Minimising pain and trauma during wound dressing procedures

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The incidence of chronic wounds has been increasing globally with the rise in the number of diabetic patients and an ageing population. It is expected that the incidence of neuropathic pain due to chronic wounds will also increase. This case features a patient diagnosed with Buerger's disease and type 2 diabetes mellitus who presented with gangrene of the left toes and associated pain.

Page points

1. *Patients experience most pain at dressing change*
2. *Traditionally, the majority of wound-related pain management has targeted acute pain*
3. *The incidence of chronic wounds has been increasing recently, due in part to the rise in the number of diabetic patients and an ageing population*

Figure 1. The fingertips of both the patient's hands had been amputated due to Buerger's disease.

INTRODUCTION

Endurance is often seen as a virtue but when it comes to wound care, 'putting up' with pain can have a negative effect on healing[1]. Traditionally, the majority of wound-related pain management has targeted acute pain resulting from surgery or trauma. However, the incidence of chronic wounds has been increasing recently, due in part to the rise in the number of diabetic patients and an ageing population. It is expected that, because of this, the incidence of neuropathic pain due to chronic wounds will increase.

Pain signals are transmitted through the peripheral nerves to the spinal cord and muscle tension increases with the excitation of reflex motor nerves. This sympathetic excitement contracts the blood vessels, causing increased metabolism in the muscles and localised reduction in blood flow, leading to ischaemia in the tissue. Pain-causing substances (eg cations and bradykinin) and pain-amplifying substances (ie prostaglandins) released from hypoxic tissue further stimulate the peripheral nerves and spinal cord, causing a vicious cycle of pain that inhibits wound healing[2].

In addition, when pain is not taken seriously, peripheral and central sensitisation occur, causing a subsequent reorganisation in the central nervous system and leading to complex and chronic pain[3]. The patient's 'firing threshold' perception of pain also decreases in chronic wounds, due to repetitive stimulation by inflammatory mediators. This can cause strong pain during wound treatment, even from slight nociceptive stimuli (primary hyperalgesia), leading to situations where the patient's protestations are perceived as an over-reaction.

An apparently normal-looking periwound area can also be hyperalgesic (secondary hyperalgesia), and even mild stimulation, such as that caused by peeling off an adhesive dressing, may cause unbearable pain. Non-nociceptive stimuli, such as pressure and contact, do not normally cause pain, however, in chronic wounds they may begin to do so (allodynia), meaning that abrasive clothing or even the slight movements of passers-by may be perceived as pain. Finally, if vessels that nourish the nerves are damaged due to peripheral arterial disease, neuropathic pain, as well as nociceptive pain, can occur in the wound area[2].

Patients with wounds experience the greatest amount of pain at dressing change and it is recommended that they are treated in accordance with relevant consensus statements[4].

CASE REPORT

This case features a 64-year-old man who had been diagnosed with Buerger's disease at the age of 30 and also had type 2 diabetes mellitus. As a consequence of the peripheral vascular disorder caused by Buerger's disease, he had undergone fingertip amputations of both hands ***[Fig 1]*** and had gangrene of his left toes with associated pain (he rated this as 10 on a numerical rating scale).

A cardiovascular physician in the hospital where the patient had undergone endovascular treatment, but who could not provide limb salvage, had referred the

Figure 2. The proximal phalanges of the patient's left second, third and fourth toes were exposed, demonstrating periwound maceration and contact dermatitis.

patient onto the authors' hospital.

The endovascular treatment had been performed using a catheter to relieve stenosis of the superficial femoral artery. The blood vessels below the patient's knee demonstrated peripheral vascular disorder caused by the Buerger's disease. Furthermore, stenosis of superficial femoral artery was caused by diabetic vascular disorder.

Debridement of the left second, third and fourth toes was performed at the previous hospital, but the patient was told that transtibial amputation would be required in order to achieve wound closure. He visited the author's clinic because he wanted to preserve his heel.

At the first visit to the authors' clinic *[Fig 2]*, the patient's skin perfusion pressure (SPP) was low at 18mmHg at the dorsum of the foot, and 28mmHg at the sole. An SPP of more than 35mmHg is thought to be required for wound healing[5]. Cilostazol was administered to treat the peripheral arterial disease and smoking cessation was also strictly enforced.

The previous clinicians had used physiological saline warmed to room temperature, rather than body temperature, to cleanse the wound and the skin had become hypersensitised to the discomfort caused by this.

Moreover, the wounds were dressed with silver sulfadiazine cream and gauze, which were not able to control the wound exudate, which subsequently caused maceration. Due to the maceration, the skin barrier function was damaged. Together, these elements resulted in contact dermatitis, another potential cause of hypersensitisation *[Fig 2]*. The associated inflammation was treated using topical steroids.

The ulcer at the base of the left second, third and fourth toes, which included the exposed proximal phalanges *[Fig 2]*, was not flat and it was necessary to prevent dead space developing between the ulcer base and any dressing material, as accumulated exudate here could have damaged the ulcer base, as well as the periwound area.

Overall, this patient's ulcer was causing wound-related pain and inhibiting healing and this needed to be treated. Therefore, a Hydrofiber® dressing incorporating silver (Aquacel AG®; ConvaTec) was applied to the ulcer base and a steroid used on the rest of the foot.

Compared with polyurethane foam or hydrocolloid dressings, the author's clinical

Figure 3. The wound contracted to the exposed proximal phalanges and exhibited epithelialisation.

Figure 4. Debridement of exposed proximal phalanges and necrotic tissue of the first and fifth toes was performed.

Figure 5. Granulation tissue covering the bone at the amputation site.

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Figure 6. Skin from the abdomen was grafted onto a section of the wound.

Figure 7. The wound at two years post healing.

Figure 8. After the wounds were healed, the patient wore therapeutic shoes to prevent the recurrence of ulcers.

opinion is that a Hydrofiber would be easier to apply to the unevenly shaped ulcers around the exposed proximal phalanges. In addition, the dressing was chosen for its antimicrobial properties — due to the inclusion of silver — since it was suspected that the ulcer was critically colonised.

The patient's SPP improved to 64mmHg at the dorsum of the foot and 60mmHg at the sole of the foot, one month after treatment began. The SPP measurements were taken approximately 5cm away from the ulcer on the dorsal and plantar skin of the foot — therefore, the SPP improvement was considered to be due to the effects of the cilostazol and the patient's strict adherence to a smoking cessation programme, rather than to the dressing itself.

Similarly, one month after initial treatment had commenced, the wound had contracted to the exposed proximal phalanx of the second, third and fourth toes and epithelialisation was present ***[Fig 3]***.

Since the SPP had now risen to more than 35mmHg, surgical removal of the exposed proximal phalanges was performed. The necrotic tissue on the first and fifth toes was also excised ***[Fig 4]***.

Secondary hyperalgesia in the skin surrounding the ulcer had been present since admission, therefore, a soft silicone dressing material was used after the debridement (Mepilex® Border; Mölnlycke Health Care).

Three weeks after the excision of the exposed bones and necrotic tissue, granulation tissue began to cover the bone at the amputation site, and skin from the abdomen was grafted under local anaesthesia ***[Figs 5 and 6]***.

Two weeks following the skin graft, an impression of the foot was taken so that therapeutic footwear could be designed. After another two weeks, the therapeutic footwear was provided and the patient was discharged. After discharge, the patient was followed up as an outpatient ***[Figs 7 and 8]***, and chronic pain disappeared with the healing of the ulcer.

DISCUSSION

Since the US Congress declared a 'Decade of pain control and research' beginning in 2001, the idea that 'receiving treatment for pain is a patient's right' has become widespread[6,7]. In wound treatment, the conventional method of focusing solely on healing the wound is being revised and the importance of patient-centered care, such as pain control, is being increasingly acknowledged[4].

Pain that is transmitted continuously and for extended periods by chronic wounds can lead to complex pain, such as hyperalgesia and allodynia[3]. Clinicians who treat wounds need to consider chronic and acute wound pain separately and be aware that chronic pain is not simply prolonged acute pain.

Therefore, the World Union of Wound Healing Societies' consensus statement, *Principles of Best Practice: minimizing pain at wound dressing-related procedures*, and the 10 principles that were introduced in it, has been proposed as a tool to prevent complex pain[4] ***[Table 1]***.

The following principles from those 10 (in no particular order) were considered vital when treating the case presented in this article.

Principle 1: identify and treat the cause of the chronic wound

The patient was diagnosed with Buerger's disease and type 2 diabetes mellitus. The main cause of the chronic wound was thought to be peripheral arterial disease. Because the stenosis of the superficial femoral artery had been improved by endovascular treatment using a catheter, cilostazol was administered for the peripheral arterial disease. Smoking cessation may also have helped in this case.

Principles 3 and 6b: cleanse the wound gently and treat local factors

Since the patient's skin had become hypersensitised, warmed physiological saline was used to cleanse the wound instead of the room temperature saline. Inflammation due to contact dermatitis was treated using topical steroids.

Principle 6a and 7: select appropriate dressing and treat infection

Due to the exposed distal phalanges, the ulcer base was not flat and it was necessary to prevent dead space between the ulcer base and dressing material, as accumulated exudate in this space can damage the ulcer base as well as the periwound area. Appropriate moisture balance was required to prevent periwound maceration. A Hydrofiber was used in this case as they swell and convert into a gel, which fills dead space[8]. Hydrofibers are activated by moisture in the wound, absorbing and trapping fluid within the structure of the dressing. Silver was chosen for its proven

antimicrobial activity[9] — it has a broad spectrum of activity and inactivates almost all known bacteria, including methicillin-resistant *Staphylococcus aureus* and vancomycin-resistant *Enterococcus*. No cases of bacterial resistance have been documented in the use of silver[8]. Therefore, a Hydrofiber dressing with silver was applied to the ulcer base.

Principle 4: select an appropriate method of wound debridement

Debridement is mainly classified into autolytic, enzymatic, biological, mechanical, surgical, and wet-to-dry methods[4]. A surgical method was selected because removal of the exposed proximal phalanges was required.

Principle 5: choose dressings that minimise trauma/pain

The *stratum corneum* constitutes the outer surface of the skin and acts as a barrier to protect deeper tissue. The cells that make up the majority of the *stratum corneum* (corneocytes) contain natural moisturising factors that are responsible for skin texture[10].

In their study, Dykes et al attached five types of adhesive dressings to the subjects' forearms — which had been painted with dye — then investigated how much dye came off when the dressings were removed[11].

Another study[12] attached various types of adhesive dressings to patients' forearms after the corneocytes in the *stratum corneum* had been stained with dye. The degree of corneocyte attachment found on removal of the dressings varied greatly and demonstrated the importance of dressing selection in the treatment of chronic wounds.[12]

Both studies showed that soft silicone dressings caused less damage to the skin surface than other tested products. Since the case featured in this article involved secondary hyperalgesia in the skin surrounding the ulcer, soft silicone dressing material was used following debridement.

CONCLUSION

Chronic wound-related pain negatively affects wound healing. Clinicians should endeavour to understand the physiology of pain and recognise the differences between acute and chronic pain.

Although patients' most important concern is often the relief of pain, wound-related pain can be underestimated by clinicians and afforded a lower priority than other wound-healing issues. One international consensus document presents 10 statements, which can be used as strategies for minimising pain at dressing–related procedures[4]. According to each of these statements, wound-related pain can be reduced by a combination of accurate assessment, suitable dressing choice, skilled wound management, and appropriate analgesic provision.

PAIN PRINCIPLES

1 - Identify and treat the cause of the chronic wound and address concerns expressed by the patient, including a pain assessment at each visit
2 - Evaluate and document pain intensity and characteristics on a regular basis (before, during and after dressing-related procedures)
3 - Cleanse wound gently — avoid the use of abrasive wipes and cold solutions
4 - Select an appropriate method of wound debridement and include the potential for causing wound-related pain
5 - Choose dressings that minimise trauma/pain during application and removal
6a - Treat infections that may cause wound-related pain and inhibit healing
6b - Treat local factors (eg inflammation, trauma, pressure, maceration)
7 - Select an appropriate dressing to minimise wound-related pain based on wear time, moisture balance, healing potential and periwound maceration
8 - Evaluate each patient's need for pharmacological (topical/systemic agents) and non-pharmacological strategies to minimise wound-related pain
9 - Involve and empower patients to optimise pain management
10 - Healthcare providers should ensure wound-related pain control for every patient

Table 1 – Wound pain consensus principles (taken from[6] — WUWHS, 2007).

CONFLICT OF INTEREST

The author has no conflict of interest to declare.

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