



Case Study

MANAGEMENT OF A CHRONIC DIABETIC FOOT ULCER USING APAMARGA HYDROGEL: AN INTEGRATIVE AYURVEDIC WOUND CARE APPROACH

Sai Dakshini^{1*}, KM Sweta²

¹PG Scholar, ²Professor & HOD, Department of PG Studies in Shalya Tantra, Sri Sri College of Ayurvedic Science and Research, Bangalore, India.

Article info

Article History:

Received: 17-06-2026

Accepted: 13-07-2026

Published: 10-09-2026

KEYWORDS:

Diabetic Foot ulcer,
Wound dressings,
Dushta vrana,
Prameha Pidaka,
Hydrogel,
Apamarga.

ABSTRACT

Diabetic ulcers affect 25% of diabetic patients and have lasting implications. In Ayurveda, such ulcers are correlated to *Mehaja Vrana*, a complication of *Prameha*. Conventional wound dressings may adhere to the wound bed, causing trauma during dressing changes and often fail to provide an optimal moist environment necessary for wound healing. Incorporating Ayurvedic phytoconstituents into advanced wound dressings may offer enhanced therapeutic benefits. **Methodology:** A 65-year-old male patient with a diabetic foot ulcer was treated with alternate day dressings with *Apamarga* Hydrogel. Wound healing was assessed through serial evaluation using Bates & Jenson wound scores. **Result:** Complete epithelialization was achieved within 28 days following 17 dressings, with progressive improvement in Bates & Jenson Wound Assessment scores and a 100% reduction in wound area. **Discussion and Conclusion:** Hydrogels are innovative wound care materials, that maintain a moist environment at the wound interface, supporting cell migration, and autolytic debridement. Fortification with *Apamarga*, known for its *Vrana Shodhana* properties, may further enhance wound healing by promoting wound bed preparation and tissue regeneration. This case highlights the potential of *Apamarga*-fortified hydrogel as an integrative approach for the management of diabetic foot ulcers.

INTRODUCTION

Diabetes mellitus is a major public health concern in India, with approximately 77 million individuals affected between the ages of 20–79. Among its complications, diabetic foot ulcers (DFU) remain one of the most challenging, affecting nearly 6.2% of adults with diabetes.^[1] DFU is defined as infection, ulceration or destruction of tissues of the foot associated with neuropathy and/or peripheral arterial disease. It is one of the leading causes of morbidity and healthcare expenditure.^[2]

In Ayurveda, diabetes can be understood under the broad spectrum of *Prameha*, a *Maha Vyadhi*– requiring early intervention failing which, leads to grave

consequences such as *Prameha Pidakas* and *Mehaja Vrana*.^[3,4] This condition is co-related to chronic non-healing diabetic ulcers. *Acharya Sushruta* has described comprehensive wound management protocols under the *Sashti Upakramas*, emphasizing individualized care and the use of various formulations such as *Taila*, *Kashaya*, and *Ghrita* for *Vrana Shodhana* and *Vrana Ropana*.^[5]

Despite advances in wound care including hydrocolloids, foams, and hydrogels, optimal healing of chronic diabetic ulcers remains a challenge. Recent research has focused on integrating bioactive herbal compounds with modern biomaterial-based dressings to combine the advantages of a moist wound-healing environment with the anti-inflammatory, antioxidant, and regenerative properties of medicinal plants. Herbal-loaded hydrogels containing agents such as *Aloe vera*, *Centella asiatica*, and *Curcuma longa* have demonstrated promising wound-healing potential through enhanced granulation, epithelialization, and collagen synthesis. ^[6,7,8]

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<https://doi.org/10.47070/ayushdhara.v13i4.2881>

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Achyranthes aspera (Apamarga), a medicinal plant widely described in Ayurveda, possesses documented anti-inflammatory, antioxidant, antimicrobial, and wound-healing activities attributed to its flavonoids, saponins, alkaloids, and phenolic compounds.^[9] However, clinical evidence regarding the use of *Apamarga*, incorporated into hydrogel-based dressings for diabetic foot ulcers remains limited.

This case report highlights the use of *Apamarga* Hydrogel, a novel hydrogel dressing in the management of a chronic diabetic foot ulcer in a 65-year-old male and evaluates its potential role in facilitating wound healing by assessing scores of the Bates and Jenson Wound Assessment Tool.

MATERIALS AND METHODS

A 65-year-old male presented to the Outpatient Department of Shalya Tantra at Sri Sri College of Ayurvedic Science and Research on 20th November 2024 with a non-healing ulcer over the dorsum of the left foot of 20 days duration. The patient reported that the lesion initially developed as a blister following a thorn prick. Despite undergoing regular wound dressings at a local clinic, the ulcer failed to show satisfactory healing, prompting him to seek further treatment. He was a known case of Type 2 Diabetes Mellitus for 16 years and was on regular oral hypoglycaemic therapy.

Clinical Findings

On General examination

- Build – Lean
- Pallor – Absent
- Icterus - Absent
- Clubbing of Nails - Absent
- Cyanosis – Absent
- Lymphadenopathy - Absent
- Oedema – Absent
- Weight - 65kg
- Height - 180cm
- BMI- 20.1 kg/m²

Ashta Sthana Pariksha

- Nadi- Vata Pradhana Pitta
- Mala- Prakruta – 1/day
- Mutra- Prakruta – 4-5/day, 2-3 times/night with no associated complaints
- Jihwa- Aliptha
- Shabda- Snigdha
- Sparsha- Anushna
- Drik- Sweta Dhavala
- Aakriti- Sthula

Local Examination

On Inspection, a solitary ulcer with approximate dimensions of 8 x 3cm, was present over the dorsum of the left foot, over the 2nd, 3rd and 4th metatarsals. The ulcer was irregular to oval in shape and appeared to be elongated vertically. The edges were unhealthy and mildly raised with well-defined margins.

The floor of the ulcer showed unhealthy granulation tissue (+++), with discharge (++). The discharge appeared to be serous to seropurulent in nature. The base corresponded anatomically to the 2nd, 3rd and 4th metatarsals. On Palpation, tenderness was absent and the local temperature was mildly raised. Mild induration was appreciable around the margins and peripheral pulses were bilaterally feeble. (Figure 01)

Investigations & Radiology

- Routine Blood investigations were carried out including a diabetic profile, Liver function and Renal function tests along with Urine routine and microscopy. (Significant findings mentioned in Table 01)



Figure 1: Ulcer during the time of First Consultation

- An X ray of the left foot was conducted to evaluate for osteomyelitis, which was subsequently ruled out.

Table 1: Blood Investigations Done on Date – 20/11/24

HB	12.3 gm%
ESR	94 mm/hr
WBC	7300/mcl
RBS	244 mg/dl
HBA1C	7.8%
Urine Sugar	Present

Therapeutic Intervention

A 5% *Apamarga* Hydrogel was prepared under aseptic conditions within the institutional premises, sterilised and stored until use. Prior to each dressing, the wound was irrigated thoroughly with normal saline to remove surface debris and exudate.

The *Apamarga* Hydrogel was then applied uniformly over the wound bed, ensuring adequate coverage of the ulcer surface. Approximately 0.5–1 g of the gel was used per dressing. The wound was subsequently covered with a sterile gauze pad and secured with a bandage.

Dressings were performed daily for the initial five sittings to facilitate wound cleansing and drainage of exudate. Thereafter, dressings were carried out on alternate days, followed by once every two days as the wound condition improved and exudate reduced. The patient was advised to maintain adequate glycaemic control and to avoid undue pressure or trauma to the affected foot throughout the treatment period.

A total of 17 dressings were administered, resulting in complete wound healing with 100% epithelialization.

RESULTS

The ulcer was assessed at baseline and monitored throughout the treatment period.



Figure 2 – Ulcer at Day 7 Figure 3 – Ulcer at Day 14 Figure 4 – Ulcer at Day 21 Figure 5 – Ulcer at 28

Table 2: Results of Bates and Jensen Wound Assessment Scores

Parameters	Day 0	Day 7	Day 14	Day 21	Day 28
Size	2	2	2	2	1
Depth	2	2	2	1	1
Edges	4	3	3	2	1
Undermining	3	2	2	1	1
Necrotic tissue type	3	3	2	2	1
Necrotic tissue amount	2	2	1	1	1
Exudate type	5	4	3	1	1
Exudate amount	4	3	3	2	1
Skin colour surrounding the wound	4	3	3	2	2
Peripheral tissue edema	3	3	3	2	2
Induration	3	3	2	2	1
Granulation tissue	4	3	3	2	1
Epithelialization	5	4	3	2	1
Total score	44	37	32	22	15

DISCUSSION

In the present case, progressive reduction in wound dimensions, exudate, necrotic tissue and BWAT scores was observed, culminating in complete epithelialization by day 28. These findings suggest that

Progressive reduction in ulcer dimensions was observed over the course of 17 dressings, accompanied by healthy granulation tissue formation and gradual epithelialization. Complete epithelialization was achieved by day 28 following the 17th dressing, corresponding to a 100% reduction in wound area as compared to baseline.

Throughout the treatment period, the wound remained free from signs of secondary infection, and showed no evidence of wound deterioration. A progressive improvement in wound characteristics was also noted on serial assessment using the Bates-Jensen Wound Assessment Tool (BWAT), performed on Days 0, 7, 14, 21, and 28. (The BWAT scores are presented in Table 02)

Representative clinical photographs obtained on Days 0, 7, 14, 21, and 28 illustrate the sequential stages of wound healing. (Figure 02, 03, 04, 05)

Apamarga hydrogel may provide a favourable wound-healing environment in chronic diabetic ulcers.

The *Sashti Upakramas* provide a comprehensive framework for wound management, encompassing various methods of *Shodhana*

(debridement and wound cleansing) and culminating in *Vaikrutapaha* measures. The breadth of these modalities underscores the Ayurvedic principle that wound care should be an individualized modality.^[5]

Many of the classical Ayurvedic wound management approaches involve repeated local applications and periodic reassessment to address the changing requirements of the wound during different stages of healing. While this allows for tailored intervention, it also highlights the potential value of developing advanced delivery systems capable of providing sustained therapeutic action. Incorporating Ayurvedic medicinal agents into modern wound dressing platforms may therefore help retain their therapeutic benefits, while enhancing ease of application, patient convenience, and dressing efficiency.

There has been a growing interest in the use of hydrogels for drug delivery owing to their stimuli-responsive properties. These gels are capable of altering their characteristics, in response to environmental factors such as temperature, pH, magnetic fields and biological stimuli. Such properties make hydrogels highly suitable for controlled and targeted drug delivery applications.^[10] Their ability to maintain a moist environment is particularly beneficial, as it promotes and accelerates the wound healing process. Also, the distinctive structural properties of hydrogels allow them to absorb wound exudate, and conform to the shape of the wound, adapting to irregular surfaces.

Importantly, hydrogels are amenable to Ayurvedic customization: their formulation can be tailored to the *Vrana Lakshanas*, enabling a personalized, *Dosha*-guided therapeutic approach that aligns with classical Ayurvedic principles while remaining compatible with modern wound-bed physiology. Their synthesis is relatively straightforward, and they can be sterilized using standard methods, making patient-specific customization feasible.

Apamarga, by virtue of its *Laghu*, *Tikshna* and *Ruksha Guna* facilitates *Lekhana* and *Shodhana* of the wound bed.^[11] This prepares the wound bed for healthy granulation formation. In the present study, progressive improvement in necrotic tissue characteristics and granulation tissue formation observed over the treatment period may be explained by these actions. Its *Tikshna* and *Sara Guna* may further contribute to *Sroto Shodhana*, helping restore local tissue homeostasis supporting the healing process.

From a contemporary perspective, *Achyranthes aspera* contains several bioactive phytoconstituents

including flavonoids, alkaloids, saponins and phenolic compounds that have demonstrated anti-inflammatory, antioxidant and wound healing properties in previous studies.^[12] Experimental evidence suggests that the plant may reduce inflammatory mediator activity, including inhibition of COX-2 expression, thereby helping to attenuate the prolonged inflammatory response commonly observed in diabetic wounds.^[13] This may explain the reduction in peripheral oedema, exudate and unhealthy wound tissue observed during the study. The antioxidant activity of these phytoconstituents may further reduce oxidative stress, facilitating progression from the inflammatory phase to the proliferative phase of healing.^[14]

Formulation of *Apamarga* as a hydrogel may have further enhanced its clinical utility. In addition to the pharmacological effects of the drug, the hydrogel base facilitated atraumatic removal during dressing changes, absorbed mild to moderate wound exudate and ensured uniform application over irregular wound surfaces. Its favourable spread ability and contact with the wound bed, may have improved local availability of the active constituents and contributed to sustained therapeutic action.

Thus, the beneficial outcomes observed in the present study may be attributed not only to the intrinsic wound healing property of *Apamarga* but also to the supportive characteristics of the hydrogel delivery system, which together created an environment conducive to effective wound repair.

Limitations of the Study

This was a single case study, which may restrict the generalizability of the findings and preclude assessment of long-term wound outcomes. The mechanisms proposed for the therapeutic effects of *Apamarga* hydrogel are based on previously reported pharmacological studies, as inflammatory markers, oxidative stress parameters and histopathological changes were not evaluated. In addition, only a single concentration of *Apamarga* hydrogel was studied, and its release kinetics were not assessed. Further large-scale studies incorporating objective laboratory parameters and longer follow-ups are required to validate these findings.

CONCLUSION

In the present case, treatment with 5% *Apamarga* hydrogel was associated with progressive improvement in wound characteristics, reduction in exudate and unhealthy tissue, enhanced granulation formation, and complete epithelialization within 28 days. The integration of classical Ayurvedic principles with contemporary hydrogel drug delivery systems represents an innovative approach to diabetic ulcer

management. Incorporation of *Apamarga* into the hydrogel matrix provided an adaptable and patient-friendly platform capable of maintaining an optimal wound-healing environment. By combining the *Vrana Shodhana* properties of *Apamarga* with the advantages of hydrogels, this formulation may help address practical challenges associated with chronic wound care. The encouraging clinical outcome observed in this case suggests that *Apamarga* hydrogel has potential as an integrative wound management strategy; however, larger controlled clinical studies are required to further establish its efficacy, safety, and mechanism of action.

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Cite this article as:

Sai Dakshini, KM Sweta. Management of a Chronic Diabetic Foot Ulcer Using *Apamarga* Hydrogel: An Integrative Ayurvedic Wound Care Approach. *AYUSHDHARA*, 2026;13(4):220-224.

<https://doi.org/10.47070/ayushdhara.v13i4.2881>

Source of support: Nil, Conflict of interest: None Declared

*Address for correspondence

Dr. Sai Dakshini

PG Scholar,

Department of PG Studies in Shalya Tantra,

Sri Sri College of Ayurvedic Science and Research, Bangalore.

Email: dakshiniraja@gmail.com

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