

Clinical and Mechanistic Study of Acupuncture in Treating Post-Stroke Cognitive Impairment

Jiaoying Li¹, Ximei Xie^{2,*}

¹Shaanxi University of Chinese Medicine, Xianyang 712046, Shaanxi, China

²Xi'an Hospital of Traditional Chinese Medicine, Xi'an 710021, Shaanxi, China

*Correspondence Author

Abstract: *As a traditional Chinese medicine treatment method, acupuncture has been widely used in the clinic. Through the literature review in the past 10 years, the author found that acupuncture treatment of post-stroke cognitive impairment has significant efficacy, and the clinical and experimental mechanism of action has been increasingly elucidated. This paper summarizes and explores the therapeutic effect of different acupuncture methods on post-stroke cognitive impairment and the regulatory mechanism of acupuncture treatment from two aspects of clinical efficacy observation and mechanism of action, to provide strong evidence and theoretical basis for clinical and scientific research workers.*

Keywords: Acupuncture treatment, Stroke, Post-stroke cognitive impairment.

1. Introduction

Stroke, also known as “Zhongfeng” in traditional Chinese medicine (TCM), can be clinically classified into ischemic stroke caused by cerebral artery stenosis or occlusion due to emboli from various etiologies, and hemorrhagic stroke resulting from vessel rupture due to hypertension, fragile vessel walls, or other factors. Stroke is often accompanied by various complications and sequelae, among which post-stroke cognitive impairment (PSCI) has become a focus of clinical research due to its high incidence and poor prognosis. Acupuncture has shown significant efficacy in treating PSCI. A variety of acupuncture methods are used in clinical practice, such as body acupuncture, scalp acupuncture, electroacupuncture, and some characteristic needling techniques. This article reviews the therapeutic effects and mechanisms of action from the above aspects as follows:

2. Clinical Observations and Mechanisms of Electroacupuncture for PSCI

Electroacupuncture (EA) therapy delivers continuous micro-pulse currents to one or more groups of needle handles via an electroacupuncture device, achieving active stimulation of muscle contraction around the acupoints, enhancing the sensation of qi (vital energy), and offering advantages such as adjustable parameters and visible or observable, quantifiable therapeutic factors. LIU Jiao [1] applied EA at Shenting (DU24) and Baihui (DU20) for two weeks and found, using the Montreal Cognitive Assessment (MoCA) and Loewenstein Occupational Therapy Cognitive Assessment (LOTCA), that patients' global cognitive function improved compared to baseline. After four weeks of treatment, patients' executive function, attention, and concentration also significantly improved, indicating that EA can enhance post-stroke cognitive ability with a time-accumulating effect. Liu Qingzhen [2] subjected cerebral ischemia-reperfusion rats to EA at Shenting and Baihui and observed that EA downregulated *gabbr1* mRNA expression in the hippocampus, inhibited the G protein-coupled receptor GABAB, reduced inhibitory effects within the central nervous system, altered synaptic signal transmission efficiency, enhanced synaptic

plasticity, and thereby improved learning and memory after stroke. Additionally, Han Jie [3] confirmed the efficacy of EA combined with repetitive transcranial magnetic stimulation (rTMS) for PSCI and quantified the effects through changes in various biochemical indicators, making the conclusions more objective and credible. The effectiveness of acupuncture may be attributed to the downregulation of lipocalin 2 (LCN2) expression in the mouse hippocampus [4], affecting multiple downstream inflammatory factors regulated by LCN2, as well as inhibiting microglial activation via the nuclear factor- κ B signaling pathway, reducing neuroinflammation in the brain, decreasing cerebral infarct volume, and promoting neurological recovery after cerebral ischemia-reperfusion.

3. Clinical Observations and Mechanisms of Scalp Acupuncture for PSCI

The brain is the “shen ming zhi fu” (house of spirit intelligence), and the head is the “zhu yang zhi hui” (meeting place of all yang channels). As the body surface projection closest to the central nervous system, scalp acupuncture for PSCI includes not only classic point prescriptions based on traditional meridian theory but also distinctive methods developed by various schools based on modern anatomy and pathophysiology. Professor Yu Zhishun proposed the “field theory” [5], suggesting that the acupuncture field directly acts on the diseased area to produce a local effect of the acupoint, and through the conduction system such as meridians, produces a distant effect. Thus, the action of scalp acupuncture may transmit the stimulation effect generated by needling to the cerebral cortex via the “acupuncture field,” improving the excitability of cortical nerve cells. Guan Ying [6] observed the use of clustered scalp needling with prolonged needle retention, selecting the vertex, pre-vertex, and frontal regions, retaining needles for 6–8 hours, twirling every 30 minutes for the first hour and then every two hours thereafter. Results showed that after four weeks, scores on the Trail Making Test, Clock Drawing Test, and Functional Independence Measure significantly improved, and serum levels of TNF- α and IL-6 were suppressed, indicating protection of brain tissue and control of neuronal inflammation, thereby better improving cognitive function in

PSCI patients.

Other studies have indicated that scalp acupuncture can downregulate the activation of endoplasmic reticulum stress mediators, possibly participating in the mechanism that inhibits neurological deficits induced by middle cerebral artery occlusion (MCAO), promoting lysosomal phagocytosis of endoplasmic reticulum fragments, and significantly reducing the expression of pro-apoptotic proteins such as CHOP, phosphorylated JNK, and cleaved caspases-3 and -9 [7]. Evidence also shows that the tissue layer stimulated by scalp acupuncture (skin, fascia, muscle, periosteum) influences its effects on the cerebral cortex, with different anatomical structures mediating distinct signaling pathways, regulating neurotransmitter release, and activating cortical excitability to achieve therapeutic outcomes [8].

4. Clinical Observations and Mechanisms of Body Acupuncture for PSCI

The location of stroke is in the brain, with key pathogenesis including orifice blockage and spirit hiding, and spirit failing to guide qi. Qi stagnation leads to meridian obstruction, while the brain connects to the five zang organs via meridians and is nourished by them. Based on the holistic concept of TCM, body acupuncture selects points on the limbs, chest, abdomen, and back to treat PSCI in various ways. Back-shu points, where the qi of the zang-fu organs infuses into the lumbosacral region, have both local effects and, as they belong to the Bladder Meridian which “ascends from the vertex to enter the brain,” distant effects. The five zang organs are closely related to the brain; while they are regulated by the brain, normal brain function also requires the coordinated regulation of the five zang organs and nourishment by the essence, qi, blood, and body fluids they produce. Nie Yapeng [9] needled the five zang back-shu points (Liver Shu, Heart Shu, Lung Shu, Kidney Shu, Spleen Shu) for two months and demonstrated significant advantages in improving patients’ cognitive function.

After acute cerebral ischemia, massive free radical production exacerbates oxidative damage to ischemic brain tissue; upon revascularization, a second burst of reactive oxygen species causes reperfusion injury [10]. Therefore, scavenging free radicals and enhancing the antioxidant capacity of brain cells to protect the brain from oxidative stress is crucial. Studies have shown that needling at Baihui (DU20) significantly increases the levels of important antioxidant enzymes such as glutathione peroxidase and superoxide dismutase in brain tissue, helping to enhance antioxidant capacity and exert protective effects [11]. In stroke [12], severe hypoxia and glucose deprivation leading to mitochondrial dysfunction initiate a cascade of brain injury. Timely restoration of mitochondrial respiratory function and increased ATP production can improve neurological impairment and cognitive dysfunction after cerebral ischemia. Acupuncture can maintain mitochondrial morphology and functional homeostasis, improve the balance between apoptosis-related factors, stabilize mitochondrial permeability, inhibit the release of mitochondrial contents that trigger apoptosis; on the other hand [13], it can activate mitophagy pathways and signaling pathways in the cortex surrounding the ischemic area, removing accumulated damaged mitochondria, thereby

protecting brain tissue and improving cognitive function.

5. Clinical Observations and Mechanisms of Other Characteristic Acupuncture Methods for PSCI

The “Xingnao Kaiqiao” (consciousness-restoring and orifice-opening) acupuncture method, developed by Academician Shi Xuemin, targets the key pathogenesis of “orifice blockage and spirit hiding” and establishes treatment principles of “restoring consciousness, opening orifices, nourishing liver and kidney,” supplemented by “dredging meridians.” A comprehensive stroke treatment system has been formed and widely used clinically. Hu Hao [14] added Xingnao Kaiqiao acupuncture combined with Huansha Dan (a TCM formula) to conventional treatment and observed scores on MoCA, Activities of Daily Living (ADL), and Mini-Mental State Examination (MMSE). The results showed that Xingnao Kaiqiao acupuncture combined with Huansha Dan had a significant therapeutic effect on PSCI patients. Zhu Huibin et al. [15] selected stroke patients with hemiplegia and treated them with Buyang Huanwu Decoction combined with Xingnao Kaiqiao acupuncture. After treatment, the level of central nervous system specific protein significantly decreased, brain-derived neurotrophic factor levels significantly increased, and blood flow velocities in the anterior cerebral artery, posterior cerebral artery, and basilar artery significantly improved, leading to the conclusion that Buyang Huanwu Decoction combined with Xingnao Kaiqiao acupuncture effectively improves cognitive function in stroke patients with hemiplegia. Thus, the Xingnao Kaiqiao method plays an indispensable role in treating PSCI.

Based on the Xingnao Kaiqiao method, supplemented by nourishing kidney essence and emphasizing the role of kidney essence in nourishing brain marrow, points on the Kidney Meridian are often selected, leading to the development of the “Tianjing Yizhi” (fill essence and benefit intelligence) acupuncture method [16]. Randomized controlled trials showed significant improvements in MoCA, MMSE, and Barthel Index (BI) scores. Additionally, the study found that this method effectively downregulates serum homocysteine (Hcy), reducing factors that cause recurrent brain injury and improving patient prognosis. This effect may be attributed to acupuncture-mediated promotion of neuronal repair in ischemic stroke patients. Acupuncture can promote cell proliferation in the ischemic area and adjacent damaged areas after MCAO, while also improving abnormal brain tissue morphology after cerebral infarction [17]. Researchers observed changes in Nissl bodies in neurons after cerebral infarction: over 6–48 hours, the area of degenerating neurons significantly expanded. After Xingnao Kaiqiao acupuncture treatment, the damaged neuronal area in the cerebral infarct lesion gradually decreased, and injury was significantly alleviated, demonstrating that acupuncture can improve abnormal brain tissue morphology after MCAO in rats. One study found that needling at Neiguan (PC6) and Quchi (LI11) activates astrocytes, enhances monocarboxylate transporter function, promotes the transport and utilization of lactate (an anaerobic glycolysis product), thereby meeting the energy demands of neurons during cerebral ischemia. Acupuncture can upregulate glial fibrillary acidic protein (GFAP) in an astrocyte model of cerebral ischemia, promote astrocyte

activation, reduce stroke-induced astrocyte apoptosis, and exert neuroprotective effects [18].

6. Conclusion

As one of the common sequelae of stroke, PSCI is more preventable than other vascular dementias. As a common clinical treatment for PSCI, acupuncture is simple to perform, safe, and effective, improving patients' clinical symptoms and quality of life, and has gained acceptance among many patients. For example, electroacupuncture can promote brain remodeling by improving neurotransmitter transmission efficiency; scalp acupuncture regulates qi and blood flow in the head by stimulating corresponding reflex zones on the scalp, thereby modulating neurological function; body acupuncture focuses on holistic functional regulation; and the Xingnao Kaiqiao method targets the disease pathogenesis, broadening clinical treatment approaches. The neural mechanisms, clinical efficacy evaluation, and individualized treatment protocols of acupuncture for PSCI are currently hot research directions. It is expected that dedicated researchers will make significant progress in these areas and continue to promote, innovate, and develop traditional Chinese medical techniques.

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