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Research Progress on Integrated Chinese and Western Medicine Treatment of Tourette Syndrome in Children

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Abstract: Tourette syndrome is a common neuropsychiatric disorder that affects the physical and mental health of children. Early detection, diagnosis, and treatment are crucial to prevent serious impacts on the affected children, their families, and society. In recent years, there has been an increasing trend towards using a combination of methods in the clinical treatment of children with Tourette syndrome. This approach has achieved remarkable results, leading to a reduction in the rate of Tourette syndrome symptoms in children. In recent years, a combination of clinical methods has been used to treat children with Tourette syndrome, resulting in significant improvement in control rates. This article reviews the etiology of infantile Tourette syndrome and the progress made in Chinese and Western medicine treatments, providing a reference for further treatment of the condition.

Keywords: Child; Tourette syndrome; Chinese medicine treatment; Western medicine treatment

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1. Introduction

Tourette syndrome (TS) is a common chronic neurological disorder of childhood characterized by multiple motor tics and involuntary vocalizations [1]. Research has shown [2] that children with TS are more likely to experience anxiety, depression, mental retardation, autism, and other complications than their unaffected peers. If left untreated, TS can have a significant impact on children's physical and mental health, as well as on their families and society as a whole [3]. The incidence of these disorders has been increasing in recent years, likely due to a greater awareness of TS and its susceptibility to various environmental and psychological factors. This article reviews the research findings on the treatment of TS using both Chinese and Western medicine. The aim is to provide a reference for future clinical diagnosis and treatment.

2. Western medicine

2.1. The etiology and pathogenesis of pediatric TS

The etiology and pathogenesis of pediatric TS in Western medicine is still a controversial topic both domestically and internationally. Numerous studies have suggested that genetic factors, immunological factors, trace elements, psychosocial factors, maternal factors, dietary factors, and the length of exposure to electronic screens may be closely related to the onset of TS. Genetic factors are considered the primary cause of TS [4]. Family studies of twins have also shown that TS is significantly hereditary, with relatives of people with the condition having a much higher risk of developing it than the general population [5]. Previous research suggested that TS was inherited in an autosomal dominant pattern. However, recent studies have shown that TS is more likely to be caused by a combination of genetic and environmental factors, rather than changes in a single gene [6].

2.2. The treatment of TS

2.2.1. Medication treatment

Pharmacological treatment is often combined with psycho-behavioral interventions to improve the clinical symptoms of children with TS. The most common clinical treatments include antipsychotics, central α-agonists, dopamine receptor blockers, and antiepileptic drugs. These medications regulate the imbalance of neurotransmitters to alleviate symptoms. Haloperidol, thiamphenicol, and sulpiride are antipsychotic drugs. Haloperidol was the first clinically used drug to treat pediatric TS. Studies have shown that haloperidol and sulpiride have comparable efficacy, but sulpiride has fewer and milder adverse effects [7]. Therefore, sulpiride is recommended as one of the first-line clinical drugs in European guidelines. Thiamphenicol and sulpiride, which have selective dopamine D2 receptor antagonism, can significantly reduce the number of tics without affecting the child's cognitive function. Adverse effects are also usually well tolerated [8]. Antiepileptic drug therapy is not recommended as a routine treatment option due to the lack of evidence from high-quality clinical studies. In clinical practice, it is important to carefully consider other medications, such as cannabinoids and botulinum toxin, due to the lack of high-quality studies and unknown safety profiles. The efficacy of current Western medications is limited, and there is no global consensus on their use. Therefore, to improve the outcome of TS in children, pediatricians should formulate a comprehensive and individualized drug treatment plan based on the child's condition, drug efficacy, and safety.

2.2.2. Psycho-behavioral therapy

Numerous studies have demonstrated that the medication used for TS is associated with adverse effects that negatively impact the physical and mental health of children, making them less safe [9-11]. As a result, medical practitioners have started to investigate safer and more effective treatment options. Psycho-behavioral interventions are recommended as the preferred treatment for TS [12]. This is because such treatments can improve the patient's self-regulatory control and autonomy. Currently, psycho-behavioral approaches to treating TS include psychoeducation and supportive therapy (PST), habit reversal training (HRT), and comprehensive behavioral intervention treatment (CBIT) [13]. PST is an evidence-based psychotherapeutic intervention [14]. In this way, patients and their relatives can better understand and accept the illness and cope with it successfully. Goussé [15] demonstrated a positive correlation between the level of social support and the level of perceived stress and anxiety-depression in the "Perceived Stress, Social Support, Coping Strategies, and Anxiety-Depression Questionnaire for Parents of Children with TS." It was noted that psychoeducational training and the optimization of social support for parents could reduce their stress. HRT is a well-researched behavioral intervention for reducing tics associated with TS. It consists of four main components: awareness training, competitive response training, building motivation, and generalization of new skills [16]. Huang *et al.* [17] conducted a 16-week habit

reversal training for children with tic disorders online. The observation group showed significant improvement in Yale Generalized Tic Severity Scale (YGTSS) scores as compared to the control group. This suggests that habit reversal training can be effectively implemented via online platforms to treat pediatric TS. The use of internet-based psychological and behavioral treatment for children with TS can also reduce fear and uneasiness associated with hospital treatments and improve clinical efficacy to some extent.

In 2001, Woods *et al.* proposed the Integrated Behavioral Treatment for Tourette Syndrome [18]. This approach is based on habit reversal therapy and has been expanded to develop into an integrated treatment. This treatment is based on assessing the patient's functional status, providing relaxation therapy, behavioral rewards, and other treatments. In 2019, the American Academy of Neurology (AAN) released the first guidelines for the treatment of multiple tic disorders. These guidelines listed CBIT as a recommended first-line treatment for Tourette Syndrome [19]. Xu [20] discovered that the incidence of side effects in children who underwent CBIT intervention alone was significantly lower than that of the population treated with medication. This finding is beneficial for improving the quality of life of children with tic disorders and is well-received.

2.2.3. Other treatments

In addition to drug therapy and psychological behavioral therapy, some scholars have found that repetitive transcranial magnetic stimulation (rTMS), deep brain stimulation (DBS), and colistin acupoint patches have shown good efficacy and safety for refractory TS.

The rTMS is a safe and reliable method of cortical stimulation that was invented in 1985. It is widely used due to its painless and non-invasive nature. This technique is effective in treating psychoneurological disorders such as depression, TS, and autism spectrum disorders in children [21]. Wang *et al.* [22] conducted a study on 40 cases of pediatric TS. The subjects were randomly divided into a treatment group and a control group. The study showed that both high-frequency (10 Hz) and low-frequency (1 Hz) rTMS treatments improved the patients' conditions. However, low-frequency (1 Hz) rTMS treatments were found to be more effective. In Sun's study,45 children with TS [23] were given either low-frequency (1 Hz) or high-frequency (10 Hz) rTMS treatment. The results were consistent with those of Wang.

DBS is a neurosurgical procedure that involves precise localization by stereotactic methods and electrical stimulation of specific targets in the brain, thereby altering the excitability of the corresponding neural nuclei [24]. While there are behavioral and pharmacological treatments available for TS, they may be less effective for some patients, and even lead to the deterioration of TS in some cases. Li Y *et al.* [25] treated 40 patients with TS using DBS. This resulted in an alteration of neurotransmitter delivery in the brain, which reduced serum dopamine (DA) levels and increased 5-hydroxytryptamine (5-HT) levels. This therapy significantly improved the clinical efficacy of tic disorders and relieved patients' clinical symptoms with few complications. However, deep brain electrical stimulation therapy is an invasive treatment and is primarily used for patients with TS over the age of 12.

Another form of Clonidine Transdermal Patches medication is Clonidine Transdermal patch therapy, which is similar to acupoint therapy in Chinese medicine. Children find Clonidine Transdermal Patches more acceptable than oral administration of Clonidine Transdermal Patches, and they do not experience withdrawal symptoms of Clonidine Transdermal Patches medication. Wang *et al.* [26] discovered that Clonidine Transdermal Patches scalp patches are a safe and effective treatment for TS in children, with significantly higher long-term efficacy than thiamphenicol. However, clinical studies have shown that Clonidine Transdermal Patches scalp patch treatment still has a 3.08% incidence of adverse effects [27] and is often considered ineffective, resulting in discontinuation due to its slow onset of action.

3. Traditional Chinese medicine (TCM)

3.1. The etiology of TS

There are no detailed records of TS in ancient medicine. However, based on the typical symptoms, it is categorized as "liver wind," "slow convulsion," "convulsion," "blistering," and spasm according to Chinese medicine [28]. Most doctors in past generations believed that this disease was caused by "wind" in the liver. For instance, in his work, "Pediatric Medicine Prescription," Qian Yi, a renowned pediatrician from the Song Dynasty, attributed the cause of this disease to "liver wind." In the *Medical Compendium*, Ming Dynasty physician Lou Ying explained that trembling and shaking, as well as vibration and movement, are caused by wind tremors that enter the liver meridian and disrupt the flow of qi, resulting in tremors in the head, hands, and feet. Some medical practitioners believe that "liver wind" may be caused by blood deficiency. For example, in the Qing Dynasty, Yu Genchu stated that as the blood is unable to nourish the body's tendons and veins, it tends to result in the body's tendons and veins being restricted in their expansion and contraction and unable to move freely, hence the term hand cramp, which is similar to the clinical manifestation of Tourette's syndrome. Therefore, it is called the internal deficiency of the dark wind, commonly known as the "liver wind."

4. The treatment of TS

4.1. TCM

TCM has been proven effective in treating TS. Scholars have analyzed various literature related to TS in children, noting that domestic studies focus on researching the safety and efficacy of TCM in treating children with multiple tic disorders [29]. TCM scholars have mainly focused on evidence-based treatment for TS in children. Luo [30] highlighted that the primary cause of TS was the internal movement of liver wind and the production of phlegm due to spleen deficiency. This aligns with the perspective of Liu *et al*., [31] which stated that treatment should focus on calming the liver and quenching the wind to strengthen the spleen. Commonly used medicines are the Sizijunzi soup, which benefits the qi and strengthens the spleen, and the Wenshitang soup, which is used for the stomach and bile. Yang [32] discovered that while most scholars commonly treat pediatric TS from the 'liver and spleen,' treating it from the 'heart and liver' appeared to be more effective Additionally, adding products to clear away the heart-fire and tranquilize the mind on top of liver-cleansing and liver-quenching medicines can further enhance the therapeutic effect. Zhou [33] recommends treating children with TS using Guipi soup combined with consistent decoction. For children with excess syndrome, Zhou suggests using Pinelliae Rhizoma, Atractylodes, and Tianma Tang combined with Zhen Gan Xi Feng Tang. The main goal of TCM in treating children with TS is to restrain wind, stop spasms, calm liver-yang, and remove heat and also toxins [34] Tianma Gou Teng Yin is particularly effective, where the symptom distribution is based on deficiency syndrome. The patient's physique is the basis of the symptoms and is a key element of the disease. Due to the hereditary nature of the constitution, there is a correlation between certain hereditary factors and the child's physique [35]. This correlation has been confirmed by both Western medicine and modern TCM practitioners in clinical research. Therefore, treatment should not only be based on identified evidence but also on the child's constitution.

4.2. Acupuncture and moxibustion therapy

Acupuncture and moxibustion therapy involves the use of needles and moxibustion to stimulate specific points on the body's surface and regulate the flow of qi and blood through the body's meridians to treat various diseases. As a popular method of treatment in TCM, acupuncture and moxibustion therapy offer several advantages in treating pediatric TS, including high efficacy, safety, minimal adverse reactions, and

low treatment costs. This form of treatment is popular due to the fast-acting effect of acupuncture and the slower effect of moxibustion. Mia [36] used Taixi acupuncture to treat pediatric TS. They also performed gentle manipulative massages after acupuncture to relieve tension in patients. The results showed that the experimental group had a much higher total effective rate than the control group, which was treated with Western medicine. This indicates that Taixi acupuncture is more effective for treating pediatric TS. Hu treated pediatric TS using acupuncture and moxibustion therapy [37]. The total effective rate of the treatment group was 92.5%, which was higher than that of the control group, at 75%. The treatment was effective, and there were no incidences of adverse reactions. Wu *et al.* [38] also used the same acupuncture therapy as Hu, but the acupoints taken differed. Wu utilized acupuncture points such as Fengchi, Taichong, Zhongkou, Fengsanli, Baihui, Sanyinjiao, Neiguan, and Shenmen. Meanwhile, Hu selected different acupoints based on the children's behavioral patterns. Acupuncture therapy may cause mild discomfort, and children's fear of the equipment may result in low compliance and hence limited administration. Furthermore, the lack of uniformity in diagnostic and therapeutic criteria may also impact the effectiveness of acupuncture in treating TS in children.

4.3. Treatment by way of pasting on acupoint patches

According to Wang [39], the use of acupoint patches is more effective and safer than treatment using traditional Western medicine. Both Yuan [40] and Wang [39] used acupoint patches to treat pediatric TS and achieved significant therapeutic effects. However, there were some differences in the prescriptions and acupoint selection between the two. Yuan administered a basic formula consisting of Por Shen (10 g), Yuan Zhi (6 g), Yi Zhi Ren (10 g), Papaya (10 g), Stiffworm (10 g), Cordyceps (10 g), Bai Shao (15 g), Sheng Gan Cao (3 g), Paeoniae Radix Alba (15 g), and Margaritifera Concha (20 g). The acupoints selected for treatment were Shen Men, Shen Que, and Taichong. A paste was made by grinding *Atractylodes macrocephala*, *Pinelliae Rhizoma*, tangerine peel, stiff silkworm, *Pseudostellariae Radix*, Poria, *Angelicae Sinensis*, Margaritifera Concha, and other herbs into powder and mixing them with vaseline. This paste was then applied to the children's Baihui, Hegu, Shenmen, Shengcong, Taichong, and Fengchi points, as well as the Sanyinjiao and Lianquan points, with alterations made according to the symptoms. Niu [41] treated children with tic disorders using only Chinese medicine acupoint patches. They used a 1:1 mixture of *Cornus officinalis* and Huanglian to prepare the patches, which were then applied to the bilateral Yongquan points and large vertebrae. The treatment was effective in 94% of the 36 cases of tic disorders. The total effective rate of medication treatment for the experimental group was 94.4%, which was significantly higher than the control group's rate of 66.7%. The children in the experimental group also showed a higher degree of compliance with no reported adverse reactions.

4.4. Massage and other therapies

Massage is a fundamental technique in TCM that stimulates acupoints to pass through the meridians to treat diseases. Li [42] and Che [43] both used massage to treat children with TS who experienced spleen deficiency and liver hyperactivity. Although they used different massage techniques, the overall outcome was good. He [44] summarized Professor Liao Pindong's treatment experience and reported the results of treating 32 children with TS using Liao's massage technique. The results showed that Liao's method had a slower onset of action, but the efficacy in the later stages of treatment was comparable to that of medication. The patient's outcome was better and more stable during the follow-up period. Yang [45] found that many patients had abnormal bone development due to incorrect sitting postures in their daily lives. Chiropractic therapy was found to relieve local muscle spasms and regulate the qi and blood of meridians. The scholar then treated 21 patients with TS once a day using TC techniques such as tendon management, chiropractic method, curvature adjustments, and

functional exercise. After 4 weeks of treatment, the effective rate was determined to be 95.2%. Massage therapy is a painless and convenient therapy that is popular among children and their parents. However, it has certain limitations in terms of time and has a slow onset of action. Therefore, it is mostly used as an adjunctive therapy when treating children with TS.

5. Conclusion

The treatment of pediatric TS is improving along with the development of medical technology. Most scholars are actively exploring new green treatment modalities to improve their quality of life. TCM has a broad prospect in treating children with TS and combining it with Western medicine has provided a more significant effect. The pathogenesis of TS remains unclear, as does the pharmacological mechanism of TCM for treating TS. As of now, clinical research regarding the treatment of children with TS has been conducted in small sample sizes, and there has been no large-scale research conducted. Additionally, the effect of TCM is slow. Future clinical studies should increase sample sizes and consider extending the duration of the follow-up to better observe the long-term effect of TCM on TS.

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The authors declare no conflict of interest.

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