

# IMPORTANCE OF WOUND DEBRIDEMENT IN MANAGEMENT OF DIABETIC FOOT ULCERS

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This case report will explore the importance of wound debridement in the management of diabetic foot ulceration (DFU) in a patient with type 2 diabetes.

## PATIENT DETAILS AND HISTORY

The patient was a 63-year-old man who presented to the Diabetes Unit, University College Hospital Galway, requiring urgent treatment for foot ulceration. He was immediately referred to the podiatry-led diabetic foot clinic within the Diabetes Unit for assessment and wound management.

The patient had been diagnosed with type 2 diabetes thirteen years ago and was controlling his condition with a combination of Novorapid® (Novo Nordisk), fast-acting insulin, and Levemir® (Novo Nordisk), long-acting insulin. His last HbA1c was 7.2% suggesting fairly good glycaemic control, however, the International Diabetes Federation (2005) advocate HbA1c readings of 6.5% or below in most people with type 2 diabetes. At the time of treatment the patient was also taking atorvastatin, a lipid-lowering drug, and an ACE-inhibitor (perindopril) to control



Figure 1. Ulceration on initial presentation.

his hypertension. The patient was overweight with a body mass index (BMI) of 29.3 kg/M<sup>2</sup>.

On initial presentation there was a plantar ulcer over the left fourth metatarsophalangeal joint (MTPJ) (Figure 1). The wound was dry and necrotic with callused margins. Additionally the patient reported no pain from the ulcer.

## ASSESSMENT AND ESTABLISHMENT OF TREATMENT OBJECTIVES

Whenever a patient presents with DFU it is imperative to undertake a comprehensive assessment

of the patient and the ulcer. It is particularly important to establish the underlying aetiology. Zimny et al (2002) found that healing times in DFU is predominantly determined by the aetiological cause of the ulcer, with shortest healing times in neuropathic ulcers (due to nerve dysfunction), compared to neuroischaemic foot ulcers (due to a combination of nerve dysfunction and a poor blood supply).

The underlying aetiology can be determined by undertaking vascular and neurological assessments.

## Vascular assessment

It is important to investigate the vascular supply to the feet to establish whether there is an adequate blood supply for wound healing to occur. In terms of vascular assessment, the National Institute for Health and Clinical Excellence (NICE, 2004) advocate pulse palpation as a minimum, however, it is usually necessary to undertake further tests such as Doppler examination. In this case all foot pulses (dorsalis pedis and posterior tibial pulses) were manually palpable, and Doppler examination revealed strong, regular, triphasic (healthy



Figure 2. Following sharp debridement, revealing extensive ulceration.

sounding) foot pulses, suggesting no evidence of peripheral arterial disease.

### Neurological assessment

As the patient presented with a painless ulceration, it was suspected that he had sensory neuropathy (loss of sensation). Neurological examination was undertaken to confirm this diagnosis. This involved testing both feet for vibration perception threshold with a 128MHz tuning fork. Vibration perception threshold testing is a valuable measure to identify peripheral neuropathy (Garrow and Boulton, 2006). Both feet were also tested with a 10g monofilament. This simple test can determine whether the patient can feel light touch sensation. In this case both vibration perception and light touch sensation were reduced, indicative of sensory neuropathy in both feet.

The findings of the vascular and neurological tests in this case suggest that the aetiology of the ulcer was sensory neuropathy and therefore the ulcer was classified as neuropathic foot ulceration.



Figure 3. Pre-debridement.



Figure 4. Post-debridement.

### WOUND MANAGEMENT

The management of diabetic foot ulceration is based on the principles of wound debridement, identification and management of infection, the use of dressings to maintain a moist healing environment and offloading/redistributing pressure from the wound (Hinchcliffe et al, 2008). Optimum local wound care is essential to prepare the wound for healing. Edmonds et al (2004) recommend regular sharp debridement to remove necrotic tissue and callus which will reduce local pressure, facilitate drainage and stimulate new tissue formation. Sharp debridement by a skilled practitioner is considered to be the gold standard in wound debridement with the exception of DFU requiring extensive surgical debridement (Leaper, 2002).

### WOUND DEBRIDEMENT

The term debridement is described by Hinchcliffe et al (2008) as the removal of surface debris, slough and infected matter from the wound bed in an attempt to leave clean, viable tissue. In this case the wound was dry and necrotic with hyperkeratosis (callus) to the wound margins. Edmonds and Foster (2006) discuss the role of hyperkeratosis in diabetic foot ulcer formation in the neuropathic foot. Hyperkeratosis around wound margins indicates repetitive stress and localised tissue trauma. Sharp debridement is required to remove hyperkeratosis in the diabetic foot to reduce localised pressure and avoid further tissue damage (Edmonds and Foster, 2006). Sharp debridement should only be undertaken by a practitioner with

sufficient training and skill in the technique. In this case the wound was debrided by the podiatrist to remove the callus and all dead and devitalised tissue.

Following sharp debridement an extensive ulceration was revealed (*Figure 2*). The wound was probed, with a blunt sterile probe, to establish the depth and extent of the ulceration. The wound edges were undermined and the ulcer extended distally to level of fourth and fifth interdigital space and medially towards the plantar third MTPJ. However, the wound did not probe to bone. If bone is visible or probed with a sterile probe when inserted into the wound (probe to bone test), osteomyelitis (bone infection) is indicated (Cavanagh et al, 2005).

## IDENTIFICATION AND MANAGEMENT OF INFECTION

There were no obvious signs of infection, for instance rubor (redness) or malodour. The wounds were reviewed by the consultant diabetologist and it was agreed that antibiotic therapy was not required. It is important to note that the classic signs of infection can be masked in the diabetic foot due to arterial disease and/or neuropathy, therefore, a wound swab was taken.

## DRESSINGS

There is currently insufficient evidence to suggest that any one particular wound dressing is superior in the management of DFU. However, general consensus suggests that the dressings used should be non-adherent thus minimising the risk of tissue damage on removal, while providing an optimum

environment for wound healing dependent on the wound type, volume of exudate and therapeutic objectives (American Diabetes Association, 2003). In this case the wound was debrided to healthy tissue and there was a moderate amount of wound exudate. A hydrofiber wound dressing, Aquacel® (ConvaTec) was selected as a primary dressing to absorb the exudate and provide a moist environment for healing. A secondary polyurethane foam dressing, Allevyn® (Smith & Nephew), was applied. A referral was made to the practice nurse for redressing within 48 hours, and a weekly review appointment was made within the diabetic foot clinic.

## OFFLOADING

DFU frequently occur on the plantar aspect of the foot at sites of high shear and pressure. A pivotal aspect of DFU management is effective redistribution and relief of pressure (Armstrong et al, 2001). It is important to implement offloading strategies immediately to prevent further tissue trauma and facilitate the healing process (International Diabetes Federation, 2005; NICE 2004). The patient had previously had an insole manufactured to reduce pressure to the area but these insoles were showing signs of wear. Temporary padding was applied to the existing insole to redistribute pressure from the site of ulceration. A referral was made to the orthotist for a review of his insoles and therapeutic footwear.

## ONGOING WOUND MANAGEMENT

At each review appointment it is

important to revisit the principles of optimum wound management. Wound debridement should be viewed as an ongoing necessity to remove any dead or devitalised tissue. At each consultation the wound should be assessed for any signs of infection, as infection in the diabetic foot can spread rapidly.

At week 8 this patient attended the diabetic foot clinic for his regular review. He complained of some mild discomfort in his left foot. On examination the wound had callused margins, there was localised cellulitis, and haemorrhagic (bloody) exudate, all signs that are indicative of infection (*Figure 3*). Cavanagh et al (2005) stated that a diabetic patient presenting with a foot infection must receive timely assessment and prompt management. If infection is not controlled it can spread rapidly. Edmonds (2005) recommends an initial prescription of broad spectrum antibiotics and that wound swabs should be sent for culture followed by aggressive use of antibiotics, tailored to the results of the swab.

The wound was debrided to remove all dead and devitalised tissue (*Figure 4*), a wound swab was taken and the consultant diabetologist prescribed a 10-day course of Augmentin® (Glaxo-Smith-Kline) (a penicillin-based antibiotic). An antimicrobial dressing was also selected in conjunction with the systemic antibiotics, to manage the infection topically. A silver-impregnated hydrofiber dressing (Aquacel®, ConvaTec) was applied as a primary contact layer for its antimicrobial properties, to





Figure 5. Complete healing was achieved by week 12.

manage the exudate and provide a moist healing environment. A secondary polyurethane foam dressing, Allevyn® (Smith & Nephew), was applied. On the following visit, one week later, the infection had resolved.

### LONG-TERM MANAGEMENT

In this case the ulcer was fully healed by week 12 (Figure 5). However, healing should not be viewed as the endpoint of treatment. Recurrence of DFU is high, even in specialist clinics. Reports from published literature suggest that 25–80% of ulcers recur per annum (Lavery et al, 2007). It is important therefore that healthcare professionals ensure that patients are made aware that they are at risk of further episodes of foot ulceration in the future.

As part of his long-term management plan, this patient requires regular assessment and treatment by a podiatrist, to include regular debridement of plantar callus to reduce localised pressure and the risk of foot ulceration. Tight glycaemic

control, regular monitoring of neurological and vascular status, as well as the use of total contact insoles and therapeutic footwear will all minimise the risk of further episodes of foot ulceration in this high risk patient.

### CONCLUSION

The management of DFU is often challenging and many factors must be addressed to achieve positive outcomes, for instance achieving glycaemic control, offloading the wound, prompt recognition and management of infection and appropriate dressing selection. This case has given particular consideration to the importance of sharp debridement in the management of diabetic foot ulceration and in the prevention of ulcer recurrence once healing has occurred. **WE**

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