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# *The Role of Traditional Chinese Medicine Appropriate Technology in the Management of ICU-Acquired Weakness: A Review*

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***Abstract:*** ICU-acquired weakness is a common complication among critically ill patients, significantly impacting clinical outcomes. Improving rehabilitation outcomes, facilitating patients' return to society, and enhancing their quality of life are urgent areas requiring attention and research. Currently, the role of traditional Chinese medicine (TCM) in critical care rehabilitation is increasingly recognised. To understand the application of appropriate TCM techniques in patients with ICU-acquired weakness, this article reviews the theoretical foundations of TCM, as well as the principles of action, operational methods, and effects of acupuncture therapy, acupoint stimulation, massage therapy, meridian massage, and acupoint injection. The aim is to provide a reference for future research and clinical application.

## 1. Introduction

ICU-acquired weakness (ICU-AW) denotes neuromuscular dysfunction occurring in the intensive care unit (ICU), presenting clinically with ventilator dependence, limb weakness or paralysis, diminished or absent tendon reflexes, and muscle atrophy. It has emerged as a critical factor affecting ICU patients' recovery trajectory and long-term quality of life. Epidemiological studies indicate an ICU-AW prevalence of approximately 25%–32%, rising to 67% among ICU patients with sepsis [1]. This condition not only increases treatment costs and mortality risk but also contributes to long-term adverse outcomes [2]. Conventional Western medical approaches primarily rely on early mobilisation, nutritional support, and functional rehabilitation, yet clinical practice remains constrained by numerous limitations. With the rapid advancement of critical care medicine, nursing strategies have shifted focus from reducing mortality to optimising quality of life and improving outcomes. The role of appropriate traditional Chinese medicine (TCM) techniques in critical care rehabilitation has become increasingly prominent. These techniques, also termed TCM external therapies, are based on the principles of syndrome differentiation and holistic care [3]. This paper reviews the application of appropriate TCM techniques in ICU-AW patients, providing

reference for future research and clinical practice.

## 2. Theoretical Foundations of Traditional Chinese Medicine for ICU-AW

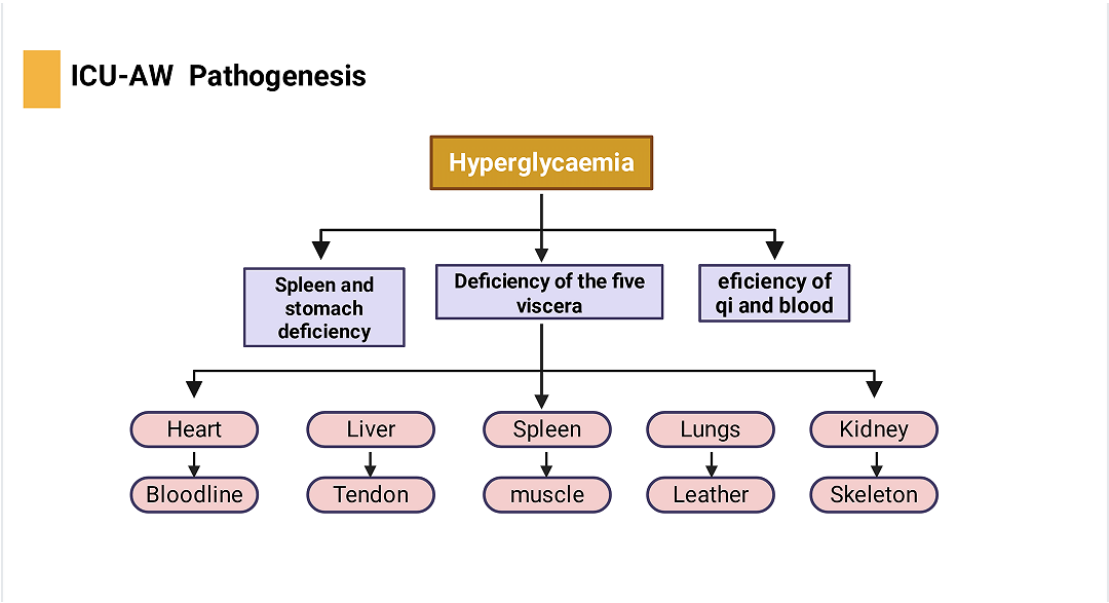


Figure 1 The TCM Etiology and Pathogenesis of ICU-AW

Within TCM theory, ICU-AW patients exhibiting clinical manifestations of 'limb atrophy with weakness and loss of strength, joints lax and uncontrolled, termed atrophy syndrome' are categorised under the diagnostic framework of 'atrophy syndrome'. Its core pathogenesis can be summarised in three aspects: 'spleen-stomach deficiency, qi-blood insufficiency, and deficiency of the five zang organs'. Figure 1 illustrates the TCM etiology and pathogenesis of ICU-AW. The Huangdi Neijing (The Yellow Emperor's Inner Canon) first articulated the concept of 'wei syndrome,' proposing the core principle that 'treatment of wei must focus solely on the Yangming meridian.' This emphasises the pivotal role of the spleen and stomach in the prevention and management of wei syndrome [4]. The spleen and stomach constitute the foundation of acquired constitution and the source of qi and blood generation. Governing the muscles and limbs, they are particularly vital in severe cases where pathogenic toxins flourish, depleting vital energy, or where prolonged bed rest impairs qi, leading to impaired spleen-stomach transformation and transport functions. This results in a deficiency in the generation of qi and blood, causing inadequate nourishment of the muscles and consequently manifesting symptoms such as limb weakness and muscular atrophy. In his treatise 'Discourse on the Five Types of Atrophy' within the 'Three Causes and One Pathology: Discourse on Diseases and Formulas' [5], the Northern Song Dynasty medical scholar Chen Yan explored the pathological mechanisms of atrophy syndrome. He emphasised that its essence lies in the exhaustion of internal organ functions rather than isolated organ dysfunction, stating: 'It is not solely spleen deficiency that causes atrophy; weakness in any of the five viscera may lead to atrophy.' 'The human body is formed by skin and hair, blood vessels, tendons and fascia, muscles, and bone marrow, while internally governed by the liver, heart, spleen, lungs, and kidneys. If one indulges in unrestrained emotions, fails to regulate joy and anger, and combines overwork with idleness, it leads to depletion of the vital essence and blood within the five viscera, thus causing atrophy.' The lungs govern the health of skin and hair, the heart directs the circulation of blood vessels, the liver is vital for the vitality of tendons, the spleen and stomach are the source of nourishment for muscles, and the kidneys are crucial for the strength of bones. Imbalances in any

of the ‘five zang organs’ can lead to the onset of ‘impotence syndrome. ’ Specifically, lung heat can cause problems with the skin and hair, leading to skin wrinkling and hair loss; Heart heat disrupts blood vessel function, causing vascular atrophy; liver heat deprives tendons and fascia of nourishment, resulting in tendon atrophy; spleen heat impairs muscle nutrition, leading to muscular atrophy; kidney heat damages bone marrow, causing skeletal atrophy. This exposition reflects traditional Chinese medicine's distinctive perspective on the pathogenesis of atrophy disorders, emphasising the interplay between zang-fu organs. Severe cases of atrophy frequently involve multiple factors, leading to the depletion of both congenital and acquired physiological foundations, which subsequently damages the five zang organs. Traditional Chinese medicine thus offers novel avenues for the prevention and treatment of ICU-AW.

## 3. Appropriate Traditional Chinese Medical Techniques for ICU-AW

### 3.1 Acupuncture Therapy

Regarding acupuncture point selection, numerous scholars advocate ‘treating atrophy exclusively through the Yangming meridian.’ As the meridian abundant in qi and blood, stimulating Yangming points regulates qi and blood circulation while unblocking meridians. Clinically, points such as Jianyu (LI15), Quchi (LI11), Shousanli (LI10), Hegu (LI4), Biguan (ST36), and Zusanli (ST36) are frequently selected to address atrophy. The potential mechanisms underlying the effective action of ST36 are multifaceted. and summarized in Figure 2. Jiang Wen's [6] study on acupuncture treatment for ICU-acquired weakness employed the points Baihui, Guanyuan, bilateral Quchi, and bilateral Zusanli. The intervention involving the aforementioned acupuncture technique (lifting-thrusting-rotating manipulation: 30 times/min, 20-min retention) combined with Bu Zhong Yi Qi Tang decoction improved patients' muscle strength and gastrointestinal function. Professor Yan Li, inheriting the essence of Shen's long-needle technique, selected Tiantu and Zhongwan as primary points, supplemented by Fengfu, Fengchi, Zusanli, Sanyinjiao, and Zhaohai as auxiliary points. Combined with the Wen Dan Tang formula, this integrated approach of acupuncture and herbal decoction regulated the spleen and stomach while tonifying the liver and kidneys, thereby effectively treating atrophy. Furthermore, Feng Yu et al. built upon these foundations by integrating Dong Yuan's acupuncture methodology. Their application of the ‘channel-guiding and qi-directing’ technique enhanced muscle strength in patients with spleen-stomach deficiency-type atrophy syndrome and improved TCM pattern differentiation indicators, offering valuable insights. Tang Xinyan [7] employed mild moxibustion therapy on acupoints including Zhongwan (CV12), Qihai (CV6), Zusanli (ST36), and Sanyinjiao (SP6), supplemented with the Bu Zhong Yi Qi Tang formula for comprehensive intervention. This approach facilitated muscle strength recovery and optimised quality of life in ICU-AW patients, while effectively improving physiological status through regulation of serum IL-6, TNF-α, and insulin-like growth factor-1 levels. Liu Biyuan et al.developed the ‘Wei San Zhen’ therapy, integrating the core principles of Professor Jin Rui's ‘Jin San Zhen’ approach. Selecting Zusanli (ST36), Taixi (KI3), and Sanyinjiao (SP6) as primary points, they quantitatively analysed clinical indicators including maximum gastrocnemius electromyographic (EMG) values, 4-metre walking speed, and balance function. Results demonstrated superior outcomes in all measured parameters for patients receiving the ‘Three Needles for Atrophy’ therapy compared to the conventional acupuncture control group. Although multiple studies confirm acupuncture's generalisability and safety in enhancing muscle strength among ICU-AW patients, existing research exhibits heterogeneity in operational methodologies. Future studies should expand sample sizes and adopt multi-centre approaches to further explore this protocol's application in ICU-AW patients.

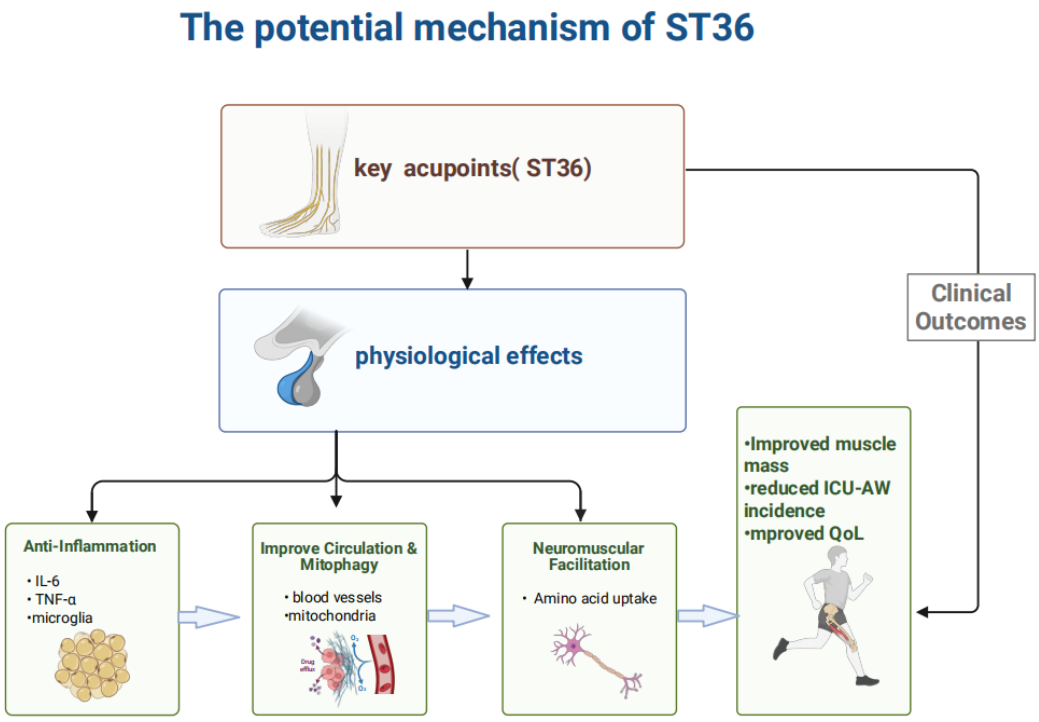


Figure 2 The potential mechanism of ST36

## 3.2 Acupoint Stimulation

Electroacupuncture represents the fusion of traditional Chinese medicine with modern medical science. By delivering sustained electrical stimulation to specific acupoints, it partially substitutes the practitioner's manual needling technique to achieve the therapeutic effect of ‘deqi’ (the sensation of qi). From a modern medical perspective, electroacupuncture involves inserting needles into designated points and applying low-frequency electrical currents to activate neural pathways, promote muscle vibration, enhance local blood circulation, and modulate immune function. Geng Zixiang [8] summarised that electroacupuncture stimulates acupoints to promote sepsis improvement, shorten mechanical ventilation duration, regulate blood glucose and lipid levels, enhance nutritional status, and provide analgesia, thereby preventing and treating ICU-AW. Wang Shuangle [9] administered electroacupuncture to the Huantiao, Futu, Zusanli, Xuanzhong, and Taichong points. Results demonstrated increased lower limb muscle strength at discharge compared to pre-treatment levels, alongside greater mean thickness of the quadriceps femoris and greater feather angle of the gastrocnemius muscle. This study confirmed that early implementation of acupoint stimulation via electroacupuncture improves lower limb muscle strength. Shang Weiming et al. applied electroacupuncture stimulation to the Neiguan, Zusanli, Sanyinjiao, and Quchi points on the Hand Yangming Meridian using a continuous wave mode, combined with joint mobilisation exercises. This approach effectively reduced the incidence of ICU-AW. Chen Y et al. observed that electroacupuncture mitigates inflammation, oxidative stress, and apoptosis by inhibiting microglial activation. This suggests that acupoint electrical stimulation may reduce ICU-AW incidence by improving immune status and correcting immune dysregulation. Although preliminary evidence supports the efficacy of electroacupuncture for treating ICU-AW, current acupoint selection lacks standardisation. Consequently, large-scale, multicentre, high-quality randomised controlled trials are required to provide higher-level evidence.

### 3.3 Anqiao Therapy

Anqiao, also known as Fu Xing or massage, originates from traditional Chinese medical therapies dating back to the Warring States period. ‘An’ refers to pressing and kneading the skin and muscles, while ‘qiao’ denotes the swift lifting of the limbs. Through the subtle application of ‘sound, intention, breath, and force, ’ it achieves multidimensional regulation and stimulation of the patient's skin, muscles, meridians, viscera, and bones. Atrophy syndrome represents a complex condition within traditional Chinese medicine, where treatment strategies emphasise dual-action targeting both the underlying cause and the affected limb. This holistic approach accelerates the rehabilitation process through synergistic effects. An Jingmin [10] implemented acupoint massage combined with early mobilisation for mechanically ventilated ICU patients, employing the One-Finger Zen technique to press points including Tianshu (ST25), Shenque (CV8), Baihui (GV20), Hegu (LI4), and Zhongwan (CV12). Results demonstrated that the observation group receiving combined intervention exhibited superior outcomes in muscle strength recovery, gastrointestinal function improvement, and enhanced self-care abilities compared to the control group. Existing literature indicates that acupressure targeting the Qu Chi and He Gu points on the hand Yangming meridian, alongside the foot Yangming meridian points, Zusanli and Fenglong, involves applying one minute of pressing stimulation followed by two minutes of kneading to each designated point. The practitioner applied the balanced tonification and dispersion technique for three minutes per point. When combined with limb movement training, this approach effectively reduces the incidence of ICU-AW and enhances patients' self-care abilities [11]. The advantage of acupoint massage lies in its strong penetrative power and non-invasive nature. This therapy is not only simple to perform and easy to implement but also time- and labour-efficient. It not only promotes local muscle contraction and accelerates blood flow but also enhances neuromuscular excitability. Simultaneously, through the regulatory function of the meridian system, it achieves dual effects of local improvement and overall balance. When administering acupoint massage therapy, healthcare personnel must comprehensively assess the patient's condition to determine the presence of thrombosis or bleeding risks, ensuring the therapy's suitability.

### 3.4 Meridian-Following Massage

Meridian-following massage therapy is grounded in the theories of qi and blood circulation and zang-fu organ systems. It follows the pathways of the human meridian system, applying specific techniques to corresponding meridians and acupoints to unblock meridians, regulate qi and blood, and balance yin and yang, thereby exerting a muscle-nourishing effect. Existing research confirms that meridian-based massage therapy enhances muscle strength in ICU patients [12] and optimises sleep quality, particularly benefiting those exposed to light and sound stimuli in the ICU. Wang Yanhong et al. [13] applied massage therapy to the Hand Yangming Large Intestine Meridian of both upper limbs, stimulating acupoints such as Hegu (LI4), Quchi (LI11), Jianyu (LI15), Shousanli (LI10), and Shouwuli (LI11) through thumb pressure and kneading. For the Stomach Meridian of the Foot-Yangming on both lower limbs, palm-pressing techniques were employed, with effective stimulation via thumb-pressing at the Fenglong, Zusanli, Shangjuxu, and Xiajuxu points. For excess patterns, pressing was applied against the meridian direction; for deficiency patterns, pressing followed the meridian direction. Following a 5-day intervention, the treatment group exhibited higher MRC and BI scores than the control group, greater rectus femoris cross-sectional area, and a lower incidence of ICU-acquired weakness. Liang Bing et al.enhanced near-term therapeutic outcomes and quality of life by integrating meridian-based acupoint activation and finger-pressure techniques into conventional rehabilitation protocols, administered twice daily for 20–30 minutes per session. When performing meridian-following massage, ensure the patient's haemodynamic

parameters remain stable to guarantee treatment safety. This therapy offers advantages of high safety, cost-effectiveness, and non-invasiveness, requiring only one practitioner to administer, facilitating its implementation.

### 3.5 Other Techniques

Table 1 Characteristics and application of common TCM techniques for ICU-AW

| Technique | TCM Rationale | Key Acupoints | Operation Method | Frequency & Duration | Precautions |
|---|---|---|---|---|---|
| Acupuncture | Regulate Qi and blood, strengthen spleen/stomach | Zusanli (ST36), Quchi (LI11), Hegu (LI4) | Filiform needle insertion with reinforcing/reducing techniques | 20-30 min, once daily | Avoid in severe coagulopathy; ensure sterility |
| Electroacupuncture | Enhance stimulation, continuous effect | Zusanli (ST36), Neiguan (PC6) | Needles connected to electro-acupuncture device (e.g., 2 Hz continuous wave) | 20-30 min, once/twice daily | Contraindicated in patients with pacemakers |
| Moxibustion | Warm and tonify Qi, dispel cold-damp | Zusanli (ST36), Qihai (CV6), Guanyuan (CV4) | Mild-warming moxibustion 2-3 cm above skin | 15-20 min per point, once daily | Monitor skin to prevent burns |
| Tuina / Acupressure | Unblock meridians, stimulate muscles/nerves | Along Yangming meridians (e.g., ST, LI) | Kneading, pressing, pushing (e.g., thumb pressing) | 3-5 min per point, 1-2 times daily | Avoid over pressure in patients with osteoporosis |
| Acupoint Injection | Combine acupuncture and herbal effects | Zusanli (ST36) | Injection of small dose (e.g., Astragalus injection) | 1-2 mL per point, once daily | Perform skin allergy test; avoid if local infection |

With advances in modern science and technology, appropriate TCM techniques for ICU-AW are no longer confined to ancient traditional methods such as acupuncture and massage. Based on the theory of 'treating paralysis by exclusively targeting the Yangming meridian,' various appropriate TCM techniques can be applied to Yangming meridian points, including acupoint injection, medicinal stick massage, acupoint plaster application, and finger pressure stimulation. These methods synergistically enhance paralysis treatment. For instance, administering injections at Yangming meridian points that regulate the spleen and stomach, tonify the middle energiser and qi, activate blood circulation and unblock collaterals, boost immunity, and nourish nerves aims to synergistically produce unique therapeutic effects for paralysis treatment. Research by Wang Minhui et al. [14] indicates that intervention with Astragalus injection effectively reduces the incidence of ICU-acquired weakness (ICU-AW) in ICU patients with sepsis, while also improving the Acute Physiology and Chronic Health Evaluation II (APACHE II) score and the Sequential Organ Failure Assessment (SOFA) score. Existing literature indicates that acupoint injection with Astragalus injection effectively promotes muscle strength recovery in patients with paralysis due to cerebral infarction. Liao Lulei et al. [15] demonstrated that administering Astragalus injection at the Zusanli acupoint in patients with diaphragmatic dysfunction aided muscle strength recovery. Based on similar mechanisms, this therapy may also be applied through pattern differentiation to ICU-AW patients presenting with spleen-stomach deficiency syndrome. Moreover, moxibustion—a traditional external treatment in Chinese medicine—improves gastrointestinal function through its warming and tonifying mechanism, thereby enhancing nutrient utilisation and intake. This exerts a

positive therapeutic effect on atrophy syndromes. Acupoints such as Qihai (CV6), Guanyuan (CV4), and Tianshu (ST25) may be selected [10]. TCM nursing, grounded in 'syndrome differentiation-based care,' achieves both symptomatic relief and root cause treatment through syndrome-differentiated dietary therapy, emotional regulation, and appropriate TCM techniques. It demonstrates distinct advantages in critical care rehabilitation. However, specialised training in TCM nursing is still in its infancy, necessitating urgent strengthening of professional rehabilitation nursing education to meet growing societal demands. Concurrently, high-quality clinical research must be designed to provide robust evidence for TCM clinical practice. Table 1 details the characteristics and practical application of common TCM techniques for ICU-AW, serving as a clinical reference.

## 4. Conclusion and Outlook

Appropriate TCM techniques possess a long history, traceable to ancient texts. The ancient medical compendium Fifty-Two Prescriptions for Diseases, unearthed from the Mawangdui Han Tombs, detailed external TCM therapies such as fumigation, water baths, heat application, medicated plaster application, and massage. By directly applying medicinal substances or physical interventions to specific body surfaces, These techniques harness transdermal absorption and meridian conduction principles to activate and strengthen meridian energy, thereby unblocking channels, promoting qi and blood circulation, harmonising organ functions, and enhancing immune defence. This external-to-internal approach simultaneously eliminates pathological factors and fortifies vital energy, achieving therapeutic outcomes while circumventing potential gastrointestinal damage from systemic medication. Traditional Chinese Medicine's distinctive insights undoubtedly pioneer novel pathways for the treatment and care of ICU-acquired pressure ulcers.

Leveraging its unique advantages of minimal adverse reactions and safety, appropriate TCM techniques hold broad application prospects in treating and preventing ICU-acquired pressure ulcers. Demonstrating verifiable efficacy, these techniques are convenient to administer and readily scalable, yielding numerous achievements. As stated in Suwen: Discussion on Different Methods and Appropriate Treatments: 'Therefore, when treatments differ yet all diseases are cured, it is because the nature of the disease is understood and the fundamental principles of treatment are grasped'. Both Chinese and Western medicine possess distinct characteristics and strengths. Future medical practice should emphasise their complementary and mutually reinforcing roles, leveraging the unique value of appropriate TCM techniques to achieve integrated internal and external regulation and holistic treatment, thereby attaining optimal therapeutic outcomes. Concurrently, given the compromised immune function and communication barriers in critically ill patients, clinical practitioners must identify and define the indications and contraindications for various TCM appropriate techniques. They should rationally regulate dosage and intensity to prevent potential harm. TCM emphasises holistic regulation, advocating treatment tailored to time, place, and individual, with precise identification of syndrome patterns to formulate personalised therapeutic plans. Currently, the application of appropriate TCM techniques exhibits diverse characteristics, lacking unified standards or consensus. Further in-depth exploration and systematic research are required. Future efforts should focus on deepening the theoretical foundations of these techniques and investigating the mechanisms underlying their clinical efficacy, thereby promoting the effective translation of scientific achievements. Concurrently, new therapeutic strategies and approaches within critical care medicine should be developed.

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