Title: Pain management of burn injuries in pediatric patients

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Objectives:

1. To learn about the pathophysiology of pain in burn patients
2. To learn about the epidemiology of pediatric burn injuries
3. Review the multimodal intraoperative and postoperative analgesic management of pain in burn patients
4. Discuss pharmacologic and non-pharmacologic strategies to deal with opioid and sedative tolerance

Case:
Your patient is a 10-year old boy with burns on both legs. He suffered injuries during a family camping trip when he was horse playing near a camp fire. He was in a burlap potato sack when he tripped and fell on the fire. The extent of his injury is approximately 30% TBSA.

1. Is this a significant burn?
2. How does one determine the extent of injury in a child?
3. Until what age can you use the rule of 9's to approximate total body surface are (TBSA)?
4. What are common mechanisms of burn injury?
5. Do they differ by age group?
6. What are major causes of mortality in pediatric burns?
7. Summarize important pathophysiologic changes involved in burn injuries in the following systems: cardiovascular, pulmonary, renal, endocrine, gastrointestinal, and neurologic.

The patient was intubated in the field, as there was concern for inhalation injury. He is currently sedated and intubated being maintained on a propofol infusion and receiving regular boluses of morphine. Nursing staff state his behavior has been very difficult to manage. He has been noted to erupt in tears or suddenly awake from sedation trying to remove his monitors.

8. What other history would you want to know in regards to his behavior?
9. What would your differential be for "difficult behavior" in this burn patient?
10. Do you suggest any medication adjustments to his primary team?
11. How would you determine if this were pain?
12. Would you consider a neuraxial technique in this patient?
13. Is there a role for peripheral nerve blocks in burn patients?

The child had a paradoxical reaction to midazolam three years ago when he was pre-medicated before a tonsillectomy and adenoidectomy. His morphine infusion was increased 6 fold over night. Over the last 5 hours, Doppler signals and his sensory exam are concerning for impending vascular compromise to the lower extremities. The patient is taken emergently to the operating room for bilateral fasciotomies. Induction goes smoothly but when surgery starts, his pressure drops to 50/29 and his heart rate increases from 140s to 160s.

14. Is there anything else you can suggest for agitation? Does this change your intraoperative plan?
15. How will you manage his increasing morphine requirement in the operating room?
16. What are the different types of burn injury pain?
17. What receptors are involved in burn injury pain?
18. Suppose the surgeon asks that you maintain strict vigilance over the hemodynamics because he believes the child is going into SIRS or sepsis, do you change your analgesic plan? Why or why not?
19. How will you maintain anesthesia and analgesia during this case?

The patient gets through the surgery but continues to require daily wound debridements under general anesthesia. You have provided the anesthetic several times and have noticed a steady increase in his propofol and ketamine total dose as well as higher opioid continuous infusion rates.

20. Is this due to drug tolerance? What else could this be?
21. Are there ways to avoid developing tolerance or is this an inevitable outcome of long-standing infusions?

He is eventually extubated 16 days after his initial debridement, in part due to a complicated post-operative course which included ARDS. He continues to need daily wound care but this is increasingly difficult given his anxiety around procedures.

22. What non-pharmacological interventions options exist for this child?
23. What can you do as a provider to help him with his emotional distress?
24. What can the burn trauma surgeon do to help decrease pain and therefore anxiety?
25. At what point does this recurrent pain from procedures or operations become chronic pain?
26. What are the chronic pain syndromes in the burn population?

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