

# Diabetic Foot ulcers: update on management

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## Key words

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## Key points

1 working day referral to foot protection team

Delayed referral leads to chronic wounds

Chronic wounds susceptible to further complication

Heavy cost to quality of life and NHS

## Consent for images

Written consent for images has been taken, these have been created by the authors.

## Abstract

Diabetic foot ulceration is costly, both in terms of NHS expenditure and quality of life for the patient. This article reviews the current guidelines for assessment and management of the diabetic foot ulcer and provides instruction on undertaking vascular and neurological assessments on the diabetic foot. Wound assessment, with an overview of TEXAS and SINBAD wound classification systems are also explored, as is the importance of 1 working day referral for expert assessment for any new diabetic foot ulcer to reduce wound complications, length of hospital stays and ultimately amputation.

## Introduction

The health, social and economic consequences of diabetes mellitus continue to receive major government, media and societal attention, due to the ever increasing prevalence and incidence of this non-communicable disease (Public Health England 2018). People with diabetes, who do not achieve consistent self-management optimised health goals, have an increased risk of developing macro-and micro-vascular complications (Diabetes UK / National Diabetes Foot Care Audit 2014-2017, 2018). Diabetic Foot Disease (DFD) is a term used to describe a complex array of factors in the microvascular (peripheral nerve damage) and macrovascular (peripheral arterial disease) complications affecting people with diabetes, (Mishra, Chharbar, Kashikar & Mehndiratta (2017). The most recent estimates of the extent of DFD are that 1 in 3 people with diabetes are at risk of developing the disease, and 10% will develop a Diabetic Foot Ulcer (DFU) at some point in their lives (NICE 2016). An altered health outcome of this was that 7,305 major amputations were performed on people with diabetes between 2014-2017 (Diabetes UK/ National Diabetes Foot Care Audit 2014-2017, 2018). Overall, diabetes mellitus accounts for £10 billion of the NHS budget per year, and 80% of this is spent on dealing with the complications of type 2 diabetes alone, which represents an unmanageable burden on NHS resources, (NICE 2016). This paper outlines the state of the art debate, policy and research to promote improved services and practices to prevent and manage DFD.

The main sources of data for prevalence estimates of Diabetic Foot Disease are from the NHS services provided prevention/treatment outcomes, reported in the National Diabetes Foot Care Audit and the National Diabetes Audit (NHS Digital 2019). The National Diabetes Audit Complications and Mortality 2015-2016, presents the most recent figures that can be accessed in relation to amputations as a result of DFD (NHS Digital 2019). The National Diabetes Foot Care Audit showed that more commissioners are taking part in the data collection (75%), and services have developed in response to increasing demand, with 85% of those surveyed stating that they have a clear referral pathway for specialist care for those people at increased risk of developing a foot ulcer. There is also an improvement in referral time from self- to health care professional referral of more severe ulcers. However, the audit also found that training for primary care staff in routine foot examinations for people with diabetes needs to increase significantly, the delays in expert referral need to improve, to better than the current average 2 week wait, and to improve the current 66% of an ulcer healing after 24 weeks needs to improve.

## Prevention and Screening

Diabetic foot ulceration occurs due to a combination of factors including neuropathy, peripheral arterial disease and deformity (Bowering, 2001). These factors can lead to a cascade of consequences – delayed healing, infection and ultimately amputation. A patient presenting with a new ulceration who is assessed to have moderate / severe infection, peripheral arterial disease or a walking disability or previous amputation are at a three to five-fold risk of amputation at 180 days (Ferreira, Carvalho, & Carvalho, 2018). Assessment of both feet is vital to be able to establish what underlying issues may be present. Outlined below are the procedures for assessing circulation and protective sensation.

Prior to physically assessing vascular and neurological status, an overall visual inspection of both feet should occur, considering the colour and nutrition of the skin, presence of any bony deformity and lesions. Once an overall idea about the feet has been established, and a thorough holistic history take has highlighted if there are any potential symptoms of peripheral arterial disease, peripheral neuropathy or infection, assessment should then occur.

#### Palpation of pulses.

To successfully palpate foot pulses, clinicians should avoid using the index finger to prevent detection of own pulse. Figures 1 and 2 indicate the anatomical location of both the dorsalis pedis and posterior tibial arteries. If even one pulse is unpalpable this indicates the presence of peripheral arterial disease and that underlying major vascular disease may also be present (Criqui, Fronek, Klauber, Barrett-Connor, & Gabriel, 1985; Mohammadi et al., 2016).

*Figure 1 Palpation site for Dorsalis pedis artery*



*Figure 2 Palpation of posterior tibial artery*



#### Testing for loss of protective sensation

The monofilament is recommended as part of the neurological assessment within NG19 (NICE, 2016). The 10 sites outlined in Figure 3 includes all the common sites of diabetic foot ulceration, and the dermatomes innervating the foot. The monofilament, when pressed to give a bend of 1cm, exerts 10 grams of pressure at the point of application. The filament should be placed at each site for no more than 2 seconds and should not be allowed to twist / scrape across the skin surface. For correct usage, the filament should be “warmed up” by being bent against the skin 3 times prior to assessment beginning. A “cold” fibre may exert more pressure, and so may falsely give the impression of protective sensation. Areas of thickened skin should be avoided as even in the presence of normal sensation; a light pressure would not be detected at the site. A loss of sensation at one site indicates that protective sensation is not intact.

Figure 3 Testing sites for Monofilament and monofilament bent correctly



## Wound Assessment and Referral

Current NICE guidelines (2016) recommend that either TEXAS or SINBAD should be used to classify a diabetic foot ulcer. The use of a classification system can be considered a quality control check, ensuring that the complexities of the wound are assessed. TEXAS (Armstrong, Lavery, & Harkless, 1998) is a staging system which enables the clinician to document depth and presence of infection and/ or ischaemia within a diabetic foot ulcer. Neuropathy is not recorded with TEXAS and so not all involved within the management of the wound may be aware of this issue.

Table 1 The University of Texas Staging System for Diabetic Foot Ulcers, adapted from Armstrong et al 1998.

Stage	Grade			
	0	1	2	3

A	Pre or post ulcerative lesion completely epithelialized	Superficial ulcer, not involving tendon capsule or bone	Ulcer penetrating to tendon or capsule	Ulcer penetrating to bone or joint
B	Infection	Infection	Infection	Infection
C	Ischaemia	Ischaemia	Ischaemia	Ischaemia
D	Infection and ischaemia	Infection and ischaemia	Infection and ischaemia	Infection and ischaemia
Score: Grade ____ Stage _____				

For SINBAD (Ince et al., 2008) (Site, Ischaemia, Neuropathy, Bacterial infection, Area, Depth) to be fully completed, the clinician must perform a more detailed assessment of the ulcer. The system incorporates consideration of location, presence of neuropathy and ischaemia, size of ulceration and whether infection is present. A score  $\geq 3$  is considered a severe ulceration. The national diabetes foot care audit (NHS Digital, 2019) utilises the SINBAD score to review patient care. The audit results from 2017 indicate that a delay in referral for expert assessment results in more severe ulcers and delayed healing. Any patient who has an ulceration should be referred to specialist services within 1 working day (NICE, 2016). A delay in referral of only 14 days impacted seriously upon healing times, and these wounds were more likely to be severe. People with severe ulcers are 1½ times more likely to be admitted to hospital and 3x more likely to be admitted for foot disease and 3x more likely to undergo amputation. The case for swift referral is conclusive.

Table 2 SINBAD, adapted from Ince et al 2008.

Category	Definition	SINBAD Score
Site	Forefoot (distal to tarso-metatarsal joint)	0
	Midfoot / Hindfoot	1
Ischaemia	At least one pulse palpable on the affected foot	0
	Neither pulse palpable	1
Neuropathy	Protective sensation intact	0
	Protective sensation lost	1
Bacterial Infection	None	0
	Present	1
Area	Ulcer $\leq 1\text{cm}^2$	0
	Ulcer $\geq 1\text{cm}^2$	1
Depth	Ulcer confined to skin and subcutaneous tissue	0
	Ulcer reaching muscle, tendon or deeper	1
Total possible score 6		

## Current Recommended Treatment

### Holistic review of each patient

The benefits of prompt referral to a specialised foot care team and the benefits of multidisciplinary team work has long been established (van Acker, Leger, Hartemann, Chawla, & Sidduqui, 2014). All underlying issues need addressing for optimum healing. A thorough holistic review is necessary to understand the complexities of each individual case. Patients should be reviewed to ensure good

glycaemic control and nutritional status. Focussing upon the ulceration itself, infection or ischaemia should have prompt review and management to resolve infection and improve perfusion where possible.

### Offloading

Research is clear, the diabetic foot ulceration must be offloaded (Bus et al., 2018). There are numerous options for offloading, all are focussed upon reducing the excessive pressure which could destroy the newly healing tissue. Offloading can be considered in 2 camps – removable and non-removable. Non-removable is normally a total contact cast, designed to encapsulate the leg below the knee, removable is presented in a number of forms, such as below knee removable total contact cast, air walker, slipper cast and offloading insole. Negotiation is required with a patient to strike a balance between optimal offloading and compromises to their life.

### Infection

The International Working Group of the Diabetic Foot (Lipsky et al., 2015) published guidelines to assist clinicians in deciding upon the extent of infection and the best choices for antimicrobial treatment. This determined if an infection was mild, moderate or severe by looking at the extent of signs and symptoms present. Mild was classified as contained with the skin and subcutaneous tissue, with erythema extending less than 2cm<sup>2</sup> from the ulceration; moderate where erythema extended past 2cm<sup>2</sup> and effecting muscle, tendon or joint, and severe infection when there is a systemic impact on the body. Focussing upon the use of antibiotics, the guidelines recommended that antibiotics should not be used in clinically uninfected ulcerations, and for mild to moderate infections a 1-2 week course of oral antibiotics was normally sufficient.

## Biofilms

Biofilms, a community of mixed microbes residing together within an extracellular matrix, are present in 6% of acute ulcers and 60% of chronic ulcers (James et al., 2008). In order to maintain their own survival, the biofilm holds a wound in a chronic inflammatory state. This is not the acute inflammatory state necessary for the first phase of wound healing, rather the static dull inflammation associated with a non-healing ulceration. Suspect biofilm if a wound begins to delay healing. Biofilms are undetectable through traditional wound swabbing procedures and so current recommendations are focussed upon a practitioner utilising their clinical skills of observation to determine if a biofilm may be present (Angel et al., 2016). If biofilm is suspected, a combination debridement and use of topical antimicrobials is recommended to reduce recurrence (Schultz et al., 2017) A summary adapted from International Wound Institute and the wound biofilm expert panel is shown in table 3.

*Table 3, Consider Biofilm Presence adapted from Angel et al (2016) & Schultz (2017)*

Consider Biofilm Presence if:
Failure of appropriate antibiotics
Recalcitrance to appropriate antibiotics / topical
Delayed healing recurs after cessation of antibiotics
Delayed healing despite optimal holistic wound management
Increased exudate
Low grade Chronic inflammation
Low grade erythema
Poor or friable granulation tissue
Secondary signs of infection

## Dressing choice

The systematic reviews by Cochrane exploring choice of dressing selection and use of topical antimicrobials in the diabetic foot (Dumville et al., 2017; Wu, Norman, Dumville, O'Meara, & Bell-Syer, 2015) indicated that the quality of research at present is not sufficient in order to specify one dressing regime over another. Instead, recommendations are that a combination of factors should be evaluated for dressing selection. Clinicians should use their wound care assessment skills as part of the decision making process and adhere to basic principles of wound dressing, aiming to maintain a moist, warm, infection free wound bed. NICE (2019) have produced recommendations that UrgoStart® dressing should be considered as an option for a diabetic foot ulcer. The recommendation is based upon a review of the EXPLORER trial (Edmonds 2018) which compared healing times of UrgoStart® vs UrgoTul® (45% vs 30% respectively) for individuals with neuro-ischaemic, non-infected ulceration  $\geq 1\text{cm}^2$  not probing to bone.

## Conclusions

Delayed referral and sub-optimal management of DFU can result in chronic ulceration, with concomitant increased resource use, and decreased patient well-being. Research and audit clearly demonstrate that individuals with chronic ulceration are at higher risk of biofilm, infection and ultimately amputation. The message is clear; swift referral and holistic multidisciplinary management is key in the management of the diabetic foot. Understanding the patient's journey, and destemming achievable healthy goals, defined by the patient, in the context of their perceived quality of life, will optimise well-being.

## CPD Reflective Questions

Are you aware of your local Foot Protection Team or Diabetic Foot MDT contact details?

If you were the first clinician to see a diabetic foot ulceration, what assessments should you undertake?

What are the consequences of a delayed referral for expert opinion on the healing times of a diabetic foot ulceration?

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