

Advances in the Clinical Treatment and Prognosis of Patients with Diabetic Foot Using Both Traditional Chinese and Western Medicine

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Abstract: Diabetic foot is a serious diabetic complication characterized by localized lower-extremity (below-ankle) tissue ulceration induced by chronic neuropathy, angiopathy and secondary infection. It severely impairs patients' quality of life and serves as a leading cause of diabetes-related disability, mobility loss and mortality, bringing great physical agony and heavy economic burdens to patients and their families. Therefore, its prevention and treatment have become a vital public health concern. With growing public recognition, multiple interventions including negative-pressure wound therapy and hyperbaric oxygen therapy have been applied, and multidisciplinary strategies are advocated to elevate cure rates and lower amputation and mortality risks. This paper reviews recent advances in traditional Chinese medicine (TCM) for diabetic foot. Oral TCM treatment mainly adopts staged intervention and syndrome-differentiated therapy; external TCM modalities cover herbal foot soaks and topical wound medications, while new TCM preparations are under clinical exploration. It also illustrates patient-oriented health education, case management, risk screening and holistic foot care, offering references for diabetic foot prevention. To cut its incidence and control disability and amputation rates, this review summarizes the progress and prognostic profile of integrated Chinese-Western therapy for diabetic foot.

Keywords Diabetic Foot; Integrated traditional Chinese and Western Medicine Treatment; Research Advances; Pathogenesis

1. Introduction

Diabetic foot ulcer refers to foot lesions occurring in patients with diabetes mellitus as a

result of chronic hyperglycemia, encompassing conditions such as neuropathy, vascular disease, and foot infections. Diabetic foot ulcer is also known as diabetic arterial occlusive disease or diabetic gangrene; it differs from common foot ulcers or gangrene and represents a complication secondary to foot infections, ulcers, or deep tissue destruction associated with diabetic peripheral neuropathy and lower extremity vascular disease. It is one of the most common severe complications in advanced-stage diabetes mellitus. Diabetic foot ulcers can be classified into three types: neuropathic, pure ischemic, and neuro-ischemic; in China, the neuro-ischemic type is more prevalent among diabetic foot patients, whereas the pure ischemic type is less frequent [1]. The treatment of diabetic foot ulcers is highly challenging, often involving prolonged disease courses and substantial financial costs, imposing considerable economic burden on affected families. Therefore, it is necessary to summarize the clinical management and prognosis of patients with diabetic foot ulcers. This article reviews the current integrated traditional Chinese and Western medical approaches to the treatment and prognosis of such patients in China, with the aim of providing insights and methodologies for clinical practice.

2 Western Medical Treatment

Given the numerous complications and prolonged course of diabetes mellitus, the majority of therapeutic interventions should be based on foundational management. The Western medical approach to treating diabetic foot ulcers primarily encompasses foundational therapy, conventional therapy, and preventive therapy; foundational therapy includes patient education and glycemic control, among other measures. Conventional therapy mainly involves the use of medications for infection prevention, debridement, and surgical interventions. Adjuvant therapies are also frequently employed

in the management of diabetic foot ulcers, such as hyperbaric oxygen therapy. Additionally, the prevention and treatment of arteriosclerosis in diabetic foot patients are essential. The prognosis of diabetic foot requires regular monitoring of vascular and nutritional status.

2.1 Diabetic foot Assessment

The most widely used and extensively adopted clinical tool for assessing diabetic foot conditions and determining appropriate treatment strategies is the Wagner scoring system. The Wagner classification divides diabetic foot into six grades: Grade 0: No ulceration; however, the patient has risk factors for developing an ulcer; Grade 1: Ulceration with skin surface breakdown but without infection; Grade 2: Deep ulceration, often accompanied by soft tissue inflammation, but without bone infection or abscess; Grade 3: Deep ulceration with severe infection accompanied by bone tissue involvement or abscess; Grade 4: Partial gangrene; Grade 5: Total foot gangrene [2].

2.2 Anti-Infection

Patients with diabetes mellitus often exhibit impaired immune system function, which can hinder the healing of ulcers and increase the risk of both primary and recurrent infections; therefore, anti-infective therapy constitutes a critical component of the overall management of diabetes [3]. The standardized and appropriate use of antimicrobial agents can effectively control infections and prevent the onset or spread of new infections. Empirical administration of broad-spectrum antimicrobial agents, followed by transition to targeted therapy once the etiology is identified, enables precise control of infections. The use of anti-infective agents should adhere to principles of safety, timeliness, and selectivity. For patients with mild diabetic foot, empirical anti-infective therapy is highly recommended; typically, antimicrobial agents targeting Gram-positive bacteria—such as doxycycline or amoxicillin-clavulanate—are employed [4]. In cases of moderate to severe infections, where the ulcerative lesions are deeper and the disease course is prolonged, mixed infections are common, involving a diverse range of pathogens—including Gram-negative, Gram-positive, and anaerobic bacteria. Although the specific causative pathogens may not always

be identified, clinicians generally prescribe broad-spectrum antimicrobial agents as the first-line treatment for patients with moderate to severe infections to cover potential pathogens [5]. It is important to note that the use of broad-spectrum antimicrobial agents should comply with antibiotic stewardship principles to minimize the risk of antibiotic resistance; once microbiological culture and susceptibility testing results are available, therapy should be promptly adjusted to narrow-spectrum antimicrobial agents for targeted treatment of the identified pathogen.

2.3 hyperbaric Oxygen Therapy

Studies have demonstrated a positive correlation between increased tissue partial pressure of oxygen and the prognosis of diabetic foot; when the partial pressure of oxygen exceeds 75 mmHg, the healing rate for diabetic foot ulcers can approach 100%. Hyperbaric oxygen therapy is generally recommended for patients with diabetic foot ulcers classified as Wagner grade >3. This therapy can inhibit bacterial growth and proliferation, thereby reducing wound infection and tissue necrosis; it also constricts blood vessels, lowers capillary pressure, and accelerates the absorption of edema. Additionally, hyperbaric oxygen therapy stimulates the release of vascular endothelial growth factor, promotes neovascularization, and improves microcirculation [6]. Currently, there is no unified clinical standard for the treatment of diabetic foot ulcers; therefore, it is necessary to establish a comprehensive and scientifically sound assessment system tailored to each patient's treatment goals, as well as the type and severity of the ulcer.

2.4 Operative Treatment

Surgical intervention holds significant importance for patients with diabetic foot ulcers, as it determines whether the patient's lower extremities can be preserved. Therefore, a thorough preoperative assessment of the patient's lower extremities is essential to determine whether surgical treatment is warranted. The most commonly employed surgical approaches fall into two categories: limb salvage surgery and amputation surgery. Limb salvage surgery can reduce the risk of postoperative complications; currently, common limb salvage techniques include transverse tibial bone repositioning and the improvement of lower

extremity ischemia to facilitate vascular reconstruction pathways [7]. When limb salvage surgery is not feasible due to technical constraints, amputation may be the only option to save the patient's life. Postoperative care must also focus on preventing and managing complications such as postoperative infection, hemorrhage, fever, orthopneic pneumonia, atelectasis, and deep vein thrombosis (DVT) of the lower extremities.

3.1 Mechanisms of TCM in Treating Qi Deficiency and Blood Stasis Type DF.

3. Chinese Traditional Treatment

In exploring the pathogenesis of diabetic foot, the condition originates from consumptive thirst (Xiaoke). With prolonged Xiaoke, yin deficiency gradually intensifies, and impairment of yin eventually injures yang. Alternatively, phlegm-dampness may be generated internally, which, lacking the warming and transforming power of yang qi, accumulates over time into blood stasis; or the external attack of toxic pathogens may render qi and blood unsmooth and obstruct the meridians and collaterals, giving rise to various concurrent syndromes [8]. According to the *Chinese Guidelines for the Prevention and Treatment of Diabetic Foot (2019 Edition)*, TCM clinical practice commonly differentiates diabetic foot into five syndrome types: (1) accumulation of dampness-heat with decay of tendons and putrefaction of flesh; (2) heat-toxin damaging yin with stasis obstructing the collaterals; (3) qi-blood deficiency with stasis obstructing the collaterals; (4) liver-kidney yin deficiency with stasis obstructing the collaterals; and (5) spleen-kidney yang deficiency with phlegm-stasis obstructing the collaterals [9]. It can thus be seen that the formation of stasis and deficiency constitutes the key link in the onset of diabetic foot.

3.1 Internal Therapy

Internal therapy applies TCM syndrome-differentiation thinking to treatment based on syndrome differentiation, with emphasis on holistic examination and on distinguishing the root (*ben*) from the branch (*biao*). For the syndrome of dampness-heat accumulation, the therapeutic principle is to clear heat, drain dampness, resolve toxins, and transform stasis, with the *Simiao Yong'an Decoction* (from *Yanfang Xinbian*, New Compilation of Tested Prescriptions) combined

with the *Yin-Zhi-Lian Decoction* (Xi Jiuyi's tested formula) as the base, modified accordingly. For the syndrome of heat-toxin damaging yin, the principle is to clear heat, resolve toxins, nourish yin, and activate blood, with the *Gubu Decoction* (from *Waike Zhenquan*, True Interpretations of External Medicine) modified. For the syndrome of qi-blood deficiency, the principle is to supplement qi, nourish blood, transform stasis, and unblock collaterals, with the *Shengmai Powder* (from *Neiwai Shang Bianhuo Lun*, Clarifying Doubts about Internal and External Injuries) combined with the *Xuefu Zhuyu Decoction* (from *Yilin Gaicuo*, Corrections of Errors in Medical Literature) as the base, modified accordingly. For the syndrome of liver-kidney yin deficiency, the principle is to nourish and enrich the liver and kidney, activate blood, and unblock collaterals, with the *Liuwei Dihuang Pill* (from *Xiao'er Yaozheng Zhijue*, Key to Diagnosis and Treatment of Children's Diseases) modified. For the syndrome of spleen-kidney yang deficiency, the principle is to warm and supplement the spleen and kidney, transform phlegm, and unblock the vessels, with the *Jinkui Shenqi Pill* (from *Jingui Yaolue*, Essentials from the Golden Cabinet) modified [10]. In summary of the above five clinically commonly used differentiations, "blood stasis" plays a consistently important role throughout the development of diabetic foot. Therefore, in the application of internal therapy, medicinals that resolve turbidity, lower lipids, activate blood, and unblock collaterals — such as ginkgo leaf (*Yinxingye*) and alisma (*Zexie*) — should be incorporated, which is of considerable significance.

3.2 External Therapy

TCM external therapy runs through the entire treatment of diabetic foot, including herbal fumigation-and-washing and herbal topical application. The mechanisms of TCM external therapy were recorded as early as in *Liyu Pianwen* (Parallel Prose on External Therapies) and *Yangke Gangyao* (Outline of Ulcer Medicine). As diabetic foot is prone to infection, timely debridement and removal of necrotic tissue (*qingchuang qufu*) is of great significance for preventing and controlling infection and delaying disease progression. Herbal components can effectively remove necrotic tissue and promote the generation of new

granulation tissue. The actions of TCM external therapy in promoting granulation, relieving pain, activating blood, and resolving stasis are also markedly superior to those of Western-medicine debridement alone. The herbal topical preparations currently used in clinical practice are mainly powders and ointments, which generally exert the effects of clearing heat and resolving toxins, promoting granulation and relieving pain, and activating blood and resolving stasis. Yu Wenxia et al. [11] reported that, in treating patients with moderate-to-severe diabetic foot ulcers, the application of *Jiazhu Huanglian* (pangolin-scale and coptis) ointment combined with debridement yielded results markedly superior to debridement alone. Herbal fumigation-and-washing acts directly on the affected part; through the action of heat, it relaxes and activates qi and blood and accelerates drug absorption. This modality generally exerts the effects of supplementing qi and activating blood, relaxing sinews and unblocking collaterals, and reducing inflammation and relieving pain. At present, TCM external therapy combined with debridement is commonly used in clinical practice and has achieved favorable efficacy in the treatment of diabetic foot.

3.3 Acupuncture and Tuina (Massage)

Acupuncture and tuina exert the effects of unblocking the meridians and activating collaterals, harmonizing qi, blood, yin, and yang, and reinforcing and supplementing healthy qi (*zheng qi*). They can not only reduce the administration of medication, but also protect peripheral nerves and enhance therapeutic efficacy. Since the foot is distant from the heart, the blood returning to the heart flows more slowly than in other parts of the body, and diabetic foot is prone to blood stasis and stagnation, the application of acupuncture and tuina can unblock the meridians and activate collaterals, thereby delaying the progression of diabetic foot. Acupuncture and tuina not only produce the effects of warming the meridians, unblocking collaterals, activating blood, and resolving stasis, but can also effectively relieve vascular spasm and lower vascular resistance. Related studies have shown that needling specific acupoints can stimulate pancreatic islet β -cells to secrete insulin, thereby achieving the goal of lowering blood glucose. Clinically used acupuncture modalities include simple

acupuncture therapy, acupoint injection therapy, and electroacupuncture therapy [12]. Li Bing et al. [13], through a controlled trial involving 108 patients with diabetic foot, found that in the experimental group receiving warm needling (*wen zhenjiu*) therapy, the serum IGF level was significantly elevated while the serum MMP-9 level was decreased, which effectively enhanced local tissue repair. A meta-analysis showed that simple acupuncture can markedly improve blood flow, enhance therapeutic efficacy, and shorten the disease course. Cai applied acupoint injection of *danshen* (*Salvia miltiorrhiza*) and vitamin B12 at Zusanli (ST 36), Weizhong (BL 40), Quchi (LI 11), and Waiguan (TE 5) in treating diabetic peripheral neuritis, and found that the acupoint injection group was superior to the simple needling group. Guan Yuxiang et al. [14] clinically observed 100 patients with mild diabetic foot who received tuina massage treatment and, using the UK foot screening assessment criteria for scoring, found that correct tuina massage can better prevent the occurrence of high-risk diabetic foot and reduce the risk of amputation.

3.4 Preventive Treatment of Disease (Zhi Wei Bing)

"Unmanifest disease" (*weibing*) refers to a state in which the disease has not yet occurred or has not yet manifested symptoms, and "preventive treatment of disease" means arresting the progression of disease at the budding stage of its development. To achieve this, physicians are required to possess sound professional competence, to maintain a holistic viewpoint, to administer treatment in accordance with the three factors (*sanyin shizhi* — seasonal conditions, geographical conditions, and individual constitution), and to differentiate syndromes, integrate multiple diagnostic methods (*duozhen hecan*), and analyze and grasp the patterns of disease development and transmission. As diabetic foot is caused by diabetes mellitus, its pathogenesis is yin deficiency with dryness-heat, which leads to deficiency and then to stasis. Diabetic foot is dominated by stasis and stagnation of the blood vessels; therefore, in terms of "preventing disease progression once it has occurred," early intervention should be carried out, and whether the stasis results from deficiency or from excess, attention should be paid to the application of methods that activate blood and resolve stasis.

Du Xu et al. [15], through clinical observation of 60 patients with grade-0 diabetic foot treated with Chinese medicinals for supplementing qi, activating blood, and unblocking collaterals, found that their fasting blood glucose, postprandial blood glucose, glycosylated hemoglobin, blood lipids, and BMI all improved markedly. The application of the concept of "prevention before disease onset" to diabetic foot is essentially the regulation and control of diabetes. Modern medical research has found that the patient's blood flow can be improved with blood-activating and stasis-resolving medicinals. Diabetic foot corresponds to the TCM concepts of "prolonged illness entering the collaterals" (*jiubing ruluo*) and "blood stasis obstructing the collaterals" (*yuxue zuluo*); this pathogenesis runs through the entire course of the disease. Improving lipid metabolism can effectively delay or prevent the progression of diabetic microangiopathy. Clinical studies have found that adding such medicinals when treating diabetic foot can reduce the occurrence of complications [16].

4. Discussion and Prospects

Diabetic foot is a comprehensive infection induced by a prolonged state of hyperglycemia. As one of the severe complications of diabetes mellitus, it not only involves the blood vessels and nerves, but also causes destruction of the patient's tissues, giving rise to local infection and necrosis. In clinical practice, reducing the amputation rate serves as the effective therapeutic goal. In the future, on the basis of integrated traditional Chinese and Western medicine in the treatment of diabetic foot, TCM treatment should be administered alongside Western-medicine therapy, so that the two therapeutic approaches complement each other's strengths and further enhance efficacy, thereby achieving the goals of alleviating clinical symptoms, improving prognosis, and enhancing patients' quality of life. This will facilitate continued in-depth research, bring greater application value into play, and benefit patients and humankind alike.

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