

An Analytical Study of An Integrative Approach to the Management of Diabetic Foot Ulcer

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Abstract

Diabetic foot ulcer (DFU) is a sobering condition present in 34% of diabetes patients, with a recurrence rate of 40%. DFU can be correlated as Dushta Vrana described by Acharya Sushruta. DFUs are more prone to infection. A 56-years-old diabetic patient with non-healing ulcer in right foot was treated with an integrative therapy. Vrana Prakshalana with Gomutra, sharp debridement, daily dressing with Jatyadi Taila, Manjishtadi Kshara Basti, Manjishtadi Lepa, Pranayama, charted wholesome diet and internal medications were incorporated. By the 35th day of treatment, formation of healthy granulation and epithelialisation, decrease in discharge and improvement in blood sugar were noticed. Vrana Shodhana, Ropana, Sophahara, Pramehahara properties of the interventions were used here which led into ulcer healing. Thus, an integrated approach is necessary to heal a multi-system involving disease like DFU.

Keywords

Diabetic Foot Ulcer, Madhumehaja Vrana, Jatyadi Taila, Gomutra Arka, Pranayama, Manjishtadi Kshara Basti, Dushta Vrana.

Introduction

Diabetes Mellitus is a common metabolic disease characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action or both. The prevalence of Type II Diabetes Mellitus is 8.7% in adults aged 20-79 years, according to International Diabetes Federation (IDF), Diabetes Atlas (2015)¹. This represents 415 million people worldwide. India stands second, next to China among developing countries in diabetes cases².

Diabetic foot ulcer (DFU) is defined as a full thickness wound which is present at a level distal to the ankle in patients with diabetes mellitus³. The majority of foot ulcers start as a result of minimal trauma in the presence of sensory neuropathy. The duration and intensity of hyperglycaemia cause nerve damage and worsen the DFU. It is estimated that 19 to 34% of patients with

diabetes mellitus are likely to be affected with a DFU in their lifetimes. The IDF reports that 9.1 to 26.1 million people will develop DFUs annually⁴. Treatment of DFU accounts for half of the total cost in diabetic care. Still it may leave an unhealed ulcer in 20% of cases by the year⁵, which can lead to a gangrene. Also, chance of recurrence after complete healing of an ulcer is 40% within one year³.

The abnormalities in micro- and macro-vascular abnormalities, impaired epithelialization, reduced angiogenesis⁶, oxidative stress by hyperglycaemia at wound environment are causative mechanisms involved in impaired wound healing⁷. DFUs are more prone to infection than non-diabetic wounds. Wound infection prolongs the inflammatory phase by increasing the production of inflammatory cytokines and tissue destruction⁸.

DFU can be correlated as Madhumehaja Dushta Vrana described by Acharya Sushruta. Gomutra Arka Prakshalana followed by dressing with Jatyadi Taila⁹ helps in improving wound healing by Shodhana and Ropana effects. Shodhana includes enzymatic and mechanical debridement, autolytic processes; while Ropana is understood as granulation formation and migration of epidermal cells. Optimized blood glucose and control of infection aid in proper wound healing¹⁰.

Case Study

Chief complaints

A male patient of 56 years, working as a fruit vendor at Tumkur, Karnataka, reported to SDM College of Ayurveda and Hospital, Hassan with complaint of non-healing ulcer on right foot for three months with blackish discolouration of right big toe since one week. Swelling of right lower limb since one week.

History of present illness

The patient is a known case of diabetes mellitus since four years, under medications since two years. Three

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months back, he developed a blackish discolouration on the second and third toes of right foot. These toes were later surgically removed from an allopathic hospital which resulted in a wound. One week back, he noticed similar discolouration on the great toe. The wound formed after removal of toes, was gradually increasing in size with foul-smelling discharge containing pus. Touch and pain sensations were reduced on right foot especially near the wound site. Swelling of right lower limb was also noticed. Then the patient took consultation from Shalya Tantra Out Patient Department of SDM College of Ayurveda and Hospital, Hassan.

Personal History

The patient had good appetite. The bowel and bladder habits were regular. He used to have sound sleep, was a chronic smoker for fifteen years and left smoking since last one year.

History of past illness

Patient is a known case of Diabetes mellitus since four years, under oral hypoglycaemic agents since two years.

Drug History

Tablet Glimepiride 2mg + Metformin 1000mg 1-0-1 B/F

General Examination

The blood pressure of patient was 130/80 mmHg on supine position. The pulse rate was 76 beats/min. The patient had mild pallor, right inguinal lymphadenopathy, no cyanosis; except gangrenous changes of first digit of right lower limb, oedema of right lower limb below the knee joint and no dehydration. There was no icterus or clubbing present.

Gait: limping gait.

Systemic Examination

Per abdomen, cardiovascular, respiratory, CNS examination yielded normal findings.

Local Examination:

- Unilateral non-pitting oedema of right lower limb below the knee joint with erythema and raised local temperature, suggestive of cellulitis.
- Dry gangrenous changes of the first digit of right lower limb were noted.
- Post amputation status of second and third digits.
- Peripheral Arterial Pulse Examination- see Table 1.

Table 1 – arterial pulsations of right lower limb

Artery of right lower limb	Pulsations
Dorsalis Pedis	Feeble

Anterior Tibial	Palpable
Posterior Tibial	Palpable
Popliteal	Palpable
Femoral	Palpable

Examination of the Ulcer

Inspection:

- An ulcer on right foot approximately 8cm x 6cm in dimension and a depth of 1.8cm with slough and inflamed edges.
- Surrounding skin was inflamed and oedematous.

Palpation:

- Local rise of temperature and tenderness were present.
- Bleed on touch and induration were absent.

Investigations

- Haemoglobin 9.2 gm%
- Total leucocyte count - 13,500 cells/mm³
- Differential leucocyte count
 - Neutrophils – 72%,
 - Lymphocytes – 24%,
 - Monocytes – 1%,
 - Eosinophils – 3%,
- Fasting Blood Sugar – 147.2 mg/dL
- Two-Hour Postprandial Blood Sugar – 188.2 mg/dL
- Fasting urine sugar - 1%
- Post-prandial urine sugar - 2%
- HbA1c - 9.2%

Therapeutic Interventions – Medical and Surgical:

1. Ray's amputation of first metatarsal bone in the operation theatre under local anaesthesia.
2. Proper antibiotic after swab culture and sensitivity report.
3. Injection Insulin Isophane (70%) + Human Insulin (30%) - short and long acting, for strict control of blood glucose levels.
4. Daily twice Vrana Prakshalana (cleaning of ulcer) with Gomutra Arka (Distilled cow's urine).
5. Daily twice dressing with Jatyadi Taila
6. Manjishtadi Kshara Basti – Karma Basti (Table 2 and Table 3)

Table 2- Niruha Basti Ingredients:

Sl. No.	Niruha Basti Ingredients	Dose
1	Makshika	50ml
2	Saindhava Lavana	12g
3	Sneha- Ksheerabala taila	80 ml

4	Kalka of Shatapushpa	10g
5	Mahamanjishtadi kwatha	200ml
6	Gomutra	200ml
7	Dhanyamla	50ml

Table 3: Karma Basti Schedule

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VASTI	A	A	N	A	N	A	N	A	N	A	N	A	N	A	N
DAY	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
VASTI	A	N	A	N	A	N	A	N	A	N	A	A	A	A	A

Niruha Basti – Mahamanjishtadi Kwatha - 200ml,

Gomutra- 200ml and Dhanyamla-50ml.

Anuvasana Basti – Ksheerabala Taila 80ml.

7. Tablet Gandhaka Rasayana¹¹ 2-0-2 A/F
8. Asanadi Kashaya¹² 15 ml BD B/F
9. Manjishtadi Lepa¹³ external application as Sheeta Lepa below left knee joint till foot for 45 minutes and then removal – twice daily for first 15 days.
10. Punarnavashtaka Kashaya¹⁴ 15 ml BD B/F for first 15 days.
11. Daily Pranayama for 30 minutes in the morning.
12. Antidiabetic diet from Pathyahara Kitchen of SDM Hospital was used. Here Wholesome diet specially charted for Diabetes patients were given to the patient. It included the following: (Table 4)

Table 4: Pathyahara Kitchen's Antidiabetic diet

Sl.No.	Pathya Food/Drink	Timings
1	Laja Manda	3pm
2	Moong dal Khichdi	Lunch
3	Ragi Peya	Dinner
4	Ragi Roti/ Yava Roti	Breakfast
5	Mudgamalaka Yusha	11am
6	Shunti Jala	100ml TID as sips

3. Exudate Type Type of Exudate from wound bed

Exudate type	Day 1	Day 7	Day 14	Day 21	Day 28	Day35
Watery/ Thick/ cloudy/ Purulent/ red/ pink	Reddish	Purulent	watery	Watery	Watery	watery

4. Infection – Local and Systemic

Signs Of Infection	Day 1	Day 7	Day 14	Day 21	Day 28	Day 35
Pain	+	+	+	+	+	+
Erythema	++	++	++	+	-	-
Oedema	++	++	++	+	+	+

Assesment Criteria

The assessment of wound healing was done with "The Triangle of Wound Assessment"¹⁵. It is recognised as a holistic tool to ensure effective wound care¹⁶. Three parameters are checked - assessment of wound bed, tissue type and periwound skin. It gives a guideline for removal of non-viable tissue, management of exudate, bacterial burden, and problems of periwound skin within 4 cm of wound edge¹⁷.

The Fasting and Post Prandial Blood sugar were checked on regular intervals.

Cellulitis was assessed using measurement of local temperature with an infrared thermometer, mid-calf circumference and total WBC count at regular intervals¹⁸.

Observations

A) Wound Bed

1. Tissue Type: expressed as percentage of tissue type in the wound bed

Type of Tissue (In %)	Day 1	Day 7	Day 14	Day 21	Day 28	Day 35
Necrotic	40	30	10	0	0	0
Sloughy	30	30	20	10	5	5
Granulating	40	50	70	75	85	90
Epithelializing	0	0	0	10	20	35

2. Exudate Level

Level of Exudate from wound bed

Level of Exudate	Day 1	Day 7	Day 14	Day 21	Day 28	Day 35
Dry/Low /Medium /High	Medium	Medium	Medium	Low	Low	Low

Local Warmth	++	+	+	+	-	-
Exudate	++	++	++	+	+	+
Friable Granulation Tissue	+	++	++	++	+++	+++
Malodour	++	+	+	+	-	-
Pocketing	+++	++	+	+	-	-
Abscess/Pus	++	++	+	-	-	-
Cellulitis	+++	++	++	++	+	+
General Malaise	++	+	+	+	-	-
RAISED WBC COUNT (Cells/Mm3)	13,500	12,800	12,300	11,800	10,200	8000
Lymphangitis	+	+	-	-	-	-

B) Wound Edge

Edge of the wound	Day 1	Day 7	Day 14	Day 21	Day 28	Day 35
Macerated/Dehydrated/ Undermining/ Rolled/ sloping (healthy)	Rolled	Rolled	Sloping	Sloping	Sloping	Sloping

C) Periwound Skin

PERIWOUND SKIN	Day 1	Day 7	Day 14	Day 21	Day 28	Day 35
Maceration/ excoriation/ Dry skin/ hyperkeratosis/ callus/ eczema	Hyperkeratosis	-	-	-	Healthy	Healthy

D) Fasting and Two-Hours Post Prandial Blood Sugar

DAY	DAY 1	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35
Fasting Blood Sugar(mg/dL)	147.2	123.5	128.0	93.6	85.2	81.4
Post Prandial Blood Sugar (mg/dL)	188.2	128.2	108.0	135	125.2	121.3

E) Assessment of Cellulitis

Parameters	Local temperature (° F)	Mid-calf circumference (cm)	Total WBC Count (cells/mm3)
Day 1	98.2	37.5	14,300
Day 7	97.5	36.8	13,500
Day 14	97.2	36.4	11,200
Day 21	97.2	35	11,000
Day 28	96.4	34.5	10,800
Day 35	95.9	34	9000

Discussion:

Post amputation, one course of antibiotic therapy was given based on swab culture and sensitivity report.

Daily Shodhana of the wound with Gomutra Arka helped in reducing the bacterial load and mechanical removal of slough from the wound site. Unlike other chronic ulcers, DFUs do not heal fast due to pathogenic microbial infections. Low blood supply, uncontrolled inflammatory response, reduced re-epithelialisation

and presence of biofilm-associated infections are the causes¹⁹. The poly-microbial load associated with biofilm is refractory to the conventional antibiotic therapy²⁰.

Gomutra²¹, according to Acharya Sushruta is Katu, Teekshna, Ushna and Ksharana in action. Gomutra Arka, obtained after distillation process, loses its pungent odour and augments antimicrobial and antifungal drugs' action²². It augments B- and T-lymphocyte blastogenesis; and IgG, IgA and IgM antibody titres in mice. It increases



FIGURE 1 – Pre amputation of the first phalanx.



Figure 2 -Post transmetatarsal amputation Status.



Figure 3: Day 3



Figure 4: Day 7



Figure 5: Day 10



Figure 6: Day 14



Figure 7: Day 21



Figure 8: Day 28



Figure 9: Day 35.

(Figure were taken by the corresponding author himself.)

interleukin-1 and interleukin-2 secretions and phagocyte activity of macrophages²³. Wounds treated with Gomutra have shown significant infiltration of polymorphonuclear cells, neovascularization and fibroblast proliferation²⁴. Anti-diabetic potential of Gomutra may be attributed to its antioxidant properties²⁵. Volatile fatty acids present in Gomutra Arka may be contributing to reduction in oxidative stress in diabetic wounds²⁶. Hence Gomutra Arka was used for Prakshalana in the subject. There was significant decrease in necrotic and slough tissues from seventh day post amputation surgery.

Jatyadi Taila was used because of its Shodhana and Ropana, Chedana, Amapachana, Kapha Vata Shamana, Raktashodhaka and Lekhana actions. Jatyadi Taila is already proven to improve cellular proliferation, rapid epithelization and collagenisation marked by significant increase in protein, hydroxyproline and hexosamine content in the granulation tissue²⁷. Bark of Nimba and Haridra -ingredients of Jatyadi Taila, have significant anti-inflammatory and anti-bacterial activity²⁸. Aqueous extract of Nimba leaves decreased blood sugar in dogs²⁹. Swarasa of Jati plant showed antibacterial activity against Staphylococcus Aureus³⁰.

The oxidative stress from high blood glucose causes endothelial injury, inflammation and oxidized lipid accumulation at endothelial walls (macro-vascular complications of diabetes). Manjishtadi Kshara Basti is used expecting its Ksharana action. Moreover, antioxidant quality of Gomutra and Manjishta³¹ might have helped in reducing endothelial injury induced inflammation and improving blood supply.

In-vitro antifungal and antibacterial action of Gandhaka Rasayana is already proven³². As it is indicated in Prameha and Vatamaya, Gandhaka Rasayana in tablet form was used for two months.

Asanadi Kashaya, which is indicated in Prameha was used expecting its anti-diabetic activity³³.

Alepa is considered as the first and foremost important treatment in all types of Sopha³⁴. It is especially beneficial in Avidagdha Sopha and reduces Daha, Kandu and Ruja³⁵. Application of Sheeta Manjishtadi Lepa³⁶ inflicts local pressure by the binding property of Shali Pishti and reduces local warmth by Sheeta Guna. Manjishta being Varnya helped in reducing the erythema. The osmotic gradient created by Lepa application might have reduced the swelling associated with cellulitis. By 15 days of application, local warmth, redness and swelling were reduced.

Punarnavashtaka Kashaya was given for initial 15 days, since it has Sothahara and Tridosahara and Mutrala properties³⁷.

Sympathetic activation is directly linked with rapid and sustained increase in circulating glucose concentrations³⁸. As an attempt to curb sympathetic activities and trigger parasympathetic system, in turn reducing blood sugar, Pranayama exercises were incorporated in the treatment schedule³⁹.

Pathya Ahara is inevitable in the management of Prameha. Cereals such as Godhooma, Yava, Jeernasali are explained by Acharya Sushruta as Pramehahara⁴⁰. These were used in Roti and Peya forms. Mudga Yusha was adopted because of its low glycaemic index, high

fibre content, antioxidant effects⁴¹. Laja Manda and Jeeraka Sidha Takra were used to refresh the patient and reduce polyphagia. Probiotics in Takra improved gastric motility and digestion⁴². Shunti Jala was used thrice a day to promote insulin sensitivity and control blood glucose⁴³.

Diabetic Gangrene had set in the first phalanx with pus discharge and mild pain (Figure 1). Transmetatarsal amputation of the involved joint was performed (Figure 2).

On 3rd day of surgery, clots at the wound site were removed (Figure 3). Foul smelling thick discharge prior to operation was reduced after sharp debridement. By 7th day, seropurulent discharge was noticed on dressings. Black scabs which appeared on the ulcer edge were removed. Healthy granulation was appearing on wound bed (Figure 4). Seropurulent discharge was reduced by 10th day. Non-viable tissues were debrided (Figure 5). By 14th day, discharge had significantly reduced (Figure 6). Warmth and oedema - features of cellulitis at the

right lower limb had reduced. Healthy granulation tissue started covering the bone ends. By 21st day, ulcer bed became reddish. Discharge was serous in nature. Non-viable tissues were reduced (Figure 7). By 28th day, there was further reduction in size of the ulcer (Figure 8). By 35th day, there was minimal discharge of <0.5ml, with epithelial tissue covering the wound edges. Granulation at the ulcer bed was healthy (Figure 9).

Conclusion

It is understood from the study that an integrated approach is useful in the management of DFU. Care was taken on curbing the blood sugar level by hypoglycaemic agents and Pramehahara Aushadhi. Cellulitis, by Bahiparimarjana and Antaparimarjana simultaneously. Daily Prakshalana, debridement and dressing accelerated the wound healing process. Patient was advised to follow Pathyaharavihara during the entire course of the treatment.

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A choice for oral health; Sapthachadadi Kashayam (Gandoosham)

Abstract

Oral health is now considered an important and integral part of general health because poor oral health causes pain, discomfort, affects speech, ability to eat, sleep, self-esteem and confidence. Oral disorders may also result in increased morbidity and mortality, disfigurement and ultimately reduce the quality of life of the affected individual. Sapthachadadi Kashaya is a poly herbal formulation mentioned in Ashtangahrudayam uttarasthanam mukha roga prathisheda. The diseases of oral cavity ie, oshta, ganda, dantha, danthamoola, jihva, gala etc are comes under mukharoga. Sapthachadadi kashaya is specially mentioned for mukha paka in which the patient may exhibit symptoms like pyria, tongue crack, mouth ulcers, sensitivity of tongue etc. This kashaya can be used internally and mainly as gandoosha for diseases pertaining to oral cavity.

Key words

Mugapaka, oral hygiene, gandoosha, Sapthachadadi Kashaya

Introduction

Oral health is now considered an important and integral part of general health because poor oral health causes pain, discomfort, affects speech, ability to eat, sleep, self-esteem and confidence. Oral disorders may also result in increased morbidity and mortality, disfigurement and ultimately reduce the quality of life of the affected individual. Oral cavity is a part of our body which is easily and constantly get exposed to exogenous risk factors. It can be contaminated through food, drinks, junk food and addiction of tobacco, smoking, alcohol etc. If these habits get continued, toxins may get accumulated into the oral cavity. Bacteria invading these toxins leads to oral diseases. Ultimately resulting in bad oral hygiene

and may lead to various oral diseases.

In Ayurveda literature, there are two methods of practice followed for oral hygiene, Kavala (Gargling) and Gandoosha (Holding fluid inside the mouth/ Oil Pulling). Kavala is a procedure of holding comparatively small quantity of liquid in the mouth; make it move briskly inside and spitting out quickly. Gandoosha Filling the mouth with oil or medicated water daily and holding for a few minutes without moving it inside the oral cavity. Hold the liquid in mouth till mouth gets filled with phlegm or till secretions from nose/ eyes begins. Kavala and Gandusha are the procedures described in Dincharya.

The mukha i. e. oral cavity works as a reflector of body health by acting as a gateway of alimentary canal. Therefore it is considered as a most important part of Urdhwajatru. By eliminating toxins Gandoosha helps to maintain oral cavity clean and healthy. Depending upon the therapeutic effect and dosha dominance there are few types of Gandoosha recommended in the texts. Among them sapthachadadi kashaya is used as ropana gandoosha where kashaya is used as the media for gandoosha karma.

Many mouthwashes that are available in the market contain fluoride, which has been known to cause some gastric distress. Sapthachadadi kashaya is orally safe, palatable and does not destroy any digestive juices and is presently known to have antimicrobial, antiviral, anti-inflammatory, antioxidant, anticancer, anti-adherent, and anti ulcer properties in various published biomedical researches. The wound healing and cellular immune responsive action would have contributed to the observed therapeutic role in radiation-induced oral mucositis¹.

The cumulative effect of below mentioned ingredients suggest that this formulation can be effectively promoted as a supporting aid for preventing the complication of