

A case report of an effective treatment for diabetic foot ulcers with integration of traditional Chinese medicine and Western medicine

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Abstract

Diabetes contributes 75–85% of the factors predisposing to foot amputations, usually in association with infection and gangrene. The treatment of foot ulcers is expensive, and the effectiveness of treatment varies. We report herein a case of a diabetic foot ulcer that was treated with integrated traditional Chinese and Western medicine, with desirable cost-effective results. Traditional Chinese medicine (TCM) therapeutic principles include improving the spleen, nourishing yin, regulating qi, and resolving dampness, as well as activating stagnant blood. Western medicine includes wound debridement, skin grafting, and use of insulin, antibiotics, and vasodilators. The patient was treated with a holistic multidisciplinary approach (i.e., a combination of TCM and Western medicine, surgical management, education for diabetic foot care, and psychological counseling). Without this approach, the patient might have ended up with foot amputation and/or sepsis. © 2009 Elsevier Inc. All rights reserved.

Keywords: Diabetic foot; Integrated traditional Chinese and Western medicine; Cost

1. Introduction

A foot ulcer caused by peripheral neuropathy, vascular insufficiency, and infection is the most serious indication for foot amputation. The cumulative lifetime incidence of foot ulcers in diabetic patients can be as high as 15%, making it a leading cause of nontraumatic amputations worldwide (Boulton, 2004). An amputation is performed every 30 s throughout the world; 85% of amputations are preceded by an ulcer (Edmonds, 2006). This situation will worsen in the future as the incidence of foot ulcers increases with the ever-growing global prevalence of type 2 diabetes, particularly in developing countries (Andrew, Vileikyte, & Ragnarson, 2005; Ramachandran, 2004; Wong & Wang, 2006).

In this article, we present our experience in treating a case of diabetic foot ulcer with integrated traditional Chinese and Western medicine, from which we introduce a cost-effective way to manage diabetic foot ulcers.

2. Case report

A 74-year-old man who has been suffering from type 2 diabetes mellitus for more than 20 years and from diabetic retinopathy for 4 years presented to our clinic on April 10, 2005, with a gangrenous heel of the left foot, which primarily manifested as a foot ulcer 3 months before. Although he had been informed by two different surgeons that he will likely die of severe infection without below-the-knee amputation, the patient refused surgery. The patient complained of thirst, abdominal distention, diarrhea (three to four times per day), fatigue, cold sensation of the lower limbs, and asthenia when walking, and he was bedridden most of the day. He denied having had fever or chills. Physical examination demonstrated a height of 178 cm and a weight of 62 kg. His blood

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pressure was within the normal range (135/75mmHg). His lower limbs were relatively cold compared to his other body parts. His left dorsalis pedis area was edematous and erythematous. His dorsalis pedis and posterior tibial arteries were palpable, but with feeble pulses. A pale yellow wound bed located at the heel of the left foot was approximately 7.0×5×3cm in size. It had a slightly foul discharge with no malodor, from the base of which calcaneus was evident (Fig. 1). Blood tests revealed the following: hemoglobin, 140g/l; total white blood cell count, 10.7×10^9 ; granulocytes, 78%; fasting glucose, 13.5mmol/l; postprandial glucose, 16.8mmol/l; HbA_{1c}, 14.1%. Radiographs suggested a thickened calcaneal periosteum without osseous impairment. The tongue was light red, with circuitous veins under it, while the buds of the tongue were white and abundant. A slack and powerless radial artery pulse was palpated. The main diagnoses included type 2 diabetes mellitus, a gangrenous plantar region of the left heel (Wagner classification IV), and diabetic retinopathy with visual impairment of both eyes.

The patient was advised on a special diet for diabetes. A pair of soft cotton shoes that fit the patient's feet was made, which was then worn by the patient. Health education related to diabetes mellitus and diabetic foot, such as avoiding pressure on the impaired limb, was provided to the patient and his caregivers. In regards to the impaired foot and eyes, the patient was told to reduce physical activities in order to reduce load on the feet, which coincided quite well with his own liking. The clinician performed daily inspection of the feet and palpation of the dorsalis pedis pulse. Insulin was injected subcutaneously as 14 U of Humulin-R (short-acting) insulin at half an hour before breakfast, 10 U of Humulin-R (short-acting) insulin at half an hour before lunch, and 10 U of Humulin-R (short-acting) insulin with 4 U of NPH (intermediate-acting) insulin at half an hour before supper to maintain a fasting glucose level below 6.1mmol/l, a postprandial glucose level below 7.8mmol/l, and an HbA_{1c} level below 7%. Cefuroxime sodium (2g/day) was given intravenously for 12 days until the edematous and erythe-



Fig. 1. Photograph showing a wound bed at the plantar area of the left heel of a 74-year old man with type 2 diabetes mellitus.

matous left dorsalis pedis had returned to normal. In order to improve microcirculation, the patient was given two vasodilators, troxerutin (0.3g/day) and Sanqi Panax Notoginseng (20ml/day), intravenously for two therapy cycles (each cycle lasted for 14 days). Mecobalamin, one of the two coenzyme forms (the other is adenosylcobalamin) of vitamin B12, was injected intramuscularly at 500mg/day for 28 days (two therapy cycles). As reported by [Yaqub, Siddique, and Sulimani \(1992\)](#), mecobalamin is an effective treatment for diabetic neuropathy.

In the perspective of traditional Chinese medicine (TCM), the differential diagnoses include the following: qi and yin deficiency, dampness stasis due to spleen asthenia, and qi stasis leading to blood stagnation (as reflected in the patient's symptoms, the features of the tongue, and the pulse characteristics at the beginning of hospitalization). The therapeutic principles used were as follows: improve the spleen, nourish yin, regulate qi, resolve dampness, and activate stagnant blood. Ten herbs were prescribed based on syndrome differentiation: Radix Astragali, 50 g; Radix Pseudostellariae, 30 g; Szechwan Lovage Rhizome, 30 g; Rhizoma Atractylodis Macrocephalae, 20 g; Radix Cyathulae, 30 g; Rhizoma Dioscoreae, 30 g; Rhizoma Anemarrhenae, 15 g; Semen Coicis, 30 g; lumbricus (earthworm), 10 g; Radix Glycyrrhizae, 5 g. The herbs and 1000 ml of potable water were put together into a TCM-extracting machine, which is a special device for decocting TCM herbs. After every decoction, 600 ml of decoction, which made up a potion of herbal medicine, remained. This potion of herbal medicine was divided equally into six medicine packages. Each time, one package (100ml) was given to patients for drinking 1 h before a meal, three times a day; this lasted for 4 months.

The wound was managed according to its clinical stages. During the initial stage (the first month), repeated nibble debridement/silkworm debridement was performed until there was no new necrosis observed and until the discharge from the wound had ceased. In addition, saline dressing therapy including 6 U of Humulin-R insulin, 10mg of anisodamine, and 0.2g of amikacin sulfate, which was applied on the wound every other day. During the middle stage (the second month to the fourth month), the dressing was applied every 2 days. The medications for the dressing were changed to a TCM herb called Qufushengji powder to eliminate necrotic tissues and to facilitate tissue regrowth. [Figs. 2 and 3](#) show gradual changes in the wound. In the final stage, punctuate skin grafting from the skin of the same thigh to the wound bed was performed after 3 months of herbal dressing. Two months later, the wound has healed, and the patient has remained free of ulceration, with a palpable pulse at the dorsalis pedis (this was the status at the time this article was written).

3. Discussion

Diabetic foot contributes 75–85% of the factors predisposing to amputations, usually in association with infection

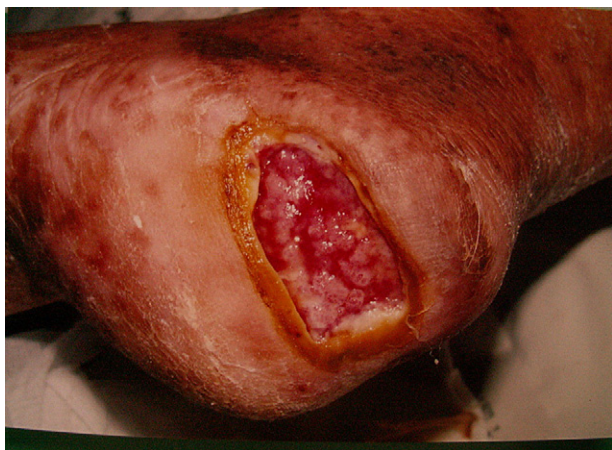


Fig. 2. The wound bed after herbal dressing every other day for 4 months.

and gangrene (Andrew et al., 2005). This condition will worsen in tandem with the increasing global prevalence of type 2 diabetes, and its impact will be seen mostly in developing countries (Andrew et al., 2005; Ramachandran, 2004; Wong & Wang, 2006). This condition poses a great burden, with both emotional and economic aspects, not only to the patient but also to the patient's caregivers (Nabuurs, Huijberts, & Nieuwenhuijzenk, 2005). A large retrospective cohort study revealed that the attributable cost for a patient with a new foot ulcer was US\$27,987 for 2 years after diagnosis, which was fivefold more than that for diabetic patients without ulcers (Scott, Newton, & Blough, 1999).

A diabetic foot can be defined as an ulceration and/or destruction of deep tissues associated with peripheral neurologic abnormalities and vascular disease, usually accompanied by infections (International Working Group on the Diabetic Foot, 1999). The mechanism of ulceration is very complex and is associated with many factors, which can be categorized into three distinct groups: pathophysiologic changes, anatomic deformities, and environmental influences (Dinh, 2006). The pathophysiologic changes lead to peripheral sensory neuropathy, peripheral autonomic deficits (Cavanagh, Lipsky, Bradbury, & Botek, 2005), peripheral vascular disease, and a compromised immune system that reduces wound-healing capability. The anatomic deformations are the consequences of motor neuropathy and Charcot neuroarthropathy. The environmental factors, such as infection and acute or chronic trauma, often act as the precursors of ulceration. In developing countries, lack of public education on diabetes and lower socioeconomic status contribute to ignorance on diabetic ulcers, ultimately leading to foot amputation.

The essential causes of neuropathy and vascular disease are hyperglycemia and other metabolic disorders. Hence, maintaining homeostasis of the internal environment and controlling blood glucose level are of high priority. Hyperglycemia, which is an independent risk factor for a major amputation, was corrected with insulin injection, and a stable blood glucose target ($HbA_{1c} < 7\%$, fasting glucose

$< 6.1 \text{ mmol/l}$, and postprandial glucose $< 7.8 \text{ mmol/l}$) was gradually achieved. A regimen consisting of TCM herbs, vasodilators, and agents to nourish nerves induced a vast improvement in fatigue and in the cold sensation of the lower limbs, and resolved the other symptoms, including thirst, abdominal distention, diarrhea, and fatigue. After 3 months of hospitalization, the patient began to feel a warm sensation in the lower limbs, which had developed better sensitivity to painful stimuli.

A diabetic foot ulcer is a unique type of chronic ulcer with its own characteristics, and its healing is much more difficult compared to that of an ordinary wound. The wound is classified into four stages according to the color of its base, which reflects the healing process: black phase (tissue necrosis stage), yellow phase (inflammation stage), red phase (granulation stage), and pink phase (epithelialization stage). We treated the wound based on this classification. The patient's foot ulcer was in the yellow phase. Hence, the most important strategy was to eliminate the bacterial, cellular, and necrotic burdens. Repeated nibble debridement/silkworm debridement was performed with concomitant saline dressing and antibiotic therapy to facilitate the transition from the yellow phase to the red phase (granulation stage). Once the wound bed had appeared to remain at the red phase with poor proliferation of granulation, which could not be stimulated by recombinant bovine basic fibroblast growth factor, the recombinant bovine basic fibroblast growth factor and the TCM herb were used. After the second dressing of Qufushengji powder, granulation was evident, which then gradually expanded and covered the calcaneus and wound bed. The residual wound, which was approximately $2.5 \times 2.5 \times 1 \text{ cm}$ in size, was transplanted with a punctuate skin graft. On follow-ups, no ulcer had relapsed, and the feet had maintained their mobility.

The mechanism of diabetic foot is very complicated, involving many different factors. Despite aggressive treatment for diabetic foot, individualized therapy must be tailored to each patient according to one's gender, age,



Fig. 3. The healed wound.

pathophysiology, expectations, and financial situation (especially in developing countries where the insurance system is very limited). As the patient did not have an infection, only a short period of antibiotic therapy was used, avoiding adverse reactions from long-term antibiotic administration. Nerve-nourishing agents and vasodilators were given to the patient throughout the treatment in order to improve his peripheral neuropathy and vascular disease. The TCM principle of “boosting qi, adding collateral dredging, activating stagnant blood, and dissolving stasis” was applied. The patient was treated with a multidisciplinary holistic approach (i.e., a combination of TCM with Western medicine, surgical management, education for diabetic foot, and psychological counseling). The outcomes were desirable.

The superiority of integrated traditional Chinese and Western medicine for diabetic foot is undeniable (Chen, 2005; Hu, Chang, Bao, Li, & Zhang, 2004). Insulin played a crucial role in controlling blood glucose, while TCM played an equivalent role in improving the symptoms, maintaining the internal environment, regulating the immune system, and reducing insulin resistance. The therapeutic principles include improving the spleen, nourishing yin, regulating qi, and resolving dampness, as well as activating stagnant blood. The patient’s confidence in the therapy increased considerably, leading to better compliance with the treatment.

During the long-term therapy with TCM herbs, the insulin dosage was had been tapered to 10 U of Humulin-R (short-acting) insulin at half an hour before breakfast, 8 U of Humulin-R (short-acting) insulin at half an hour before lunch, and 10 U of Novolin 30R at half an hour before supper to stabilize blood glucose level, which fluttered between 5.2 and 6.3mmol/l (fasting glucose) and between 6.5 and 7.8mmol/l (postprandial glucose).

Studies have indicated that TCM therapy for diabetic foot greatly decreases the amputation rate. In an analysis of 330 cases of severe diabetic foot in China by Hu et al. (2004), an amputation rate of 6.6% was reported, which was much lower than the amputation rate with either Western medicine or TCM alone. External TCM therapy requires different strategies according to different wound phases. For example, in the black and yellow phases, tissue injury must be avoided to preserve enough viable tissues to accelerate healing. TCM Qufushengji powder has a positive effect on necrotic tissue liquefaction, granulation, and proliferation. It is important to prescribe an appropriate proportion of Qufu (to get rid of slough) and Shengji (to facilitate tissue growth) according to the individual’s wound bed. As hydrargyrum is one of the components of Qufushengji powder, the dosage must be established with caution. The positive outcome of this case demonstrated that a combination therapy of Western medicine and oral and external TCM is a promising approach for treating diabetic foot.

Treatment of diabetic foot poses a great burden not only to developing countries but also to developed countries. It has been reported that the mean cost for the treatment of a single diabetic ulcer is US\$5227, and that treatment of a case of

Wagner classification IV diabetic foot costs US\$21,292 (Giovanni, Greta, & Muls, 2006). The challenge is how to deal with the increasing prevalence of foot ulcers as related to the increasing global prevalence of type 2 diabetes. Many cost-effective remedies such as honey (Jannifer & Mark, 2005) and maggot debridement (Edward & Philip, 2004) have been proven to be effective in wound healing. TCM is a very promising novel treatment not only for local treatment but also as a holistic approach.

Integrated traditional Chinese and Western medicine therapy is cost-effective compared with Western medicine therapy alone. The Wagner classification IV foot ulcer was cured at an expense of only ¥12,000 (US\$1560) during the entire course of treatment (2005–2006), which was only one fourth of the cost reported by Giovanni et al. (2006). We support the integrated traditional Chinese and Western medicine therapy for diabetic foot in the form of Chinese patented medicine or as an effective element in a holistic approach, leading to better results with lower cost. TCM has a unique theoretical system, and it has made a great contribution to the health of mankind. The underlying idea of TCM is the holistic concept of finding the relative dynamic balance of yin and yang, as well as searching for a harmonious state. The body and external environment together create an organic whole, and the body itself epitomizes the larger universe. The universe is the macrocosm, while the human being is a smaller microcosm within the larger macrocosm (Long et al., 1998). Having overcome barriers, TCM may contribute a cantus to the symphony of world medicine.

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