A REVIEW ON DIABETIC FOOT ULCER: COMPLICATION OF DIABETES MELLITUS
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ABSTRACT

In present scenario sedentary life style, lot of stress and over nutrition are important etiology of diabetic mellitus, as one of the most prevalent disease in the world. Diabetic foot ulcer is often quite dreaded disability cause of non traumatic lower extremity amputation. It occurs in 15% of all patient with diabetes mellitus and precedes 84% of all lower leg amputation. The classical triad such as angiopathy, neuropathy & infection in the formation of Diabetic foot ulcer vividly explained. The pathogenesis of foot ulcer is complex. Preventing of this condition should be first priorities. To help reduce the enormous burden of foot ulceration on both patient and health resource. The management of Diabetic foot ulcer required based on Blood sugar control, debridement, advanced dressing, and offloading modalities. Furthermore, surgery to heal chronic ulcer and recurrence should be considered as essential component of management. Also, Hyperbaric oxygen therapy, electrical stimulation could be used as adjacent therapies for rapid healing of Diabetic foot ulcer. In Ayurveda literature, Aacharya Sushruta has described sixty treatment modalities for Vrana. Shodhana (purification) by guduchyadi kwatha and Lepana (coating) by tiladi lepa having excellent result in diabetic foot ulcer.

Keywords: Diabetic foot ulcer, Angiopathy, Neuropathy, Shodhana (purification), Lepana (coating).

INTRODUCTION

Diabetic foot ulcer common problem through the world, resulting the major medical, socio and economic consequences for the patient1. It is the major complication of diabetes mellitus, diabetic foot is inherited and acquired are characterized by hyperglycemia, a relative lack of insulin. It is estimated prevalence of 12-15% among all individuals with diabetes and precedes 84% of all lower leg amputation2. Diabetic foot ulcer has classical triad of neuropathy, ischemia and infection. For diabetic foot ulcer many classification has given Wagner-Meggits, Gibbons, Coleman’s classifications etc.3

In Ayurveda literature, Acharya Charaka4, Acharya Sushruta5, Acharya Vagbhatta6, Acharya Madhava7 has described DUSTA VRANA. Dusta vrana having following symptom like foul smell, continuously pus discharge, formation of cavity etc. All symptom are similar to diabetic foot ulcer. Ayurveda gives many preventive measure and complete cure of diseases with minimum chance of recurrence. For better wound healing and minimum scar forming Acharya Sushruta explained treatment modalities like Shashti upkrama (sixty types of treatment modalities)5, Saptokrana (seven modalities of treatment)5. Shodhana (purification) with Guduchi kasaya8 & Tiladi lepa (external application)2 is great management procedure to achieve the main goal of wound healing.

Etiology

Vrana having doshik involvement known as a dushta vrana9. Nija vrana from the beginning is in the awastha having signs and symptoms of vitiated doshas. Agantuja vrana, though i.e. initially shuddha, gets transformed into this awastha after vitiation of doshas. Dushta is one of which there is localization of doshas or getting vitiated by doshas Vrana which smell foul, has abnormal colour with profuse discharge, intense pain and takes long period to heal is said to be dushta, the feature of dushta Vrana will according to the predominant doshas present in it.

In modern review10

Slightly injury to glucose laden tissue, Diabetic atherosclerosis, Peripheral neuritis they are three main causes leading diabetic foot ulcer.
Pathogenesis
Probable samprapti of dusta vrana\textsuperscript{16}

\begin{center}
\begin{tikzcd}
& VRANA \\
\downarrow & \\
\text{Contaminated diet, carrying of heavy} & \text{Defective surgical procedure} \\
\text{Load, severe exercise and emotion} & \text{like Mithya Bandha (defective bandaging)} \\
\text{Factors like anger, sadness etc.} & \text{Roksha (dry) are iatrogenic.} \\
\downarrow & \downarrow \\
\text{Rakta dhatu become vitiated by other dosha} & \text{Destructing of other Mansadi dhatu} \\
\downarrow & \downarrow \\
\text{Factors provocations} & \\
\downarrow & \\
\text{Manifest Dusta Vrana/Infected Wound} & \\
\end{tikzcd}
\end{center}

According to modern review
1. Increased glucose in the tissue precipitates infection.
2. Diabetic microangiopathy
3. Increase glycosylated hemoglobin decreases the oxygen dissociation and oxygen utilization.
4. Diabetic neuropathy involving all sensory, motor, and autonomous components\textsuperscript{16}.
5. Associated atherosclerosis

Following Pathology occur due to diabetic foot ulcer

\begin{center}
Neuropathy, microangiopathy, infection
\downarrow
Spreading ulcer
\downarrow
Cellulitis
\downarrow
Spreading cellulitis
\downarrow
Abscess
\downarrow
Gangrene
\downarrow
Osteomyelitis
\downarrow
Septicemia with ketoacidosis
\end{center}
Sites of ulcer
Commonest site is foot-planter aspect, Lower limb, scrotum, perineum, back also affected.

Clinical Feature
1. Diabetic foot ulcer has thick margin of keratinized tissue.
2. Ulcer is spreading and deep, edge callus & scales, copious discharge.
3. Foot deformity-hammer toe, clawing of toe.
4. Local pain in deep infection, burning, shooting type pain present.
5. In autonomic neuropathy- dry skin with cracks, bounding pulses, dilated dorsal vein warm foot.

Table 1: Symptom as per the different Ayurvedic literatures

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Sushruta samhita 21</th>
<th>Charaka Samhita 22</th>
<th>Astanga samgraha 23</th>
<th>Astanga hridaya 24</th>
<th>Madhava nidana 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>vedanyukta associated with shravva (pain with discharging excessively)</td>
<td>Shvetatva (pale)</td>
<td>atisamvritta (excessive narrow mouth)</td>
<td>atisamvritta (excessive narrow mouth)</td>
<td>does not posses may feature of sudhha vrana (fresh wound)</td>
<td></td>
</tr>
<tr>
<td>deergha kala anabandhi (chronic)</td>
<td>Avasannaa (depressed edge)</td>
<td>Ativivrutha (excessive wide mouth)</td>
<td>Ativivrutha (excessive wide mouth)</td>
<td>Pootigandha (unpleasant smell)</td>
<td></td>
</tr>
<tr>
<td>daha (burning sensation)</td>
<td>Atishoola Varmitavata (thickened edge)</td>
<td>Atimrudu (soft)</td>
<td>Atimrudu (soft)</td>
<td>Arushaka</td>
<td></td>
</tr>
<tr>
<td>Paaka (suppuration)</td>
<td>Atipinjara (yellowish)</td>
<td>Kathina (hard)</td>
<td>Kathina (hard)</td>
<td>Utsangi (tortuous tracks)</td>
<td></td>
</tr>
<tr>
<td>Kandu (itching)</td>
<td>Neelava (blue)</td>
<td>Atiutseda (excess sweat)</td>
<td>Atiutseda (excess sweat)</td>
<td>Charsitha (chronic)</td>
<td></td>
</tr>
<tr>
<td>Shopha (inflammation)</td>
<td>Shyavatava (dusky red)</td>
<td>Avased (sweating absent)</td>
<td>Avased (sweating absent)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Podika (pockets)</td>
<td>Atipootitava (excess pus)</td>
<td>Aatisheeta (excess cold)</td>
<td>Aatisheeta (excess cold)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atisamvritta (excessive narrow mouth)</td>
<td>Kumbhmukhaata vranas (pin-pointed)</td>
<td>Ushana (hot)</td>
<td>Ushana (hot)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ativivrutha (excessive wide mouth)</td>
<td>Vicharana (discolouration)</td>
<td>rakta, krushna or panduta (reddish, black, pale in colour)</td>
<td>rakta, krushna or panduta (reddish, black, pale in colour)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atimrudu (soft)</td>
<td>Bahusruavva (profuse discharge)</td>
<td>poottamamsa sira. snayu etc (discharges)</td>
<td>poottamamsa sira. snayu etc (discharges)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kathina (hard)</td>
<td>Maharaja (excessive pain)</td>
<td>Kandu (itching)</td>
<td>Kandu (itching)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>vedana pitika (painful pockets)</td>
<td>vedana pitika (painful pockets)</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Classification
According to Wagner Meggits classification 26
Grade 0- foot pain only
Grade 1- Superficial ulcer of foot
Grade 2- deep ulcer of foot
Grade 3- ulcer with bone involvement
Grade 4- forefoot gangrene
Grade 5- whole foot gangrene.

Investigation
1. Complete Blood Count usually demonstrates high total count with low Hb% (in infection) 27
2. Blood sugar test
3. Urine ketone bodies.
4. Discharge for culture & sensitivity
5. Arterial Doppler of the limb
6. X-Ray of part to see osteomyelitis.

Prevention
Life style modification, Blood pressure control, Lipid management, Glycemic control, Smoking cessation etc. are preventive measures for diabetic foot ulcer.

Treatment
Diabetic foot ulcer is a one of the of wound (dusta vrana). Wound healing is natural process but inhibited by many factors like infection, foreign bodies, vitiation of doshas. The management of Diabetic foot ulcer required based on Blood sugar control, debridement, advanced dressing, and offloading modalities. If Diabetic foot ulcer is neglect, lead chronic ulcer and recurrence. If once complication develop the treatment choice is surgery and also, Hyperbaric oxygen therapy, electrical stimulation could be used as adjacent therapies for rapid healing of Diabetic foot ulcer. These therapies are costly and produce many other side effects.

Acharya Sushruta described lots of treatment for dusty vrana like Shasthi Upkrama (sixty types of treatment modalities), Saptokrama (seven types of treatment). In Shasthi upkrama, shodhan (purification) 31 lepan (external use) etc are elaborately described. Acharya Sushruta was a keen observer to get a quick result, and he prescribed enema of guduchi and freshly prepared tiladi lepa applied daily on ulcer & kept till it starts drying. later lepa was removed followed by regular gauze dressing with jatyadi taila.

Guduchi Kasaya

Guduchi 32
Botanical name - Tinospora cardifolia
Roghagnata - Shotha (Inflammation), Raktavikara (Bleeding), Shoolat (Pain).
Karma – Vednasthapana (Analgesic), Raktashodhaka (Blood purifier). 
Pharmaceutical action - Aqueous extract of stem of Tinospora cardifolia have anti- hyperglycemic effect probably by stimulation of insulin release via modulation of beta cell & ca concentration. 26
Mode of application – External use for vrana- Shodhana (purification).
Table 2: Description of content of Tiladi lepa

<table>
<thead>
<tr>
<th>Drug</th>
<th>Botanical name</th>
<th>Rogaghanata</th>
<th>Prabhava</th>
<th>Pharmacological action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nimba94</td>
<td>Melia azadirachta</td>
<td>Kushta, shotha, updama, madhumeha</td>
<td>Vranoropana, vrina Shodhana (purification) (purification), kushghna, krimighna, madhumehanashka</td>
<td>Antulcer, anti-inflammatory, antiviral, antibacterial, antihyperglycemic55</td>
</tr>
<tr>
<td>Tila16</td>
<td>Sesamum indicum</td>
<td>Vrina, vbaraoga</td>
<td>Vatakaphashamsana twakprasadan, vranoropana, vrina Shodhana (purification)</td>
<td>Antihyperglycermic</td>
</tr>
<tr>
<td>Haridra57</td>
<td>Curcuma longa</td>
<td>Shotha, kushta, kandu, prameha</td>
<td>Frameghna, krimighna, shothhara, raktaprsadaka, kushghna, vrya, vrina Shodhana (purification) (purification), vranoropana.</td>
<td>Angiogenesis, in hence fibroblast proliferation</td>
</tr>
<tr>
<td>Daruharidra58</td>
<td>Berberis aristata</td>
<td>Vrina, kandu</td>
<td>Kapha prita shamka shothhara, vedna shapana, vrina Shodhana (purification)</td>
<td>Anti-fungal, local anesthetesa, antimicrobial, anti-inflammatory</td>
</tr>
<tr>
<td>Trivitta79</td>
<td>Operculina turpathan</td>
<td>Shotha, sthulya,</td>
<td>Shothahar, lekhhana,</td>
<td>Uler protective, anti-secretory, antimicrobial, anti-inflammatory, antioxidant.</td>
</tr>
<tr>
<td>Yasthamadhu41</td>
<td>Glycyrrhiza glabra</td>
<td>Vranashotha, prameha, kandu, skin diseases,</td>
<td>Vranoropana, dahaprashmaha, raktashodhaka</td>
<td>Anti-inflammatory, immunomodulator2, reduce serum cholesterol, hepatic cholesterol, anti-atherosclerotic</td>
</tr>
<tr>
<td>Ghrita45</td>
<td>-</td>
<td>Visha, krimi,</td>
<td>Rasayana, rakshogha, medohara, lekhana</td>
<td>Healing processes like collagenation and epithelization, immunomodulator, antimicrobial</td>
</tr>
</tbody>
</table>

Mode of application
Lepa (Local application on wound)
For the treatment of Diabetic foot ulcer- Shodhan by Guduchi kasaya & Tiladi lepa for local application is may be beneficial due having some following property-
1. Vedana shamaka
2. Raktashodhaka
3. Vranashodhaka
4. Vranoropaka
5. Madhumehanashaka

DISCUSSION
Diabetic foot comes under dusta vrana (infected ulcer). If Diabetic foot ulcer will not treat; the most common complication will be happened like non traumatic amputation in lower extremities. Guduchi kasaya shodhan (purification) & Tiladi lepa has lots of properties which help to treat diabetic foot ulcer. Properties of component of guduchyadi kasaya and tiladi lepa -
Guduchi- Its having anti hyperglymeric effect
Nimba- antulcer anti-inflammatory anti hyperglymeric property
Tila – anti hyperglymeric Sandhava – Anti septic, antiptyreptic, anti viral, antituiler
Haridra – Ant diabetic, Angiogenesis, enhance fibroblast proliferation
Daruharidra – anti fungal, local anesthesia, antimicrobial, anti-inflammatory
Trivitta – Ulcer-protective, anti-secretory, antimicrobial
Ghrita – increase healing processes like collagenation and epithelization, immunomodulator, antimicrobial
Yasthamadhu –Anti-inflammatory, reduce serum cholesterol & hepatic cholesterol, anti-atherosclerotic
All prosperities of drugs help to enhance wound healing in diabetic foot ulcer.

CONCLUSION
Diabetic foot ulcer is a debilitative disease with severe consequences in diabetic patient. It is important to carefully and completely foot care to all diabetic patient. Aacharya Sushruta has explained vrina (wound) in detail as a concourse of wound healing procedures i.e. sixty upakrama (sixty modalities of treatment) which includes local as well as systemic use of different drugs & treatment modalities one of such purification therapy Shodhan chikitsa by Guduchi kasaya (anti hyperglycemic action) & Lepan Chikitsa (coating) by Tiladi lepa (antibacterial property with enhance wound healing) have excellent result in dusta vrina treatment.

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