST 36 (kidney, stomach and spleen meridians) were used in accordance with the common pattern of disharmony for each of the fourteen participants. Each of the subjects was treated 32 times by the researcher, twice a week for 16 weeks, the duration of each treatment was 30 minutes. Acupuncture of points KID 3, SP 6 and ST 36 tended to increase BUA 8.8% ($p=0.005$) when comparing the test results of Groups A+B pre and post treatment. The balance between bone formation and resorption improved, OSTN increased 30.9% ($p=0.006$) which indicates an improvement in bone formation, D-PYR was reduced by 18.5% ($p=0.002$) indicating a decrease in bone absorption, when comparing the test results of Groups A+B pre and post acupuncture treatment.

Chen (2010) studied the influence of acupoint catgut-embedding therapy on the quality of life, the reproductive endocrine and bone metabolism of postmenopausal women. A total of 65 women with climacteric syndrome were enrolled and randomly assigned to two groups, thirty-three in the treatment group on whom acupoint catgut-embedding was performed with Shenshu (BL23), Sanyinjiao (SP6) and Guanyuan (CV4) as main acupoints, and thirty-two in the control group who were only medicated with a chinese supplement (Fufuchun Capsule) for a treatment period of 3 months. A further 28 women with childbearing potential and normal regular menstrual cycle were selected and the reproductive endocrine hormone were tested in the ovulatory period as controls. The levels of serum follicle stimulating hormone (FSH) and luteinizing hormone (LH) of postmenopausal women were higher, and serum estradiol [E(2)] and testosterone (T) were lower than those of normal women ($P<0.01$). After treatment, the levels of serum E(2) In both groups and T in the treatment group were increased, while in the control group the serum E(2) increase was more significant than that in the treatment group ($P<0.05$), and serum T showed no statistical difference. The levels of serum FSH, LH, osteocalcin, calcitonin, parathyroid hormone and alkaline phosphatase were reduced significantly in both groups after treatment ($P<0.05$). This result suggests that acupoint catgut-embedding enhanced QOL in postmenopausal women and may regulate the hypothalamic-pituitary-ovarian axis to raise the serum E(2) level which may be significant in preventing and curing the osteoporosis in postmenopausal women.

5. Conclusion

Acupuncture is an effective strategy to assist with fracture-related bone pain (hip but not vertebral fractures) with few but several importantly rare side effects such as pneumothorax and infection. Whilst there are currently no high-level of evidence RCTs to suggest the benefits of acupuncture in bone health, there are several small animal and human trials suggesting its benefits in improve bone formation and turnover markers, bone structure and density and increase in estradiol levels in post-menopausal women, and testosterone in rats. Given the sparsity of evidence, however, further high-quality RCTs are required in this area comparing with sham acupuncture.

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Part 2

Particular Techniques

6

Yamamoto New Scalp Acupuncture (YNSA): Development, Principles, Safety, Effectiveness and Clinical Applications

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Witten/Herdecke Private University
Germany

1. Introduction

In the nineteen sixties, the Japanese physician and scientist Toshikatsu Yamamoto discovered an independent acupuncture system. Dr. Yamamoto presented this method, which originally consisted of five points, for the first time at a Japanese Ryodoraku Congress in Japan in 1973. For twelve years, using these highly effective points, which he termed basic points, he successfully treated stroke patients suffering from pain and paralysis. Taking second place only to ear acupuncture, YNSA (Yamamoto et al., 2010) is today the most widely and frequently used form of acupuncture and is gaining increasing significance.
Since 1973, in addition to the basic points, several other points have been discovered namely sensory point, brain points, Y points, extra points, treatment points on the thorax and in the region of the pubic bone, dorsal treatment points and additional peripheral points as well as various diagnostic points. Hardly any other acupuncture system can be described as so fertile since Dr. Yamamoto is untiring in his search for new methods of treatment, points and somatopes in his daily work. In Japan, acupuncture was largely practised by masseurs, which meant that it was not highly regarded in classical medicine nor, in particular, at university medical schools. Interest in and receptiveness to acupuncture is gradually increasing, also at some Japanese universities. YNSA has been the subject of numerous studies and publications. YNSA is also used very successfully in veterinary medicine, for example to treat cats and dogs. A number of research projects and publications on YNSA are eagerly awaited in the near future.

2. Principles of YNSA

The basic points are still used successfully in daily practice. Acupuncture needles are applied ipsilaterally at these basic points for pain therapy while for the treatment of central paresis they are applied contralaterally to the paretic side.
YNSA is a special form of traditional acupuncture. The method is based on a somatotope on the scalp. In the same way as with ear or mouth acupuncture, the entire organism is projected here on a defined area of the scalp. The locomotor system is at the boundary of the forehead and hair, whereas the internal organs are represented via Ypsilon points on both temples. Scalp acupuncture distinguishes a yin somatotope at the front of the scalp and a yang

somatotope at the back of the scalp. With the aid of the special Japanese neck diagnostics, the associated Ypsilon therapy points in the temples or the corresponding cranial nerve points are revealed via pressure-sensitive points in the neck region. As a representative of each meridian, there is a pressure point on the neck and an associated treatment point in the region of the temples. If, for example, the kidney point on the neck is sensitive to pressure the needle is applied to the corresponding Ypsilon point in the temple. If the needle has been correctly positioned in the temple region then the pressure sensitivity in the neck disappears consecutively and thus provides immediate verification for correct positioning of the needle.

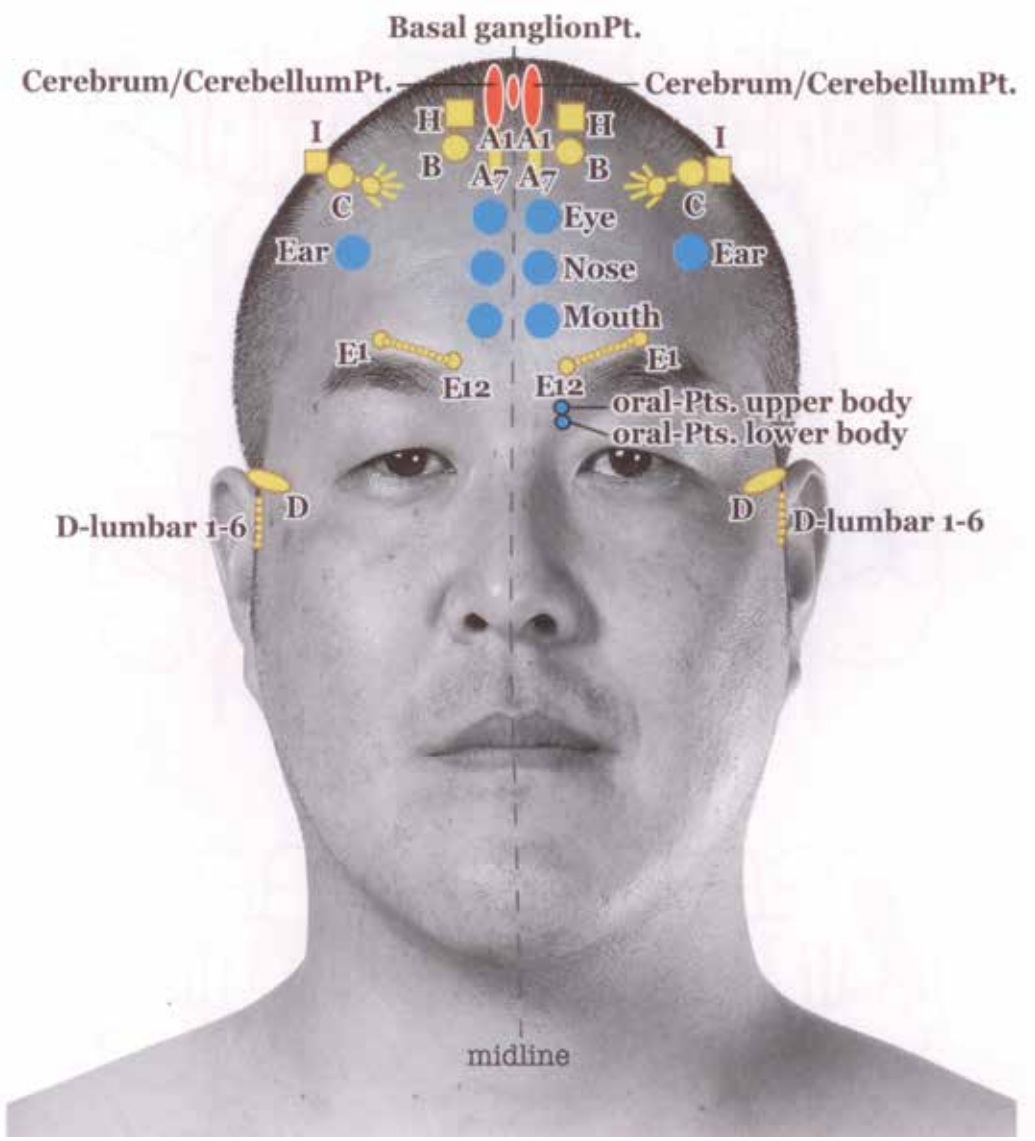

Fig. 1. Schematic representation of the frontal YNSA basic points. Needles are applied ipsilaterally for the treatment of pain and contralaterally for the treatment of paralysis.

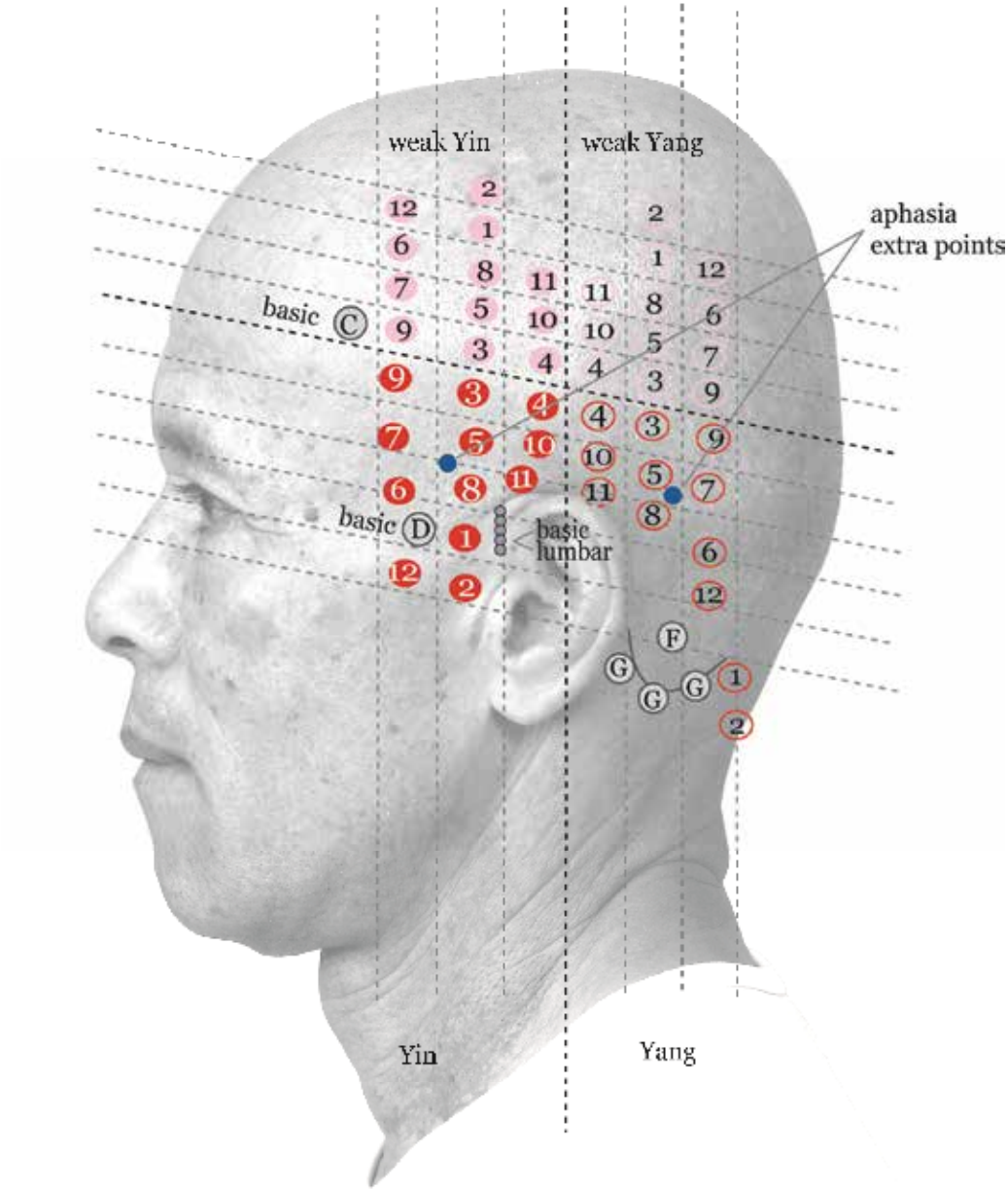

Fig. 2. Ypsilon points. Abdominal or neck diagnosis leads to the selection of the Ypsilon points in a treatment session

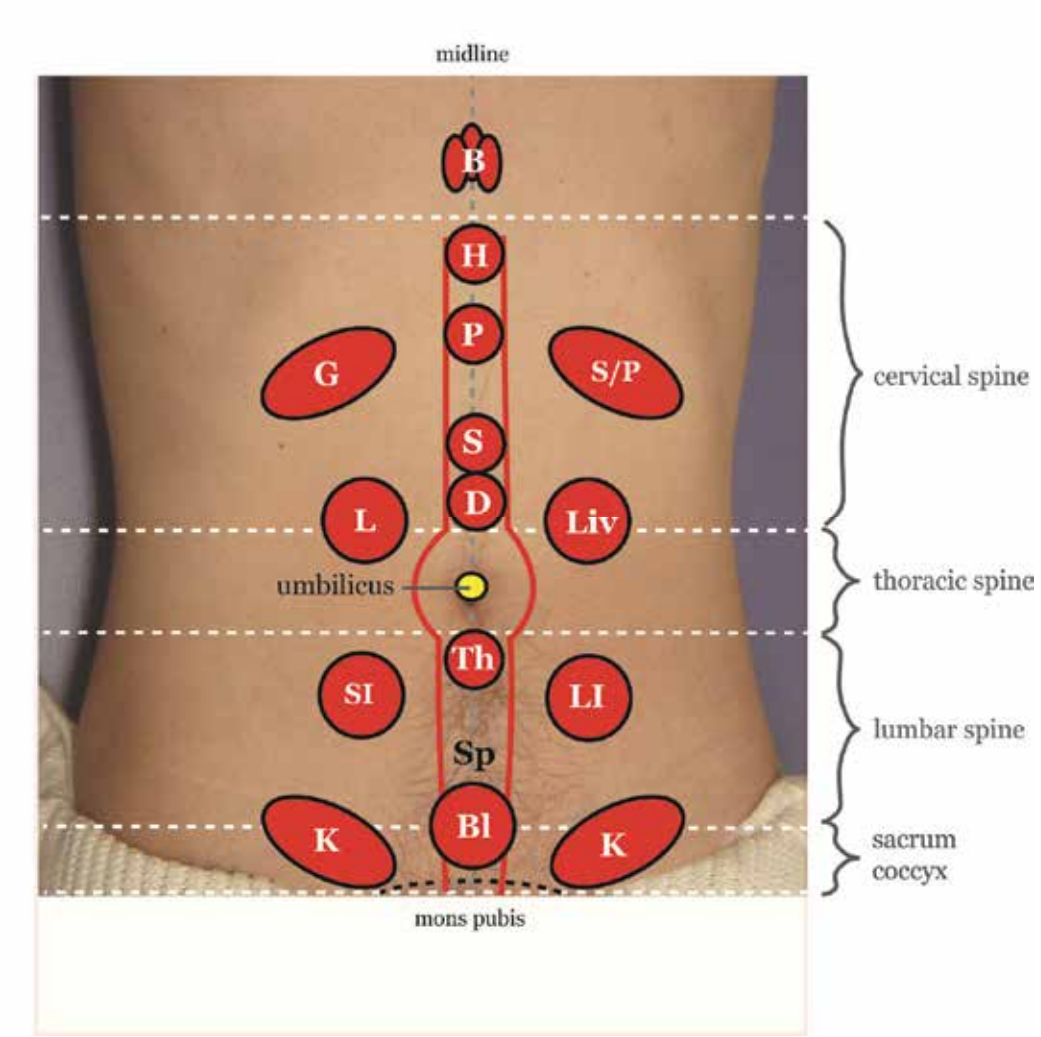

Fig. 3. The abdominal diagnosis leads to the Ypsilon or cranial nerve points

In contrast to the pulse and tongue diagnosis of traditional Chinese medicine, Yamamoto New Scalp Acupuncture (YNSA) is characterized by the special feature abdominal wall and neck diagnostics. These diagnostic procedures enable the acupuncture points to be identified individually in each treatment situation indicating where the needles are to be applied for each individual person in the respective treatment situation. When the needle is correctly positioned, the sensitivity to pressure felt by the physician and patient disappears. This check makes it possible to discover whether the needle is correctly positioned. It is important to investigate the diagnostic points on the arm and neck by shifting the pressure to the side. In doing so, the points are palpated with the tip of the thumb. Applying pressure solely to the points may falsify the results of the examination. In the case of abdominal wall diagnostics, the examination is performed by palpation using the index, middle and ring fingers with gently circling movements.

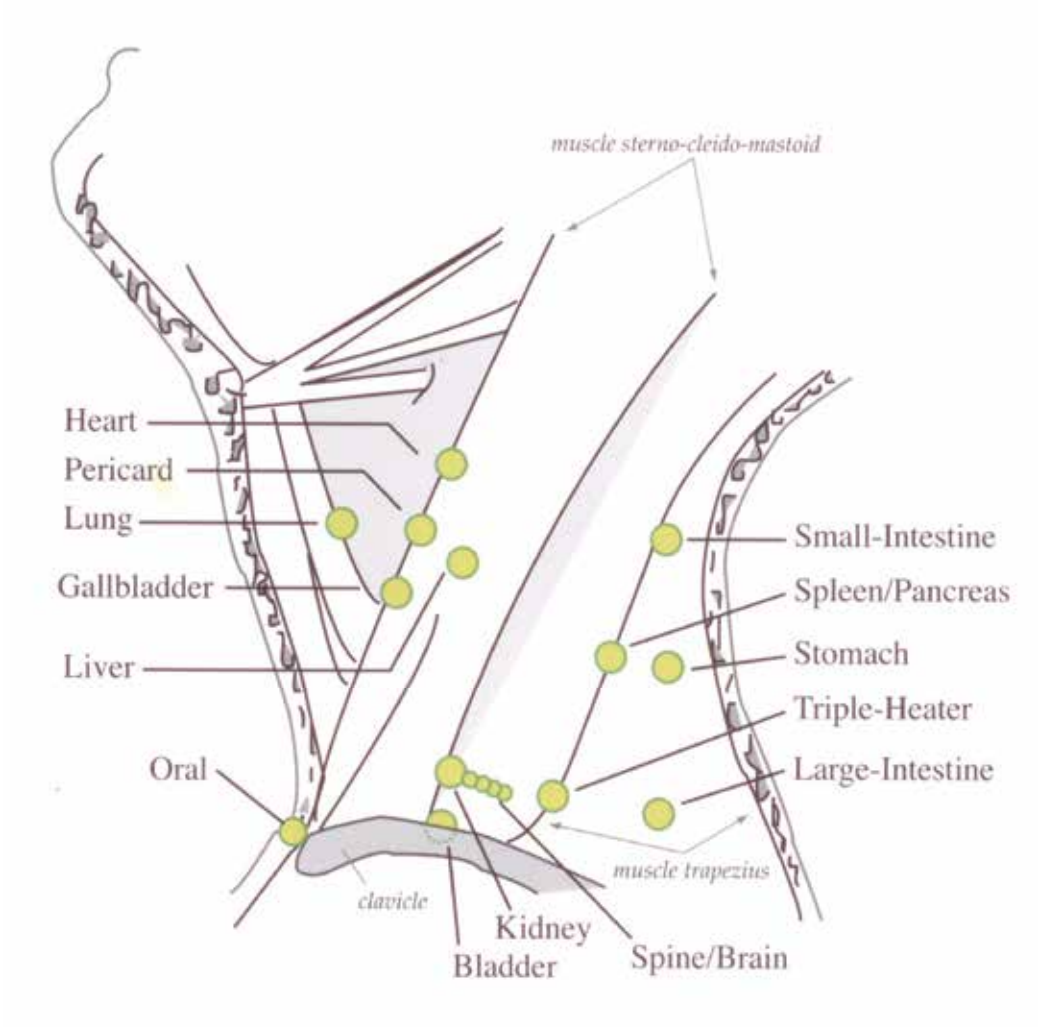

Fig. 4. Neck diagnosis is used to find the treatment points of the patient

2.1 Relevance of the YNSA cranial nerve points

The cranial nerve points are highly active acupuncture points on the frontal scalp. Using these points, disorders of the corresponding meridians and the cranial nerves can be treated. For example, the lung cranial nerve point, the glossopharyngeal point is used for the treatment of the swallowing disorders after stroke as well as pulmonary disorders of different origin. Based on the YNSA-Yin basic point A, 12 cranial nerve points are located in a row in the dorsal direction up to DuMai20 for approximately 6-8 cm. For the practical use, the cranial nerve points are identified by the adbdominal or neck palpation technique. The painful abdominal or neck points show the way to the corresponding cranial nerve points. After correct acupuncture of the relevant cranial nerve points, the pain intensity of the abdominal or neck sites should be reduced, similar to the Ypsylon points. Similar to the other YNSA points, the cranial nerve points display small treatment areas, which are

identified using careful palpitation. Acupuncture is then performed at the point with the highest pain intensity. Similar to the basic, brain and Ypsilon points, a careful palpitation is necessary and important for the localization of the cranial nerve points. The known Ypsilon and cranial nerve points can be used alone and in combination. It is important that the treated acupuncture point is reported as painful by the patient. A site which is not painful should not be treated. The cranial nerve points have shown to be very suitable for treatment of motor and other neurological symptoms.

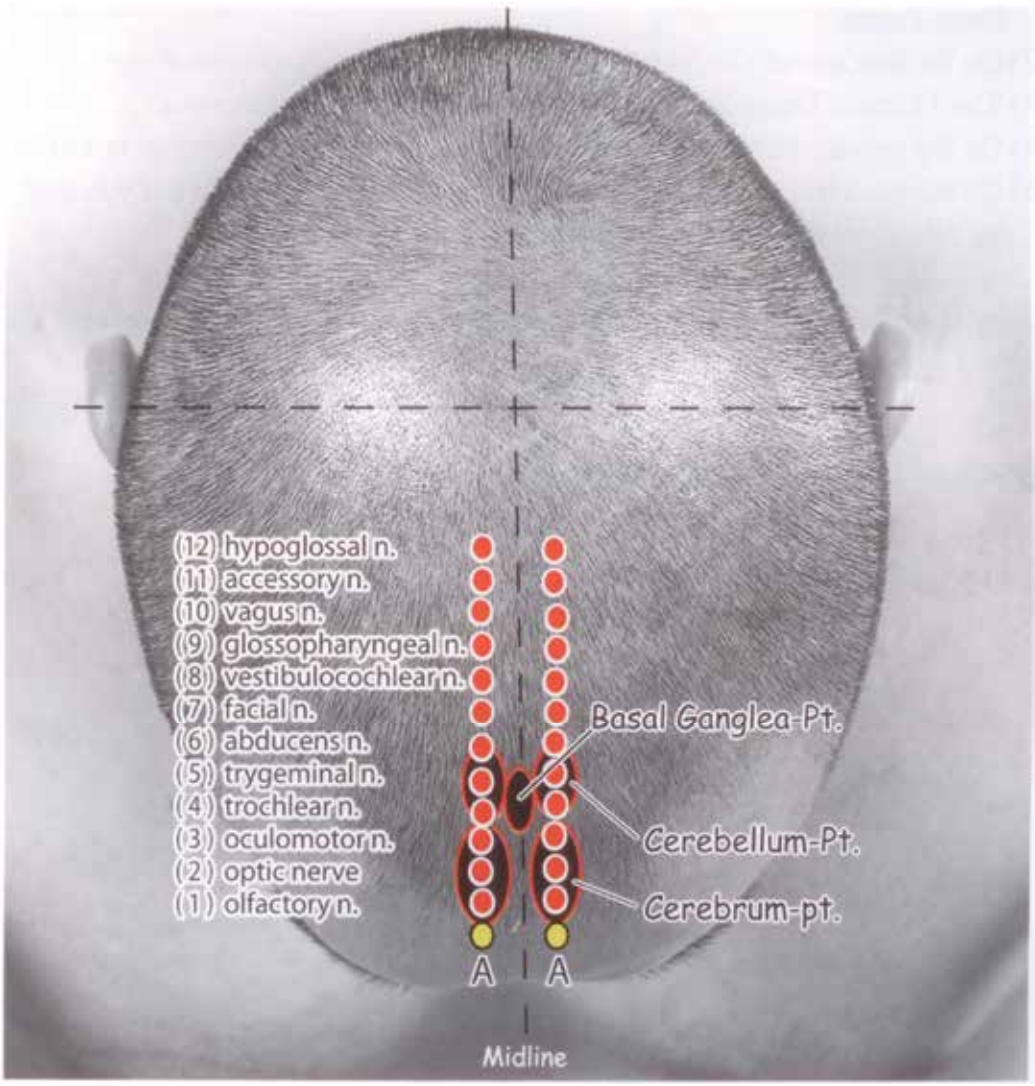

Fig. 5. The cranial nerve points and brain points with Yin-basic-point A

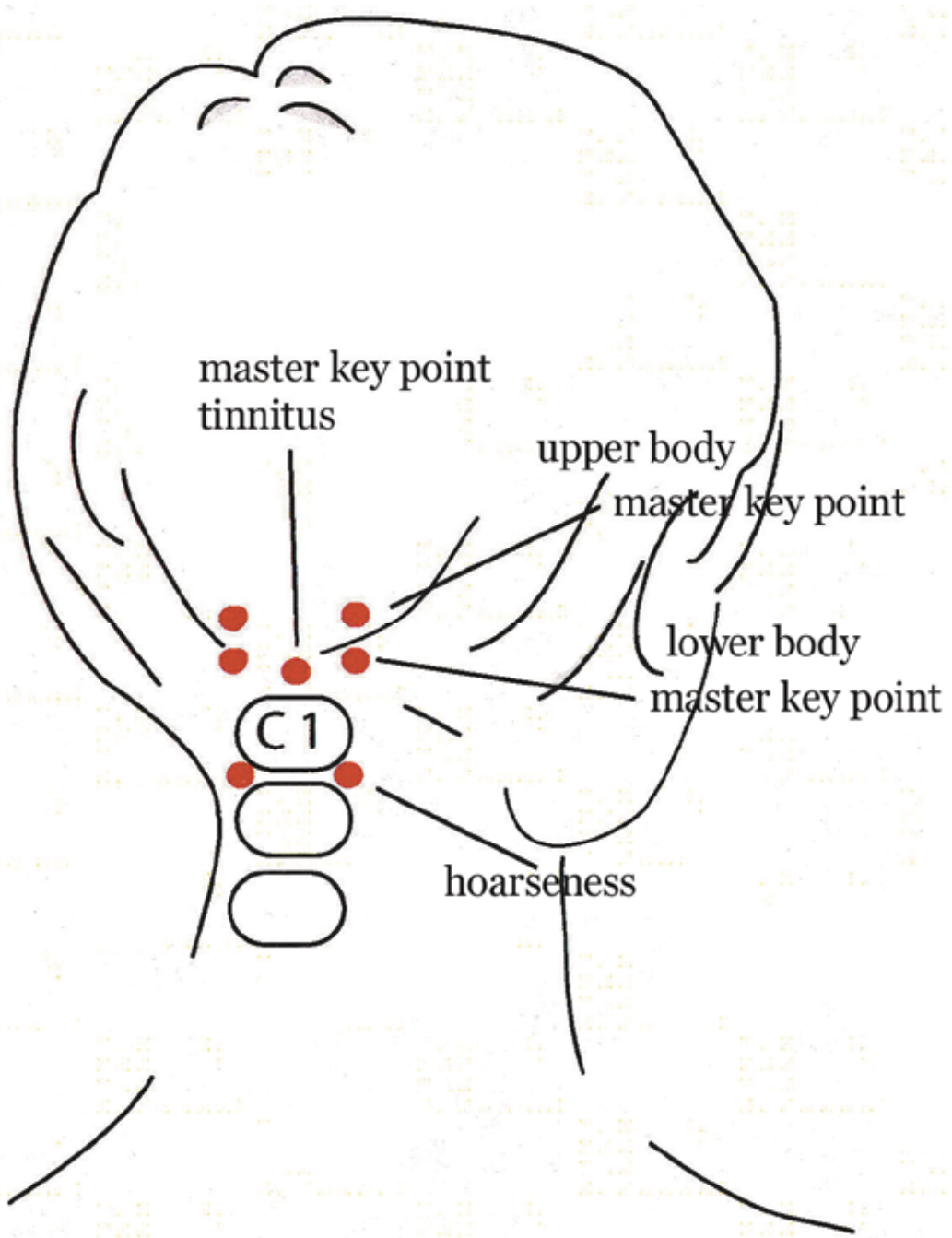

Fig. 6. Master key points for tinnitus, upper and lower body with hoarseness points

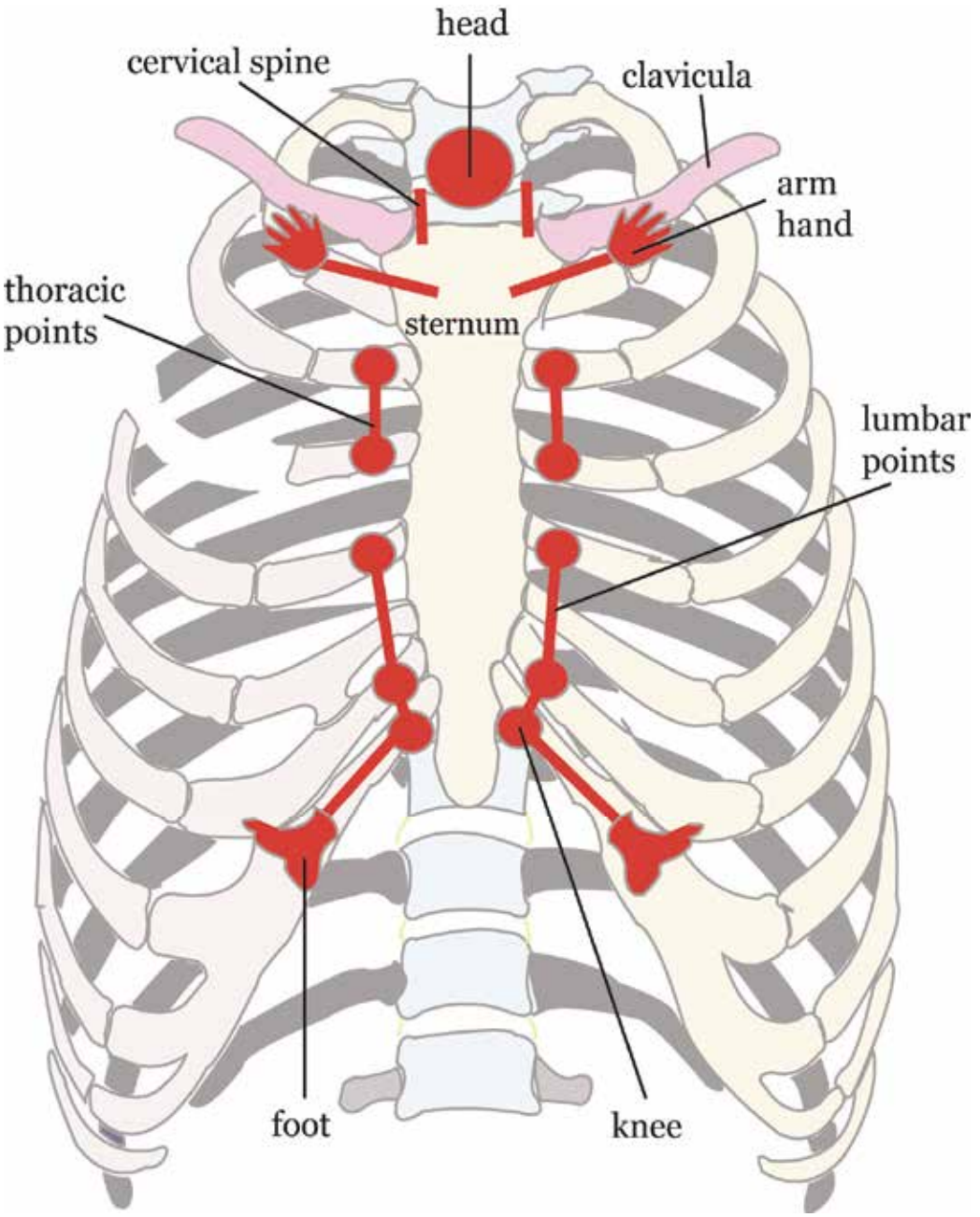

Fig. 7. Yamamoto New Chest Acupuncture

In the Yamamoto New Chest Acupuncture pain is treated ipsilaterally, hemiparesis contralterally. Very effective is especially the treatment of distubances of the locomotor system.

3. On the safety of acupuncture in the Thoracic region

Numerous references to side effects caused by acupuncture treatment can be found in medline. The investigation presented here was motivated in particular by reports of pneumothorax after acupuncture. After an autopsy on a corpse, the depth of various acupuncture needles penetrated into the thorax was investigated. The study was performed on a female corpse. For unknown reasons, the patient had been subjected to resuscitation and due to this measure had suffered a series of fractured ribs on the right-hand side. Issue investigated: Is it possible to apply acupuncture treatment safely in the thoracic region, in particular intercostally? Observations: Acupuncture in the thoracic region involves a greater or lesser degree of risk depending on the thickness of the subcutaneous fatty tissue. The longer the needle, the greater is the risk. In view of the fact that in some places the intercostals muscles are only 2 to 3 mm thick, the ribs themselves in the present case are 3 to 4 mm thick and the skin is 1 to 2 mm thick, in the case of a slim or cachectic person an acupuncture needle 1 cm in length can potentially lead to pneumothorax if applied intercostally. In order to ensure the greatest possible safety in acupuncture, it is necessary to choose needles that are as short and thin as possible and to apply them tangentially at the flattest possible angle. Additional safety can be achieved by moving the tip of the needle towards the rib or corpus sterni. If, as for example in the case of thoracic Yamamoto New Chest Acupuncture, the needles are to remain in position in the patient so that further physiotherapy measures can be applied, then they must be secured by a good adhesive plaster. It appears safest to apply the needles above the ribs and only above the xiphoid process, the corpus and manubrium sterni.

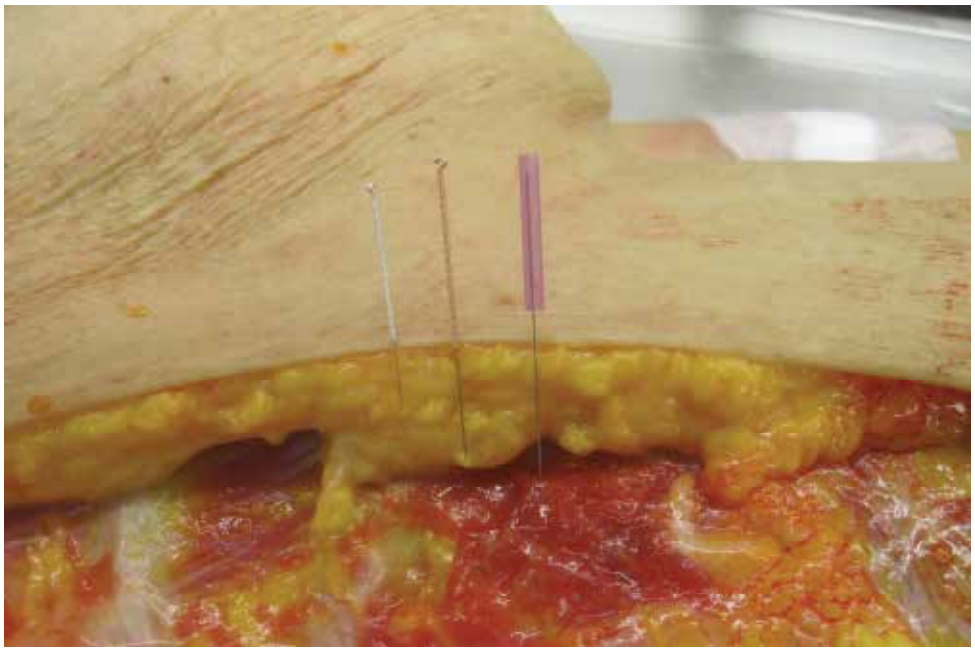

Fig. 8. Acupuncture needles of various lengths. In comparison: The depth of penetration into the subcutaneous fatty tissue can be seen. Penetration depth of the needles with respective lengths of 10, 15 and 25 mm in relation to skin and subcutaneous tissue.

Conclusions: The safety of acupuncture in the front thoracic region depends on the length of the needle and the angle at which the needle is inserted. The greatest possible safety can be achieved by applying short, thin needles above the ribs or towards the ribs or the corpus sterni.

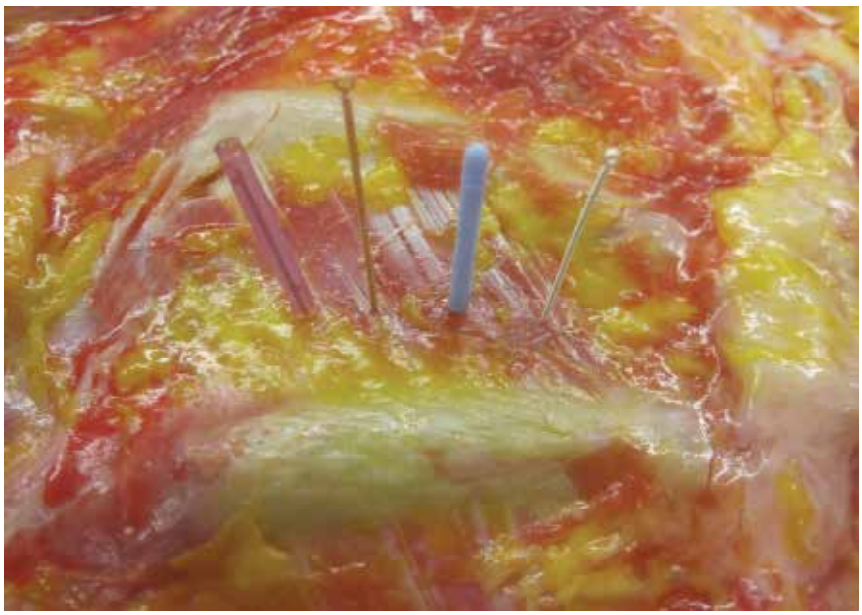

Fig. 9. Intercostal acupuncture with 4 different types and lengths of needles

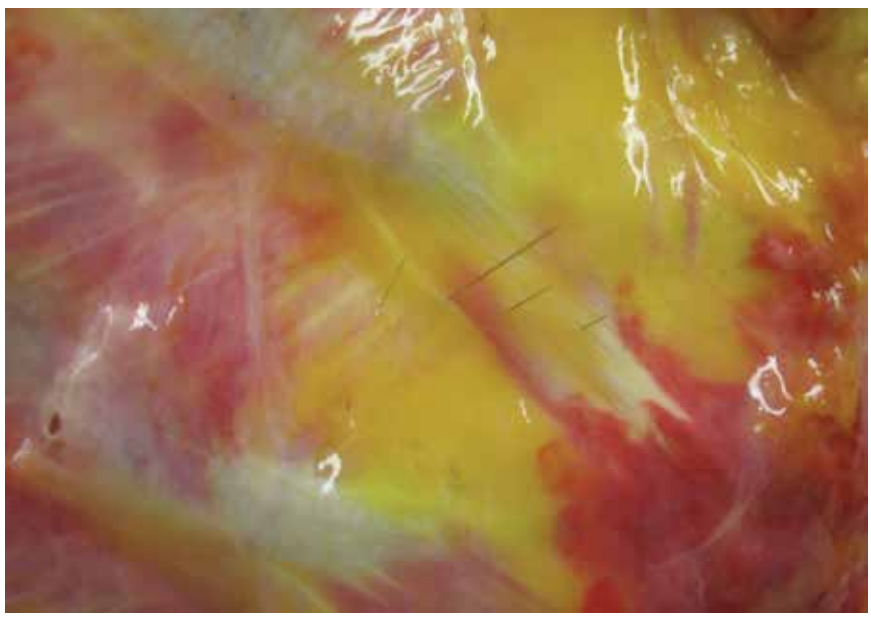

Fig. 10. These acupuncture needles penetrating through the intercostal muscles and into the thorax.

Fig. 11. The thickness of the ribs and the intercostal muscles

Fig. 12 The rib is 4 mm thick

4. Effectiveness and clinical applications

4.1 Functional Magnetic Resonance Imaging (fMRI)

With the aid of functional magnetic resonance imaging (fMRI), it was possible to demonstrate the good effectiveness of YNSA for stroke patients. In this study, a new metal-free acupuncture needle developed by the author was applied. Benefits associated with YNSA have been shown in studies in patients after stroke, in patients with musculoskeletal pain and in emergency medicine. In the Western world stroke is still the leading cause of disability in adults, often in the form of hemiparesis. The goal of the investigation introduced here was to correlate the effect of YNSA in hemiparetic stroke patients to cortical activation visualized in fMRI. The neurological correlates of YNSA were studied in 17 patients with ischaemic stroke in the right hemisphere suffering from residual paresis of the left hand and in 19 healthy volunteers. A new acupuncture needle for magnetic resonance imaging developed by Schockert was used in this study. Similar to the principle of an indwelling venous cannula, the needle is positioned in the acupoint, the steel cylinder removed, and the remaining plastic part is fixed in the acupoint by a plaster. The size of the plastic part remaining in the acupoint corresponds approximately to an acupuncture needle of the dimensions 0.30 x 30 mm (Schockert et al., 2010).

According to the ethical vote all participants have signed a consent before the treatment.

The fMRI study was performed in a 1.5 tesla Philips MRI system (TR 3000 ms, TE 50 ms, FA 90 °) in a box-car design. Patients were treated lying down and were instructed via video goggles to open or close their left hand. The fMRI paradigm was: five conditions with 120 sec duration each: 3sec closing of the fist, 2sec opening of the fist, 30 sec break. Three runs of fMRI were performed: no acupuncture, sham acupuncture (patient is blinded: acupressure without insertion of a needle), real acupuncture. The data were analyzed using an SPM2 evaluation program. All patients and volunteers were first subjected to sham acupuncture and then to YNSA. The sham acupuncture consisted of a single application of pressure by a finger nail in the centre of an imaginary line between TE23 and GB14. In the genuine YNSA, needles were applied to the Yin points of the Basal Ganglia, Cerebellum, and Basic point C. Of the 17 investigated patients, only five could be evaluated due to motion artefacts. On account of inhomogeneous lesions no group analysis was performed as cortical activation was different in each patient. Generally, in contrast to the sham acupuncture, genuine acupuncture was accompanied by significant cortical activation in the motor, premotor and supplemental motor cortex.

Eight of 17 patients felt subjectively better after the YNSA. The patients experienced a reduction of spasm and an improvement of the movement of the paralysed upper extremities. The 5 patients from whom the data were evaluated all showed subjectively clinical benefit after the YNSA treatment. Data from 13 healthy volunteers could be analysed without artefacts. In these subjects it was possible to perform a group analysis. In contrast to the patients, the volunteers displayed a decrease in cortical activation during YNSA. Without acupuncture: Cortical activation was shown in the motor cortex, cingulate gyrus and occipital lobe. Sham acupuncture: Cortical activation identical to that in subjects without acupuncture. Genuine acupuncture: No activation in the cingulate gyrus. The cingulate gyrus is part of the limbic system, a multimodal area with important afferent and efferent connections which is involved in planning of complex and difficult movements. Theoretically, a lack of activation in the cingulate gyrus could be a training effect or the result of selective inhibition of this area by

YNSA. Without acupuncture or with sham acupuncture cortical activation was observed close to the region of the vertex of the scalp, where GV20 is situated. This activation is not seen after genuine acupuncture. So it is conceivable that this is a specific YNSA effect. The effects look promising but could be the result of generalised stimulation. The reliability of the data analysis must also be verified. The design of the study shows methodological deficits. For studies in the future the documentation has to be done even more thoroughly with objective methods of measurement. The following practical problems were seen during the conduct of this study: Patients were lying down still in the scanner for about one hour. This was very tiring and difficult for the patients. In addition, it is conceivable that patients had major concentration problems during the third block (genuine acupuncture). We assume the results of this study could potentially support the use of YNSA as an adjunctive measure in stroke rehabilitation. In view of the fact that eight patients felt subjectively better after the treatment and in view of the changes in the cortical activations in the motor, premotor and supplemental motor cortex we assume that this benefit justifies the hypothesis that the YNSA treatment itself had this positive influence and is the cause of the positive effects described by the patients. As stroke is the leading cause of disability in the western world we assume that it is justified to suggest further larger controlled clinical trials and fMRI studies with more participants to investigate the phenomenon we have seen in this investigation (Schockert et al., 2010).

4.2 YNSA in PET-CT

4.2.1 YNSA activates cortical nociceptive and motor centers in patients with chronic pain of the locomotory system

The clinical application of Yamamoto New Scalp Acupuncture (YNSA) often shows immediate and long lasting effects in patients with locomotor disturbances such as pain syndromes, chronic stroke and Parkinson's disease. However, little is known about the underlying mechanisms of YNSA.

The aim of the study was to investigate potential areas of the central nervous system influenced by YNSA in the treatment of such patients. To this end, changes in the cerebral glucose metabolism were measured by PET-CT. We measured three subjects that were treated with YNSA for chronic pain syndromes in their lower extremities. Each patient was measured twice. The first measurement served as a baseline scan to assess the basic brain activity of the patient. The second measurement was acquired four to five days later, and the patient was treated with YNSA shortly before the beginning of the scan. Points were selected individually after YNSA neck diagnosis. A visual analogue scale (0-10) was used to assess pain reduction. Each subject's PET data were spatially coregistered to correct for differences in head position between the two scans. Consequently, the data were normalized to a template brain and smoothed with a 12 mm isotropic kernel in order to account for anatomical differences between the subjects. Finally, demeaning was applied to correct for global changes of signal intensity. All these steps were carried out using SPM 8 (Wellcome Trust Center for Neuroimaging, London) and FSL 4.1 (FMRIB, Oxford), respectively. After these pre-processing steps, data from the two measurements could be directly compared to each other. An increase in glucose metabolism (and thus of cortical activity) of more than 10% was considered significant. An average pain reduction of 4.4 ± 2.7 points was achieved with YNSA. PET data showed increased activity in the following cortical and subcortical areas: thalamus, lateral frontal- und dorsolateral prefrontal cortex (DLPFC), insula, medial and ventromedial prefrontal cortex, posterior cingulate cortex (PCC), cerebellum, basal ganglia and periaqueductal grey (PAG).

The reported activations could all be assigned to either the nociceptive (thalamus, insula, DLPFC, PAG), motor (cerebellum, basal ganglia) or attention networks (PCC, lateral frontal cortices). As changes in the level of attention were not monitored in this study, they cannot be ruled out. Thus we do not consider the observed activations in the attention network (PCC, lateral frontal cortices) a direct effect of YNSA. The average reduction in pain scale score and corresponding change in nociception system activation can be considered a direct effect of acupuncture. As VAS values were lower under YNSA as compared to baseline, these activations cannot simply be a result of the painful needle manipulation. The activation of the motor system, especially in the basal ganglia, offers a possible explanation for the efficacy of YNSA in general locomotor disorders. In this context, it is interesting to note that the YNSA point "basal ganglia" was used for treatment in two of the three subjects.

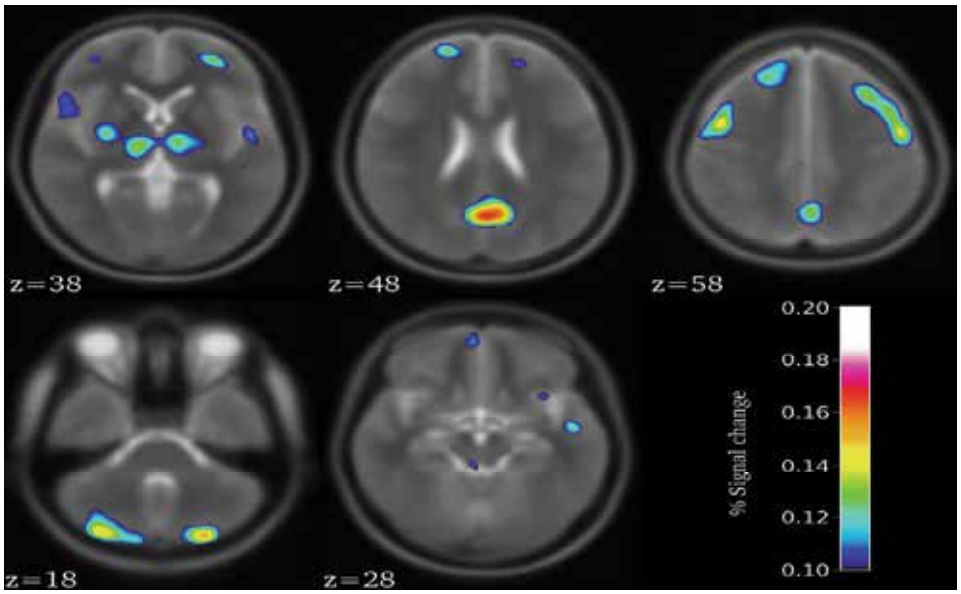

Fig. 13. Group results of the PET measurement. Contrast: Scan with YNSA needles in place > Baseline scan. Only signal changes of 10% and more are shown.

4.3 YNSA in emergency medicine

Due to the good effectiveness of YNSA, especially since YNSA takes effect very rapidly, I would like to propose that YNSA and other acupuncture methods could be applied as supportive measures both in emergency medicine and by the emergency services. YNSA has already been successfully employed by the emergency services. Acupuncture has also been used in military applications. There is thus an urgent need for further extensive studies on the application of acupuncture by the emergency services (Chen el al., 2010).

4.3.1 YNSA in emergency medicine – a case report

Various acupuncture methods are successfully applied in emergency medicine throughout the world and have also been studied scientifically. I myself regularly apply acupuncture in my daily practice and in emergency medical work. In the case history described here, I would like to present YNSA and show that I have employed YNSA to support emergency medical measures during pregnancy. The patient herself described YNSA as extremely

effective and soothing. On 23 April 2007, an emergency call was passed on to the rescue vehicle from the control centre at 19:15 concerning a pregnant patient who was experiencing severe back pain, dyspnoea and pain in the thorax. In a thorough physical examination of the 41-year-old patient an auscultation revealed that all sections of the lungs were free without any rattling noise or spasticity, after the immediate administration of oxygen the oxygen saturation was 99 %, blood pressure was 150/90 and pulse 100. An ECG did not show any pathological abnormalities. After a venous cannula had been inserted into the bend of the left arm and lactated Ringer's solution had been administered to the patient, a decision was taken to apply Yamamoto New Scalp Acupuncture as an analgesic. Upon closer questioning, the patient said that she had severe thoracic and back pain, and that the back pain, which did not radiate into the legs, was the most problematic for her. She said she had not felt well all day, but she did not want to take any painkillers. The patient agreed to be treated by acupuncture as pain therapy. According to the current procedures for YNSA, a neck diagnosis was first applied. The neck diagnosis led to the identification of the correct acupuncture points for this patient. The following 8 points were applied: basic points A right and left, basic points D and E right, parietally situated Y point kidney and brain points cerebrum, cerebellum and basalganglia. All needles have been inserted for about 5 milimeters into the scalp. Then the pressure sensitivity in the neck disappeared. There has been no stimulation or rotation of the needles in this treatment. The patient had already been treated by acupuncture on previous occasions and also experienced rapid relief of her symptoms by the scalp acupuncture applied under emergency conditions. Upon arrival in hospital, the patient had a complete relief from her symptoms.

In his book on acupuncture in emergency medicine that appeared in 1994, Richard Umlauf describes the points for body acupuncture and the points of various microsystems for their use in difficult and life-threatening illnesses. He considers these methods very efficacious and recommends their application. Acupuncture could be of great benefit in emergency medicine, especially for analgesic purposes since acupuncture may also be regarded as evidence-based medicine. Since the GERAC study this is particularly true of the treatment of knee and back pain. Although acupuncture research is under way throughout the world and acupuncture is also used in the emergency services, acupuncture cannot yet be described as evidence-based emergency medicine (EBEM). Like many other measures in complementary medicine, acupuncture offers a valuable, efficient and reliable adjuvant therapy option for all existing orthodox emergency treatments. Both for ethical and quite particularly for cost-saving reasons, the application of acupuncture and complementary medicine could also establish a permanent place in emergency medicine. Larger clinical trials are warranted to investigate the YNSA effects in emergency patients. In recent years, I have applied YNSA as a supportive measure or as a sole therapy for the relief of pain in a wide range of cases, for example acute renal colic and also for dyspnoea caused by asthma, in the emergency rescue service and also for emergency public health services. YNSA makes it possible to provide efficient therapy by applying needles to just a few points. The international literature describes a wide range of applications of various forms of acupuncture – also including acupressure – for use in emergency medicine, but also side effects due to body acupuncture that has not been applied correctly. As yet there are no articles on YNSA for emergency medicine in the international literature. I would like to encourage a discussion on increasingly including YNSA and other acupuncture methods in emergency public health services and also in emergency medical services as a complement to and in support of orthodox medicine. This will require extensive studies on the application of acupuncture by the emergency services. I hope for the sake of all affected emergency patients that acupuncture will be increasingly applied as an adjuvant and supportive method in the emergency services.

Fig. 14. Patient ready for transport: patient treated by ECG, oxygen and YNSA. The patient experienced relief from all symptoms after treatment with just 8 needles.

5. Conclusion

Working with YNSA is very encouraging and satisfying due to the frequently occurring immediate effects and lightning effects. YNSA finds widespread acceptance amongst patients.

6. Acknowledgment

Dr. Toshikatsu Yamamoto, I thank you very much for teaching me your YNSA.

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7

Toyohari Meridian Therapy: A Form of Acupuncture that Challenges our Assumptions while Opening New Vistas for Explorations of Acupuncture

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1. Introduction

Toyohari Meridian Therapy (TMT) [東洋はり] evolved in Japan in the second half of the last century. Originally developed and practised primarily by blind acupuncturists, its theoretical basis lies in historical Chinese medical traditions [Birch, Felt 1999, Fukushima 1991]. Choice of acupuncture points is predominantly guided by Five Phase (Element) Theory. However, there is a startling difference between TMT and current Chinese traditional forms of acupuncture in terms of needling technique. Needles are not usually inserted in the 'root treatment' of TMT- instead, the qi is manipulated at the surface of the skin, with the tip of the needle only very lightly touching or not touching the skin in most cases. Another difference from current Chinese acupuncture is the notion, in TMT, that acupuncture points or acupoints are dynamic- their actual location whilst based on traditional notions of where acupoints are located anatomically as espoused by most modern acupuncture texts may differ slightly from the purported anatomical location. A key skill of the TMT practitioner is locating the acupoints, via the sense of touch using the lateral corner of the index finger near the fingernail. Once the 'live' acupoint is located, the practitioner forms a circle with their index finger and thumb, termed the 'oshide', at the surface of the skin, lightly touching the patient's body. The needle shaft is then inserted between the practitioner's thumb and forefinger so that the tip is above the acupoint, with the practitioner's thumb and forefinger grasping the needle shaft, whilst the handle of the needle is lightly held in the other hand. The practitioner then awaits the arrival of qi and applies particular needling techniques, depending on whether the aim is to supplement or drain.

Diagnosis of the primary pattern (sho) and secondary sho depends on synthesis of data from a case history, abdominal diagnosis and pulse diagnosis. Unlike in traditional Chinese medicine, tongue diagnosis is not a feature of TMT. Abdominal diagnosis involves palpation of the skin and wall of the abdomen. The five phases and their corresponding

zang organ-meridian correspondences are mapped onto specific regions of the abdomen. The meridians are also palpated on the lower arm and lower leg. Pulse diagnosis is relied on heavily to guide the practitioner not only in initial diagnosis of the primary 'sho' or pattern of disharmony (as well as secondary pattern of disharmony) but during the actual treatment, giving the practitioner vital feedback on the effect of their needling technique on the patient's system. The Kozato technique is a technique developed to provide practitioners with feedback on their needling techniques by working in teams, with at least one person palpating the radial pulse and providing verbal feedback on the change to the quality of the pulse (depth, speed, force) whilst the practitioner feels for the acupoint, and performs the needling. The technique is a valuable aid to training of TMT practitioners.

Interest is growing in this unique form of Meridian Therapy, particularly in western countries. Many sighted practitioners now practice TMT in Australia, the US and Europe and various textbooks in English have aided the training of those outside Japan. Scientific research into TMT has begun, including investigations into the reliability of TMT diagnosis and the physiological correlates of pulse changes felt by the practitioner. How acupuncture works has still not been conclusively established. However, the way in which the mind-body is described by forms of Traditional East Asian Medicine (TEAM), such as Chinese medicine, is underpinned by a very different paradigm to that underpinning the biomedical model of the mind-body. One could argue that the Chinese medicine view of the mind-body is a kind of 'energetic' model (Ayurvedic medicine also has its own energetic model of the mind-body). There are inherent difficulties in trying to explain how systems of medicine such as Chinese medicine and therapies such as TMT work using a biomedical framework since they are such different paradigms. Clearly something else is going on in TMT that may not due to the physical stimulation of proprioceptors or the triggering of a neurochemical response in the same way as may occur with current forms of Chinese acupuncture since it doesn't typically involve insertion of the needle. TMT may also offer unique opportunities for exploring the scientific basis of traditional forms of acupuncture; Manaka postulated twenty five years ago that for research to examine the traditional East Asian concepts and descriptions of the body and how to treat patients, it may be necessary to use low-level stimulus input methods in order to maximise our ability to capture the effects of those systems [Manaka, Itaya 1986, Manaka et al. 1995].

This chapter will cover the origins of Toyohari Meridian Therapy, its theoretical basis, techniques used in diagnosis, and treatment protocols and approaches. It will also explore some of the scientific research into TMT with discussion on the directions of future research.

2. Historical development

The term 'Meridian Therapy' [経絡治療] refers to a traditional style of acupuncture that emerged in Japan in the late 1930s [Birch, Felt 1999, Fukushima 1991, Shudo 1990]. By 1913 modern Western style medicine had come to dominate in Japan and traditional forms of acupuncture had become severely limited through government regulations [Birch, Felt 1999, Locke 1980, Manaka et al. 1995, Shudo 1990]. Meridian Therapy evolved during similar period that the modern Chinese 'traditional Chinese medicine' [中醫], TCM acupuncture evolved, subjected to different political and historical pressures and influences [Birch, Felt 1999, Scheid 2002, Sivin 1987, Taylor 2004, Unschuld 1985]. Meridian Therapy emerged out of a period of careful investigation of the classical literature where the founding members of

the Meridian Therapy movement, such as Sorei Yanagiya, Keiri Inoue, and Sodo Okabe, tried and tested different interpretations of the classics until they found a model with methods that appeared to work and was reproducible. This style like other traditional forms of acupuncture such as the current TCM style in China is based on interpretations and attempted reproductions of the historical literatures of acupuncture [Birch in preparation, Birch, Felt 1999]. The field of acupuncture has always manifested different traditional styles of acupuncture following different interpretations of the 'traditional' texts such as the Huangdi Neijing [黃帝內經] and Nanjing [難經] [Birch, Felt 1999, Birch, Lewith 2007, Goldschmidt 2009, Scheid 2002, Unschuld 1985, 1986, 2003], no less so today than historically [MacPherson, Kaptchuk 1997, Schnyer et al. 2007].

The earliest texts describing acupuncture date from around the first to second centuries BCE [Lo 2001, Unschuld 2003]. They take as a focus a model of the body very different from models that developed in Europe at that time or in later millennia in the West [Kuriyama 1999]. The core model that we find in these historical texts is one of the body containing twelve jingmai [經脈] meridians or channels, which circulate qi [氣] around the body to help keep the body's normal physiology intact and to help protect the body from disturbing influences [Unschuld 2003]. One of the earliest texts on acupuncture, the Huangdi Neijing Lingshu [黃帝內經靈樞] (hereafter the Lingshu), gives a kind of definition of (traditional) acupuncture: chapter seventy-five describes needling as a method for "regulating qi" [調氣] [Rochat de la Vallee 2006:79]. Acupuncture needles are applied to specific locations on the jingmai, the xue [穴] acu-holes or acupoints. The Lingshu describes the acu-holes in ways that are contrary to the preconceptions of people in the modern period, influenced by modern anatomical models of the body [Sivin 1987]. Of the acu-holes the Lingshu tells us that there are three hundred and sixty five locations where the qi travels in and out of the body and that the nature of these are not of the skin, flesh, sinews or bones, ie are not anatomical in origin or nature. Of this Sivin comments "a modern Westerner expects these points of communication, where the physician's needles can affect the circulation, to be places in tissue, but here we find them related instead to processes" [Sivin 1987:51].

TMT, following the focus of the Meridian Therapy movement, placed significant focus on ideas and methods that are described in the Nanjing [Shudo 1990]. Five phase classifications and correspondences are extensively used to help with classification of findings and observations. Radial pulse and abdominal palpations are given priority and exhibit development and refinements to help with choosing the correct diagnosis and treatment. Simple patterns based on reading of Nanjing sixty-nine form the core of the process of pattern recognition and treatment. This chapter of the Nanjing provides a basis for selecting on which meridians to direct treatment and which acupoints on the meridians to treat [Fukushima, 1991, Ono 1988, Shudo 1990]. The primary patterns or 'sho' are the primary targets of the 'root treatment' (in Japanese 'honchiho', in Chinese 'zhibenfa' [治本法]). The root treatment focuses on correcting underlying disturbances of qi circulation among the twelve meridians regardless of the nature and location of symptoms. The theory of Nanjing sixty-nine states that one should always apply supplementation, bu [補] before draining, xie [寫] techniques [Fukushima 1991, Shudo 1991, Unschuld 1986:583], practically interpreted in Meridian Therapy to mean focus on finding what is xu [虛] or vacuous and take that as the primary target or first step of treatment. Nanjing sixty-nine also says 'for conditions of xu, vacuity, bu, supplement the mother. This is understood to mean, for example if the lung (metal) is xu, vacuous, one should supplement the spleen (earth) since earth if the mother of

metal. This led to the identification of a few primary patterns formed by looking for weakness in two consecutive channels in the five-phase engendering cycle [Shudo 1990] – see Table one. Then after carefully selecting the 'pattern' of which meridians to focus on (see Table 1) the supplementation technique [補法] is applied to acupoints on those two channels.

Primary patterns or sho	Two meridians involved	Five-phase engendering cycle relationship
Lung vacuity sho	Lung and spleen both weak	Earth is the mother of metal
Spleen vacuity sho	Spleen and heart both weak	Fire is the mother of earth
Liver vacuity sho	Liver and kidney both weak	Water is the mother of wood
Kidney vacuity sho	Kidney and lung both weak	Metal is the mother of water

Table 1. The primary patterns or sho

The Lingshu also described nine types of needles [Lu, Needham 1980:102-103], including the 'round-headed', yuanzhen [員鍼] and blunt, shizhen [鍉鍼] needles which were not inserted into the body or through the skin, but were instead applied on the surface of the body to influence the qi of the patient [Birch in preparation, Birch, Ida 1998:48-54]. Thus, while it may seem unusual today to talk of an acupuncture system such as TMT where the needles are not inserted, we can see historical precedents dating back over two thousand years in China. TMT is not alone as a system of acupuncture that routinely uses non-inserted needling methods; other systems can easily be found [Kobayashi 2008, Ono 1988].

There is an important concept in traditionally based forms of acupuncture, that for needling to be successful, the qi must arrive at the needle. The more common term used for this in modern literature is 'deqi' [得氣] meaning to 'obtain the qi', though another term is found commonly in the early historical texts, 'qizhi' [氣至], the 'arrival of qi'. Today the more common understanding of deqi is that it refers to sensations that the person being needled might experience, such as 'throbbing, aching, tingling' etc [Anon 1980, Cheng 1987]. However the early descriptions of these two terms either explicitly refer to them as sensations that the practitioner feels (see Nanjing seventy-eight [Unschuld 1986:635] or require mastering skills in order for the qi to arrive that cannot locate the sensations in the patient, so that it is as much about the level of inner development of the practitioner as it is about the manipulations of the needle [Birch 2004, Birch in preparation, Chace 2006, Chace, Bensky 2009, Yang 2007]. TMT, like its progenitor Meridian Therapy, takes the idea from the Nanjing that it is the superior physician that feels the qi with their left hand as the standard to which the practitioner should aspire [Fukushima 1991, Shudo 1990]. Thus there has been a significant focus in TMT on helping the student and practitioner develop the internal skills necessary to be able to reproduce the difficult needling techniques. In TMT the 'Kozato method' has played an important role in accelerating the development of learning of these skills. We can see dating from the earliest texts on acupuncture an idea that for the needling to be effective in its influences on the qi, the inner state of the practitioner (calm emotions, quiet mental focus, posture, state of relaxation etc) is important, thus we see other historical precedents for the TMT needling techniques.

Although modern forms of acupuncture that have become more popular have focussed on inserting needles into relatively fixed anatomical locations on the body surface, focussing on physical movements and manipulations of the needle to produce therapeutic effects [Birch, Felt 1999, MacPherson, Kaptchuk 1997, Schnyer et al. 2007] we find the ample evidence dating from the earliest original texts of acupuncture for practice methods that use non-inserted needling methods to non-anatomically based points on the body surface. In addition, the inner state of the practitioner is much more important than him/her being simply the person moving the needle. TMT is a system that has attempted to reproduce these early descriptions [Birch in preparation].

3. TMT diagnosis and treatment

Following the models of practice that became established in the general practice of Meridian Therapy in Japan, TMT places great emphasis on palpation of the radial pulses and the abdominal region in order to select the 'primary pattern' for root treatment [Birch, Felt 1999]. Through clinical experience reflex regions of the abdominal wall have been agreed upon as useful targets for diagnosis since they show clear changes reflecting problems in associated meridians. The method of palpation involved very softly stroking across the skin of the abdomen to see if there are changes of skin texture or temperature in those regions [Fukushima 1991]. Palpation of the radial pulses has been an important feature of TEAM since the Han dynasty [Lu, Needham 1980, Unschuld 1985, 1986]. Meridian Therapy has tended to follow methods for doing this introduced in the Nanjing [Fukushima 1991, Shudo 1990]. Two basic approaches are used in TMT, classifying the overall 'quality' of the pulses in relation to strength, speed and depth and palpating the three positions of the pulses that can be palpated in the region where they are described (along the radial bone, proximate to, over and distal to the styloid process) to examine differences in strength [Fukushima 1991]. After the patient has been questioned, the meridians that might be associated with the symptoms of the patients are palpated on the legs and arms. Following this the abdominal region is palpated and then the radial pulses are palpated. The pattern is most commonly decided by finding a concordance between the findings on the abdomen and the findings in the pulses. Specifically the region on the abdomen of that pattern must show signs of weakness and the positions of the two pulses associated with the pattern (see Table 1) must also be relatively weak. The symptoms and other findings of the patient may or may not match. This is an important issue to emphasise. In 'Understanding Acupuncture' the authors argued that the primary nature of diagnosis in traditional forms of acupuncture is to select treatment, not to describe an objectively existing 'disease' or 'disorder' [Birch, Felt 1999:218-222]. TMT is quite explicit about this, the phrase 'diagnosis is treatment' is taken as an expression of this idea. Thus the purpose of diagnosis is to help select the treatment. The treatment that is applied to the 'primary pattern' is, as was described above, part of the root treatment, 'honchiho' [本治法]). The principle purpose of this diagnosis is to help decide the best strategy for regulating the qi (tiao qi [調氣]. The findings of the abdominal and pulse position diagnosis are especially useful for deciding how best to do this on each patient. The general 'quality' of the pulse (depth, strength and speed) is used to help the practitioner judge how well the needling has been applied. These general qualities are not used to decide what treatment to apply. Rather, since they are thought to reflect something of the overall

condition of qi in the patient, they are useful as indicating what kind of changes in the qi of the patient have been produced by the needling.

This focus on abdominal and pulse diagnosis in diagnosis is thus a natural point of focus for studies investigating TMT since if the findings are not consistent or there is poor agreement about them then a less than optimal treatment may be given to the patient. Further the emphasis on pulse quality changes is also a natural target for studies of TMT. The practitioner must be able to reliably judge them otherwise the foundation of practice and needling effects are of questionable value. We will see later that the first stages of research in TMT have examined these two issues. Once studies show that these aspects of diagnosis are valid, it then becomes possible to examine the TMT needling methods and treatments with more confidence that appropriate judgements about their choices and applications have been made, which is naturally the first step before any physiological or clinical studies can be conducted.

4. TMT needling techniques

The needling methods in TMT developed out of systematic efforts to reproduce historical Chinese descriptions of needling coupled with feedback by palpation among colleagues of how well each interpretation works [Birch, in preparation]. The notion of the non-fixed 'live' acupoints (where the location of the acupoint is not determined by anatomical location alone, but by the sensation in the practitioner's index finger on palpation along and/or near the meridian) is also based on efforts to examine and reproduce early historical Chinese literature.

Following traditional ideas TMT applies a supplementation needle technique (hoho [補法]) for deficient (xu) conditions, draining (xie [寫]) needle techniques for replete, shi [實] conditions, as required according to the condition of the patient. Meridian Therapy in general has a relatively simple form of draining needle technique [Shudo 1990] while TMT currently has six different techniques according to what is felt in the pulses and how the overall condition is judged [Birch 2010, Fukushima 1991], while Ono had nine different techniques [Ono 1988]. Like other forms of traditional acupuncture, TMT also has a number of 'branch treatment' (Japanese hyochiho, Chinese zhibiaofa [治標法]) methods [Shudo 1990, 2003]). In TMT these branch treatments include 'naso' (treatment of the region of the suprclavicular fossa), 'muno' (treatment of the inguinal region), 'kikei' (a unique extraordinary vessel treatment method), 'shigo' (a method that employs the theory of 'midday-midnight') and a number of other simple needling or moxa methods [Fukushima 1990]. TMT treatment most often consists of a judicious combination of 'root' and 'branch' treatments to match each individual patient on the day of treatment.

Here we describe the supplementation technique (hoho [補法]). The following is a précis of more extensive descriptions currently in preparation [Birch in preparation]. In this needling method, the needle tip is held at the skin surface or perhaps touches the skin, it does not penetrate the skin. The methods described here cannot be learnt from textbooks but only through highly structured supervised training with regular feedback. In the Toyohari Association, one of the founders, Mr Kozato found that it is possible to monitor the radial pulses throughout the needling techniques and that based on the changes that are felt in the pulses, one can give continuous feedback to the technique. This is the 'Kozato hoshiki' or Kozato method [Fukushima 1990]. Given that the pulses ('mai' [脈]) were said to reflect the

state of qi in the body and the theory of pulse diagnosis in the Nanjing informs that one can read the radial pulses to understand the condition of qi in the body and in the jingmai, meridians [Unschuld 1986], it is natural that one would feel the radial artery pulses to ascertain how well the needling has affected the condition of the qi. In the Kozato method, one can give feedback to every stage of the needling as different changes occur at each stage. A silver needle (40mm long, 0.18mm gauge) is used for this technique. After selecting the appropriate acupoint to be treated, the practitioner stands in the correct position relative to that acupoint. Holding the needle in the right hand (sashide), the practitioner places their left hand on the patient in order to find the acupoint. Touching very lightly the left index finger is softly and slowly stroked along the (flow of) meridian (jingmai) to be treated looking for the ('live') acupoint to be needled, paying attention to find signs of weakness to identify the exact location. The weak-feeling point has certain physical characteristics (is soft, loose, etc) but more subtle feelings are also detected, and the (experienced) practitioner becomes aware of something - touching or contacting the qi of the patient (at the 'live point'). After finding the exact ('live') location to be needled, and still touching very softly, the practitioner places the thumb of the left hand next to the index finger, pressing the pads of finger and thumb gently together directly over the acupoint to be supplemented. This forms the 'oshide'. In order to stabilise the oshide, the other fingers of the left hand are placed lightly so as to 'secure' the oshide. These movements are done all the while retaining the awareness of the qi at the point to be treated. The practitioner relaxes and adjusts their posture so as to relieve any unnecessary tension and then introduces the needle into the space between the index finger and thumb over the acupoint, angled along with the flow of the channel and directed towards the acupoint. Very carefully and slowly and the practitioner advances the needle tip towards the acupoint with their right hand (sashide) paying special attention to feeling when the needle tip contacts or engages something (contacts the qi). This can occur with the needle tip a small distance above the actual surface of the skin or at the skin surface. The practitioner feels this contact in their left hand (though other sensations elsewhere in their body may also be detected) [Birch 2004]. Once the practitioner has ascertained that the needle is at the correct 'depth' (here the language is depth within the flow of qi, not within the body), the right hand stops advancing the needle and holds the needle handle very softly while the left hand finger and thumb are pressed slightly more together (this is called 'sayuatsu' or 'left-right pressure' to seal the space around the needle tip to prevent qi leakage). Throughout these actions the practitioner remains calm and quietly focused noticing and relieving any tension that develops in their body. With the needle no longer advancing the practitioner seeks a change in the feeling (of qi) at the tip of the needle. If this change does not come automatically the practitioner may apply additional subtle manipulations with the right hand very gently until this change of feeling starts. As the change starts and the feeling (of qi - usually felt in the left hand) increases, the practitioner monitors it, then at the last moment increases the pressure of the left finger and thumb and as the patient inhales he rapidly removes the needle from the acupoint while simultaneously rolling the index finger or thumb over the acupoint (to close the 'hole' or space where the needle had been). The timing of this increased 'left-right pressure', needle removal and closure of the 'hole' is very precise and takes time to learn. The pressure is maintained on the acupoint for about one breath, then the digit is removed and the technique finished.

5. Challenges and questions posed by TMT needling methods

Recent conclusions from among experts involved in acupuncture research are that we don't know the mechanisms of how acupuncture work, we have a lot of evidence of correlation between the application of needling techniques and measured physiological changes, but know little about the mechanisms inside the body [Hammerschlag, Zwickey 2006, Hammerschlag et al. 2007]. The neurochemical endorphin model is one attempt to describe how acupuncture analgesia works, for example [Pomeranz, Berman 2003]. Much acupuncture research has been based predominantly on the current biomedical model of the body. This particular model rests on certain fundamental underlying assumptions [Foss, Rothenberg 1987]. However, the way in which the mind-body is described by forms of TEAM, such as Chinese medicine, is underpinned by a very different paradigm to that underpinning the biomedical model of the mind-body [Birch, Lewith, 2007]. The Chinese medicine view of the mind-body is a kind of 'energetic' model. Ayurvedic medicine (Indian traditional medicine) and Tibetan medicine also have their own energetic models of the mind-body. There are inherent difficulties in trying to explain how systems of medicine such as Chinese medicine and therapies such as TMT work using a biomedical framework since they are underpinned by such different paradigms and it is necessary not to ignore these aspects.

It appears to us that something else is going on in TMT that may not be due to the physical stimulation of proprioceptors or the triggering of a neuro-chemical response in the same way as may occur with TCM style acupuncture, since TMT doesn't typically involve insertion of the needle. It manipulates the qi at the surface of the skin, often without even touching the skin. Typical TEAM acupuncture texts describe the meridians as pathways in which qi circulates, that traverse the skin as well as inside the body to connect with the related internal systems such as the zang-fu organs. Acupoints then are variously described as points on meridians (on the surface of the body) where the qi is accessible or concentrated. But what if the Chinese medical notion of the meridians extended above the body's physical surface, akin to how Ayurveda understands the body? In the Ayurvedic model of the body, the mind-body is envisaged as a series of energetic bodies, each enveloping the previous one and extending further out in space, vibrating at progressively higher frequencies. The physical body is the densest of the bodies, that is, vibrating at the lowest frequency compared with the others. Information is progressively stepped down from one energetic state (body) to another. These energetic bodies surrounding the physical body could be thought of as energetic templates for the physical body. They also provide a means by which information from the environment impacts on the human, and ultimately the means by which we are all connected. Disturbance in the energetic bodies may eventually lead to dis-ease in the physical body. For further descriptions of such models, the reader is referred to books by Gerber (Gerber 1988), Cousins (Cousins 2005) and McTaggart (McTaggart 2003).

Such theories of how the human mind-body works are not simply metaphysical ideals, for they are finding support in the areas of modern physics and biophysics. McTaggart's book 'The Field' describes a coherence of thought and experience amongst many scientists across the globe for the concept of an energy field that connects everything, termed the 'Zero Point Field' (McTaggart 2003). German scientist Fritz Popp has documented that all living things, including plants, animals and humans emitted a permanent current of photons (light), with humans emitting the lowest number compared with plants. In humans, these biophoton emissions follow biological rhythms with a high degree of coherence in healthy subjects

[Popp 2002, Popp, Cohen 1997], whereas in subjects with cancer, the coherence and natural periodic rhythms was seen to be lost [Popp 2009]. He theorises that biophoton emissions are a kind of correction mechanism to minimise disturbances within the Zero Point Field. He further postulated that these bio-photon emissions play a central role in cell coordination and communication, that DNA is one of the most important stores of light and sources of biophoton emissions and that DNA may use frequencies as an information tool (McTaggart 2003, Popp, Nagel et al. 1984). Popp described how 97% of DNA is associated with bio-photon transmission and 3% with genetic information (Cousens 2005). On this Cousens explains: 'The DNA communication of bio-photons communicates with the cells and sets the electromagnetic field for the cell to communicate with the rest of the body, with all the other cells, along with the intracellular matrix' (Cousens 2005). Here, we might be seeing a convergence of thought about the energetic nature of the body and traditional descriptions such as TEAM. Of course this area of theoretical linking needs much work and verification, but the similarities are suggestive and support the notion that we may need to take a different approach to investigating traditional practice methods such as acupuncture. Popp [McTaggart 2003, Popp et al. 2005] and colleagues have even found possible evidence linking his theories with those of acupuncture and suggested possible models for understanding this [Ho, Knight 1998].

So, in considering how TMT works, where are we to begin? It must be with the understanding that we begin any investigation with a set of assumptions about the nature of reality. In using western scientific research methodologies, underpinned by reductionism and mechanism, we need to acknowledge the inherent limitations as well as exploit the advantages of this style of inquiry. Whilst much has been written about the limitations of what is considered the gold standard of scientific research, the randomised controlled trial (RCT), scientific inquiry is not limited to RCTs and a range of other research methodologies are useful in investigating acupuncture. For a comprehensive description, the reader is referred to the book Acupuncture Research (MacPherson et al. 2007). We need to also remember that with particular models such as the biomedical and Chinese medical models, there is a language and set of theories that have developed to describe them, and such concepts are not always readily translatable across medical cultures. For example, the concept of 'qi' is particularly hard to define- more than fifty kinds of qi in the body and in nature are mentioned in the Huangdi Neijing Suwen [Leo 2011:105], Porkert lists thirty-two types of qi [Porkert 1974:167-173], and simply translating qi as 'energy' may fail to communicate the many nuances of the term 'qi' [Birch, Bovey in preparation, Felt 2008]. We feel it is necessary to expand the models of what we are doing when we attempt to research TEAM practice methods such as acupuncture and that seeking correlation with and using models from developing areas in physics and bio-physics may be helpful. This work will necessarily take some time. Thus as a first approach to investigating TMT we chose very basic and simple approaches rooted in its practice before attempting more elaborate basic science or clinical trial approaches. Our initial work is summarised in the next section.

6. Some research findings in TMT

The fact that TMT is so different from the more popular forms of acupuncture found today and yet, like other forms of traditional acupuncture such as TCM acupuncture is clearly based in the historical classics of acupuncture raises many issues for researchers interested in investigating acupuncture. It challenges the preconceptions of many about what

constitutes the practice of acupuncture. It places the practice of pulse diagnosis at the heart of understanding both what do to in treatment and the condition of the patient both before and after needling has been done. It raises important questions about the relationship of needling and claims to have influenced the qi with a needle by bringing the practitioner much more into the picture than clinical and basic science investigations of acupuncture have permitted to date. It requires the development of models and then appropriate research methods that allow these aspects to be appropriately investigated.

In recent times, research has been conducted that has put TMT diagnosis under the microscope. In TMT treatment follows diagnosis. If diagnosis is not accurate, there can be less confidence that optimal treatment is received. Diagnosis in CM and TMT is, however, somewhat subjective. One way of ascertaining whether we have the correct diagnosis or not is to see if others agree with it (though it is possible of course to have several practitioners all agreeing on an incorrect diagnosis). Inter-rater reliability is a measure of the level of consistency of a measurement between two or more practitioners. Whilst there have been several studies investigating the inter-rater reliability of pulse, tongue diagnosis, other information collected in a CM examination and CM syndrome diagnosis (O'Brien and Birch 2009), few studies have focussed on TMT. An Australian study into the reliability of pulse diagnosis, abdominal (Hara) diagnosis and diagnosis of the primary and secondary sho between two experienced TMT practitioners conducted in 62 healthy Australians found a reasonable level of agreement for the basic pulse characteristics of depth (57%), speed (61%) and strength (77%), and for two regions of the Hara using abdominal diagnosis (O'Brien et al. 2009). However level of agreement for the primary and secondary sho diagnoses was only 48% and 44% respectively, suggesting that there is room for improvement (O'Brien et al. 2009). This was the first study and only study to date to have comprehensively assessed inter-rater reliability in TMT. Earlier studies of the reliability of pulse diagnosis in Meridian Therapy found a variable level of agreement on basic pulse characteristics (Birch 1997), in one study ranging from no correlation to substantial to almost perfect correlation (Birch 1997).

TMT treatment relies heavily on pulse diagnosis. Changes in the pulse characteristics indicate to the practitioner that the treatment is complete. The practitioner is able to feel the difference in the quality of the pulse, but it is not known if there are any physiological correlates of these changes that can be measured objectively with medical instrumentation. To begin investigating this we initiated exploratory research in Australia to examine possible physiological correlates within the cardiovascular system of the pulse following a TMT root treatment (O'Brien et al. manuscript in preparation). The study was designed to see if the 'Sphygmocor' device, a standard tool in cardiovascular medicine, could detect changes that correlated with the reliable judgment of two practitioners that the radial pulses changed following a TMT root treatment. This is an example not only of cross-disciplinary research but also research seeking the intersections of knowledge between two medical systems.

Probably more than any other system of acupuncture, TMT helps highlight elements of treatment that are not usually made explicit during the teaching and description of needling methods that are very much based in the traditional historical literature on needling methods. This allows us not only to highlight and identify those elements but helps us rethink how we might go about constructing valid investigations of acupuncture methods that claim to be based in the traditional literature and models and which claim to work

through their influences on the qi. One important aspect to highlight is that the mental state and more general inner state of the practitioner seem to be crucial for the needling to be successful. This raises a number of interesting and important possibilities that require ongoing work in model developments so that an expanded range of research strategies can be used to investigate a therapy like TMT acupuncture [Birch 2009, in preparation-a, in preparation-b].

7. Conclusion

TMT is a unique style of Meridian Therapy. Originally practised predominantly by blind Japanese practitioners, increasingly it is becoming popular amongst sighted practitioners and is now practised in many western countries. It requires a high degree of skill, not only in diagnosis, but also to locate the 'live' acupoint correctly and manipulate the acupuncture needle effectively. It challenges the practitioner to develop a very keen sensitivity of the sensation of touch in particular. TMT poses challenges in understanding how it may achieve its therapeutic outcomes, since in a root treatment typically the acupuncture needle does not touch the surface of the skin. The conventional biomedical model of how the body operates is likely to be superceded eventually by emergent models that describe the mind-body in terms of 'energy' and energy fields. Such models, based on quantum physics, are already developed and may provide a better framework from which to understand how TMT works. Chinese medicine, after all, could be described as an energetic model of the mind-body. It is important that research is conducted with a full awareness of the advantages and limitations of western scientific methodology, and of the underlying paradigms and assumptions upon which scientific research rests. TMT, like other forms of TEAM, has not stopped developing. It is therefore important that practitioners and researchers continue to put TMT 'under the microscope' and test it out in creative ways.

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Part 3

Special Issues

8

Acupuncture for Inpatients in General Hospitals – Special Features of this Service

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1. Introduction

Acupuncture and related techniques have increasingly been offered in conventional medical settings in Western societies. The number of patients seeking acupuncture therapy has increase [Chernyak et al 2005]. Acupuncture has become a thriving and notable part of ordinary healthcare systems. The contact of Acupuncture with the Western culture created the concept of Western acupuncture that is an adaptation of Chinese acupuncture using knowledge of anatomy, biochemistry, physiology, and pathology.

Acupuncture in hospital became an integrated complementary therapy. Its efficacy is scientifically based, it's a medical specialty and, recently, is considered for coverage by insurance companies of health. Acupuncture as treatment for inpatients has potential to support recovery, to abreviate the period of hospitalization and avoid unnecessary surgeries [SantaAna 2001]. However, few general hospitals offer this service and the scientific literature that describes this activity is practically nonexistent.

2. Differences between outpatients and inpatients

We have observed that acupuncture given to inpatients at the hospital differs in several ways from that given to outpatients, due to fundamental difference between the two populations.

Compared to outpatients, inpatients tend to have more severe and acute conditions, a worse general state, stress by the environment, apprehension by the non usual procedures, and necessity for more immediate results of the therapys [Nasir 1998]. Analgesic therapies must produce short-term results, and there is reduced opportunity for developing a strong relationship between the patient and the practitioner. In spite of this, the literature about these differences is practically nonexistent.

The fundamental differences between these populations were already listed in our previous publication [Saad et al 2009]. Figure 1 summarizes the particularities of inpatients that impact in acupuncture treatment. It also brings suggestions of attitudes of the practitioner to contour these obstacles.

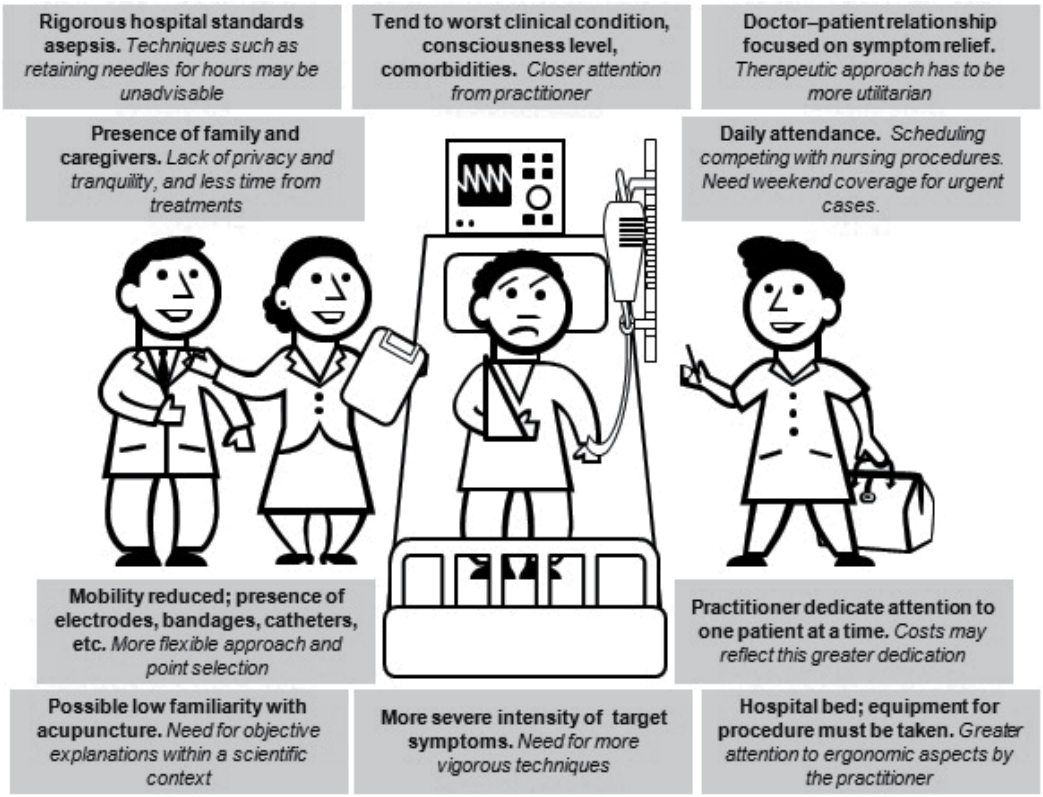

Fig. 1. Particularities of inpatients state that impact in acupuncture treatment (bold highlight) and suggestions of attitudes to contour these obstacles (italic highlight).

3. Potential areas for hospital acupuncture

SURGERY: in pre-surgery period, acupuncture activates endogenous opioids. During surgery, it promotes deep analgesic effect and sedation in painfull procedures (hysteroscopy, etc.). In post-surgery period, it reduces the need for symptomatic medication (mainly for pain and nausea).

In the preoperative stage, acupuncture can be used to reduce postsurgery pain, as a complement to anaesthesia and to increase patients' comfort before and after surgery [Lin 2006]. A previous study [Wang et al 2003] showed that most surgical patients would accept complementary practices as part of their perioperative management. Among these practices, acupuncture was the only modality patients accepted to pay out of pocket al if it were not covered by their insurance company.

EMERGENCY DEPARTMENT (ED): In this service, Acupuncture is a viable option for some clinical conditions. It doesn't cause drowsiness as do the opioids; the patient leaves the service awaken [Grout 2002]. So, it can be advantageous both for patients and for healthcare service.

A paper published by a Cuban hospital reported the results of using acupuncture associated with the ED during one year. In this retrospective study, a total of 2705 patients attended. A

reduction in the administration of 6192 injected and 850 oral medications was reported [Sanchez et al 2007].

A study in New Zealand [Yates et al 2009] showed that more than half of ED patients had used a complementary therapy in the past. The majority of the surveyed patients would follow the advice of their doctor if a complementary therapy was prescribed, suggesting that such an offer is practical in a hospital setting.

A report of acupuncture use for muscle-scheletal pain at the ED of Phoenix Memorial Hospital (Arizona, USA) registered a complete relief in 17% of patients, a partial relief in 74% and no relief in only 5% [Grout 2002]. This report also registered that no patient worsened with acupuncture, and the use of this therapy did not increased significantly the time of the patient at the ED.

REHABILITATION: A study with 1502 in-patients in a rehabilitation unit of a general hospital in Singapore showed that one of the factors associated to higher functional independence at delivery was the use of Acupuncture [Sien 2007].

In fact, the effectiveness of acupuncture as an analgesic reveals significant improvement. In this description of results of a chinese hospital, the use of acupuncture in controlling resulted in a mean effectiveness rating of 74% [Yun 1999].

ONCOLOGY: patients with câncer have reported an increased use of complementary and alternative medicine (CAM). Many individuals with cancer have turned to acupuncture because their symptoms persisted with conventional treatments or as an alternative or complement to their ongoing treatments. Acupuncture is an well documented way to reduce many of the symptoms to the cancer or secondary to its treatment [Cohen et al 2005; Wesa et al 2008]. Antiemetic studies are the most prevalent and contain the most conclusive results. Several studies have found that acupuncture significantly reduces the number of emesis (vomiting) episodes for patients receiving chemotherapy [COHEN et al 2005].

Positive effects in the few studies about oncologic symptoms include: respiratory distress associated with end-stage cancer, xerostomy by salyvary glands irradiation and fatigue post-chemotherapy. Besides, potential benefits documented anedoctally include: hot flushes due to hormonal imbalance, peripheral neuropathy, chemotherapy-induced leucopeny, anorexy and constipation. While studies on pain control vary due to the heterogeneity of pain, there are few studies investigating pain caused from cancer and the removal of cancerous tumors. Acupuncture can collaborate with the reduction of symptoms in patients under palliative care [Pan et al 2000]

PEDIATRICS. Acupuncture already showed promising results as potential treatment for handling diverse clinical conditions, specially those that course with pain. Acupuncture has been well studied in infants for the prevention and treatment of nausea and vomit by diverse etiologies (as chemotherapy or post-operative), showing to be a trustable and efficient approach [Jindal et al 2008]. Acupuncture can help to reduce the need for antiemetic drugs and episodes of vomit in pediatric oncology, besides improveing the alert level during chemotherapy session.

The acceptability of the acupuncture by infants tend it be higher in patients with chronic illnesses, severe symptoms or in hospitalization by acute conditions [Jindal et al 2008]. In neonates hospitalized using opioids or benzodiazepines for pain or sedation, acupressure can improve agitation, pain and symptoms of the retreat of opioids [Golianu et al 2007].

OBSTETRICS AND MATERNITY. Acupuncture can be used for back pain, pubalgia, ciatalgia, pelvic pain, without risk to the fetus. During the birth, acupuncture promotes

smaller pain, higher relaxation, higher seric endorfine and triptamine concentration [QU et al 2007]. Acupuncture during the birth reduced the need of painkillers and had high rate of satisfaction of patients [Neisheim et al 2003].

4. Treats and opportunities

In order to consider adopting acupuncture, the hospital management directory must consider administrative factors such as [SantaAna 2001]: consumers' needs, scope of service, reimbursement, availability of an experienced team and mission of the institution.

Underutilization of acupuncture in hospital may be expected and is already described in North American university hospitals [Highfield et al 2003]. In a research among hospitals affiliated to the Harvard Medical School [Highfield et al al 2003], acupuncture was present in 8 in 13 institutions. It were available for inpatients only in 1 of them. The reference inside the own institution were reduced. Telephone operators has not information about which sector offered Acupuncture, or even if there was acupuncture in the hospital.

This publication [Highfield et al 2003] associated the underutilization to factors as absence of internal communication, complexity for reimbursement and conflicts of communication (language of the chinese traditional medicine), professional staff did not know that the service were offered; medical community divergencies about Acupuncture; the service resulted by the effort of a minority.

Questions about the competency to practice acupuncture must be established. This issue is discussed worldwide, and each country has its local legislations to assign who is allowed to perform acupuncture.

Medical Acupuncture is the treatment performed by a physician who obtains additional training and qualifications in acupuncture. By similarity, the concept extends to other licensed health care professionals such as dentists, physiotherapists, chiropractors, osteopaths, and even veterinarians who integrate acupuncture in their practices within the scope of their professional licenses.

Indeed, acupuncture should only be offered when fully incorporated into orthodox healthcare and used as a therapeutic tool for the treatment of some defined clinical conditions. A professional with formal biological science training is the ideal provider of acupuncture because of the consistent training curriculum in most countries. When this Professional offers acupuncture:

- An assessment of risks and benefits can be made based on knowledge of comorbidities of the patient treated.
- An orthodox clinical diagnosis is considered, and the practitioner makes sure that the causes, not only the symptoms, are being treated.
- Fundamental areas related to the treatment process, such as clinical psychology and bioethics, are observed.
- Responsibilities are monitored not only by civil legislation, but also by national professional councils.
- Communication with other patients' therapists is easier, by conversion of TCM terms to a physiologic language.
- He/she may provide acupuncture alone, conventional treatment of his/her competence, or a combination of both.
- The concept of evidence-based medicine, with respect to efficacy, safety, and cost-effectiveness, is better understood.

- Coverage and reimbursement policies for treatment can be considered by insurance companies.

A safe, ethical, efficacious treatment with acupuncture can only be offered when all these conditions are present [Saad 2009]:

- Executed by a professional graduated in biological sciences
- Respecting the scope of the provider license practice
- Fully incorporated into an orthodox healthcare plan
- Used for the treatment of well-defined clinical conditions.

5. Experience of the Hospital Israelita Albert Einstein

We present the experience of the Service of Acupuncture of the *Hospital Israelita Albert Einstein* (HIAE), that offers acupuncture to inpatients since October 2005. Our institution is a private tertiary general, with 489 inpatient beds located in S. Paulo (Brazil). It is one of the most respected healthcare organisations in Latin America and has been accredited by Joint Commission International since 1999.

The Service of Acupuncture of the HIAE It is associated to the Multiprofessional Service of Rehabilitation. Currently, the team is composed of 3 hired physicians, all board-certified by the Brazilian Medical Association, because, in Brazil, acupuncture is a medical specialty. Among these professionals, two act with outpatients, in the Rehabilitation Center, and one offers the therapy to the inpatients, in their beds.

Acupuncture is performed only by physicians, and is available for any patient who accepts this treatment. For outpatients, it is offered two or three times per week. For inpatients, it is performed, in most cases, on a daily basis.

In the HIAE, acupuncture is offered as a therapy, and not as a clinic (because Chinese Medicine itself is not offered). It is always combined with the conventional treatment, intended to support it. It follows the concept of Medical Acupuncture [White et al 2009]: na adaptation of the millenary Chinese practice that uses modern knowledge of anatomy, physiology, pathology and evidence-medicine, incorporated to the proper western medicine, and not as an alternative medical system.

Once routine treatment is in progress, medical acupuncture, if appropriate, can be used as a complementary modality. We have observed a good level of adherence to therapy from patients and a relevant analgesic effect in association with other medication and physical therapies. Since our hospital advocates a short length of stay and discharge immediately after clinical stabilisation, inpatients referred to acupuncture actually receive an average of four sessions until their discharge.

The acupuncture points are chosen according to the present needs, focusing the symptoms. All the sessions are carried out by the physician with over 15 years of professional experience. The efficacy of the treatment is evaluated considering the control of the symptoms and/or the reduction of the rescue medicines need. For this purpose, it can be used the statement of the patient, of companions, of the professional staff (physician, therapists, nurses).

The treatment is completed as planned only in about 45% of the cases, because of the dynamic of an hospital routine (appearance of clinical intercourrences, hospitalar discharge when patient becomes stabilized).

In general, the objectives are entirely reached in about 67% of cases when we consider only the cases where the treatment was completed as planned. Even when treatment were not completed (both because clinical intercourrence or either by prescription suspension), some benefits of acupuncture can be noted.
Figure 2 shows a gross average of outcomes from acupuncture for inpatients at our service, based on data observation experience (unpublished data)

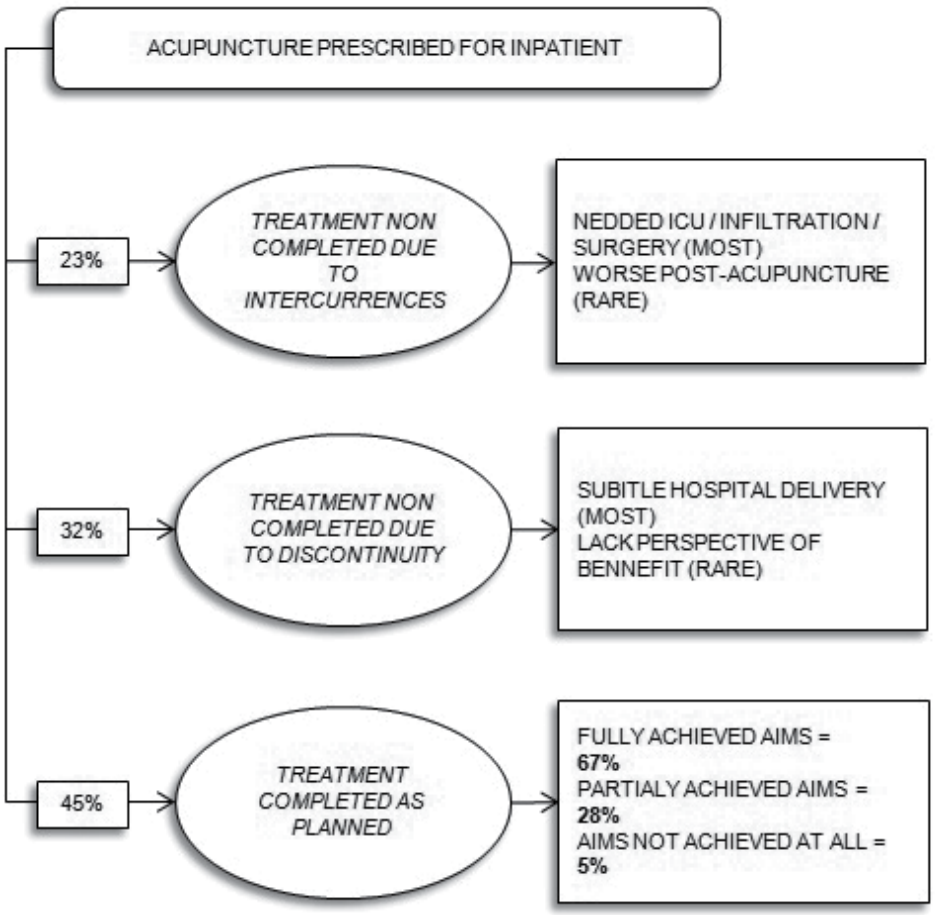

Fig. 2. Gross average of outcomes from acupuncture for inpatients at HIAE (ICU = Intensive Care Unit)

Acupuncture in our hospital environment brought diverse advantages recognized by the clinical staff and by the institution. In the HIAE, Acupuncture conquered respect and there are still fields for growing.

6. Conclusion

Acupuncture as treatment for inpatients in general hospitals has potential to support recovery, abreviate the period of hospitalization and avoid unnecessary surgeries.

Acupuncture given to inpatients differs in several ways from that given to outpatients, due to fundamental difference between the two populations.

The dynamic of acupuncture offered to inpatients is very different of that offered for outpatients, resulting in high rate of discontinuity by intercourrences. Even so, many patients tend to be benefited by this treatment.

Introduction of acupuncture for inpatients in general hospitals must pay attention to the particularities of inpatients that impact in acupuncture treatment, the potential areas for hospitalar uses of acupuncture the predictable treats when offering this service. We hope the above description of the experience of our service could encourage other hospitals to develop an acupuncture service.

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Acupuncture Transmitted Infections

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1. Introduction

Among all modalities of alternative medicine, acupuncture is one of the most widely recognized and evidence-based. According to the central concept in Traditional Chinese Medicine, healthy functioning of the various organ systems depends on the body's circulating energy, known as *Qi*, moving in a harmonious and balanced way through a network of meridians (channels) and collaterals beneath the skin. In this network of meridians, the most important are the 12 main meridians and two of the eight extra meridians, *Du Mai* and *Ren Mai*. By inserting and manipulating fine needles into specific acupuncture points that are located in these channels of energy, it can promote the harmonious flow of *Qi* and stimulate the body's own healing response. By 2010, more than 350 specific acupuncture points have been defined in the World Health Organization classification system. Throughout the years, acupuncture has been widely used for chronic pain, digestive, allergic and menstrual problems as well as cessation of smoking and drug and alcohol rehabilitation.

Involving the insertion of needles up to several centimeters beneath the skin, the practice of acupuncture may pose risks to the recipients. Among all acupuncture associated complications, transmission of pathogenic microorganisms is one of the most important (Woo et al., 2010). With the increasing use of acupuncture globally, infections transmitted by acupuncture have become an emerging health problem. Needle reuse and/or inadequate skin disinfection has led to the transmission of infectious agents, including pyogenic bacteria, mycobacteria and blood borne viruses, from environment-to-patient and patient-to-patient. In this article, we reviewed all cases and outbreaks of acupuncture transmitted infections published in the English literature in the past four decades. The importance of setting up and implementation of proper infection control guidelines is also discussed.

2. Methods

For initial screening, "acupuncture" was used as the key word for Medline search in the English literature. The results were then manually screened for cases and outbreaks of infections transmitted by acupuncture. All infections transmitted by acupuncture were included.

3. Acupuncture transmitted pyogenic bacterial infections

All reported cases of pyogenic bacterial infections claimed to be associated with acupuncture treatment were sporadic ones, with the exception of one recently reported outbreak (Table). In the past four decades, a total of 52 isolated cases of pyogenic bacterial infections claimed to be associated with acupuncture treatment were reported in the English literature (Baltimore & Moloy, 1976; Izatt & Fairman, 1977; Jones & Cross, 1980; Pierik, 1982; Hadden & Swanson, 1982; Jefferys et al., 1983; R.J. Lee & Mcllwain, 1985; Davis & Powell, 1985; Warwick-Brown & Richards, 1986; Gillbert, 1987; Scheel et al., 1992; Spleman et al., 1993; Garcia & Venkataramani, 1994; Kirschenbaum & Rizzo, 1997; C.Y. Chen et al., 1997; Matsumura et al., 1998; Yazawa et al., 1998; Lau et al., 1998; Ha et al., 1999; Origuchi et al., 2000; Ishibe et al., 2001; Nambiar & Ratnatunga, 2001; Laing et al., 2002; Uchino et al., 2002; S.Y. Lee & Chee, 2002; Shah et al., 2002; Woo et al., 2003; Y.P. Cho et al., 2003; Lin & Choong, 2003; Kettaneh et al., 2003; Daivajna et al., 2004; Saw et al., 2004; M.H. Chen & Huang, 2004; Studd & Steward, 2004; Vucicevic et al., 2005; Bang & Lim, 2006; Simmons, 2006; Seeley & Chambers, 2006; S. Lee et al., 2008; Tien et al., 2008; Richter et al., 2008; Morgan, 2008; Wu et al., 2009; Woo et al., 2009; Ogasawara et al., 2009; Nakajima et al., 2010; J.W. Kim & Y.S. Kim, 2010; Macuha et al., 2010; Koo et al., 2010; Chung et al., 2011) (Figure). Thirty-one (60%) of the cases were reported in the recent 10 years, which is probably related to the increase awareness of this disease entity and reporting of cases. The male to female ratio of the 52 patients was 23 to 29. The median age was 53 (range 12 - 84). Cases were reported globally from Asia, Europe, America and Australia. In most cases, pyogenic bacteria were transmitted from the patients' skin flora or the environment because of inadequate skin disinfection. Pain and/or stiffness were the reason for acupuncture in 37 (80%) patients, followed by smoking cessation (three patients), weight reduction (three patients), post-encephalitic vegetative state (two patients) and dyspepsia (one patient).

References	Origin	No. of patients involved	Microbes	Diagnosis	Source of outbreak	Mode of transmission	Outcome
Bacterial infections							
Murray et al., 2008	Australia	8	Methicillin resistant *Staphyloc-occus aureus*	Septic arthritis and bursitis, pyomyositis, bacteremia	Acupuncturist is a nasal carrier of the same methicillin resistant *Staphylococcus aureus*	Poor infection control practices and sterile techniques e.g. touch sterile, gloved hand with ungloved hand	All survived
Mycobacterial infections							
Ryu et al. 2005; Song et al., 2006	Korea	40	*Mycobacteri um abscessus*	Cutaneous infections	Not known	Not known	Majority with residual skin lesions
Tang et al., 2006	Canada	32	*Mycobacteri um abscessus*	Cutaneous infections	Not known	Not known	All developed residual scarring or hyperpigmenta tion

References	Origin	No. of patients involved	Microbes	Diagnosis	Source of outbreak	Mode of transmission	Outcome
Kim et al., 2010	Korea	3	*Mycobacterium tuberculosis*	Cutaneous infections	All patients received acupuncture from an illegal acupuncturist	Not known	All skin lesions resolved, one with residual mild hyperpigmentation
Koh et al., 2010	Korea	109	*Mycobacterium abscessus*	Cutaneous infections	Contaminated disinfectant (diluted glutaraldehyde)	Diluted glutaraldehyde prepared few months prior use contaminated physical therapy devices which were applied to patients prior to acupuncture	Unknown
Viral infections							
Boxall, 1978	UK	36	Hepatitis B virus	Clinical hepatitis, details not mentioned	Not known	Repetitive use of unsterilized needles	Not mentioned
Stryker et al., 1986	USA	6	Hepatitis B virus	Icteric hepatitis	A patient with hepatitis B infection	Improperly sterilized needles	All survived
Slater et al., 1988	Israel	5	Hepatitis B virus	Clinical hepatitis, details not mentioned	A patient towards the end of her incubation period	Improperly sterilized or unsterilized needles	Not mentioned
Kent et al., 1988	USA	35	Hepatitis B virus	Icteric hepatitis (n = 11), asymptomatic (n = 24)	A patient with hepatitis B infection	Repetitive use of unsterilized needles or transfer of infectious material to sterile needles through the hands of acupuncturist	All survived and hepatitis B virus surface antigen negative
Walsh et al. 1999	UK	5	Hepatitis B virus	Icteric hepatitis	Hepatitis B virus surface antigen and e antigen positive acupuncturist	Not known	Not mentioned

Table. Outbreaks of pyogenic bacterial, mycobacterial and viral infections associated with acupuncture

Clinical diagnosis of pyogenic bacterial infections associated with acupuncture is usually not difficult because of the relatively short incubation period, in terms of days. For localized infections, meridian- and acupuncture point-specific lesions were characteristics, as acupuncture involves insertion of needles into specific acupuncture points at specific locations along the various meridians. Among the 52 sporadic cases, 37 (71%) patients had musculoskeletal and/or skin infections usually in the form of abscesses or septic arthritis, corresponding to the site of insertion of the acupuncture needles. One case involved use of pharmacopuncture (injection of herbal ingredient which was not produced by sterile standard processes through a thin tube for the purpose of combining effect of acupuncture and the herb) and resulted in multiple abscesses in the psoas region (Koo et al., 2010). In spite of the relatively short incubation period for pyogenic infection associated with acupuncture, the implantation of permanent needles could result in infection occurring years after acupuncture. One case with permanent needles inserted 13 years ago developed prosthetic joint infection two months after total knee arthroplasty, despite sterile synovial fluid and tissue obtained pre-operatively and intra-operatively during primary arthroplasty (Nakajima et al., 2010). It is possible that subclinical infection resulted from the permanent needles in the joint gave rise to prosthetic joint infection after surgical manipulation. Eight (15%) patients had infective endocarditis and/or mycotic and/or infected atrial myxoma. In most of these cases, the infections were attributed to acupuncture because of a temporal relationship between acupuncture and the infections, of which the incubation period ranged from 2 to 18 days except for one case, and absence of other identified events resulting in transient bacteremia for cardiovascular infections. For the exceptional case, the aortic mycotic aneurysm developed six months after acupuncture, which made the causal relationship less convincing (Origuchi et al., 2000). For the remaining cases, one patient each had meningitis with lumbar epidural hematoma, endophthalmitis complicating cervical spondylitis, retroperitoneal abscess, intraabdominal abscess, empyema thoracis and bacteremia without other primary focus of infection.

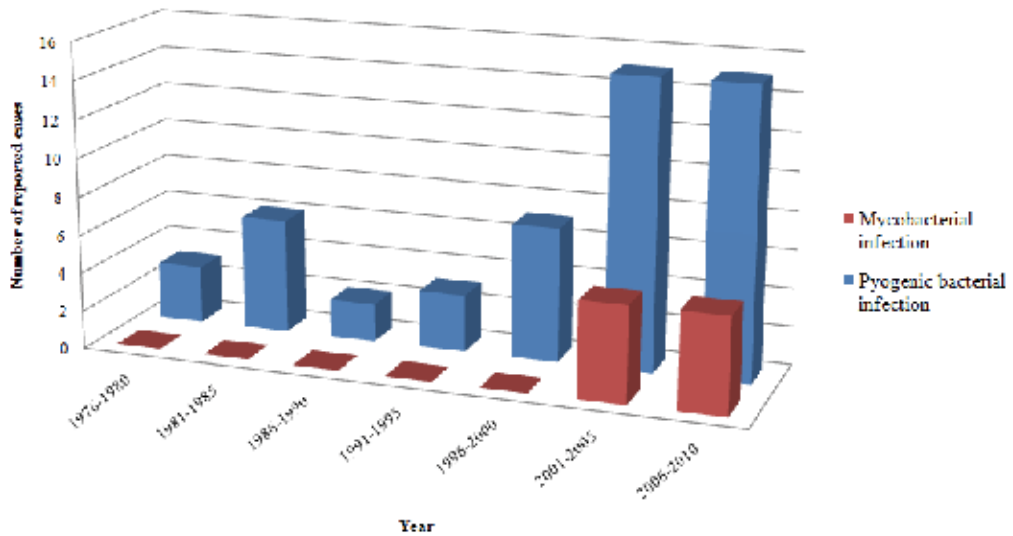

Fig. Sporadic cases of pyogenic bacterial and mycobacterial infections transmitted by acupuncture reported in the English literature

As in other musculoskeletal and/or skin infections, *Staphylococcus aureus* is the most common bacterium causing pyogenic infections associated with acupuncture. Among the 41 (79%) patients with positive cultures in the sporadic cases, 37 (90%) and five (10%) had monomicrobial and polymicrobial infections respectively. The most common bacterium recovered was *Staphylococcus aureus* [22 (54%) cases], followed by *Pseudomonas aeruginosa* [five (12%) cases], *Escherichia coli* [three (7%) cases], *Enterococcus faecalis* [two (5%) cases], *Bacteroides fragilis* [two (5%) cases] and one case each of *Staphylococcus epidermidis*, group A streptococcus, group B streptococcus, *Streptococcus anginosus*, *Streptococcus bovis*, *Listeria monocytogenes*, *Clostridium botulinum* + *Clostridium histolyticum* + *Clostridium subterminale*, *Bifidobacterium longum*, *Propionibacterium acnes* and *Klebsiella pneumoniae*. For the patient with infected atrial myxoma associated with *Streptococcus bovis*, the authors attributed acupuncture to be the cause of infection just because the patient had received repeated courses of acupuncture during a two-month period before the onset of infection, without mentioning the possibility of the gastrointestinal tract as a source of the bacterium (Uchino et al., 2002). Since *Streptococcus bovis* is not part of the skin flora, this case of *Streptococcus bovis* infected atrial myxoma associated with acupuncture was not convincing. Nineteen (37%) of the patients had positive blood cultures. All of them had monomicrobial bacteremia, with *Staphylococcus aureus* being the most common bacterium recovered [11 (58%) cases], followed by one case each of group A streptococcus, group B streptococcus, *Streptococcus bovis*, *Bifidobacterium longum*, *Propionibacterium acnes*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Klebsiella pneumoniae*.

Pyogenic bacterial infections associated with acupuncture had resulted in major morbidity and mortality with long duration of antibiotics and hospital stay. Standard antibiotics with or without surgical intervention were the mainstay of treatment for pyogenic bacterial infections associated with acupuncture. Among the 35 (67%) patients in the sporadic cases with duration of antibiotics reported, four (11%), six (17%) and 18 (51%) received 2 to <4 weeks, 4 to <6 weeks and ≥6 weeks of antibiotics respectively. Thirty-five (67%) patients required drainage and/or other surgical treatment. Overall, three (6%) patients died. Although most infections started with localized infections and almost all patients were immunocompetent, a significant proportion had resulted in serious consequences, such as joint destruction, paraplegia, necrotizing fasciitis and multiorgan failure.

In addition to the 52 isolated cases, one outbreak of methicillin resistant *Staphylococcus aureus* infections associated with acupuncture, which represented the first reported outbreak of pyogenic infections associated with acupuncture, was described recently from Australia (Table) (Murray et al., 2008). Five of the patients had septic arthritis and bursitis and the other three had pyomyositis. Three patients had bacteremia. The source of the outbreak was traced to an acupuncturist, who carried the same methicillin resistant *Staphylococcus aureus* as the patients in his nasal cavity, demonstrated by pulsed field gel electrophoresis and ribotying. All patients responded to prolonged antibiotics treatment (median 72 days, range 21 – 127 days) and none of the patients died.

4. Acupuncture transmitted mycobacterial infections

In contrast to pyogenic bacterial infections, only eleven sporadic cases of acupuncture-associated mycobacteriosis have been reported in the English literature (Woo et al., 2001, 2002; Ara et al., 2003; H.J. Cho et al., 2010; W.J. Lee et al., 2010; Guevara-Patiño et al., 2010; Castro-Silva et al., 2011) (Figure). On the other hand, four outbreaks have been described

(Table) (Ryu et al., 2005; Song et al., 2006; Tang et al., 2006; J.K. Kim et al., 2010; Koh et al., 2010). While one outbreak involved 32 patients from Canada, the other three were all reported from Korea including the largest outbreak involving up to 109 patients (Koh et al., 2010). One of them, involving 40 patients, was reported by two groups from Korea (Ryu et al., 2005; Song et al., 2006), whereas the other one involved only three patients (J.K. Kim et al., 2010). Although only rarely documented by positive culture of environmental samples, mycobacteria were believed to be transmitted from the environment to the patients via contaminated equipments used for acupuncture treatment in most cases, such as cotton wool swabs, towels, hot pack covers and boiling tank. In the largest outbreak reported from Korea (Koh et al., 2010), *Mycobacterium abscessus* was isolated from the contaminated disinfectant (diluted glutaraldehyde) which was believed to be the source of outbreak. During the disinfection process, the electrodes for interferential current and low-frequency therapies may have been contaminated and mycobacteria were transmitted to the skin of the patients during physical therapy. The subsequent needle penetration then introduced the infection.

All mycobacterial infections associated with acupuncture were characterized by localized meridian- and acupuncture point-specific lesions without dissemination. In the Canadian outbreak involving 32 patients, all lesions developed over previous acupuncture sites, and about one third of the patients had 10 or more lesions (Tang et al., 2006). Usually the lesions first appeared as erythematous papules and nodules that subsequently developed into large pain pustules, abscesses and ulcerative lesions after several weeks to months (Woo et al., 2001, 2002; Ara et al., 2003; H.J. Cho et al., 2010; W.J. Lee et al., 2010; Guevara-Patiño, et al., 2010; Castro-Silva et al., 2011; Ryu et al., 2005; Song et al., 2006; Tang et al., 2006). Among all the reported cases, only around 10% of them had systemic symptoms (Koh et al., 2010).

In contrast to pyogenic bacterial infections, acupuncture-associated mycobacteriosis were often associated with delay in diagnosis. Acupuncture-associated mycobacteriosis were associated with a relatively long incubation period. In the Korean and Canadian outbreaks that involved a total of 184 patients, the median incubation periods ranged from one week to 4.75 weeks (Ryu et al., 2005; Song et al., 2006; Tang et al., 2006; J.K. Kim et al., 2010; Koh et al., 2010). This is in line with the long incubation periods of one to three months in infections due to rapidly growing mycobacteria, as reported in cases of *Mycobacterium chelonae* and/or *Mycobacterium fortuitum* infections of breast implants, midpalmar space, epidural space, and skin (Safranek et al., 1987; O'Brien & Rawluk, 1999; Clegg et al., 1983; Camargo et al., 1996; Crick & Vandevelde, 1986). The long incubation period rendered patients unable to associate the event of acupuncture with the clinical illness. Moreover, patients tended to delay in seeking medical advice because of the indolent and relatively mild symptoms. In the Canadian outbreak, some patients continued to receive acupuncture treatments while they had lesions on their bodies (Tang et al., 2006). Furthermore, failure of the attending clinicians to recognize acupuncture-associated mycobacteriosis as a cause of indolent skin and soft tissue infection due to a lack of awareness of such a disease entity, as well as the assumption of "adequate" skin disinfection with alcohol and the use of disposable acupuncture needles, have also resulted in delay in diagnosis. In the four sporadic cases of mycobacterial infections associated with acupuncture reported earlier in the year 2001 and 2002, the diagnosis was made during subsequent infectious disease consultations, when the patients recalled the history of acupuncture only on direct questioning of whether the involved site has been penetrated by sharp objects in recent months (Woo et al., 2001, 2002).

In the two outbreaks reported in the mid-2000s, the median time to correct diagnosis was about three to four months (Ryu et al., 2005; Song et al., 2006; Tang et al., 2006). Of note is that the first case of acupuncture transmitted mycobacterial infection was reported in 2001 (Woo et al., 2001), 25 years after the first case of acupuncture transmitted pyogenic bacterial infection was described!

The reported cases of acupuncture mycobacteriosis were caused by both rapidly and slow growing mycobacteria, as recovered in biopsy specimens of the lesions, which responded to the anti-mycobacterial treatment for the corresponding mycobacteria with or without surgical excision. In the three large outbreaks, *Mycobacterium abscessus* was the causative microbe isolated (Ryu et al., 2005; Song et al., 2006; Tang et al., 2006; Koh et al., 2010), whereas in the sporadic cases, a wider variety of mycobacteria were recovered, including *Mycobacterium chelonae*, *Mycobacterium nonchromogenicum*, *Mycobacterium abscessus*, *Mycobacterium avium* complex and *Mycobacterium haemophilum* (Woo et al., 2001, 2002; Ara et al., 2003; H.J. Cho et al., 2010; W.J. Lee et al., 2010; Guevara-Patiño et al., 2010; Castro-Silva et al., 2011). In addition to the conventional laboratory methods, 16S ribosomal RNA gene sequencing and/or sequencing other housekeeping genes were important for identification of the *Mycobacterium* species responsible for causing the infections (Woo et al., 2008). Despite generally not environmental in origin, *Mycobacterium tuberculosis* was identified as the causative microbe in one outbreak involving three patients who developed cutaneous infection corresponding to the acupunctural sites (Kim et al., 2010). The diagnosis was confirmed by polymerase chain reaction in two patients with one of them also being cultured positive. Histologically, all cases were characterized by typical features of mycobacterial infections, such as granulomatous inflammation, caseous necrosis and epithelioid and multinucleated giant cells with or without the presence of acid fast bacilli (Woo et al., 2001, 2002; Ara et al., 2003; H.J. Cho et al., 2010). For medical treatment against the rapid growers, we recommended a combination of imipenem, clarithromycin/azithromycin and amikacin in the first few weeks for a rapid reduction of mycobacterial load and reducing the chance of emergence of resistance, followed by clarithromycin/azithromycin maintenance for a few more months. Surgical excision would be necessary for large lesions. Although most patients responded, a lot of the patients had residual scarring and/or hyperpigmentation.

5. Acupuncture transmitted viral infections

Theoretically, all blood borne viruses can be potentially transmitted by acupuncture. In the literature, the best documented cases were hepatitis B virus, and to a less extent, hepatitis C virus. Most cases of acupuncture associated blood borne virus infections were due to transmission of the virus from one acupuncture patient who carried the virus to another. Occasionally, the infection was transmitted from the acupuncturist who carried the virus to the patient. In all these cases, reusable acupuncture needles that were inadequately sterilized were used. As a result of the increasing use of disposable needles, the incidence of blood borne viruses transmitted by acupuncture will be expected to decrease.

5.1 Hepatitis B virus

Among the blood borne viruses transmitted by acupuncture, hepatitis B virus is the best documented one, and is also the one involved in the largest number of outbreaks globally,

which have provided invaluable information on the epidemiology of acupuncture transmitted hepatitis B virus infections. A total of five acupuncture transmitted hepatitis B virus outbreaks have been reported in the English literature, involving more than 80 patients (Table) (Boxall, 1978; Stryker et al., 1986; Slater et al., 1988; Kent et al., 1988; Walsh et al., 1999). In most of the outbreaks, the sources were patients with hepatitis B virus infections. Hepatitis B virus was transmitted from one patient to another through improperly sterilized or unsterilized reusable acupuncture needles. In one of the outbreaks, a hepatitis B virus surface antigen and hepatitis B virus e antigen positive acupuncturist was believed to be the source, although the acupuncturist denied testing the sharpness of needles on his own skin before inserting them into patients.

5.2 Hepatitis C virus

Unlike hepatitis B virus, hepatitis C virus infections are almost always asymptomatic in the acute phase. Therefore, it is difficult to ascertain that acupuncture as the definite route of transmission of the virus by tracing the source and performing molecular typing studies. Moreover, outbreaks, if occurred, would be difficult to recognize, and therefore none have been reported in the literature. On the other hand, most evidence for the association of hepatitis C virus infection with acupuncture came from epidemiological and case control studies. In more than 10 of these studies carried out in different parts of the world, acupuncture was found to be an independent risk factor for hepatitis C virus infections (Karmochkine et al., 2006; Kweon et al., 2006; Karaca et al., 2006; Lasher et al., 2005; Ernst & Sherman, 2003; Shin et al., 2000, 2002; Sanchez et al., 2000; Sun et al., 1999; Balasekaran et al., 1999; Kayaba et al., 1998; Sulaiman et al., 1995; Kiyosawa et al., 1994; Cavalheiro Nde et al., 2009).

5.3 Human immunodeficiency virus

Unlike hepatitis B virus transmitted by acupuncture with concrete evidence of outbreaks and molecular typing that confirmed the same hepatitis B virus strain from the source and recipients and hepatitis C virus transmitted by acupuncture with evidence from case-control studies, the evidence of human immunodeficiency virus transmitted by acupuncture was just circumstantial. In all the five cases of "acupuncture associated human immunodeficiency virus infections" reported in the English literature, the human immunodeficiency virus positive patients had no other risk factors for the human immunodeficiency virus infection, such as transfusion, sexual intercourse, haemophilia, intravenous drug use or other injections, operation, and tattooing, other than acupuncture (Chamberland et al., 1989; Vittecoq et al., 1989; Castro et al., 1988; Wiwanitkit, 2003).

6. Infection control in acupuncture

To prevent acupuncture transmitted infections, strict adherence to proper infection control guidelines is mandatory. Although guidelines for carrying out the proper procedures of acupuncture are available (Chinese Medicine Registration Board of Victoria), implementation of such guidelines, even in developed countries, is far from ideal. To prevent transmission of microbes from acupuncturists to patients, acupuncturists should be vaccinated against hepatitis B virus and they should not test the sharpness of needles on their own skin before inserting them into patients. To prevent patient-to-patient

transmission of blood borne viruses, the use of disposable acupuncture needles should be strictly followed. Needle reuse should be discouraged because almost all hepatitis B virus outbreaks, and probably other undocumented cases of patient-to-patient transmission of blood borne viruses, were transmitted by improperly sterilized reuse needles. In a recent survey, it was found that in village clinics in mainland China, reusable acupuncture needles were disinfected with alcohol rather than being sterilized, due to concerns that sterilization might blunt the needles (Reynolds & McKee, 2008). Furthermore, proper disinfection of work area (Chinese Medicine Registration Board of Victoria) and physical device, as well as good personal hygiene and proper skin disinfection before needle insertion is the cornerstone to prevent environment-to-patient transmission of pyogenic and mycobacterial infections. Medicinal herbs or agents used for pharmacopuncture treatment must be produced and controlled by sterilization or standardization. Among the infectious agents transmitted by acupuncture, mycobacteria survive the best in disinfectants. As mycobacteria are resistant to chlorhexidine, we recommend that the acupuncturist should wash his/her hands with alcoholic chlorhexidine or povidone iodine before acupuncture treatment. Surgical masks should be worn during needle insertion. The patient's skin should be disinfected by swabbing with 75% alcohol that is properly reconstituted without top up. While there was inadequate evidence to support a "minimum disinfection time", the Australian Acupuncture Association Infection Control Guidelines for Acupuncture recommended that the skin disinfection time should be at least 30 seconds or the site of insertion should be "just dry" before the patient's skin is pierced (Australian Acupuncture Association Limited, 1997). However, our results showed that mycobacteria can survive in alcohol for up to 45 seconds (Woo et al., 2002). Therefore, skin disinfection time of at least one minute is recommended before insertion of acupuncture needle. To ensure adequate time for disinfection, the acupuncturist can disinfect a group of acupuncture sites before inserting the needles in a sequential order.

7. Conclusion

In the 1970s and 1980s, the majority of the infections associated with acupuncture were sporadic cases of pyogenic bacterial infections, mainly due to *Staphylococcus aureus*, as well as outbreaks of hepatitis B virus infections. As a result of the increasing use of disposable needles in developed in countries, the reported incidence of blood borne viruses transmitted by acupuncture has decreased in 1990s, while acupuncture-transmitted pyogenic bacterial infections persisted. In 2000s, a novel clinical syndrome, acupuncture mycobacteriosis, mainly caused by rapidly growing mycobacteria, has emerged. Due to the relatively hardy nature of mycobacteria, the long incubation period and difficulty in making diagnosis, mycobacteria has caused acupuncture associated outbreaks involving large numbers of patients. The case reports and outbreaks on acupuncture-transmitted infections we summarized in this article are just the tip of the iceberg of a global emerging problem. Although China is presumably the country where acupuncture is most widely used and the hygienic conditions in mainland China are far from ideal with the use of reusable acupuncture needles still in practice, none of the reports of sporadic cases or outbreaks were from mainland China. In 2009, there were first reports of methicillin resistant *Staphylococcus aureus* transmitted by acupuncture. We predict that the emergence of community-associated methicillin resistant *Staphylococcus aureus* infections would further aggravate the problem. To prevent acupuncture-transmitted infections, more resources should be spent on

implementation of proper infection control guidelines, as the financial burden due to prolonged hospitalization and antimicrobial and surgical treatment, the long-term sequel and mortality would be far beyond that used for implementation of guidelines.

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Acupuncture is growing in popularity world-wide. Acupuncture and related techniques are useful tools for treating a spectrum of diseases. However, there are still many areas of controversy connected to it due to the fact that mechanisms of action of acupuncture are not entirely clear. Another debilitating element is the absence of a convincing model of sham acupuncture for a control group in clinical trials.Therefore, there are still inappropriate prejudice and unfamiliarity regarding acupuncture. I hope this book can contribute to guide the advance of this ancient medical art. The reader will here find texts wrote by authors from different parts of the world. The chapters cover strategic areas to collaborate with the consolidation of the knowledge in acupuncture. The main objective is to share elements to make acupuncture more and better offered at health systems worldwide.

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