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A review of outcome of diabetic foot disease in a rural population

KEYWORDS: diabetes, foot ulcer, neuropathy, amputation, peripheral arterial occlusive disease.

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ABSTRACT *Complications of diabetic foot disease have become more prevalent since advances in the treatment and increased life expectancy.*

Herein we review the clinical presentation and the outcome in patients with diabetic foot disease (DFD) presenting in our hospital which is located in a rural area. One hundred and seventy three patients with the mean age of 60 years, both male and female were included in the study. Various conditions included under the heading of 'DFD' were managed in appropriate manner. Patients were followed up over a period, and outcome was noted to complete the study.

Out of 173 patients 166 had Type-II diabetes while 7 had Type-I. Mean duration of diabetes was 13 years. Nineteen percent patients had neuropathic ulcer, 6.35% patients had neuroischaemic ulcer, and 10.98% feet were ischaemic (5.78% ischaemic ulcer + 5.2% tissue devitalization). Major lower limb amputations were performed in 17.91% of patients.

Introduction

DFD is not a single disease entity unlike IHD, peptic ulcer disease etc. DFD comprises a spectrum of disorders with varying pathological and clinical natures. At one end of the spectrum lies a simple callosity, and a devastating gangrene necessitating major amputation of commonly one but occasionally both lower limbs at the other.

Fig. 1: A callosity

Fig. 2: Infected vascular gangrene of both feet

There are no clear-cut criteria found in the literature as to which entities should be considered in the term – 'Diabetic foot disease'. However, the following presentations encountered in clinical practice were included:

- Chronic abscess (without or with osteomyelitis)
- Acute spreading ulcer
- Callus
- Neuropathic ulcer
- Ischaemic / Neuroischaemic ulcer

Established gangrene of foot e.g. infected vascular gangrene.

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Fig. 3: Chronic abscess of 4th toe with osteomyelitis

Fig. 4: Acute spreading ulcer

Fig. 5: Neuropathic ulcer

Fig. 6: Neuroischaemic ulcer Fig. 7: Ischaemic foot

Fig. 7: Ischaemic foot

Aetiology of diabetic foot disease is truly multifactorial:

- Neuropathy
- Vascular disease
- Infection
- Connective tissue abnormalities
- Haematological disturbances.

Identification of the dominant causative factor is essential in planning the treatment. The concept of classifying diabetic foot as neuropathic, ischaemic and neuroischaemic is very useful.

Chronic abscess is treated with incision, drainage, and debridement. If osteomyelitis and septic arthritis are present, then digital amputation is carried out through appropriate level.

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Acute/subacute spreading ulcer is often associated with significant tissue destruction. The operative procedure consists of thorough debridement.

Callus is treated by shaving off with a scalpel. Removal of callus reduces pressure and consequently the risk of ulceration is reduced.

The principle aim in treating **neuropathic ulcer** is relief of pressure, and that can be achieved by one or more of: chiropody, orthotics and surgery. In addition, infection should be eradicated when present.

The presence of an **ischaemic ulcer** basically suggests critical limb ischaemia (CLI). Restoration of blood supply is indicated when appropriate, but in a rural setting in India, it is almost always impossible, and the affected limbs are usually lost sooner or later.

Established gangrene of foot requires a 'major' amputation. A major amputation is one which is carried out through any level above ankle. The most appropriate level is selected to strike the best balance between assurance of stump healing and achieving maximal stump length. Maximal stump length is essential as most patients in rural setting do not get artificial limb fitted for various reasons such as the lack of easy availability of artificial limb service, non-affordability, rough and bumpy terrain of the west coastal area which becomes a deterrent for efficient use of a prosthetic limb etc. Through-knee disarticulation is appropriate in many patients.

Material and Methods

This study was conducted on DFD cases between January 2014 and June 2015 in BKL Walawalkar Hospital, District Ratnagiri. All the patients were hospitalized except for those having only callus.

History was obtained. A physical examination was carried out with emphasis on an ulcer, sensory neuropathy, ischaemia, a deformity, and the patient's footwear for detecting sites of excessive wear.

A neurological examination was performed testing the sensation to light touch (cotton wool), tenderness (pins), vibrations (128 Hz tuning fork), and tendon reflexes at ankle. Peripheral neuropathy was considered to be present, if three of the four sensations were absent. The presence of normal foot pulses was considered to rule out any significant peripheral arterial occlusive disease (PAOD) whereas weakness or absence of foot pulses was considered to imply the presence of a PAOD; in that case, the foot was labeled 'ischaemic'.

On the basis of clinical information obtained, a foot was labeled neuropathic, ischaemic or neuroischaemic.

Doppler study of arteries was requested in those patients who were clinically found to have a PAOD. Patients with normal pulses were not subjected to Doppler study. 'Routine' investigations were carried out including: FBC, blood sugar levels, BUN, S. creatinine, S. electrolytes and ECG. Patients with CLI were advised to get arteriography done, but none of them could get the same done for various reasons like non-availability of the facility in our hospital, unwillingness to go to a city where the facility was available, non-affordability etc. Biodata of the patients including age and gender was recorded. Patients were followed up over a variable period until the end point was reached. The end points were: 1. 'Significant' reduction in size and hardness of callus, 2. Disappearance of callus, 3. Healing of ulcer, 4. Healing of wound following surgery – incision and drainage / debridement / amputation. Outcome was noted and the patients were declared to have completed the study.

Patients who came back with recurrence of their previous problem (for which they were included) were excluded from the study second time as that would interfere with statistical data and create confusion in results.

Results

Out of 173 patients, 166 (95.95%) had Type-II diabetes while 7 (4.04%) had Type-I. Mean duration of diabetes was 13 years. Nineteen percent feet were neuropathic, 17.34% feet were ischaemic. Ischaemic feet included ischaemic ulcer, neuroischaemic ulcer and tissue devitalization (Table 1).

Table 1 – Incidence of clinical presentation

Clinical presentation	Number	Percentage
Chronic abscess	36	20.8
Acute spreading ulcer	43	24.85
Callus	109	63
Neuropathic ulcer	33	19.07
Ischaemic ulcer	10	5.78
Neuroischaemic ulcer	11	6.35
Tissue devitalization	9	5.2
Established gangrene of foot	19	10.98

Apart from the cases of established gangrene of feet, 24 (13.87%) patients had CLI. CLI was confirmed by measuring ankle-brachial pressure index (ABPI) (Table 2).

Table 2 - ABPI

ABPI	**Number** (out of 24)	**Percentage** (of 24)
0.5	5	20.83
0.4	17	70.83
0.3	2	8.33

Minor amputation was performed in 15 patients while 31 patients underwent major amputation (Table 3).

Table 3 – Incidence of amputation

Level of amputation	Number	Percentage
Digital (including 'ray')	11	6.35
Distal foot	4	2.31
Below knee	9	5.2
Through-knee disarticulation	10	5.78
Above knee	11	6.35
Simultaneous bilateral below knee	1	0.57

Out of 31 major amputations, 18 were performed for established gangrene of foot. One patient (out of 19) of established gangrene of foot went against medical advice and later lost to follow up. Ten patients (out of 24) with CLI denied further investigation (arteriography) and subsequently did not follow up. The remaining 14 patients (out of 24) with CLI also could not undergo arteriography for various reasons, but followed up later with worsening of their clinical situation finally demanding major amputation.

Patients with callus were treated with chiropody and orthotics. Out of 109 patients with callus, 76 (43.93% of 173, 69.72% of 109) patients did not follow up again. In 17 (9.82% of 173, 15.59% of 109) patients the size and hardness of callus decreased 'significantly'. In 16 (9.24% of 173, 14.67% of 109) patients callus disappeared.

Twenty seven (15.6% of 173, 81.81% of 33) neuropathic ulcers took on an average 6.5 weeks to heal. Six neuropathic

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ulcers (3.46% of 173, 18.18% of 33) neither healed nor worsened during the study period of 1.5 years.

Wounds following incision and drainage or debridement took on an average 6.1 weeks to heal. And wounds following amputations healed in 4.2 weeks average. Outcome of DFD is summarized in Table 4.

Table 4 – Summary of outcome

Outcome	**Number** (out of 173)	Percentage of 173	Percentage Category-wise
'Significant' decrease in size and hardness of callus	17	9.82	15.59 of 109
Disappearance of callus	16	9.24	14.67 of 109
Healing of neuropathic ulcer	27	15.6	81.81 of 33
Neuropathic ulcers which neither healed nor worsened	6	3.46	18.18 of 33
Minor amputations	15	8.67	-
Major amputations	31	17.91	-

Discussion

Diabetes is a world-wide problem. Up to 25% of all diabetics develop some or the other foot problem during the course of their illness[1]. The diagnosis and management of certain identifiable or predisposing factors may reduce end-stage complications of DFD[2].

Diabetic foot care has indeed improved significantly over the past decade. There has been a clearer understanding of the causal factors leading to limb loss and increasing consensus on the management of various aspects of DFD[3]. Barriers to implementation of prevention and management strategies include delay in recognition of DFD, poor access to proper health care, and heterogeneity in the practice of specialists. Primary care providers perform complete examination of the foot only infrequently. They may also lack the time and training to educate at-risk people with diabetes. Adherence to guidelines is uneven. Beliefs regarding the utility and cost-effectiveness of limb salvage efforts may range from doubt to pessimism and nihilism, even among specialists[4].

Our study proves that calluses can disappear, and neuropathic ulcers can heal if patients follow the prescribed orthotic treatment religiously.

About 10% of all diabetics will require a lower limb amputation of some kind, at some point of time in their lives. Patients in old age group face the maximum risk of amputation[1]. In addition to the loss of mobility and independence[5], depression and anxiety are very prevalent among people with diabetes who have experienced limb loss[6]. In our study group, limb salvage could have been attempted in 14 patients (out of 24) with CLI, if they could get arteriography done.

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Abbreviations: DFD, Diabetic Foot Disease; IHD, Ischaemic Heart Disease; FBC, Full Blood Count; BUN, Blood Urea Nitrogen; S., Serum; ECG, Electro-CardioGram; CLI, Critical Limb Ischaemia; PAOD, Peripheral Arterial occlusive Disease.

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