

# Sedation and Pain Management in Burn Patients

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## KEYWORDS

• Pain management • Sedation • Burn • Anesthesia • Operative management

## KEY POINTS

- Pain management in patients with burn injuries, while challenging, is critically important to optimum care of this population.
- Better outcomes in healing, anxiety, and rehabilitation are linked to good pain control in burns.
- Pain assessment requires understanding of acute, chronic, and procedural forms of burn-related pain.
- Multimodal pharmacologic approaches, with opioids as the mainstay of pain control, are ideal for burn-injured patients.
- Perioperative management demands understanding of complex physiology and dynamic pharmacokinetic changes that occur during the acute injury and resuscitation phase, especially in larger burns.

## INTRODUCTION

From the moment of injury through rehabilitation and beyond, pain control is a major challenge in the management of patients with burn injuries. In fact, some argue that burn pain is the most difficult to treat among any etiology of acute pain.<sup>1</sup> The therapies used to treat burn injuries may exacerbate the difficulty of pain control because most of these interventions are associated with pain, be it dressing changes, excision and grafting, or physical therapy. These therapies can cause pain that is equivalent to or worse than the pain of an initial burn injury. Therefore, pain management must be a foundation of burn care. Good pain control is linked to better wound healing, sleep, participation in activities of daily living, quality of life, and recovery.<sup>2,3</sup>

Despite profound improvements in modern burn care, suboptimal and inconsistent pain management persists throughout all stages of burn treatment. Without aggressive pain control, patients are likely to suffer not only from the acute experience of pain in itself, but the secondary morbidities of higher pain levels, including long-term anxiety and posttraumatic stress,<sup>4,5</sup> or even delayed wound healing.<sup>6</sup> The unique challenge of burn pain is further complicated by a relative dearth of standardized approaches.<sup>7</sup> Instead, tradition and personal/institutional biases often dictate pain management. The complex interaction of anatomic, physiologic, pharmacologic, psychosocial, and premorbid issues can make the treatment of burn pain particularly difficult. An overview of pain management strategies specific to the treatment of burn injuries is summarized here.

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## MECHANISMS AND TYPES OF PAIN IN BURNS

Although burns are classified according to depth, area, and severity of injury, pain does not necessarily correlate with these measures. The individual experience of pain varies widely between patients and throughout the healing process in burn injuries.<sup>7</sup> Because individuals have varying pain thresholds, coping abilities, and even physiologic responses to injury, patients may experience disparate levels of pain despite having similar injuries.<sup>7</sup> The most immediate and acute form of burn pain is the inflammatory nociceptive pain attributed to burn injury and tissue trauma. Nociceptive pain is often followed by and potentially exacerbated by procedural pain related to the treatment of burn wounds, be it surgical debridement, grafting, staple application and removal, physical therapy, or dressing changes. As burn wounds begin to heal, neuropathic pain, characterized by a throbbing or constant burning sensation potentially adds an additional layer of discomfort.

Although all burns are painful, conventionally, deeper, full-thickness burns are thought to be somewhat less painful than superficial and partial thickness burns because of afferent nerve destruction.<sup>8</sup> However, this does not always play out in clinical practice.<sup>9</sup> Additionally, full-thickness burns eventually require debridement and grafting and subsequent dressing changes that all lead to substantial pain. At the time of burn injury, tissue damage is the primary mechanism of pain. Stimulation of local nociceptors transmits an impulse via Ad and C fibers to the dorsal horn of the spinal cord. Peripheral sensory nerves and descending influences from cortical areas can modulate the magnitude of the pain impulse.<sup>10</sup> Ultimately, conscious perception of pain is regulated by areas of the brain, often named the "pain matrix," which is thought to involve a network of higher cortical areas and the thalamus.<sup>11,12</sup> The conscious perception of pain is affected not only by the burn wound itself but also by context, cognition, pharmacologics, mood, and other predisposing factors.<sup>10</sup> Burn pain also may vary and fluctuate widely over the span of recovery. Therefore, the successful treatment of burn pain should involve a multimodal approach tailored to the patient and scenario.

## PAIN ASSESSMENT

The first step in determining a pain treatment plan is assessing the degree of the patient's pain, which, in the case of burn injuries, may be mild to excruciating. Reliable, valid pain assessment

tools in form of verbal adjective, numeric, or visual analog scales (VASs) can be useful guides for pain management in burns. In adults, VAS and numeric rating scales (NRSs) are commonly used.<sup>13</sup> Both NRS and VAS have undergone repeated validation and have performed well in different patient populations.<sup>14</sup> Children, especially those who are preverbal, and noncommunicative adults present a more difficult challenge. Observational scales and physiologic indicators, such as heart rate and blood pressure, may be used to gauge pain in these populations.

Second, understanding the type and chronicity of a patient's pain is useful for tailoring pain management strategies. The Patterson burn pain paradigm provides a roadmap for the management of burn pain through 5 different phases of injury, treatment, and recovery.<sup>15</sup> (1) Background pain is pain that is present while the patient is at rest, results from the thermal tissue injury itself, and is typically of low to moderate intensity and long duration. (2) Procedural pain is brief but intense pain that is generated by wound debridement and dressing changes and/or rehabilitation activities. (3) Breakthrough pain describes unexpected spikes of pain that occur when background analgesic effects are exceeded, when at rest, during procedures, or with stress. (4) Procedural pain is an expected and temporary increase in pain that occurs after burn excision, donor skin harvesting, grafting, or interventions, such as the placement of central lines due to the creation of new and painful wounds in the process. (5) Chronic pain is pain that lasts longer than 6 months or remains after all burn wounds and skin graft donor sites have healed. The most common form of chronic pain is neuropathic pain, which is the result of damage sustained by the nerve endings in the skin. Each of these 5 phases presents unique challenges in the management of burn pain. Clinicians should be prepared to adjust treatment strategies using both pharmacologic and nonpharmacologic techniques, discussed in further detail in the next sections.

## PATHOPHYSIOLOGY AND PHARMACOLOGIC CONSIDERATIONS

Major burns cause massive tissue destruction and activation of a cytokine-mediated inflammatory response leading to dramatic pathophysiologic effects.<sup>16</sup> The inflammatory response is initiated within minutes of burn injury, which results in a cascade of irritants that sensitize and stimulate pain fibers. Burn wounds may become primarily hyperalgesic to mechanical and/or thermal stimuli.<sup>10</sup> Two distinct phases, a burn shock

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