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Case Report

Multidiscipliary approach of Ayurveda and conventional principles in the management of diabetic foot ulcer - DFU: A Case Report

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ABSTRACT:

Background: Diabetic foot ulcer is a frequent complication of diabetic mellitus that constitutes a considerable burden in terms of direct medical expenditures, as well as prolonged hospital stays and disability periods. **Clinical findings**: This case report presents a foot ulcer of traumatic onset, in a 60-year-old male with a long history of type 2 diabetes mellitus. He was initially unaware about the ulcer till foul smell started to appear and presented to the out patient department of Shalya Tantra with a big ulcer at the foot with blackish discoloraion. It was diagnosed as a *Madhumehajanya Vrana* (diabetic foot ulcer). **Intervention:** After careful clinical evaluation, an integrative treatment plan including surgical wound debridement, medicinal leech therapy, wound care with Ayurvedic remedies, offloading using plaster casts, and a combination of Ayurvedic and allopathic medications for diabetes management was planned. **Outcome:** Gradually there was a significant reduction in infection, improved wound appearance, and complete healing achieved within 13 weeks. No adverse reactions were reported during the treatment, and no recurrence was observed throughout the 31 month follow-up period. **Conclusion:** Four week old diabetic foot ulcer of wagner grade 04, was successfully managed through a multidisciplinary approach that integrating Ayurvedic and allopathic wound care principles, thereby avoiding amputation. This case highlights the potential of integrating Ayurvedic and conventional approaches in diabetic foot ulcer management. Randomized controlled clinical trials, comparative clinical trials and black box study designs can be conducted to substantiate these findings.

KEYWORDS: Diabetic foot ulcer; *Vrana*; Ayurveda; *Jaloukavacharana*; Leech therapy; *Securinega leucopyrus*; Case report

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1. INTRODUCTION

Diabetic foot and its complications constitute a considerable burden in terms of direct medical expenditures, as well as prolonged hospital stays and disability periods. Neuropathy, Vasculopathy and accidental trauma are key factors in developing diabetic foot ulcers. The incidence of DFU in neuropathic patients is as high as 7.5%. [1] According to the 2013 Diabetes Atlas by the International Diabetes Federation, India's current diabetic population is 65.1 million, and without prompt preventive measures, it is expected to reach 142.7 million by 2035. [2] Diabetes accounts for nearly 80% of annual non-traumatic amputations. About 20% of severe diabetic foot infections result in amputation, leading to increased morbidity and dependency in old age. Importantly, 85% of diabetes-related lower-limb amputations are preceded by foot ulcers. [3,4] Amputation is linked to perioperative mortality rates of 10–15%. [5] Despite advancements in wound care, high ulcer recurrence rates persist due to unresolved factors like peripheral neuropathy, foot deformity, increased plantar stress, and peripheral vascular disease even after wound healing. Hence, Ayurveda has a crucial role in addressing these issues through holistic approach. Sushruta's 60 treatment modalities for wound healing encompass topical applications and internal medicines.

This case report presents a unique case of diabetic foot ulcer which was developed following a sharp trauma. It went unnoticed by the patient because of severe neuropathy and later noticed after the onset of foul smell and systemic inflammation. The case was successfully managed through a multidisciplinary approach without surgical amputation highlighting its potential in managing complex, chronic and infection prone wounds, underscoring its relevance in contemporary diabetic care.

2. CASE REPORT:

A 60-year-old male with a 10-year history of type 2 diabetes mellitus (T2DM) presented with a 4-week-old plantar foot wound (right), resulting from trauma with a glass piece. He was not aware about the ulcer as he didn’t experience any sort of pain over that area. Then he started experiencing foul smell from his foot and identified the wound on inspection. On that day, his attender (wife) removed 2 glass pieces from the wound, and they were waiting for a natural healing for the next few weeks. But it showed no signs of healing and they noticed blackish discoloration over the wound associated with an increase in foul smell. Then he visited the Shalya Tantra outpatient department for further management. He was regularly taking allopathic oral antidiabetic drugs [Tab. Sitagliptin (50mg) + Metformin (500mg)], had no significant medical history but a family history of diabetes. He has tobacco-chewing habit (more than 20 per day) since adolescence. With stable vitals, he exhibited pallor (Hb – 10.4 g%) and had a body mass index of 23.33 Kg/m^2.

Clinical findings

Clinical examination revealed a Grade 04 Wagner classification ulcer, 11.4cm x 4cm x 2cm in size, with foul smell, necrosed tissues, undermined edges, irregular margins and diminished sensation at right plantar aspect of foot (Figure 1A). There was a greyish

discolored area near the wound. Pedal pulses were feeble, local temperature was slightly raised. X-Ray showed no osteomyelitis changes, and discharge culture revealed gram-negative bacteria (pseudomonas aeruginosa). Fasting blood sugar at admission was 163 mg/dL.

The presence of *Durgandha* (foul smell), *Puya* (Pus), *Varna Vaishamyata* (discoloration) were also noted. Details about differential diagnosis is given in table 1. Bilateral lower limb arterial color doppler study was performed on 4th day of treatment (16/12/2025). It showed minimal atherosclerotic changes noted in form of altered spectral waveform involving bilateral lower limb arterial system. According to the report, limited evaluation due to overlying bandage was possible at anterior tibial artery, posterior tibial artery and dorsalis pedis artery of right leg. The diagnosis got delayed as the pain was masked by neuropathy preventing the patient from identifying the ulcer until the onset of foul smell. Considering these diagnostic challenges, and based on the clinical findings along with laboratory investigations as shown in table 2 and X-Ray findings, the condition was diagnosed as *Madhumehajanya Vrana* (diabetic foot ulcer). Wagner grade 4 is significantly associated with an increased risk of amputation, morbidity and systemic sepsis. After explaining the prognosis to patient, a multidisciplinary treatment by including Ayurvedic wound care principles and Allopathic antidiabetic, and infection control regimen was planned.

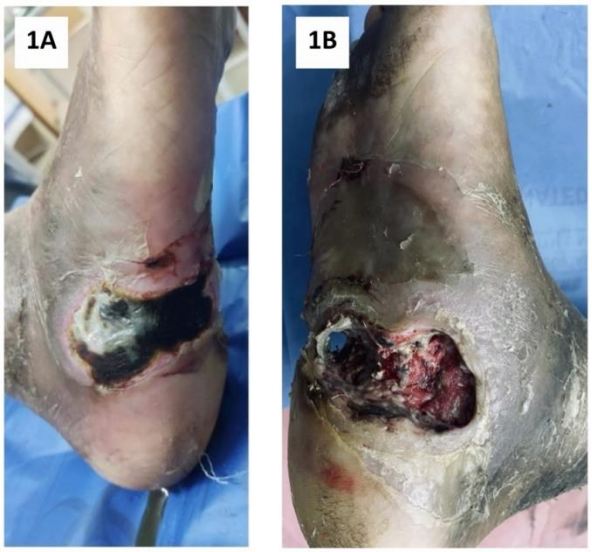

Figure 1A-B: Before treatment wound images. Wound image before debridement (1A), wound image after debridement (1B)

Table 1- Differential diagnosis

Sl. No.	Differential diagnosis	Inclusion	Exclusion
1.	Osteomyelitis	Deep ulcer near the bony part with foul smelling discharge and elevated ESR – therefore considered.	X-ray showed no bone involvement. Hence osteomyelitis was excluded.
2.	Venous ulcer	In the present case there was an ulcer with discoloration at surrounding area.	Typical venous ulcer occurs above medial malleolus and are associated with varicosities and venous stasis changes. But present case is a plantar ulcer, With no varicosities or clinical signs of venous insufficiency. Hence excluded.
3.	Pressure ulcer	The plantar ulcer is prone to pressure effects. Hence pressure ulcer was considered.	In this case, the patient is ambulatory, there was a history of glass trauma at the site.

			Hence excluded.
4.	Necrotizing soft tissue infection	This condition was included because of the rapid progression and presence of necrotic tissues and elevated WBC.	Absence of severe systemic toxicity, hemodynamic instability or rapidly spreading erythema / crepitus on presentation. Hence excluded.
5.	Diabetic foot ulcer	Considering the Plantar location, presence of neuropathy, necrotic tissues, signs of infection and known case of type 2 diabetic mellitus supports the diagnosis of DFU. Therefore this was considered as the primary diagnosis.	

Table 02 – Baseline hematological investigations

Baseline investigations	
Hemoglobin	10.4 g%
Total R.B.C.	3.95 mill./c.mm
Total W.B.C.	13430 /cu.mm.
Neutrophils	84%
Lymphocytes	9.4%
E.S.R.	120 mm after one hour
CRP	34 mg/L
F.B.S.	163 mg/dL
Uric acid	9.72 mg/dL
Total proteins	6.25 g/dL

Intervention

Written informed consent was obtained before starting the treatment.

- Oral antibiotics given for 2 weeks, oral anti-diabetic medicines and Ayurvedic medicines were given from day 01 till complete healing (details are given in table - 3). All the Ayurvedic medicines were given from institute's O.P.D. / I.P.D medicine supply.
- Surgical wound debridement: Patient was kept in supine position. Vitals were checked and found to be within normal limits. Wound and surrounding area was cleaned with povidone iodine solution followed by spirit. Draping was done with sterile cut sheet. Patient could not appreciate any sensation at the affected site. Hence no anaesthesia was administered. Wound was thoroughly debrided with a combination of surgical blade no.15, scissor and scoop. All the dead and devitalized tissues were removed from the wound (figure 1B; table 3). complete hemostasis was achieved. Wound was packed with gauze pieces soaked in povidone iodine solution. Bandage was applied. Patient was stable during the procedure.
- *Jaloukavacharana* (Medicinal leech therapy): One sitting of *Jaloukavacharana* was done as a day care procedure. Patient was kept comfortably in sitting position. Leeches were placed in water mixed with *Haridra* (*Curcuma longa*) powder and then rinsed in plain water before application. Under aseptic precautions, 3 medium sized leeches were attached at the surrounding area of wound. After around 20-25 minutes all the leeches were self-removed.

Bandaging was done and complete hemostasis was achieved (figure 2A-D; table 3).

- Regular wound care with Ayurvedic medicines: Under aseptic conditions, wound was cleaned with gauze pieces soaked in *Panchavalkala Kwatha* and dressing was done with gauze pieces impregnated with *Katupila Taila*. Dressing was done regularly in the morning hours. The wound was examined daily, and in the presence of excessive slough tissues, *Sphatika Bhasma* was additionally applied along with *Katupila Taila* for dressing. Patient was advised to avoid water contact at the ulcer site, keep the dressing intact and maintain foot hygiene till complete healing.
- Offloading with plaster cast (below knee posterior slab, 4 rolls of plaster of Paris rolls were used for layering) was given throughout the healing period. Re-offloading was performed in every seven days.

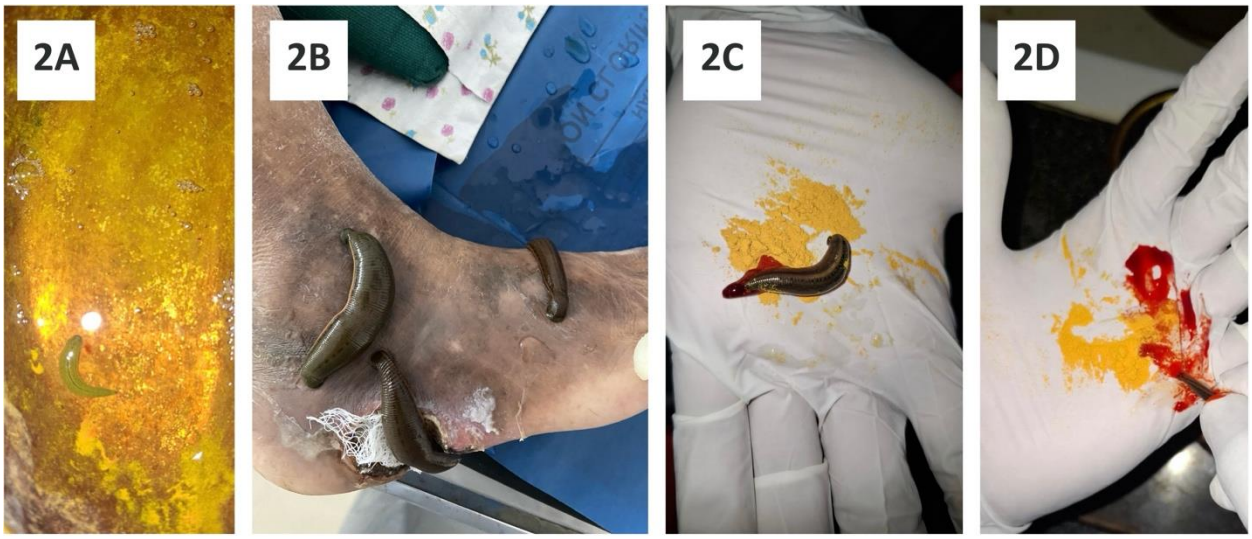

Figure 2A-D: Steps of *Jaloukavacharana* (Medicinal leech therapy)
leech placed in water mixed with *Haridra*(2A), leeches applied near the ulcer area (2B),
Haridra applied to leech to induce vomiting (2C), Vomiting of leech (2D)

Timeline

The timeline of events and brief explanation of treatment given are shown in table 03.

Table 03: Intervention and timeline of events

Date	Complaints	Prescribed treatments
12/12/2022 (Week 01)	Unhealthy wound with foul smell and necrosed tissues at the floor, with irregular margins and undermined edges on the plantar aspect of right foot (Wagner classification grade 04)	1. Inj. Cefuroxime sodium (750mg) 12 hourly, intravenously. 2. Tab. Sitagliptin (50mg) + Metformin (500mg) once daily, orally. 3. Tab. Empagliflozin (25mg) once daily, orally. 4. inj. Insulin Aspart (100U/ml) 4-6-4 units subcutaneously. 5. *Manjishtadi kashayam* 60 ml twice daily before food, orally. 6. Tab. *Kaishora guggulu* 1g. thrice daily after food with warm water, orally. 7. Tab. *Sanjeevani vati* 125 mg, thrice daily after food with warm water,

		orally. 8. *Panchavalkala Kwatha* and *Katupila Taila* – for cleaning and dressing the wound respectively. *Sphatikachurna* was also used along with *Katupila Taila* occasionally based on the amount of slough present in the wound.
13/12/2022 (Week 01)	(Wagner classification grade 03)	• Surgical wound debridement done under aseptic precautions. • All above medicines (1-8) continued. 9. Offloading done.
19/12/2022 (Week 02)	Foul smell absent. Slough present. (Wagner classification grade 02)	• Leech therapy performed. • 1-9 continued.
27/12/2022 (Week 03)	Slough present, wound status improving. (Wagner classification grade 02)	• Antibiotics stopped. • 2-9 continued.
03/01/2023 (week 04)	Slough reduced, regular margins	• 2-9 continued.
13/01/2022 (Week 05)	Greyish discoloration near the wound decreased, wound become relatively clean	• 2-9 continued.
21/01/2023 (week 06)	Wound healthy, mild slough, sloping edge, regular margins	• 2-9 continued.
29/01/2023 (Week 07)	Healthy wound, appreciated some tactile sensations	• 2-9 continued.
04/02/2023 (week 08)	Healthy wound, no slough, mild serous discharge	• 2-9 continued.
11/02/2023 (week 09)	Healthy wound, depth reduced	• 2-9 continued.
18/02/2023 (weel 10)	Healthy wound	• 2-9 continued.
25/02/2023 (week 11)	Healthy wound, no discharge	• 2-9 continued.
07/03/2023 (Week 12)	Good wound contraction. (Wagner grade 01)	• 2-9 continued.
13/03/2023 (Week 13)	Wound healed completely (Intact skin but foot at risk)	• 2-7 continued. • Advised to wear protective shoes.

13/04/2023 (1st month follow up)	No recurrence	• 5-7 stopped. • 2-4 continued.
14/10/2025 (31st month follow up)	No recurrence	-

Follow up and outcomes (results)

Foul smell was completely absent from 5th day after the debridement. Notable amount of slough on the wound up to 3 weeks after debridement. It was removed regularly by using mosquito forceps. As the infection gradually subsided, the administration of antibiotics was ceased after two weeks. The greyish discoloration near the wound was decreased gradually and the wound became relatively clean by 5th week (Figure 3; table 3). He was able to appreciate some amount of tactile sensations by the end of 7th week. By the end of 13th week, the wound completely healed (Figure 4; table 4) and all Ayurvedic medications were continued further for a period of one month.

Adherence to medication was ensured through daily monitoring of drug intake and dressing logs maintained during hospital visits. Tolerability was assessed based on patient-reported symptoms and daily monitoring for any adverse events. There were no adverse reactions; all Ayurveda medicines were well tolerated. No recurrences observed in 31 months follow up.

Table 4: Assessment of wound size, blood sugar level and sensation at affected part

Week	Ulcer size	Random Blood Sugar	Tactile Sensations at affected part
1	45.6 cm^2	163 mg/dL	Absent
3	41.8 cm^2	148 mg/dL	Absent
5	33 cm^2	176 mg/dL	Absent
7	18.2 cm^2	168 mg/dL	Mild
9	7.2 cm^2	180 mg/dL	Mild
11	1.2 cm^2	156 mg/dL	Mild
13	Completely healed	172 mg/dL	Mild
14	One month follow up	FBS: 122 mg/dL PPBS: 88 mg/dL	

Figure 3: Wound image at 5th week of treatment

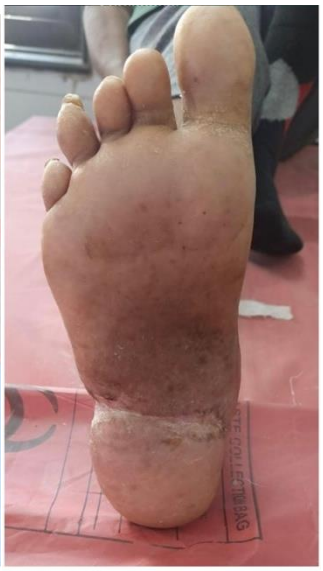

Figure 4: After treatment status

3. DISCUSSION

Hyperglycemia in diabetes mellitus (Type 1 or Type 2) leads to various pathological consequences, including increased protein kinase C activity, advanced glycation

end product formation, and elevated reactive oxygen species, micro and macrovascular complications at foot, peripheral neuropathy and ischemia. [6]

In the present case, protective sensation at foot was absent due to peripheral diabetic neuropathy that predisposes to unnoticed trauma and ulcer formation (figure 1A). Reduced tissue regeneration, angiogenesis, and neurological disturbances are responsible for impaired healing in DFU. [7] Standard DFU management focus on infection control, vascular optimization, blood sugar control, off-loading and wound debridement. In the present case, administration of Ayurvedic medicines and leech therapy were integrated along with conventional interventions such as antibiotics and debridement. Intravenous antibiotics, combined with Ayurvedic medicines, were employed for infection control (table 3). Sharp debridement helped to visualize the full extent of ulcer and removal of necrosed tissues (figure 1B).

The absence of pedal pulses in the presence of a palpable popliteal pulse as presented in this case is a classic finding in diabetic arterial disease because of the selective involvement of the tibial arteries below the knee. [8] Early consideration of revascularization is essential as ischemia can impede healing. Leech saliva contains over twenty bioactive substances with thrombolytic, anti-coagulant, anti-inflammatory, antimicrobial, and pain-relieving effects. Leeches also help to blood vessel recanalization, reducing venous congestion, increasing blood flow, and aiding in wound healing. [9]

Minimizing forces on the ulcerated area is crucial. Complete immobilization may lead to risks like thrombosis, muscle wasting, depression, and secondary ulcers. Plaster casts are a practical solution to offload the wound while allowing partial activity, effectively reducing plantar pressures and equal distribution of pressure on whole foot. [10]

Clean surfaces and open sinuses promote faster healing of ulcers. Surgical debridement effectively removes necrotic tissues, but some slough and pus discharge were still present in the initial post-debridement period. The ingredients of *Panchavalkala Kwatha* are having anti-inflammatory, analgesic, antimicrobial, and wound healing properties. [11] *Katupila Taila* (oil form of *Securinega leucopyrus*) has proven antimicrobial, anti-inflammatory and free radical scavenging properties which are beneficial in wound healing. [12] The base of *Katupila* oil, which is sesame oil, maintains moisture at the dressing site, aids in the healing process, and when used with herbal drugs, is beneficial in promoting the healing of chronic wounds.

Sphatika (Potash Alum) possesses astringent and hemostatic properties, promoting tissue contraction, reducing inflammation, and enhancing wound healing. [13] *Manjishtadi Kashaya* acted as a blood purifier, while *Kaishora Guggulu*, acted as *Rakta Shodhaka* (a natural blood cleanser), supports skin health, and beneficial for diabetes and skin diseases. Additionally, *Guggulu* gum contains an active compound, 5(1-methyl, 1-aminoethyl)-5-methyl-2-octanone, which demonstrates significant antibacterial activity against

gram-positive bacteria and moderate activity against gram-negative bacteria. [14]

Sanjivani Vati is a detoxifying formulation and has the capacity to remove *Aama* (*endotoxins*) this might have cleared the *Srotorodha* (blockage of arteries of gangrenous part) and improved the blood circulation. [15]

Strength of this case report includes proper wound monitoring, evidence-based integration of Ayurvedic and conventional treatment modalities, detailed documentation and clinical progression (table 3 & 4). However, this is a single case report. Performing an arterial imaging studies (Doppler / CT angiography) after the treatment would have objectively quantified the improvement in ischemic changes. Neuropathic and ischemic ulcers may get benefitted from an integrative approach combining standard DFU care with selective Ayurvedic therapies. Larger controlled studies with objective vascular and biochemical assessments are essential to validate these findings in evidence based DFU care.

4. CONCLUSION

A 4 week old diabetic foot ulcer was effectively managed using a combination of Ayurvedic and conventional ulcer management principles consisting of swab culture from the wound, hematological investigations to understand the status of infection, optimal use of antibiotics, wound care through herbal and herbo-mineral compounds, medicinal leech therapy, and oral use of Ayurvedic medicines to breakdown the pathogenesis (*Samprapti Vighatana*). The treatment was well tolerated by the patient, wound healed completely within 13 weeks, without any adverse drug reactions or recurrence during follow-up. Such types of multidisciplinary approach can significantly enhance outcomes in *Madhumehajanya Vrana*.

Key messages:

- The case report presented a chronic case of type 2 diabetes mellitus (10 years) with a traumatic ulcer at the neuropathic foot.
- Surgical wound debridement, *Jaloukavacharana* (medicinal leech therapy), Ayurvedic wound care (*Panchavalkala kwatha* for wound cleaning, *Katupila Taila* and *Sphatika Bhasma* for wound dressing), offloading with below knee plaster cast and concurrent use of allopathic antidiabetic and antibiotic therapy were given.
- Complete healing of wound was achieved in 13 weeks.
- 31 months follow up showed no recurrence.
- No adverse effects observed.
- Integrated approach resulted in successful wound healing, sensory improvement and avoided amputation. Patient was able to appreciate the tactile sensation at affected site by the 7th week of treatment.

Declaration of Patient Consent – The authors confirm that they have acquired a patient consent form, in which the patient or caregiver has granted permission for the publication of the case, including accompanying images and other clinical details, in the journal. The patient or caregiver acknowledges that their name and initials will not be disclosed, and sincere attempts will be undertaken to safeguard their identity. However, complete anonymity cannot be assured.

Patient perspective - Initially I was unaware about the wound. After realizing the condition, I was anxious that I might lose my limb. But after a few days of treatment, I started regaining sensations in my foot. I observed the gradual reduction of foul smell and a steady contraction of the wound during the healing period. This treatment motivated me to take better care of my health.

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Data collection and literature search: SP

Writing Original Draft: SP

Reviewing & Editing: SP, DTS

Approval of Final Manuscript: All the Authors.

Declaration of Generative AI

The authors declare this manuscript was written without the use of generative artificial intelligence tools. All the content, including text generation, data analysis and references was developed and reviewed by the author without assistance from AI technologies.

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