Case Report

A novel effective integrated approach to heal Diabetic foot Ulcer and possibly avoid amputation - A case report

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ABSTRACT

A diabetic foot ulcer (DFU) is a debilitating and severe manifestation of uncontrolled and prolonged diabetes. It presents as ulceration, usually on the plantar aspect of the foot. This case report presents a novel holistic approach that leverages the strengths of both conventional and Ayurvedic medicine. Aloe Vera, known for its miraculous benefits in Ayurvedic medicine, is used here, along with conventional medicine, to heal a DFU. The patient was a known case of diabetes mellitus, brought to the health centre in a seriously ill condition with >550mg/dl random blood sugar (RBS) levels recorded in a glucometer. Maggots present in the ulcer were removed using hydrogen peroxide (H_2O_2), followed by adequate wound debridement. The treatment started with Insulin for four days, followed by oral intake of T. Metformin daily. In addition, diet control of blood sugar was done along with intermittent administration of an antibiotic injection. Ceftriaxone and Sulbactam were administered. Wound dressing was performed using Aloe Vera gel collected directly from the plant's inner leaf gel. With regular wound care, the healing process improved, and tissue regeneration was observed. The patient's RBS levels were reduced to 200-350 mg/dl. This case demonstrates that a holistic approach combining Ayurveda and conventional medicine can facilitate diabetic wound healing and reduce amputation rates and complications related to amputation.

Key words: Diabetic Foot, Aloe Vera, Wound healing, Integrative Medicine.

The International Working Group on the Diabetic Foot (IWGDF) defines Diabetic foot ulcers (DFUs) as an infection, ulceration, or destruction of tissues of the foot associated with neuropathy and/or peripheral arterial disease in the lower extremity of a person with a history of diabetes mellitus [1]. DFUs are considered a serious complication of uncontrolled diabetes. The pathological mechanisms underlying DFUs include neuropathy, vascular insufficiency, and secondary infections resulting from foot trauma. If not treated promptly using a patient-centred approach, DFUs can lead to amputation and even death. The lifetime risk of a patient with diabetes developing a foot ulcer has been estimated to be 19–34%. Approximately 50–70% of patients with DFUs die within five years, and about 5% require major amputation [2, 3].

In many rural areas, lack of awareness about risk factors, limited availability of screening programmes, and the asymptomatic nature of early disease often lead to undiagnosed high blood sugar levels. Additionally, the absence of symptoms related to target organ damage is a major deterrent to screening for diabetic complications [4].

Access this article online

Received – 11th March 2026

Initial Review – 12th March 2026

Accepted – 12th March 2026

Quick response code

Current therapeutic strategies for DFUs include conventional methods such as surgical debridement, antibiotics, vascular assessment, offloading, and amputation, as well as adjuvant therapies such as placental-derived products, sucrose octa-sulfate–impregnated dressings, leucocyte and platelet-rich fibrin (PRF) patches, hyperbaric oxygen therapy (HBOT), and negative pressure wound therapy (NPWT), often combined with interdisciplinary approaches [5]. A major challenge in treating diabetic wounds with antibiotics is the increasing prevalence of antibiotic-resistant bacteria, particularly multidrug-resistant organisms (MDROs) [6, 7]. Therefore, providing evidence-based and patient-centred approaches for DFU management is critical. Integrated approaches are cost-effective, improve quality of life, and reduce the financial burden on patients. The present study demonstrates the integration of Ayurveda and conventional medicine in the management of DFU.

Aloe vera (Aloe barbadensis Miller, family Asphodelaceae [Liliaceae]), a traditional medicinal plant, was used in this case. Aloe Vera is globally abundant and thrives in hot, dry regions across Africa, Asia, Europe, and the Americas. Major production hubs include India, China, Mexico, and the USA,

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supplying large quantities for cosmetic, food, and pharmaceutical industries, making it a widely available and popular ingredient worldwide [8, 9]. A wide range of phytochemicals, such as acemannan, aloe-emodin, aloin, aloesin and emodin, present in Aloe Vera have demonstrated various pharmacological activities, including antioxidant, antimicrobial, antidiabetic, and wound-healing properties [10, 11]. Studies have also shown that both leaf and root extracts of Aloe Vera can be used alongside conventional antibiotics to combat infectious agents, particularly in skin infections. Medicinal plants represent one of the safest and most cost-effective alternative sources of antimicrobial agents [9].

CASE PRESENTATION

This is a study done in a Health centre, in the remote area of Odisha state in India. The diagnosis and treatment were supported by Telemedicine. The authority has given the authorization, and the patient provided informed consent for publication of this case report and the patient's perspectives on the study. A 63-year-old hypertensive male with a history of more than five years of type-2 diabetes, without proper treatment, was brought to the health centre. He was under allopathic treatment for a foot ulcer for the past year. They have done surgical debridement under local anaesthesia. But he did not achieve any satisfactory relief. Initial blood sugar monitored was 'High'(>550mg/dl) in glucometer, pulse rate was 86 beats /min, Blood pressure (BP) was 160/90 mmHg, and Hemoglobin (Hb) level was 10gm/dl. He was under medication of Tablet Metformine (1000-0-500mg), for diabetes, and Tablet telmisartan 40mg once daily for hypertension. The patient was brought into the health centre in an exhausted, weak, and non-responsive state.

Initially, he was placed on intravenous (IV) normal saline. Anti-diabetic treatment started with Injection Insulin (30U – 0 – 0) for 4 days, followed by Metformine (1000-0-500mg) and Telmisartan 40mg daily was continued. He was having a wound in the heel of the left leg (Figure 1a) with dimensions of 5.5cm x 3cm x 2.5 cm. The foot ulcer was painless and foul-smelling with worms. It was initially cleaned using 2.5-3.5% hydrogen peroxide (H_2O_2), and debridement was done without local anaesthesia using sterile scissors. Injection Ceftriaxone and sulbactam (1.5 gm-0-0) for four days after debridement was given, the patient was under observation for 3-4 hrs in the health centre. The wound was impregnated with fresh Aloe Vera gel, and a dressing was applied with sterile cotton gauze. For four days, it was done twice a day, followed by once per day for two weeks. The Aloe Vera gel was applied by the following method: a leaf was collected from a fresh plant (from the health centre garden) on the same day of wound dressing; the bottom end and outer covering of the leaf were removed. The gel obtained was applied directly to the ulcer area to cover the wound to a 1-2 mm thickness. This was covered with a sterile cotton, which was continued until the ulcer was healed. The wound was irrigated for 5 minutes in slightly warm (room temp.) saline before every dressing. Thereafter, every alternate day for two weeks, followed by every third day until it healed. The Antibiotic treatment and dressing were done as described in Table I. The appearances of the initial to the healed ulcer are shown in Figure 1(a-d).



Figure 1. The progress of the ulcer healing (a: 1st day of treatment after removal of maggots, b: after 15 days of treatment, tissue regeneration occurs, c: after 40 days of treatment, wound size decreased, d: after 65 days of treatment, wound almost healed)

DISCUSSION

In the integrated approach of the present case, locally available Aloe Vera gel obtained directly from the plant leaf was used. The results were very satisfactory, without a significant financial burden on the patient or family. The integration of conventional and Ayurvedic medicine (plant gel) for the treatment of a chronic foot ulcer helped in the healing of the chronic wound. Economic status and lack of awareness about the severity of the disease were major factors that prevented the patient from maintaining blood sugar levels below 200 mg/dl. Under these conditions, the locally available Aloe Vera leaf gel was found to be very effective when used along with a single antibiotic, injection of Ceftriaxone and Sulbactam. The wound healed gradually without complications, and with proper medication, no recurrence was observed. It has been reported that the polysaccharides present in Aloe Vera (miracle plant) gel possess several therapeutic properties, including immune stimulation, anti-inflammatory effects, wound-healing activity, promotion of radiation damage repair, antibacterial, antiviral, antifungal, antidiabetic, and antineoplastic activities, stimulation of haematopoiesis, and antioxidant effects. It can also maintain a moist atmosphere in wound care [12-14].

Table 1. Timeline of the management

Days	Findings	Management and Medication
1-4	Family history of Diabetes mellitus RBS: 'high'(>550mg/dl) Hb-10gm/dl BP 160/90mmHg Foul-smelling wound on the left heel with maggots, seropurulent discharge, and diminished sensation.	• Maggots removed with H2O2 • Debridement done with scissors. • Insulin (30U-0-0) and Injection ceftriaxone with Sulbactam (1.5 gm-0-0) IV daily. • Telmisartan 40mg /day continued. • Dressing of the wound with Aloe Vera gel, covered with sterile cotton gauze twice daily. • Advised diet control and modification with low-carbohydrate and more protein.
5-15	RBS: 355-550mg/dl. Clear wound without discharge or smell	• Tablet Metformin (1000-0-500mg) • Aloe Vera gel dressing once daily.
16-30	RBS: 200 to 500mg/dl. Wound healing: accelerating tissue growth around the edge of the wound. (Figure 1b)	• Injection Ceftriaxone with Sulbactam (1.5gm-0-0) intravenously for the first 4 days, • Antidiabetic medication as above • Aloe Vera gel dressing: once daily.
31-45	Hb-12.4 gm/dl RBS: 280 to 500mg/dl. Visible tissue regeneration and decreased wound size. (Figure 1c)	• Antibiotic and antidiabetic drugs as above. • Wound dressing with Aloe vera gel: daily.
46-60	RBS: 235-327mg/dl 3/4th of the ulcer healed.	• Discontinued antibiotic injection. • Antidiabetic medication as above • Dressing with Aloe Vera gel: every third day
61-72	RBS: 281 to 327mg/dl. Ulcer healed. (Figure 1d)	• Aloe Vera gel dressing: every third day. • Continue diet control, periodic check-up, and regular intake of antidiabetic drugs.

It is necessary to have an interdisciplinary DFU team including healthcare professionals with comprehensive knowledge of different aspects of diabetic foot care [15, 16]. There are reports on an integrative approach combining Vrana Chikitsa from Ayurveda, along with infection control and offloading according to conventional medicine facilitate faster healing of chronic DFU [17]. This study reporting the dressing of wounds with Aloe Vera gel effectively supports current strategic treatments for DFU, such as local wound care, debridement, vascular assessment, active infection control, and moderate glycaemic control. This approach can reduce the healing time, amputation rates, severity of amputation, and the financial burden on the patient and family. To establish these findings, further studies, like randomized controlled trials (RCTs) with larger study groups, are needed to improve wound healing strategies and patient care.

CONCLUSION

This study emphasises the integrated approach of combining Ayurveda and conventional medicine to treat chronic DFU to avoid amputation and its complications. Aloe Vera gel, along with conventional medicine, was found to be effective in healing DFU without further recurrences with proper diabetic control.

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How to cite this article: Thresiamma KC., Jaimy P Scaria, Alphona KA.. A novel effective integrated approach to heal Diabetic foot Ulcer and possibly avoid amputation - A case report. Indian J Integr Med. 2026; 6(1):66-69.

Funding: None; *Conflicts of Interest: None Stated*