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Case Study

# UNLOCKING HEALING POTENTIAL: A CASE STUDY ON THE MANAGEMENT OF DIABETIC FOOT ULCER

**Patel Vishva R[1]*, Duragappa H[2]**
*[1]PG Scholar, [2]Professor, Department of Shalyatantra, Government Ayurveda Medical College, Bangalore, Karnataka, India.

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## ABSTRACT

Diabetes stands as one of the most prevalent diseases globally, and diabetic patients are at risk of developing foot ulcers as a microvascular complication. These ulcers stem from diabetic neuropathy or atherosclerosis, leading to ischemia or breakdown of glucose-laden tissue, resulting in inflammation and ulceration. If left untreated, these ulcers can become infected, spreading to the underlying tissues. In Ayurveda, such ulcers are termed as *Madhumehajanya Vrana*. Sushruta Acharya outlined *Anushastra Karma* for managing *Vrana*, which includes *Ksharakarma* (application of alkalis) and *Jalukavacharana* (leech therapy). *Kshara* functions by actions like *Chhedana, Bhedana, Lekhana and Ropana*. *Jalukavacharana* possesses anti-inflammatory properties, promotes fresh blood supply by removing vitiated *Dosha* from the blood, and fosters wound healing by forming healthy granulation tissue. A 65-year-old female patient presented with a non-healing wound on the plantar aspect of her left foot below the greater toe since 8 months, associated with foul-smelling pus discharge for 6 months. She had a known history of diabetes mellitus since 10 years. The ulcer measured 4cm x 3cm x 2.5cm, GRBS was 380mg/dl with HbA1c of 12%. Patient was treated with *Ksharataila* infiltration, application of *Tilwaka pratisaraneeya kshara* followed by *Lekhana* of callosity present over the edges of the ulcer, and *Jalukavacharana* therapy for four sessions with seven days interval, in addition to internal medications. Glycemic control was achieved by Inj. Insulin Mixtard 30/70 30 units in morning and 15 units at night.

## INTRODUCTION

Diabetic foot ulcers (DFUs) are persistent wounds on the foot or feet linked with neuropathy and/or peripheral arterial disease in individuals with diabetes mellitus (DM). The causes of DFUs are multifactorial, involving diabetic neuropathy, diabetic atherosclerosis causing ischemia and glucose laden tissue is quite vulnerable [1]. India being the Diabetes Capital of the World has a Prevalence of 65.1 million suffering from DM of the entire Indian population being 1.33 billion of worlds 6 billion people. This states that almost half of the Indian population will sometime in their life be detected with diabetes.

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Almost 15–20% of the population suffering from diabetes is seen to have diabetic foot ulcer at least once in their lifetime. It is also been noted that 10–15% of patients suffering from Diabetic Foot Ulcer require expert management or multi-disciplinary approach. Diabetic foot ulcers have many pathogenic mechanisms. These risk factors are as follows: gender (male), duration of diabetes longer than 10 years, advanced age of patients, high Body Mass Index and other co-morbidities such as retinopathy, diabetic peripheral neuropathy, peripheral vascular disease, high glycated haemoglobin level (HbA1C), foot deformity, high plantar pressure, infections and inappropriate foot self-care habits. Rough estimates are at about 1,00,000 lower limbs are amputated in India every year, of which at least 75% are neuropathic feet with secondary infections and are potentially preventable. [2]

Treatment principles for DFUs include vascular assessment, moist wound dressing, infection control with antibiotics, surgical debridement, off-loading to reduce pressure on the wound, and glycemic control.[3] Ayurvedic literature extensively discusses about the concept of wounds (*Vrana*), categorized systematically with various systemic and local medications for treatment. According to Sushruta, *Vrana* encompasses the destruction or discontinuity of body tissue, with chronic wounds (*Dustavrana*) occurring when a wound persists and becomes infected over time.

Sushruta's contributions include detailed classification, diagnosis, and treatment of wounds, with *Shashtiupakrama* (60 procedures) outlined for managing different types of wounds. ).[4] Treatment principles primarily focus on *Vrana Shodhana* and *Vrana Ropana.* For chronic wounds like DFUs, removal of debris to enable drug penetration into healthy tissue is crucial, involving techniques such as *Chedana* (surgical debridement), *Pratisaraniya kshara, Kshara taila* (topical application), *Prakshalana* (wound cleansing) and *Jalaukavacharana* (leech therapy) along with *Shamana aushadis* were the common treatment adopted in the management of *Vrana* (wound). All the *Acharya's* have explained *Prameha piḍaka* under *Upadrava* of *Prameha*, which occur on the body of the *Pramehi* having predominance of *Meda* and *Vasa*, and whose *Dhatu* are vitiated by aggravated *Vata, Pitta* and *Kapha Dosha*. In *Pramehi/Madhumehi,* there is *Kapha* predominance along with *Dravataha* increase in *Kapha* which will result in *Sarira shaithilyata*. This *Bahudrava Slesma* gets amalgamated with *Abaddha meda* (due to *Saṃana Guna)* and vitiates *Mamsa, Vasa* and further increases the *Kledata* in the *Sarira*. This gets deposited below the *Tvak* and *Mamsa pradesa* resulting in the formation of *Piḍakas*, vitiated *Kapha, Mamsa, Vasa* and *Meda*, along with *Rakta* results in the formation of *Puya* which gets accumulated below the *Tvak* and *Mamsa pradesa*. If *Sopha* containing *Puya* is not treated on time, it may burst open to form a *Vrana* or it can take *Abhyantara gati* and result in the formation of a *Nadi*.[5] Sushruta stated that the management of these *Vranas* are difficult i.e., *Krucchra sadhya*. [6]

Acharya Sushruta has elaborately explained sixty types of procedures i.e., *Shashti Upakrama* in the management of *Dushta varna.* Among those *Prakshalana, Lekhana, Visravana, Taila, Ksharakarma* and *Bandha* were utilized in this case.

## Case Report

### Chief Complaints

Patient complaints of non-healing wound over the plantar aspect of her left foot since 8 months, associated with foul-smelling pus discharge since 6 months.

### History of Present Illness

A 65-year-old female patient, with K/C/O diabetes mallitus type II since 10 years was apparently normal before 8 months then she noticed boil over plantar aspect of her left foot. Despite the initial neglect, after 2 months it burst spontaneously with pus discharge and progressed to form an ulcer with foul smelling pus discharge. The condition worsened with poor glycemic control. Seeking relief patient sought allopatic treatment at private clinic, where she was treated with cleaning and dressing of ulcer with ointment povidone iodine and metronidazole for 1 month. However she did not get any relief, prompting her to seek further management at OPD of Shalyatantra.

### Past History

K/C/O DM Type II since 10 years, Not K/C/O HTN, Thyroid disorder.

### Personal History

Patient is a vegetarian with moderate appetite, disturbed sleep, and having frequency of micturition 6-7 times per day and 1-2 times per night along with history of constipation i.e., hard stool 1 time per day.

### Medical History

Inj. Insulin Mixtard 30/70 - 30 units in morning
Inj. Insulin Mixtard 30/70 -15 units at night.

### Surgical History

Not underwent any surgery.

### Family History

All family members said to be healthy.

### Local Examination

**Table 1: On Inspection**

| | |
|---|---|
| **Number** | 01 |
| **Size** | 4cm x 3cm |
| **Shape** | Oval shaped |
| **Position** | Plantar aspect of left foot |
| **Edge** | Punched out, callosity present |
| **Floor** | Not visible |
| **Discharge** | Foul smelling pus discharge |
| **Surrounding Area** | Blackish discoloration present |

**Table: 2. On Palpation**

| | |
|---|---|
| **Tenderness** | Present over floor of ulcer |
| **Edge And Margin** | Tenderness present over edge |
| **Base** | Fixed |
| **Depth** | 2.5 cm |
| **Bleeding** | Absent |
| **Surrounding Skin** | Tenderness absent<br>Dorsalis pedis artery- palpable<br>Posterior tibial artery - palpable<br>Anterior tibial artery- palpable |

**General Examination**

Blood pressure -130/80 mmHg

Pulse rate -76bpm

Respiratory rate - 19cpm

Pallor, icterus, cyanosis, clubbing, lymphadenopathy and edema are absent.

**Systemic Examination**

CNS - Concious and well oriented to time, place and person, HMF intact, Cranial nerves – with in normal limit

CVS – $S_1$,$S_2$ heard, No cardiac murmur present

RS- Normal vesicular breath sound present, air entry bilaterally equal, no added sound present

P/A-Soft, Non-tender, elastic, no organomegaly present.

**Wagner Grading System**: Grade 3

**Examination of Lymphnodes**

No lymphadenopathy presents

**Examination of Nerve Lesions**

Touch and pain sensation present

**Table 3: Laboratory Investigation**

| | | | |
|---|---|---|---|
| **Hemoglobin(g/dl)** | 12.7 | **Total count(WBC)** | $9.4*10^3$/uL |
| **RBC** | $4.58*10^6$ /uL | **PLT** | $285*10^3$/uL |
| **ESR** | **40mm/1st hr** | **FBS** | 260 mg /dl |
| | | **PPBS** | 350 mg /dl |
| **CT** | 4’45’’ | **HbA1C** | 12 % |
| **BT** | 2’15’’ | **HIV** | Negative |
| | | **HBSAG** | Negative |

**Table 4: Methodology**

| | | |
|---|---|---|
| **1-44 days** | **Medications** | **Dosage** |
| | *Nishakathakadi Kashaya* | 15ml – 0 – 15ml (B/F) |
| | *Varunadi Kashaya* | 15ml – 0 - 15ml (B/F) |
| | *Tab. Laghusuta shekhara* | 1-0-1 (B/F) |
| | *Tab.Triphala guggulu* | 2-0-2 (A/F) |
| | *Tab.Gandhaka rasayana* | 1-0-1 (A/F ) |
| | *Triphala choorna* | 0-0-1 tsf with lukewarm water |
| | **Therapeutic procedure** | *Vrana prakshalana* with *Panchavalkala Kashaya* |
| | | *Kshara taila* infiltration -3ml |
| | | *Madhyama tiwlavaka kshara* application over callosity present at edge followed by *Lekhana* |
| | | *Jathyadi taila kavalika* |

| | **Medications** | **Dosage** |
|---|---|---|
| **45-66 days** | *Nishakathakadi Kashaya* | 15ml – 0 - 15ml (B/F) |
| | *Mahamanjisthadi Kashaya* | 15ml – 0 - 15ml (B/F) |
| | Tab. *Laghusuta shekhara* | 1-0-1 (B/F) |
| | Tab. *Triphala guggulu* | 2-0-2 (A/F) |
| | Tab. *Gandhaka rasayana* | 1-0-1 (A/F ) |
| | *Triphala choorna* | 0-0-1 tsf with lukewarm water |
| | **Therapeutic procedure** | *Vrana prakshalana* with *Panchavalkala Kashaya* |
| | | *Kshara taila* infiltration -3ml |
| | | 4 sitting of *Jalaukavacharana* on interval of 7 days (on 45th, 52th, 59th and 66th day) |
| | | *Jathyadi taila kavalika* |

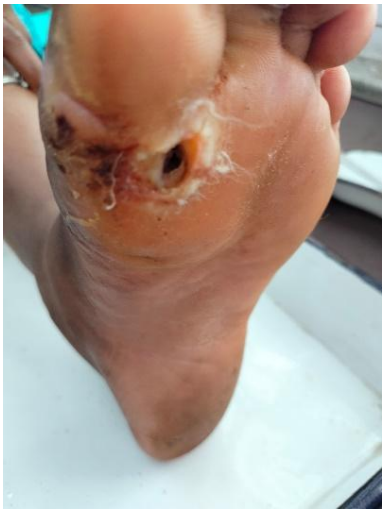
| | **Medications** | **Dosage** |
|---|---|---|
| **67- 160 days** | *Nishakathakadi Kashaya* | 15ml – 0 - 15 ml (B/F) |
| | *Mahamanjisthadi Kashaya* | 15ml – 0 - 15 ml (B/F) |
| | Tab. *Laghusuta shekhara* | 1-0-1 (B/F) |
| | Tab. *Triphala guggulu* | 2-0-2 (A/F) |
| | Tab. *Gandhaka rasayana* | 1-0-1 (A/F ) |
| | *Triphala choorna* | 0-0-1 tsf with lukewarm water |
| | **Therapeutic procedure** | *Madhyama tiwlavaka kshara* application over callosity present at edge followed by *Lekhana* for 7 days<br>*Vrana prakshalana* with *Panchavalkala Kashaya* |
| | | *Jathyadi taila kavalika* |

**OBSERVATION AND RESULT**

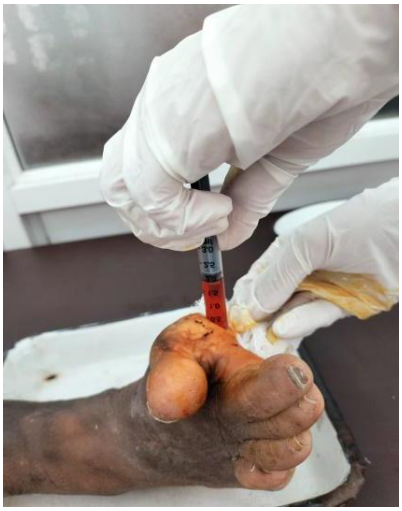
Patient presented with wound over plantar aspect of left foot associated with foul smelling pus discharge diagnosed as diabetic foot ulcer with size of 4cm x 3cm x 2.5cm (figure:1) with HbA1C = 12%. Physician opinion taken for glycemic control and treatment for diabetic foot ulcer started with *Panchavalkala Kashaya* wash for cleaning, *Kshara taila* infiltration (figure:2), *Madhyam tilwaka kshara* application over callosity followed by *Lekhana, Jathyadi taila kawalika* along with internal medication (table: 4) for 44 days. By the 20th day, pus discharge decreased and foul smell reduced. Pus discharge completely stopped by 40th day. Reduction in callosity observed after *Lekhana* and *Kshara* application. Depth of the ulcer measured as 1.7cm after 40 days of treatment.

*Jalaukavacharana* was planned on the interval of 7 days (on 45th, 52th, 59th and 66th day). After 2 sessions of *Jalaukavacharana*, healthy granulation tissue observed over floor of ulcer (figure:3) so sessions of *Jalukavacharana* were continued to enhance the healing process.

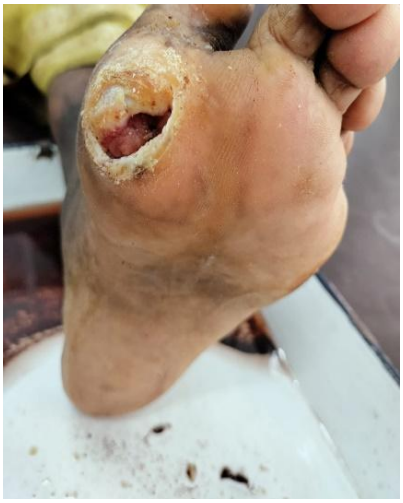
After 2 months, ulcer became superficial, with size of 2cm x 1.5 cm, along with healthy granulation tissue over floor of ulcer and callosity present over edge (figure: 4). *Pratisraniya tilwaka kshara* applied over callosity followed by *Lekhana* for another 7 days. *Panchavalkala Kashaya* wash for cleaning of ulcer followed by *Jathyadi taila kavalika* was continued for last 3 months along with internal medication. Ulcer healed with scar mark in total 160 days (figure: 7).



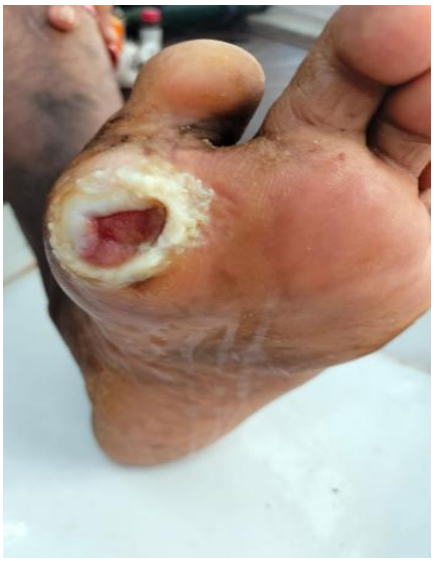
**Before Treatment**



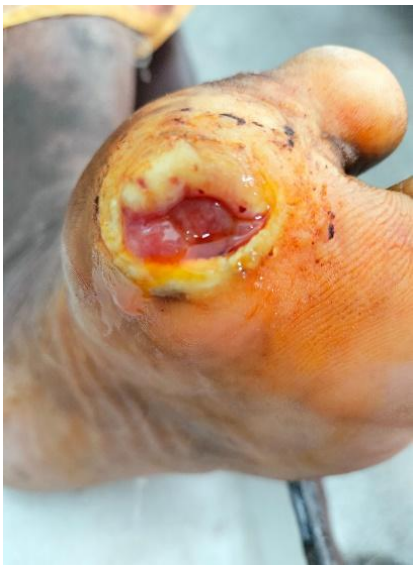
**on 2nd day: *Ksharataila* infiltration**



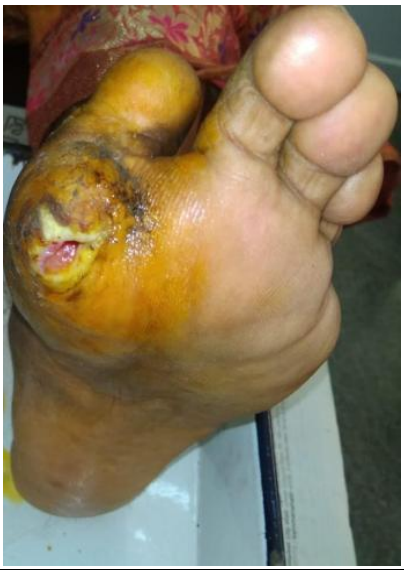
**on 40th day: Depth measured as 1.7cm**



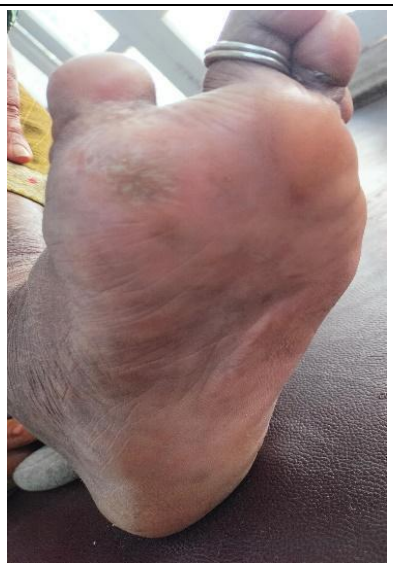
**On 66th day: Callosity present over the edge and margin**



**On 85th day of treatment (size 2cm x 1cm)**



**On 110th day of treatment**



**On 160th day of treatment wound completely heald with scar mark**

## DISCUSSION

*Madhumehajanya Vrana*, mentioned by Acharya Sushruta as *Krucchra Sadhya vrana*, which can be correlated with diabetic foot ulcers. In contemporary times, the prevalence of diabetic foot ulcer has been steadily increasing, necessitating meticulous care, daily dressing, glucose level control, and infection prevention.

In this particular case, the ulcer exhibited *Kaphaja dosha dushti* (imbalance of the *Kapha dosha*) and involvement of the *Rasa* (plasma), *Rakta* (blood), and *Mamsa* (muscle) *Dhatus* (tissues). The treatment approach was determined based on the predominance of *Dosha* and *Dhatu* involvement. Treatment was planned in accordance with the principles governing the vitiation of *Rasavaha* and *Raktavaha srotas* (macro and micro-channels of blood), aiming to restore balance and promote healing.

Pharmacological action of *Panchavalkala* proves that all the five drugs of *Panchavalkala* are found to have anti-inflammatory, analgesic, antimicrobial, and wound healing properties.

*Ksharataila* mentioned in Chakradatta for management of purulent discharge from mouth and teeth. In this case *Kshara taila* infiltration was done for purulent discharge from ulcer. *Apamarga Kshara Taila* is evidence based oil preparation having a potential effect on autolytic tissue debridement by its alkaline property and might help in the development of healthy granulation. In short *Apamarga Kshara Taila* perform multimodel actions which involved *Chedana, Lekhana*, and *Ropana* by virtue of their properties to promote wound healing.[7]

*Ksharakarma* is one among the *Shashti upakrama*. Kshara possesses several qualities that make it beneficial in the management of vrana. Its lekhana quality enables the scraping of unhealthy tissue, facilitating debridement and the formation of healthy granulation tissue for effective healing. Additionally, its shodhana attribute ensures thorough cleansing of the ulcer, reducing microbial load and creating a sterile environment to prevent infections.

The majority of *Jatyadi taila's* constituents contain *Tikta, Kashaya Rasas*, and *Laghu, Ruksha Gunas*. *Jatyadi Taila* is *Tikta* and *Kashaya Rasa Pradhana*, both of which are *Pitta Kapha hara* and have the properties of *Vrana Shodhana, Ropana, Pootihara*, and *Vedanasthapana*. *Jaati* contains salicylic acid, which has antibacterial, anti-inflammatory, and antifungal properties.

*Visravana* is also included by Acharya Sushruta in *Shashti upakrama*. *Jalukavacharana* is type of *Ashastrakrita raktamokshna.* Hirudin, hyaluronidase, kallikrein, histamine, collagenase, bdellins, eglins present in saliva of leech possesses activity of wound healing. Hirudin is capable to increase surface perfusion due to its anti-coagulation effect. Presence of Histamine, a vasodilator constituent improves blood circulation by dilating capillary bed in that area and might help in flushing out of the unwanted substances from the ulcer. Thus, possibly cellulites was controlled. Other substances like hyaluronidase, bdellins, eglins possesses anti-inflammatory and antibiotic properties. All these in combination, possibly played a great role in controlling inflammation and helped in wound healing.[8-10]

## CONCLUSION

Ayurvedic principles, guided by Sushruta Acharya, effectively treated a diabetic foot ulcer (DFU) through *Ksharakarma* and *Jalukavacharana* therapy. *Ksharakarma*, via *Kshara taila* infiltration and *Tilwaka kshara* application, facilitated debridement and healthy tissue formation. Jalukavacharana therapy enhanced wound healing by improving microcirculation. This integrative approach combining internal medications and topical treatments successfully healed the DFU, demonstrating Ayurveda's potential in managing DFUs. Further exploration of such approaches is warranted in clinical practice.

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***Address for correspondence**
**Dr. Patel Vishva R**
PG Scholar,
Department of Shalyatantra,
Government Ayurveda Medical College, Bangalore, Karnataka
Email:
vishvapatel6298@gmail.com