

# Assessment and management of diabetic ulcers in the primary health care setting

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## Case scenario

John is a 62 year old gentleman who has been suffering from type 2 Diabetes Mellitus for the past 7 years. He presents to the clinic with an ulcer 5 mm in diameter on the lateral aspect of the right foot near the metatarsophalangeal joint area. The ulcer is just involving the epidermis, appears dry and is not erythematous. It has developed two days ago after wearing a new pair of shoes for 10 days. He is currently on metformin 500mg tds and gliclazide 80mg daily.

## Introduction

Diabetic patients presenting with skin lesions and ulcers need urgent assessment and intervention because the vast majority of diabetic foot complications resulting in amputation begin with the development of skin ulcers. The prompt and aggressive treatment of diabetic foot ulcers can often prevent exacerbation of the problem and eliminate the potential for amputation.<sup>1,2</sup> This will allow prompt healing of the lesion and prevent recurrence once it has healed. Multidisciplinary management programmes that focus on education, prevention, regular foot examinations, aggressive intervention, and optimal use of therapeutic footwear have demonstrated significant reductions in the incidence of lower-extremity amputations.<sup>3,4</sup>

## Key words

Ulcers, diabetes

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## Initial assessment

When a patient presents with an ulcer, the initial assessment should aim to determine the cause of the ulcer. The main causes of ulcers in diabetics are due to neuropathy, ischaemia, or a combination of both. Inappropriate footwear (as in this case), or foot deformities can lead to pressure areas which are prone to ulceration. Therefore, a meticulous history and a proper examination are of vital importance.

## History taking

In the presence of an ulcer, the patient should be questioned about the presence of pain in the ulcer itself and in the lower limbs. The presence of pain in the ulcer may denote ischaemia or an infective process. If pain is present in the lower limbs, further enquiry is needed to determine whether this is due to a neuropathy or due to claudication as a result of peripheral vascular disease.

The diabetic control of the patient is of utmost importance. The results of previous HbA<sub>1c</sub> levels will help determine this.

A history of smoking, hypertension and hyperlipidaemia are three risk factors that should be looked into. These commonly contribute to the increased prevalence of peripheral arterial occlusive disease in diabetics.<sup>5</sup> The presence of microvascular and macrovascular complications of diabetes (like retinopathy, nephropathy, neuropathy, cardiovascular and cerebrovascular complications) must also be elicited.

The medications the patient is taking are also important. For example, Beta-adrenergic blocking drugs have previously been discouraged in peripheral arterial disease because of the possibility of worsening claudication symptoms. However, this concern has not been borne out by randomised trials; therefore, beta-adrenergic-blocking drugs can be safely utilised in patients with claudication.<sup>6</sup> In particular, patients with peripheral arterial disease who also have concomitant coronary disease may have additional cardioprotection with beta-adrenergic-blocking agents.<sup>7</sup>

Footwear habits, like barefoot walking or the purchase of new footwear which was either tight or loose fitting, have also to be enquired about. New footwear was in fact the cause of the ulcer in the patient discussed here and, if this issue is overlooked, the results might not be successful. The usage of proper socks, which preferably have to be worn inside out to prevent the sewing line from causing pressure to the foot, has to be checked. Scald injuries could also have been the cause and so one should ask for example about the use of hot water bottles.

### Physical examination

Physical examination of the extremity having a diabetic ulcer can be divided into 3 broad categories:

1. Examination of the ulcer and general condition of the extremity
2. Assessment for the presence of vascular insufficiency
3. Assessment for the presence of peripheral neuropathy.

Visual inspection is necessary to check for deformities leading to pressure points, callus formation, cellulitis, fungal infections, dry skin, and fissures. Thin or shiny skin and the absence of hair may denote an element of ischaemia. Thickened nails or badly cut nails may be causing harm. One must also check carefully between the toes since fungal infections may be present there. It is also important to inspect the footwear for poor fit, rough areas, or worn out parts which are causing pressure.

An adequate description of ulcer characteristics, such as size, depth, appearance, and location should be done (as has been described in the above case). This will be essential for the mapping of progress during treatment.<sup>8</sup> Gentle probing can detect sinus tract formation, undermining of ulcer margins, and dissection of the ulcer into tendon sheaths, bone, or joints. The existence of odour and exudate, and the presence and extent of cellulitis must also be noted.

Classification of ulcerations can facilitate a logical approach to treatment and aid in the prediction of outcome. Several wound classification systems have been created. The most widely accepted classification system for diabetic foot ulcers and lesions is the Wagner ulcer classification system (Table 1), which is based on the depth of penetration, the presence of osteomyelitis or gangrene, and the extent of tissue necrosis.<sup>9</sup>

The University of Texas diabetic wound classification system (Table 2) assesses the depth of ulcer penetration, the presence of wound infection, and the presence of clinical signs of lower-extremity ischemia.<sup>10</sup> This system uses four grades of ulcer depth (0 to III) and four stages (A to D), based on ischaemia or infection, or both. The University of Texas system is generally

**Table 1: Wagner Classification of Diabetic Foot Ulcers**

<b>Grade 0:</b>	No ulcer in a high risk foot
<b>Grade 1:</b>	Superficial ulcer involving the full skin thickness but not underlying tissues
<b>Grade 2:</b>	Deep ulcer, penetrating down to ligaments and muscle, but no bone involvement or abscess formation
<b>Grade 3:</b>	Deep ulcer with cellulitis or abscess formation, often with osteomyelitis
<b>Grade 4:</b>	Localised gangrene
<b>Grade 5:</b>	Extensive gangrene involving the whole foot

predictive of outcome, because wounds of increasing grade and stage are less likely to heal without revascularization or amputation.<sup>10</sup>

The adequacy of the blood supply of the lower limb must also be determined. Peripheral arterial occlusive disease is four times more prevalent in diabetics than in nondiabetics.<sup>11</sup> All lower limb pulses should be checked. The foot is also examined for capillary return in the nail bed and pallor on elevating the foot. Ankle-brachial index determinations using a Doppler are very important. Subjective assessment of peripheral pulses, especially in diabetics, is often unreliable and the ankle-brachial index will give an objective assessment of the situation. An index less than 0.80 is abnormal, and if it is less than 0.45 it is severe and limb-threatening. Further investigations by the vascular surgeon, like angiography, will then be necessary. Vascular status must always be assessed because ischaemia portends a poor prognosis for healing without vascular intervention.

Neuropathy is a major aetiological component of most diabetic ulcerations and is present in more than 82% of diabetic patients with foot wounds.<sup>12</sup> Failure to perceive the pressure of a 10-g monofilament is a proven indicator of peripheral sensory neuropathy and loss of protective sensation.<sup>13</sup> Other common modalities that can detect insensitivity are a standard tuning fork (128Hz) and a neurologic reflex hammer.

One must keep in mind that diabetes is a systemic disease. Hence, a comprehensive physical examination of the entire patient is also vital. During such a visit, the patient has also to be checked for other complications of diabetes. The cardiovascular system should be assessed to include BMI, waist circumference, and blood pressure. A fundoscopy should always be done in order to check for signs of diabetic retinopathy. Lipid levels, and HbA<sub>1c</sub> should also be arranged if the patient has defaulted from his/her regular follow-up. Serum creatinine and urinalysis for micro-albuminuria should be done to assess the kidney. Liver function tests are also important since nonalcoholic steatohepatitis is seen more frequently in diabetic patients.<sup>14</sup>

### Short-term management

The management of diabetic ulcers needs a multidisciplinary approach. The doctor responsible for the patient's care has to liaise with podiatrists and the foot care clinic, the Tissue Viability Unit, and with a vascular surgeon. Effective care involves a partnership between patients and professionals, and all decision making should be shared. Multidisciplinary management programmes that focus on patient education and empowerment, regular foot examinations, aggressive intervention, and optimal use of therapeutic footwear have demonstrated significant reductions in the incidence of lower-extremity amputations.<sup>3,4</sup>

Rest and relief of pressure are essential components of treatment and should be initiated at first presentation. In this particular instance, the ill-fitting footwear should be replaced. Crutches or a wheelchair can also be recommended to totally off-load pressure from the foot. Although total contact casting (TCC) is considered the optimal method of management for neuropathic ulcers, it must be reapplied weekly and requires

**Table 2:** University of Texas Wound Classification System of Diabetic Foot Ulcers

<b>Grade 0-A:</b>	Pre or post-ulcerative lesion completely epithelialised
<b>Grade 0-A:</b>	Pre or post-ulcerative lesion completely epithelialised, with infection
<b>Grade 0-A:</b>	Pre or post-ulcerative lesion completely epithelialised, with ischaemia
<b>Grade 0-A:</b>	Pre or post-ulcerative lesion completely epithelialised, with infection and ischaemia
<b>Grade I-A:</b>	Non-infected, non-ischemic superficial ulceration
<b>Grade I-B:</b>	Infected, non-ischemic superficial ulceration
<b>Grade I-C:</b>	Ischaemic, non-infected superficial ulceration
<b>Grade I-D:</b>	Ischaemic and infected superficial ulceration
<b>Grade II-A:</b>	Non-infected, non-ischaemic ulcer that penetrates to capsule or bone
<b>Grade II-B:</b>	Infected, non-ischaemic ulcer that penetrates to capsule or bone
<b>Grade II-C:</b>	Ischaemic, non-infected ulcer that penetrates to capsule or bone
<b>Grade II-D:</b>	Ischaemic and infected ulcer that penetrates to capsule or bone
<b>Grade III-A:</b>	Non-infected, non-ischaemic ulcer that penetrates to bone or a deep abscess
<b>Grade III-B:</b>	Infected, non-ischaemic ulcer that penetrates to bone or a deep abscess
<b>Grade III-C:</b>	Ischaemic, non-infected ulcer that penetrates to bone or a deep abscess
<b>Grade III-D:</b>	Ischaemic and infected ulcer that penetrates to bone or a deep abscess

considerable experience to avoid iatrogenic lesions. Acceptable alternatives to TCC are removable walking braces and orthotic devices like the “half shoe”.

One has to initiate and supervise wound management with regular follow up. Although numerous topical medications and gels are promoted for ulcer care, relatively few have proven to be more efficacious than saline wet-to-dry dressings.<sup>8</sup> Topical antiseptics, such as povidone-iodine, are usually considered to be toxic to healing wounds.<sup>8</sup> Generally, a warm, moist environment that is protected from external contamination is most conducive to wound healing. This can be provided by a number of commercially available special dressings, including semipermeable films, foams, hydrocolloids, and calcium alginate swabs.<sup>15</sup> Table 3 below gives some examples.

The patient presented in this article in fact did very well with a hydrocolloid dressing and replacement of the ill-fitting new shoe. Should there be necrotic, callus, or fibrous tissue it should be debrided once adequate perfusion of the limb has been confirmed.<sup>8</sup> Unhealthy tissue must be sharply debrided back to bleeding tissue to allow full visualisation of the extent of the ulcer and detect underlying abscesses or sinuses. Soaking ulcers is controversial and should be avoided because the neuropathic patient can easily be scalded by hot water.<sup>8</sup> Currently, there is lack of trial evidence on the use of the following interventions in the treatment of foot ulcers and they are not recommended: cultured human dermis (or equivalent), hyperbaric oxygen therapy, topical ketanserin or growth factors.<sup>16</sup>

Vascular surgery consultation for possible revascularization should be sought when clinical signs of ischaemia are present or when there is no access to objective assessment of the perfusion of the limb. Prompt referral is important in those who may benefit from revascularisation.

Aspirin should be started if the patient is not already on it, unless there are contraindications to its use. In that case adenosine diphosphate (ADP) receptor inhibitors like clopidogrel or ticlopidine may be used. In non-critical peripheral ischaemia, there is no indication for warfarin treatment as the complexities of management and bleeding risks seem to far outweigh the benefits, unless the patient has concomitant problems needing anticoagulation such as atrial fibrillation.<sup>17</sup> Statins should also be started.<sup>18</sup>

Deep or longstanding ulcers may need radiographic examination to check for osteomyelitis.

One should be careful about the following signs and symptoms and hence one must also instruct the patient to watch out for these changes as well in order to detect any deterioration immediately.

- Changes in the ulcer, like increase in size or change in colour.
- Redness of the skin around the ulcer, or the skin going black.
- New-onset of discharge from the ulcer.
- When this happens, one should take cultures from the purulent drainage or curetted material from the ulcer base. When infection is present, aerobic and anaerobic cultures should be obtained, followed by initiation of appropriate broad-spectrum antibiotic therapy.<sup>8</sup> Antibiotic coverage should subsequently be tailored according to the clinical response of the patient, culture results, and sensitivity testing. If the cellulitis progresses to a moderate state the patient has to be referred for inpatient treatment.
- Development of new ulcers or blistering.

**Table 3:** Characteristics and uses of Wound Dressing Materials

### Alginate

**Examples:** AlgiSite, Comfeel, Curasorb, Kaltogel, Kaltostat, Sorbsan, Tegagel

**Description:** This seaweed extract contains guluronic and mannuronic acids that provide tensile strength and calcium and sodium alginates, which confer an absorptive capacity. Some of these can leave fibers in the wound if they are not thoroughly irrigated. These are secured with secondary coverage.

**Applications:** These are highly absorbent and useful for wounds having copious exudate. Alginate rope is particularly useful to pack exudative wound cavities or sinus tracts.

### Hydrofiber

**Examples:** Aquacel, Aquacel-Ag, Versiva

**Description:** An absorptive textile fibre pad, also available as a ribbon for packing of deep wounds. This material is covered with a secondary dressing. The hydrofibre combines with wound exudate to produce a hydrophilic gel. Aquacel-Ag contains 1.2% ionic silver that has strong antimicrobial properties against many organisms, including methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant *Enterococcus*.

**Applications:** These are absorbent dressings used for exudative wounds.

### Debriding agents

**Examples:** Hypergel (hypertonic saline gel), Santyl (collagenase), Accuzyme (papain urea)

**Description:** Various products provide some degree of chemical or enzymatic debridement.

**Applications:** These are useful for necrotic wounds as an adjunct to surgical debridement.

### Foam

**Examples:** LYOf foam, Spyrosorb, Allevyn

**Description:** Polyurethane foam has some absorptive capacity.

**Applications:** These are useful for cleaning granulating wounds having minimal exudate.

### Hydrocolloid

**Examples:** Aquacel, CombiDERM, Comfeel, Duoderm CGF Extra Thin, Granuflex, Tegaserb

**Description:** These are made of microgranular suspension of natural or synthetic polymers, such as gelatin or pectin, in an adhesive matrix. The granules change from a semihydrated state to a gel as the wound exudate is absorbed.

**Applications:** They are useful for dry necrotic wounds, wounds having minimal exudate, and clean granulating wounds.

### Hydrogel

**Examples:** Aquasorb, Duoderm, IntraSite Gel, Granugel, NormlGel, Nu-Gel, Purilon Gel, (KY jelly)

**Description:** These are water-based or glycerin-based semipermeable hydrophilic polymers; cooling properties may decrease wound pain. These gels can lose or absorb water depending upon the state of hydration of the wound. They are secured with secondary covering.

**Applications:** These are useful for dry, sloughy, necrotic wounds (eschar).

### Low-adherence dressing

**Examples:** Mepore, Skintact, Release

**Description:** These are various materials designed to remove easily without damaging underlying skin.

**Applications:** These are useful for acute minor wounds, such as skin tears, or as a final dressing for chronic wounds that have nearly healed.

### Transparent film

**Examples:** OpSite, Skintact, Release, Tegaderm, Bioclusive

**Description:** These are highly conformable acrylic adhesive film having no absorptive capacity and little hydrating ability, and they may be vapour permeable or perforated.

**Applications:** These are useful for clean dry wounds having minimal exudate, and they also are used to secure an underlying absorptive material. They are used for protection of high-friction areas and areas that are difficult to bandage such as heels (also used to secure IV catheters).

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- Ulcer becoming painful or uncomfortable. This might mean it is getting infected and prompt treatment has to be initiated.
- Any new smell from the ulcer may also indicate that it is getting infected.
- Any new swelling. This might cause further problems like for example the shoe now may become tight and thus cause a new ulcer.
- Development of fever may denote that the ulcer is now infected.

Initial empirical antibiotic therapy of an infected ulcer should be with flucloxacillin, co-amoxiclav, or clindamycin.<sup>19</sup> The antibiotic is then changed according to the culture results. Antibiotic treatment should be given for at least 7 to 14 days in infections that appear to be localized.<sup>19</sup> Patients with non-healing or progressive ulcers with clinical signs of active infection (redness, pain, swelling or discharge) despite appropriate oral antibiotic treatment should be referred to receive intensive, systemic antibiotic therapy.

## Prevention

All diabetic patients should be taught about self-care and self monitoring of their feet. Daily self-examination of the feet should be carried out to look out for colour changes, swelling, and breaks in the skin. If mobility is limited, one can use mirrors for self-examination. Any new pain or numbness has to be reported to the family doctor. Footwear should be well-fitting and appropriate socks should be worn. Some patients would need insoles or special shoes if they have any deformities and so should be referred appropriately. No barefoot walking is allowed. The need of proper hygiene with daily washing and careful drying should also be emphasized. Nail care, and the dangers of corn removal should be highlighted and regular attendance at a podiatrist should be encouraged. The patients who have neuropathic feet also have to be educated regarding the dangers of hot water, electric blankets, hot water bottles, and similar threats to pain-insensitive feet, which can be easily scalded without the patient even noticing. Dry skin should be treated by regular application of moisturising agents and emollients. The patients have to be educated so that they immediately consult their family doctor should any skin wound develop.

One also has to try to achieve optimal glucose control and also control the risk factors for cardiovascular disease (like hypertension, hyperlipidaemia and obesity). If the patient is a smoker, smoking cessation is essential for preventing the progression of occlusive disease. Microvascular complications have also to be kept in mind and the patients have to be assessed for retinopathy, nephropathy, and other symptoms of neuropathy (like altered bowel habits). Liaison with other specialists is also important in this field.

The patients need to be recalled and reviewed as part of their ongoing diabetic care. Their feet have to be checked at every visit. One must also ensure that they are being seen regularly by a podiatrist in order to prevent and catch problems at an early stage.

## Conclusion

Lower limb ulcers are common in patients with diabetes. Appropriate assessment and management will lead to good results and avoidance of complications as happened in this patient. If treatment is delayed or inappropriate treatment is rendered, the lesion can become infected, resulting in gangrene and/or amputation. Multidisciplinary management is of prime importance and should tackle patient education, regular foot examinations, optimal diabetic control and aggressive interventions when necessary.

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