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Case Studies

Treatment of Diabetic Foot Osteomyelitis with Persian Medicine: A Case Report

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Abstract

Osteomyelitis of the lower extremity is a commonly encountered problem in patients with diabetes and is an important cause of amputation and admission to the hospital. The patient presented in this article was a 52-year-old diabetic man with a diabetic foot osteomyelitis who was referred to Vali-e-Asr Persian medicine clinic. He was treated with Persian medicine methods. The treatment methods of Persian medicine were: modification of lifestyle such as sleep and nutrition, oral herbal therapy, wound washing with herbal decoctions, dry cupping, wet cupping, venesection and leech therapy. During the period of 52 days, the foot ulcer and the osteomyelitis were improved. This case report demonstrates that using the capacities of Persian medicine in addition to conventional treatments, helped to markedly improve the patient's condition.

Keywords: Diabetic foot osteomyelitis; Persian medicine; Herbal therapy; Dry cupping; Wet cupping; Venesection; Leech therapy

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Introduction

Osteomyelitis of the lower extremity is a commonly encountered problem in patients with diabetes and is an important cause of amputation and admission to the hospital [1]. Diabetic foot osteomyelitis (DFO) is the consequence of a soft tissue infection that progresses into bone by breaching the cortex and invading the medullary cavity. It is estimated that 20% of infected diabetic foot ulcers will result in DFO. Infected diabetic foot ulcers in this patient group are associated with prolonged antibiotic therapy, hospitalization and surgery. Increased healthcare costs, adverse drug reactions and antibiotic resistance are associated with overuse of antibiotics [2].

An ulcer area larger than 2 cm^2, a positive probe-to-bone test result, an erythrocyte sedimentation rate of more than 70 mm/h, and an abnormal plain radiograph result are helpful in diagnosing the presence of lower extremity osteomyelitis in patients with diabetes [1]. Currently, MRI is widely used as the diagnostic modality of choice for an early diagnosis of pedal osteomyelitis because it gives extensive details of the nature and extent of both bony as well as soft tissue involvement [3].

It has not been established whether the optimal treatment of DFO is surgical intervention in conjunction with appropriate antibiotics or by systemic antibiotic pharmacotherapy alone [2]. A number of experts claim that early surgical excision of all infected or necrotic bone is essential. Others suggest that surgery should not be performed routinely, but instead only in patients who do not respond to antibiotic treatment or in case of particular clinical indications. Most patients, however, received prolonged courses of broad-spectrum antibiotics, which increase the risk of diarrhea caused by *Clostridium difficile* or the emergence of multidrug-resistant organisms [4]. Therefore, trying to use complementary medicine methods to treat this disease seems rational.

Persian Medicine consists of all the knowledge and practices used in diagnosis, prevention and elimination of diseases in Persia from ancient times to present. Persian scholars have expressed their experiences based on the theory of temperaments (*Mizaj*) and humors which is definitely different from conventional medicine. Temperaments have several types: temperate, hot, cold, dry, wet, hot and dry, hot and wet, cold and dry and cold and wet. Each of these temperaments, if get out of its natural state, causes the disease. So, in Persian medicine theory, temperament modification and removal of waste material and humors from the body form the basis of treatment [5].

In the resources of Persian medicine, soft tissue infections that penetrate deep into the tissues and damage them are mentioned by different names, such as "*Akeleh"*, "*khoraj"*, "*dobayleh"*, etc. In their description, it is mentioned that the infection and corruption which occurs in the tissues with the symptoms of wound, swelling, inflammation and purulent discharge, spreads rapidly and eats the flesh around it. In the treatment of these cases, the scholars of Persian medicine used venesection (*Fasd*) and herbal drugs to modulate the dystemperament and remove waste materials [6-7].

This article presents a DFO patient treated with Persian medicine.

Case Report

On 7/14/2022 a 52-year-old man, known case of diabetes, referred to Vali-e-Asr Persian Medicine Clinic, Enghelab Ave, Tehran, Iran. The patient had a diabetic foot ulcer on the right big toe with purulent discharge and numbness in the foot. He had been referred to conventional medicine, antibiotic treatment had been started and finger amputation was recommended. After starting antibiotic therapy, the patient developed itchy brown spots on the right leg. Therefore, antibiotic therapy was discontinued by conventional medicine doctors. Considering the side effects of antibiotic therapy for the patient and planning the surgical treatment by the conventional medicine, the patient refused to continue that treatment, and insisted on stopping the antibiotics and referring to Persian medicine clinic, so antibiotic therapy was discontinued respecting the patient's decision. At the time of referral to the Persian medicine clinic, despite the recommendation to continue the conventional medicine treatment by Persian medicine doctors, the patient did not do so. Written informed consent was obtained from the patient for the publication of this case report and any accompanying images, with assurance of anonymity.

The patient suffered from hypertension, and used Losartan 25 mg twice a day and Metoprolol 50 mg once a day. However, according to the patient, in spite of above medications, hypertension was not controlled. The patient used insulin injection to control blood glucose; In this way, 13 units of Novorapid® insulin three times a day (at morning, noon and night), in addition of 23 units of Lantus insulin® at night. In the test that was done before referring to the Persian medicine clinic, the patient's fasting glucose was 160 and hemoglobin A1c was 8%. The patient complained of stress and anxiety (based on the BAI questionnaire), as well as constipation (according to the definition of constipation in Persian medicine texts), and stated that his defecation is once every 2 days and with difficulty. The patient usually slept from 2:00 PM to 10:00 AM. On examination, the big toe of the right foot was swollen with purulent and bloody discharge (Figure 1). The dorsalis pedis pulse of the affected foot was weak and the foot was cold. The left foot had a normal pulse and temperature, and there was no numbness. Vital signs of the patient were as follows: OT: 37.1 PR: 78 RR:89 BP: 160/80

An MRI of the affected foot was performed for the patient, and the result was as follows: The signal change of T1 low, T2 high is seen in the distal phalanx of the big toe of the right foot, which suggests osteomyelitis. Edema of the plantar surface of foot and the proximal tendons of the

toes are seen (Figure 2).
In the first visit, the patient's sleep, nutrition and anxiety were managed. The patient was advised to gradually reduce his daytime sleep and increase his night sleep time so that the sleep time was set from 10-11 at night to 6-7 in the morning. In terms of nutrition, the patient was advised to follow the dietary recommendations for diabetes prescribed by conventional medicine; also, to avoid consuming slow-digesting foods (e.g. spaghetti, pasta, lasagna, fried food, etc.) industrial snacks, sauces and beverages, eggplant, lentils, coffee, cocoa and ice. He was advised to add rose water (*Rosa x damascena* Herrm.), saffron (*Crocus sativus* L.), cardamom (*Elettaria cardamomum* (L.) Maton), thyme (*Thymus vulgaris* L.) and cumin (*Cuminum cyminum* L.) to his diet.
The drugs prescribed in the first visit were:
1. Drinking a glass of whey protein mixed with 30 g of flixweed (*Descurainia sophia* Webb ex Prantl.), every morning on an empty stomach. In this way that the patient should boil the milk for 20 minutes, then turn off the heat. While the milk is hot, pour a little vinegar into it, then filtrate the yellow water over it (containing whey protein) and drink a glass of which mixed with 30 g of flixweed in 3 steps, 10 minutes apart. The patient should walk at intervals of 10 minutes and also avoid eating breakfast for an hour after drinking this mixture.
2. Drinking a brewed mixture of chicory (*Cichorium intybus* L.) seeds (5 g) and leaves (20 g) plus a little saffron in a glass of chicory distilled water.
3. Drinking a cup of herbal decoction of chamomile (*Matricaria chamomilla* L.), common malva (*Malva sylvestris* L.), willow bark (*Salix alba* (L.)), chicory root (*C. intybus*), pennyroyal (*Mentha pulegium* L.), thyme (*Thymus vulgaris*), *Nepeta menthoides* Boiss. & Buhse, worm wood (*Artemisia absinthium* L.) and lemon balm (*Melissa officinalis* L.); 5 g of each.
4. A glass of the mentioned decoction should be filtrated and the wound should be washed daily with it and bandaged with sterile gauze.
5. Dripping sweet almond oil in the nose at night before going to bed
6. Wet cupping therapy of the legs
Posterior of the lower legs, 10 cm below the Popliteal fossa was cleaned, and cupping was performed with disposable cupping glasses for a few minutes by a Persian medicine specialist. The suction of the glasses was gradually increased. After the skin under the glasses expanded and became red, some scratches on the skin's surface were made with a scalpel, and blood-letting was carried out in three 5-minute periods. At the end, the area was dressed with honey. Wet cupping was done in only one session. After the wet cupping, the patient's blood pressure decreased to 130/70. The patient was advised to use the above medicines in addition to recommendations of conventional medicine and also continue to dry-cup the legs every other day at home.
The patient referred again on 7/21/2022. He stated that the constipation is resolved and defecation is easily done 2-3 times a day. The patient's anxiety decreased and the sleeping time was adjusted according to the previous order. In the examination, vital signs were stable and blood pressure was 130/80. The brown spots on the leg had been faded and the patient stated that itching had also decreased significantly. The swelling of the other right toes had resolved. The wound of big toe was slightly inflamed and red, but there was no purulent discharge. The pulse of the dorsalis pedis of the right foot was a little stronger than before and the foot was warmer in touch than before. The patient stated that the numbness of the foot has somewhat decreased. In this session venesection of right saphenous vein was performed. The patient was advised to continue the previous treatments in addition to the treatments prescribed by conventional medicine, but instead of washing the wound with previous combined decoction, use sumac decoction to wash and after washing, bandage the wound with sterile gauze soaked in honey.
The patient referred for the third visit on 7/28/2022. Defecation was still easy, 2-3 times a day. Stress and anxiety had improved, vital signs were normal and blood pressure was 125/80. The itchy brown spots on the leg had disappeared. The foot wound did not have inflammation, redness or discharge and was healing (Figure 3).
The pulse of the dorsalis pedis of the affected foot was much better compared to the second visit, and the foot was warm. The patient mentioned that the numbness in the foot has decreased a lot. In the new test FBS was 93 mg/dL and HbA1c was 7.2%. In this session, venesection of left saphenous vein was performed. The patient was advised to continue consuming flixweed and whey, dripping sweet almond oil in the nose, washing the wound with sumac decoction and dressing with sterile gauze and honey, but the rest of the drugs were discontinued.
The patient referred for the 4th visit on 8/14/2022. The patient had no other complaints except a brief numbness of the foot, vital signs were normal in the examination, and the wound was healed. There were no redness, inflammation, or discharge (Figure 4).
The dorsalis pedis pulse of the affected foot was palpable and the foot was warm. In this visit, the patient's medication was discontinued and leech therapy was performed with 6 medicinal leeches around the wound. Only one leech therapy session was performed for the patient. The patient was advised to go to the radiology center for a new MRI of the affected foot one week after the leech therapy.
The patient referred on 9/4/2022. In the examination, the wound was completely healed, the numbness of foot had improved, and the patient had no specific complaints. The MRI report was as follows:
The soft tissue shows no abnormalities. The bone marrow signal, trabecular pattern, and epiphyseal lines are all normal. There are no subchondral signal changes and no

osteophytes. There is no evidence of abnormal soft tissue mass or abscess formation (Figure 5).
The patient was advised to continue the medications and prescriptions of conventional medicine.

Figure 1. Before treatment

Figure 2. MRI before treatment

Figure 3. During treatment

Figure 4. After treatment

Figure 5. MRI after treatment

Discussion

As expressed above, in the resources of Persian medicine, soft tissue infections that penetrate deep into the tissues and damage them are mentioned by different names, such as "*Akeleh"*, "*khoraj"*, "*dobayleh"*, etc. Recognizing the type of wound and the patient's temperament and based on that, herbal treatment, venesection (*Fasd*) and leech therapy are therapeutic measures that are used in the sources of Persian medicine for the treatment of infectious wounds [6-7].

The first advice to the patient was to follow the diet and medication recommended by conventional medicine, so that Persian medicine can be used as a complementary to conventional medicine in better treatment of the disease.

In Persian medicine, the first step of treatment of all diseases is lifestyle modification [6-7]. In this patient, some lifestyle issues such as nutrition, sleep and mental state needed to be corrected, which were the first recommendations of Persian medicine.

From the Persian medicine view point, adjusting the sleeping time improves the wound healing process [6-7]. Persian medicine scholars believe that the body has an inherent intelligence managing its affairs, called the Nature (*Tabiat-e-modabbereh*), which is planned by God. in Persian medicine, it indicates an innate power in the body with tact that controls all aspects of the body. It is not under the control of the person. It is believed that its acts are in the events of the best affairs for the body. In the sudden events happened for the body, reflexes of the body are under the control of the Nature (*Tabiat-e-modabbereh*) [8]. One of the scheduled things for the Nature (*Tabiat-e-modabbereh*) is sleep time, so its best is from early night to before sunrise. Therefore, if this time is not observed, the Nature (*Tabiat-e-modabbereh*) will weaken and the disease will overcome the body [6-8]. In the above patient, when we adjusted the sleeping time, the patient's stress and anxiety was also decreased.

As mentioned, the production of appropriate humors in the body is the basis of maintaining health and treating diseases in Persian medicine, and any factor that changes the quality and quantity of the humors can cause disease or interfere with its improvement. Since humors are produced from food, so diet modification is another important principle of lifestyle in Persian medicine [6-7]. In addition to the precautions of the diabetic diet, avoiding industrial and processed foods and beverages, some slow-digesting foods (e.g., spaghetti, pasta, lasagna, fried food, etc.), coffee, cocoa, lentils, eggplant and ice is also important from the Persian medicine point of view. These foods produce inappropriate humors which disturbs the wound healing process.

As mentioned, the patient was advised to use rose water (*R. damascena*), saffron (*C. sativus*), cardamom (*E. cardamomum*), thyme (*T. vulgaris*) and cumin (*C. cyminum*) in his diet. Persian medicine believes that rose water penetrates quickly into different parts of the body and strengthens the Nature (*Tabiat-e-modabbereh*) to fight disease; it also creates euphoric feeling. Saffron reduces anxiety and strengthens the body and Nature (*Tabiat-e-modabbereh*). In addition, it protects the humors from corruption and prevents their infection. Saffron also helps the drugs to reach different organs and is a skin cleanser. Cardamom is anti-anxiety. Thyme and cumin clean up the body organs from moisture and waste materials that cause and deteriorate the infection [9].

The antimicrobial and anti-inflammatory properties of rose water, especially in skin infections, have been described in conventional medicine articles [10]. Saffron, cardamom, cumin and thyme also exhibit antimicrobial and anti-inflammatory activities [11-13].

One of the first things that was prescribed to the patient was bovine whey protein. Scholars of Persian medicine believe that whey protein cleans the body and especially the vessels from waste materials and thereby improves the blood flow in the vessels. It also improves constipation and prevents infection of the humors [14]. The special method of consuming whey protein, as mentioned in the case report, on an empty stomach and at 10-minute intervals, as well as mixing it with flixweed (*D. sophia*), strengthens the aforementioned properties. Conventional medicine believes that bovine whey proteins contain β-lactoglobulin, α-lactalbumin, immunoglobulins, bovine serum albumin, bovine lactoferrin and lactoperoxidase, together with other minor components which possess antimicrobial, anti-inflammatory and immunomodulatory activities [15]. Flixweed exhibits antimicrobial, analgesic, antipyretic and anti-inflammatory effects. The laxative properties of whey protein and flixweed have also been stated in various articles. In addition, whey protein and flixweed are potent antidiabetic agents [16-18].

Another medicinal combination prescribed to the patient in the first visit was a brewed mixture of chicory (*C. intybus*) seeds and leaves plus a little saffron in the chicory distilled water. Persian medicine believes that chicory cleans the body organs, especially vessels, from waste materials and also possess anti-inflammatory, antiseptic and antipyretic effects. The saffron that was added to the medicinal composition was to drag the effect of the medicine to the organ and to help the medicine to have a better effect on the organ with its immunomodulatory effect and the property of strengthening the Nature (*Tabiat-e-modabbereh*) [9,14]. Conventional medicine studies demonstrate the antimicrobial effects of chicory seeds and leaves especially against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Candida albicans* and *Escherichia coli* [19]. chicory also possess antidiabetic, anti-inflammatory, anti-itching, analgesic, sedative, immunological, and wound healing effects [20,21].

Therefore, because in diabetic foot ulcers, vascular disorders are one of the main problems of the patient, it is useful to prescribe such herbal drugs that play a role in purging the vessels.

The other prescription was herbal decoction of chamomile (*M. chamomilla*), common malva (*M. sylvestris*), willow bark (*S. alba*), chicory root (*C. intybus*), pennyroyal (*M. pulegium*), thyme (*T. vulgaris*), *N. menthoides*, worm wood (*A. absinthium*) and lemon balm (*M. officinalis*). The patient was advised not only to drink this decoction, but also to wash the foot ulcer with it. Persian medicine experts believe that all of these medicinal plants either orally or topically possess anti-inflammatory, antiseptic and wound healing properties. In the Persian medicine view point chamomile, chicory, thyme, *N. menthoides* and worm wood are vascular purgatives and clean the body organs, especially vessels, from waste materials. Chamomile, thyme, *N. menthoides* and lemon balm have antitoxic properties. *N. menthoides* and lemon balm are anti-anxiety, strengthen the body powers and the Nature (*Tabiat-e-modabbereh*). Chamomile, willow bark and thyme are antipyretic. Willow bark and worm wood are astringent and common malva prepares waste materials for elimination from the body, and is laxative and anti-itching [9,14].

Conventional medicine represents that chamomile, thyme, common malva, chicory root, willow bark, pennyroyal, *N. menthoides*, worm wood and lemon balm have significant antimicrobial activity. Antidiabetic, anti-inflammatory and wound healing properties of chamomile are represented in the articles. Willow bark is an analgesic, anti-inflammatory and antipyretic. Pennyroyal exhibits antihyperglycemic effects, as well as promoting infected wound healing by increasing antibacterial properties, decreasing inflammatory phase and accelerating proliferation phase of wound healing process [22-31].

Common malva has antinociceptive, wound-healing and anti-inflammatory properties [23]. *N. menthoides* and lemon balm synergistically act against anxiety and depression [32]. *N. menthoides* also has antinociceptive and anti-inflammatory effects [33]. Antidiabetic and anti-inflammatory effects of Melissa officinalis are demonstrated in various articles [34].

As mentioned, the patient was advised to put a drop of sweet almond oil in the nose at night to reduce stress and improve sleep quality. Persian medicine believes that insomnia is caused by dry temperament of the brain, so using sweet almond orally and its oil topically strengthens the brain and provides moisture, so improves the quality of the patient's sleep. Especially dripping sweet almond oil into the nose accelerates the absorption of moisture in the brain. In addition, sweet almond and its oil are also anxiolytic [6-7]. Conventional medical investigations also state that eating sweet almonds improves sleep and reduce anxiety. Additionally, several clinical trials have shown that almond oil used in aromatherapy to dilute lavender oil potentiated its sleep quality, antistress and anxiolytic effects [35-36].

The patient's blood pressure was 160/80 when he was referred, and in the first visit, the patient's legs was wet-cupped, and after the wet-cupping (*Hijama*) therapy, the blood pressure decreased to 130/70. Articles demonstrated that wet-cupping therapy is effective for reducing systolic blood pressure in hypertensive patients [37-38]. Also, the patient was advised to continue to dry-cup the legs every other day at home.

By doing all the above measures and considering the effects of the drugs and cupping, previously said, in the patient's next visit one week later, many symptoms had improved and the wound was gradually healing.

In the second visit, a venesection *(Fasd)* of right saphenous vein was performed for the patient. From the point of view of Persian medicine, venesection performs a general cleansing for the body, especially the saphenous vein venesection is suitable for cleaning the feet [6-7].

As mentioned, in the second visit, the patient was asked to wash the wound with sumac (*Rhus coriaria*) decoction and after washing, the wound should be bandaged with sterile gauze soaked in honey. From the point of view of Persian medicine, the reason for washing the wound with sumac at this stage was that, after cleaning the wound from infectious secretions, an astringent substance should be used, which at the same time prevents the re-accumulation of waste materials in the wound, and these two characteristics are found in sumac [9,14].

An article by Alsarayreh and colleagues in 2021 indicated that using *R. coriaria* fruit extract topically has a potent diabetic wound healing capacity by decreasing inflammatory interleukins and increasing wound contraction due to collagen expression and neovascularization [39].

According to the measures taken, blood glucose and hypertension were controlled in the third visit, and as seen in the figure 3, the wound was healing. Another venesection of the left saphenous vein was performed for the patient.

As mentioned before, in the 4th visit, the wound was healed and had no redness, inflammation, or discharge. The patient only complained of brief numbness in the foot. The dorsalis pedis pulse of the affected foot was palpable and the foot was warm. In this visit, the patient's medication was discontinued and leech therapy was performed. Because the patient felt some numbness in the foot, a local treatment was needed to remove the waste material from that area. Scholars of Persian medicine believe that leech therapy cleans the waste materials locally, after cleansing the whole body by oral drugs [6-7]. Using leech therapy for treatment of diabetic foot ulcers has been stated in numerous case reports and articles, and its positive effects have been confirmed [40-41].

As mentioned above, a week after leech therapy, the MRI was repeated, which was normal.

Through the Persian medicine treatment protocol, the patient was relieved from the side effects of antibiotic therapy and the possible complications of surgery and limb amputation which may have occurred in conventional medicine treatment.

Conclusion

The patient was cured with a combination of Persian medicine treatment methods, including oral and topical medicines, wet cupping, venesection and leech therapy, which caused effective blood supply to the limb and its repair. It shows that in such patients, using the capacities of Persian medicine in addition to conventional treatments, helped to markedly improve the patient's condition.

Conflict of Interests

None.

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None.

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