An overview of acupuncture for the treatment of limb spasticity in cerebral palsy-A mini review

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Abbreviations
ICF-CY, International Classification of Functioning, Disability and Health for Children and Youth; TCM, Traditional Chinese medicine.

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Abstract
Cerebral palsy is a common chronic disabling disease in children with special needs, and rehabilitation for cerebral palsy is characterized by a long period, multiple methods and limited efficacy. Due to the limited motor function of cerebral palsy patients, the quality of life of patients is reduced, and their ability to participate in society is reduced, so the improvement of patients’ motor function has become an important goal of cerebral palsy rehabilitation. The motor function of cerebral palsy has become an important goal of cerebral palsy rehabilitation. Limb spasticity is one of the main clinical signs of cerebral palsy patients, and the more severe the limb spasticity is, the greater the impact on the patient’s motor function, so improving limb spasticity in patients with cerebral palsy is particularly important. Acupuncture, as a Chinese medicine treatment method, has been widely used in the clinical treatment of cerebral palsy in China, and has shown certain efficacy. To promote the clinical application of acupuncture technique in cerebral palsy limb spasticity, this paper analyses and summarizes the relevant literature on acupuncture treatment of cerebral palsy limb spasticity summarizes the current status of the clinical application of acupuncture in cerebral palsy limb spasticity, and provides clinical references for the reasonable application of acupuncture in cerebral palsy limb spasticity.

Keywords: cerebral palsy; limb spasticity; acupuncture treatment; mini review

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Introduction
Cerebral palsy, referred to as cerebral palsy, is a developmental disorder commonly seen in children with special needs, which is mainly manifested by central motor and postural developmental disorders and activity limitations. Currently, the prevalence of cerebral palsy among children aged 1-6 years is 2.46 per 1,000 in China, and the prevalence of cerebral palsy reported in foreign countries is 1.4 per 1,000 to 3.2 per 1,000 [1]. Cerebral palsy, as a chronic disease that requires long-term rehabilitation, creates a serious disease burden and economic burden for affected children and their families, and optimising rehabilitation outcomes is an important clinical issue in this disease [2]. Nowadays, there are many rehabilitation training methods for cerebral palsy, mainly divided into two categories: Western medicine rehabilitation and Chinese medicine rehabilitation. Clinical rehabilitation programmes are mainly based on the type of disease of the child with cerebral palsy [3]. The “China Cerebral Palsy Rehabilitation Guidelines (2022)” classifies cerebral palsy into five categories: spasticity, ataxia, ataxia, Worster-Drought syndrome, and mixed-type, of which the spasticity type is further classified into spastic quadriplegia, spastic paresis, and spastic hemiparesis according to the spasticity limbs [1]. Spastic cerebral palsy is the main type of cerebral palsy and is characterised by hypertonia, which is caused by developmental damage to the child’s brain, mainly in the pyramidal system, including the corticomo areas [4]. The core of spasticity is the detachment reflex, which is a movement disorder characterized by a velocity-dependent increase in muscle tone with tendon reflexes due to a hyperactive detachment reflex [5]. The main clinical manifestation of spastic cerebral palsy is limb spasticity. 

Limb spasticity can present clinically as upper limb dorsiflexion, adduction, internal rotation, thumb adduction, lower limb adduction, internal rotation, crossover, knee dorsiflexion, scissor step, pointed foot, foot inversion, tendon reflex hyperactivity, ankle clonus, cone-bundle sign, and folding knife sign. Limb spasticity can directly cause movement disorders in children, or secondary musculoskeletal problems can worsen the degree of movement disorders in children, thus affecting the ability of daily life activities of the patients, lowering the quality of life of the patients, and increasing the burden of medical treatment and the burden of the family and society. Limb spasticity is an important clinical problem to be solved in the rehabilitation of cerebral palsy patients.

At present, there are numerous treatment methods for cerebral palsy patients with limb spasticity, which can be classified into Chinese medicine rehabilitation therapy and Western medicine rehabilitation therapy according to the medical origin. Western medicine rehabilitation therapy is to assess neuromusculoskeletal and movement-related functions and motor function of cerebral palsy patients under the framework of ICF-CY, to judge the degree of limb spasticity, and to give rehabilitation treatments, which mainly include motor control training, physical factor therapy, medication, surgical treatment and auxiliary appliances, etc. [6–8]. Traditional Chinese medicine (TCM) rehabilitation therapy is under the guidance of TCM theories, using acupuncture, moxibustion, tuina, Chinese medicine and other treatment methods, of which acupuncture is a TCM rehabilitation method often used in the clinical treatment of cerebral palsy [9–12]. This paper takes acupuncture intervention in cerebral palsy limb spasticity as the observation target and demonstrates the current clinical application of acupuncture in treating cerebral palsy limb spasticity by summarising the main Chinese medical theories and methods of needle application used in the process of acupuncture.

TCM Theories of Cerebral Palsy Limb Spasticity

TCM dialectical system of cerebral palsy limb spasticity
The diagnosis and treatment of Chinese medicine are characterised by the patient’s clinical symptoms which are collected in detail through the method of observation, hearing, questioning and examination, and then different theories of symptoms-based treatment, such as the eight principles of evidence-based treatment, disease-based treatment, internal organs-based treatment, and the six meridians-based treatment, are applied to classify the symptoms, and then the corresponding treatment measures are taken. TCM has a mixed understanding of cerebral palsy, which is summarised in general terms as “five delays”, “five softnesses”, “five hardresses”, and cerebral palsy with spasticity belongs to the category of “five hardresses”. Cerebral palsy limb spasticity belongs to the category of “five hardresses”, and the disease mechanism is due to the congenital insufficiency of the child, the marrow is not full, the heart and spleen are weak, the qi and blood are deficient, the limb muscles and veins are out of use and out of nourishment, and the muscles and veins are contracted, resulting in the limbs being strong and the activities being out of order [13–14]. It can be seen that cerebral palsy limb spasticity is the result of the common disorder of successive generations, and the mixture of deficiency and solidity, which makes clear identification and typing especially important for guiding the clinical treatment.

The identification of cerebral palsy is diverse. The China Cerebral Palsy Rehabilitation Guidelines (2022) classify cerebral palsy into five categories: liver and kidney deficiency, heart and spleen deficiency, phlegm and stasis obstruction, spleen deficiency and hyperactivity of the liver, and spleen and kidney weakness [15]. Ma Bingxiang (2009) classified paediatric cerebral palsy into four types: kidney deficiency and marrow deficiency, phlegm and blood stasis obstruction, and liver-qi wind internal movement, which was later expanded into six categories: liver and kidney deficiency syndrome, spleen and kidney deficiency syndrome, yin deficiency and wind movement syndrome, deficiency of the heart and spleen syndrome, phlegm and blood stasis obstruction, and spleen deficiency and hyperactivity of the liver syndrome [16]. Wang Xuefeng (2005) classified paediatric cerebral palsy into four types: spleen and kidney deficiencies, spleen and liver deficiencies, liver and kidney deficiencies, and liver-strength and spleen-weakness, and pointed out that spasticity cerebral palsy belonged to the liver-strength and spleen-weakness type, and further elaborated the pathogenesis of spasticity cerebral palsy was due to the liver-blood depletion was too much, the liver-yang was uncontrolled, and the yang was transformed into wind, which was caused by internal movement of the wind, resulting in the contracture of the tendons and veins and the joints were not favourable for flexion and extension. Muscle loss of nutrition, muscle weakness, contracture of tendons and veins, strong limbs, unfavourable joints and other limb spasm manifestations [17]. Lei Yanfeng (2000) classified paediatric cerebral palsy into idiotic, demented and foolhardy types [18]. Liu Huanrong (1999) classified paediatric cerebral palsy into five types: insufficiency of the liver and kidney, deficiency of the spleen and kidney, insufficiency of the heart and blood, internal movement of the liver and wind, and wind-phlegm obstruction of the collaterals [19]. (Table 1)

It can be seen that there is a lack of uniform criteria for TCM diagnosis and typing of cerebral palsy. The reason for this is that, firstly, the idea of TCM diagnosis and treatment is flexible and broad, and doctors choose different TCM diagnostic thinking and obtain different clinical typing. Secondly, the basic information of TCM diagnosis and typing comes from the clinical manifestations of cerebral palsy, which are complex and limit the implementation of standardized diagnostic and treatment procedures. TCM is a kind of empirical medicine, experience originates from clinical practice, practice can produce evidence, and evidence feeds back to the clinic, so drawing on evidence-based medical methods and big data analysis technology is a valuable approach to solve this problem and is suitable for active development in future work on cerebral palsy.

Acupuncture theory for cerebral palsy limb spasticity
Acupuncture treatment technology is under the guidance of the basic theory of traditional Chinese medicine, according to the function of internal organs, meridians and collaterals, the use of TCM diagnostic eight outline theory, the clinical symptoms are summarized, evidence-based treatment. The core of acupuncture treatment is the treatment of the internal organs and meridians, and the law of acupuncture treatment

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is “the meridians are over, the main treatment is over”. At present, the acupuncture treatment of cerebral palsy limb spasticity is mainly based on meridians and meridians to carry out evidence-based treatment, in which the meridian-based treatment emphasises the taking of acupuncture points according to the meridians and the discriminative use of the fourteen meridians and the eight odd meridians for the preparation of the acupoints, and the role of the overall function of the more focused on the function [20–22]. The treatment of meridian tendons flexibly uses the sinewy parts of the twelve meridians, i.e., the twelve meridian tendons. In TCM theory, meridian tendons play a role in restraining the bones, moving the joints, maintaining the normal motor function of the body and maintaining normal body posture [23]. Children with cerebral palsy exhibit abnormal postures consistent with the pathological characteristics of meridian tendon disease in TCM, which is suitable for the treatment of meridian tendon stimulation, which focuses more on the local function in its action. The application of the theory of acupuncture identification to the clinical treatment of cerebral palsy limb spasticity is more practical.

**Acupuncture treatment for cerebral palsy limb spasticity**

**Selection of acupuncture meridians and acupoints**

For the selection of meridians for cerebral palsy limb spasticity, yang meridians such as stomach meridian, bladder meridian and gallbladder meridian are better for relieving muscle spasticity and lowering muscle tone, and yin meridians such as spleen meridian, liver meridian and kidney meridian are more effective in improving joint spasticity [21]. The yin and yang stilt meridians can regulate limb movement, improve muscle tone balance, and relieve lower limb spasms. The Directing Vessel governs the yang energy of the whole body, regulates the qi and blood yin and yang of the whole body, and can improve limb spasms [22]. According to meridian and meridian identification and treatment, the most commonly used acupoints for clinical treatment of cerebral palsy limb spasticity are Baihui, Si Shencong, Temporal Three Needles, Brain Three Needles, Shoulder, Quchi, Hegu, Waiguan, Huanjiao, Yanglingquan, Ashisani, Xieyi, Sanyinjiao, and Taichong [24].

**Selection of specific needling methods**

According to the current literature, acupuncture methods regarding cerebral palsy mainly include body acupuncture, head acupuncture and combined acupuncture, which is a simple generalisation based on the site of acupuncture [25]. Specific acupuncture treatments need to be considered such as the selection of the acupuncture site, the choice of the needle, the technique of needle entry and other combined methods. Needle tools for cerebral palsy limb spasticity are generally millimetre needles, the length of which is chosen according to the location of the acupuncture point to be needled, secondly, intradermal needles are also more commonly used, each with its strengths compared with millimetre needles.

Acupuncture therapy in clinical practice emphasises the needle entry technique and a variety of characteristic stabbing methods based on the needle entry technique, which make the clinical treatment of cerebral palsy abundant, but the reproducibility is not good. The Tong Guan Li Qiao acupuncture method was inherited from Shi Xue Min by Liu Min Le [26], the Cong Ceng Tong Luo acupuncture method was created by Guo Chun Guang [27], the “four-needle therapy” created by Zhou Zhi Jie [28], the Ling Gu Bafa acupuncture method summarized by Liu Zhen Huan [29], and the Cone Zone acupuncture method made good use of by Wang Sheng Qiang [30], etc., are mostly summaries of the long term experience of medical practitioners, and they are lacking in evidence-based evidence and are difficult to be reproduced. Evidence-based evidence is also difficult to repeat and verify, which limits the clinical promotion of acupuncture methods.

Based on pure millimetre acupuncture, new millimetre acupuncture methods have also been derived, such as warm acupuncture, electro-acupuncture, floating acupuncture, intradermal acupuncture, and so on. There are literature reports about the total effective rate of different needling treatments for spastic cerebral palsy, warm needling + electro-acupuncture + rehabilitation > body needling + cephalic needling + moxibustion + rehabilitation > warm needling + rehabilitation > body needling + cephalic needling + rehabilitation > electro-acupuncture + rehabilitation > body needling + cephalic needling > body needling + rehabilitation, and it is proposed that the combined effect of multiple therapies is superior to the treatment of a single method [25].

At present, the clinical research on cerebral palsy limb spasticity generally adopts the integrated treatment method and the efficacy is clear, which shows that both clinicians and researchers recognize the role of integrated therapy. However, a series of clinical questions remain to be solved, such as how to standardize the development and criteria for integrated therapies, how to evaluate the clinical efficacy of integrated therapies, and whether the development of integrated therapies needs to take into account health economics. Doctors who have been engaged in the clinical treatment of cerebral palsy for a long time can easily find that, in the clinical treatment process of this disease, the diversity of acupuncture methods and the diversity of integrated methods confuse the doctors to a certain extent, and how to choose the most effective method from the many acupuncture methods is also a clinical problem faced by the acupuncture treatment of cerebral palsy with limb spasms. In the future, the use of evidence-based methods and big data analysis, based on the conduct of large-sample normative acupuncture clinical studies, maybe a way to obtain more optimal acupuncture interventions.

**Improvements of acupuncture in limb spasticity of cerebral palsy**

Zhu Min et al. observed the therapeutic effect of acupuncture in 86 children with spastic cerebral palsy and found that after 3 months of continuous treatment, the children’s symptoms of limb spasticity were significantly improved through clinical spasticity index scales and modified muscle tone scale [31]. After 3 months of continuous treatment, the children’s limb spasticity symptoms were found to be significantly improved by the clinical spasticity index scale and modified dystonia rating scale, and the total effective rate was 93.02% [31]. Zhou Yingying observed that children with spastic cerebral palsy
showed significant improvement in limb spasticity and fine motor ability through acupuncture at the acupoints of Sishencong, Baihui, Shusani, and Sanyinjiao. Gong Weida et al. [32]. By comparing the treatment of 94 children with spastic cerebral palsy by acupuncture combined with Bobath therapy with that of Bobath therapy alone, it was found that acupuncture can improve the limb spasticity of the children and improve the children’s gross and fine motor abilities, as well as accelerating the children’s intracerebral blood flow and improving their intelligence [33]. Zheng Desong et al. used the dystonia grading scale to assess the degree of limb spasticity and observed that the total effective rate of acupuncture treatment for 62 children with cerebral palsy was 93.55% [34].

Summary

The use of acupuncture in the treatment of cerebral palsy limb spasm is a summary of the long-term clinical experience of Chinese medicine, and the identification of organs and meridians is the foundation of Chinese medicine, while the identification of internal organs and meridians is the core of acupuncture treatment, and the acupuncture points are the effect points of acupuncture. Although the treatment of cerebral palsy limb spasticity has accumulated a lot of experience in long-term clinical application, how to find the best clinical plan for acupuncture treatment of cerebral palsy limb spasticity, and how to formulate a standardised clinical procedure for acupuncture treatment, need to be further researched. Evidence-based thinking and big data analysis may be the key to solving this series of clinical problems in the future, which is also a direction that acupuncture research needs to pay attention to.

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