

Introduction

Wound-related pain is common, highly subjective¹⁻⁴ and can be particularly distressing for both patients and clinicians⁵. It has multiple causes and, unfortunately, is often managed inadequately^{6,7}. This article discusses wound infection as a cause of pain, outlines strategies for effective pain management, and considers the role of antimicrobial dressings in minimising or preventing pain when a wound is infected.

Authors: Mudge E, Orsted H.

Full author details can be found on page 5.

What causes pain in wounds?

Pain is a common experience for patients with wounds. Some wounds are generally more painful than others, and this may be associated with the underlying aetiology, eg ischaemia in arterial ulcers⁸.

At a physiological level, wound pain arises from tissue damage (nociceptive pain) or from dysfunction of the nervous system (neuropathic pain) (Box 1). Pain from chronic wounds may have both nociceptive and neuropathic elements⁹.

There are many triggers of wound pain. Tissue damage as a result of trauma, particularly during the dressing change procedure, has been described by patients as the worst part of living with a wound¹⁰.

Wound pain has numerous, often interlinked, causes that may relate to:

- **the wound itself, eg the initial injury, the inflammatory response or infection**
- **interventions, eg topical treatments (including dressings), dressing removal, cleansing, debridement or compression therapy**
- **other local pathology, eg oedema, allergic reactions, ischaemia or arthritis.**

In addition, there are many psychological and emotional factors associated with living with a chronic wound that can exacerbate a patient's pain perception, such as anxiety, stress, fear, depression, wound malodour or high exudate levels¹¹.

Sustained pain can produce physiological changes that increase perception of pain (Figure 1). Ongoing stimulation of a pain pathway can result in increased sensitivity of peripheral pain receptors (**primary hyperalgesia**) and increased transmission of

pain impulses to and within the brain (**secondary hyperalgesia**). In effect, these changes increase the amount of pain perceived to arise from a painful stimulus. Ongoing pain can also result in **allodynia** – the experience of pain as a result of a stimulus, eg a light touch on skin, that would not usually cause pain.

Wound pain can be categorised as:

- **Background pain – continuous or intermittent pain that is felt even at rest**
- **Incident pain – pain that occurs during day-to-day activities such as mobilisation or coughing**
- **Procedural pain – pain that results from routine procedures such as dressing changes or wound cleansing**
- **Operative pain – pain associated with significant wound intervention, eg debridement or wound biopsy⁹.**

What affects perception of pain?

Thresholds for feeling pain are remarkably constant from individual to individual. However, for patients with chronic wounds, many pain experiences may derive from past pain memories¹². The response of individuals and their tolerance of the pain will therefore differ markedly. Qualitative studies in people experiencing chronic wound pain have shown that individuals experience fluctuations in both the intensity and type of wound pain and that these may vary throughout the day and night⁴.

Gate Control Theory

The way in which people experience pain is complex. Very early pain research emphasised the mechanical nature of pain as a self-protective mechanism that forces an individual to move away from danger¹³. But it was the Gate Control Theory¹⁴ that finally acknowledged the role of brain processes in the perception of pain. The concept behind this theory describes how nociceptive signals transmitted to the spinal cord have to pass through a 'gate' before they can be transmitted to the brain for pain to be perceived. Numerous factors affect how 'open' the gate is. Some forms of peripheral stimulation can 'close' the gate, explaining why when someone receives a bump, rubbing the area involved can reduce the pain perceived.

Box 1 What is pain?

Pain is felt as a result of the brain's response to disease or damage to the body. There are different types of pain:

- **Nociceptive pain** – arises from damaged tissue⁹. Signals are picked up by sensory receptors in nerve endings in the damaged tissue. The nerves transmit the signals to the spinal cord, and then into the brain where the signals are interpreted as pain⁹. Nociceptive pain may be described as 'sharp' or 'stabbing'.
- **Neuropathic pain** – is caused by damage to or dysfunction of the nervous system, and is a major contributor to chronic pain⁹. It may differ in character from nociceptive pain, eg produce burning or tingling sensations.

In addition, the brain is thought to directly influence how far open or closed the gate in the spinal cord is, as can certain chemicals such as stress hormones. This may explain how, for example, stress and anxiety can result in a pain experience without apparent injury, and, how, conversely, a soothing distraction, such as relaxing music may diminish pain.

How does pain affect quality of life?

Pain is a common experience of patients with chronic wounds. Many studies have identified a reduction in quality of life in association with wound pain¹⁵. Aspects of quality of life that may be negatively affected by pain include interpersonal relationships, work and social activities, and emotional wellbeing^{15,16}.

The experience of pain has an impact on a number of psychological processes such as reduced self-belief, isolation and loss of identity and many patients with chronic wound pain may experience sleep disturbance, which will further impact on their tolerance of pain^{16,17}.

Pain is an individualised experience and differences in personal, familial and cultural backgrounds can lead to variations in a person's experience and expression of

pain¹⁸. There is therefore potential for errors to occur when assessing a patient's pain if healthcare professionals are not aware of the cultural factors that may affect individual patients¹⁰.

Why are infected wounds painful?

Wound infection is a complex process that results from a detrimental interaction between the patient and the pathogen(s) that can delay healing and cause and amplify wound pain^{19,20}. Wound infection is one of the most challenging aspects of wound management and a major contributor to healthcare costs globally²¹.

The main underlying cause of infection-related wound pain is the inflammatory response stimulated by the infecting microorganisms. This response causes the release of inflammatory mediators and stimulates the production of enzymes and free radicals, which can cause tissue damage. Pain may result from direct stimulation of peripheral pain receptors by the mediators, from tissue damage, and from the swelling that occurs as part of the inflammatory response. The inflammation and cell damage may also increase the sensitivity of the pain receptors and central nervous system, so increasing the overall perception of pain (Figure 1)^{8,22}.

What is the character of pain related to wound infection?

Although there is little written about the specific character and nature of pain related to wound infection, a Delphi study exploring the criteria for wound infection²³ found the following:

- **Pressure ulcer infection is associated with increasing pain severity and/or change in nature of pain**
- **Surgical site infection is associated with unexpected pain/tenderness that begins or increases around the wound area. If the area surrounding the wound is painful to touch, this should be a cause for concern**
- **Infection in burns and partial /full thickness wounds are associated with the onset of pain in a previously pain-free wound.**

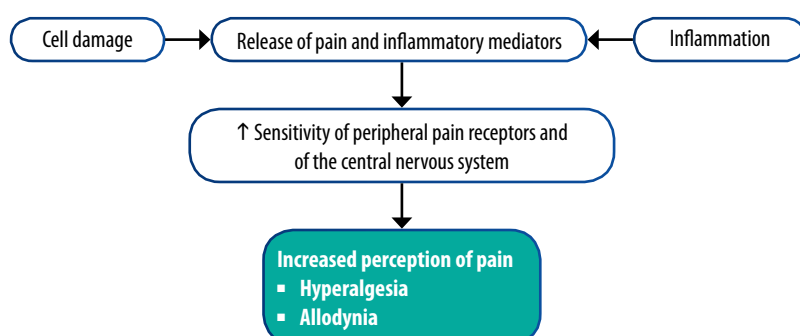
Any sudden onset of pain, change in type of pain or increase in intensity of pain in any wound type is therefore a significant indicator for infection.

What other wound infection-related factors may contribute to the pain experience?

Further indicators of wound infection that may impact on comfort and, by causing distress, contribute to pain include: friable granulation tissue that bleeds easily; increased exudate production; abnormal smell; and wound breakdown²⁴. However, it should be noted that these signs and symptoms are not always apparent, especially in patients with other chronic comorbidities (such as diabetes) or during the early stages of infection²⁵⁻²⁷.

In particular, wound exudate produced in response to colonisation or local infection of a wound may contribute to wound pain. Chronic wound exudate contains increased levels of free radicals and numerous enzymes, such as matrix metalloproteinases (MMPs), that can

Figure 1 Sensitisation to pain⁸



damage healthy wound tissue and may be harmful to the surrounding skin²⁰. The resulting damage can be likened to a chemical burn and can be extremely painful.

Stress and anxiety from wound infection and/or wound pain can indirectly impair wound healing by activating the hypothalamic-pituitary-adrenal axis. This stimulates cortisol production, which in turn can suppress the immune system¹⁷. Stress can be induced by anticipation of pain, eg prior to dressing changes⁴.

Why, when and how should pain be assessed?

It is important to conduct regular pain assessments to monitor patients' pain over time²⁸. Pain measurement tools can be used to help patients communicate their own pain experience. Several validated quantitative and qualitative tools have been designed to measure baseline data and monitor changes over time²⁹ (Figure 2).

The simplest example is the visual analogue scale (VAS) that asks the patient to indicate the severity of his/her perceived pain experience on a straight line graded from 'no pain' to 'worst possible pain'. Other basic pain assessment tools include numerical/descriptive colour scales and pain faces^{30,31}. There are a number of validated multifaceted tools, including the McGill Pain Questionnaire³², that ask specific questions about patients' pain experiences, and can provide valuable insight into the nature of their pain and its affect on quality of life. The use of pain diaries

may also give a useful indication of how pain is affecting the patient³³.

Pain descriptors

Patients' descriptions of their pain experience are useful for healthcare providers, as terms such as 'dull', 'aching' or 'tender' tend to be used to describe pain of a nociceptive origin, whereas descriptors such as 'shooting', 'burning' or 'stabbing' are more likely to be associated with neuropathic pain. However, healthcare professionals need to be aware that this may not always be the case as the location of pain may not be in the wound itself and many types of pain may co-exist.

Pain rarely remains constant and qualitative work in the area of wound pain has shown that the majority of patients acknowledge that the severity of their pain fluctuates and tend to use descriptors such as 'normal' pain and 'acute' pain to describe their overall pain experiences of living with a chronic wound⁴. 'Normal' pain may be used to describe the kind of dull ache that is there all the time and 'acute' pain may be used to describe a kind of sudden intense pain experienced on occasions throughout the day.

The terms 'localised' or 'throbbing' are sometimes used to describe pain caused by wound infection. However, pain related to wound infection is often unexpected and different from any previous pain associated with the wound. Therefore, a statement from a patient that they are experiencing a new type of pain or a more intense pain experience would possibly be a better alert to infection than the character of the pain itself⁸.

Figure 2 Validated pain scales⁹

Point to each face using the words to describe the pain intensity. Ask the patient to choose a face that best describes how he/she is feeling and record the number



Wong-Baker FACES Scale

From Hockenberry MJ, Wilson D, Winklestein ML. Wong's Essentials of Pediatric Nursing (ed 7), St Louis 2005, p 1259. Copyright, Mosby Inc. Reprinted with permission.

Ask the patient on a scale of 0–10, where 0=no pain and 10=worst possible pain, to choose a number that best places his/her current level of pain



Numerical rating scale

Ask the patient to pick a point on the continuum that best describes the severity of the pain



Ask the patient which phrase best describes his/her current level of pain



Verbal rating scale

Using pain assessments

The effectiveness of pain management relies on the implementation of a treatment strategy and consistent, careful and regular assessment and re-assessment using a validated pain scale⁸. The accurate documentation of pain scores and descriptors allows for trends in the pain experience to be recognised and appropriate intervention to be taken to reduce pain. In this way, the nature of the pain, its causes, when it occurs, duration and what exacerbates or abates it can be documented to identify the most appropriate treatment⁸.

Management of infection-related wound pain

There are two main aspects to the management of pain associated with an infected wound:

- **management of wound pain**
- **treatment of the cause, ie the wound infection.**

Treatment of the wound infection, by reducing bacterial load and so reducing the inflammatory stimulus to the nervous system, should result in a reduction in pain. However, this may take some days and the pain itself also requires immediate management.

How should wound pain be managed?

Pain management should include pain assessment before, during and after every dressing change to ensure that the patient's pain is managed effectively⁸. Such ongoing assessment will allow healthcare professionals to identify any triggers that can be modified or avoided to reduce pain.

A consensus document published in 2008 aimed to provide guidance in the management of wound-related pain and made a number of recommendations (Box 2)³⁴.

Box 2 Consensus recommendations for managing wound-related pain (adapted from³⁴)

- Choose dressings that minimise trauma and pain during application and removal
- Treat infections that may cause wound-related pain and inhibit healing
- Treat local factors that may induce wound-related pain (eg inflammation, trauma, pressure, maceration)
- Select an appropriate dressing to minimise wound-related pain based on wear time, moisture balance, healing potential and periwound maceration
- Evaluate each patient's need for pharmacological (topical/systemic agents) and non-pharmacological strategies to minimise wound-related pain
- Involve and empower patients to optimise pain management
- Healthcare providers should ensure wound-related pain control for every patient

Analgesia

The principles of wound pain management apply to any painful wound. The appropriate use of analgesics and co-analgesics is key⁹. Separate analgesic strategies may be required for background pain and the pain arising from wound procedures. However, not all wound pain responds to systemic analgesics and qualitative work has revealed that there is often a stigma attached to the use of pain-relieving medication. This includes fear of polypharmacy and dependency or addiction¹⁰.

Dressing changes

Dressing changes are a major contributor to wound pain⁸. In patients with a wound infection whose nervous system has become sensitised, dressing removal, wound cleansing and dressing application may prove particularly painful. Analgesia may need to be timed for maximum efficacy during dressing changes, and the patient may find music or some other form of distraction helpful. Even when a dressing change is managed well and the choice of dressing minimises pain, the patient's past experience of painful dressing removal may lead to increased anxiety at dressing change⁸.

Prevention of trauma on dressing removal is fundamental to minimising pain at dressing change. Superficial nerve endings in the skin may be sheared or irritated in shallow wounds, macerated skin or skin that has been repeatedly stripped by adhesive dressing materials. The stinging and burning associated with superficial skin damage has been reported

to produce a worse pain experience than deeper wound pain^{8,35}.

Inappropriate dressing selection that causes the dressing to adhere to the wound bed, can cause trauma and pain when the dressing is removed⁸. Some dressings may also leave fibres in the wound that need to be physically removed by the clinician^{35,36}.

In addition to preventing trauma on removal, Turner described the ideal dressing as having the following characteristics³⁷:

- **removes excess exudate and toxins**
- **maintains high humidity at the dressing–wound interface**
- **allows for gaseous exchange**
- **provides thermal insulation**
- **prevents secondary infection**
- **is free from particulate and toxic components.**

Careful attention to the dressing change procedure may help to avoid or minimise the pain experienced. Strategies include ensuring a quiet, non-stressful environment, reassurance, avoiding prolonged wound exposure, gentle handling and frequent verbal checks with the patient during the procedure⁹.

Treat the wound infection

In line with the European Wound Management Association document⁸ and the World Union of Wound Healing Societies' consensus statements^{9,34}, treatment of the underlying cause is the most important consideration in the management of wound pain. In the case of infection-related wound pain, this will

involve reducing the microbial burden of the wound through:

- **the use of systemic and/or topical antimicrobials as indicated by the severity of the infection**
- **wound debridement to remove slough and necrotic tissue**
- **wound cleansing to remove debris**
- **good hygiene practice to prevent cross-contamination**³⁸.

Antimicrobials

Antimicrobial is a term given to a number of agents, such as antibiotics and antiseptics, that can kill or inhibit the growth of microorganisms, including bacteria and fungi (yeasts and moulds).

Due to an increase in antibiotic-resistant strains of bacteria, wound dressings containing topical antimicrobials that are not antibiotics such as silver, iodine, honey or polyhexamethylene biguanide (PHMB) are popular choices. The broad spectrum of antimicrobial activity of these agents may make them particularly suited to treating infection in chronic wounds, which frequently contain a wide range of microorganisms³⁹⁻⁴².

Although it is an antibiotic-silver combination, silver sulfadiazine also has broad spectrum antimicrobial activity and is used topically, as a cream or as part of a dressing, to treat wound infection⁴³.

In general, topical antimicrobials are recommended for the treatment of localised

wound infections. Recent studies have demonstrated a reduction in the clinical signs of wound infection when using topical antimicrobials^{44,45}, as well as a statistically significant reduction in exudate⁴⁵. However, currently there is insufficient evidence to help clinicians choose between the different products available. Systematic reviews of the use of topical antimicrobials in chronic wounds^{46,47} have revealed a lack of robust data. This underlines the difficulties of gathering good evidence of efficacy, which may be due, in part, to the wide range of wounds and diversity of the products studied, and the ethical difficulties of conducting outcomes research in patients with chronic wounds.

Selecting a topical antimicrobial

Factors to consider when selecting a topical antimicrobial dressing (Box 3) include the range of antimicrobial efficacy, the availability of the antimicrobial agent (ie how much of the agent contained in the dressing is delivered to the wound

Box 3 Features for the ideal antimicrobial dressing²¹

- Sustained antimicrobial activity
- Provides a moist wound-healing environment
- Allows consistent delivery of the antimicrobial in the dressing over the entire surface of the wound
- Allows monitoring of the wound with minimum interference
- Manages exudate if this is a problem
- Comfortable
- Provides an effective microbial barrier
- Absorbs and retains bacteria
- Avoids wound trauma on removal

for antimicrobial action and over what time period) and the potential for host cell toxicity^{48,49}. The conformability of the dressing should also be considered to limit the formation of dead space where bacteria can flourish⁵⁰.

Other considerations include whether the dressing is able to:

- **protect the surrounding skin from the potentially damaging enzymes in exudate**
- **manage wound odour**
- **prevent bleeding from friable tissue.**

Dressing choice has the potential to contribute to pain reduction in patients with infected wounds. However, clinicians should be mindful of the wide range of other opportunities for identifying, reducing and preventing pain that can help to minimise the impact of infection-related wound pain on patients' psychological welfare and quality of life.

Supported by an educational grant from Systagenix. The views expressed in this 'Made Easy' section do not necessarily reflect those of Systagenix.

Author details

Mudge E¹, Orsted H²

1. Research Fellow, Department of Dermatology and Wound Healing, Cardiff University, Cardiff, UK
2. Director – CAWC Institute of Wound Management and Prevention, and Clinical and Educational Consultant, Canadian Association of Wound Care, Calgary, Alberta, Canada

Summary

Wound infection is responsible for increased pain severity. This in turn can delay healing and have a negative effect on patients' quality of life. Early detection and prompt intervention to treat the wound infection and appropriate dressing selection are essential for effective pain management, together with a realistic understanding of the patient's psychological and cultural background. Frequent assessment and re-assessment, together with the use of non-adherent antimicrobial dressings may be useful in reducing dressing-related wound pain and combating wound infection.

To cite this publication

Mudge E, Orsted H. Wound Infection and Pain Management Made Easy. *Wounds International* 2010; 1(3): Available from <http://www.woundsinternational.com>

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Further reading

World Union of Wound Healing Societies (WUWHS). *Principles of best practice: Wound infection in clinical practice. An international consensus*. London: MEP Ltd, 2008.

References on wound infection, data on antimicrobials and National Institute for Clinical Excellence (NICE) guidelines on surgical site infections can be found at <http://www.woundinfection-institute.com>.