Pain Management in Burn Patients

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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 coagulation with surrounding tissue hypoperfusion and capillary vasoconstriction
- local responses to systemic responses
## Features of burn depths associated with pain

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

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

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