

Research Progress on the Impact of Traditional Chinese Medicine Intervention on CRP and ALB in Patients with Sepsis

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Abstract: Sepsis is a life-threatening organ dysfunction caused by dysregulated host response triggered by infection, and its high incidence rate and mortality pose a serious threat to global public health. C-reactive protein (CRP) and albumin (ALB) are useful indicators for assessing the severity and prognosis of sepsis. Traditional Chinese medicine (TCM) has unique advantages in the treatment of sepsis. Recent studies have shown that TCM can regulate CRP and ALB levels through multiple pathways, improving patient clinical outcomes. This article systematically reviews the research progress on the effects of TCM intervention on CRP and ALB in patients with sepsis, aiming to provide theoretical basis and clinical reference for the treatment of sepsis with TCM.

Keywords: Traditional Chinese Medicine, Sepsis, C-reactive protein, Albumin, Research Progress.

1. Introduction

Sepsis is a life-threatening organ dysfunction caused by dysregulated host response to infection [1], and it is one of the most common and deadly critical illnesses in clinical practice. According to the global sepsis disease burden report published by The Lancet in 2020, there were approximately 48.9 million cases of sepsis globally in 2017, with approximately 11 million related deaths, accounting for nearly one-fifth of the total global mortality, posing a heavy burden on global public health systems [2]. C-reactive protein (CRP) is primarily synthesized by hepatocytes and rapidly increases under acute infection and tissue injury conditions. With a serum half-life of approximately 19 hours, it is a widely used clinical marker of acute inflammation [3]. Albumin (ALB) is the most abundant protein in plasma, primarily synthesized in the liver, with a half-life of approximately 19 days. It plays a crucial role in maintaining plasma colloid osmotic pressure, substance transport, and antioxidation [4].

Traditional Chinese medicine has a long history and rich experience in the treatment of sepsis. Its overall concept and the theoretical system of syndrome differentiation and treatment provide a unique idea for the treatment of sepsis. In recent years, with the deepening research on the modernization of traditional Chinese medicine, more and more studies have confirmed that traditional Chinese medicine can effectively regulate the CRP and LB levels of patients with sepsis, and improve the clinical symptoms and prognosis of patients [5]. This article will review the research progress of traditional Chinese medicine intervention on CRP and ALB in patients with sepsis.

2. Traditional Chinese Medicine's Perspective on Sepsis

Sepsis, a critical illness in modern medicine, lacks an exact counterpart in ancient Chinese texts. Based on symptoms like high fever, chills, delirium, rash, hemorrhage, dyspnea, cold

extremities, and feeble pulse, it falls under warm diseases, warm toxins, furuncles turning yellow, toxin sinking inward, and collapse. "Analysis of Warm Diseases" notes that "warm toxins invade lungs first, then spread to pericardium," mirroring sepsis's rapid onset and multi-organ damage [6]. TCM sees sepsis as root deficiency with branch excess, involving toxins, heat, stasis, and deficiency throughout. It arises from external toxin invasion, internal toxin buildup, and vital qi deficiency. External toxins include modern pathogens; internal toxins form from qi stagnation, phlegm, and stasis. Obstructed fu qi and waste accumulation, with turbid toxins, further harm organs and qi, akin to intestinal barrier breakdown and endotoxin translocation. Vital qi deficiency underlies disease onset [7-9].

Objective indicators reflect TCM pathogenesis: elevated CRP indicates excessive heat and epidemic toxicity, with inflammatory storm as its microscopic sign; decreased ALB suggests qi-yin deficiency, essence-blood-fluid loss, and vital qi weakness. TCM treats sepsis by clearing epidemic toxins and nourishing qi-yin, reducing CRP, improving ALB, and correcting the "pathogen excess with vital qi injury" state.

3. The Impact of Different Traditional Chinese Medicine Intervention Methods on CRP and ALB in Patients with Sepsis.

Clinical research mainly falls into four categories: TCM injections, classic TCM compounds, TCM monomers/active ingredients, and external TCM therapies, with different interventions focusing on CRP and ALB effects.

3.1 Traditional Chinese Medicine Injections

3.1.1 Xuebijing Injection

Xuebijing Injection is based on the Xuefu Zhuyu Decoction, a traditional Chinese medicine prescription created by Qing Dynasty physician Wang Qingren. It is composed of Chinese herbs such as safflower, Ligusticum chuanxiong, red peony

root, angelica, and salvia miltiorrhiza. It has the effects of promoting blood circulation to remove blood stasis, clearing heat and detoxifying, and strengthening the body's resistance to eliminate pathogenic factors. It is mainly used for sepsis with a syndrome of heat-toxicity and blood stasis, and is recommended in the "Guidelines for the Diagnosis and Treatment of Sepsis with Integrated Traditional Chinese and Western Medicine." The Kangfuxin [10] team divided 60 sepsis patients into a control group and an observation group. The control group received conventional Western medicine treatment, while the observation group received additional Xuebijing Injection for a course of 7 days. The results showed that after treatment, the observation group had significantly lower CRP levels, higher ALB levels, and better APACHE and SOFA scores compared to the control group. This suggests that Xuebijing Injection can inhibit inflammation and improve the body's protein status. Research by Professor Qiu Haibo's team has shown that Xuebijing Injection not only significantly reduces CRP levels in patients but also decreases the 28-day all-cause mortality rate in sepsis patients by 7.3%, while also significantly lowering CRP levels in patients [11].

3.1.2 Shenfu Injection

Shenfu Injection, formulated with two traditional Chinese medicinal herbs, red ginseng and aconite root, exerts therapeutic effects in restoring yang to reverse collapse and replenishing qi to stabilize the body. It represents a classical traditional Chinese medicinal prescription for the treatment of "syncope" and "collapse" syndromes and is indicated for patients with septic shock complicated by yang deficiency.

Clinical studies have shown that Shenfu Injection can significantly reduce the CRP levels in patients with sepsis. A randomized controlled trial involving 72 patients with sepsis revealed that after 7 days of treatment with Shenfu Injection in addition to conventional therapy, the CRP levels in the observation group decreased by 35.7% compared to the control group ($P < 0.05$), and the incidence of acute kidney injury was significantly reduced [12]. Another study focusing on patients with sepsis complicated by acute liver injury demonstrated that after treatment with Shenfu Injection, the CRP levels decreased by 52.1% compared to before treatment, and the improvement in liver function indicators was significantly better than that in the control group [13]. A study on the combination of Xuebijing and Shenfu Injection revealed that the combination therapy could reduce the CRP levels in sepsis patients by 48.6%, which was significantly better than the single-drug group, suggesting a synergistic effect between the two drugs in terms of anti-inflammatory activity [14].

3.2 Classic Chinese Herbal Compound Prescription

3.2.1 Huanglian Jiedu Decoction

Huanglian Jiedu Decoction, composed of Rhizoma Coptidis, Radix Scutellariae, Cortex Phellodendri, and Fructus Gardeniae, originates from "Wai Tai Mi Yao". It has the effect of purging fire and detoxifying, primarily treating the syndrome of excessive heat-toxin in the triple warmer. It is a representative prescription for clearing heat and detoxifying. Animal experiments have shown that Huanglian Jiedu

Decoction can reduce the serum CRP level in sepsis mice induced by lipopolysaccharide by 45.3%, while also decreasing the levels of pro-inflammatory factors such as TNF- α and IL-6, and improving the survival rate of mice [15]. Clinical studies have demonstrated that Huanglian Jiedu Decoction combined with conventional treatment can reduce the CRP level in sepsis patients by 36.8% ($P < 0.05$) compared to the control group, and the improvement in the Acute Physiology and Chronic Health Evaluation II (APACHE II) score is significantly better than that of the control group [16]. The anti-inflammatory mechanism of Huanglian Jiedu Decoction is primarily related to inhibiting the activation of the NF- κ B signaling pathway: its active ingredients, such as berberine and baicalin, can inhibit the phosphorylation and nuclear translocation of the NF- κ B p65 subunit, reducing the synthesis and release of pro-inflammatory factors [17].

3.2.2 Dachengqi Decoction

Dachengqi Decoction, comprising rhubarb, magnolia, citrus aurantium, and mirabilite, is from Treatise on Febrile Diseases. It purges heat-stagnation, treating Yangming fu-shi syndrome, and represents purging – interior – promoting – exterior therapy. Clinical studies show that in sepsis patients with intestinal dysfunction treated with Dachengqi Decoction enema, CRP levels dropped 34.2% ($P < 0.05$) post-treatment vs controls, with reduced intra-abdominal pressure and shorter intestinal recovery time [18]. Experimental studies reveal it lowers serum endotoxin in septic rats, inhibits NF- κ B pathway activation, and reduces inflammatory factor release [19].

3.2.3 Xuefu Zhuyu Decoction

Xuefu Zhuyu Decoction, composed of peach kernel, safflower, angelica, raw rehmannia root, ligustilide, red peony root, achyranthes bidentatae, platycodon grandiflorum, bupleurum root, aurantium immaturus, and liquorice, originated from "Yi Lin Gai Cuo" and is a representative prescription for promoting blood circulation and removing blood stasis. Experimental studies have shown that Xuefu Zhuyu Decoction can reduce the serum CRP level in septic rats by 40.5%, simultaneously lowering the levels of pro-inflammatory factors such as TNF- α and IL-1 β , and alleviate tissue damage [20]. Clinical studies have demonstrated that Xuefu Zhuyu Decoction can decrease the CRP level in patients with sepsis complicated by coagulation dysfunction by 35.8% ($P < 0.05$) after treatment, and significantly improve coagulation function indicators [21]. The anti-inflammatory mechanism of Xuefu Zhuyu Decoction is related to improving microcirculation and inhibiting the release of inflammatory factors: its active ingredients, such as tanshinone and paeoniflorin, can inhibit platelet aggregation, improve microcirculation, and reduce the accumulation of inflammatory factors in tissues [22].

3.3 Monomers and Active Ingredients of Traditional Chinese Medicine

3.3.1 Emodin

Emodin, a natural anthraquinone derivative extracted from the

Chinese herbal medicine rhubarb, possesses various pharmacological activities such as anti-inflammatory, antioxidant, antibacterial, and immunomodulatory effects. It is currently one of the most intensively studied Chinese herbal monomers. A study published in *Advanced Science* in 2025 by Liu Qingquan's team from Beijing Hospital of Traditional Chinese Medicine revealed that emodin can inhibit the formation of neutrophil extracellular traps (NETs) by targeting BCL-10 in neutrophils and regulating the BCL10/MALT1 complex. This significantly alleviates sepsis-induced cytokine storms and coagulopathy, and reduces patients' CRP levels [23]. Clinical studies have shown [24] that when sepsis patients are treated with emodin in addition to conventional Western medicine, their CRP levels decrease by 48.7% ($P<0.05$) after 7 days of treatment compared to the control group, while their ALB levels increase by 14.2% ($P<0.05$), and the 28-day all-cause mortality rate decreases by 8.2%. Another study focusing on sepsis patients with acute kidney injury showed that after emodin treatment, patients' CRP levels decreased by 56.3% compared to before treatment, ALB levels increased by 16.7%, renal function indicators significantly improved, and the rate of renal replacement therapy decreased by 12.5% [25].

3.3.2 Picroside II

Picroside II is a flavonoid compound extracted from the traditional Chinese medicine *Picrorhiza scrophularia*, exhibiting pharmacological activities such as anti-inflammatory, antioxidant, and immunomodulatory properties. According to a study published by Chen Wei's team in *ACS Nano* in 2025, picroside II can simultaneously and effectively inhibit pyroptosis and improve intestinal dysbiosis. The novel traditional Chinese medicine nano-formulation Z-MON-P (loaded with picroside II) constructed by them can inhibit pyroptosis-related cytokine storms at multiple levels, reduce CRP levels in sepsis patients, while reshaping the intestinal microbiota, improving intestinal barrier function, reducing intestinal albumin loss, and enhancing ALB levels. Experimental studies have shown that picroside II can decrease serum CRP levels by 45.3% and increase ALB levels by 18.7% in septic rats, while significantly increasing the abundance of beneficial gut bacteria and significantly improving intestinal mucosal barrier function [26].

3.3.3 Curcumin

Curcumin, a polyphenolic compound extracted from the traditional Chinese medicine turmeric, exhibits various pharmacological activities such as anti-inflammatory, antioxidant, and immunomodulatory properties. Clinical studies have shown that in patients with sepsis treated with curcumin, the CRP level decreased by 38.5% ($P<0.05$) after 7 days of treatment compared to the control group, while the ALB level increased by 11.9% ($P<0.05$). Additionally, the duration of mechanical ventilation and hospitalization was reduced in these patients [27].

3.4 External Treatment Methods of Traditional Chinese Medicine

For sepsis patients who cannot take oral medication or have

nasal feeding, external treatment of traditional Chinese medicine, as an auxiliary method, mainly includes Chinese herbal enema, acupuncture and moxibustion, etc.

3.4.1 Chinese herbal enema therapy

This method involves injecting Chinese herbal medicine solution into the rectum through the anus, where it is absorbed by the intestinal mucosa to exert therapeutic effects. It allows the medication to directly act on the intestine, avoiding first-pass effects in the liver and enhancing the bioavailability of the drug. This method is particularly suitable for critically ill patients who cannot take oral medication. Clinical studies have shown that enema therapy with Dachengqi Decoction for patients with sepsis and intestinal dysfunction reduced CRP levels by 34.2% ($P<0.05$) compared to the control group after treatment, and increased ALB levels by 11.8% ($P<0.05$). Additionally, patients experienced reduced intra-abdominal pressure and a shorter recovery time for intestinal function [18]. Another study revealed that combining Chinese herbal enema with conventional treatment reduced CRP levels by 38.7% and increased ALB levels by 12.5% in sepsis patients, leading to a decreased incidence of multiple organ dysfunction syndrome [28]. However, it is not recommended as a standalone treatment.

3.4.2 Electroacupuncture

The treatment method combining electroacupuncture with the fundamental principles of acupuncture for the heart meridian system is more stable and controllable in its effects. An experimental study on septic rats showed that electroacupuncture at the Zusanli (ST 36) point significantly reduced the serum CRP level and alleviated tissue inflammation and damage [29]. Clinical studies also indicate that combining electroacupuncture at points such as Zusanli, Hegu (LI 4), and Quchi (LI 11) with conventional Western medicine treatment for sepsis can more significantly reduce patients' CRP levels, increase ALB levels, and improve clinical symptoms [30]. A randomized controlled trial involving 80 septic patients showed that after 7 days of treatment with electroacupuncture in addition to conventional therapy, the CRP level in the observation group decreased by 31.5% compared to the control group ($P<0.05$), and the ALB level increased by 12.7% compared to the control group ($P<0.05$). Additionally, patients' gastrointestinal function recovery time was shortened, and their hospital stay was reduced by 3.5 days [31].

3.4.3 Moxibustion

Moxibustion involves the application of heat generated by the burning of mugwort to stimulate acupoints, achieving the effects of warming and unblocking meridians, dispersing cold and alleviating pain, and strengthening the body's vital energy to expel pathogenic factors. Clinical studies have shown that moxibustion at acupoints such as Guanyuan, Qihai, and Zusanli can increase the ALB levels in patients with sepsis, improve their nutritional status, and reduce the level of CRP [32]. A study involving 60 patients in the recovery phase of sepsis demonstrated that moxibustion combined with conventional treatment can increase the ALB level by 14.3%, decrease the CRP level by 28.7%, and improve the six-month

survival rate of patients [33].

4. Existing Issues

Despite certain research achievements in regulating CRP and ALB levels in sepsis patients with traditional Chinese medicine (TCM), there are still some issues. Firstly, the mechanism of action of TCM in treating sepsis is not yet fully understood. Although some studies have explored the mechanism of action of TCM in regulating CRP and ALB levels, most research remains at the cellular and animal experiment levels, lacking in-depth molecular mechanism studies. Furthermore, the multi-component and multi-target characteristics of TCM make the study of its mechanism of action more complex. Secondly, the quality of clinical research needs to be improved. Currently, clinical research on TCM treatment for sepsis is mostly small-sample, single-center studies, lacking large-sample, multi-center, randomized controlled clinical trials. This limits the credibility and generalizability of research results. Additionally, the evaluation indicators for the efficacy of TCM in clinical research are not comprehensive enough. Most studies only focus on changes in biochemical indicators such as CRP and ALB, while the evaluation of patients' clinical symptoms, quality of life, and long-term prognosis is insufficient. Lastly, the quality control and standardization of TCM urgently need to be addressed. The administration route, dosage, and treatment duration of TCM also lack unified standards, affecting the efficacy and safety of TCM in treating sepsis.

5. Conclusion

Traditional Chinese Medicine (TCM) intervention has unique advantages in the treatment of sepsis, capable of regulating the levels of CRP and ALB in sepsis patients through multiple pathways, alleviating inflammatory responses, and improving patients' nutritional status and clinical outcomes. Compound prescriptions, monomers, and effective components of traditional Chinese herbs, as well as acupuncture and other traditional Chinese medical therapies, all exhibit a certain regulatory effect on the levels of CRP and ALB in sepsis patients. The mechanisms of action primarily involve regulating inflammatory signaling pathways, improving gut microbiota, and modulating immune function. However, there are still some issues with TCM treatment for sepsis that require further research. In the future, efforts should be made to strengthen research on the mechanisms of action of TCM in sepsis treatment, conduct high-quality clinical studies, enhance quality control and standardization of TCM, and promote the widespread application of TCM in sepsis treatment.

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