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DIABETIC FOOT ULCERATION WITH OSTEOMYELITIS: THE IMPORTANCE OF EARLY DETECTION

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This case study explores the management of a chronic diabetic foot ulcer complicated by severe soft tissue infection (cellulitis) and bony infection (osteomyelitis) in a patient with type 2 diabetes.

PATIENT DETAILS AND HISTORY

The patient was a 64-year-old man who regularly attended the podiatry clinic at the University of Huddersfield for routine treatment. He had been diagnosed with type 2 diabetes mellitus 16 years before and was controlling his condition with a combination of insulin and metformin. He also had a history of hypertension and dyslipidaemia (high lipid levels in the blood). Both are factors that can increase the risk of arterial disease. At the time of treatment he was taking captopril, an ACE-Inhibitor and simvastatin, a lipid-lowering drug, to control his hypertension and dyslipidaemia respectively. He was an ex-smoker and he reported a family history of cardiovascular disease.

The patient contacted the podiatry staff by telephone complaining of mild discomfort in the previous three days and some discharge from his second toe. He was told to apply a sterile dressing and to

attend for immediate emergency treatment. As an existing high-risk patient at the podiatry clinic, he had been informed of the high-risk appointment slots for those with poor tissue viability and delayed healing and had been told to contact the clinic between appointments for urgent treatment should he become aware of any problems. He presented to the podiatry clinic on the same day for emergency treatment (Figure 1).

On initial presentation the right second toe was red and swollen, with maceration to the wound periphery. The patient reported no pain from the ulcer. On probing the wound with a blunt sterile probe, it was found to be full thickness extending to underlying bone, which was therefore indicative of bony infection (osteomyelitis). This warranted management of the presenting infection.

ASSESSMENT AND ESTABLISHMENT OF TREATMENT OBJECTIVES

Foot ulceration is a common problem associated with the chronic complications of diabetes, including peripheral neuropathy (nerve dysfunction) and peripheral vascular disease (poor blood supply). This patient had a known



Figure 1. Initial presentation: ulcer over the proximal interphalangeal joint of the right second digit.

history of sensory neuropathy (loss of sensation) in both feet and a recurrent history of chronic foot ulceration. However, he had received regular vascular assessments and there was no evidence of arterial deficit in his lower limbs; his foot pulses were strong on palpation and a Doppler examination revealed a healthy blood perfusion to both feet.

The patient was an active man who was employed as a caretaker and had to wear steel toe-capped boots every day. He had a history of recurrent foot ulcers, which frequently occurred on his digits. It was thought that these ulcerations occurred as a direct consequence of intermittent compressive stresses over his toes from his steel toe-capped

boots, particularly as his toes were slightly clawed and, therefore, the joints were more prominent and at greater risk of pressure from footwear (*Figure 1*).

However, as the patient had presented with a new episode of ulceration it was essential to try to establish the underlying aetiology.

Neurological status

Neurological tests were performed to confirm the presence of sensory neuropathy. This involved testing both feet with a 10g monofilament to ascertain the patient's ability to feel light touch (International Working Group on the Diabetic Foot, 1999; National Institute for Health and Clinical Excellence [NICE], 2004), and a neurothesiometer, an instrument that tests vibration perception threshold (VPT). VPT is a useful measure that identifies peripheral neuropathy in patients with diabetes (Garraway and Boulton, 2006). As expected, the tests revealed loss of sensation in both of the patient's feet.

Vascular status

It is imperative to establish the vascular status of the lower limb when presented with a new or non-healing diabetic foot ulcer. NICE (2004) advocate regular screening for vascular insufficiency to include, as a minimum, pulse palpation. In the foot it is common practice to feel for the dorsalis pedis and posterior tibial pulses (Baker et al, 2005). Doppler examination and other non-invasive tests such as the ankle brachial pressure indexes (ABPI) are also useful clinical assessments for establishing arterial perfusion. In this case, Doppler examination revealed

strong, regular foot pulses and findings from the ABPI were within normal range (0.9), suggesting no evidence of peripheral arterial disease.

Identification of infection

Prompt recognition of infection in the diabetic foot is vital to prevent significant deterioration. Infection can spread rapidly in individuals with diabetes, which can lead to necrosis, gangrene and/or amputation (Edmonds, 2005). However, identifying infection can be difficult as the classic signs of infection, such as rubor (redness) and pain, are frequently absent due to the presence of arterial disease and neuropathy.

However, in this case, the digit was red and swollen with a slight malodour, suggesting the presence of bacterial infection. Therefore, taking into account that the wound could be probed to bone and that an anaerobic odour was evident, a bony infection (osteomyelitis) was indicated. A swab was taken and broad spectrum systemic antibiotics (flucloxacillin) were dispensed. Watkins (2003) advocates the use of wide spectrum antibiotic cover in the treatment of infected diabetic foot ulcers.

Glycaemic control

In order to facilitate the wound healing process of diabetic foot ulcers it is crucial to achieve optimum glycaemic control. The patient's diabetes was under the management of his GP who was consulted on the patient's current control as a blood test revealed that his HbA_{1c} results (which is a measurement of glucose levels in the blood) were high (12%). The International Diabetes Federation

recommends that readings should be equal to or less than 6.5% (International Diabetic Federation, 2005). The patient's current medication was metformin and insulin. The GP advised that he would review the medication and possibly consider insulin therapy in order to control the patient's glucose levels, but only if the patient did not respond to dietary advice from a dietician in order to restrict carbohydrate intake. In addition, the GP advised that he would review the patient's current exercise regimen.

TREATMENT

The wound underwent sharp debridement by a podiatrist in order to remove devitalised and macerated tissue from the surrounding lesion to promote an optimum healing environment. The primary objectives in this case were control of the causative factors and patient education. Photographic evidence was taken with the patient's consent, in order to record accurate baseline measurements and ensure accurate communication within the multidisciplinary team.

Dressings

Selecting the most appropriate dressing, in order to create the ideal wound-healing environment, should not be underestimated in the treatment of diabetic foot ulcers (Cullum et al, 2000). In this case, Aquacel Silver (ConvaTec, Uxbridge), a silver-impregnated Hydrofiber® dressing, was selected as a primary contact layer to provide antimicrobial properties, absorb exudate and maintain a moist environment for healing. Silver dressings have been shown to have effective antimicrobial properties

(Cooper, 2004). At present there are limited clinical studies that evaluate the effectiveness of silver dressings in the treatment of diabetic foot ulcers, hence the need for systemic antibiotic therapy (Bergin and Wraight, 2006). A foam dressing, Biatain (Coloplast, Peterborough) was selected for thermal insulation, conformability and cushioning properties around the digit. It was recommended that the patient return in two days for a dressing change and review.

MANAGEMENT STRATEGIES

Since pressure relief is paramount to ensure an optimum wound healing environment for diabetic foot ulcers (Frykberg et al, 2006), the patient was provided with temporary footwear incorporating a wider toe box and soft upper. He was advised to refrain from wearing his steel toe-capped boots. However, taking into account the patient's employment it was felt that this may not be feasible in the long term — therefore, it was decided that the patient should be signed off work by his GP for a minimum of seven days, dependent on the progress and review of the infected dorsal lesion.

The patient returned to the podiatry clinic within two days and presented with marked deterioration (*Figure 2*). Spreading cellulitis was visible, extending from the patient's foot and up on to the lower leg. Haemopurulent exudate (wound fluid containing bloody pus) was also evident at the wound base. The patient reported symptoms of 'deep pain' and so, taking into account the presenting



Figure 2. Presentation after two days of treatment: the ulcer over the proximal interphalangeal joint of the right second digit shows marked deterioration.

symptoms, it was decided that urgent management of the infection was warranted. Infection in the diabetic foot is not to be underestimated and can spread rapidly, causing extensive tissue necrosis (death) and requiring possible amputation (Edmonds, 2005). The GP was telephoned from the clinic and the patient was duly admitted to hospital for intravenous antibiotic therapy and rest.

The patient returned to clinic after 14 days in hospital where he received IV antibiotic therapy and consistent wound care, which was managed by the nursing staff on the ward. Silver dressings continued as the dressing of choice. On presentation to the clinic, a marked improvement was evident (*Figure 3*). There was less swelling, the wound was superficial and new epithelialisation tissue was visible around the wound margins. The patient continued to attend the clinic on a twice-weekly basis, for a further six weeks, to ensure optimum wound healing provision



Figure 3. Presentation to the podiatry clinic after 14 days in hospital: proximal interphalangeal joint of the right second digit shows marked improvement after multidisciplinary treatment.

and continuity of care with respect to choice of dressings. The ulcer went on to heal within 10 weeks.

LONG-TERM TREATMENT

A referral was made to the orthotist to request therapeutic footwear with a view to ensuring sufficient pressure relief to the toe box. This was done as a

preventive measure to preserve tissue viability in the digits. Therapeutic footwear can be a useful adjunct to assist the healing of diabetic foot ulcers by offering extra width and depth (Maciejewski et al, 2004). The patient was also offered emergency contact details with a named clinician should further problems arise.

The patient was advised that he should consider alternative footwear with a wider toe box and was permitted to return to work on the premise that he did not wear steel toe-capped boots. The patient advised that his employee had referred him for lighter duties until he received appropriate footwear from the orthotist.

PREVENTION OF RECURRENT FOOT ULCERS

Regular multidisciplinary review of clinical outcomes is essential in diabetic foot ulcers, as is establishing the continuity and effectiveness of wound dressing regimens. This can be enhanced with the use of baseline measurements to ensure accurate and effective treatment of diabetic foot ulcers across both primary and secondary care.

Since inadequate footwear can contribute to both plantar and dorsal pressure, and therefore inhibit the wound healing process, review of footwear should be an integral part of the management plan in high-risk wound care. Appropriate patient education and empowerment should be considered within the management plan through health promotion in accordance with tight glycaemic control and with

a view to optimising the patient's own control of their diabetes and foot health.

CONCLUSION

The management of diabetic foot ulcers is often complex and challenging, however, this case has outlined that prompt intervention and multidisciplinary management of acute infection and osteomyelitis in the diabetic foot can result in positive outcomes. This patient's care was undoubtedly enhanced by immediate identification of all causative factors, including the rapid identification and management of osteomyelitis. The importance of effective communication links between the patient and both the primary and secondary care teams in order to promote optimum wound healing within the high-risk foot cannot be over-estimated. **WE**

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