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Study on the Treatment of Cubital Tunnel Syndrome with Traditional Chinese and Western Medicine

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Abstract: ***Cubital tunnel syndrome is a common peripheral nerve entrapment disorder. Currently, early-stage patients benefit significantly from conservative treatments including oral Chinese herbal medicine, acupuncture, massage, and scalpel acupuncture, yielding favorable outcomes. For patients with unresponsive conservative treatment, worsening symptoms, or moderate-to-severe cubital tunnel syndrome, timely surgical intervention is essential to prevent irreversible ulnar nerve damage. Multiple surgical approaches exist, such as in situ ulnar nerve release, ulnar nerve transposition, and medial epicondylectomy. Postoperative recovery of the ulnar nerve is a prolonged and complex process involving nerve cell regeneration, axonal regeneration, myelin repair, and neural functional remodeling. At this stage, incorporating Traditional Chinese Medicine (TCM) principles—primarily focusing on nourishing qi and blood—through herbal medicine and acupuncture can promote ulnar nerve functional recovery. This approach effectively integrates TCM and Western medicine, leveraging the strengths of both disciplines for clinical application. Through literature review, this paper provides an overview of relevant research progress in applied anatomy, causative factors and pathogenesis, diagnosis, auxiliary examinations, classification, and treatment.***

Keywords: Cubital tunnel syndrome, Ulnar nerve, Functional recovery, Traditional Chinese medicine therapy, Western medicine therapy, Integrated Chinese and Western medicine therapy.

1. Introduction

Cubital tunnel syndrome is a type of ulnar nerve entrapment disorder, also known as delayed ulnar neuritis, with an incidence rate comparable to carpal tunnel syndrome [1]. Patients typically exhibit clinical symptoms of ulnar nerve damage, primarily manifesting as sensory disturbances and muscle weakness in the affected ulnar nerve distribution area. Severe cases may lead to clinical manifestations such as muscle atrophy, impaired finger movement, and “claw hand” deformity. Traditional Chinese Medicine (TCM) classifies early-stage cubital tunnel syndrome under the category of “bi syndrome,” with primary patterns including qi stagnation and blood stasis, or wind-cold-dampness bi. Severe and late-stage cubital tunnel syndrome falls under the category of “wei syndrome,” primarily characterized by deficiency of both qi and blood, or deficiency of liver and kidney. Treatment approaches for cubital tunnel syndrome remain inconsistent. However, with technological advancements, most patients now opt for conservative management or minimally invasive surgery. This article systematically reviews recent diagnostic and therapeutic strategies for cubital tunnel syndrome, elucidating its pathogenesis and clinical management to enhance clinical practice.

2. Causes and Pathogenesis

The cubital tunnel possesses a unique structure as a fibro-osseous passage formed by the ulnar collateral ligament, Osborne ligament, and flexor carpi ulnaris muscle [2]. Any factor increasing pressure within this tunnel can compress the ulnar nerve, leading to edema and degeneration. Numerous factors may increase cubital tunnel pressure, including smoking, alcohol consumption, diabetes, arthritis, rheumatoid arthritis, and space-occupying lesions (primarily ganglion cysts). When such lesions cause ulnar nerve entrapment, they may trigger acute exacerbations of ulnar neuritis. Ulnar nerve injury is a progressively deteriorating condition. As severity increases and duration prolongs, it triggers a series of pathological changes. In the early stage, persistent compression impairs peripheral blood circulation, disrupting the blood- barrier and causing ulnar nerve edema. In the intermediate stage, prolonged ischemia causes thickening of the nerve’s epineurium and alterations in surrounding soft tissues. By the late stage, the ulnar nerve trunk hardens, with progressive swelling and tumor-like changes around its edges. Connective tissue proliferates between nerve bundles, leading to irreversible neurodegeneration. In the early stage, irreversible neurodegeneration has not yet occurred in the ulnar nerve, and its extensibility remains unaffected. After decompression, the nerve can gradually recover [3]. In patients with mid-to-late stage disease, degenerative proliferation around the ulnar nerve compromises its extensibility, necessitating surgical advancement of the ulnar nerve to reduce nerve damage. Traditional Chinese medicine posits that early pathogenesis often stems from external pathogenic factors disrupting the flow of defensive qi and nutritive blood, leading to impaired qi and blood circulation, meridian obstruction, and consequent pain and swelling. In advanced stages, based on the principle that “qi deficiency causes numbness, blood deficiency causes stiffness,” prolonged disease depletes blood and qi, resulting in inadequate nourishment of tendons and vessels, subsequently manifesting as hand weakness and atrophy. Key precipitating factors include external traumatic injury and chronic fatigue. The underlying pathogenesis stems from spleen-stomach qi and blood dysfunction causing transport and transformation disorders, subsequently leading to qi and blood deficiency. Thus, the disease mechanism involves meridian obstruction resulting from a mixture of deficiency and excess, characterized by underlying deficiency with superficial excess.

3. Diagnosis

Diagnosis of cubital tunnel syndrome relies on medical

history, symptoms, physical examination, and auxiliary tests. In recent years, MRN (magnetic resonance neurography) and high-frequency ultrasound have become available to assess nerve damage and its severity. Clinically, swelling of the muscles surrounding the elbow joint—resulting from trauma or prolonged compression—causes entrapment of the ulnar nerve. The most characteristic feature of cubital tunnel syndrome is numbness, tingling, and sensory disturbances in muscles innervated by the ulnar nerve. Symptoms worsen during shoulder abduction, elbow flexion, wrist flexion, and forearm supination. In later stages, atrophy may develop in the wrist flexors, finger extensors/flexors, intrinsic hand muscles, and little finger abductor. Froment's sign and Wartenberg's sign become positive [4].

3.1 Electromyography

EMG serves as the gold standard for clinically diagnosing cubital tunnel syndrome. It can determine the site of nerve compression based on changes in nerve conduction velocity at the axillary, elbow, and wrist sites. Additionally, it assesses disease severity by evaluating motor and sensory nerve conduction velocities. EMG can differentiate between conditions with similar symptoms, such as thoracic outlet syndrome, cervical radiculopathy, and Guyon's canal syndrome. However, needle electromyography is invasive, which may cause patient reluctance, and EMG cannot identify the specific causative factor.

3.2 High-Frequency Ultrasound Examination

High-frequency ultrasound primarily utilizes acoustic imaging principles to assess the cross-sectional area of the ulnar nerve, evaluate surrounding soft tissues and vascularity, and aid in identifying specific etiologies [5]. It demonstrates high specificity for cystic lesions with a detection rate of 35%, and can be combined with EMG for further diagnosis [6]. Ghanei et al. [5] found that nerve cross-sectional area serves as an evaluative metric. Their study demonstrated that high-frequency ultrasound exhibits sensitivity and specificity of 92.7% and 93.2%, respectively, for detecting nerve damage, while sensitivity and specificity for assessing perineural vessels are 66% and 93.2%, respectively. Bai Xiaojiang et al. [7] concluded that high-frequency ultrasound not only achieves high detection rates for cubital tunnel syndrome with 100% accuracy but also aids in identifying the location and severity of compression. Gong Chunli et al. [8] found that high-frequency ultrasound enables dynamic monitoring of cubital tunnel pressure to identify precipitating factors. As a noninvasive, simple, and efficient examination method, high-frequency ultrasound can not only localize ulnar nerve compression sites but also clarify etiology, making it suitable as a routine tool for detecting cubital tunnel syndrome.

3.3 MRI

MRI findings of altered ulnar nerve signal intensity and diameter at the elbow, along with abnormal signals in the muscles it innervates, constitute the most direct diagnostic indicators of cubital tunnel syndrome. Magnetic resonance imaging provides relatively accurate diagnosis of nerve sheath cysts, enabling assessment of the nerve compression site and surrounding tissue conditions, as well as evaluation of the degree of atrophy in the flexor carpi ulnaris and flexor digitorum profundus muscles. However, some scholars have noted that MRI serves only as an adjunct to diagnosis and cannot be used to evaluate treatment efficacy or disease prognosis.

3.4 MRN

MRN provides direct visualization of the location and severity of nerve compression and degeneration, making it increasingly used in recent years to assess peripheral nerve function. On T1-weighted and T2-weighted MR images, peripheral nerves should exhibit signal intensity similar to skeletal muscle. On fat-suppressed images, peripheral nerves should appear isointense to mildly hyperintense, without displacement or interruption. When ulnar nerve inflammation occurs, it appears as high signal intensity on T2W1 images. Transverse sections can reveal ulnar nerve displacement, while the perinebral area and soft tissues innervated by the ulnar nerve exhibit edema-like or fatty infiltration signals [9]. MRN offers distinct advantages in assessing the cross-sectional area and damage of individual nerves, and can evaluate denervated muscle function. MRN also has limitations. Its relatively low resolution makes it difficult to assess nerve regeneration or axonal integrity. Furthermore, MRN requires sophisticated equipment and specialized techniques, resulting in higher costs and certain clinical limitations. Despite these drawbacks, MRN enables earlier diagnosis of nerve injury and plays a crucial role in the early detection of disease.

4. Grading of Cubital Tunnel Syndrome

Carpal tunnel syndrome severity is classified into mild, moderate, and severe grades based on symptoms and ancillary test results [10]. Mild: Characterized by intermittent paresthesia in the little and ring fingers. Electromyography (EMG) shows nerve conduction velocity >40 m/s. Moderate: Characterized by intermittent paresthesia in the little and ring fingers, reduced grip strength on the affected side, decreased finger dexterity, and EMG showing nerve conduction velocity 30–40 m/s. Severe: Persistent numbness, abnormal 2-PD (rest ≥6 mm, motion ≥4 mm), development of "claw hand" deformity, loss of finger adduction and abduction function, EMG showing nerve conduction velocity <30 m/s. Traditional Chinese Medicine (TCM) Pattern Differentiation for Cubital Tunnel Syndrome: (1) Qi Stagnation and Blood Stasis Pattern: Obstruction of meridians in the elbow impedes qi and blood flow, causing pain and numbness. Secondary manifestations: Pale red tongue with ecchymoses, thin white coating, wiry-thready pulse. (2) Wind-Damp Obstruction Pattern: Wind-damp pathogenic factors invade the elbow, obstructing tendons and bones, causing pain and stiffness. Secondary manifestations include: red tongue, thin white coating, floating pulse. (3) Liver-Kidney Deficiency Pattern: Weakness of liver and kidney fails to nourish tendons and bones, leading to hand weakness, claw hand deformity, and muscle atrophy. Secondary manifestations include: pale tongue with thin white coating, wiry pulse. (4) Qi and Blood Deficiency Syndrome: Insufficient qi and blood in the elbow impedes local circulation, causing hand weakness, claw hand deformity, muscle atrophy, and limited flexion/extension. Secondary symptoms: Pale complexion, shortness of breath,

reluctance to speak, limb fatigue, pale tongue with white coating, and weak, fine pulse.

5. Treatment of Cubital Tunnel Syndrome

5.1 Traditional Chinese Medicine Treatment

Extensive data indicate that conservative treatment yields significant efficacy and favorable outcomes in early-stage elbow tunnel syndrome patients [11]. Traditional Chinese medicine (TCM) plays a crucial role, employing methods such as herbal medicine, acupuncture, massage, and acupuncture-scalpel therapy. For middle-to-late stages, the TCM principle "Treating atrophy by exclusively targeting the Yangming" is applied, focusing on fortifying the spleen and stomach, replenishing qi and nourishing blood, and moisturizing tendons, vessels, and muscles.

5.1.1 Formulas and Medications

Formulas should be selected based on syndrome differentiation. According to Notes on Medical Forest Corrections, the Shentong Zhuyu Decoction—which promotes blood circulation, removes stasis, unblocks meridians, alleviates pain, dispels wind, and eliminates dampness—is indicated for qi stagnation with blood stasis syndrome and wind-cold-dampness bi syndrome. According to the Annotated Essential Prescriptions for Emergencies, the Du Huo Ji Sheng Decoction, which nourishes the liver and kidneys and relaxes tendons to relieve pain, is suitable for liver and kidney deficiency patterns; for qi and blood deficiency patterns, the Huang Qi Gui Zhi Wu Wu Decoction (from Essential Prescriptions from the Golden Cabinet) should be administered orally to tonify qi and blood and activate blood circulation to remove stasis.

5.1.2 Acupuncture and Tuina

Based on the TCM principle of "unblocking stagnation," treatments that promote blood circulation, remove stasis, and unblock meridians are used to disperse localized stagnation of qi and blood and restore meridian flow. Acupoint selection follows the principle of "treating where the meridians pass and where the symptoms manifest." Points selected include Yanglao (SI1), Zhizheng (SI2), Houxi (SI3), and Xiaohai (SI4) on the Hand-Taiyang Small Intestine Meridian; Zhongzhu (TE4), Yangchi (TE5), and local Ashi points on the Hand-Shaoyang Large Intestine Meridian. Guo Mengshuai [12] et al. found acupuncture to be effective in treating cubital tunnel syndrome, significantly restoring finger movement function and alleviating numbness in the ring and little fingers. Luo Jing [13] et al. observed that acupuncture at Dong's Extraordinary Points combined with moxibustion and hand function exercises yielded relatively significant results for cubital tunnel syndrome. Tuina primarily involves kneading, shaking, flexion-extension, flicking the forearm, or applying pressure to acupoints using the One-Finger Zen technique (corresponding to acupuncture points).

5.1.3 Acupuncture Scalpel

The scalpel needle releases adhesions and scar tissue surrounding the ulnar nerve, loosens the origin and insertion points of the arcuate ligament, relaxes surrounding tendons and ligaments, and increases elbow joint volume. By following the nerve's course within the canal, it can sever certain ligaments and release adhesions between canal contents to relieve compression. Zhang Tianmin [14] et al. found that the "two-point" release technique using needle knife can relieve ulnar nerve compression caused by ligaments, representing a minimally invasive surgical method. Acupuncture, massage, and needle knife therapy are the preferred non-surgical treatment options, while oral Chinese herbal medicine provides effective supplementation to other therapies.

5.2 Western Medical Treatment

5.2.1 Conservative Treatment

Conservative Western medical treatments include nighttime elbow immobilization, ultrasound and pulsed therapy, and medication [15]. Patient health education is essential, advising reduced elbow activity and avoidance of sustained pressure on the elbow. This not only improves patient compliance but also slows disease progression. Maintaining a 45° elbow flexion and neutral forearm position at night can suppress inflammatory responses. Ultrasound and pulsed therapy utilize ultrasound waves and low-frequency currents to enhance blood circulation around the cubital tunnel, improve tissue metabolism, and alleviate muscle tension. Medications include peripheral nerve nutrients like mecobalamin, nonsteroidal anti-inflammatory drugs (NSAIDs), and corticosteroids; however, the therapeutic efficacy of NSAIDs and corticosteroids remains controversial [15]. Patients who fail to respond to conservative treatment after 3 months, experience progressive disease worsening, or develop muscle atrophy should undergo surgical intervention.

5.2.2 Surgical Treatment

Ulnar nerve in situ release is a minimally invasive procedure with rapid recovery and low complication rates. However, this technique has limitations and is indicated only when ulnar nerve subluxation is absent, no joint deformity exists, no abnormal masses are present peripherally, and no bowstringing of the ulnar nerve occurs during elbow flexion [16].

Ulnar nerve transposition involves relocating the ulnar nerve to a non-compressed area, helping protect it from further injury. Surgical techniques include submuscular, intermuscular, subcutaneous, and pedicled subfascial transposition. Submuscular and intermuscular approaches carry risks of bleeding, leading to secondary soft tissue adhesions that may re-compress the transposed nerve; thus, these methods are rarely used clinically [17]. Researchers have found that vascularized subfascial ulnar nerve transposition provides a soft surrounding environment for the ulnar nerve, safeguards its postoperative blood supply, and yields favorable outcomes [18].

Medial epicondylectomy is a surgical technique that removes the medial epicondyle of the humerus to relieve ulnar nerve compression. However, there is no unified standard for the extent of bone resection clinically, which is typically

determined based on the severity of the patient's condition. Removing the medial epicondyle allows the ulnar nerve to migrate anteriorly and medially relative to the bony surface, effectively relieving tension on the ulnar nerve caused by traction. Postoperative symptom improvement is also notable [19]. Researchers have found that this surgical approach avoids flexor scar formation and reduces ulnar nerve traction without affecting its branches. However, it may lead to complications such as decreased flexor muscle strength, compromised joint stability, and recurrence of symptoms [20, 21]. O'Grady et al. reported that partial resection of the medial epicondyle of the humerus carries a lower complication rate than total resection of the medial epicondyle [22].

For endoscopic ulnar nerve release, Tsai et al. [23, 24] performed the procedure on 76 patients by inserting an endoscope into a specially designed glass tube. This allowed detailed visualization of deep fascia, the flexor carpi ulnaris muscle, and the ulnar nerve, achieving an excellent success rate of 87%. Compared to the aforementioned surgical approaches, endoscopic surgery offers advantages such as smaller incisions, faster recovery, protection of surrounding vessels, and reduced scar formation. However, due to its high technical demands, requirement for advanced equipment, and relatively increased costs, its clinical adoption faces challenges. Nathan et al. [3] proposed a minimally invasive approach based on in situ ulnar nerve release. Yu Cong [25] and colleagues performed in situ ulnar nerve release via a small incision on nine patients with cubital tunnel syndrome, observing reduced complication rates and faster postoperative recovery with satisfactory outcomes. In recent years, the mini-incision technique has gained widespread adoption. Numerous clinical researchers have employed mini-incision in situ ulnar nerve release for cubital tunnel syndrome, consistently demonstrating its advantages and achieving satisfactory outcomes [26-31]. Liu Ju et al. [32] conducted postoperative follow-ups on patients undergoing ultrasound-guided micro-incision in situ release. Using the upper limb peripheral nerve function assessment criteria proposed by the Chinese Society for Surgery of the Hand, they found an excellent/good rate of 85.7% in the micro-incision group and 86.0% in the traditional incision group, with no statistically significant difference between the two groups.

5.3 Integrated Traditional Chinese and Western Medicine Therapy

Following cubital tunnel surgery, combined with traditional Chinese medicine treatment, significantly aids in ulnar nerve recovery. Gao Xing [33] et al. studied 94 patients and found that oral administration of Jian Gu Capsules after minimally invasive cubital tunnel surgery improved ulnar nerve conduction velocity, IL-1 (interleukin) and NGF (nerve growth factor) levels, and increased the cure rate for cubital tunnel syndrome. Wang ping [34] and colleagues detected serum levels of IL-1, TNF-α, and NGF in 80 patients. They found that patients treated with cobamamide combined with Huangqi Guizhi Wuwu Tang after cubital tunnel enlargement surgery showed significantly greater improvement in ulnar nerve conduction velocity and upper limb function compared to those receiving cobamamide alone. Liu Jie [35] and colleagues demonstrated that patients with cubital tunnel syndrome who underwent subcutaneous anterior release of the ulnar nerve and subsequently took Bu Yang Huan Wu Tang effectively increased ulnar nerve conduction velocity and accelerated recovery from ulnar nerve injury. Research by Yu Hang [36, 37] and colleagues indicates that combining Huangqi Guizhi Wuwu Tang with surgery for small-incision ulnar nerve release in cubital tunnel syndrome patients eliminates postoperative hematoma, enhances neurotrophic factor expression, and promotes peripheral blood circulation, yielding significantly better outcomes than surgery alone. Furthermore, during the perioperative period of cubital tunnel enlargement and reconstruction in moderate-to-severe cases, combining Huangqi Guizhi Wuwu Tang with effectively promotes ulnar nerve repair, resists inflammatory tissue, and reduces surgical complication rates. Wu Qing et al. [38] studied 60 patients with cubital tunnel syndrome and found that postoperative treatment combining acupuncture with oral methylcobalamin yielded more significant results than methylcobalamin alone. Zhao Jing [39] indicates that administering Chinese herbal decoctions postoperatively in patients with severe cubital tunnel syndrome can effectively promote ulnar nerve functional recovery. In summary, employing traditional Chinese medicine (TCM) therapeutic methods postoperatively for cubital tunnel syndrome accelerates ulnar nerve recovery and reduces inflammatory responses, yielding favorable therapeutic outcomes.

6. Conclusion

Patients with early-stage cubital tunnel syndrome can achieve complete recovery through conservative treatment, preventing irreversible nerve damage. For those with no significant improvement after early conservative management, or those with severe clinical manifestations and auxiliary examination findings, corresponding surgical intervention is required. Surgery typically involves decompressing the compression factors. However, prolonged ulnar nerve damage often leads to pathological changes in nerve fibers. Given the prolonged recovery time for peripheral nerves, traditional Chinese medicine (TCM) approaches can be leveraged. By applying TCM principles and selecting formulas or acupuncture points based on syndrome differentiation, therapies can replenish qi and nourish blood, accelerate peripheral blood circulation around nerves, and promote neural recovery. Integrating Chinese and Western medicine achieves complementary benefits—combining strengths, mitigating weaknesses, and drawing from diverse strengths — to alleviate patient suffering and enhance clinical outcomes.

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