

# Holistic Approaches: Ayurveda and Conventional Medicine in Diabetic Foot Ulcer Care: A Case Series

P. Sreenadh\*, T. S. Dudhamal

## ABSTRACT

Diabetic foot ulcers (DFUs) are a significant complication of diabetes, often leading to non-healing wounds that are prone to infection and may result in amputation or death. Given the complex pathogenesis, an integrative approach combining Ayurveda and conventional medicine can be more effective. This report presents three cases of DFUs on the sole. Following adequate wound debridement, the ulcers were managed using the principles of *Vrana Chikitsa* from Ayurveda, along with infection control and offloading according to conventional treatment principles. Regular wound care and assessments were done. The wounds gradually became healthy, with a reduction in slough and smooth healing observed in all cases. Complete wound contraction was achieved in <1 and a 1/2 months, with no recurrence observed during a 1-year follow-up. This holistic approach can facilitate faster healing in chronic, non-healing DFUs.

**Keywords:** Ayurveda, Diabetic ulcer, Dushtavrana, Katupilam, Panchavalkala

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## INTRODUCTION

The development of skin ulceration in the foot of a diabetic is a serious medical condition, which, if not healed promptly, can lead to amputation. The risk of a patient with diabetes developing a foot ulcer across their lifetime has been estimated to be 19–34%. In addition, the incidence rates for ulcer recurrence remain high: 40% within 1 year after ulcer healing, and 65% within 5 years.<sup>[1]</sup> In diabetes, nerve damage (diabetic neuropathy) can lead to the development of ulcers following unnoticed injury, while inadequate blood flow (ischemia) hinders the healing of wounds. These factors are worsened by diabetic-related immune system suppression, increasing the risk of severe infections.<sup>[2]</sup> The aim of diabetic foot treatment in conventional medicine is to heal tissues while ensuring proper function and weight-bearing for walking. Key management principles include antibiotic therapy for invasive infections, along with tissue debridement or, if necessary, amputation, and reducing foot pressure until healing is complete. Although there are many treatment modalities which are available, diabetic ulcers are resulting in major physiological and psychological as well as economic consequences for the patients, their families, and society.

The Susruta Samhita provides a comprehensive account of wound and ulcer management, delineating 60 specific approaches (*Vrana upakramas*) that align with Ayurvedic principles of wound healing. Ayurveda offers a rich array of herbal and herbomineral preparations suitable for various stages of wound healing to disrupt pathogenic processes. The methodical application of wound treatment concepts such as *Nidana parivarjana* (avoidance of causative factors), *Amapachana* (detoxification), *Srotoshodhana* (clearing channels), *Vrana shodhana* (wound cleansing), and *Vrana ropana* (wound healing) holds promise for managing diabetic ulcers. *Katupila* (*Securinega leucopyrus*), a traditional Sri Lankan remedy, exhibits notable *in vitro* antimicrobial activity.<sup>[3]</sup> This case series demonstrates the integration of *Katupila* into classical Ayurvedic strategies for managing diabetic foot ulcers (DFUs) across three distinct patient cases.

Department of Shalya Tantra, Institute of Teaching and Research in Ayurveda (Institute of National Importance), Jamnagar, Gujarat, India.

**Corresponding Author:** P. Sreenadh, Department of Shalya Tantra, Institute of Teaching and Research in Ayurveda (Institute of National Importance), Jamnagar, Gujarat, India. E-mail: drsreenadh@yahoo.com

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## Case 1

A 42-year-old normotensive male with a 5-year history of type 2 diabetes mellitus (T2DM) presented with non-healing ulcer of gradual onset in the left sole for 4 months. Ulcer was painless but associated with foul smell. He had a surgical history of amputation of left big toe 2 years ago due to a road traffic accident and left 4<sup>th</sup> toe due to non-healing ulcer 2 months ago. He was under allopathic treatment for the ulcer but did not get any satisfactory relief. Concerned about the prospect of another amputation, he sought conservative management at this hospital. He was taking allopathic anti-diabetic medicines regularly (inj. Insulin 12-0-12), had the family history of diabetes, habit of tobacco chewing, and cigarette smoking (more than 10/day) for more than 25 years. Vitals were stable (Blood pressure 124/88 mmHg, Pulse rate 86 beats/min, SpO<sub>2</sub> 100%). Local examination revealed a 1.8 cm × 2.6 cm × 0.2 cm circular ulcer with callous margin and foul smell at the left sole with seropurulent discharge [Figure 1]. Local temperature was normal, and tenderness was absent. Sensations at the sole was diminished, dorsalis pedis and anterior tibial artery pulse were feeble. Fasting and postprandial blood sugar before treatment was 120 mg/dL and 168 mg/dL, respectively. The diagnosis was a DFU (Wagner's classification 2: Deeper, full thickness extension).



Figure 1: Casee 1 before treatment



Figure 2: Case 2 before

### Case 2

A 60-year-old male with a 10-year history of T2DM presented with non-healing ulcer of gradual onset in the left sole for 1 year. The ulcer initially manifested as a small lesion, posing no impediment to his daily activities. Over time, however, the ulcer expanded in size, resulting in discomfort during walking and intermittent thick discharge. He had a surgical history of amputation of the left fourth and fifth toe 3 years ago, right big toe 7 years ago and right fifth toe 10 years ago due to non-healing ulcer. He had been consistently taking allopathic anti diabetic medicines (tab. Metformin 500 mg), and anti-hypertensive medications (tab. Telmisartan 40 mg), had the family history of diabetes. Personal history revealed no addiction to tobacco, cigarette, and alcohol. Vitals were stable (Blood pressure 130/86 mmHg, Pulse rate 80 beats/min, SpO<sub>2</sub> 100%). Local examination revealed a 2 cm × 1.2 cm × 1 cm circular ulcer with irregular margin and punched out edge and the floor covered with slough at left sole [Figure 2]. Pus mixed serous discharge was noted. Local temperature was normal and mild tenderness was present. Sensations at the sole were diminished, and both dorsalis pedis and anterior tibial artery pulse were feeble. X-ray of the affected part showed osteomyelitic changes of the underlying bone. Fasting and postprandial blood sugar before treatment were 192 mg/dL and 278 mg/dL, respectively. The diagnosis was a DFU (Wagner's classification 3: Deep abscess formation or osteomyelitis).

### Case 3

A 64-year-old non-hypertensive male with approximately 12-year history of T2DM presented with non-healing ulcer of gradual onset in the right sole for 9 months. It was associated with foul smell and pain that aggravated during walking and standing. No relevant surgical history was obtained. He had been inconsistently taking allopathic anti-diabetic medicines, had the family history of diabetes. Habit of tobacco chewing for more than 30 years. Vitals were stable (Blood pressure 112/76 mmHg, Pulse rate 74 beats/min, SpO<sub>2</sub> 99%). Local examination revealed a 2.3 cm × 1.5 cm × 3.2 cm oval shaped ulcer with punched out edges and callous margins with foul smell and pus discharge at right sole [Figure 3]. Local temperature was slightly elevated, and tenderness was present. Sensations at the sole were diminished, and both dorsalis pedis



Figure 3: Case3 before treatment

and anterior tibial artery pulse were feeble. X-ray of the affected part showed osteomyelitic changes of the underlying bone. Fasting and postprandial blood sugar before treatment were 192 mg/dL and 278 mg/dL, respectively. The diagnosis was a DFU (Wagner's classification 3: Deep abscess formation or osteomyelitis).

### DIAGNOSTIC ASSESSMENT

The clinical examination focused on assessing the size, shape, margin, floor, and depth of the ulcer. Baseline blood sugar evaluation was conducted to devise an appropriate diabetic care plan. The diagnosis was established in accordance with Wagner's classification for DFUs. After a thorough analysis of signs and symptoms, adhering to Ayurvedic principles, the patients were diagnosed with *Dushtavrana* (non-healing ulcer), and treatment was accordingly planned.

### THERAPEUTIC INTERVENTION

An integrative approach was devised, taking into consideration the severity of the condition as per Wagner's classification and the involvement of *Dosha* (*Vata*, *Pitta*, *Kapha*) and *Dushya* (*Rasa*, *Rakta*, *Mamsa*, *Medas*, *Asthi*). Anti-diabetic medications were prescribed following consultation with the physician. In the case

1, regular removal of the callous margin was performed using scissors, while thorough surgical debridement was conducted in cases 2 under local anesthesia [Figure 4] and case 3 under ankle block anesthesia [Figure 5]. Swab culture revealed the presence of *Pseudomonas aeruginosa* in case 1 and 2 whereas *Escherichia coli* and *P. aeruginosa* in case 3. Antibiotics [Table 1] were prescribed during the post-debridement period (for 5 days in all three cases). Subsequently, Ayurvedic medications [Table 1] were initiated.

## RESULTS

Significant advancements in wound contraction were consistently noted across all cases. The wound progressive becomes healthier, concomitant with a gradual reduction in slough quantity. Complete wound healing was achieved within 40 days [Figure 6], 34 days [Figure 7], and 42 days [Figure 8], respectively, for cases 1, 2, and 3.

## Timeline

Timeline of events is detailed in Table 1.

## DISCUSSION

Control of diabetes is essential in treating the DFU cases. All the patients were taking allopathic antidiabetic medications since long. But, the blood sugar levels were not under normal limits. Hence, the dose was revised after consulting with a diabetologist. Antibiotics are essential to prevent/counter the osteomyelitic infection. Hence, they were advised after necessary surgical wound debridement. Higher plantar pressures are pivotal in the pathophysiology of diabetic ulcer. Hence, it is essential reduce the plantar pressure for a smooth healing process. As it is unrealistic to immobilize the patient till wound healing, cast made up of plaster of paris were used to off-load the affected limb. They not only minimize the plantar pressures but also prevent the accidental injuries due to neuropathy. New off-loading casts were applied on weekly interval. Debridement is widely regarded as a fundamental practice in wound management. This procedure offers multiple advantages, including the elimination of necrotic tissue, bacteria, and senescent cells, while also promoting the activity of growth factors.<sup>[4]</sup>

*Katupila* contains *Kashaya* and *Tikta rasa*. The *Kashaya Rasa* (astringent) facilitates *Lekhana* (scraping) of devitalized tissues



Figure 4: Case 2 after debridement



Figure 6: Case 1 after treatment



Figure 5: Case 3 after debridement



Figure 7: Case 2 after treatment

**Table 1:** Timeline of events

Timeline of events		
Case 1	Case 2	Case 3
Day 1: Clinical evaluation		
Baseline blood investigations including hiv, hcv, hbsag, vdrl		
Day 2: Unhealthy wound with foul smell and callus margins. Seropurulent discharge present. (wagner's classification 2) Wound cleaned with <i>panchavalkala kwatha</i> and callus margins removed with scissor Dressing done with <i>katupila taila</i> Inj. Insulin 14-0-14	Day 2: Unhealthy ulcer with callous margins. Wagner's classification 3. 1. Under local anesthesia, surgical wound debridement done by following strict aseptic precautions 2. Wound was cleaned with <i>panchavalkala kwatha</i> and dressing done with <i>katupila taila</i> 3. Tab. Metformin 500 mg 1-0-1 orally	Day 2: 1. Under ankle block anesthesia, surgical wound debridement done 2. Wound was cleaned with <i>panchavalkala kwatha</i> and dressing done with <i>katupila taila</i> 3. Inj. Insulin 12-0-12
4. Inj. Cefotaxime and sulbactam 1.5g, intravenously, 12 hourly (for 5 days)		
5. Inj. Ranitidine 50 mg, intravenously, 12 hourly (for 5 days)		
6. <i>Manjishthadi kwatha</i> 60 mL twice daily, before food		
7. <i>Sanjivani vati</i> 125 mg, 1-1-1 after food		
8. Tab. <i>Kaishora guggulu</i> 2 tablets (1 g) thrice daily, after food with warm water		
9. Off-loading of the affected limb with posterior slab		
Day 10: Healthy ulcer. No foul smell present. Serous discharge Continued 1, 2, 3, 6, 7, 8, 9 till the completion of treatment	Day 8: Healthy ulcer. Serous discharge present. Continued 1, 2, 3, 6, 7, 8, 9 till the completion of treatment	Day 10: Unhealthy wound, slough present. Continued 1, 2, 3, 6, 7, 8, 9 till the completion of treatment
Day 20: Healthy ulcer. Wound size reduced. Mild serous discharge	Day 14: Good wound contraction. Mild serous discharge from wound	Day 20: Healthy wound. No slough present. Wound is healing from the base.
Day 30: Healthy ulcer. Good wound contraction. Mild serous discharge	Day 28: Good wound contraction. No discharge from wound	Day 30: Healthy wound. Good wound contraction.
Day 40: Wound completely healed Continued 3. Stopped all other medicines	Day 34: Completely healed wound. Continued 3. Stopped all other medicines	Day 42: Completely healed wound Continued 3. Stopped all other medicines
Follow up after 1 year: no recurrence noticed		

**Figure 8:** Case 2 after treatment

from the wound and makes the wound clean. It minimizes the discharges from the wound by virtue of its *Stambhana* (holding) property. Its *Sandhankara* (uniting) and *Ropana* (healing) properties promote wound contraction and healing, respectively. The *Tikta rasa* (bitter) also helps in wound healing with its *Soshana* (drying up the abnormal discharges) and *Shodhana* (helps to prepare the wound bed) properties. Antimicrobial effect of *Katupila* is proven through *in vitro* studies.<sup>[5]</sup> The drug also contains calcium oxalate crystals, tannins, and oils that help in wound healing. *Katupila Taila* is having an acidic pH. Acidic environment helps in wound healing by reducing toxicity of bacterial end products, controlling wound

infection, increasing antimicrobial activity, altering protease activity, releasing oxygen, and enhancing epithelization and angiogenesis.<sup>[6]</sup>

The ingredients of *Panchavalkala* are found to have anti-inflammatory, analgesic, antimicrobial, and wound healing properties.<sup>[7-12]</sup> Oxidation process at the wound site hampers the wound healing. Hence, antioxidants shield the tissue from the oxidative damage. Specifically, the flavonoids rich portion of *Vata* (*Ficus benghalensis* L.), *Ashwatha* (*Ficus religiosa* L.), *Plaksha* (*Ficus lacor* Buch-Ham.), and *Parisha* (*Thespesia populenea* Soland. ex corea.) exhibit good antioxidant property in laboratory settings. Tannins, phytosterols, and flavonoids are having anti-inflammatory properties.<sup>[13]</sup> Tannins have been reported to possess ability to increase the collagen content, which is one of the factors for promotion of wound healing.<sup>[14]</sup>

The supportive drugs also might have helped the wound healing process. *Sanjeevani vati* has srotoshodhana effects which might have cleared the blockage of the arteries affected by diabetic complications.<sup>[15]</sup> *Kaishora Guggulu* have detoxifying and rejuvenate properties. *Guggulu* gum contains 5(1-methyl, 1-aminoethyl)-5-methyl-2-octanone, that showed significant antibacterial activity against gram-positive bacteria and moderate activity against gram-negative bacteria.<sup>[16,17]</sup>

## CONCLUSION

This study employed a multidisciplinary approach combining Ayurvedic and conventional wound healing principles to treat three cases of DFUs. All wounds healed gradually without complications, and no recurrences were observed after 1 year.

These results highlight the potential efficacy of integrating diverse therapies for DFU management. Further research, especially randomized controlled trials, is needed to refine wound healing strategies and improve patient care.

## CONFLICTS OF INTEREST

The authors declare no potential conflicts of interest with respect to research, authorship and/or publication of this article

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