AYURVEDIC MANAGEMENT OF DIABETIC FOOT: A CASE REPORT

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Abstract: The diabetic foot as an infection, ulceration and or destruction of deep tissues associated with neurological abnormalities and various degrees of peripheral vascular disease in the lower limb. Foot ulcers are a serious diabetes complication, and are a major cause of morbidity. During their lifetime, fifteen percent of Diabetics experience foot ulcers with major health-related decreases in quality of life and the use of a substantial amount of health care services. A quarter of the Diabetic population is at increased risk of foot injuries as a result of the presence of Diabetic neuropathy or an arterial circulatory disorder. The average healing duration for diabetic foot lesions is about four months. Ten percent of all lesions persist for more than one year, which incurs further costs for outpatient care. Fifteen percent of all foot ulcers in Diabetics do not heal before the patient's death. In 1999, the American Diabetes Association recognized several basic principles of diabetic wound healing - off-loading, debridement, use of appropriate dressings, medical and surgical treatment of infection and vascular reconstruction and or amputation or reconstructive foot surgery when necessary. However, the disease can be better treated in Ayurveda through Jalaukavacharan, Vrana Chikitsa and Shaman Chikitsa. This article aims to summarize the presentation, examination, work up, and Ayurvedic management of the patient with Diabetic foot.

Keywords: Diabetic Foot, Diabetic mellitus, Diabetic Ulcer, Jalaukavacharan, Madhumehari Vati.

INTRODUCTION

Diabetes is a concern for all in the world. It is the most common endocrine disorder with metabolic disorders and long-term complications affecting the skin, kidneys, nerves and blood vessels. The number of people diagnosed with Diabetes grew five-fold in the years between 1958 and 1993. In 1994, 135 million worldwide patients were living with Diabetes Mellitus. It is estimated that this number will grow to more than 300 million by the year 2025. India currently has 30 million diabetics and is expected to have 57 million diabetics by 2025.

India has the dubious distinction of being the world's diabetic city over the next few years; it will stress the country's finances with its attendant complications. Foot ulcers are a serious diabetes complication, and are a major cause of morbidity. During their lifetime, fifteen percent of diabetics develop foot ulcers with major health-related decreases in quality of life and use of a substantial amount of healthcare resources. As diabetes mellitus has become a widespread human condition, many diabetic patients present with foot infections and severe foot complications as well. If it is ignored patient will lose both his foot and life. Every year’s death is due to its complications (2.1 percent in urban, 1.5 percent in rural areas), which are prevalent in age groups between 40–60 years that affect both sexes equally. Owing to ignorance, analfabetism and poverty, complications are more prevalent among citizens of lower economic background.

The World Health Organization defines the diabetic foot as an infection, ulceration and or destruction of deep tissues associated with neurological abnormalities and various degrees of peripheral vascular disease in the lower limb. In Dutch consensus, the diabetic foot is defined as a diversity of foot abnormalities caused by neuropathy, micro-angiopathy, limited joint mobility and other consequences of metabolic disturbances, mostly occurring in combination, in patients with Diabetes Mellitus. Both definitions are descriptions of causal factors and resulting foot disorders. This emphasizes that the Diabetic foot is more a syndrome rather than a disease. Fifteen percent of all foot ulcers in Diabetics do not heal before the patient’s death.

The etiopathogenesis of diabetic foot lesions are multifactorial. Any of these include diabetic neuropathies, vasculopathy, impaired diabetes control and bacterial infection. The reasons for diabetic foot are - 1. Foot is the most vulnerable part of the body, overlooked by the patient for injury and infection. 2. The site of preference for neuropathy and ischemia is also the foot.

Treatment requires careful wound care, effective microbiological control with sufficient antibiotics and tight glycemic regulation. Numerous recent methods such as vacuum dressing, platelet-derived growth factors, larval therapy have revolutionized diabetic foot care. Long standing uncontrolled diabetes causes peripheral vascular changes and neurological changes which aggravates the disease course through ulceration, infections deformities and other systemic complications.
Standard treatment care was given to this patient, which included oral hypoglycemic drugs for good control of Diabetes, health education, Jalaukavacharan and regular wound care.

**Classification of Diabetic foot**

The Meggitt – Wagner (1983) classification is a well-known and validated system for foot ulcers and commonly used.9

**Classification of Diabetic foot -**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 0</td>
<td>Pre or post-ulcerative lesion completely epithelialized</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Superficial, full thickness ulcer limited to the dermis, not extending to the subcutis</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Ulcer of the skin extending through the subcutis with exposed tendon or bone and without osteomyelitis or abscess formation</td>
</tr>
<tr>
<td>Grade 3</td>
<td>Deep ulcers with osteomyelitis or abscess formation</td>
</tr>
<tr>
<td>Grade 4</td>
<td>Localized gangrene of the toes or the forefoot</td>
</tr>
<tr>
<td>Grade 5</td>
<td>Foot with extensive gangrene</td>
</tr>
</tbody>
</table>

**University of Texas - classification system for Diabetic foot wounds**10

<table>
<thead>
<tr>
<th>Stage</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Pre or post-ulcerative lesion completely epithelialized</td>
<td>Superficial wound not involving tendon, capsule or bone</td>
<td>Wound penetrating to tendon or capsule</td>
<td>Wound penetrating to bone or joint</td>
</tr>
<tr>
<td>B</td>
<td>With infection</td>
<td>With infection</td>
<td>With infection</td>
<td>With infection</td>
</tr>
<tr>
<td>C</td>
<td>With ischemia</td>
<td>With ischemia</td>
<td>With ischemia</td>
<td>With ischemia</td>
</tr>
<tr>
<td>D</td>
<td>With infection &amp; ischemia</td>
<td>With infection &amp; ischemia</td>
<td>With infection &amp; ischemia</td>
<td>With infection &amp; ischemia</td>
</tr>
</tbody>
</table>

**Edmonds & Foster classification** - Based on clinical tests and determination of the ankle brachial pressure index – Foot ulcers –

1. Neuropathic
2. Neuro-ischemic

**Broadsky** suggested the ‘depth-ischemia classification’ which is a modification of the Meggitt - Wagner Classification.

A - Not ischemic
B - Ischemic without gangrene
C - Partial gangrene of the foot
D - Complete foot gangrene with grades 1-3

(similar to the Meggitt – Wagner classification)

**Macfarlane and Jeffcoate** proposed the S (AD) SAD classification for diabetic foot ulcers.11

According this system, ulcers are classified on the basis of – Size, (Area & Depth), Presence of Sepsis, Arteriopathy, and Denervation

**Examination of the foot in Diabetic patients**

<table>
<thead>
<tr>
<th>Clinical</th>
<th>Examination</th>
<th>Objective testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape and deformities</td>
<td>Toe deformities Prominent metatarsal heads Foot-Hallux valgus Charcot deformity Callus</td>
<td>Radiograph of foot pressure studies</td>
</tr>
<tr>
<td>Sensory function</td>
<td>Vibration (128-Hz fork) Thermal proprioception Semmes-Weinstein filaments</td>
<td>Biothesiometry Thermal-threshold testing</td>
</tr>
<tr>
<td>Motor function</td>
<td>Wasting, weakness Ankle reflexes</td>
<td>Electrophysiological tests</td>
</tr>
<tr>
<td>Autonomic function</td>
<td>Reduced sweating, callus, Warm foot, distended dorsal foot veins</td>
<td>Quantitative sweat test Thermograph for Skin temp</td>
</tr>
<tr>
<td>Vascular status</td>
<td>Foot pulses, pallor cold feet, Oedema</td>
<td>Non-invasive Doppler studies TcPO2</td>
</tr>
</tbody>
</table>
**Instrumentations:**

**Diabetic Ulcer Severity Score system**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Score 0</th>
<th>Score 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palpable Pedal pulses</td>
<td>Presence</td>
<td>Absence</td>
</tr>
<tr>
<td>Probing to bone</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Ulcer site</td>
<td>Toes</td>
<td>Foot</td>
</tr>
<tr>
<td>Ulcer number</td>
<td>Single</td>
<td>Multiple</td>
</tr>
</tbody>
</table>

**Ulcer grading depending on depth** - Ulcer grades Wound depth as measured by sterile blunt probe

- **Grade 1** - Dermis
- **Grade 2** - Subcutaneous tissue
- **Grade 3** - Fascia
- **Grade 4** - Muscle
- **Grade 5** - Bone

**Functional tests** done to assess depth of ulcer to detect the presence of osteomyelitis - The functional tests done are Nerve conduction Neurologic examination Quantitative nerve testing of muscle strength Threshold of vibratory, cooling or warming sensation Autonomic function.

**Staging**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 0</td>
<td>(No neuropathy) No symptoms and fewer than 2 abnormalities on testing</td>
</tr>
<tr>
<td>Stage I</td>
<td>No symptoms, but 2 or more abnormalities of functional testing</td>
</tr>
<tr>
<td>Stage II</td>
<td>Symptoms of lesser degree than state III along with 2 or more functional abnormalities</td>
</tr>
<tr>
<td>Stage III</td>
<td>(Disabling neuropathy) Disabling symptoms and 2 or more functional abnormalities.</td>
</tr>
</tbody>
</table>

**Leriche-Fontaine classification (for critical limb ischemia)**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>Asymptomatic or effort pain</td>
</tr>
<tr>
<td>Stage IIA</td>
<td>Effort pain, Pain free walking distance &gt;200 mt</td>
</tr>
<tr>
<td>Stage IIB</td>
<td>Pain free walking distance &lt;200 mt</td>
</tr>
<tr>
<td>Stage III A</td>
<td>Rest Pain, Ankle arterial pressure &gt; 50 mm Hg</td>
</tr>
<tr>
<td>Stage III B</td>
<td>Rest Pain, Ankle arterial pressure &lt; 50 mm Hg</td>
</tr>
<tr>
<td>Stage IV</td>
<td>Trophic lesions, Necrosis or Gangrene</td>
</tr>
</tbody>
</table>

**Visual Analog Survey Scale**

![Visual Analog Survey Scale Image]

**CASE DESCRIPTION**

This is the case study of a male farmer, 46, who was diagnosed twelve years ago with type-2 diabetes mellitus. Initially this condition was followed by responsive and peripheral motor neuropathy, metatarsophalangeal arthropathy without symptoms of osteomyelitis and diabetic arthropathy.

The patient had presented ulcers in his right feet for six years now, in the metatarsophalangeal area. These had never completely healed in this period. He did not present partial nor total amputations.

He lives in the village in a mud house with his family. He couldn't work because of his wound, and reported feeling so sad that he didn't want to go out to associate with his companions. The only thing that he had the option to do was lie in bed for most of the day, and even that didn't improve it. He spent most of his time sitting on bed for long periods of time; which used to worsen his symptoms.

He had extreme trouble with the following tasks: long standing, walking and sitting longtime. He feels fatigue while standing and have numbness in both legs. Prior to diabetic wound, he reports that he had an active lifestyle, exercise regularly and travelled extensively, but due to uncontrolled diabetes mellitus, the patient became weak and complication in the form of diabetic neuropathy were start which interfere his quality of life.

The patient reported having no other significant neurological issues, but had a history of DM, hypertension, anxiety, and depression. He drinks liquor occasionally, and has smoked regularly. Surgical history was noncontributory.
He had needed several admissions in Allopathic hospital due to recurrent infections and had needed debridement and antibiotics course in multiple occasions. Amputation had previously been proposed but he had still refused. Currently and according to the patient himself, while he is aware of the key considerations in the management of diabetic foot ulcers his compliance has not been as constant as it should have been, particularly with regard to pressure relief and offloading of the area.

**OBSERVATION, EXAMINATION, AND EVALUATION**

- Site of lesion - Sole (metatarsophalangeal area) of the right foot.
- Size of Ulcer – 3x4 cm wide
- Duration of Diabetes mellitus – 12 years
- Incidence of peripheral neuropathy and vascular disease – PVD and neuropathy
- Bone Involvement - No bone infection
- Causative organism – on culture test Staphylococcus aureus organism is detected.
- Local symptoms – They present a large amount of hyperkeratosis, swollen borders with exudation and bad smell. Onychomycosis is present in all nails. Ulcerated Wound with Discoloration. No pitting edema in the tibial region.
- Mode of presentation - Infections that are mild include fascia, muscles, and tendons. The patient has a 2 cm diameter cellulite which causes systemic symptoms. A certain probability of amputation is imposed by patient status.

**Trophic Changes**

- Skin color - Normal
- Condition of hair on legs - Black
- Nails – Onychomycosis in nails
- Wasting of muscles - absent
- Sweating - absent

**General Physical Examination:**

- Pulse - 88/min
- Blood Pressure - 140/90mm of Hg
- Weight - 70 kg
- Height - 168 cm
- Body mass index (BMI) - 24.8 kg/m2
- Pallor - No pallor
- Lymphadenopathy - No lymphadenopathy

**Other Examination:**

- Peripheral pulsation - Present
- Sensations - Loss
- Tendon reflexes - Normal
- Other foot - Normal
- The probing to bone test is performed to determine the degree of communication between the surface of the ulcer and the joint, and it is negative.
- Meggitt – Wagner (1983) classification- Grade II
- Leriche-Fontaine classification: stage III B.
- Pain visual analogue scale (VAS): 6/10 at night time predominance, forcing him to wake up and move his legs.
- Diabetic Ulcer Severity Score – Palpable pedal pulses – 0, Probing to bone – 0, Ulcer site – 1, Ulcer number – 0.
- Ulcer grading depending on depth – Grade 4
- Functional test – Stage II
Laboratory investigation

- **Hb% - 11.8gm%**
- **TLC – 5800/cu mm**
- **Neutrophils – 70%, Lymphocytes -23%, Monocytes – 7 %, Eosinophil – 0, Basophils – 0**
- **Platelet count – 176 k/uL**
- **Serum calcium – 8.6 mg%**
- **Vitamin D, 25 Hydroxy, Serum – 72.2 ng. mL**
- **Blood urea - 42 mg/dl**
- **Serum creatinine - 0.7 mg/dl**
- **Serum Uric Acid - 6.2 mg/dl**
- **Serum Alkaline Phosphatase – 101 U/L**
- **Total cholesterol- 165 mg/dl**
- **Triglycerides - 112 mg/dl**
- **HDL - 36 mg/dl**
- **LDL - 66 mg/dl**
- **TSH – 3.4 ml U/L.**
- **HbA1C in blood: 8.6%**
- **FBS - 158 mg/dl.**
- **PPBS - 264 mg/dl.**
- **Urinary sugar - +++**
- **Urine for ketone bodies - Present**
- **pus-culture and sensitivity – Staphylococcus aureus pathogens colonize the skin.**
- **X-ray foot – No bony lesion found.**
- **Doppler ultrasound – Doppler Ultrasound reveals calcified laminar plaques with atherosclerotics, particularly in distal territories. He experiences a biphasic movement of pedal and tibial arteries due to impaired vascular elasticity in the retro-malleolar territories. In chronic arteries this is associated with moderate ischemia. – In the right foot the ankle-brachial index (ABI) is determined with the result 1.2.**

**TREATMENT SCHEDULE:** The following treatment was administered -

1. Yastimadhu Taila for local application for 3 months
2. Madhu for cleaning the wounds – for 3 months
3. Jalaukavachar – Once in week for six weeks
4. Oral Medication - Madhumehari vati (Gudmara, Jamun beej, Saunth, Lohabhasma and Shilajit) 1 Tab BD for 3 months after food with water.
5. Gandhak Rasayan Vati – 1 BD for 3 months after food with water.
RESULT: After completion of three-months treatment clinical assessments were made from the interrogation with patient and assessment of objective parameters. The outcome observed was a drastic change in the parameters as:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Before Treatment</th>
<th>After Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection</td>
<td>Large amount of hyperkeratosis, swollen borders with exudation and bad smell. Onychomycosis is present in all nails. Ulcerated Wound with Discoloration. No pitting edema in the tibial region. No Wasting of muscles, No sweating, Size of Ulcer - 3x4 cm wide, Peripheral pulsation- Present Sensations Loss and normal tendon reflexes</td>
<td>Normal skin color (no discoloration), no edema, swelling over tibial region, Normal Tendon reflex, sensation present (mild loss occasionally), no wasting of muscle, Peripheral pulsation present</td>
</tr>
<tr>
<td>Probing to bone test</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Meggitt-Wagner classification</td>
<td>Grade II</td>
<td>Grade 0</td>
</tr>
<tr>
<td>Leriche-Fontaine classification</td>
<td>Stage III B</td>
<td>Stage I</td>
</tr>
<tr>
<td>Pain VAS</td>
<td>6/10</td>
<td>2/10</td>
</tr>
<tr>
<td>DUSS – Ulcer site</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ulcer grading depending on depth</td>
<td>Grade 4</td>
<td>Grade 0 the wound is completely epithelialized</td>
</tr>
<tr>
<td>Functional test</td>
<td>Stage II</td>
<td>Stage 0</td>
</tr>
<tr>
<td>FBS</td>
<td>158 mg/dl</td>
<td>118 mg/dl</td>
</tr>
<tr>
<td>PPBS</td>
<td>264 mg/dl</td>
<td>194 mg/dl</td>
</tr>
<tr>
<td>HbA1C</td>
<td>8.6%</td>
<td>7.3%</td>
</tr>
<tr>
<td>Urine Sugar</td>
<td>+++</td>
<td>+</td>
</tr>
</tbody>
</table>

There was improvement in overall symptoms and objective parameters after three months treatment. There was reduction in VAS pain score, Meggitt-Wagner classification, Leriche-Fontaine classification for ischemia, Diabetic ulcer severity score and functional test. There was no side effect observed during the treatment as well as after the completion of treatment.

DISCUSSION

Foot infections are common complications of diabetes mellitus and are severe. Which is a condition of interrelated metabolic, ischemic, and neuropathic components which are interrelated. Foot infections among diabetics are 12 per cent prevalent. Fifteen per cent of diabetics grow foot ulcer in lifespan and 50% of non-traumatic amputations are attributable to Mellitus Diabetes. Good knowledge of lesion etiopathology is the key to understanding the diagnosis and approaching its treatment which reduces the risks associated with delayed diagnosis or inappropriate treatments.

The clinical evidence supports the use of compressive therapy as an effective and stable solution for mixed-origin ulcers. Madhu and Yashtimadhu dressings have an effective antimicrobial activity without unnecessary moisture for the rapid cleaning of wound and non-viable tissues. It removes fibrin and necrotic tissue from an ulcer bed and provides a clean wound bed that is well vascularised. Honey is a medium which is hyperosmolar and prevents bacterial growth. It creates a physical barrier due to its high viscosity, and the presence of the enzyme catalase gives antioxidant properties to the honey. Yashtimadhu assisted in regeneration of the skin, healing, anti-ulcerogenic, anti-inflammatory activities. In general, chronic wounds do not cure with dressings but epithelize when the cause is resolved. Jalauka's biomechanical wound care is antiphlogistic, used for near-by blood deliberation and is also anticoagulant. The saliva of Leech produces an unpredictable combination of different organically and it is beneficial to minimize inflammation and pain by pharmacologically active substances that are secreted into the wound. It reduces local blood obstruction, relieves venous pressure by increasing venous drainage and improves oxygenated blood supply near the region being applied. Drug combination of Madhumehari Vati gives anti-diabetic properties. Gandhak Rasayan is a versatile ayurvedic medicine which has powerful anti-bacterial, anti-microbial and anti-viral properties. This may have contributed to the healing of wounds and helped the patient regain and maintain good health.
Foot treatment, prophylactic skin and nail treatment, and footwear preparation reduces the possibility of developing foot ulcers. The best approach is to prevention. Therefore, by delivering adequate treatment, we need effective processes and procedures that ensure proper assessment and enforcement by the patient. The presence of patients and their community enhances the outcomes. Throughout the process the patient became aware of the value of self-care. After three months of therapy the right foot has fully healed and the blood sugar level is under control.

CONCLUSION

The present case study signifies the role of Ayurvedic treatment in treating Diabetic foot with positive outcomes. The patients can make significant gains in symptoms, VAS pain score, Meggitt-Wagner classification, Leriche-Fontaine classification for ischemia, Diabetic ulcer severity score and functional test in a relatively short period of time. Additionally, there were also no ethical issues that arose during the duration of the Ayurvedic treatments of the patient. Although this case study was conducted in a single patient with a limited period of time, programming of the mass study with large statistical study is necessary for further evaluation.

REFERENCES