

# Research Progress of Chinese Medicine Treatment of Diabetic Foot

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**Abstract:** With the increasing incidence rate and mortality of malignant tumors, the means of treatment for malignant tumors are also growing, but radiotherapy is still one of the important means of treatment for tumor patients. However, the toxic side effects of radiotherapy make it difficult for patients to tolerate the subsequent pain and psychological pressure, leading to the termination or interruption of treatment, thereby reducing the efficacy of radiotherapy and causing tumor progression. Modern research has shown that the combination of traditional Chinese medicine and radiotherapy can improve adverse reactions caused by radiotherapy, enhance the body's immunity and clinical efficacy, improve patients' quality of life, and prolong survival. This article reviews the research progress on the toxic side effects of traditional Chinese medicine on radiotherapy for malignant tumors in recent years, providing a basis and suggestions for subsequent clinical research.

**Keywords:** Traditional Chinese Medicine; Tumors; Radiotherapy; Toxic Side Effects

## 1. Introduction

Diabetic foot (DF) is a common and serious complication of diabetes. Traditional Chinese medicine belongs to the category of "gangrene". In recent years, the incidence of diabetic foot has been increasing year by year with the increasing incidence of diabetes [1]. It is often associated with infection or different degrees of lower extremity arterial occlusive disease, severe cases can involve muscle and bone tissue. It has the characteristics of high morbidity, high disability rate and high mortality. The annual mortality rate is as high as 11 % in patients with ulcers and 22 % in patients with amputations [2]. Its treatment is difficult and the course of disease is long, which brings a heavy burden to the patient's family and society. It is reported that the per capita treatment cost of DF patients in the United States is USD 8658, and the total cost in the country is as high as USD 13 billion [3]. Traditional Chinese medicine treatment of gangrene has a long history and has achieved good results. It plays an important role in modern DF treatment. This article reviews the traditional Chinese medicine treatment methods of the disease in recent years, in order to provide reference for clinical treatment.

## 2. TCM internal treatment

### 2.1. Treatment by typing

According to the overall performance of DF patients and the different symptoms of the wound, the "Chinese Expert Consensus on the Prevention and Treatment of Diabetic Foot with Integrated Traditional Chinese and Western Medicine" [4] formulated by the Peripheral Vascular Disease Committee of the Chinese Association of Integrated Traditional Chinese and Western Medicine divided the disease into three types : qi and yin deficiency type, qi deficiency and blood stasis type and damp-heat accumulation type. It is recommended that the treatment of deficiency of both qi and yin should be based on replenishing qi and nourishing yin, activating blood circulation and dredging meridians. Qi deficiency and blood stasis type is mainly to invigorate qi and activate blood, remove blood stasis and dredge vessels. The dampness-heat accumulation type is mainly based on clearing heat and removing dampness. The "Chinese diabetic foot prevention and treatment guidelines" [5] divided the disease into damp heat toxin accumulation-muscle rot and flesh rot syndrome, heat toxin injury yin-collateral stasis syndrome, qi and blood deficiency-collateral stasis syndrome, liver and kidney yin deficiency-blood stasis syndrome and spleen and kidney yang deficiency-phlegm and blood stasis syndrome. Five types of syndrome. The

treatment of dampness-heat toxin accumulation-tendon rotten meat rot syndrome is mainly based on clearing away heat and detoxifying, which can be modified by Simiao Yong'an Decoction and Yinzhilian Decoction. The treatment of heat-toxin injury yin-collateral stasis syndrome is mainly based on clearing heat and removing blood stasis, and Gubu Decoction is recommended. The treatment of qi and blood deficiency-collateral stasis syndrome is mainly based on tonifying deficiency and removing stasis, which can be modified by Shengmai Decoction and Xuefu Zhuyu Decoction. The treatment of liver and kidney yin deficiency-blood stasis syndrome is mainly based on tonifying kidney and removing blood stasis, and Liuwei Dihuang Pill can be used. The treatment of spleen and kidney yang deficiency-phlegm and blood stasis obstruction syndrome is mainly based on Fuyang Huatan, and Jinkui Shenqi Pill can be used to add and subtract. Domestic well-known doctors also treat the disease based on syndrome differentiation according to their own clinical experience. Professor Bohua yang <sup>[6]</sup> believes that the pathogenesis of DF is the deficiency of spleen and kidney yang, and the complex sense of toxin, which leads to blood stasis, blood stasis for a long time, heat, pus and ulcer. According to his many years of clinical experience, Professor Yang summarized gangrene into two main syndromes, qi deficiency and blood stasis type and toxic heat accumulation type. Qi deficiency and blood stasis type pays attention to Yiqi Tongmai, emphasizes the timely treatment, this type is the key to the prognosis of the disease. The treatment of toxic heat accumulation type is to detoxify and dredge the veins. Professor Yang believes that any adverse substance that can cause normal dysfunction or pathological state of the body can be called toxic pathogen. The key to the treatment of this type is detoxification, and the clinical medication should be flexible to add and subtract, in order to remove the evil to the pulse. According to the etiology and pathogenesis of gangrene, Professor Ai Rudi <sup>[7]</sup> divided it into three categories : cold-dampness obstruction syndrome, damp-heat toxin syndrome and qi-blood deficiency syndrome. Cold dampness obstruction syndrome focuses on the use of angelica, cassia twig, red peony root, safflower, asarum and so on to disperse cold and dredge collaterals. Damp-heat toxin syndrome focuses on the use of Lonicera japonica, Scrophulariae Radix, Angelicae Sinensis Radix, Achyranthes bidentata, Dendrobium. Raw Astragalus and so on to clear heat and activate blood. Qi and blood deficiency syndrome emphasizes the use of raw Astragalus, Radix Adenophorae, Rhizoma Atractylodis Macrocephalae, Poria, Pericarpium Citri Reticulatae, etc. to replenish qi and nourish blood. At the same time, we should pay attention to the therapeutic principle of "removing is actually unblocking, and tonifying is also unblocking." In clinical practice, we can flexibly add and subtract the use of insect drugs to achieve the effect of "removing is actually unblocking". Although the various societies and experts on the syndrome differentiation of this disease are not the same, but all include qi deficiency, blood stasis and damp heat. The treatment is mainly based on the addition and subtraction of classical prescriptions. Qi deficiency syndrome was treated with Sijunzi decoction to supplement qi and blood. Damp-heat syndrome with three seconds pill addition and subtraction to clear heat and dampness. Blood stasis syndrome with Xuefu Zhuyu Decoction to promote blood circulation. There are also some doctors self-made prescriptions for the treatment of this disease, clinically achieved good results.

Hongtao Xu et al. <sup>[8]</sup> divided 60 patients into control group and treatment group by random number table method. The control group was treated with routine treatment, and the treatment group was treated with Gancao Fuzi Decoction (cooked Fupian 9g, Guizhi 9g, fried Baizhu 15g, Gancao 9g, Yuanhu 15g, Wuzhuyu 9g, Baijiezi 30g) on the basis of routine treatment. After 4 weeks, the total effective rate of the treatment group was 93.33 %, which was much higher than that of the control group ( 76.67 % ). The treatment group was significantly better than the control group in improving limb skin cooling, limb soreness score, and TCM clinical syndromes.

## 2.2. Treatment by stages

According to the changes of different stages of the disease, some doctors also use the method of combination of stage and type to treat DF by stages. Based on "wound bed preparation", Gonglang Cui <sup>[9]</sup> divided it into black stage (tissue necrosis stage), yellow stage (inflammatory exudation stage), red stage (granulation tissue stage) and pink stage (epithelialization stage). The black stage is generally seen in dry gangrene, with many necrotic tissues and dry desquamation, with obvious pain. The external treatment is to remove the scab first and then gradually debridement. Yellow period is common in wet gangrene, wound exudation more, occasionally carrion, pus dripping. Fumigation or soaking is selected for treatment, and pus is removed if necessary. The red stage carrion has been removed, the pus has been exhausted, the wound is red and fresh, and Shengji Yuhong ointment can be used for external use to simmer the pus. The granulation tissue in the powder stage grew well and the epithelium proliferated. The treatment is mainly to protect the wound and avoid infection. Huaafa Que <sup>[10]</sup> divided gangrene into acute attack period, improved remission period and recovery period. Acute exacerbation of toe ulceration or unclear boundary, redness and heat pain, pus dripping, odor, pain unbearable. The treatment is to clear

heat, remove dampness and detoxify, with Simiao Yong"an Decoction. In the acute attack period, the local redness, swelling and heat pain were significantly relieved, the pus was thin, and the carrion gradually receded. Treatment and camp detoxification. The prescription was modified with Buyang Huanwu Decoction. During the recovery period, the toe ulceration lasted for a long time, the pus was clear, the carrion was completely removed, there was no redness, swelling, heat pain, and the pain was mild. Treatment with Yiqi Huoxue Shengji. Prescription with ginseng Yangrong decoction. The key to syndrome differentiation by stages lies in the process of disease. Although the staging methods of various physicians are different, most of them believe that the early stage is dominated by evil excess, mainly damp-heat toxin, and the treatment is mainly based on clearing heat, removing dampness and detoxification. In the later period, qi and blood were weak and vital qi was insufficient. The treatment is mostly based on Renshen Yangrong Decoction. Based on "surgical authenticity · gangrene", Du Yuqing divided gangrene into three stages: initial stage, ulceration stage and recovery stage. In the early stage of gangrene, there is a cloud in ancient books, "the beginning of the yellow bubble in the water, that is, moxibustion", which shows that moxibustion plays an important role in the treatment of early gangrene. It shows that moxibustion can not only keep the wound dry and reduce the possibility of infection; it can also increase the energy necessary for wound healing and promote wound healing. The ulceration period advocates "cutting in the flesh and cutting in the fingers". In the ulceration period, the pus on the wound surface is dripping and the disease spreads. Debridement is the key to the treatment, depending on the situation with the use of Yiqi Huoxue Huayu drugs, improve lower limb blood circulation ; toe amputated if necessary. The key to the recovery period is to avoid pus formation in "shengji Lianchuang". Shengji Yuhong ointment can be used to promote the shedding of carrion, the gradual growth of new meat, and the gradual healing of sores.

### 3. TCM external treatment

#### 3.1. External washing of Chinese medicine

External washing of traditional Chinese medicine is an external treatment method of traditional Chinese medicine decoction, which is washed or bathed locally. The efficacy can pass through the skin, hair follicles and other channels to the disease. Studies have shown that external washing of traditional Chinese medicine can increase local blood perfusion and increase oxygen partial pressure, and its warm work can further improve the clinical treatment effect. Wenyan Li et al.<sup>[11]</sup> randomly divided 60 patients with DF into two groups. The control group was treated with routine treatment, and the treatment group was treated with Sihuang Lotion (Rhubarb 50g, Viola yedoensis 50g, Scutellaria baicalensis 30g, Cortex Phellodendri 30g, Radix Paeoniae Rubra 30g, Bletilla striata 10g) on the basis of routine treatment. Results : Among the 30 patients in the treatment group, 12 cases were clinically cured, 0 cases were markedly effective, 14 cases were effective, 4 cases were ineffective, and the total effective rate was 86.7%. Among the 30 patients in the control group, 12 cases were clinically cured, 1 case was markedly effective, 8 cases were effective, 9 cases were ineffective, and the total effective rate was 70%. It has more advantages in improving local skin temperature, skin color, pain and so on. Aihua Shuai et al. divided 80 DF patients into observation group and control group by random number table method, 40 cases in each group. The control group was treated with routine treatment. On the basis of routine treatment, the observation group was treated with Zhonghe Yuzu Decoction (Huanglian 40g, Huangqin 40g, Huangbai 40g, Xuanshen 30g, Jinyinhua 30g, Danggui 30g, Gancao 30g, Zhizi 30g, Lianqiao 30g, Zihuadiding 30g). After 2 weeks, the TCM syndrome score, A-DQOL score, VAS score and blood glucose in the observation group were significantly lower than those in the control group. Jiazhou Yang<sup>[12]</sup> treated 44 patients in the control group with conventional hypoglycemic and anti-infective treatment. The treatment group was treated with Huoxue Shengji Decoction (Shengdihuang 25, Danggui 20, Meiyao 15, Danshen 15 g, Xuanshen 15 g, Jixueteng 15 g, Rendongteng 15 g, Luoshiteng 15 g, Honghua 10 g) bathing the affected area on the basis of debridement with hydrogen peroxide washing. After 6 weeks, the total effective rate of the treatment group was significantly higher than that of the control group (90.91% vs 72.73%). The wound oxygen partial pressure and quality of life score of the treatment group were much higher than those of the control group, and the wound area and wound PH value were lower than those of the control group. Guoxiang Chen<sup>[13]</sup> made his own Wenyang Sanyu foot bath prescription (Sanleng 15 g, Ezhu 15 g, Ganjiang 12 g, Wufupian 12 g, Xixin 10 g, Duhuo 12 g, Guizhi 12 g, Zhimahuang 10 g, Biyao 12 g, Ruxiang 12 g, Baijiezi 10 g, Yanhusuo 12 g). 60 patients with diabetic foot were treated with leaching, and the control group was treated with conventional western medicine. The results were observed after 2 months. In the treatment group, 16 cases were cured, 27 cases were markedly effective, 15 cases were effective, 2 cases were ineffective, and the total effective rate was 96.67%. A randomized controlled clinical trial of external washing treatment was carried out by doctors.

Jian Dong<sup>[14]</sup> randomly divided 60 patients with diabetic foot into two groups, the control group routine hypoglycemic and daily care. On the basis of the control group, the experimental group was treated with traditional Chinese medicine foot bath (Aiye 30 g, Guizhi 30 g, Taoren 20 g, Baizhi 20 g, Baishao 20 g, Tougucao 20 g, Honghua 15 g, Chuanxiong 20 g, Frankincense 10 g, Myrrh 10 g). The improvement of blood oxygen saturation at the tip of the toe and the symptoms of coldness and numbness of the toe pain in the experimental group were significantly better than those in the control group.

### 3.2. External application of traditional Chinese medicine

External application is a treatment method in which the drug is ground into powder, mixed with other liquids or matrices to form a paste, and then applied to the affected area or local area. Tianyi Yu et al.<sup>[15]</sup> randomly divided 30 patients with diabetic foot ulcers into 2 groups, 15 cases in the control group and 15 cases in the experimental group. The control group was treated with routine debridement and dressing change, and the experimental group was treated with ulcer No. I gauze ( Forsythia 100 g, Scutellaria 50 g, Paeonia 30 g, Angelica 30 g, Sophora 30 g ) on the basis of the conventional group. After 30 days, it was found that the scores of symptoms and signs, clinical inflammatory indexes and inflammatory factors in the experimental group were significantly lower than those in the control group. Yingying Liu<sup>[16]</sup> divided 100 patients with diabetic foot into two groups, 50 in the study group and 50 in the control group. The control group was treated with routine injection of insulin glargine and ethacridine lactate solution, and the study group was treated with Ruyi Huangjin powder on the basis of the control group. After 3 months, in the study group, 10 cases were cured, 20 cases were markedly effective, 18 cases were effective, 2 cases were ineffective, and the total effective rate was 96 %. And the patient's fasting blood glucose, postprandial 2h blood glucose, glycated hemoglobin and other indicators were significantly lower than the control group. Shuang Wang<sup>[17]</sup> treated 45 patients in the observation group with basic treatment of Tianlou Jiedu Xiaozhong Powder (Quanshen 2 g, Chonglou 1.5 g, Shannai 1 g, Zhitian Nanxing 1 g, Camphor 0.5 g), and 45 patients in the control group were treated with basic treatment + Ruyi Jinhuang Powder. After 4 weeks of treatment, the ulcer area of the observation group was significantly smaller than that of the control group ( $2.30 \pm 0.61$  vs  $1.19 \pm 0.46$ ), and the therapeutic effects of pain, swelling and lesion range were significantly better than those of the control group. Weiwei Jia<sup>[18]</sup> randomly divided 60 patients with diabetic foot into two groups, the observation group and the control group, 30 cases in each group. The control group used sensitive antibiotics and controlled blood glucose. The observation group was externally applied with Zidan gauze on the basis of the control group. Results In the observation group, 13 cases were cured, 12 cases were markedly effective, 5 cases were effective, and the total effective rate was 100 %. And the wound swelling subsided time and wound healing time was significantly less than the control group. It is suggested that Zidan gauze can promote wound healing by controlling bacterial infection and reducing inflammatory response.

### 3.3. Chinese medicine fumigation

Chinese medicine fumigation is to add the treated Chinese medicine liquid to the Chinese medicine steam instrument, and use the steam generated by the heated liquid to fumigate the local area. This method is more conducive to the absorption of the active ingredients of the drug by the human body. Si Xiong<sup>[19]</sup> compared the clinical efficacy of moxibustion alone and moxibustion combined with traditional Chinese medicine fumigation by controlled trial. 100 patients with DF were randomly divided into two groups according to the ratio of 1: (1) All patients were given routine debridement after oral administration of metformin hydrochloride and aspirin enteric-coated tablets. The control group was treated with moxibustion (Bafeng, Sanyinjiao, Zusanli, etc.). The experimental group was treated with traditional Chinese medicine fumigation (Spatholobus suberectus, Salvia miltiorrhiza, Panax notoginseng powder, etc.) for 30 min each time on the basis of the control group. After one month, the wound area of the two groups after treatment was smaller than that before treatment, and that of the experimental group was smaller than that of the control group. The serum levels of tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) and hypersensitive C-reactive protein (hs-CRP) in the two groups after treatment were lower than those before treatment, and the experimental group was lower than the control group. It is suggested that traditional Chinese medicine fumigation has obvious anti-inflammatory effect and significant clinical effect. Lingzhi Bao<sup>[20]</sup> developed appropriate hypoglycemic plans, microcirculation elasticity improvement, nutritional support, and other treatment methods for a control group of 25 patients based on their specific conditions. The study group was treated with traditional Chinese medicine fumigation (Angelica sinensis, Chuanxiong, Salvia miltiorrhiza, Guizhi, etc.) for 30 min on the basis of the reference group. After 20 days, the total effective rate of the study group was significantly higher than that of the reference group (92.0 % vs 68.0 % ). Yanhong Zhang<sup>[21]</sup> divided 80 patients with DF into control group

and treatment group, 40 cases in each group. The control group was treated with western medicine + nursing intervention. In the study group, western medicine treatment + nursing intervention + traditional Chinese medicine fumigation treatment (Tougucao, Spatholobus suberectus, Myrrh, Ramulus Cinnamomi, Salvia miltiorrhiza) was fumigated for 30 minutes each time. After 20 days, 26 cases were markedly effective in the study group, 12 cases were effective, 2 cases were ineffective, and the total effective rate was 95 %. And the nursing satisfaction of the study group was higher than that of the control group.

### 3.4. Acupuncture Therapy

Acupuncture therapy is a kind of treatment method with traditional Chinese medicine characteristics, in which filiform needles are inserted into acupoints or tapped along meridians. In recent years, it has been widely used in the treatment of DF. Xiaowei Li et al. [22] used acupuncture combined with western medicine to treat DF. 80 DF patients were divided into control group and study group by random number table method, 40 cases in each group. The control group was treated with insulin + cilostazol. On the basis of the control group, the study group was treated with acupuncture at Zusanli, Yinlingquan, Sanyinjiao and other acupoints. The needle was inserted and twirled, and the needle was retained for 30 minutes after getting qi. In and moxibustion. After 8 weeks, 13 cases were cured, 17 cases were markedly effective, 7 cases were effective and 3 cases were ineffective in the study group. The total effective rate was 92.50 %. After treatment, the basic fibroblast growth factor (bFGF) of DF patients in the study group was lower than that in the control group, and the vascular endothelial growth factor (VEGF) and serum insulin-like growth factor-1 (IGF-1) were higher than those in the control group. The wound healing time was lower than that of the control group, and the wound healing rate was higher than that of the control group. It shows that acupuncture can promote wound healing by regulating the levels of bFGF, VEGF and IGF-1. Yinlu Cui [23] believes that qi deficiency and blood stasis, toxin damage the pulse is the basic pathogenesis of this disease. Using self-made Tongbi Decoction (Astragalus, Atractylodes, Salvia miltiorrhiza, etc.), combined with acupuncture Guanyuan, Yanglingquan, Zusanli and other acupoints, the needle was needled to deqi, and the needle was retained for 30 minutes. The effective rate was 82.5 %, and the effective rate of the control group was 70 %. The difference was statistically significant ( $p < 0.05$ ). Ke Liu et al. [24] randomly divided 60 patients with DF into simple dressing change group, negative pressure wound therapy (NPWT) group, warm acupuncture + NPWT treatment group, 20 cases in each group. The simple dressing change group was treated with routine debridement and dressing change, and the NPWT group was treated with negative pressure device on the basis of the simple dressing change group. The dressing was changed once every four days, and the negative pressure device could be removed when the wound exudation was improved. Warm acupuncture + NPWT treatment group was treated with warm acupuncture on the basis of NPWT treatment group. Two groups of main points plus local selection of 1-2 points to do with the point, the main distribution of alternate use. After 8 weeks of observation, the wound healing process of the warm acupuncture + NPWT treatment group was significantly faster than that of the other two groups. The results of serum indicators showed that the levels of interleukin-6 (IL-6) and CRP in serum decreased significantly after warm acupuncture + NPWT treatment, and the levels of VEGF and IGF-1 increased significantly.

### 3.5. Massage

Tuina massage is a physical therapy method of pushing, holding, pressing, kneading, lifting and kneading on local acupoints or meridians. Xiaohong Fan [25] divided 126 DF patients into control group and study group. The control group was treated with conventional western medicine such as hypoglycemic drugs and promoting blood circulation and removing blood stasis. On the basis of the control group, the study group was treated with Taohong Siwu Decoction foot bath and foot acupoint massage (adrenal gland, spleen, stomach, pancreas, foot pituitary and other reflex areas), 30 min / time, once daily. Results The study group was far superior to the control group in terms of improvement, limb skin color, limb soreness, limb pain, and limb movement limitation. After treatment, the ankle brachial index of the study group was significantly higher than that of the control group. Xia Huang [26] covered 32 patients in the control group with sterile gauze after debridement and dressing change. The patients in the observation group were treated with traditional Chinese medicine wet compress (Sophora flavescens, Atractylodes, Phellodendron, etc.) combined with acupoint massage (Yanglingquan, Sanyinjiao, Zusanli, Yongquan, Taichong). Each acupoint was kneaded for 15 s, once in the morning and once in the evening. After three months, the total effective rate of the observation group was significantly higher than that of the control group (90.63 % vs 58.75 %). The wound healing rate of the observation group was higher than that of the control group, and the levels of CRP and IL-6 inflammatory

factors in the observation group were significantly lower than those in the control group. It is suggested that traditional Chinese medicine wet compress combined with acupoint massage can reduce inflammatory reaction and promote wound healing. Ying Chen et al. [27] randomly divided 150 DF patients into control group, observation group 1 and observation group 2. 50 cases in each group were given necessary diabetic diet, blood glucose control, basic symptomatic treatment and so on. The control group ethacridine lactate gauze wet compress local. The observation group 1 was treated with wet compress of traditional Chinese medicine (Huangqin, Huanglian, Huangbai, Kushen, etc.) on the basis of the control group. The observation group 2 was treated with acupoint massage (Zusanli, Sanyinjiao, Taixi) on the basis of the observation group 1. Yanglingquan, etc.) 1-3 times / day, 20 minutes each time. In addition, the patient self-massages from the foot to the knee joint, with fever as the degree, once in the morning and evening each day, 15-30 minutes / time. After 1 month, observe the ulcer size of group 1 and group 2. Ulcer depth is less than the control group. Transcutaneous oxygen partial pressure, ABI and foot skin temperature were higher than those in the control group.

### 3.6. Removing rot and clearing tendons

Jing Wang [28] randomly divided 100 patients with DF into conventional debridement group and traditional Chinese medicine treatment group. There were 50 cases in each group. The traditional Chinese medicine treatment group was treated with Xi's Qufu Qingjin surgery combined with Rhodiola ointment ( Rhodiola micropowder granules, sesame oil, medical yellow wax ) for external application. Xi's Qufu Qingjin operation ( after routine disinfection, cut or expand the wound, fully expose the necrotic tissue, muscle and tendon "pecking method "to remove the necrotic tissue, fascia and tendon at the lesion ) was applied twice a day. After one month, 11 cases were cured, 24 cases were markedly effective, 13 cases were effective, 2 cases were ineffective, and the total effective rate was 96 %. The decrease of TNF- $\alpha$ , IL-6, VEGF, bFGF and other factors in the traditional Chinese medicine treatment group was much higher than that in the conventional debridement group, and the area of granulation tissue in the traditional Chinese medicine treatment group was larger than that in the conventional debridement group, and the ulcer area was smaller than that in the conventional debridement group. The inner diameter of blood vessels and the blood flow velocity of dorsalis pedis artery in the TCM treatment group were larger than those in the conventional debridement group, suggesting that the mechanism of Qufu Qingjin surgery combined with Hongjingtian ointment in the treatment of DF may be closely related to its inhibition of inflammatory indicators and improvement of dorsalis pedis artery blood flow. Hechen Huang [29] divided 78 patients with DF into experimental group and control group according to the random number table method. Both the control group and the experimental group had basic treatment (health education, blood glucose control, etc.). The control group was treated with routine debridement and dressing change, once a day, for a total of two months. The experimental group was treated with tendon clearing (incision of skin) on the basis of the conventional group. Drainage layer by layer, remove carrion, tendon, fascia) combined with traditional Chinese medicine application, traditional Chinese medicine filling. After two months, the wound exudation and wound area of the experimental group were smaller than those of the control group. The pain and swelling around the wound were significantly improved. In the experimental group, 20 cases were cured, 8 cases were markedly effective, 7 cases were effective, 4 cases were ineffective, and the total effective rate was 89.74 %.

## 4. TCM internal and external treatment

On the basis of conventional treatment, Yaou Niu [30] used oral administration of traditional Chinese medicine and external washing of traditional Chinese medicine to treat 46 DF patients. Internal use of Salvia miltiorrhiza, yam, Achyranthes, safflower, peach kernel, red peony root, astragalus, atractylodes, spatholobus stem, earthworm. Ligusticum wallichii and angelica sinensis were added to those with weak qi and blood. Spleen wet resistance with Poria, Alisma, Coix seed. The traditional Chinese medicine external washing prescription selects myrrh, frankincense, angelica, honeysuckle, safflower, chrysanthemum, coptis chinensis, wulingzhi, licorice, and the above-mentioned drug decoction to take the decoction for external washing, continuous soaking for 30 min, once a day, continuous treatment for two weeks. Results 15 cases were markedly effective, 22 cases were effective, 9 cases were ineffective, and the total effective rate was 80.43 %. Li Yuan [31] randomly divided 80 patients with DF into control group and study group, 40 cases in each group. The control group was treated with routine treatment, and the study group was treated with oral administration and external application of traditional Chinese medicine on the basis of routine treatment. The main prescription of traditional Chinese medicine is Chuanxiong, Dilong, Niuxi, Chishao, Taoren, Gegen, Jixueteng, Shenghuangqi, Maidong, Honghua. The

patients with ulceration and decay were added with honeysuckle, forsythia, and Scrophularia. Yang deficiency plus epimedium, psoralen, dodder. One dose per day, twice a day, 15 days for a course of treatment. Angelica, phellodendron, dandelion, coptis, rhubarb decoction of the above drugs. The gauze strip soaks the wound surface for external application. Depending on the situation, it can be inserted into the deep part of the ulcer, and then the wound surface is rinsed with the liquid. Once a day, each time 10-20ml, a course of 15d. After 15 days of treatment, 22 cases were cured, 16 cases were markedly effective, 2 cases were ineffective, and the total effective rate was 95.00%. Limb pain, numbness and skin ulcers were significantly relieved. Ruiying Qiao<sup>[32]</sup> randomly divided 86 patients with diabetic foot into observation group and control group, 43 cases in each group. The control group improved circulation, nutrition nerve and other conventional treatment. On the basis of the control group, the observation group was treated with compound cortex phellodendri liquid coating (forsythia, cortex phellodendri, honeysuckle, dandelion, centipede) and modified Simiao Yong'an decoction (honeysuckle, scrophulariae, angelica, licorice, dandelion, cortex phellodendri, earthworm, red peony root, cortex moutan, raw rehmannia, astragalus). Those with obvious pain were added with Angelicae Dahuricae Radix and Corydalis Rhizoma. Compound cortex phellodendri liquid coating conventional washing, if necessary, deep washing, sterile gauze infiltration compound cortex phellodendri liquid wet compress, 1-2 times / d. Chinese medicine decoction twice, 200ML / time, 2 times / day. After 1 month, 21 cases were markedly effective, 20 cases were effective, 2 cases were ineffective, and the total effective rate was 95.35%. The observation group was significantly better than the control group in terms of wound improvement, granulation tissue growth, wound healing time, etc., and the blood flow velocity and blood perfusion of the dorsal foot in the observation group were better than those in the control group.

## 5. Summary

In summary, diabetic foot is lingering and difficult to heal, and the course of disease is long. Modern Chinese medicine treatment has its own advantages and characteristics. First of all, Chinese medicine treatment has a systematic and scientific theoretical basis. It not only emphasizes the combination of disease differentiation and syndrome differentiation, the combination of internal treatment and external treatment, but also has a holistic concept and pays attention to the conditioning of the whole body. There are many kinds of treatment methods, including oral administration of traditional Chinese medicine and external washing. A variety of methods, such as external application, fumigation, acupuncture, massage, anti-corruption and tendon-clearing techniques, play an indispensable role in the treatment of diabetic foot. Secondly, traditional Chinese medicine has a long history of treating diabetic foot, with definite curative effect and low price. It can greatly relieve the economic pressure of patients. Finally, compared with western medicine, the adverse reactions of traditional Chinese medicine treatment are greatly reduced, and the patients' acceptance is higher. Of course, traditional Chinese medicine treatment also has its disadvantages. There are many literatures reporting the clinical experience of well-known experts in China. Big data clinical research can be carried out to provide solid data support for further research on expert experience. In terms of therapeutic mechanism, traditional Chinese medicine treatment of DF can regulate the levels of vascular endothelial growth factor (VEGF), serum insulin-like growth factor-1 (IGF-1), basic fibroblast growth factor, (bFGF) CRP and IL-6 inflammatory factors. Other molecular biological mechanisms can be further explored.

## References

- [1] Chinese Diabetes Society, Chinese Society of Infectious Diseases, Chinese Society for Tissue Repair and Regeneration, et al. Chinese guideline on prevention and management of diabetic foot (2019 edition)(I) [J]. Chinese Journal of Diabetes Mellitus, 2019, 11(2): 92-108.
- [2] Margolis DJ, Malay DS, Hoffstad OJ, et al. Incidence of diabetic foot ulcer and lower extremity amputation among medicare beneficiaries, 2006 to 2008[M]. Rockville (MD): Agency for Healthcare Research and Quality (US), 2011(17): 22049565.
- [3] Skrepnek Grant H, Mills Joseph L, Lavery Lawrence A, et al. Health Care Service and Outcomes Among an Estimated 6.7 Million Ambulatory Care Diabetic Foot Cases in the U.S.[J]. Diabetes care, 2017, 40(7):936-942.
- [4] Peripheral Vascular Disease Professional Committee of Chinese Association of Integrative Medicine. Chinese Expert Consensus on the Prevention and Management of Diabetic Foot with Integrative Medicine (1st edition) [J]. Journal of Vascular and Endovascular Surgery, 2019, 5(5):379-402.
- [5] Xu Xuying. China's Prevention Treatment Guidelines for Diabetic Foot [J]. Chinese Journal for Clinicians, 2023, 51(4):394-397.

- [6] Jia Hui, Yang Bohua. Shallow about Experience of Yang Bohua in TCM Treating gangrene of digit [J]. *Journal of Basic Chinese Medicine*, 2012, 18(7):748-749.
- [7] Song Wei, Ai Rudi, Xiao Min, et al. Master of Traditional Chinese Medicine Surgery Ai Rudi's Experience in Using "General Methods" to Distinguish and Treat Antlers [J]. *Lishizhen Medicine and Materia Medica Research*, 2021, 32(10):2519-2521.
- [8] Xu Hongtao, Xu Yongcheng, Yang Jianfei, et al. Clinical Effect of Modified Gancao Fuzi Decoction on Thromboangiitis Obliterans of Cold Coagulation in Vein [J]. *World Journal of Integrated Traditional and Western Medicine*, 2023, 18(11):2259-2263.
- [9] Zhang Bang, Ma Haitao, Cui Yan. Cui Gongrang's Experience in Treating Gangrene Based on the Theory of "Wound Bed Preparation" [J]. *World Journal of Integrated Traditional and Western Medicine*, 2020, 15(10):1805-1808.
- [10] Que Huafa, Tang Hanjun, Xiang Huanyu, et al. Health-Supporting and Blood-Activating Therapy and Syndrome Differentiation in Stage for Diabetic Foot Gangrene in 71 Cases [J]. *Shanghai Journal of Traditional Chinese Medicine*, 2003(10):30-32.
- [11] Li Wenyan, He Chunhong, Zhang Jingyun. Chinese Medicine Fumigation and Washing in the Treatment of Diabetes Foot [J]. *Guangming Journal of Chinese Medicine*, 2023, 38(46):4618-4620.
- [12] Yang Jiazhou. Clinical Observation on Huoxue Shengji Recipe in Treating Diabetic Foot [J]. *Chinese Medicine Modern Distance Education of China*, 2022, 20(10):100-101.
- [13] Chen Guoxiang. Clinical Observation on Self-made Wenyang Sanyu Foot Bath in the Treatment of Diabetic Foot of Yang Deficiency and Blood Stasis [J]. *Guangming Journal of Chinese Medicine*, 2019, 34(13):1952-1954.
- [14] Dong Jian. Clinical Observation of Targeted Nursing Combined with Chinese Herbal Foot Bath on Patients with Diabetic Foot [J]. *Chinese Medicine Modern Distance Education of China*, 2020, 18(2):135-136.
- [15] Yu Tianyi, Liang Xuwei, Zhao Gang. Clinical Observation on External Application of Chuangyang I in Treating Diabetic Foot Ulcer of Damp Heat Toxin Excess Type [J]. *Chinese Journal of Surgery of Integrated Traditional and Western Medicine*, 2022, 28(02):248-251.
- [16] Liu Yingying. Ruyi Jinhuang Powder in the Treatment of Diabetic Foot of Dampness-heat in Lower Jiao Type [J]. *Guangming Journal of Chinese Medicine*, 2024, (06):1181-1183.
- [17] Wang Shuang. The Application of External Application of Tianlou Jiedu Xiaozhong Powder in Patients with Diabetic Foot [J]. *Guangming Journal of Chinese Medicine*, 2020, 35(13): 2016-2018.
- [18] Lei Weiwei. Clinical Observation on Zidan Gauze External Application in the Treatment of Diabetic Foot [J]. *Chinese Medicine Modern Distance Education of China*, 2017, 15(21):88-90.
- [19] Si Xiong. The effect of moxibustion combined with traditional Chinese medicine fumigation on the treatment of elderly patients with diabetic foot and its impact on inflammatory factor levels [J]. *Medical Equipment*, 2021, 34(20): 107-108.
- [20] Bao Lingzhi. Chinese Herbal Medicine Fumigation and Washing in the Treatment and Nursing of Diabetic Foot [J]. *Guangming Journal of Chinese Medicine*, 2020, 35(06):926-928.
- [21] Zhang Yanhong. Clinical Observation on the Treatment and Nursing of Diabetic Foot by Traditional Chinese Medicine Steaming Therapy [J]. *Guangming Journal of Chinese Medicine*, 2021, 36(04): 648-650.
- [22] Li Xiaowei, Yun Zhe, et al. Acupuncture combined with Western medicine in the treatment of diabetic foot in 40 cases [J]. *Global Traditional Chinese Medicine*, 2018, 11(08): 1255-1257.
- [23] Cui Yinlu, Wang Xin, Zou Benhong. Discussion on the Significance of Acupuncture Combined with Tongbi Decoction on Diabetic Foot with Deficiency of Qi and Yin [J]. *Guangming Journal of Chinese Medicine*, 2020, 35(23):3764-3766.
- [24] Liu Ke, Liu Zhichuan. Effect of warm acupuncture combined with NPWT technique on serum VEGF, IGF-1, IL-6 and CRP in patients with diabetic foot [J]. *Jilin Medical Journal*, 2019, 40(01):24-27.
- [25] Fan Xiaohong. Taohong Siwu Tang combined with foot reflex zone massage for the treatment effect of diabetic foot [J]. *Reflexology and Rehabilitation Medicine*, 2018, 27(04): 102-103.
- [26] Huang Xia. The effect of traditional Chinese medicine wet compression combined with foot acupoint massage on the treatment of diabetic foot ulcers [J]. *Modern Diagnosis and Treatment*, 2023, 34(17): 2553-2556.
- [27] Chen Ying, Gan Yu, Dai Lu, et al. A randomized controlled study on the treatment of diabetic foot ulcer by Chinese medicine wet compress combined with acupoint massage [J]. *Chinese Journal of Modern Drug Application*, 2023, 17(07):142-145.
- [28] Wang Jing, Fan Li, Li Wei. Clinical Study on Method of Dispelling Ulcer and Clearing Tendons Combined with Rhodiola Root Ointment for External Application in the Treatment of Diabetes Foot Ulcer [J]. *Henan Traditional Chinese Medicine*, 2022, 42(10):1547-1551.
- [29] Wang Lixiang, Huang Renyan, Liu Guobin. Clinical Efficacy of Therapy of Clearing Sinew

*Combined with Zizhu Ointment in Treatment of Diabetic Foot Sinew Gangrene [J]. Liaoning Journal of Traditional Chinese Medicine, 2023, 8(07):102-105.*

[30] Niu Yaou. *Clinical Observation on Oral Administration and External Application of Chinese Medicine in the Treatment of Diabetic Foot [J]. Chinese Medicine Modern Distance Education of China, 2023, 21(06):127-128.*

[31] Li Yuan. *Clinical Observation on Oral Administration of Buyang Huanwu Decoction and External Washing of Compound Huangbai Solution in the treatment of Diabetic Foot Ulcer [J]. Chinese Medicine Modern Distance Education of China, 2020, 18(09):76-77.*

[32] Qiao Ruiying, Zhang Mingwei, Cai Hong. *Therapeutic Efficacy Analysis of Simiao Yongan Decoction Plus Flavor Combined with Compound Huangbai Liquid in the Treatment of Diabetic Foot with Dampness-heat-toxicity Exuberance Type [J]. Diabetes New World Magazine, 2023, 26(20):24-27.*