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CLINICAL REVIEW

Understanding Pain in Burn Victims

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Severe burns are among the most painful forms of trauma that affects the person both physically and psychologically.¹ Several surveys confirm that pain in burn victims is felt from the time of injury, through the treatment process, and occasionally even after the treatment is completed.² This highlights the importance of not only understanding the types and mechanism of burn pain but also its potential sequelae.

Mechanism of Pain in Burn Patients

The mechanism of burn pain consists of two phases: primary hyperalgesia and secondary hyperalgesia. Primary hyperalgesia occurs after tissue injury causes the release of inflammatory mediators that sensitizes skin nociceptors in the area. These nociceptors then send a signal to the spinal cord, which results in sensitization of the injury site to all stimuli. Following that, the area surrounding the tissue injury also becomes sensitized, which is called secondary hyperalgesia.³

Several Factors that Impact Burn Pain

- Depth of Burn:

First-degree burns: Tissue injury is superficial and involves only the epidermis. Pain is generally mild to moderate and healing occurs within a week.

Second-degree burns: Involve parts of the dermis which is more painful because there is damage to skin nociceptors and exposure to nerve endings. As the wound heals, nerve regeneration can sometimes be disordered, leading to neuropathic pain.

Third degree burns: Involve destruction of nociceptors and causes the affected areas to become insensate. While one would expect that these deeper burn injuries should not be painful, in actuality third degree burns also contain areas of more shallow burns where nerve endings are not completely destroyed. The duration of pain can last from days to months or longer.¹

- Stage of Healing:

Simplistic observation suggests that burn wounds at an earlier stage of healing tend to be more painful due to their acute nature and the release of inflammatory mediators such as hydrogen ions, prostaglandins and bradykinin caused by tissue damage. The reality, however, is more nuanced. As

wounds heal, continuous or repeated peripheral stimulation of nociceptive afferent fibers leads to increased sensitivity in surrounding unburned areas expanding the affected areas.

- Nature of Procedures:

Procedures performed on burn victims such as debridement, staged skin excision and grafting, dressing changes, hydrotherapy and hyperbaric oxygen chambers all contribute to furthering the patients' individual pain experience. Areas far from the burn injury that serve as donor sites for auto-grafting often elicit just as much pain as the initial burn site.

- Patient Characteristics:

Certain populations such as the pediatric age group tend to be more vulnerable and sensitive to pain than their adult counterparts. The entire process ranging from the initial burn to admission in an unfamiliar environment with strangers can be psychologically traumatic to a child. Pain management should focus not only on the injury but also on managing their anxiety and adjunct services such as a child life specialist who can help with coping strategies and play an essential part of the care team.

- Psychological Factors, Such as Depression and Anxiety:

Patients with a high level of anxiety and comorbidities such as depression tend to report a higher level of background pain.⁴ Severe anxiety is associated with more disabling and severely limiting pain.

Types of Burn Pain

Pain from burn injury is usually classified temporally, from the acute phase to the chronic phase.³ There are several forms of burn pain that have been identified: background pain, procedural pain, breakthrough pain, neuropathic pain, and chronic pain. It is important to distinguish these different types of pain as management of each differs.

Background Pain

This form of pain is consistently present while a patient is at rest. Background pain is often lower in intensity than other forms of pain but frequently has a longer duration. It is most optimally managed with regularly scheduled analgesics such as nonsteroidal anti-inflammatory agents or long acting opiates

that provide a long lasting coverage with continuous serum therapeutic blood levels.⁵

Procedural Pain

Procedural pain is of a higher intensity and of shorter duration than background pain. Following the burn pain and release of inflammatory mediators, these sensitize the surrounding tissue so that procedures and manipulations that stimulate the patient lead to triggering of nerve endings and primary hyperalgesia in already damaged tissue. These include dressing changes, repositioning, wound care including chemical stimuli such as antiseptics or topical creams, central line placements, physical therapy, and repositioning the patient.

Procedural pain is the most intense form of pain that is often undertreated and found to cause significant anxiety and distress in burn patients. Clinical experience suggests that severe pain experienced during the first dressing change can evoke extreme anxiety and emotional distress with subsequent dressing changes and further lead to long-term pain issues.⁵ Short acting, potent opioid analgesic should be timed to act during peak procedure-induced primary hyperalgesia. Anxiolytic agents, such as benzodiazepines, have been found to reduce pain and anxiety associated with burn dressing changes. However, these need to be administered in a closely monitored setting, as patient's response to benzodiazepines could be highly variable, ranging from respiratory depression to no response at all⁶ or conversely a paradoxical reaction. Other classes of sedative hypnotics such as ketamine⁷ and propofol,⁸ significantly reduce pain and associated anxiety, but their use is usually limited to the critical care setting.

Of the non-pharmacologic adjuncts, hypnosis⁹ and music¹⁰ have been demonstrated to significantly reduce pain and anxiety when used as an adjunct to opioid analgesics.

Breakthrough Pain

Breakthrough pain refers to spikes of increased pain felt by patient at rest without any known trigger. Patients with burn pain experience transient worsening of pain either precipitated by movement or due to changing mechanisms of pain or related to inadequate analgesics.³

Chronic Burn Injury Pain

Chronic burn pain is pain that lasts for months after initial injury. It may be present long after the primary burn injury has healed. Chronic pain is identified as an onerous burden for many burn victims. One study surveyed members of the Phoenix Society for Burn Survivors and found, 52% of respondents reported on-going burn-related pain an average of twelve years after injury.² The mechanism underlying chronic pain in burn victims is not completely understood, however, it appears that development of chronic pain correlates to the severity of initial burn injury.¹ There are several potential causes for the development of chronic pain including ischemia induced peripheral nerve damage and abnormal regeneration of damaged nerves. It has also been found that damage to peripheral nerves leads to changes in the spinal cord which suggests contribution

of the central nervous system to the neuropathic pain.⁵ Although few studies have evaluated their effect on chronic pain after burn injury, centrally acting agents used to treat neuropathic pain, including antidepressants (e.g., amitriptyline), anti-convulsants (e.g., gabapentin), and clonidine may prove useful in this patient population.⁵

Psychological Impact of Acute Burn Pain

Several studies have studied the psychosocial impact of pain in burn victims and have found a strong correlation between pain and anxiety.¹¹ Ashburn reported that patients who endure painful procedures, often report a high degree of anxiety associated with the procedures.¹² Anticipatory anxiety has been found to lower pain tolerance, and can intensify the feeling of fear, helplessness, depression, and dissatisfaction, which may contribute to poor patient participation with treatment plans, delayed healing, and prolonged hospitalization.¹³ It has been suggested that interventions that reduce overall distress in the hospital may improve both physical and psychological recovery.³

Long Term Sequelae of Burn Pain

Burn pain not only has an effect in the acute period after injury, but has been shown to have long term sequelae. Up to 50% of patients with severe burns, report persistent pain that can last between five to eleven years.¹⁴ These patients also reported clinically significant depressive and PTSD symptoms.¹⁴ Several factors have been associated with persistent burn pain including longer inpatient admissions, severity of the burn, higher levels of acute pain during treatment of their burn injury, and increased total body surface area involvement.¹⁴

Patients with chronic burn-related pain have reported interference with sleep, work, and mood in up to 45% of patients.² Activities demanding physical strength or social interaction beyond the household level, such as sports activities and work are particularly affected.¹⁵ Moi showed burn related pain significantly interfered with patients' health status and work, and symptoms persisted even at 47 months after initial injury.¹⁵ Twenty percent of working aged patients were unemployed, and chronic pain was shown to be the strongest risk factor for unemployment.¹⁵ Full thickness injury, the number of operations, length of hospitalization and the presence of deformities were factors associated with decreased employment rate 47 months after injury.¹⁵

Patients who reported chronic burn pain also reported lower satisfaction with information they received about pain treatment and expectations in improvement of pain symptoms.¹⁴ Satisfaction with chronic pain treatment was associated with confidence and trust in the healthcare provider, which could suggest that psychological factors play a role in development of chronic pain.¹⁶

Conclusion

Burn injury along with its treatment is multi-modal. There are many factors that contribute to the injury itself as well as its treatment. Burn pain is not only associated with physical implications but also has lasting psychological associations that

should be taken into consideration in attempts to reduce long-term sequelae.

REFERENCES

1. **Morgan M, Deuis JR, Frøsig-Jørgensen M, Lewis RJ, Cabot PJ, Gray PD, Vetter I.** Burn Pain: A Systematic and Critical Review of Epidemiology, Pathophysiology, and Treatment. *Pain Med.* 2018 Apr 1;19(4):708-734. doi: 10.1093/pm/pnx228. PubMed PMID: 29036469.
2. **Dauber A, Osgood PF, Breslau AJ, Vernon HL, Carr DB.** Chronic persistent pain after severe burns: a survey of 358 burn survivors. *Pain Med.* 2002 Mar;3(1):6-17. Pub Med PMID: 15102213.
3. **James DL, Jowza M.** Principles of Burn Pain Management. *Clin Plast Surg.* 2017 Oct;44(4):737-747. doi: 10.1016/j.cps.2017.05.005. Epub 2017 Jul 15. Review. PubMed PMID: 28888299.
4. **de Heer EW, Gerrits MM, Beekman AT, Dekker J, van Marwijk HW, de Waal MW, Spinhoven P, Penninx BW, van der Feltz-Cornelis CM.** The association of depression and anxiety with pain: a study from NESDA. *PLoS One.* 2014 Oct 15;9(10):e106907. doi: 10.1371/journal.pone.0106907. eCollection 2014. Erratum in: *PLoS One.* 014;9(12):e115077. PubMed PMID: 25330004; Pub Med Central PMCID: PMC4198088.
5. **Summer GJ, Puntillo KA, Miaskowski C, Green PG, Levine JD.** Burn injury pain: the continuing challenge. *J Pain.* 2007 Jul;8(7):533-48. Epub 2007 Apr 16. Review. PubMed PMID: 17434800.
6. **Patterson DR, Ptacek JT, Carrougner GJ, Sharar SR.** Lorazepam as an adjunct to opioid analgesics in the treatment of burn pain. *Pain.* 1997 Sep;72(3):367-74. PubMed PMID: 9313277.
7. **Humphries Y, Melson M, Gore D.** Superiority of oral ketamine as an analgesic and sedative for wound care procedures in the pediatric patient with burns. *J Burn Care Rehabil.* 1997 Jan-Feb;18(1 Pt 1):34-6. PubMed PMID: 9063785.
8. **Sheridan RL, Keaney T, Stoddard F, Enfantio R, Kadilack P, Breault L.** Short-term propofol infusion as an adjunct to extubation in burned children. *J Burn Care Rehabil.* 2003 Nov-Dec;24(6):356-60. PubMed PMID: 14610418.
9. **Jensen MP, McArthur KD, Barber J, Hanley MA, Engel JM, Romano JM, Cardenas DD, Kraft GH, Hoffman AJ, Patterson DR.** Satisfaction with, and the beneficial side effects of, hypnotic analgesia. *Int J Clin Exp Hypn.* 2006 Oct;54(4):432-47. PubMed PMID: 16950685.
10. **Fratianne RB, Prensner JD, Huston MJ, Super DM, Yowler CJ, Standley JM.** The effect of music-based imagery and musical alternate engagement on the burn debridement process. *J Burn Care Rehabil.* 2001 Jan-Feb;22(1):47-53. PubMed PMID: 11227684.
11. **Byers JF, Bridges S, Kijek J, LaBorde P.** Burn patients' pain and anxiety experiences. *J Burn Care Rehabil.* 2001 Mar-Apr;22(2):144-9. PubMed PMID: 11302603.
12. **Ashburn MA.** Burn pain: the management of procedure-related pain. *J Burn Care Rehabil.* 1995 May-Jun;16(3 Pt 2):365-71. Review. PubMed PMID: 7642683.
13. **Henry LL.** Music therapy: a nursing intervention for the control of pain and anxiety in the ICU: a review of the research literature. *Dimens Crit Care Nurs.* 1995 Nov-Dec;14(6):295-304. Review. PubMed PMID: 8631212.
14. **Browne AL, Andrews R, Schug SA, Wood F.** Persistent pain outcomes and patient satisfaction with pain management after burn injury. *Clin J Pain.* 2011 Feb;27 (2):136-45. PubMed PMID: 21268301.
15. **Moi AL, Wentzel-Larsen T, Salemark L, Hanestad BR.** Long-term risk factors for impaired burn-specific health and unemployment in patients with thermal injury. *Burns.* 2007 Feb;33(1):37-45. Epub 2006 Oct 31. PubMed PMID: 17079085.
16. **Andrews RM, Browne AL, Wood F, Schug SA.** Predictors of patient satisfaction with pain management and improvement 3 months after burn injury. *J Burn Care Res.* 2012 May-Jun;33(3):442-52. doi: 10.1097/BCR.0b013e31823359ee. PubMed PMID:22210057.

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