Review Article

Management of burn wound pain in the hospital setting

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Source of submission: Written specifically for AMSJ

160 character summary of article: Thermal injury poses a challenge to the clinician. Through proper consideration of therapeutic options burn pain can be managed to aid rehabilitation.

Keywords: burns, pain medicine, plastic surgery, acute pain

Number of tables: 1

Number of figures: 0

Word count: 2267
Abstract

In Australia, burns are common, accounting for around 5500 hospital injuries each year. The proper management of burn pain is crucial to the rehabilitation process and in reducing the chance of long term psychological sequelae, such as depression and post-traumatic stress disorder.

A wide array of therapeutic options is available to the clinician in managing burn pain in a hospital setting. These evidence-based options include opioids, non-opioid medications, anxiolytics, anaesthetics, as well as relaxation techniques and cognitive behavioural therapy.

In managing chronic pain, therapeutic options vary between pharmacological and non-pharmacological approaches used for acute pain. Consideration of these pain relief options can optimise the management of patients with burns and maximise their rehabilitation, leading to earlier hospital discharge.
Introduction

Thermal injury to the skin can be one of the most painful forms of trauma [1]. In Australia, burns accounted for around 5500 hospital admissions and constituted 1.2% of all injury causes in 2014 [2]. The most common cause of burn injuries is contact with hot substances and materials, such as fluids and cooking equipment, with the most commonly injured body parts being the wrists and hands [2].

Burn pain poses a unique challenge to clinicians because its intensity varies greatly between patients and the perception of pain fluctuates over the course of a patient’s admission [3]. Furthermore, there is currently limited evidence on management of burns injury. Current treatment is based on data extrapolated from several randomised clinical trials, case series and reports, and relevant areas of pain medicine [4]. This type of pain can also be unpredictable and depends on anatomical, physiological, psychological, and premorbid behavioural factors [2]. Distinctive to burn injury is the notable link to psychological harm. Burn wounds are associated with disorders such as acute stress disorder, depression, suicidal ideation, and post-traumatic stress disorder for as long as two years after the initial injury [5]. Moreover, insufficient management of burn pain itself has been associated with a range of diseases and loss of patient confidence, which can complicate treatment and slow rehabilitation. Inadequately managed pain can also limit patient mobilisation and thereby limit physiotherapy that can cause prolonged hospital stays and hospital acquired infections [6,7]. This relationship has been documented in the literature with burn pain being a stronger predictor, rather than the size of the burn or the length of hospitalisation, of psychological adjustment [8]. It is because of this that the management of pain in patients suffering from burn injuries should be carefully considered in order to maximise recovery.

A number of Australian guidelines exist for burn injuries, including those by the New South Wales (NSW) State-wide Burn Injury Service, Australian Pain Management Association, Australian and New Zealand Burn Association, The Royal Children’s Hospital and The Royal Australian College of General Practitioners. The aim of this review is to assess the available literature in order to provide a comprehensive review of evidence-based approaches to managing burn pain in a hospital setting.
Methods

In November 2017, a systematic search of the PubMed, Cochrane, and UpToDate databases was conducted using combinations of keywords such as “burn”, “thermal injury”, “pain”, “hospital”, “analgesia”, and “management” to identify available data sources. Only studies in English were included in the review. Selection criteria for the review included academic articles from peer-reviewed journals and evidence-based clinical resources, such as UpToDate and BMJ Best Practice.
Managing initial acute pain

The instant pain that follows a burn injury is due to the stimulation and damage of skin thermoreceptors, mechanoreceptors, and a selection of exogenous and endogenous mediators [7]. Nerve endings that are entirely destroyed will not transmit pain, but those that remain undamaged and exposed will generate pain throughout the time and course of treatment, a response termed primary hyperalgesia [7]. Furthermore, damaged and regenerating nerve tissues can give rise to complex neuropathic pain syndromes, whereby the sensation of the painful stimulus outlives its expected duration [1]. Other symptoms characteristic of neuropathic pain include tingling, stiffness, cold or hot pain, as well as itching [1].

Pain assessment is an important component of pain care and should be assessed regularly. Evidence-based scores include the Verbal Numerical Rating Score, a score from 0 to 10 ranked from no pain to the worst pain possible [9]. Also useful is the Wong-Baker FACES® Pain Rating Scale, which uses visual faces to represent pain and is useful if patients have difficulty quantifying their pain numerically [9].

First-aid management of burns include cooling the area with tepid or cold water for 20 minutes, which may terminate the burning process and reduce the pain of the injury [3,4,6]. Elevation of the injured part and the application of a compressive dressing, or oedema gloves in the case of hand burns, can help reduce oedema and can minimise the development of pain associated with swelling and stiffness [4,6,10]. Immediate and effective analgesia medication should be provided. Rapid options include intranasal fentanyl or intravenous (IV) morphine [3]. Non-steroidal anti-inflammatory (NSAID) medications may be useful as adjuncts to opioids or used alone to manage small burn injuries [7].

Managing burn pain in the hospital

There are different types of pain experienced by burn patients in the hospital, for which adequate analgesia strategies should be considered. These range from background pain, which is continuous and present at rest, procedural pain evoked during dressing removal and cleaning, as well as emotional and psychological pain experienced by the individual [11,12]. While pharmacological and non-pharmacological methods exist for managing burn pain, a multimodal approach to pain management has provided good results in controlling pain while minimising the patients’ risk of experiencing side effects [1]. Strategies that utilise pre-emptive regular dosing with supplemental prescriptions for breakthrough pain are most effective in practice [1].

During the transition from acute burn injury to burn healing, burns can contract and be a source of pain to patients [13]. It is important, therefore, that pre-emptive pain control is utilised to ensure adequate allied health support can be provided, ideally from the day of patient admission into hospital [10]. For example, stretching injured tissue during physiotherapy or occupational therapy in the hospital setting is vital to optimise burn recovery and support return of function [10,18]. Inadequate pre-emptive pain control jeopardises the crucial role these allied health service have in the rehabilitation process, increasing the risk of scarring and contractures [10,14].

Pharmacological pain management options include opioid analgesics, non-opioid analgesics, anxiolytics, and anaesthetics (Table 1). The type of medication used is determined by the severity of the pain, anticipated duration of the pain and availability of intravenous access.
These medications have variable durations of action and should be titrated to meet the needs of the patient in each clinical setting [3]. In order to control background pain associated with burns, it is recommended to aim for near constant plasma levels of regularly scheduled analgesics, such as long-acting analgesics, non-opioid analgesics, or long-acting IV opioid infusions in patients unable to take oral medications [3]. Guidance from a pain specialist should be sought early and can guide the implementation of a multimodal pain strategy.

**Pharmacological Pain Management**

**Opioid analgesics**

Opioids are a mainstay option for the treatment of burn pain, especially in the acute phase [17]. They are also the most efficacious medication in perioperative moderate and severe pain management [17]. Opioids can be delivered via a variety of routes, including oral, intravenous, transdermal, sublingual and rectal routes. It is available in short or long-acting formulations [17]. In the initial presentation of severe burns, analgesia is best achieved by titration of IV opioids, as other routes may be less reliable in the presence of hypovolaemia and vasoconstriction associated with burns [4]. For acute burn injuries, patient-controlled analgesia (PCA) with IV morphine can be considered. It offers the burn patient a safe and effective method of achieving flexible analgesia, provided the patient is alert and competent enough to use the device [4]. For breakthrough pain during the acute phase or healing phase, short-acting potent opioids should be used and can be titrated to effect by increasing the dose while maintaining the dosing interval [15]. For example, short-acting opioids such as fentanyl can provide good analgesia during dressing changes when administered via target-controlled IV infusions of PCA [4]. During the acute phase, controlled release or long half-life opioids, such as methadone, can be effective for background pain when administered by clinicians trained in its use [13,16]. Side effects are common with opioids, with some studies finding that up to 92% of patients experience at least one side effect, such as constipation, nausea, respiratory depression, or sedation [17]. Prophylactic antiemetics and aperients should be considered when opioids are given [8].

**Non-opioid analgesics**

Paracetamol and NSAIDs provide mild analgesia and can supplement opioids. Paracetamol and NSAIDs exhibit a ceiling effect in their dose-response relationship, rendering them unsuitable as single agents for the treatment of severe burn pain, but they can be effective as adjuvants to opioid medications for background pain [18]. Care should be taken when using NSAIDs in older patients and in patients with renal impairment or gastric injury. While NSAIDs are effective against inflammatory pain, their use should not be recommended in patients with significant burns who are at an increased risk of renal failure [19].

Other non-opioid medications which have been shown to be useful in controlling acute pain are neuropathic agents, such as antidepressants and anticonvulsant agents [20]. Antidepressant medications, such as tricyclic antidepressants, can enhance opioid analgesia, especially in patients with chronic pain [20]. Also, there is evidence that anticonvulsant agents, such as pregabalin and gabapentin, can be used to reduce pain following acute burn injury, with gabapentin use being associated with reduced opioid usage [4,21]. The use of pregabalin or gabapentin should be considered by clinicians as a part of multimodal analgesia for patients suffering from neuropathic pain after acute burns injury [4,21].

**Anxiolytics**
Anxiolytic medications are commonly used in burn units to reduce patient anxiety before or during procedures, such as debridement and to reduce the exacerbation of pain [2]. Studies have shown that benzodiazepine therapy can improve post-procedural pain scores in burn patients, although one recent study investigating this found the effect to only be significant in those with high baseline pain [22]. The benzodiazepine midazolam may be useful for its dissociative, anxiolytic, and sedative qualities and may help reduce pain in patients undergoing dressing changes or wound cleaning [11].

Anaesthetics

A range of anaesthetics have a role in the management of burn pain if used under the guidance of a trained clinician such as an anaesthetist [3,4]. General anaesthesia or deep sedation with anaesthetic agents, such as propofol, may be considered for patients undergoing intensely painful procedures, such as large dressing changes [3,4]. Also, the inhaled agent nitrous oxide can be useful during short, moderately painful procedures, typically as a 50% mixture in 50% oxygen [3,10]. This can be self-administered by an awake, cooperative and spontaneously breathing patient via a mouthpiece or mask [3]. The anaesthetic agent ketamine can have potent analgesic effects when administered at subanaesthetic doses and can be used to facilitate procedures such as dressing changes [4]. Ketamine induces a dissociative state with a fast onset of action and distressing psychomimetic symptoms [1,10].

Non-pharmacological pain management

Relaxation techniques

Relaxation techniques are used to lower arousal, including unnecessary muscle tension that can increase pain, particularly during dressing changes and debridement [1]. Techniques that have been shown to be useful include deep breathing, progressive muscle relaxation and music interventions [1,22]. One quasi-experimental study of 64 burn patients investigating abdominal breathing exercises found a significant reduction in pain scores compared to the control group [22]. This effect may be dependent on the technique of relaxation; however, a separate study investigating jaw relaxation techniques did not detect a significant difference in pain intensity [23].

Cognitive behavioural therapy (CBT)

These techniques include diversion, information provision, coping skills, and relaxation techniques that modify the patient’s thought process about painful experiences [24]. Catastrophising pain can increase levels of perceived pain and CBT aims to reduce these perceptions and provide control to the patient in their pain management [25]. CBT has been shown to be an effective pain control technique in treating procedural pain [19,25]. While its use for the hospitalised burn patient has not been explored in the literature, evidence does highlight its utility in reducing anticipatory pain and distress, reducing catastrophic thinking during procedures and assisting to distract from pain by diverting attention [26].

Chronic burn pain

Damage inflicted by burns can cause a range of chronic pain syndromes in patients. Studies have found that chronic burn pain is a significant problem, with one study in the United States finding 52% of burn patients had ongoing pain around 12 years after injury [15]. This can significantly affect the patient’s rehabilitation by affecting sleep, impairing performance and resulting in depressive symptoms [1]. General advice for the management of chronic pain involves consideration of the principles of multimodal analgesia with support from
interdisciplinary team members [23]. In the management of chronic burn pain, conventional analgesics, such as opioids, have a lesser role and should be monitored diligently for ongoing benefit and adverse outcomes [1,22]. Treatment with antidepressants, such as amitriptyline, and anticonvulsants, such as pregabalin and gabapentin, also have a role in controlling neuropathic pain and reducing opioid requirements [1,15].

When considering non-pharmacological treatment options, there is some evidence to suggest CBT and hypnosis therapy can assist in management of pain [1,3,4]. Hypnosis has been well described in conjunction with conventional analgesic medication, with case reports suggesting synergistic and stand-alone effects in patients undergoing burn dressing changes [1,3]. In cases of resistant chronic pain, patients should be referred to a pain specialist for ongoing management.
Conclusion

The effective management of pain after a burn injury is essential in the acute hospital setting, as well as in the subsequent program of rehabilitation. Burn injury pain is a common medical problem, for which many therapeutic management options exist. This review has highlighted a range of currently used evidence-based therapeutic options. A multimodal analgesic plan should consider options such as opioid and non-opioid analgesics, anaesthetics, anxiolytics, as well as relaxation techniques and CBT as required. Input from a pain specialist should be sought early in cases of both acute and chronic burn pain.
Acknowledgements

Thank you to Dr Helen Douglas and the Fiona Stanley Hospital Burns Unit for your kind support.
References


Table 1. Pain management options for burn pain in the hospital setting.

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<thead>
<tr>
<th>Pain management options for burn pain in the hospital setting</th>
<th>Level of evidence available</th>
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<tbody>
<tr>
<td><strong>Pharmacological</strong></td>
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<tr>
<td>Opioids</td>
<td>I [27-28]</td>
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<tr>
<td>Non-opioids (paracetamol, non-steroidal anti-inflammatory drugs)</td>
<td>Paracetamol - III-2 [29]</td>
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<tr>
<td>Anxiolytics (midazolam)</td>
<td>I [30]</td>
</tr>
<tr>
<td>Anaesthetics (ketamine, nitrous oxide, propofol, sevoflurane)</td>
<td>Ketamine – II [31]</td>
</tr>
<tr>
<td><strong>Non-pharmacological</strong></td>
<td></td>
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<tr>
<td>Relaxation techniques</td>
<td>III-1[32]</td>
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