Pain Management in Burn Patients

RATTAPHOL SEANGRUNG, MD

Department of Anesthesiology

Faculty of Medicine

Ramathibobi Hospital Mahidol University

Introduction

- Ideal method “multidisciplinary approach”

1. specific treatment
2. pain management
3. psychological support
4. physical rehabilitation

Introduction

- Challenging for pain management

1. initial emergency room through the rehabilitation phase
2. complex physiology
3. chronic nature
4. long-term post-traumatic stress and general emotional distress
5. highly variable and unreliable predicted by clinical assessment

Problems for pain management

Gaps between Evidence and Practice

- inadequate attitudes and knowledge
- incomplete, sporadic, or nonstandard pain assessment
- concerns about the side effects
- dependence on opioids
- opioid addiction
- psychological distance

How to approach

- understand the type of tissue damage
- understand the nature of standard burn care
- aggressive pain control
- avoid the undertreatment
- humanistic management

Provide proactive plans and management

- individualized care
- consideration of the clinical context
- efficacy of multiple classes of medications
- efficacy of modes of drugs delivery
- nondrug techniques

Outcome of optimal pain management

- improves patients' quality of life and satisfaction
- reduces the risk of many complications
- permits earlier discharge
- facilitates recovery through multiple mechanisms
- reduce short-and long-term costs of care

Pathophysiology

- depend on location and extent
- different sources: heat, cold, electricity, or chemicals/radiation
- molecular level: toxic inflammatory mediators
- cellular level: protein denaturation and coagluation with surrounding tissue hypoperfusion and capillary vasoconstriction
- local responses to systemic responses

Features of burn depths associated with pain

Burn Depth	Appearance	Blistering	Sensation
Epidermal	Red	None	Painful
Partial Thickness			
Superficial	Pink with wet appearance Brisk cap-refill	(+)	Painful
Deep	Pale/fixed red staining Poor cap-refill	(+/−)	Painful or painless
Full Thickness	Leathery white or brown	None	None in burned area (+/−) Pain at edges

Types of pain in burn patients

- often severe and extreme

1. burn depth
2. total body surface area affected
3. mechanism of injury
4. various patient factors

- both nociceptive and neuropathic

Types of pain in burn patients

- four different categories

1. rest pain (constant, dull background pain)
2. breakthrough pain (intermittent, short duration, rapid onset/offset, sometimes excruciating pain)
3. procedural pain (short duration, greatest intensity, occurring with certain activities
4. psychogenic pain (anticipatory pain in the absence of mechanical stimulation)

Pain management options

Pharmacologic

Nonpharmacologic

Pain management options

- Pharmacologic management of burn pain

1. opioids
2. N-Methyl-D-Aspartate (NMDA)-receptor antagonists
3. Nonsteroidal Anti-Inflammatory Agents (NSAIDS)
4. gabapentinoids
5. Na+-channel blockers: local anesthetics
6. α2-adrenergic agonists
7. anxiolytics

Pain management options

Opioids

- morphine, hydromorphone, and fentanyl
- administered by a variety of routes
- inexpensive and familiarity
- greater than maximum recommended doses (acute phase)
- acute opioid tolerance and opioid-induced hyperalgesia

reversed by methadone or nonopioid analgesic
(ketamine, dextromethorphan, and clonidine)

Pain management options

Opioids

methadone

- receptor binding properties

  mu-opioid

  N-methyl-D-aspartate (NMDA)-receptor antagonist

  serotonin and norepinephrine reuptake inhibitor
- oral, parenteral, and rectal routes
- variable and unpredictable potency

Pain management options

Opioids

fentanyl

- rapid onset of action and quick redistribution from the central circulation
- administer intravenous or transmucosal
- useful adjunct for procedural burn care activities
- patient-controlled analgesia (PCA)

Pain management options

N-Methyl-D-Aspartate (NMDA)-receptor antagonists

ketamine

- reduced the area of secondary hyperalgesia
- antihyperalgesia and anti-allodynia
- synergistic effects with superior pain relief
- reduced opioid consumption
- less risk of respiratory depression and negligible psychomimetic or dissociative effects (1 to 3 mcg/kg/min)

Pain management options

N-Methyl-D-Aspartate (NMDA)-receptor antagonists

ketamine

- patient-controlled analgesia for burn dressing
- no risk of developing tolerance
- no risk of withdrawal
- long-term sedation and analgesia
- effective analgesic agent for pediatric burn patient

Pain management options

N-Methyl-D-Aspartate (NMDA)-receptor antagonists

dextromethorphan

- reduced excitatory transmission of primary afferent pathways
- effective in neuropathic/wind-up pain
- unable to receive ketamine and no psychomimetic effects
- synergistic effects with superior pain relief
- reduced opioid consumption
- 60 mg twice a day to 90 mg three times a day

Pain management options

Non steroidal anti-inflammatory agents (NSAIDS)

- reduce the neurogenic inflammatory pain and fever
- time and dose limitation
- ceiling effect
- risks of bleeding and renal dysfunction
- acetaminophen: useful for background postburn pain in children

Pain management options

gabapentinoids

gabapentin and pregabalin

- suppresses transmission
- activates and enhances the efficacy and release of descending noradrenergic neuronal activity
- decrease primary mechanical allodynia
- useful in reducing neuropathic burn-related pain
- decreased opioid consumption

Pain management options

gabapentinoids

- pregabalin (up to 300 mg twice a day over a period of 28 days) significantly reduced several aspects of the neuropathic pain and pain associated with procedures
- after treatment with pregabalin in a burn outpatient clinic found 69% of patients experienced some reduction in pain score

Pain management options

Na+-channel blockers: local anesthetics

- reduce primary and secondary hyperalgesia
- intravenous lidocaine:

  - attenuate long-term inflammation-induced tissue responses to thermal injury

  - attenuate cytokine-induced cell injury in endothelial and vascular smooth muscle cells
- treatment of neuropathic pain

Pain management options

Na+-channel blockers: local anesthetics

- peripheral regional nerve blockade
- neuraxial block
- postoperative pain control
- aware of the potential infectious complications

Pain management options

α2-adrenergic agonists

clonidine and dexmedetomidine

- highly selective central and peripheral α2-adrenergic agonists
- decrease noradrenaline release at presynaptic receptor sites
- reduce pain intensity
- morphine-sparing effect
- analgesia and sedation

Pain management options

α2-adrenergic agonists

clonidine and dexmedetomidine

- anti-inflammatory effects
- improved macrophage function
- antiapoptotic activity
- reduced delirium
- reduced mortality

Pain management options

α2-adrenergic agonists

clonidine and dexmedetomidine

- Clonidine: 2 to 5 mcg/kg PO, 0.1 to 0.3 mg/24 hr TTD, or 30 mcg to 300 mcg IV for procedural sedation in chronic opioid/chronic pain patients
- Dexmedetomidine: iv infusion at 0.2 to 1 mcg/kg/hr but may be bolused intermittently in small doses of 4 to 8 mcg iv push with minimal side effects

Pain management options

Agents	Examples	Mechanism of Action	Administration
Opioids	Fentanyl, morphine, Hydromorphone	mu-R agonism	IV, PO, IM, TD
Methadone		mu-R agonism, NMDA-R antagonism, serotonin- and NE-reuptake inhibition	PO
NMDA antagonists	Ketamine Dextromethorphan	Noncompetitive NMDA-R antagonism	IV(Ketamine) PO(dextromethorphan)
NSAIDs	Ketorolac Ibuprofen APAP	Cyclooxygenase (COX-1 and -2) inhibition	IV, PO, PR
Gabapentinoids	Gabapentin Pregabalin	Ca2+ channel blockade (α2δ-1 subunit-containing channels)	PO
Local anesthetics	Lidocaine Bupivacaine Ropivacaine	Na+ channel blockade	IV (lidocaine), epidural/intrathecal, perineural, TD
α2 adrenergic agonists	Clonidine Dexmedetomidine	Central and peripheralα2-adrenergic blockade/sympatholysis	IV (dexmedetomidine), PO

Pain management options

- Nonpharmacologic management of burn pain

1. helpful in the treatment
   - long-term nature of rehabilitation
   - possible development of chronic pain
   - stress-related disorders
2. modalities
   - virtual reality
   - music therapy
   - relaxation techniques

Pain management options

- Nonpharmacologic management of burn pain

Method	Purported Mechanism of Action
Virtual reality	Mostly visual distraction/decrease in processing of incoming nociceptive signals
Music therapy	Auditory distraction/attenuation of stress response to pain
Relaxation techniques	Behavioral management of anxiety, especially immediately pre-procedure/dressing changes

Summary

- understand the principles of analgesia and the importance of delivering the right drugs at the right time
- aggressive multimodal and multidisciplinary approach
- consists of both nociceptive and neuropathic components
- both pharmacologic and nonpharmacologic modalities