



## Ayurveda Management of Diabetic Foot Ulcer - A Case Report

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**Abstract:** Diabetic foot ulcer (DFU) is a major complication of Diabetes Mellitus (DM). DFU treatment principles consist of wound debridement, off-loading and education. *Shastiupakrama* (60 procedures) principles are explained for the management of *Dustavrana*(Chronic wound)which has been adopted in this study. The main objective of the study was to see the effect of Ayurvedic treatment in the management of DFU. A 46 years old male presented with the complaints of a non-healing ulcer at left great toe. The patient had a history of trauma with stone during working in the agricultural field and was treated conservatively with antibiotics and anti-inflammatory drugs by his family doctor. Patient was under regular medication for Diabetes Mellitus and Hypertension. On examination revealed an ulcer over the left great toe measuring 3 cm x 2cm with slough and blackish discolouration around the ankle region. Vasculopathy and neuropathy were evident by peripheral arterial palpation and Semmes-Weinstein Monofilament (SWM) test respectively. The case was effectively managed by both internal and external procedures with oral medications. The case was diagnosed as DFU as per contemporary science and *Dustavrana*(Chronic wound) as per Ayurveda based on *laxana*. The case was managed with treatment procedures like *Chedana*(Excision/Debridement), *Prakshalana*(Wound cleansing), *Lepa*(Topical application), *Bandhana*(Bandaging), *Jalaukavacharana*(Leech therapy), *Manjistadi kshara basti*(Medicated enema) and *Shamanaoushadi*(Internal medications). The ulcer took 3 months for complete healing with improvement in the patient's quality of life to perform his routine activities. The adopted *Ayurveda* treatment has given promising results in the management of DFU. Further research in this aspect with Randomized Controlled Trial is essential.

**Keywords:** Diabetic Foot Ulcer, Ayurveda, *Dustavrana*, *Shastiupakrama*, *Vrana Shodhana*, *Vrana Ropana*

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## I. INTRODUCTION

Diabetic foot ulcers (DFU) are chronic wounds in the foot or feet associated with neuropathy and/or peripheral arterial disease of the lower limb in patients with diabetes mellitus (DM).<sup>1</sup> Diabetic foot ulceration (DFU) is a common concern in diabetic individuals, with more than 15% of them developing DFUs at some point in their lives.<sup>2</sup> Diabetic foot ulcer is mainly caused by a combination of three factors: ischemia owing to atheroma, peripheral neuropathy resulting in trophic skin changes and immune suppression triggered by excess of sugar in the tissues, which prompts the foot susceptible to infection.<sup>3</sup> DFUs will become an even greater burden for health systems around the world as the prevalence of Diabetes Mellitus (DM) rises, and they may prove to be one of the most expensive diabetes complications.<sup>2</sup> Diabetic foot problems are a major cause for prolonged hospitalization due to rapidly spreading disease; approximately 70% of admitted patients need surgical intervention which ranges from simple debridement to toe or limb amputation.<sup>4</sup> Notably, more than half of patients who have their limbs amputated owing to DFU are estimated to die within 5 years, a rate that is higher than that of most malignancies.<sup>2</sup> The treatment principles of DFU are highlighted under these headings like vascular assessment, ulcer care by moist dressing, infection control by antibiotics, surgical debridement, wound off-loading and control of glycaemic index.<sup>5</sup> *Vrana* (different types of wounds) are not only described in Ayurvedic literature, but they are also classified in a systematic manner, with different systemic and local medications and preparations to treat them. The concept of *Vrana* (wound) was explained by *Sushruta*, he not only described different types of wounds in detail, but also provided a descriptive etiopathogenesis of wounds as well as treatment options.<sup>6</sup> Destruction or discontinuity of the body tissue is called *Vrana* (wound) and *Dustavrana* (chronic wound) occurs when a *vrana* (wound) persists for a longer period of time and develops features of infection.<sup>7</sup> In India, a study estimated a prevalence rate of chronic wounds in the community as 4.5 per 1000 population whereas that of acute wounds was nearly doubled at 10.5 per 1000 population.<sup>8</sup> *Acharya Sushruta* has contributed many chapters for classification, diagnosis of *vrana* (wound) and described *Shashtiupakrama* (60 procedures) for treating different varieties of *vrana* (wound).<sup>7</sup> The treatment consists of mainly two important principles i.e., *Vrana Shodhana* (Wound cleansing) and *Vrana Ropana* (Wound healing). *Dustavrana* (Chronic wound) is a long-standing ulcer where removing debris enabling drugs to reach healthy tissue is more important.<sup>9</sup> *Chedana* (Excision), *Vrana Lepa* (Topical application), *Prakshalana* (Wound Cleansing), *Jalaukavacharana*

(Leech therapy) to remove *dushitarakta* (impure blood), *Taila* (Oil) application, *Basti* (Medicated enema) and *Shamanaushadis* (Internal medications) were the common treatment adopted in the management of *vrana* (wound). Because of its anti-inflammatory, anti-oxidant and antibacterial capabilities, the scientific rationale for using the herbal drugs in wound healing therapies has been established in recent research.<sup>10</sup> Practice of *Jalaukavacharana* (Leech therapy) for bloodletting has become one of the most efficient treatment procedures for chronic wounds, according to *Ayurveda*. According to ancient *Ayurveda* records, leech therapy is an efficient treatment that can be used to reduce pain and decrease suppuration in all inflammatory, suppurative and painful conditions. Medicinal leeches remove impurities from the blood and speed up the healing process.<sup>10</sup> As per the Experimental studies when there are more than  $1 \times 10^5$  organisms per gram of tissue, wound repair can be impaired, independent of the type of microorganism.<sup>6</sup> As a result, it's imperative that a medicine used to treat a wound infection also decrease the microbial load. Hence, to fulfil the above said objective, we report a case of DFU which was treated with adopting Ayurveda treatment principles.

## 2. CASE REPORT

A 46 years old male presented with the complaints of non-healing ulcer at left great toe associated with foul smell, blackish discoloration around ulcer and at ankle region for 10 months, reduced sensation at left foot in the last 2 years. He was a known case of Diabetes Mellitus for 20 years, hypertension in the last 5 years and was under regular medication for these conditions i.e., Tablet GP I and Tablet Telmikind AMH. The case was treated at SVM Ayurvedic Medical College, PG Research Centre and RPK Ayurvedic Hospital from 29/07/2020 to 17/10/2020 (OPD/IPD No. 2012346 / 2001286). The patient had a history of trauma with stone while working in an agricultural field, which got infected due to the ignorance by the patient. The patient was treated conservatively with antibiotics and anti-inflammatory drugs by his family doctor. The patient responded well initially, as he was diabetic and due to ignorance complete relief was not obtained which resulted into non-healing ulcer. The authors certify that they have obtained consent from the patient for publication. The ulcer was associated with foul smell due to presence of necrotic tissue, blackish discoloration surrounding the ulcer (Fig.1) and at the ankle region with reduced sensation at foot region. Past history and family history data did not yield any specific findings in relation to the disease.



Fig.1. Ulcer before treatment and after Debridement

## 2.1 Clinical Findings

Patient was heavily built (BMI-27) with good nutrition, there was no icterus, cyanosis, clubbing, peripheral limb oedema, regional lymph nodes were not palpable and gait was normal. Systemic examinations like cardiovascular, respiratory and central nervous system examinations yielded normal findings. The patient was well oriented to time, place and person with normal vitals (BP – 130/90 mm Hg, Pulse – 75/min, Spo2 – 98%). Local examination revealed a single oval shaped non-healing ulcer over the plantar aspect of the left great toe with foul smell due to necrosed tissue. Size of the ulcer was 3 cm x 2cm with punched out edges, no discharge; floor was covered with tightly adhered slough (Necrosed tissue), depth was 5 mm up to hallucis tendon sheath with blackish discoloration at ankle region. Palpation revealed indurated punched out margins, local rise of temperature around the ulcer with absent tenderness. Peripheral arterial pulsations of the left lower limb like dorsalis pedis, anterior tibial, posterior tibial and popliteal artery pulsation were not appreciated. Right lower limb arteries like dorsalis pedis, anterior tibial, posterior tibial were feeble on palpation. Superficial and deep venous system were normal, there were no signs of varicosity or deep vein thrombus on palpation. Neurological assessment was done using Semmes-Weinstein monofilament (SWM) which revealed diminished sensation (grade 1). The ulcer was diagnosed as grade 2 (deep ulcer with no bony involvement) as per the Wagner classification of Diabetic foot.

## 2.2 Timeline

In January 2020, patient landed into foot ulcer at the left great toe, which occurred due to trauma with stone during working. Patient was treated with antibiotics and local dressing at his village. Symptomatic relief was seen but due to ignorance resulted into non-healing ulcer. In July 2020, the patient visited Ayurveda hospital for treatment of Diabetic

Foot Ulcer and it was managed with different treatment procedures, oral medication and *basti*(medicated enema).

## 2.3 Diagnostic Assessment

Patient was advised with blood investigations which revealed haemoglobin was 11.6 gm %, Total Leucocyte Count was 8,100 cells / mm<sup>3</sup> and ESR 78mm/hr, Random blood sugar - 239 mg/dl, FBS – 195 mg/dl, PPBS – 290 mg/dl, Blood urea - 40 mg/dl and Creatinine - 1.6 gm%. Arterial Doppler which was advised to rule out vasculopathy revealed moderate atherosclerotic changes in left leg (Anterior and posterior tibial artery and dorsalis pedis) with reduced flow in digital artery of left great toe (peripheral vascular disease affecting medium sized vessels – Diabetic vasculopathy). Chest X - ray showed normal findings and X ray foot did not show any signs of Osteomyelitis. The case was diagnosed as Diabetic Foot Ulcer (Wagner Grade 2) and *Dustavrana* (Chronic wound) as per Ayurveda with *vata*, *kaphadosha* predominance.

## 2.4 Therapeutic Interventions

Analyzing the *samprapti ghataka*, following inferences were drawn i.e., *dushya* were *Rasa*, *Rakta*, and *Mamsa*, *srotodusti* was *sanga*. The treatment was planned considering *shasthiupakrama* principle (Table I) i.e., initially ulcer debridement on left great toe (plantar aspect) without (Fig.1) using anaesthesia as there was no pain. *Jalaukavacharan* (Leech therapy), *Vranashodhana*(Wound cleansing) with *Panchavalkala kashaya prakshalana*(Cleansing), *Lepa*(Topical application), *Vimlapana* (Circular movements with thumb and index finger) and *Vranaropana* (Wound healing) with *Jatyaditaila* application, *Bandhana* (Bandaging) (Fig.2).<sup>11-13</sup> *Manjistadi kshara basti* (Medicated enema) (Table II) to improve ulcer healing and managing vasculopathy.<sup>14</sup> *Shamanaoushadi* (Internal medications) like *Chandraprabha vati*, *Asanadi kashaya*, *Tablet Grab* were administered to control DM, reduce infection and promote healing.<sup>15,16</sup>

**Table I – Ayurveda treatment plan of Diabetic foot ulcer management**

Plan	Intervention Details	Duration (Days)									
		Day 1 (29/7/21)	Day 5 (02/8/21)	Day 10 (07/8/21)	Day 25 (22/8/21)	Day 30 (27/8/21)	Day 35 (01/9/21)	Day 40 (06/9/21)	Day 45 (11/9/21)	Day 68 (04/10/21)	Day 81 (17/10/21)
<i>Chedana</i>	Ulcer Debridement	✓									
<i>Raktamokshana</i>	<i>Jaluoka avacharana</i>	✓	✓		✓	✓					
<i>Vrana Prakshalana</i>	With <i>Panchavalkala Kashaya</i>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Vimlapana</i>	With <i>Jatyadi taila</i>	✓	✓	✓	✓	✓	✓	✓	✓		
<i>Vrana Lepa</i>	<i>Nimba Patra Kalka</i> and <i>TilaKalka lepa</i>	✓	✓	✓							
<i>Vrana Bandhana</i>	Dressing with <i>Jatyadi taila</i>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Oral Medication	<i>Asanadi Kashaya</i> 20 ml two times a day after food with warm water <i>Chandraprabha Vati</i> 2 tablets two times a day after food <i>Tab Grab</i> 500 mg 1 tablet two times a day after food	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Basti</i>	<i>Manjistadi Kshara Basti</i>	✓	✓	✓		✓	✓	✓			

Table II – Ingredients of Manjishthadi Kshara Basti		
Contents	Ingredients	Quantity
Madhu	Honey	80 ml
Saindhava Lavana	Rock salt	5 grams
Sneha (Oil)	Manjishthadi Taila	60 ml
Kalka (Paste)	Yashtimadhu (Glycyrrhizaglabra)	10 grams
Kashaya (Decoction) – 200 ml	1. Manjistha (Rubiacordifolia)	20 grams
	2. Hareetaki (Terminaliachebula)	10 grams
	3. Vibheetaki (Terminaliabellerica)	10 grams
	4. Amalaki (Phyllanthusemblica)	10 grams
	5. Katuki (Picrorhizakurroa)	10 grams
	6. Vacha (Acoruscalamus)	10 grams
	7. Daruharidra (Berberisaristata)	10 grams
	8. Guduchi (Tinosporacordifolea)	10 grams
	9. Nimba (Azadirachta indica)	10 grams
	Dry coarse powder in equal quantity	
Gomutra	-	50 ml
Anuvasana Basti	Manjistadi Taila	70 ml



**Fig.2. various treatment procedures**

## 2.5 Follow Up And Outcome

The patient developed ulcer over the second toe (plantar aspect) after the first discharge (Fig.3) due to increased pressure over the fingers with barefoot walking. The patient was treated with the same medicines during second time admission along with cotton pad application at the left foot to reduce pressure. Ulcer assessment was done on every 5<sup>th</sup>

day during admission by Bates Jensen wound assessment tool and advised to reduce pressure over foot.<sup>17</sup>The ulcer healed completely after 3 months (Table III) (Fig.4) with normal scar formation, now the patient can perform his routine activities without any difficulty. Follow up of the patient was done for 1 year; there was no recurrence of ulcer. Blood investigations were performed after 3 months which were found within normal limits.



**Table III – Assessment of various Wound parameters by Bates Jenson Criteria**

Sl. No.	Wound parameters	Day 1 (13/1/21)	Day 5 (17/1/21)	Day 10 (22/1/21)	Day 25 (06/2/21)	Day 30 (11/2/21)	Day 35 (16/2/21)	Day 40 (21/2/21)	Day 45 (26/2/21)	Day 68 (22/3/21)	Day 81 (6/4/21)
1.	Size	2	2	2	2	2	2	1	1	1	1
2.	Depth	3	3	3	2	2	2	2	2	1	1
3.	Edges	3	2	2	2	2	2	1	1	1	1
4.	Undermining	2	2	1	1	1	1	1	1	1	1
5.	Necrotic Tissue Type	4	3	3	2	2	2	1	1	1	1
6.	Necrotic Tissue Amount	4	3	3	2	2	2	1	1	1	1
7.	Exudate type	4	4	3	3	1	1	1	1	1	1
8.	Exudate Amount	3	3	2	2	2	2	1	1	1	1
9.	Skin Colour Surrounding Wound	5	5	5	1	1	1	1	1	1	1
10.	Peripheral Tissue Oedema	3	3	3	2	2	2	2	2	1	1
11.	Peripheral Tissue Induration	3	3	3	2	2	2	2	2	1	1
12.	Granulation Tissue	5	5	4	3	3	3	2	2	2	1
13.	Epithelialization	5	5	5	4	4	3	3	2	2	1
	<b>Total Score*</b>	<b>46</b>	<b>42</b>	<b>38</b>	<b>27</b>	<b>25</b>	<b>25</b>	<b>19</b>	<b>18</b>	<b>15</b>	<b>13</b>

\* Total score suggests that sum total of all parameters if it is more than 50 i.e., ulcer degeneration and less than 15 is ulcer regeneration



**Fig.3. Healing of Ulcer during treatment**



**Fig.4. various pictures of Ulcer healing**

### 3. DISCUSSION

Foot ulcers are a major consequence of diabetes mellitus that causes substantial mortality and morbidity. DFU is the most serious public health hazard, with increasing incidence considerably over the years. Standard treatment principles have been shown to be effective, yet there is still a considerable gap between existing and planned ulcer healing outcomes.<sup>5</sup> The main aim of treatment is control of infection

and blood sugar followed with proper care of the ulcer. Management of blood sugar was achieved through oral medications like *AsanadiKashaya*<sup>18</sup> and *Chandra Prabha vati*<sup>19</sup>(Table I) which are proven to possess hypoglycemic effects. *Shastiupakramas* (60 procedures) are the special contributions of *Acharya Sushruta* specially explained in the context of wound management.<sup>20</sup> In one of the clinical study, slough, swelling, redness, pain, discharge, tenderness and malodour in wounds showed statistically significant reduction

following the treatment with *Panchavalkala* cream.<sup>21</sup> *Panchavalkala* are found to have anti-inflammatory, analgesic, antimicrobial and wound healing properties.<sup>6</sup> In our study *Prakshalana* (Wound cleansing) of an ulcer with *Panchavalkala Kwatha* (Table I) efficiently decreased the microbial load and helped in mechanical removal of slough and debris from the wound thereby hastened the healing process. The qualities like *Krimighna* (Anti-worm), *Kandughna* (Anti-itching), *Lekhana* (Scraping) help for *Shodhana* (Cleansing) of *Dushtavrana* (Chronic wound) and makes it *Shuddhavrana* (Clean wound) and promotes wound healing.<sup>22</sup> In this study *Nimbapatra* (Neem leaves) and *Tila* (Sesame) *Kalka lepa* (Topical application) (Fig.2) acts as debriding agent and help in cleansing of an ulcer. *Jatyadi Taila* (*Jatyadi* oil) is an extremely useful wound healer as it possesses antimicrobial activity which has been proven scientifically.<sup>13</sup> In this patient *Vimalapana* (Fig.2) (circular movements with thumb and index finger) with *Jatyadi Taila* (*Jatyadi* oil) includes which smoothen hard fibrous tissue and generates healthy base for healing and also promotes healing of ulcer by increasing local blood circulation. *Jalaukavacharana* (Leech therapy) (Table I) is recommended for the treatment of *Dustavrana* (Chronic wound), DFU and arterial diseases. More than 100 bioactive compounds are found in leech saliva (LS).<sup>23</sup> These are responsible for a variety of therapeutic effects such as anticoagulant, anti-inflammatory, anaesthetic, thrombolytic, vasodilator, anti-oedematous, bacteriostatic and blood and lymph circulation improving qualities.<sup>23</sup> In this case elimination of impure blood from the wound with *Jalaukavacharana* (Leech therapy) improved the blood circulation surrounding an ulcer by its anti-inflammatory and vasodilator activity and the procedure also complemented and enhanced the efficacy of other treatments. *Asanadi Gana* is indicated for the treatment of diseases like *Kushtha*, *Panduroga Shwitra*, *Krimi*, *Kaphaja-Vikara*, *Prameha* and *Medo dosha*. The drugs consist of the properties like *Laghu*, *Ruksha guna*, *Kashaya*, *Tikta Rasa* and recent researches have proved its anti-diabetic effect.<sup>18</sup> Here, *Asanadi kashaya* which was administered internally removes excessive *Kapha* and *Meda* from *Srotas* by *Kashaya* and *Tikta rasa*. *Laghu* and *Ruksha guna* absorb the excess *Kapha*, *Meda* and *Kleda* and improve the consistency of tissue elements. *Chandraprabha vati* has got very remarkable effect in mitigation of *Prameha* which correlates in many ways with obesity, metabolic syndrome and diabetes mellitus (*Madhumeha*) as it contains herbo-mineral ingredients showed remarkable anti-diabetic effects in several studies.<sup>19</sup> In this case along with its anti-hyperglycaemic effect, it improved digestion and strength of the patient. Capsule GRAB is a proprietary Ayurvedic medicine that comprises *Vranapahari Rasa*, *Triphala Guggulu*, *Gandhaka Rasayana*, *Arogyavardhini Vati*, *Guduchi*

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(*Tinosporacordifolia*. Thunb) and *Manjistha* (*Rubia cordifolia*. Linn), all of which are used to treat *vrana* (wound) (Table I) and *prameha* (diabetes) in clinical practice.<sup>24,25,26</sup> *Basti* (Medicated enema) is a procedure in which medications are administered through rectal route and acts as *shodhana* (purifying therapy) in *Vrana Chikitsa*. *Basti* (Medicated enema) is indicated in conditions like *Adhaha kaya janya Vrana* (ulcers prone to lower limbs) and specially indicated in all the *dosha* vitiation.<sup>27</sup> It contains medications possessing qualities like *Ushna virya*, *Katu rasa* and *Laghu ruksha guna* and performs *Srotomarga vishodhana*, *Vrana shodhana* and *Rakta prasadana* (Table II). The medications employed in the *Basti* (Medicated enema) have been shown to have anti-inflammatory, antifungal, antibacterial, antioxidant and antitumor properties.<sup>27</sup> *Manjisthadi kshara basti* (Table II) is a *Anubhuta Yoga* consisting of *Manjisthadi Kwatha* (*Rubia Cordifolia*. Linn) and other drugs which cleared *Srotavarodha* (blocked channels) and aided in proper circulation of nutrients to an ulcer.

## 4. CONCLUSION

Treatment of Diabetic foot ulcer in an old age is always a challenge for treating surgeons and requires aggressive management. The ulcer healed completely with minimal scar and total duration of healing was 3 months. The present case was successfully managed by various internal and external treatment procedures like *Chedana* (Excision/Debridement), *Prakshalana* (Wound cleansing), *Lepa* (Topical application), *Bandhana* (Bandaging), *Jalaukavacharna* (Leech therapy), *Manjisthadi kshara basti* (Medicated enema) and *Shamanaushadi* (Internal medications) which has given promising results with improvement in the quality of patient life. Infection control at initial phase followed with proper treatment planning can prevent the complications. Hence, further Randomized Clinical Trials are necessary with good sample size to provide evidence based practice.

## 5. AUTHOR CONTRIBUTION STATEMENT

Dr. Asma conceptualized, designed and gathered the data with regard to this study. Dr. Omprakash Dave and Dr. Hemant Toshikhane analysed the data and necessary inputs were given towards designing of the manuscript. All authors discussed the case, methodology and results and contributed to the final manuscript.

## 6. CONFLICT OF INTEREST

Conflict of interest declared none

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