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Diabetic Foot Ulcer Aloe vera Therapy

Zahra Ashouri Saheli

Department of Microbiology, MaS.C., Islamic Azad University, Masjed Soleiman, Iran

*Corresponding Author: Email: Zashourisaheli@iau.ir

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ABSTRACT

A 75-year-old white man with a 25-year history of diabetes mellitus, got a foot infection and ulcer by trauma, in such a way that trauma occurred in the right foot ankle, and then a wound infection and necrosis quickly developed, despite amputation and taking diabetic medicine, respectively. So, the patient was taking antibiotic therapy and diabetic medicine as prescribed by the surgeon, but there was no improvement in the ulcer. Therefore, Aloe vera (Aloe barbadensis Miller) therapy was done for twenty days. Ulcer removed and new and healthy layers of skin formed. Due to the ineffectiveness of antibiotics because of antibiotic resistance developing in bacteria, and also, invasive and wide-spectrum but limited positive effect surgery method, Aloe vera therapy, as a natural and noninvasive method, is a good alternative instead of using those methods. Also, this method does not have any side effects on the foot and other organs.

Keywords: Ulcer, Diabetic, Antibiotic resistance, Aloe vera

INTRODUCTION

Diabetic foot ulcers (DFUs) are among the most common complications of diabetes, especially in developing countries. DFUs occur in 7.2% of Africans and 5.5% of Asians [1]. Most DFUs develop due to several factors, including excessive pressure on the feet caused by occupational activities, local trauma, hyperglycemia, suppressed and or impaired immunity, inadequate blood supply, neuropathy, and both micro-vascular and macro-vascular diseases. But the causes of DFUs are monomicrobial and polymicrobial infections. Monomicrobial infections are those caused by gram-positive cocci, e.g., Staphylococcus aureus, Streptococcus spp, which are responsible for the mildest infections in diabetic feet. However, synergistic interactions between aerobic and anaerobic bacteria — including gram-positive cocci, e.g., Enterococcus faecalis, and gram-negative bacilli, e.g., Pseudomonas spp, E. coli, Klebsiella, Proteus, Enterobacter cloacae — can lead to polymicrobial chronic infections in diabetic feet [2-6]. Approximately 15% of DFUs, whether gangrene (caused by Clostridium perfringens) or non-gangrene types, result in osteomyelitis, which is the leading cause of foot amputations in about 85% of cases. Critical ischemia with gangrenous changes in the foot may also occur due to microangiopathy, leading to more than 200,000 foot amputations annually worldwide [3,5, 7, 8]. Diabetic foot infection and ulcer management contains early lesions diagnosis and treatment in the early phase, wound care, antibiotic therapy, and invasive medical treatment (debridement of necrotic soft tissue and bone) in the acute phase, along with modification of host factors. However, treatment of DFUs can be difficult because of the risk of antibiotic resistance.

Antibiotic resistance in the deeper DFUs that occur in anaerobic and 78.2% of chronic wounds biofilm-forming organisms is caused by long-term and more frequent patient interaction with healthcare and more repeated antibiotic therapy [3-5]. Due to these problems in the treatment of DFUs, it is better to use an herbal alternative method. It is significant to use a flowering succulent plant named Aloe vera (Aloe barbadensis miller) and known as ‘herbal panacea’, ‘miracle plant’, ‘nature healer’, and ‘true aloe’ that has demonstrated its positive properties in different situations of human existence, like cosmetic, food, drink, medicine, and even for food animals. Aloe vera contains a rich source of vitamins, minerals, phytochemicals, hormones, acemannan (D-isomer mucopolysaccharide in Aloe vera leaves), glucose, and mannose polysaccharides [9-12, 14, 20].

This study explains diabetic foot ulcer and infection have limited and cleaned up by Aloe vera therapy.

MATERIALS AND METHODS: Case Report

A 75-year-old white man with a 25-year history of diabetes mellitus lost the fingers of his right foot and the knee of another leg because of DFUs and underwent surgery recently. In the three-weeks treatment period in the hospital after amputation, the patient took three tablets of Glibenclamide 5mg q.8h, two tablets of Metformin hydrochloride 500mg q.12h, and sometimes the patient used B. complex vitamin and or Multivitamin pills. No assessment methods of the blood supply were performed.

After being discharged from the hospital, the patient continued recovery at home. After the recovery period, the patient tried to walk, but he experienced significant imbalance due to the amputations, despite using assistive devices such as a cane, walker, wheelchair, and a below-knee prosthesis for his left leg. As a result, he spent most of his time bedridden or sitting during the day and night.

After a while, an unknown trauma occurred in the right foot ankle, and then a wound infection and necrosis quickly developed in the ankle (Fig. 1). According to Wagner’s classification, the ulcer was graded as Grade 2, characterized by a deep ulcer penetrating ligaments and muscle.

Fig. 1 Loss of ankle skin layers and creation and spread of necrosis due to infection development caused by an unknown trauma.

So, the patient took cefixime 400 mg daily and ampicillin 500 mg q.12h in addition to the aforementioned tablets and vitamins, as prescribed by the surgeon. But there was no improvement in the ulcer. Therefore, home care based on Aloe vera therapy was initiated and performed daily for twenty days. Antibiotic treatment was not continued during the Aloe vera therapy. However, other medications – including three tablets of Glibenclamide 5mg q.8h, two tablets of Metformin hydrochloride 500mg q.12h, and sometimes B. complex vitamin and or Multivitamin pills- were continued during Aloe vera therapy.

Aloe vera therapy was performed following the standard ulcer-cleaning procedure, which included cleansing with a routine antiseptic and disinfectant agent before the final application of fresh Aloe vera leaf to the wound site.

The following materials were used:

1- Sterile gloves
2- Physiologic serum
3- Scissors for cutting blackened and necrotic parts of the ulcer (disinfected by boiling water)
4- Povidone Iodine 10% solution (Betadine, trade name)
5- The latex part of a slice of washed Aloe barbadensis miller (Aloe vera) leaf
6- A clean knife for cutting Aloe vera leaf (disinfected by boiling water)
7- sterile gauze
8- Bandage

METHODS

First, sterile gloves were worn due to the necessity of wearing them at all times during cleaning and managing the ulcer. Then, the ulcer was washed with physiologic serum until it obtained its natural shape. Consequently, the thin, blackened, and dead part of the ulcer was cut by disinfected scissors (Fig. 2A, B). In the next step, ulcer was washed by Povidone Iodine 10% solution (Betadine, trade name) completely (Fig. 2 C). Then, latex part of a slice of washed Aloe barbadensis miller (Aloe vera)'s leaf was cut in half by a disinfected knife, was placed on the ulcer. Next, a sterile gauze was put on this Aloe vera leaf that its latex was in contact with the ulcer. Finally, the area was covered and secured with a bandage

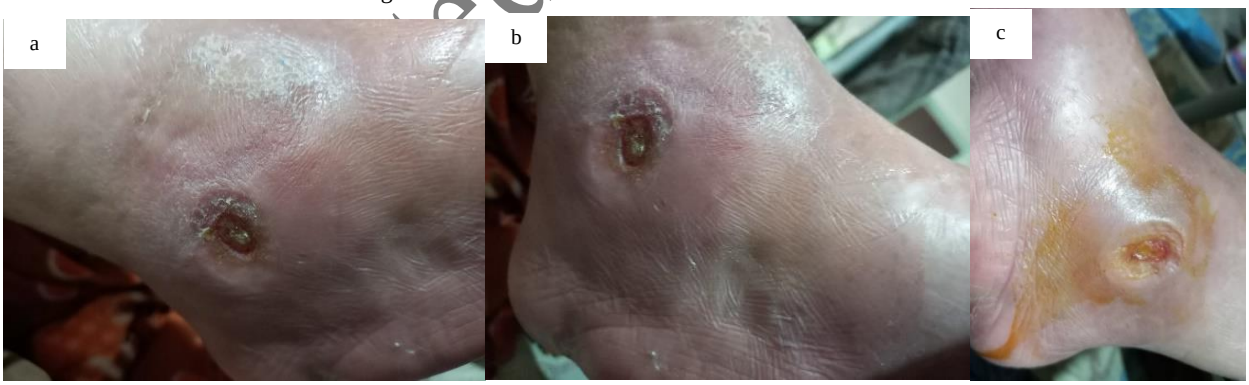

Fig. 2 Removing and washing. dead part was removed from skin by sterilized scissors. (a, b), washing ulcer was done by Povidone Iodine 10%. (c)

RESULTS

Throughout the twenty-day course of Aloe vera therapy, only topical betadine was applied. Progressive healing of the ulcer was observed, accompanied by the formation of new and healthy epithelial layers on the ankle (Fig. 3). By the end of the twentieth day, complete re-epithelialization and restoration of the ankle skin were achieved (Fig. 4).

Fig. 3 Removal of the ulcer and then, formation of new and healthy skin layers in during twenty days Aloe vera therapy.

Fig. 4 Complete improvement of skin ankle.

DISCUSSION

328 million people are involved with diabetes mellitus estimated and its global prevalence is rising and to 2035 approximately 592 million people will be involved with this type of diabetes [4]. Diabetes mellitus developed by increase in body weight and decreased physical activating extensively [15]. In the Western Pacific region, one in eight adults aged 20–79 years has diabetes, with prevalence rising by about 0.4% per year after the age of 20 [13]. In Iran, the prevalence of diabetes mellitus has been reported to be higher among women in Yazd Province compared with men [19]. In contrast, in Egypt, men are more prone to diabetic foot infections than women, that it is the highest number of people that live with diabetes [16]. The population of Indian adults aged 18-69 years have 9.3% and 24.5% of diabetes and impaired glucose tolerance respectively [17]. In 2017, the global prevalence number and disability-adjusted life-years number of diabetes got to 476.0 million and 67.9 million, with a 129.7% and 116.7% increase, respectively [12]. During recent decades, the prevalence of type 2 diabetes has increased in Iran and other low and middle-income countries [19]. Also, a study of prevalence of diabetes mellitus in Iran between 1996 and 2004 by using meta-analysis and meta-regression methods showed that prevalence of type 2 diabetes was 24% for more 40 years; and it increased because of their lifestyle and work activities [1]. Diabetes insufficient control can direct patients to DFUs. Therefore, it has been estimated that 15% of these patients will develop DFU in their lifetime. In 2014-2015 the annual cost of diabetic foot care in England was estimated to be about £1bilion. But however, this cost is essential because of consequences of lack of diabetic foot care [4]. Hence, lesions early diagnosis and then, antibiotic therapy are very important. But antibiotic therapy is facing a problem that is called antibiotic resistance developing whether by chromosomal genes or by plasmids in bacteria. Antibiotic resistance in bacteria is as follows; 100% resistance to vancomycin, methicillin and monobactam in Staphylococcus aureus and polymyxin B resistance in Pseudomonas spp. And also, 100% resistance to ampicillin and norfloxacin and 83% resistance to tetracycline in Pseudomonas aeruginosa. 92% amoxicillin, 60% amoxicillin-clavulanic acid and 72% cephalosporins resistance has occurred in gram-negative aerobic organisms. 72% fluoroquinolone and 2% carbapenem resistance were seen in Enterobacteriaceae, a family with gram-negative facultative anaerobic characteristic. Anaerobic organisms have shown high resistance to clindamycin, penicillin, cefoxitin, imipenem and metronidazole [9, 21, 22]. Due to these high resistance rates and the lack of effective infection control, surgical amputation—sometimes even far from the infected region—is often considered by surgeons, frequently without adequate attention to the patient's psychological condition.

According to a study Aloe vera has very valuable applications. They include: 1- Aloe vera's polysaccharides cause increase in immune system activity. 2- Aloe vera has successfully therapeutic effects on mouth ulcers, Herpes simplex and psoriasis. Also, Aloe vera prevents formation of gastric ulcers. 3-It is important that Aloe vera has antibacterial characteristic, especially against cause of food toxin gram-positive bacteria and zoonosis-causing bacteria. Also, Aloe vera has bacteriostatic property against Streptococcus pyogenes, Shigella flexenary and Klebsiella spp. 4-Furthermore, Aloe vera has antifungal characteristic and suppresses candida activity. 5- Antiviral and antitumor activities of Aloe vera do direct and indirect ways by anthraquinones being in the outer palp of Aloe vera as known latex and stimulation of the immune system respectively.6- Aloe vera causes reduced blood glucose levels and lower blood lipid levels in diabetics and hyperlipidaemic patients respectively by its some inorganic elements including vanadium, manganese, copper and specially polysaccharides. 7- its lectin may be responsible of treatment effects on first and second degree burns [10]. 8- Aloe vera's enzymes have preventive and therapeutic effects on scar formation following injured skin and scar tissue respectively, by boosting new cell forming functional amino acids. [10, 23]. Also, another study states that Aloe vera has effective treatment on all acne problems and some skin infections. In addition, Aloe vera was used as moisturizer for hydrating skins [9]. Furthermore, other studies show that Aloe vera can boost immune system function by its polysaccharide component, acemannan namely [24-29]. Also, a horticulture study shows that Aloe vera

gel can keep quality of lime fruits, and even quality and quantity of lime fruits can maintain during 60 days at 4+-1 ºC by Aloe vera gel 15% treatment [18]. Therefore, because of Aloe vera antimicrobial characteristic (including antifungal, antibacterial and antiviral properties) and its treatment effects on scar tissue, acne skin, and other skin infections, burnt skin and mouth ulcers and also, development of antibiotic resistance in bacteria and for to prevent of amputation, Aloe vera therapy is a natural and noninvasive and valuable method. Furthermore, it is essential to consider the patient's mental and emotional condition when determining the timing and type of treatment.

CONCLUSION

In this study, a diabetic foot ulcer was treated by Aloe vera therapy. This approach can be effective in treatment of the patient without having side effects on the foot and other organs and microbial resistance; also this treatment is comfortable for patient.

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