Inflammation, wound size and wound healing:
A case study

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Introduction

Venous leg ulcers are complex to manage as they are often associated with delayed healing and recurrence. The presence of inflammation can play a positive and negative role in chronic wound healing. The following case study describes a client whose venous leg ulcer proceeded to heal in a timely manner, despite inflammation and bacterial burden. It raises questions regarding appropriate treatment of chronic wounds which are compromised by these conditions.

Method

This case study presents data for a participant of a randomised control trial (RCT) comparing two types of antimicrobial dressings. This client provided informed consent to participate in the trial for which approval from relevant Human Research Ethics Committees was obtained. Wound size data were calculated in this RCT using the Australian Medical Wound Imaging System[1-3]. The findings of the trial are reported elsewhere[4].

Findings

Demographics, medical and social history

This participant was a 62-year-old, Australian-born woman who spoke English. She was a health care card recipient and lived alone in her own home, independent on all activities of daily living except housekeeping, for which she reported requiring some assistance. Her medical conditions included varicose veins and epilepsy. She had a past history of venous leg ulcers and breast cancer. She did not smoke. No risk of malnutrition was detected using the Home and Community Care Nutritional Risk Screening and Monitoring Tool[5]. She did not suffer any other major comorbidities as assessed using the Charleston Comorbidity Index (age-adjusted)[6]. She was taking anti-coagulant and anti-convulsant medication.

Previous management

The participant reported that a right medial malleolus ulcer had been present for five months. It was not known whether this ulcer was recurrent but the participant reported a history of venous leg ulceration. Prior to recruitment to the trial, the participant's ulcer was treated with hydrocolloid paste and foam dressing three times per week. The participant wore compression stockings, which she applied daily for which the exact mmHg compression could not be determined. The stockings fitted reasonably well, although they were well worn. During the present episode the ulcer had progressively gained in size.

Wound and lower limb assessment

The ulcer was assessed as critically colonised, demonstrating new areas of slough and wound breakdown, impaired and delayed wound healing and associated erythema (Figure 1). Published criteria for infection and/or colonisation informed this assessment[7-10]. The wound measured 991mm^2 (74% granulation and 26% slough). There was no undermining of the wound edges. The exudate level was low (0–5ml/24 hours). The participant reported no pain (wound or leg). A baseline semi-quantitative wound swab was taken utilising zigzag technique. Bacteriological analysis suggested a heavy growth of *Staphylococcus aureus*.

A Doppler ultrasound was attended with an Ankle Brachial Pressure Index (ABPI) result of 1.07. There was minimal lower limb oedema. Haemosiderin staining was evident at the gaiter region and there were some areas of atrophe blanche. Lipodermatosclerosis was not identified. Foot sensation was assessed with a 10 gram monofilament. There was no loss of

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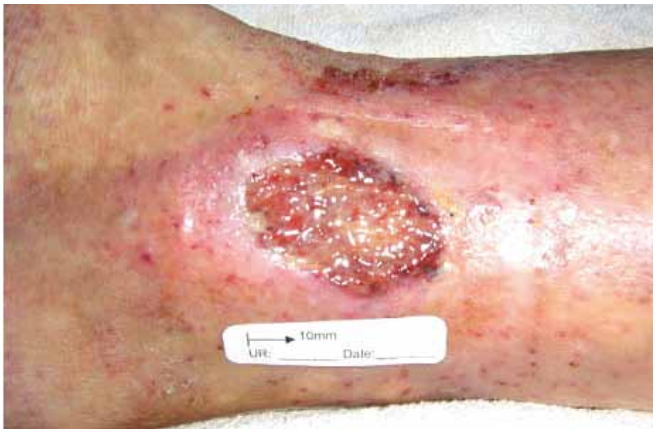

Figure 1.

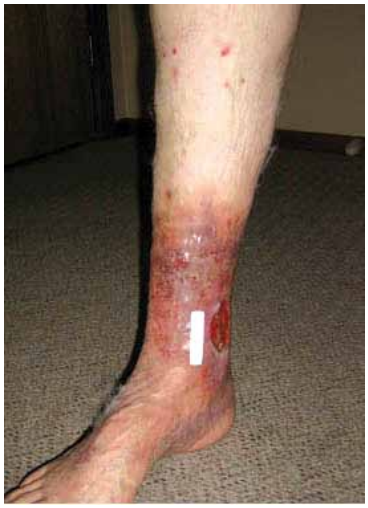

Figure 2.

protective sensation. The ABPI of the participant's left leg was also 1.07. This leg was intact.

Diagnosis

Consultation with the participant's general practitioner resulted in confirmation of venous aetiology. The result of the wound swab was made available to the general practitioner. Wound infection was not suggested and antibiotic therapy was not prescribed.

Management

The participant was randomised to receive Cadexomer Iodine antimicrobial treatment for 12 weeks or until either resolution of the bacterial burden or achievement of ulcer epithelialisation. The existing care plan was ceased and Iodosorb Powder™, Mepilex™ silicone foam and Profore™ four-layer bandage system was applied. On account of the need to reapply the primary dressing in no greater than three days, treatment was scheduled three times per week. Compression system components were used according to the manufacturer's instruction and a new system was applied each time a dressing change was required. Products were funded by the study and, therefore, provided to the participant free of charge for 12 weeks.

Progress

Following the application of the Cadexomer Iodine product, there was an increase in inflammation at the wound site, the periwound and in the gaiter area (Figure 2). A zinc dressing Steripaste™ was applied to the surrounding skin to prevent further deterioration where superficial wound areas had developed. A fortnight from commencement of the new management plan, the wound had increased in size by 39% to 1384mm^2; however, this was accompanied by a reduction in slough and increase in granulation tissue. The surrounding skin had stabilised. The participant continued to report no experience of wound pain and continued to tolerate the wound dressing and compression bandaging. The Iodosorb Powder™ treatment was at this time changed to Iodosorb Ointment™. Two weeks later, the ulcer had reduced to 772mm^2, two weeks following this (at the six-week point) the ulcer size was 399mm^2, a percentage reduction of approximately 60% since commencement of the Cadexomer Iodine treatment (Figure 3). Wound swab at this time showed a reduction in bacterial growth to a moderate level *Staphylococcus aureu*s. The ulcer continued to improve; at eight weeks it was reduced to 323mm^2, at 10 weeks 10mm^2, and at 12 weeks the ulcer was fully epithelialised. The client was recommended to wear Class 2, 20–30mmHg compression stockings to prevent recurrence.

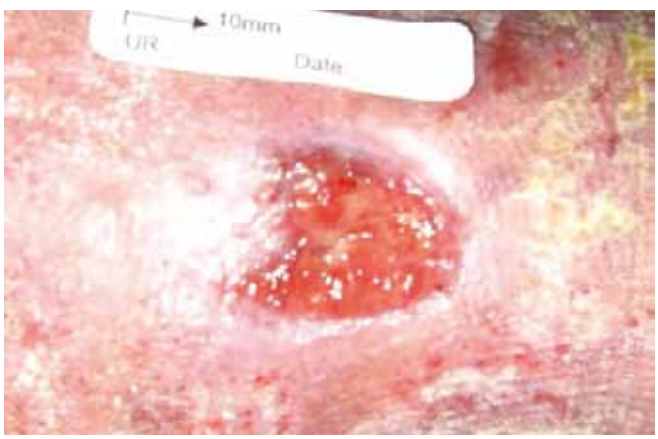

Figure 3.

Discussion

This case study highlights the clinical progress of a venous leg ulcer, which experienced increased inflammation and an increase in wound size followed by wound size reduction and timely healing.

Iodosorb™ dressings contain 0.9% Cadexomer Iodine, which provides a broad-spectrum antimicrobial effect. A recent systematic review concluded that there is some evidence to support the use of Cadexomer Iodine to promote healing of venous leg ulcers[11]. Cadexomer Iodine has been described as pro-inflammatory with in-vitro research suggesting that in addition to its antibacterial effects, Cadexomer Iodine may activate macrophage function via a pro-inflammatory effect, which stimulates production of pro-inflammatory cytokines and the arrival of monocytes and t-lymphocytes to the wound which, in turn, promotes healing[12]. Though its use should be avoided with inflamed vascultic ulcers, the introduction of the Cadexomer Iodine product in this case study is suggested to have stimulated inflammation, debridement and, ultimately, resolution of bacterial burden.

This case study is reflective of the overall trial finding of which this client was a participant with the average size of wounds treated with Cadexomer Iodine increasing in the first fortnight, while the size of wounds treated with Nanocrystalline Silver reduced in size[4]. There were, however, no significant differences between healing outcomes at 12 weeks for either antimicrobial.

This case study was selected for its ability to highlight issues associated with assessing the response of wounds to treatments and wound inflammation in particular. Questions arising from this case study include whether or not there was indication to alter the care plan given the inflammatory response that was exhibited, the substantial gain in ulcer size and the positive changes to the composition of the wound bed. Despite significant inflammation, pain was not a concern for this participant. It is important to note that treating staff were freely permitted to cease the current care plan and change treatments. The participant was not required to continue with the randomised antimicrobial if this was deemed inappropriate or if the participant did not wish to.

Clinicians are often placed in a precarious position when evaluating the effectiveness of interventions as chronic wounds require time to respond to treatment. If changed too quickly, the ability to evaluate treatment efficacy may be lost. In this case, the risk of increasing wound size and the immediate goal of care were considered and the antimicrobial treatment was continued. The goal of care – to resolve bacterial burden – was achieved. The inflammatory response may well have promoted this result. The continuation of the treatment in this case afforded the opportunity to assess and quantify this outcome. There remains a great deal to understand regarding the role of inflammation in chronic wound healing and the positive and negative impacts of antimicrobial dressing treatments on this physiological response. It is recommended that future research continues to explore the mechanisms by which these antimicrobials operate, including their impact on inflammation and how they resolve bacterial burden and promote healing.

Conclusion

Whilst the initial response to the treatment appeared to be undesirable, the ulcer did improve with respect to tissue type and then progressively reduce in size until epithelialised. The participant experienced successful healing of a venous leg ulcer, which demonstrated bacterial burden in a 12 week period with the application of Cadexomer Iodine and a four-layer compression bandage system. This case highlights the dilemma that wound inflammation may present when clinicians evaluate treatment effectiveness.

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