Foot and Ankle Surgery 22 (2016) 55–58

Contents lists available at ScienceDirect

Foot and Ankle Surgery

journal homepage: www.elsevier.com/locate/fas

# Clinical profile and surgical management of diabetic foot in Benghazi, Libya

Mohamed Benkhadoura [a,*], Mohamed Alswehly [a], Abdulwahab Elbarsha [b]

[a] Department of Surgery, Faculty of Medicine, Benghazi University, Benghazi, Libya
[b] Department of Medicine, Faculty of Medicine, Benghazi University, Benghazi, Libya

ARTICLE INFO

*Article history:*
Received 2 February 2015
Received in revised form 1 April 2015
Accepted 21 April 2015

*Keywords:*
Diabetic foot
Surgical management
Benghazi

ABSTRACT

*Background:* The aim of this study was to outline the patterns and management of diabetic foot ulcer (DFU) and compare our experience with other published data.
*Patients and methods:* All consecutive patients admitted to Al-Jala Hospital with diabetic foot from June, 2008 to May, 2013 were reviewed retrospectively.
*Results:* A total of 542 patients were studied, Wagner's grade III ulcers were the most prevalent (31%), followed by grade II (25%). About 10% of patients underwent major amputations and 24.2% underwent minor amputations. The amputation rate was 34%, and the mortality rate was 2%.
*Conclusion:* Diabetic foot infections cause significant morbidity and mortality among patients with diabetes in Benghazi. There is a need to establish a diabetic foot clinic in Benghazi with a multidisciplinary team to reduce the rates of hospital admission and amputation, as well as hospital stay duration.


## 1. Introduction

Diabetes mellitus (DM) continues to be a growing health problem worldwide, and diabetic foot complications are one of the most common causes of hospital admission among patients with DM [1,2]. The incidence of diabetic foot disease is increasing worldwide [3]. Foot ulcerations are one of the most serious and disabling complications of DM and are the most common cause of non-traumatic foot amputation [4]. Patients with DM are 15–20-fold more likely to require an amputation than those without the disease [4,5]. About 15–25% of patients with diabetes will develop diabetic foot ulcerations during their lifetime [2].

Patients with DM are more likely to develop foot ulcerations due to peripheral neuropathy, peripheral arterial disease and infection [3]. Peripheral neuropathy occurs early in the pathogenesis of diabetic foot complications and is considered the most prominent risk factor for diabetic foot ulcers. Diabetic foot infections are among the most serious and frequent complications encountered in patients with DM [2]. The greatest success in these patients results from application of preventative measures. However, managing patients with DM requires a multidisciplinary team strategy to stabilise the patient medically and control infection via adequate surgical debridement, antibiotic selection and treatment, and delayed reconstruction to achieve functional limb salvage [6–8]. The aim of this study was to outline the patterns and management of DFU and to compare our experience with other published data. Clarifying these aspects would help optimise management and aid in preventing amputation.

## 2. Patients and methods

### 2.1. Subjects

The medical records of 542 consecutive patients admitted to Al-Jala Hospital with diabetic foot from June 1, 2008 to May 31, 2013 were reviewed retrospectively.

Al-Jala Hospital is a major hospital in eastern Libya and is one of the main hospitals affiliated with Benghazi University. Ethics approval requirements for this study were waived because of its nature. All patients were followed up for at least 1 year after the discharge.

### 2.2. Data collection

Patients' characteristics, such as age, sex, occupation, education level and presence of comorbid illness, were collected. Clinical

* Corresponding author. Tel.: +218 925302701.
*E-mail address:* khdoura@yahoo.com (M. Benkhadoura).

http://dx.doi.org/10.1016/j.fas.2015.04.011
1268-7731/

**Table 1**
Classification of diabetic foot lesions.

| | |
|---|---|
| Grade 0 | High risk foot. No obvious ulcer, but may have deformity or thick callus |
| Grade I | Superficial ulcer |
| Grade II | Deep ulcer, but no bone involvement |
| Grade III | Deep ulcer, abscess, bony involvement |
| Grade IV | Localised gangrene (for example toe or forefoot) |
| Grade V | Gangrene of whole foot |

characteristics, including the type and duration of diabetes, type of treatment received, site of the foot ulcer and its clinical presentation, history of healed foot ulcers and amputations and Wagner's classification [9] were also included (Table 1). The duration of hospital stay, surgical management and outcome were recorded. Routine blood testing, including blood glucose, glycated haemoglobin (HbAlc, an indicator of glycaemic control), swabs from the ulcer, urinalysis, baseline electrocardiogram and chest and foot X-rays were reviewed.

The results of lower limb arteriography performed in patients with Wagner's grades IV and V and absent pedal pulses or those with signs of vascular involvement on Doppler were also analysed.

### 2.3. Statistical analyses

Categorical variables were analysed by using Chi-squared test. All statistical analyses were performed by using SPSS 18.0. *P* values $<0.05$ were considered to indicate statistical significance.

## 3. Results

A total of 542 patients (352 [65%] males and 190 [35%] females; average age, 59 years) were studied. The average length of hospital stay was 20 days.

The majority of patients (494, 91%) had type II DM. In total, 187 patients (34.5%) had suffered from DM for $<10$ years and 355 (65.5%) had been diagnosed $>10$ years earlier.

In this study, 443 (81.7%) patients were managed with oral hypoglycaemic agents and diet modifications, while 99 (18.3%) were treated with insulin and diet control. Haemoglobin A1C ($HbA_{1C}$) assays indicated that 64% of patients' glycaemic control was poor (levels $>7\%$).

Only 19% of patients were febrile on presentation, and leukocytosis was present in 31%. A total of 22% of treated patients had radiological evidence of osteomyelitis.

According to Wagner's grading system, grade III ulcers were the most prevalent (31%), followed by grade II (25%) (Table 2).

Toes were the most common ulcer site in 284 patients (52.4%) (Fig. 1), followed by the plantar surface of the metatarsal head in 105 cases (19.4%), the heel in 100 cases (18.5%), the dorsum of the foot in 26 cases (4.8%), 17 cases (3.1%) had multiple ulcerations and 10 cases (1.8%) had ulcers at the stump site of a previous amputation.

Trauma preceding infection was found in 76 patients (14%), whereas 55 patients (10.1%) provided no trauma history. A total of 411 patients (75.8%) did not recall receiving any injury but

**Table 2**
Clinical presentation according to Wagner's grading system.

| Grade | Number of patients | Percentage |
|---|---|---|
| 0 | 0 | 0 |
| I | 124 | 23 |
| II | 136 | 25 |
| III | 168 | 31 |
| IV | 92 | 17 |
| V | 22 | 4 |

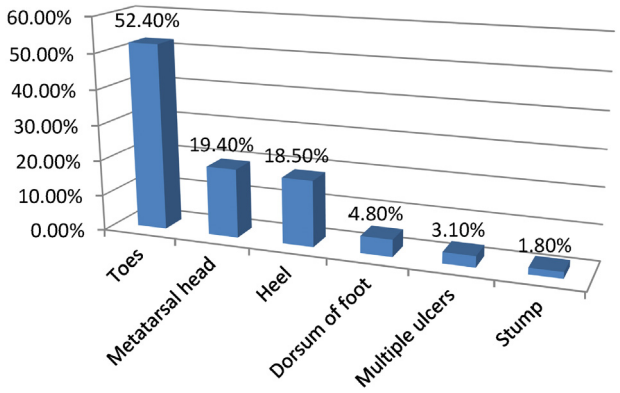


**Fig. 1.** Distribution of ulcer sites.

184 patients (33.9%) had a history of amputation. Of these, 156 (28.8%) were toe amputations, 4 (0.7%) were amputations below the knee and 24 (4.4%) were above-the-knee amputations. The amputations were in the same limb as the current ulceration in 95 patients (17.5%), whereas 59 (10.8%) were in the other limb, and 30 patients (5.5%) had both limbs amputated previously.

Positive cultures were obtained in 362 (66.8%) patients. Of these, 234 (64.6%) had polymicrobial infections and 128 (35.4%) had monomicrobial infections.

*Staphylococcus aureus* was the most common (164, 45.3%) pathogen isolated, followed by *Pseudomonas* spp. (131, 36.2%). Fungal co-infection was seen in 59 cases (16.3%).

The bacteria isolated demonstrated varying sensitivity patterns against commonly used antibiotics.

Various surgical procedures were performed (Table 3). Of the 54 (10%) major amputations, 15 were below the knee, and 39 above the knee (one case of bilateral above-knee amputation). Furthermore, 41 patients underwent an amputation for the first time, and 13 patients had a history of amputation.

Minor amputations were performed in 131 (24.2%) patients, and debridement was conducted in 340 (62.7%). Arterial bypass was performed in 17 (3.1%) patients before discharge, and 112 patients (20.6%) underwent multiple procedures during their hospital stay. The overall amputation rate was 34%.

Diabetic foot infections recurred in 294 (54.2%) patients during the study period, at either the same or another site. Of these, 127 (43.1%) patients had a recurrence after a minor or major amputation for their first lesion. The recurrence was in the same limb as the healed ulcer in 184 patients (62.6%) and in the other limb in 110 (37.4%).

Eleven (2%) patients died; three due to uncontrolled sepsis, and eight due to cardiovascular disease (mostly myocardial infarction). Mortality rate was higher in those with Wagner's grades IV and V (7.9%) compared to those with grades 0–III (7.9% vs. 0.5%, $P < 0.05$).

## 4. Discussion

While diabetic foot is an infection, symptoms, such as fever and chills, may often be absent. Hypotension, tachycardia and severe unexplained hyperglycaemia are often seen. However, $>50\%$ of

**Table 3**
Surgical procedures performed in the study patients.

| Surgical procedure | Number of patients | Percentage |
|---|---|---|
| Debridement | 340 | 62.7 |
| Minor amputation | 131 | 24.2 |
| Major amputation | 54 | 10 |
| Arterial bypass | 17 | 3.1 |