

# Diabetic foot disease in Ethiopian patients: A hospital based study

Wondwossen Amogne<sup>1</sup>, Ahmed Reja<sup>1</sup>, Amanuel Amare<sup>1</sup>

## Abstract

**Background:** Ulcers of the foot are one of the most feared and common complications of diabetes. It is a major cause of disability, morbidity and mortality among diabetic patients and about 15% develop foot ulcers in their lifetime. So far, there are few published data in relation to the high-risk diabetic foot in Ethiopian subjects.

**Methods:** A retrospective study was done to determine the various risks as well as antecedent factors, other long term complications, treatment profile and subsequent follow up of 196 patients with diabetic foot disease admitted to the Tikur Anbessa Specialized Referral Hospital from Jan 1999 to Dec 2003. Patients' medical records were reviewed using pre-prepared formats and relevant data were abstracted. The data were analyzed using Epi info version 3.4.3 statistical soft ware.

**Results:** A total of 196 patients were included in this study. The male to female ratio was 3 to 1. The median age was 60 years (IQR, 47-65). Median duration of symptoms before presentation was 21 days (IQR, 14-30) and the median duration of diabetes mellitus was 144 months (IQR, 60-216). More than two thirds had type 2 diabetes mellitus. Among 109 patients with identified antecedent risk factors for their foot problem, ill fitting or new shoes attributed in 48(44%). Neuro-ischaemic ulcers were seen in 113 (58%) of the cases and neuropathic ulcer in 63 (32%). Ulcer with cellulitis or gangrene was the most common mode of presentation seen in 92 (47%) of the patients. Ninety two (47%) patients had amputations. Re-amputation was necessary in 24 (26%) of these cases. Less than 40% of the total cases had a regular follow up either at a clinic or hospital. Diabetes was diagnosed for the first time in 7 cases (4%) on presentation with foot ulcer. The mean glycemic level was poorly controlled in over 80% of the cases. The overall mortality rate was 21% and sepsis was the most identified cause.

**Conclusion:** Lack of regular patient follow up and diabetes education on foot care, poor glycemic control, delay in patient presentation and surgical intervention as well as patients' refusal to undergo surgical interventions were the reported contributing factors for the observed high mortality.

**Recommendation:** Diabetic education on foot care, emphasis on metabolic control of diabetes, early presentation and surgical intervention when appropriate has to be highlighted in the management of diabetic patients. More studies have to be done in relation to the high-risk diabetic foot particularly in the Ethiopian setting emphasizing on preventive aspects. [*Ethiop J Health Dev* 2011;25(1):17-21]

## Introduction

Diabetes mellitus is emerging as one of the major chronic health problems in Ethiopia, although its incidence and prevalence are still unknown in the general population (1).

Ulcers of the foot are one of the most feared and common complications of diabetes. It has been estimated that 15% of all people with diabetes will have an ulcer at some stage of their life, and foot diseases are leading cause of hospitalization among such patients (2-4). The presentation of diabetic foot disease is variable, ranging from cellulitis, abscesses, and ulcers to gangrene. Surgical management depends on the presentation, and varies from minor debridement, incision and drainage, to amputation. Fifty percent of all non-traumatic lower limb amputations occur in persons with diabetes and six of every one thousand diabetics will suffer amputation each year (3). Once amputation has occurred, loss of the contra-lateral leg becomes a high probability (5). In a three-year follow up study of forty-five patients, Kucan and Robinson found that 22 (49%) of the patients

developed severe infection involving the contra-lateral foot within eighteen months (6).

An understanding of the causes of foot diseases in diabetics will enable high-risk patients to be recognized early. It has been estimated that up to 50% of the major amputations in diabetic patients can be prevented with effective education (7). A potentially preventable initiating event was identified in 86%, most often minor trauma that caused cutaneous injury (8). Inappropriate footwear is the most common source of trauma (9). This observation illustrates the importance of frequent examination of the feet in diabetic patients. Both neuropathy and vasculopathy are strong independent risk factors for the development of diabetic foot ulcers (10). Pure ischaemic ulcers, however, probably only represent 10% of diabetic foot ulcers; the remaining 90% are caused equally by neuropathy alone or in combination with ischaemia (the neuro-ischaemic ulcer) (7).

A cross sectional study done to evaluate high-risk foot among 223 Ethiopian diabetic patients showed high prevalence of foot abnormalities. Inspection of the feet

---

<sup>1</sup>Department of Internal Medicine, Faculty of Medicine, Addis Ababa University. P. O. Box 2380, Addis Ababa, Ethiopia

during the study revealed that 61.4% had skin cracks, corns, mycosis and blisters (11). Another study by the same authors (12) evaluated 33 Ethiopian diabetic patients admitted with foot problems; of the 33 admissions, 85.0% had neuropathy and 64% peripheral vascular disease of whom 45% were admitted with foot gangrene, and 15% died in hospital with sepsis.

The present retrospective study was designed with the objectives of determining the profile of patients' presentations, risk factors and other leg complications as well as to evaluate treatment experience in diabetic patients admitted with foot diseases to the Tikur Anbessa Hospital.

### Patients and methods

This is a retrospective study reviewing the medical records of diabetic patients admitted with foot diseases to the Tikur Anbessa Specialized Referral Hospital, which is the central referral and main teaching hospital of the Faculty of Medicine, Addis Ababa University. The study period was between January 1999 and December 2003. At desired precision of 5% with 95% confidence interval and an expected incidence rate of 15% of diabetics will develop foot ulcer, the sample size calculated was 196. Out of 230 medical records, 196 were selected and the criteria were at least 50% of the data required was recorded. Using a prepared format, patients' demographic and clinical profile and treatment of their diabetes, mode of presentation, and treatment outcomes following surgery were recorded. History of smoking and hypertension were recorded.

The modes of presentation were classified as: cellulitis, ulcer, gangrene and mixed lesions and the foot lesions were graded according to the classification criteria proposed by Wagner (7). According to Wagner's classification, foot ulcers are grade as follows:

### Wagner's classification

- Grade 0 – no ulcer, but the foot is at risk for ulceration.
- Grade 1 – superficial ulceration.
- Grade 2 – ulcer with deep infection, but without involvement of the bone.
- Grade 3 – ulcer with osteomyelitis.
- Grade 4 – localized gangrene.
- Grade 5 – gangrene of the whole foot.

History of identified antecedent factors prior to the occurrence of the lesion was also recorded from patients' medical records.

Glycemic level is said to be in good control if the mean of five consecutive fasting blood glucose values before admission was equal to or lower than 140 mg/dl and poor when the value was above 140 mg/dl.

Data were collected by the investigators using a prepared questionnaire and subsequently analyzed with Epi Info

2002 statistical software. Data were described using descriptive statistics.

### Ethical considerations:

The study protocol was approved by the Ethics and Research committee of the School of Medicine, Addis Ababa University.

### Operational definitions:

- The classification of type 1 and type 2 diabetes mellitus is used as described in the case notes. When there is ambiguity, the following definitions were used.
- Type 1 diabetes mellitus: age of onset less than 40 years and insulin treatment required within 12 months after the diagnosis of diabetes mellitus.
- Type 2 diabetes mellitus: middle life age onset or later and hyperglycemia managed with oral hypoglycemic agents.
- Diabetic peripheral neuropathy: is diagnosed when two or more of the following criteria were present: symptoms, sensory signs, motor signs and suggestive nerve conduction study (13).
- Peripheral vascular disease: is defined as the presence of ischemic symptoms such as intermittent claudication or rest pain and reduced or absent dorsalis pedis and posterior tibialis pulses.
- Diabetic nephropathy: was said to present when there was documented persistent proteinuria.
- Ischemic heart disease: is defined by either suggestive ECG or Echocardiography.
- Cerebro-vascular accident (CVA): was diagnosed when sudden neurological deficit occurred lasting more than 24 hours as a result of reduced blood flow in a particular artery supplying the brain.

### Results

Among 196 patients reviewed, 143 were males making the male to female ratio 3:1. The median age was 60 years (IQR, 47-65) and the median duration of diabetes was 144 months (IQR, 60-216). Of the 106 patients whose educational background was registered, only 65 (61.0%) had formal education. 121(62.0%) of the patients were on oral hypoglycemic agents, 70 (36.0%) were treated with insulin and 5 (3.0%) were on diet control and exercise only. Altogether 165 (84.0%) had type 2 diabetes mellitus while the rest had type 1 diabetes.

Median duration of symptoms of any foot lesion before presentation was 21 days (IQR, 14-30). The median duration of hospital stay was 32 days (IQR, 7-60). Among the study group 70 (36.0%) patients claimed to have regular follow up at a clinic or at a hospital whereas 7 (4.0%) had their diabetes diagnosed for the first time when they presented with foot ulcer. Among 109 patients with identified antecedent factors for their foot disease, ill-fitting or new shoes were the cause in 48 (44.0%) (Table 1).

**Table 1: Frequency of antecedent contributory factors for the foot ulcer among the patients reviewed (Jan 1999 Dec 2003)**

Factors	Number of patients (%)
Nail cutting	7 (3.6%)
Thermal injuries	7 (3.6%)
Penetrating wound	15 (7.7%)
Others (self inflicted trauma, accidents, walking barefoot, etc)	15 (7.7%)
Blunt trauma	17 (8.7%)
Ill-fitting or new shoes	48 (24.5%)
Not identified	87 (44.4%)

Ulcer was the most common mode of presentation in 61 (31.1%) of patients (Table 2). In 68 (34.6%) of the cases, the foot lesions were either Wagner grade 3 or grade 4 and 36 (18.4%) had grade 5 ulcer. Neuro-ischaemic

ulcers were seen in 113 (58.0%) of the cases and neuropathic ulcer in 63 (32.0%). Only 10 (5.0%) had purely ischaemic ulcer. In 10 patients (5%), the ulcer could not be classified due to incomplete data.

**Table 2: Modes of presentation of the diabetic foot ulcer among patients reviewed (Jan 1999 to Dec 2003)**

Type of presentation	Wagner's classification	Number of patients (%)
Cellulitis	Grade 2	12 (6.1%)
Toe gangrene	Grade 4	12 (6.1%)
Foot gangrene	Grade 5	19 (9.7%)
Ulcer with cellulitis	Grade 3	24 (12.2%)
Ulcer with toe gangrene	Grade 4	32 (16.3%)
Ulcer with foot gangrene	Grade 5	36 (18.4%)
Foot ulcer only	Grade 1	61 (31.1%)

**Table 3: Other long-term diabetes complications in study group (Jan 1999 to Dec 2003)**

Type of complication	No of Patients with the condition (%)	No of cases with available data
Cerebrovascular Accident	12 (6.3%)	191
Postural hypotension	22 (11.8%)	186
Intermittent Claudication	34 (19.8%)	172
Rest leg pain	41 (24.8%)	165
Callus over pressure areas	36 (28.6%)	126
Diabetic Nephropathy	60 (31%)	196
Ischaemic Heart Disease	39 (37.5%)	104
Cataract	80 (48.5%)	165
Erectile Dysfunction	73 (51%)	143
Diabetic Retinopathy	73 (64%)	114
Dry Feet	97 (65.5%)	148
Poor wound healing	123 (66.8%)	184
Loss of pain perception	165 (87.3%)	189
Total diabetic foot ulcer cases	196	

Diabetic nephropathy was evident in 60 (31.0%) of the whole sample and ischaemic heart disease in 39 (38.0%) of 104 patients. Intermittent claudication was (19.8%) while resting leg pain was documented in 41 (21.0%) of the cases and a dry foot was reported in 97 (50.0%). Among the 113 patients who had had direct ophthalmoscopic examination, 73 (65.0%) had evidence of non-proliferative retinopathy. Erectile dysfunction was present in 73 (64.06%) of the male patients (Table 3). History of smoking was present in 36 (18.0%), 80 (49.0%) had some evidence for -of the 165 patients evaluated for cataract and hypertension was found in 100 (51.0%) of the patients (data not shown).

**Table 4: Management of the foot problem (Jan 1999 to Dec 2003)**

Type of Intervention	Number of patients (%)
Toe amputation	17 (8.7%)
Above knee amputation	17 (8.7%)
Debridement	22 (11.2%)
Ray amputation	27 (13.8%)
Below knee amputation	31 (15.8%)
Wound care only	82 (41.8%)

**Table 5: Microbiologic studies from site of the ulcer of the reviewed patients (Jan 1999 to Dec 2003)**

Type of microorganism	Number of patients (%)
Providencia species	2 (1.7%)
Citrobacter species	2 (1.7%)
Morganella morganii	2 (1.7%)
Acinetobacter species	2 (1.7%)
Salmonella species	2 (1.7%)
E.coli	5 (4.2%)
Staphylococcus aureus	7 (5.9%)
Proteus species	17 (14.3%)
Klebsiella species	22 (18.5%)
No growth	27 (22.7%)
Polymicrobial	31 (26%)
<b>Total</b>	<b>119 (100%)</b>

The mean glycemic level was found to be above 140 mg/dl in 47 (81.0%) out of 58 cases in whom at least five consecutive fasting blood glucose determinations were available before hospitalization. Among 70 (36.0%) cases that had at least a single hospital visit following their discharge, only 5 (7.0%) had other leg complication in the form of ulcer. The median duration of follow-up for the above cases was 30 days (range 7-330 days) (data not shown).

Gas gangrene had developed in 32 (16.0%) of the cases and more than one antibiotics treatment was provided for 96% of the total cases. Bacteriological culture study from the wound site or discharge was made for aerobic organisms in 119 (61.0%) of the cases. Sixty three (53.0%) had growth for a single organism, Klebsiella species being the commonest isolate and 31 (26.0%) were polymicrobial. 27 (23.0%) of the media had no growth (Table 5). Among 174 cases with X-ray report by a radiologist of the affected foot, 87 (50.0%) had osteomyelitis and 19 (11.0%) had calcified arteries.

Twenty-six patients (13.0% of the sample population) had a previous history of foot ulcer. Five (3.0%) patients had previous amputation and only 22 (11.0%) claimed to have the habit of inspecting their feet daily. A major amputation was done on 92 (47.0%) cases and reamputation was necessary in 24 (26.0%) of these cases. Thirty one (34.0%) had below knee amputation (Table 4).

There were 41 deaths among the study sample, making the mortality rate 21% and sepsis was the main cause in 24 (59.0%). Ten (24.0%) had grade 3 ulcer, 19 (47.0%) had grade 4 ulcer and 12 (29.0%) had grade 5 ulcer. The median diabetes duration in this group was 15 years (range 1-33). Surgical intervention was made only in 14 (34.0%) and was not possible in the rest of the cases. The reasons for this are: delay in intervention, patient refusal to consent and unfit general condition for surgery.

### Discussion

Among Ethiopian diabetic patients, foot ulcer is one of the major health problems. The median hospital stay was

32 days in this study and 84.0% had type 2 diabetes. The number of patients who were under follow-up was only 36.0%. Eighty one percent of patients had poor glycemic control. Both of these factors i.e. lack of follow up and inadequate metabolic controls of glucose were found to be major risk factors for diabetic foot disease.

Factors reported with lower limb amputation in our study were: the grade of the foot ulcer according to the Wagner's classification, the presence of neuroischaemic process and poor glycemic control. Foot ulcer is the commonest mode of presentation. Neuroischaemia and neuropathy were the primary problems in 90% of the cases and 63.0% had peripheral vascular disease. Purely ischaemic lesion accounted for 5% only. This is consistent with the previous studies among Ethiopian patients (12) and from Nigeria (14).

There was an alarming in-patient mortality rate of 21.0% (out of 196 patients) and sepsis was the cause in nearly 60.0% of these cases. Surgical intervention was possible in only 34% of the deceased and not in the rest mainly due to: delay in intervention, denied consent for amputation and unfit general condition for surgery. Swab culture in our series was positive in 92 out of 119 (77.0%) patients who underwent culture studies for aerobic organisms. The result yielded wide range of bacteria; however, klebsiella and Proteus were the commonest. This implies that antibiotics coverage to manage diabetic foot disease in our setting has to include drugs active against these aerobic Gram negative bacteria.

An understanding of the causes of foot diseases in diabetics will enable high-risk patients to be recognized early. It has been estimated that up to 50.0% of major amputations in diabetic patients are preventable with effective education (7).

A potentially preventable initiating event was identified in 86.0% of the cases and most often minor trauma caused the cutaneous injury (8). In our series among 109 patients with identified antecedent contributory factors for their foot problem, ill-fitting or new shoes accounted for 24.0%, and another 50.0% had cataract, which made visual inspection of their feet difficult. This implies that emphasizing on appropriate footwear and systematic self foot examination among high-risk diabetics can reduce the incidence of foot ulcer and subsequent complications. It is clear now that diabetics with impaired vision are at greater risk of foot ulceration than others (15).

In this review, 47.0% had undergone major lower amputations (seventeen above knee and thirty one were below knee; the rest had toe and ray amputations). Previous history of foot ulcer was present only in 13.0% of these cases. This was distinct from a report, which revealed that those with previous history of foot ulceration are particularly at risk of subsequent ulceration occurring in 61.0% of patients within three years of

previous ulcer (16). The subsequent follow-up rate following discharge from the hospital is lower than 40.0% and the median duration of follow up was only 30 days (range 7-330 days). Hence the number of cases that presented with other leg complication is few.

### Conclusion

The above study demonstrated that foot ulcer is the commonest mode of presentation among hospitalized diabetics with foot diseases and the most important contributory factors were poor glycemic control, lack of proper patient follow up, neuroischaemia and neuropathy. Preventable antecedent factors like ill fitting or due to new shoes can be overcome with comprehensive education programs. The relatively high hospital mortality seen in this group primarily due to sepsis emphasizes the need for improving our diabetic foot care program. Refusal of consent for amputation was found out to be another contributing factor for the high mortality. Thus it is imperative to educate patients as well as provide empathic support about the need for early surgical intervention.

### Recommendations

Educations on diabetics' foot care, emphasis on metabolic control of diabetes, early presentation and surgical intervention when appropriate have to be highlighted in the management of diabetic patients. Improved diabetes care should be the ultimate goal in order to reduce other chronic complications of diabetes mellitus.

More studies have to be done in relation to the high-risk diabetic foot particularly in the Ethiopian setting emphasizing on preventive aspects.

### References

1. Abdulkadir J, Reja A. Management of diabetes mellitus: coping with limited facilities. *Ethiop Med J* 2001;39:349-365.
2. Younes NA, Ahmad AT. Diabetic Foot Disease. *Endocr Pract* 2006;12:583-592.
3. Palumbo PJ, Melton LJ III. Peripheral vascular disease and diabetes. In: Diabetes in America: diabetes data compiled 1984. Washington, D.C.: Government printing office, August 1985: XV-1-XV-21. (NIH publication no. 85-1468)
4. Consensus Development Conference on Diabetic Foot Wound care: 7-8 April 1999, Boston Massachusetts. *Diabetes Care* 1999;22:1354-60.
5. Ebskov B, Josephsen P. Incidence of re-amputation and death after gangrene of the lower extremity. *Prosthet Orthot Int* 1980;4:77-80.
6. Kucan JO, Robson MC: Diabetic foot infections: fate of the contralateral foot. *Plast Reconstr Surgery* 1986; 77:439-441.
7. Boulton AJM. The diabetic foot. *Medicine International* 1993; 271-274.
8. Pecoraro RE, Reiber GE, Burgess EM. Pathways to diabetic limb amputation: Basis for prevention. *Diabetes Care* 1990; 13:513.
9. Macfarlane RM, Jeffcoate WJ. Factors contributing to the presentation of diabetic foot ulcers. *Diabet Med* 1997;14:867-70.
10. Veves A, Murray HJ, Young MJ, Boulton AJ. The risk of foot ulceration in diabetic patients with high foot pressure: A prospective study. *Diabetologia* 1992;35:660-663.
11. Siyoum B, Tezera C. Survey of the high-risk diabetic foot. *Ethiop Med J* 1998;36(3): Abstract number 14.
12. Berhane S, Tezera C, Wondimu W. Outcome of diabetic patients with foot problems in Tikur Anbessa Hospital: Preliminary report. *Ethiop Med J* 1999; 37(4): Abstract number 42.
13. Veves A, Boulton AJ. Diabetic neuropathy: The diabetologist's view. In: David F. Horrobin, ed. Treatment of diabetic neuropathy, a new approach, Churchill Living stone, 1992:1-10.
14. Dagogo-Jack S. Pattern of diabetic foot ulcer in Port Harcourt, Nigeria. *Practical Diabetes Digest* 1991; 2:75-8.
15. Susan B, Geoff Gill. Diabetic foot ulceration in developed and developing countries. *International Diabetes Digest* 1997;8:8-10.
16. Apelqvist J, Larsson J, Agardh CD. Long-term prognosis for diabetic patients with foot ulcers. *J Int Med* 1993; 233:484-91.