Diabetes-related foot ulcers – detailed advice for primary care

This comprehensive review, published in *Lancet Diabetes & Endocrinology*, highlights the important roles that primary care and community teams have in identifying those most at risk of diabetic foot ulceration, how to carry out assessment once ulceration occurs and the improved outcomes when the specialist foot care team is involved within 14 days of presentation. Earlier in 2024, practical guidance from the International Working Group on the Diabetic Foot was published open access in *Diabetes/Metabolism Research and Reviews*, providing detailed advice on foot ulcer prevention, foot examination, foot self-care education, footwear choices, and assessment and management of diabetic foot ulcers. Taken together, this review and the practical guideline should act as a call to action for our practices to review how we undertake diabetic foot education and assessments, assess and manage diabetic foot ulcers, and ensure we are working closely with our local specialist diabetic footcare team.

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This review on the causes, prevention and management of diabetes-related foot ulcers by William Jeffcoate and colleagues seeks to complement the 2023 guidelines from the International Working Group on the Diabetic Foot (IWGDF). In 2023, all the IWGDF guidelines were updated, and the most useful of these for primary care are the *Practical guidelines on the prevention and management of diabetes-related foot disease* (Schaper et al, 2024), which describe the basic principles of prevention, classification and management of diabetes-related foot disease (including Charcot foot), incorporating relevant information from the seven IWGDF guidelines.

Diabetes-related foot ulceration (DFU) is defined as a break in the skin of the foot of a person with diabetes which penetrates the epidermis and part of the dermis, and occurs below the level of the malleoli. The annual incidence of DFU appears to be lower than previously identified, at <1% in most studies; however, 1-year rates of recurrence are much higher, at 7.7–44%.

Contributing factors for DFU

Contributing factors can be thought of as *predisposing*, *precipitating* and *perpetuating* factors. Multiple factors **predispose** to DFU, including neuropathy and peripheral artery disease. Distal neuropathies affect 30–50% of people with diabetes, and these can be motor (gait abnormalities and changes in foot loading), sensory (reduced awareness of trauma) or autonomic (loss of or decreased sweating, which increases ulceration risk) in nature. Peripheral arterial disease involves stenosis or occlusion of an artery somewhere between the aorta and the foot, with arteries below the knee frequently affected in diabetes; medial arterial calcification also often involves these vessels and increases mortality risk and limb loss.

DFU may be **precipitated** by a single episode of trauma or repeated trauma/abnormal forces. A UK study identified that more than half of all new ulceration was caused by inappropriate footwear, and an additional 6% due to self-treatment injury (e.g. that related to toenail cutting or callus removal) (Abbott et al, 2002).

Wound healing is delayed in people with diabetes, and this together with infection **perpetuate** the problem; healing takes from 147 to 237 days depending on ulcer location (Pickwell et al, 2013). In people with diabetes, persisting unresolved inflammation, decreased new vessel formation (angiogenesis), biofilm involvement, infection and non-migratory endothelialisation all delay healing.

Early assessment and management

The National Diabetes Foot Care Audit of England and Wales has repeatedly

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demonstrated a link between outcome and time from initial presentation to specialist multidisciplinary footcare team evaluation, with the recommendation that everyone should be seen within 14 days. Details of how to undertake an assessment and classify a foot ulcer using the SINBAD (**S**ite, **I**schaemia, **N**europathy, **B**acterial infection, **A**rea and **D**epth) system are included in the practical guidelines (Schaper et al, 2024). The initial assessment should identify whether there is any infection +/– peripheral arterial disease (PAD), and whether there are any complicating comorbidities or disabilities.

Beware the warm, apparently well-perfused foot in people with autonomic neuropathy. Since not all people with diabetes and PAD have symptoms of claudication, an ankle–brachial pressure index (ABPI) should be undertaken. Calf artery medial calcification may cause falsely high ABPI, so toe–brachial pressure index or toe pressure and pedal doppler waveform should be measured. Ulcers can then be usefully classified as neuropathic (loss of protective sensation [LOPS]), neuroischaemic (LOPS and PAD) or ischaemic (PAD but no LOPS).

The WIfI (**W**ound, presence and severity of **I**schaemia and **f**oot **I**nfection) classification can be used by specialist teams to assess risk of amputation and likely benefit from revascularisation. Less severe ischaemia may interfere with wound healing, and if this occurs, revascularisation should also be considered. Revascularisation can be via endovascular techniques or open revascularisation procedures; however, there is a high risk that reintervention will be required following endovascular procedures. Specialist teams managing DFU need to work closely with vascular surgeons experienced with both types of procedures.

Primary care teams should be aware that people with diabetes and DFU requiring revascularisation are at high risk of mortality, with annual mortality rates over 10%; thus, care and cardiovascular risk need to be optimised.

Assessment and management of infection

Infection increases risk of tissue loss, sepsis and osteomyelitis, and delays healing. A wide range of organisms are usually involved, including *Staphylococcus aureus* in the UK, and the recommendation is for antibiotic therapy, when required, to cover common Gram-positive and Gram-negative bacteria, including anaerobes. When bacteria form biofilms, they are embedded in a self-produced matrix which protects them from the host's immune system and from antibiotics. Biofilms occur in 60–80% of non-healing wounds versus 6% of acute wounds, and may contain live bacteria including "persisters": bacteria resistant to most antibiotics. Resistance genes can be transferred from one bacterial strain to another.

Infection is diagnosed clinically by the presence of two or more local signs of inflammation: swelling or induration, erythema around the ulcer, local tenderness or pain, increased warmth or purulent discharge. Microbiological assessment is essential for deciding appropriate treatment, and is best done with tissue samples rather than swabs, since the latter do not allow differentiation between colonisers and pathogens. Measurement of inflammatory markers may be helpful if tissue sampling is difficult. Intravenous antibiotics may be needed initially, with change to oral as soon as possible. Short antibiotic courses of 1–2 weeks are recommended for skin and soft-tissue infections.

Osteomyelitis (infection of the underlying bone) is more likely if the ulcer is more than 2 cm^2, the depth is >3 mm or there is an inflamed "sausage toe" appearance. Bone resection is now much less commonly the preferred management, and antibiotic courses are recommended to be shorter – from 5 days following amputation to a maximum of 6 weeks when no bone resection has been undertaken.

Wound healing

Once neuropathy has developed, there is no current way to reverse this; therefore, people will tend to continue to apply excess pressure to the damaged area, and so offloading is recommended. Offloading for as little as 20 days may shift inflammation to a healing pattern in DFU. Non-removable below-knee devices (total contact castings or pre-made knee-high walkers fitted and made non-removable) result in greatly improved outcomes compared with removable offloading devices, making ulcer healing 17–43% more likely and reducing time to healing by 8–12 days. Despite the risk of falls, limitation of daily living activities and risk of new ulceration due to poorly

fitting devices, the IWGDF guidance states that the benefits of non-removable devices outweigh the potential harms.

There is limited evidence supporting other measures to improve healing of DFUs; however, sucrose octasulfate-impregnated dressings, weekly autologous leukocyte, fibrin and platelet patches, freeze-dried placental products and oxygen therapy have been studied and found to be beneficial.

Amputation

Diabetes is implicated in up to 92% of non-traumatic major amputations and up to 89% of minor amputations, and major amputation is up to 30 times more common in people with diabetes compared to those without. There is a wide variation in the incidence of amputations across localities, with major amputation rates either stable or decreasing, and minor amputation rates either stable or increasing in many areas of the UK.

Prevention of DFU

Three criteria identify those at the greatest risk of DFU – previous ulceration, LOPS (unable to feel a 10 g monofilament) and at least one absent foot pulse. People with previous foot ulceration are 6.5 times more likely to develop a DFU, with a 40% risk of DFU recurrence at 12 months after the first ulcer.

Moderate, safe and regular physical activity may protect against first and recurrent DFU. Physical inactivity, non-adherence with recommended footwear, depression and social isolation increase the risk of recurrent ulceration, while depression, delayed help-seeking, and non-adherence with offloading treatments are associated with delayed healing.

Education may be important in DFU healing and future ulcer prevention, but studies have failed to confirm this. Outcome monitoring for specialist teams can be useful, provided that data collection does not detract from care delivery.

Implications for practice

DFUs should be assessed, managed if felt appropriate, and referred promptly in primary and community care. By the time an ulcer presents to us in practice, it may already have been present for some time, so we need to know when the lesion was first noted and, if referral to the specialist footcare team is needed, we should aim to achieve this within the optimal 14-day period. Working closely with our specialist footcare teams is vital – they can take tissue samples to aid in identification of pathogens and guide antibiotic decisions, provide offloading devices and liaise on specific wound-healing measures, as well as working closely with the local vascular teams to evaluate need for and timing of revascularisation.

This review and the IWGDF guidelines highlight areas for discussion in our practices, since DFUs may present to any member of our team, not just those specifically involved in delivering diabetes care:

- Does everyone understand the importance of prioritising face-to-face assessment, the urgency of referral, if needed, and how to contact the specialist diabetic footcare team?
- Do we code and know which people have had previous DFUs and amputations?
- Do we know whether they are still being followed up by the footcare team or whether this is now our responsibility?
- Is smoking cessation advice, vascular review or rehabilitation needed?
- Has the high mortality risk encouraged us to optimise all aspects of diabetes care, including glycaemia and cardiovascular risk management?
- When undertaking diabetes reviews, do we undertake full foot examinations, look for deformities, clearly document foot risk, inspect feet at every opportunity, encourage safe callus management with creams, and help people understand why foot care is an important part of their diabetes checks and care?
- Do we critically review the records of people requiring amputations following DFU to improve our future management?

This is an area of diabetes care where we all can really make a difference. ■

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Causes, prevention, and management of diabetes-related foot ulcers

Click here to read the review in full (subscription required)

Practical guidelines on the prevention and management of diabetes-related foot disease (IWGDF 2023 update)

Click here to read the IWGDF practical guideline (open access)