



## Pledge to Save the Feet- A Practical Approach to Diabetic Foot - South Indian Experience

### KEYWORDS

diabetes, diabetic foot, foot care, footwear, IEC

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**ABSTRACT** Morbidity and mortality due to diabetic foot in all over world is alarming .We submit a study done over 3 years in the tertiary care hospital in southern part of Tamilnadu

**Aim Of The Study:** The aim of the study is to prove that care of the foot in diabetic individuals by educating them is better than medical and surgical management.

**Material And Methods:** This is a prospective observational study in a tertiary medical care hospital setup , in southern part of Tamil Nadu , south India, between feb 2013 to feb 2015 with 1224 patients all are presented with diabetes, on regular treatment (type1 and type 2)were included in the study all of them were briefed about the complications of diabetes and specifically addressing the problems of diabetic foot.

**Results:** Patients who followed the advice and visited hospital regularly for monthly foot care program are taken as controls verses others as defaulters and we discussed the problems unique for poor Indian diabetic patients

**Conclusion:.** Education, educare,communication of information are the key of these program.

### Introduction

Among the diabetic patients problems like foot ulcerations, infections, and gangrene, are the most common cause of hospitalization. Routine ulcer care, treatment of infections, amputations, and hospitalizations cost billions of dollars every year and place a tremendous burden on the health care system. According to estimates, India presently has an annual estimated treatment cost of Rs 10,000 to 12,000 crore which is likely to witness a scaling upto as much as Rs 1,26,000 crore by 2025 (Mohan et al, unpublished observations). This figure includes direct costs, indirect costs and costs for treating diabetic complications using conservative estimates. A recent hospital based study in coastal Karnataka showed that the average total cost due to hospitalisation per annum for a diabetic person was about Rs 14,000 .in India. Approximately 40,000 lower limbs are being amputated every year (3,333 legs every month, 111 legs every day, 5 legs every hour) due to diabetes mellitus and 50% of the people with amputations will develop ulcerations and infections in the contralateral limb within 18 months. An alarming 58% will have a contralateral amputation 3-5 years after the first amputation. In addition, the 3-year mortality after a first amputation has been estimated as high as 20-50%, and these numbers have not changed much in the past 30 years, despite huge advances in the medical and surgical treatment of patients with diabetes.

### Etiology

The ulcers in the diabetics are due to the critical triad of peripheral neuropathy (sensory), deformity, and trauma . (which is most commonly seen in these patients - McNeely et al.) All three of these risk factors are present in 65% of diabetic foot ulcer patients. Calluses, edema, and peripheral vascular disease have also been identified as etiological factors in the development of diabetic foot ulcers.

Although the pathogenesis of peripheral neuropathy(sensory) is still poorly understood, there seem to be multiple mechanisms involved, including the formation of advanced glycosylated end products and diacylglycerol, oxidative stress, and activation of protein kinase C $\beta$ . Added to this hyperglycemia plays a major role in the onset and progression of neuropathy. It is important for clinicians to know the basics of evaluation and treatment of foot ulcers seen in diabetic patients.

### Evaluation

Foot ulcer evaluation should include assessment of neurological status , vascular status, and evaluation of the wound itself. Neurological status can be checked by using the SemmesWeinstein monofilaments to determine whether the patient has "**protective sensation,**" which means determining whether the patient is sensate to the 10-g monofilament

Another useful instrument is the 128 C tuning fork, which can be used to determine whether a patient's **vibratory sensation** is intact by checking at the ankle and first metatarsal -phalangeal joints. The notion is that metabolic neuropathies have a gradient in intensity and are most severe distally. Thus, a patient who cannot sense vibration at the big toe but can detect vibration at the ankle when the tuning fork is immediately transferred from toe to ankle demonstrates a gradient in sensation suggestive of a metabolic neuropathy. In general, you should not be able to sense vibration of the tuning fork in your fingers for more than 10 seconds after the time when the patient can no longer sense vibration at the great toe. Many patients with normal sensation only demonstrate a difference between sensation at their toe and sensation in the practitioner's hand of  $\leq 3$  seconds.

Both of these tests can be performed quickly in any office setting. Achilles and patellar **reflexes** can also be checked easily but are unreliable in the assessment of diabetic peripheral neuropathy. More in-depth analysis can be performed using a **vibrometer** (a device designed to more objectively measure vibratory sense), assessing temperature sense, performing nerve conduction studies, and checking position sense and balance. These tests are usually performed in a neurological laboratory.

**Vascular assessment** is important in the management of ulcer management and is essential in the evaluation of diabetic ulcers. Vascular assessment includes checking pedal pulses and capillary filling time. If pedal pulses are non-palpable then arterial Doppler and recording pulse volume waveforms should be done. The ankle brachial index (ABI) is often not helpful because of high pressures in the noncompressible arteries. However, toe pressures are very useful in determining the healing potential of an ulcer. In addition, transcutaneous oxygen measurements are often useful in determining whether a foot wound can heal.

**Ulcer evaluation** should include documentation of the wound's location, size, shape, depth, base, and border. A **sterile stainless steel probe** is useful in assessing the presence of sinus tracts and determining whether a wound probes to a tendon, joint, or bone. **X-rays** should be ordered on all deep or infected wounds, but **magnetic resonance imaging** often is more useful because it is more sensitive in detecting osteomyelitis and deep abscesses. **Signs** of infection, such as the presence of cellulites, odor, or purulent discharge should be documented, and aerobic and anaerobic cultures should be obtained of any purulent exudates. **Culturing** a dry or clean wound base has proven to be useless because most wounds are colonized, and this practice leads to overprescribing of antibiotics.

#### What are the challenges in indian diabetic patients especially in south Indian diabetics

- The agriculturist worships his agricultural land and does not enter the agricultural land with shoes or chappals. Hence, the chance of getting injury, intertrigo, athlete's foot, fungal infection, allergic or chemical induced ulcers (minor injury to major injuries) are common – **using mechanical devices for agriculture is the one remedy.**
- They are barefoot walkers, especially to temples, they walk for many miles (nearly 20 to 30 miles) per day and upto 40 – 48 days in a year during religious festivals - They are more prone for foot injuries, thorn or nail prick injuries - **IEC activities** (information, education & communication), **arranging medical camp along the way, stress on use of MCR / MCP chappals, advice use silicone in-soles in shoes** are the few remedies to prevent the above complications developing.
- Construction workers do not wear safety shoes (rubberized) and are more prone for work spot injuries (due to contact with Cement and other building materials) **the Contractor must provide safety measures to prevent these occupational hazards** at the work spot for all and especially to Diabetics.
- Inside the house, they do not wear footwear, because they are having God and Goddess pictures for worshiping in their house. Even, if they prefer wearing foot-wear, they prefer using hard based footwear – this practice must be condemned and appropriate type of footwear to be advised to these patients.
- **Bare foot Walkers** : Manual workers, Tree Climbers

, Building Workers, porters, Agricultural Labourers etc., do not wear footwear - it is a challenging task in this part of the world to manage these people, who are mostly uneducated or ill-educated and are unaware of the probable complications that he may develop in future, if proper protective gears are not used at appropriate situations or places.

- **Seeking late Medical advice** : Both educated and uneducated people prefer self-management, Native treatment, treatment by Quacks, cheap Alternate management etc., before attending a qualified physician or hospital for his / her medical needs. By this time, complications might have developed, thus, increasing the morbidity & mortality of the condition. This practice must be discouraged. This practice and proper awareness must be created to improve this condition.

#### Treatment Myths :

1. Over the injured part - they apply mud, cow dung, urine, green leaves, turmeric, sugar, coffee powder or any thing available in the vicinity, to stop bleeding - all should be discouraged,
2. Old age diabetic patient's inability to attend hospitals due to frequent illness like orthostatic hypotension, due to diabetic autonomic neuropathy
3. Self Neglect due to poverty and depression
4. carelessness due to uneducation, unemployment,
5. Lack of insurance cover in many families : they not bothered about medical insurance.
6. Lack of awareness / ignorance of govt free insurance Scheme by chief minister's comprehensive health insurance which covers more than 1100 procedures
7. Poor socioeconomic status, results in infrequent blood sugar checkups and never looked for HbA1c.
8. Bare foot walking due to poor Socio-economic Status & communal compulsions.
9. Usage of old ill-fitting hard soled unfit foot wears.
10. Increased prevalence of two-wheeler injuries, associated with or without alcohol intake.
11. Increased prevalence of neuropathy due to poor diabetic control.

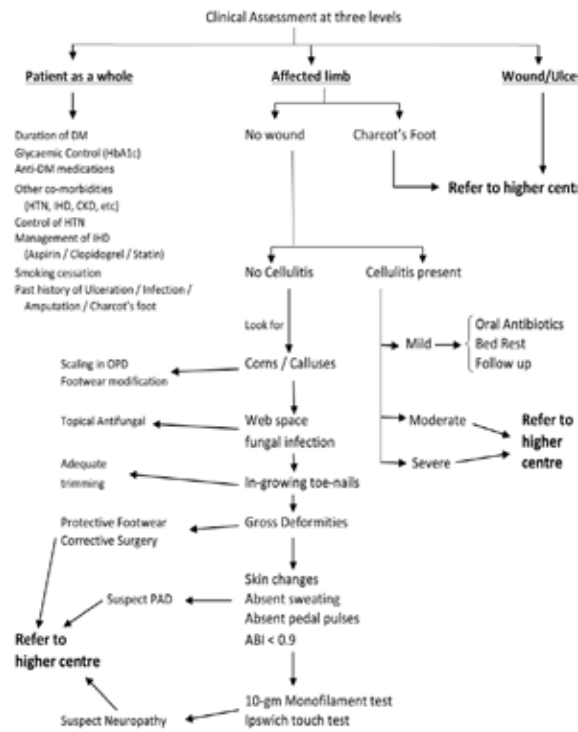
#### Patient-instructions for the care of the diabetic foot

1. Do not smoke.
2. Inspect the feet daily for blisters, cuts and scratches. The use of a mirror can aid in seeing the bottom of the feet. Always check between the toes.
3. Wash feet daily, dry carefully, especially between the toes.
4. Avoid extremes of temperatures. Test water with hand, elbow or thermometer before bathing (patient with Neuropathy is unable to assess the temperature of water he uses for bathing).
5. If feet feel cold at night, wear socks. Do not apply hot water bottles or heating pads. Do not use an electric blanket. Do not soak feet in hot water.
6. Do not walk on hot surfaces such as sandy beaches, or on cement flooring around swimming pools.
7. Do not walk barefooted in any situation.
8. Do not use chemical agents for removal of corns and calluses, corn plasters or strong antiseptics.

9. Do not use adhesive tape on the feet.
10. Inspect the insides of shoes daily for foreign objects, nail points, torn linings and rough areas.
11. If your vision is impaired, have a family member inspect feet daily, trim nails and buff calluses.
12. Do not soak feet.
13. For dry feet, use a very thin coat of lubricating oil or cream. Apply after bathing and drying the feet. Do not put oil or cream between the toes. Consult your physician for detailed instructions.
14. Wear properly fitting stockings. Do not wear mended stocking with seams. Change stockings daily.
15. Do not wear garters.
16. Shoes should be comfortable at time of purchase. Do not depend on them to stretch out. Shoes should be made of leather. Purchase shoes late in the afternoon when feet are the largest. Running or special walking shoes may be worn after checking with your physician. Purchase shoes from a shoe salesperson who understands diabetic foot problems.
17. Do not wear shoes without stockings / Socks
18. Do not wear sandals with thongs between the toes.
19. In the winter, take special precautions. Wear wool socks and protective foot gear such as fleecelined boots.
20. Cut nails straight across.
21. Do not cut corns and calluses: follow instructions from your physician or podiatrist.
22. See your physician regularly and be sure that your feet are examined at each visit.
23. Notify your physician or podiatrist at once should you develop a blister or sore on your foot.
24. Be sure to inform your podiatrist that you are diabetic.

Adapted from Levin ME: "Pathogenesis and management of diabetic foot lesions" In Levin ME, O'Neal LW, and Bowker JH, eds. *The Diabetic Foot*, 5th ed., St. Louis, Mosby year Book, 1993.

Findings Suggesting a more serious Diabetic Foot Infection	
<b>Wound Specific</b>	
Wound	Penetrates to Sub-Cutaneous tissues (eg.Fascia,Tendon, Muscle,Joint,Bone)
Cellulitis	Extensive(>2cm), distant from Ulceration or rapidly Progressive
Local Signs	Severe inflammation or induration, crepitus, bullae, discoloration, necrosis or
	Gangrene, ecchymosis or petechiae, new anaesthesia
<b>General</b>	
Presentation :	Acute onset / Worsening or rapidly progressive
Systemic Signs	Fever, Chills , hypotension, Confusion, Volume Depletion
Laboratory Tests	Leucocytosis, very high C-reacting protein or ESR
	Severe / worsening hyperglycaemia, acidosis, new / worsening azotaemia
	Electrolyte abnormalities.
Complicating	Presence of a foreign body (accidentally or Surgically implanted),
Puncture	
Features	wound, deep abscess, arterial venous insufficiency, lymphoedema, Immunosuppressive illness or treatment.
Current	Progression while on apparently appropriate antibiotic and
Treatment	supportive therapy



**Treatment**

Successful treatment of diabetic foot ulcers consists of addressing these three basic issues: *debridement, offloading, and infection control.*

**Debridement**

**Debridement** consists of removal of all necrotic tissue, peri-wound callus, and foreign bodies down to viable tissue. Proper debridement is necessary to decrease the risk of infection and reduce peri-wound pressure, which can impede normal wound contraction and healing. After debridement, the wound should be irrigated with saline or cleanser, and a dressing should be applied.

**Dressings** should prevent tissue dessication, absorb excess fluid, and protect the wound from contamination. There are hundreds of dressings on the market, including hydrogels, foams, calcium alginates, absorbent polymers, growth factors, and skin replacements. Becaplermin (which contains the -chain platelet-derived growth factor) has been shown in double-blind placebo-controlled trials to significantly increase the incidence of complete wound healing. Its use should be considered for ulcers that are not healing with standard dressings.

In case of an **abscess**, incision and drainage are essential, with debridement of all abscessed tissue. Many limbs have been saved by timely incision and drainage procedures; conversely, many limbs have been lost by failure to perform these procedures. Treating a deep abscess with antibiotics alone leads to delayed appropriate therapy and further morbidity and mortality.

**Offloading**

Having patients use a wheelchair or crutches to completely halt weight bearing on the affected foot is the most effective method of offloading to heal a foot ulceration. **Total contact casts (TCCs)** are difficult and time consuming to apply but significantly reduce pressure on wounds

and have been shown to heal between 73 and 100% of all wounds treated with them. Inappropriate application of TCCs may result in new ulcers, and TCCs are contraindicated in deep or draining wounds or for use with noncompliant, blind, morbidly obese, or severely vascularly compromised patients.

Clinicians often prefer **removable cast walkers** because they do not have some of the disadvantages of TCCs. Removability is an advantage in that it allows for daily wound inspection, dressing changes, and early detection of infection. But removability is also the greatest disadvantage in that studies have shown that patients wear them only 30% of the time they are walking (usually to and from the doctor's office).<sup>5</sup>

**Postoperative shoes or wedge shoes** are also used and must be large enough to accommodate bulky dressings. Proper offloading remains the biggest challenge for clinicians dealing with diabetic foot ulcers.

### Infection control

**Limb-threatening diabetic foot infections** are usually polymicrobial. Commonly encountered pathogens include methicillin-resistant *staphylococcus aureus*,  $\beta$ -hemolytic streptococci, enterobacteriaceae, *pseudomonas aeruginosa*, and enterococci. Anaerobes, such as *asbacteroides*, *peptococcus*, and *peptostreptococcus*, are rarely the sole pathogens but are seen in mixed infections with aerobes. Antibiotics selected to treat severe or limb-threatening infections should include coverage of gram-positive and gram-negative organisms and provide both aerobic and anaerobic coverage. Patients with such wounds should be hospitalized and treated with intravenous antibiotics.

**Mild to moderate infections** with localized cellulitis can be treated on an outpatient basis with oral antibiotics such as cephalexin, amoxicillin with clavulanate potassium, moxifloxacin, or clindamycin. The antibiotics should be started after initial cultures are taken and changed as necessary.

*Adapted from Levin ME: "Pathogenesis and management of diabetic foot lesions" In Levin ME, O'Neal LW, and Bowker JH, eds. The Diabetic Foot, 5th ed., St. Louis, Mosby year Book, 1993.*

### CONCLUSIONS

Diabetic foot ulcers are common. If treatment is delayed or improper treatment is given, these lesions can lead to infection, gangrene and amputation. Physicians and clinics that avoid delay in the treatment of the diabetic foot ulcer, exercise aggressive therapy for these ulcers, provide revascularization when indicated, use therapeutic shoes, practice the team approach, and repeatedly educate patients in foot care have reduced their amputation rates by 50% (37,40). This should be the goal of everyone who cares for patients with diabetes.

### Summary

The etiology of diabetic foot ulcers is multifactorial, but minor trauma in the presence of peripheral sensory neuropathy remains the primary culprit. Prevention of foot ulcers in high-risk individuals, such as those with neuropathy, peripheral vascular disease, or structural foot abnormalities, is of primary importance through appropriate patient education, the use of emollients, and the use of appropriately fitting shoes.

Evaluation of foot ulcers includes checking vascular and

neurological status and accurately assessing wounds. The depth of infection is arguably the most critical assessment and one that is not commonly performed in many clinicians' offices because it requires at least partial debridement and a probe to bone.

Treatment should address all three major concerns: debridement, offloading, and infection control. Not all physicians need to be capable of treating diabetic foot ulcers themselves, but it is extremely important to be knowledgeable enough to perform an initial evaluation, refer patients promptly, and help with follow-up of patients with healing wounds.

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