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Case Report

Integrative Management of Diabetic Foot Gangrene: A Case Report

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ABSTRACT:

Background: Diabetic foot gangrene (DFG) remains a major clinical challenge, particularly in patients with coexisting peripheral arterial disease. This coexistence can delay intervention, which may lead to limb loss. In Ayurveda, this condition can be considered under the concept of *Kotha* and *Dushtavrana.* Ayurveda texts clearly state the multimodal management strategy for the same. **Clinical Findings**: A 41-year-old male with a history of Type 2 diabetes mellitus for 1 year presented with black discoloration of the first to third toes of the left foot associated with swelling, pus discharge, and sensory loss. Imaging and clinical features supported the diagnosis of both Buerger's disease and Diabetic foot gangrene. After careful assessment, the overall presentation favored the diagnosis of DFG. Based on Ayurveda principles, the diagnosis of *Vata-pittaja dushta vrana* was made. **Intervention:** *Chedana karma* in the form of disarticulation of the second and third toes and debridement of the first toe was done, followed by conservative treatment. A single dose of prophylactic antibiotic was given before the procedure. It included *Panchatiktak ghrita guggulu, Gandharva haritaki churna* orally, *Jatyadi ghrita* application locally, and *Jalauka-avacharana* (leech therapy) for a total of seven alternate-day sittings. Management also included continuation of antidiabetic medication, smoking cessation, and routine supportive measures in the form of offloading using Microcellular rubber footwear and a diabetic diet. **Outcome:** Complete (100%) wound healing was seen within 14 days without any flap necrosis. Vibration perception threshold reduced from 30V (severe neuropathy) to 22 V (normal). The patient was able to resume his regular duties within a month. No adverse event was observed during the treatment. The patient was followed up for 1 year, and no recurrence of symptoms was observed. **Conclusion:** This case demonstrates integrative approach to the management of diabetic foot gangrene is beneficial in preventing major limb loss and disability.

KEYWORDS: Ayurveda, case report, diabetic foot, flap necrosis, gangrene, integrative medicine, *Kotha*

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1. INTRODUCTION

Diabetic foot gangrene is one of the major complications of diabetes mellitus (DM). It becomes a diagnostic and therapeutic challenge when vascular diseases such as peripheral arterial disease, Beurger's disease are present concomitantly. [1,2] The incidence of diabetic foot complications is rising with the increase in the cases of DM. This has contributed to amputations, morbidity, mortality as well as significant healthcare expenditure globally. The annual incidence of Diabetic foot ulcers is 1.0 % to 4.1 % with the lifetime risk of nearly 25%. [3, 4] Lower limb amputations, as a complication of DM are observed to be 2.1 to 13,7 per 1000 individuals. [4] Outcomes of the amputations remain poor. The associated mortality rates range from 13 % to 40 % in first year and increase up to 39% to 80% within five years, which are higher than those for several malignancies. [3-5] These high morbidly and mortality are attributed to the factors such as peripheral vascular diseases, peripheral neuropathies and impaired wound healing. Studies have shown that out of the newly diagnosed patients of DM have diabetic foot ulcers, 50% have neuropathic ulcers, 19.7% have ischemic ulcers and 35% have neuro-ischemic ulcers. [6] Reconstructive surgeries that allow the limb salvage are associated with various complications in the patients with DM. Flap necrosis is a major concern occurring in 6.6% (local reconstruction) to 18.2% (free flap) cases. [7] Underlying vascular compromise, susceptibility to infections and delayed wound healing are considered as the causative factors. [8] Modern diagnostic tools such as vascular imaging have limited role in differentiating the disease, especially when multiple pathologies coexist. [9] In such situation integration of Ayurveda treatment options such as *Jalauka-avacharana* along with the standard of care can help the salvage of flap necrosis. [10]

To integrate Ayurveda in the management of diabetic gangrene, parallel Ayurveda based diagnosis must be established. Ayurveda considers the condition as *Kotha* (gangrene) under the domain of *Dushta vrana* (infected wounds). Texts prescribe *Chedana* (excision) for the management of *Kotha.* [11] Further, the management of *Dushta vrana* includes *Nidaja parivarjana* (removal of causative factors) and appropriate modalities from *Shashti upakrama* (sixty treatment modalities). [12] These modalities focus on local as well as systemic aspects of healing. In this case, modalities such as leech therapy, *Vrana ropana* and *Nidana parivarjana* in the form of smoking cessation and diabetic control were utilized. Hence their integration with standard of care helps in the holistic management of diabetic gangrene.

This case report provides insights on how the integrative management strategies are beneficial in the management of Diabetic foot gangrene to prevent limb loss and avoid complication of flap necrosis in reconstructive surgery.

2. CASE REPORT

A 41-year-old diabetic male patient, a driver by profession and resident of, New Delhi, presented to the OPD of an Ayurvedic hospital with complaints of black discoloration involving the 1st to the partially amputated 3rd toe of the left foot for the past 8 months, swelling of the 2nd toe for 3 months, and pus discharge from the same region for the last 3 months. There were no complaints of intermittent claudication or rest pain. In view of the progression of symptoms and non-resolving nature of the condition despite multiple options of management, the patient sought treatment at the OPD and was admitted for further evaluation and management.

The patient was a known case of Diabetes Mellitus (DM) for 1 year and has been on regular evaluation and medication for the same as prescribed by his physician. There was no history of hypertension (HTN), tuberculosis (TB), chronic obstructive pulmonary disease (COPD), thyroid disorder, or any other chronic co-morbidity. There was a significant past surgical

history of amputation of only the distal phalanx of the 3rd toe of the left foot based on the diagnosis of diabetic gangrene, which was performed at another hospital 7 months ago.

The patient belongs to a low socioeconomic background. He gives a history of chronic bidi smoking for the past 10 years, with a consumption of approximately 20 bidis per day.

On examination, the patient was conscious and oriented to time, place and person. Physical examination revealed no signs of pallor, cyanosis, clubbing, Lymphadenopathy, edema and vitals were stable. Systemic examination did not reveal any abnormalities.

Clinical findings

The patient presented with gangrenous changes involving the tip of the left great toe, distal phalanx of the left second toe, and proximal phalanx of the left third toe. The distal phalanx of the left third toe had already been amputated. Swelling was observed in the left second toe, accompanied by mild purulent discharge. On palpation, localized temperature was raised. Sensory–motor examination revealed complete loss of over the left foot up to the ankle joint (vibration perception threshold on biothesiometry was 30 volts indicating severe neuropathy), while motor functions were preserved. The Semmes-Weinstein monofilament (SWM) test was used to assess peripheral neuropathy, which revealed diminished sensation (Grade 0) vascular assessment showed normal popliteal artery pulsation, weak pulsations of the anterior and posterior tibial arteries, and absence of dorsalis pedis artery pulsation. The contralateral (right) foot appeared normal.

Diagnostic assessment

Modern evaluation

Arterial Doppler of the left lower limb (done on 26th December 2024) showed significant narrowing of the posterior tibial artery. CT angiography (done on 26th December 2024) revealed a non-calcified atherosclerotic plaque measuring approximately 4 mm at the aortic bifurcation, extending up to 2 cm into the bilateral common iliac arteries. The left posterior tibial artery was not visualized, and a few collateral vessels were noted.

Fasting and postprandial blood glucose levels were assessed and found to be 180 mg/dL and 276 mg/dL, respectively. Glycated hemoglobin (HbA1c) was recorded at 9.7%. The lipid profile was deranged, suggestive of an atherogenic pattern suggested by Hypercholesterolemia (Total cholesterol 248 mg/dL), Hypertriglyceridemia (210 mg/dL), elevated LDL (174 mg/dL and low HDL (32 mg/dL). Hemoglobin level was within normal limits at 11.6 g/dL, while the total leukocyte count was mildly elevated at 11,600 cells/mm^3.

Table 1: Differential diagnosis

Sl. No.	Differential Diagnosis	Inclusion	Exclusion
1.	Buerger's disease (thrombo-angiitis obliterans)	History of chronic smoking (20 bidis/day) and segmental arterial involvement suggested this possibility.	The absence of rest pain and intermittent claudication made this diagnosis highly unlikely. Hence excluded.
2.	Diabetic ischemic gangrene	Known case of type 2 diabetes mellitus (1 year), atherosclerotic changes in vessels (CT angiography), and black discoloration of toes supported this. There was a chronic 10-year history of smoking which supports the smoking induced atherosclerosis.	

Diagnostic challenges

The main diagnostic challenge was due to the overlapping features of diabetic foot gangrene and Buerger's disease. To establish the final diagnosis, chronology of the clinical history and the investigations were considered. The 10-year-old history of smoking initiated the atherosclerotic changes which

were accelerated by recent onset of poorly controlled Diabetes mellitus. It resulted in rapid advancement in the arterial compromise leading to critical limb ischemia and ultimately the gangrene. Therefore, the diagnosis was made as the diabetic foot gangrene with the concomitant smoking induced atherosclerosis.

Ayurvedic Assessment

Patient presented with the condition where the affected toes were extremely *Ruksha* and *Shushka* (dry), *Shyava-krishna* (black) in color with the *Svapa* (loss of sensation/numbness) which indicated *Vata* dominance. The clinical history showed that the process of *Paka* and *Kotha* (necrosis) were progressive which indicated the persistent *Pitta* vitiation. Based on these facts, the diagnosis of *Kotha* with *Vata-pitta* dominance was made and further treatment was planned accordingly.

Prognosis: The condition was associated with significant morbidity. Due to established gangrene, the loss of toes was inevitable.

The prognosis was explained to the patient. After obtaining written informed consent patient was admitted and underwent disarticulation of the second and third toes along with the debridement of necrotic skin over first toe of the left foot under local anesthesia, followed by primary closure of the skin flaps. From the first postoperative day, based on the *Agni* (digestive capacity), *Avastha* (stage of disease), *Panchatiktaka Ghrita Guggulu* 10 mL, twice daily before meals with warm water and *Gandharva Haritaki Churna* 5 g at bedtime were initiated, along with continuation of anti-diabetic medications. Local wound care included daily dressing with *Jatyadi Ghrita*. Additionally, to pacify any residual *Pitta*, to avoid necrosis and to facilitate rapid reperfusion of the flaps, two medicinal leeches were applied on alternate days over the approximated skin flaps for a total of seven sittings. The patient was counseled to discontinue smoking and was advised a diet plan tailored for glycemic control and wound healing. Detailed intervention is summarized in Table 1.

Therapeutic intervention

Table 2: Summary of Interventions

Intervention Type	Specific Details & Dosage	Frequency / Duration
Surgical	Prophylactic Antibiotic (Single Dose); Disarticulation of 2nd & 3rd toes; Debridement of 1st toe.	Dec 29, 2024 (Day 0)
Modern (Systemic)	Tab. Metformin (500mg); Tab. Glimepiride (2mg).	Daily (Continued)
Supportive	Smoking Cessation, Microcellular Rubber Footwear, Diabetic Diet.	Dec 29, 2024
Internal Ayurveda	*Panchatikta Ghrita Guggulu* (10ml BD, before food).	Dec 30, 2024 – Jan 12, 2025
	Gandharva Haritaki Churna (5g HS, with warm water).	
Para-Surgical	*Jalaukavacharana* (Leech Therapy) - 2 leeches/sitting.	7 Sittings (Alternate days)
Topical	Daily dressing with *Jatyadi Ghrita*.	Daily until discharge

Timeline

Table 3: Timeline of events.

Date / Period	Event / Clinical Milestone
Dec 2023	Patient diagnosed with Type 2 Diabetes Mellitus; initiated oral hypoglycemics.
Apr 2024	Initial onset of symptoms: Mild black discoloration at the tip of the left 3rd toe and mild pain. No treatment was done.
May 2024	The discoloration progressed and symptoms worsened. He visited nearby hospital for the treatment. Surgical

	intervention: Amputation of the distal phalanx of the left 3rd toe.
Sep 2024	Disease progression: Progressive blackening observed in the 2nd and great toes.
Oct 2024	Onset of swelling and purulent discharge from the 2nd toe.
Dec 29, 2024	Symptoms were persistent. He visited our hospital for the treatment. After thorough evaluation, treatment was planned. Consent was taken. Hospital Admission (Day 0): Disarticulation of 2nd & 3rd toes and debridement of 1st toe performed.
Jan 8, 2025	Suture removal. Healthy well approximated wound edges.
Jan 12, 2025	Discharge (Day 14): Complete wound healing achieved; patient discharged with oral medications.
Jan 26, 2025	First Follow-up (1 Month): Healthy scar formation at amputation site; patient resumed light walking with offloading footwear.
Mar 2025	Third Month Follow-up: No signs of secondary infection or ischemia; tobacco abstinence maintained; HbA1c stabilized.
Jun 2025	Sixth Month Follow-up: Full sensory return in the surrounding tissues of the left foot; resumed regular professional duties.
Jan 2026	Final Follow-up (12 Months): No recurrence of gangrene or ulcers; patient maintains normal routine activities.

Follow up and outcome

On third post-operative day of disarticulation, wound site was viable. There was no pus discharge. On seventh day, wound edges were well approximated. No flap necrosis was observed. Sutures were removed on tenth day. Complete healing was observed within 14 days. Patient was followed up every 14 days for one month and then monthly for one year. No recurrence of symptoms was observed. Adherence was assessed by daily ward rounds during the hospital stay and daily dressing was done. After the discharge, the patient follow ups were monitored using the logbook. Patient-reported symptoms were used to assess tolerability. The patient tolerated the medication and procedure well without any adverse event during the hospital stay and throughout the follow-up period. Serial assessments are presented in Table 3.

3. RESULTS

Table 4: Clinical Assessment

Phase / Day	Date	Symptoms and local assessment	Objective assessments
Pre-Admission (Imaging)	Dec 27, 2024	Gangrenous changes in 1st–3rd toes; localized edema; purulent discharge from 2nd toe.	Color Doppler (Left Lower Limb): Monophasic flow in Dorsalis Pedis (DPA) and Posterior Tibial (PTA) arteries. Significant intimal thickening. CT Angiogram: Multi-segmental atherosclerotic plaques. 80% stenosis in the infra-popliteal segment; distal runoff to the foot is severely compromised.
Pre-Admission (Labs)	Dec 28, 2024	Foul-smelling discharge; coldness of the distal foot.	Biothesiometry: VPT = 30 V (Severe Neuropathy). Complete Blood Count: Hb 11.6 mg/dL, TLC 11600 cells/mm^3 Lipid Profile: Total Chol: 248 mg/dL; LDL: 174 mg/dL (Atherogenic pattern). HbA1c: 9.7% (Poor control).
Day 0	Dec 29,	Immediate post-op: Flaps approximated; 1st toe	-

(Surgery)	2024	debrided; mild oozing. Loss of sensory function.	
Day 2	Dec 31, 2024	Flap healthy; no soakage; mild local edema; Leech sitting 1.	Complete Blood Count: Hb 10.2 mg/dL, TLC 8670 cells/mm^3
Day 4	Jan 2, 2025	Flap margins viable; granulation appearing healthy; Leech sitting 3. No pain. No signs of infection.	-
Day 8	Jan 6, 2025	Wound edges well-approximated; no signs of marginal ischemia; Leech sitting 5.	-
Day 11	Jan 9, 2025	Suture line healed; sutures removed; Leech sitting 7 (Final). Sensory Return: Patient reported mild tingling/returning sensation in the foot.	Biothesiometry: VPT = 25 V
Day 14 (Discharge)	Jan 12, 2025	Complete Wound Healing. Flap salvage successful; healthy scar.	-
1-Month follow-up	Feb 12, 2025	Surgical scar is mature; no secondary ulceration.	Biothesiometry: VPT improved to 22V; return of protective sensation.
3-month follow-up	Mar 13, 2025	Healthy scar. No signs of infection or ischemia.	-
1-Year follow-up	Jan 2026	No recurrence of gangrene; skin is supple with normal hair growth (good perfusion).	Clinical Status: Full resumption of professional duties; no claudication. Tobacco abstinence maintained.

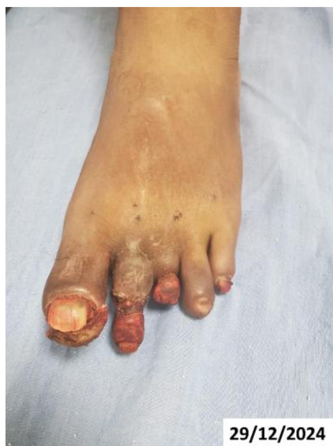

Image 1: Condition on Day 1 (Day of Admission)

Image 2: Initiation of Leech therapy on Post op Day 1

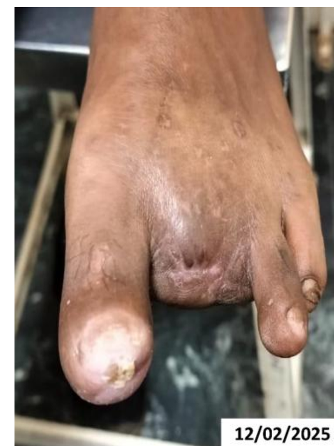

Image 3: Condition on 1-month follow-up

4. DISCUSSION

Diabetic foot ulcers and gangrene are among the most serious complications of Diabetes Mellitus, often leading to amputation and high mortality. In the present case, clinical evaluation and imaging findings were consistent with diabetic ischemic gangrene associated with atherosclerotic changes in the vessels. Based on this biomedical diagnosis, the condition was correlated with *Kotha* having *Vata-Pitta* predominance in the Ayurvedic diagnostic framework, which guided the line of management. Similar reports on management of dry gangrene show focus on pacification of *Vata* and *Pitta.* [11] The reports also show the benefit of integrated approach

involving surgical debridement, leech therapy, antibiotics, diabetic control, offloading and Ayurveda medicines. [12]

Ayurveda describes *Chedana Karma* (surgical excision or amputation) as the primary intervention in *Kotha*. [13] Accordingly, disarticulation of the gangrenous toes was performed. Post-surgical management was planned based on dosha predominance. *Panchatikta Ghrita Guggulu* pacifies *Tridosha*. It pacifies *Kapha-Pitta*, thereby reducing *kleda* (moisture), inflammation, and discharge. Due to its *Snigdha guna* (unctuousness) it pacifies *Vata.* Also, the basic ingredient of the formulation, which is *Ghrita* (ghee) pacifies *Vata-pitta.* It performs *Rakta* and *Mamsa prasadana* and *Medo-kleda shoshana*, helping to control infection and tissue necrosis. *Guggulu* causes *srotoshodhana*, improving microcirculation in ischemic diabetic tissues. *Ghrita* promotes *vrana ropana* by enhancing healthy granulation and faster wound healing. [14]

For *Dushta Vrana, Shodhana* (purification therapies) is strongly recommended. In *Vata-Pitta* dominant ulcers, *Virechana* is specifically indicated. To achieve gentle daily purification (*Nitya Shodhana*), *Gandharva Haritaki* was administered. Its constituents, *Eranda Taila* (having *Vatahara action*) and *Haritaki* (*Tridosha Shamak and Rasayana*), support both *Vata-Pitta* pacification and *Rakta Shodhana*. From an Ayurvedic perspective, purification of *Rakta Dhatu* was essential to maintain vitality of the flap and to prevent recurrence of gangrene.

Flap necrosis, a frequent complication in diabetic amputations, can be correlated with *Kotha* in which *Rakta Dushti* compromises tissue viability. Since the vitality of any tissue is dependent on *Rakta Dhatu*, ensuring *Shuddha Rakta* is a prerequisite for healing. With this rationale, *Jalaukavacharana* (leech therapy) was instituted at the site of the sutured flaps. Classical texts advise leech application in *Rakta Dushti* due to *Pitta* vitiation. Modern studies also corroborate its efficacy in preventing tissue necrosis through the anticoagulant and vasodilatory actions of leech saliva. [15] The previous case studies also demonstrated the favorable outcomes of leech therapy in the management of Beurger's disease indicating that leech therapy can potentially tackle the smoking induced changes seen in Beurger's disease. [16] It also helps in revascularization to overcome ischemia that hampers the process of wound healing. [12] Leech therapy has also been established to avoid flap necrosis by preventing ischemia induced injury. [10] Thus, leech therapy in this case provided both classical and contemporary justification.

Improvement in sensory function of the left foot observed during follow-up can be understood through the Ayurvedic concept that *Raktavaha Sira* are responsible for *Sandnya* (sensation). The combined systemic and local interventions promoting Rakta Shuddhi likely contributed to this neurological recovery. [17] Local application of *Jatyadi Ghrita* further aided wound healing due to its *Vata-Pitta* pacifying, *Vrana Shodhana* (cleansing), and *Ropana* (healing) properties.

The strengths of this case are detailed diagnostic workup in the form of laboratory tests and CT angiography to confirm the co-existence of DM and vascular pathologies, which was important to establish the complexity of the disease. Disarticulation was inevitable as the condition of the toes was beyond the possibility of salvage. But the treatment successfully prevented major limb loss and avoided the failure of reconstructive surgery (Image 3). Also, the follow-up period of one year supports the sustained results of the treatment. Though the case has successful outcomes, it has limitations. Due to the financial constraints of the patient, objective assessment in the form of CT angiography or Arterial doppler was not performed. Hence this case report cannot show objective evidence regarding the improvement in circulation. The outcomes cannot be generalized as it is a single case study. In order to generalize the management strategies, larger and well-structured studies are warranted.

Overall, the integrative Ayurvedic management ensured proper healing of the amputation stump, prevented further extension of disease into the metatarsals, and avoided flap necrosis. Importantly, *Nidana Parivarjana* (removal of causative factors) was emphasized through smoking cessation and glycemic control.

5. CONCLUSION

The diabetic foot gangrene with history of 8 months was managed successfully using integrated treatment strategy involving surgical, para-surgical and medicinal therapy. Leech therapy was done to prevent flap necrosis. Internal Ayurveda medicines focusing on *Vrana-shodhana and ropana*. The wound completely healed within 14 days without any flap necrosis. Patient tolerated the treatment well and no adverse event was noted. No recurrence was observed in the follow-up period of 12 months. This type of integrated treatment approach can enhance the outcomes of Diabetic foot gangrene.

Key messages:

- The case report presents a case of Diabetic foot gangrene which was complicated by pre-exiting smoking induced atherosclerosis.
- Case was managed using integrative approach which involved prophylactic antibiotic, antidiabetic medication, a surgical procedure (disarticulation and debridement), leech therapy (7 sittings), Ayurveda oral medication and *Vrana ropana using Jatyadi ghrita.*
- This approach resulted in complete healing in 14 days without flap necrosis
- The Sensory improvement was objectively assessed (Vibration pressure threshold reduced from 30 V to 22 V)
- Long follow-up of 12 months ensured regular monitoring for any recurrence. No recurrence was observed.
- Integrated approach resulted in successful management. Patient started his routine work within one month.

Declaration of Patient Consent – The authors confirm that they have acquired a patient consent form, in which the patient or caregiver has granted permission for the publication of the case, including accompanying images and other clinical details, in the journal. The patient or caregiver acknowledges that their name and initials will not be disclosed, and sincere attempts will be undertaken to safeguard their identity. However, complete anonymity cannot be assured.

Patient's Perspective: I was advised to cut my foot from ankle due to gangrene. I was very worried because without my foot I was not able to continue my work. This was going to affect my financial situation. I visited this hospital where the treatment was done nicely. It resulted in saving my foot. I resumed my work within one month. The disease did not recur even after one year. During the treatment, doctor advised me to stop smoking and following this advice, I was able to quit smoking.

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