Case report

Surgical debridement with early skin grafting in the management of a complex diabetic foot wound

M Herbert

The utility of surgical debridement of the chronic wound is well established in practice to improve wound healing[1-2]. It is particularly effective with wounds carrying a heavy burden of non-viable tissue, infective organisms or microbial biofilm[3]. Following surgical debridement, the patient is frequently left with a significant tissue defect. This defect traditionally results in a prolonged delay in wound healing, especially if left to heal by secondary intention (granulation/epithelialisation)[4]. This process is also complicated by the wound site being in an area of frequent movement (for example, overlying a joint or weight-bearing surface) or involving a deep cavity[5]. We present a case of complicated diabetic foot sepsis successfully managed by sequential surgical debridement, joint immobilisation and early split-thickness skin grafting.

A 60-year-old male patient presented to the emergency department of our institution complaining of fever, malaise and nausea. His past medical history included being an active smoker, diet-controlled type II diabetes mellitus, hypertension, hypercholesterolaemia and a chronic left heel ulcer of four months duration. On examination, the patient was febrile and tachycardic, with obvious gross cellulitis of the left leg originating from the wound with significant necrotic tissue overlying the calcaneus and distal tendo-achilles. Blood examination revealed a white cell count of 21.9 x10^9/L, random glucose of 18 mmol/L, a C-reactive protein level 250 mg/L and HbA1c of 6.8. The patient underwent immediate surgical debridement of the ulcer under general anaesthesia, with the resultant wound exposing the calcaneal bone periosteum as well as the tendon complex (Figure 1). High-dose intravenous antibiotics (piperacillin/tazobactam 4.5g TDS) were commenced and a negative-pressure dressing applied (VAC® KCI). Tissue sample culture grew *Staphylococcus aureus* and Group B *Streptococcus species* on culture. Foot and ankle MRI showed periosteal inflammation suggestive of possible calcaneal osteomyelitis. On day 6 following the initial surgery the wound underwent a further debridement to remove residual purulent and necrotic material, resulting in excision of the distal Achilles tendon and exposure of the calcaneum. Intravenous antibiotics were continued for six weeks under the supervision of the infectious diseases physicians and a CAM walker® used for ankle support and heel offloading. Negative pressure dressings were continued on an outpatient basis for a further four weeks. After this stage a significant tissue defect remained, but with evidence of granulation in the wound base. The decision was made to apply a split-thickness skin graft early, following wound debridement with the aim of closing the defect to allow for ankle fixation. Given the site of the wound and the proximity to calcaneal bone it was thought a skin graft would not be sufficiently durable for ambulation long term. Following ankle fixation, further surgery to provide defect tissue coverage was anticipated. Hydrosurgical debridement (using the Versajet® system) was performed prior to grafting. This allowed effective debridement without significant further loss of wound tissue. Graft tissue of 2.5 mm thickness was raised from the ipsilateral thigh

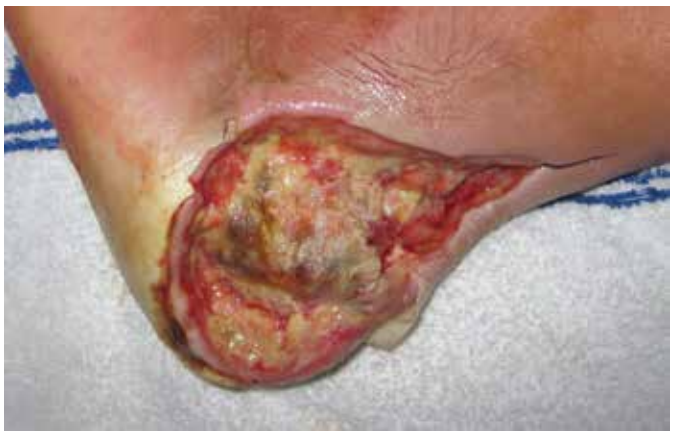

Figure 1. Lateral heel wound bed following surgical debridement.

M Herbert
MBBS

Department of Vascular Surgery, Queen Elizabeth Hospital, Woodville, SA, Australia

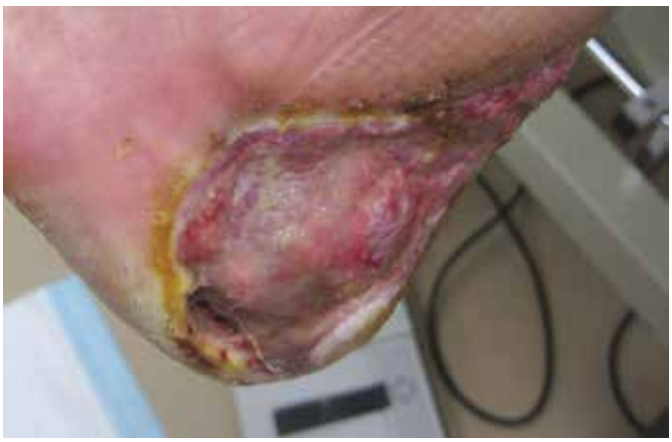

Figure 2. Day 5 following split-thickness skin grafting and VAC®.

with an electric dermatome prior to mechanical meshing and graft application. Mepitel® (Mölnlycke Health Care) non-adhesive silicone netting, followed by negative-pressure dressing therapy was applied for five days prior to wound review (Figure 2). Despite the unfavourable depth and site of the wound, graft take was good (approximately 70% of total grafted area) with steady re-epithelialisation of the residual wound base. The patient ultimately declined orthopaedic ankle fixation and elected for long-term mobilisation with an ankle splint. In light of this dressings were continued, consisting of Mepitel/dry gauze twice weekly with fortnightly outpatient review. At six months following presentation, the patient's wound was healed without ongoing dressing requirements (Figure 3). Despite initial close proximity of the skin graft to bone periosteum, significant infill of the tissue defect occurred.

This case illustrates the efficacy of sequential surgical debridement followed by early skin grafting in the management of complex chronic diabetic wounds in the extremities. Debridement removes necrotic or unviable tissue and reduces the burden of infective organisms[6]. Application of split-thickness skin grafts allows rapid epithelial coverage of defects following surgery. Meshing of grafts is advocated for prevention of haematoma or seroma collection with resultant sloughing. Successful graft take with epithelialisation provides a barrier against recurrent infection of deep structures, especially periosteum or bone. Application of skin grafts has been shown to greatly reduce ulcer healing times in diabetic patients as compared to conventional wound treatments[7]. Use of skin grafting in weight-bearing wound areas similar to that described in our patient however, has been traditionally advised against due to expected graft failure due to shear forces[8]. Other options available include soft tissue flap reconstruction, use of biological dressings or long-duration dressing regimens to promote healing. Tissue flap coverage over bone or periosteum necessitates complicated microsurgery and requires sufficient vascular flow. Biological dressings such as Dermagraft® fibroblast mesh (Advanced BioHealing) are difficult to obtain and are expensive. In the case described, skin grafting followed by careful perioperative care allowed the majority of the wound area to re-epithelialise over a short period. After initial epithelialisation, further tissue remodelling occurs, with soft tissue infill of the wound defect. When combined with debridement, strict mechanical offloading and targeted antimicrobial therapy, use of meshed skin grafts as an early wound closure method can greatly reduce wound area with resultant reduced duration of healing and consequent wound morbidity. This technique can be applied successfully to wound areas traditionally considered unfavourable for skin grafting, which currently require long-duration dressing regimens.

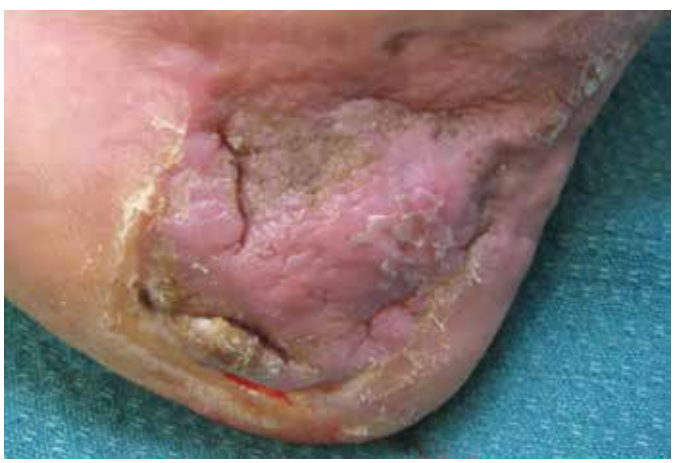

Figure 3. Wound site at six months following initial presentation.

REFERENCES

1. Schultz GS *et al.* Wound bed preparation: a systematic approach to wound management. Wound Repair Regen 2003; 11(1).
2. Steed DL, Donohoe D, Webster MW & Lindsley L. Effect of extensive debridement and treatment on the healing of diabetic foot ulcers. J Am Coll Surg 1996; 183:61–4.
3. Rhoads DD, Wolcott RD & Percival SL. Biofilms in wounds: management strategies. J Wound Care 2008; 17(ll):502–508.
4. Falanga V. Classifications for wound bed preparation and stimulation of chronic wounds. Wound Rep Reg 2000; 8:347–52.
5. Kennedy KL & Tritch DL. Debridement. In: Krasner D & Kane D, editors. Chronic wound care: a clinical source book for healthcare professionals, 2nd edn. Wayne, Pennsylvania: Health Management Publications, Inc., 1997:227–35.
6. Cardinal M, Eisenbud DE, Armstrong DG *et al.* Serial surgical debridement: a retrospective study on clinical outcomes in chronic lower extremity wounds. Wound Repair & Regen 2009; 17:306-311.
7. Mahmoud SM, Mohamed AA, Mahdi SE & Ahmed ME. Split-skin graft in the management of diabetic foot ulcers. J Wound Care 2008 Jul; 17(7):303–6.
8. Roukis TS & Zgonis T: Skin grafting techniques for soft-tissue coverage of diabetic foot and ankle wounds. J Wound Care 2005; 14:173–176.