

Research Progress on the Pathogenesis and Traditional Chinese Medicine Treatment of Cervical Spondylotic Radiculopathy

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Abstract: *Cervical spondylotic radiculopathy is one of the common clinical types of cervical spondylosis. Its main clinical manifestations include radiating pain, numbness, and weakness in the neck, shoulders, and upper limbs, which exert a considerable impact on people's daily life and work. The pathogenesis and etiology of this disease remain unclear and are generally considered to be the result of the combined action of multiple factors. Its incidence has been increasing year by year, and the affected population is becoming younger. Conservative treatment remains the main therapeutic approach. Traditional Chinese medicine is convenient, effective, and highly safe in the treatment of cervical spondylotic radiculopathy, and its clinical application has become increasingly widespread. In this paper, relevant literature on the treatment of cervical spondylotic radiculopathy with traditional Chinese medicine over the past 10 years was collected and reviewed, and the potential mechanisms and current research status of traditional Chinese medicine treatment for cervical spondylotic radiculopathy were summarized for reference.*

Keywords: Cervical spondylotic radiculopathy, Pathogenesis, Traditional Chinese medicine, Research progress.

1. Introduction

In recent years, with the advancement of science and technology, electronic products have become widely integrated into people's lives. Prolonged use of such devices and extended periods of desk work with the head bent forward have led to a gradual increase in the incidence of cervical spondylosis and a trend toward younger age at onset, seriously affecting patients' quality of life. Cervical spondylotic radiculopathy (CSR) is one of the common types of cervical spondylosis. It is caused by degenerative changes in the cervical intervertebral discs and adjacent facet joints, hypertrophy and calcification of cervical ligaments, osteophytic hyperplasia, intervertebral disc atrophy, and related factors that narrow the intervertebral foramen and compress or irritate the cervical nerve roots. Clinically, it is mainly manifested by aching pain in the neck and shoulders, radiating pain in the upper limbs, and numbness and weakness in the arms, fingers, and fingertips. In severe cases, muscle atrophy and decreased muscle strength and grip strength may occur [1]. CSR has the highest incidence among the subtypes of cervical spondylosis, accounting for approximately 70% of all cases [2]. It not only seriously affects patients' work and daily life, but also imposes a considerable psychological burden because of its tendency to recur.

Current treatment for CSR can be divided into surgical treatment and conservative treatment. Because surgical intervention is applicable only to a small proportion of relatively severe cases, and because important blood vessels and nerves are distributed throughout the cervical region, surgery is associated with relatively high risk and cost. Therefore, the vast majority of patients choose conservative treatment. Clinical investigations have shown that approximately 83% of patients with CSR experience significant symptom improvement after conservative treatment, demonstrating its effectiveness [3]. At present, many studies have explored how traditional Chinese medicine can be used to treat CSR. Owing to its diverse therapeutic

modalities, including acupuncture, tuina, herbal medicine, and functional exercise, as well as its convenience, low cost, and high safety, it has been widely accepted [4].

2. Pathogenesis of Cervical Spondylotic Radiculopathy

2.1 Understanding in Modern Medicine

CSR is a chronic progressive disease. It is generally believed that when the nerve root is directly compressed by a protruded intervertebral disc or osteophytic hyperplasia, abnormalities in sensation, movement, and reflexes may occur in the corresponding innervated region. The mechanisms underlying the various clinical manifestations of this type of cervical spondylosis can be summarized in three aspects [5]. First, various compressive factors may directly compress or traction the spinal nerve root and cause local secondary reactive edema, leading to radicular symptoms. Second, cervical symptoms may arise through the terminal branches of the sinuvertebral nerve on the dural sac wall at the root sleeve. Third, on the basis of the first two mechanisms, imbalance inside and outside the cervical spine may be induced, causing involvement of ligaments, muscles, joint capsules, and other tissues around the affected motion segment and thereby generating symptoms. For example, the longus colli, anterior scalene, and sternocleidomastoid muscles related to the involved segment may all participate in the pathological process.

2.2 Understanding in Traditional Chinese Medicine

In traditional Chinese medicine, CSR generally falls within the categories of 'Bi syndrome,' 'neck stiffness,' and 'neck and back pain.' Traditional Chinese medicine holds that the occurrence of this disease is related to multiple factors, mainly including invasion of external pathogenic factors, insufficiency of healthy qi, and chronic strain or trauma. In

Zhu Bing Yuan Hou Lun, it is stated that Bi syndrome occurs when wind, cold, and dampness invade together, producing numbness, heaviness, or pain in the muscles. This identifies exogenous pathogenic invasion as a major cause of Bi syndrome and reflects the view that CSR may result from the invasion of wind, cold, and dampness into the body surface, obstructing the movement of qi and blood. In Yixue Yuanli, it is noted that numbness may arise when qi deficiency fails to guide blood and nourish the tendons and vessels, or when blood deficiency fails to nourish the muscles, causing stagnation of the channels. This explains the relationship between deficiency of healthy qi and CSR. When qi and blood are weak and cannot ascend to nourish the head and neck, the cervical muscles lose nourishment, and pain results. Zhangshi Yitong states that prolonged desk work or intense concentration may disturb the normal circulation of kidney qi and induce pain in the head, shoulders, and back, indicating that overwork is also one of the causes of this disease. Therefore, the etiology and pathogenesis of CSR can be summarized as follows: first, invasion of wind, cold, and dampness obstructs the meridians and impairs the circulation of qi and blood; second, deficiency of qi and blood and insufficiency of the liver and kidneys lead to malnourishment of the tendons and vessels; third, chronic strain and trauma, including prolonged desk work and improper sitting posture, result in cervical injury [6].

3. Progress in Traditional Chinese Medicine Treatment of CSR

3.1 Acupuncture Therapy

As a non-surgical treatment method for CSR, acupuncture has been widely applied in clinical practice. Acupuncture treatment for CSR includes ordinary acupuncture, electroacupuncture, fire needle therapy, and other forms. Modern studies have shown that acupuncture can promote local blood circulation in the cervical region and increase local blood flow, thereby improving the local blood supply. Acupuncture can also reduce nerve root edema and inflammation and regulate immune function. In addition, acupuncture may relieve pain by stimulating the central nervous system to secrete enkephalins and endorphins. Yu Xiaoyuan et al. [7] treated patients with CSR using deep puncture of the cervical Jiaji points with long needles and set up a warm-needle group for comparison. The results showed that deep puncture of cervical Jiaji points with long needles was superior to the warm-needle group in relieving neck, shoulder, and back pain, upper-limb numbness, and related symptoms, and in improving cervical spine function. This therapy has the advantages of simple operation, definite efficacy, and high safety. Yuan Ke et al. [8] divided 104 patients with CSR into a conventional acupuncture group and an ultrasound-guided deep acupoint puncture group. The results showed that the CASCs, VAS, and NPQ scores of the ultrasound-guided group were better than those of the conventional acupuncture group, and follow-up demonstrated a lower recurrence rate. Liu Li'an et al. [9] studied Gaohuang moxibustion combined with routine acupuncture at Jiaji points and Ashi points for CSR. Through its tonifying, warming, and obstruction-dispelling effects, Gaohuang moxibustion may dredge the meridians, replenish yang qi, nourish the channels, improve the body's resistance to

external pathogens, enhance immunity, and promote neurological recovery.

3.2 Tuina Therapy

Tuina therapy is an effective external treatment of traditional Chinese medicine for CSR. The occurrence of CSR is closely related to disruption of the mechanical balance of the cervical spine, and tuina can correct static and dynamic imbalance of the cervical spine through tendon-regulating and bone-setting manipulations, improve blood circulation, and promote recovery [10]. Luo Fazhan et al. [11] found that tuina can correct displacement and dysfunction of cervical joints, relieve muscle spasm, release adhesions between the nerve root and surrounding tissues, and reduce nerve root compression, thereby alleviating pain. Shi Hongwei [12] randomly divided 128 patients with CSR into a control group and a treatment group, with 64 cases in each group. Both groups received the same routine tuina treatment, and the treatment group additionally received supine cervical chiropractic manipulation. The effective rate of the treatment group reached 90.63%, higher than the 68.75% in the control group ($P < 0.05$), indicating that both routine tuina and supine cervical chiropractic manipulation had good therapeutic effects and that their combined application produced better results. Deng Zhen et al. [13] compared routine cervical tendon-regulating traction manipulation with Shi's cervical localization rotational manipulation and found that the effective rate of the observation group was 89.47%, significantly higher than the 54.55% of the control group ($P < 0.05$), suggesting that Shi's method has more significant efficacy and provides another option for clinical treatment of CSR. As a safe and effective therapy, tuina has broad application prospects in the treatment of CSR. Scientifically applied tuina techniques, particularly when combined with other therapies, can effectively relieve pain and discomfort and improve patients' quality of life [14].

3.3 Needle-Knife Therapy

Needle-knife therapy integrates the essence of traditional Chinese acupuncture theory with the technical principles of the surgical scalpel in Western medicine [15]. Through minimal traumatic stimulation, it aims to dredge the meridians, release adhesions, and balance qi and blood. It is especially effective in the treatment of diseases involving muscles and connective tissues. Li Ruiguo et al. [16] randomly divided 60 patients with CSR into a needle-knife group and a control group receiving block therapy, with 30 cases in each group. After 6 months of treatment, the total effective rate of the needle-knife group was 96.67%, higher than that of the acupuncture group at 90.00% ($P < 0.001$), indicating that both needle-knife therapy and acupuncture can improve the symptoms of patients with CSR, but needle-knife therapy appears more effective. Wang Mian et al. [17] investigated the clinical effect of the 'three cervical knife' technique in treating refractory upper-limb numbness and pain in CSR. The total effective rate was 95.56%, higher than the 74.44% observed in the acupuncture group ($P < 0.05$), demonstrating a significant clinical effect, obvious symptom relief, lasting efficacy, and relatively high safety. Zhang Wenxing [18] compared ultrasound-guided posterior cervical paravertebral nerve block with ultrasound-guided minimally invasive

needle-knife therapy in the treatment of CSR and found that the VAS score after treatment in the needle-knife group was significantly lower ($P < 0.05$), indicating that needle-knife therapy may be more effective. Needle-knife therapy has the advantages of precise positioning, release of adhesions, minimal trauma, and high efficacy [19]. It can improve microcirculation at the lesion site and promote tissue repair. However, the procedure must be performed under aseptic conditions, and the operator must be familiar with anatomical structures to avoid damage to nerves, blood vessels, and muscle tissue.

3.4 Herbal Medicine Therapy

Traditional Chinese medicine treatment follows the basic principles of holistic regulation and treatment based on syndrome differentiation. The syndrome types of CSR in traditional Chinese medicine include the wind-cold-dampness type, phlegm-dampness obstructing the collaterals type, qi stagnation and blood stasis type, and qi-blood deficiency type [20-22]. Zhang Yan et al. [23] randomly divided 94 patients with qi stagnation and blood stasis type CSR into a control group receiving conventional treatment and an observation group receiving conventional treatment combined with modified Guizhi Jia Gegen Decoction, with 47 cases in each group. The results showed that the effective rate of the observation group was 93.6%, significantly higher than the 85.1% in the control group ($P < 0.05$), indicating good efficacy in improving pain, numbness, and related discomfort in this syndrome type and providing a new idea for clinical practice. Huang Hongling [24] studied the clinical effect of external treatment with Chinese medicine for CSR. The control group received routine acupuncture treatment, while the observation group received routine acupuncture combined with ultrasound-assisted transdermal delivery of a self-formulated herbal prescription. The total effective rate of the observation group was significantly higher than that of the control group ($P < 0.05$), indicating that ultrasound-assisted transdermal herbal therapy could relieve pain and discomfort more effectively than conventional acupuncture alone. Professor Lin Yifeng [25] proposed treating CSR from the perspective of the Governor Vessel. The Governor Vessel ascends along the spine and intersects with the three yang meridians at Dazhui, and is closely related to the cervical spine. By warming and nourishing the Governor Vessel, dredging the meridians, and nourishing the liver tendons, he summarized a prescription for neck pain that achieved significant clinical effects. Herbal medicine treatment for CSR should be based on syndrome differentiation according to the patient's specific syndrome pattern. Multiple clinical studies have confirmed the effectiveness of traditional Chinese medicine in treating CSR, and such treatment is relatively safe and widely accepted by patients.

4. Summary and Prospects

With the development of science and technology, people's lifestyles have changed. The incidence of CSR has increased year by year, and the affected population has become younger. The pathogenesis of CSR is relatively complex. At present, the generally recognized mechanisms include the theory of mechanical compression, the biomechanical theory, the theory of circulatory disturbance, and the theory of

inflammatory response. Chronic strain, trauma, and unhealthy lifestyle habits also play important roles in the development of CSR. Traditional Chinese medicine proposed methods for treating this disease at an early stage in classical literature and emphasizes symptomatic treatment based on the four diagnostic methods and accurate syndrome differentiation. Traditional Chinese medicine therapies may relieve spasm of cervical muscles, improve blood circulation, inhibit inflammatory reactions, and increase cerebral blood flow, thereby alleviating cervical nerve entrapment and improving clinical symptoms. In actual clinical practice, comprehensive treatment is often adopted to achieve better and faster therapeutic effects and improve patients' quality of life.

Although traditional Chinese medicine has shown significant efficacy in the treatment of CSR, modern research still has some shortcomings, such as non-unified diagnostic and therapeutic standards, inconsistency in efficacy evaluation, variability in diagnostic criteria, small clinical sample sizes, and a lack of high-quality clinical research, resulting in a relatively low level of evidence-based medicine. Therefore, future work should strengthen standardization and normalization, improve efficacy evaluation systems, enhance safety research on drugs and treatments, accumulate high-quality evidence-based medical data, and improve patient adherence and cooperation. Nevertheless, traditional Chinese medicine has great potential in the treatment of CSR, offers diverse therapeutic approaches, and is expected to achieve continuously improving efficacy.

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