JACS
Journal of Acute Care Surgery

Journal homepage: https://www.jacs.or.kr
https://doi.org/10.17479/jacs.2024.14.1.34
eISSN : 2288-9582 pISSN : 2288-5862

Case Report

Lidocaine and Ketamine as Sedation for Burn Wound Care in a Pediatric Patient: A Case Report

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Article history:
Received: August 24, 2023
Revised: November 04, 2023
Accepted: November 05, 2023

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ABSTRACT

This is a case report of a developmentally healthy 14-month-old female with partial thickness scald burns at multiple sites (the face, trunk, and bilateral upper extremities) that covered 14% of her total body surface area. Novel procedural pain therapy using intravenous lidocaine and oral ketamine was administered to perform daily wound care with minimal discomfort. Following this daily analgesic protocol there was sufficient analgesia and sedation with no adverse side effects. Currently, there are no studies where this analgesic combination was used during burn wound care and dressing changes in pediatric cases. The success of this protocol in a pediatric case highlights the safety and efficacy of oral ketamine when used in conjunction with intravenous lidocaine which potentially allows for a lower dose per procedure and a reduced risk of adverse effects.

Keywords: analgesia, burn, pediatrics, sedation, wound care

Introduction

Burns due to scalding are a serious cause of morbidity and mortality in pediatric patients [1]. Burn debridement is often required daily in order to achieve rapid healing, however, it is a painful procedure which causes stress for the pediatric patient, their parents, and healthcare providers. Adequate pain control in pediatric patients, for both background and procedural pain control, is paramount. Background pain occurs due to the burn, is constant, and is present while the patient is at rest. Procedural pain is associated with therapeutic intervention (invasive or noninvasive) and includes wound care, dressing changes, and insertion of catheter lines and nasogastric tubes. Breakthrough pain occurs when there is a transient exacerbation of pain associated with activity or movement. Background pain must be well managed, but it is inherently difficult to control. It is essential to address background pain in order to mitigate procedural pain [2].

It is important to have a multidisciplinary approach to achieve effective pain control in pediatric burns patients [3]. The pain control achieved by background medications is not adequate for procedural control. A 2019 survey conducted on American Burn Association members assessed nonoperating room sedation and analgesia practices for pediatric burns patients and highlighted the areas for improvement regarding pain control during dressing changes and increasing the use of multimodal analgesia [4]. In pediatric patients, it is important to consider the effects of a multimodal approach and polypharmacy. In this burn center, neuropathic analgesics, cyclooxygenase inhibitors, and mu-opioid agonists are used to address background and breakthrough pain control. These medications used in conjunction do not pose a risk of respiratory drive suppression.

Case Report

The patient was a 14-month-old female with no past medical history or contributory family history. The patient was developmentally on track and began walking between 10 to 11 months. At admission, the patient weighed 12 kg and was 85 cm tall.

The patient accidentally sustained a scald injury in the kitchen at home when she pulled hot soup onto herself. She lives with her mother, father, and 3 older siblings. The patient was transferred to the burn center for a higher level of care due to the presence of 2nd degree partial thickness burns at multiple sites (the face, trunk, and bilateral upper extremities). The total body surface area of the burn was 14% at initial encounter. The patient was experiencing moderate pain, swelling, and redness. The patient's airway was intact and she had normal breath sounds bilaterally. The patient was admitted to the Burn Intensive Care Unit for daily wound care, formal resuscitation, and further monitoring. Given the surface area of her burns, a nasogastric tube was placed with anticipation of increased nutritional requirements and resuscitation.

The patient's background pain throughout her stay was controlled with scheduled acetaminophen (15 mg/kg) and gabapentin (2.5 mg/kg) every 8 hours. On Day 1, wound care was attempted following administration of oral morphine (0.3 mg/kg) and midazolam (0.1 mg/kg). The patient experienced poor analgesia and anxiolysis with this regimen, screaming and fighting throughout her 1st day of wound care. This was very traumatic for the medical staff, the patient, and her family. After the completion of her wound care, she required 2 doses of methadone (0.1 mg/kg) for breakthrough pain medication throughout the day. At the time of the 1st administration of methadone, her pain minimally decreased from a Wong-Baker Faces Pain Rating Scale score of 9/10 to 7/10, and further decreased to 5/10 with the 2nd dose of methadone.

In response to this, on Day 2 standard intravenous (IV) lidocaine (2,000 mg/500 mL) and oral ketamine (30 mg/30 mL) protocol was administered. The patient was placed on a monitor. The standard protocol indicated that 30 minutes prior to the start of the patient's wound care, IV lidocaine was administered via a bolus of 1.5 mg/kg over 5 minutes. Twenty minutes prior to the start of the patient's wound care, 30 mg of oral ketamine was administered to achieve a target dose of 2.5 mg/kg. When the wound care was initiated, a continuous lidocaine drip was administered at 1 mg/kg/hour until the wound care had been completed. The drip was discontinued at the end of the wound care. Her daily wound care lasted from 30 to 150 minutes, requiring doses from 1.3 to 7.5 mL of the IV lidocaine drip. The combined administration of these medications is the standard protocol at this institution and was continued once daily throughout her stay. Following wound care, her pain was routinely documented as 0-2/10 using the Wong-Baker Faces Pain Rating Scale, thus the patient did not require any breakthrough pain medication after switching to this analgesic protocol.

Following this daily administration of lidocaine and ketamine, sufficient analgesia and sedation were achieved to perform her daily wound care practices comfortably and no adverse side effects were observed. To assess for cardiovascular or central nervous system toxicity throughout her wound care, neurological exams were performed and the patient was on a cardiac monitor. No adverse effects were observed and neurological exams were within the normal limits. Wound assessments did not indicate surgical intervention and after 1 week the decision was made to discharge the patient home with instructions for "at home wound care." One day prior to discharge, the patient received wound care with oral morphine (0.3 mg/kg) and midazolam (0.1 mg/kg) because her condition had improved overall, with adequate healing and a reduced level of pain. She was discharged with her background pain control, acetaminophen (15 mg/kg) and gabapentin (2.5 mg/kg) every 8 hours to be continued at home. At her 1 week follow up visit, the family reported that she continued to have good pain control with no issues.

Discussion

Pediatric burns patients deserve a recovery from their injury with the least amount of pain feasibly possible. Pain that is not properly treated can lead to noncompliance and subsequent prolonged healing. Additionally, undertreated pain may result in psychological and emotional effects following recovery [3]. Reaching a collaborative, streamlined consensus regarding pain control in pediatric burns patients could mitigate negative outcomes. Currently, there is a distinct lack of practice guidelines regarding sedation during burn wound care and dressing changes [4]. Common, but more invasive management strategies used for burn wound care include conscious sedation or general anesthesia with intubation in the operating room.

With conscious sedation, while maintaining breathing, the patient has depressed consciousness but will respond to verbal or tactile stimulation. Conscious sedation poses risks that must be closely monitored throughout the procedure. Patients' varying sensitivities to medications may lead to under or over-sedation. While under-sedation leads to poor pain control and anxiolysis, over-sedation leads to respiratory compromise with the need to emergently intubate, increasing the patient's risk of nosocomial pneumonia [5]. The IV lidocaine/oral ketamine protocol used at this institute does not compromise the airway, does not decrease respiratory drive, controls pain whilst keeping the patient relaxed, and can easily be performed at the bedside.

The IV lidocaine/oral ketamine protocol that is utilized for the pediatric population in this hospital was developed and finalized in conjunction with our pharmacy in March 2020, 9 months after implementation of the analgesic protocol for adults. Since its implementation, we have had success without complications for patients of all ages. The IV lidocaine/oral ketamine protocol is contraindicated in patients with specific

sensitivities or allergies to the medications or cardiac conduction abnormalities. This case study demonstrates a pediatric patient who successfully had her pain and anxiety treated with the IV lidocaine/oral ketamine protocol enabling wound care. There are no published studies addressing this combination of pain relief administered during burn wound care and dressing changes in pediatric patients.

Lidocaine and ketamine used in conjunction potentiate the benefits of each other. They act synergistically, enhance analgesic and sedative effects, lower the doses which are required and thus reduce potential side effects and risks [6]. Oral ketamine has a low relative bioavailability and slower absorption when compared with IV ketamine, and thus allow for safer utilization in pediatric patients [7]. Furthermore, the unique combination of oral ketamine and IV lidocaine for procedural analgesia can be used beyond the burn unit. This protocol has been successfully implemented in the Emergency Department for fracture reductions and can be applied broadly for bedside procedural pain control in children.

A limitation of ketamine use would be the emergence of reactions with adverse psychological symptoms [8]. The risk for these reactions is reduced with the administration of oral ketamine. These psychological symptoms can be reduced with concomitant administration of benzodiazepines such as midazolam, however, this was not indicated for the patient described in this case report. Ketamine can increase airway secretions and may require pre-treatment with an anticholinergic agent; however, this effect was not observed in this patient and therefore pre-treatment was not indicated.

In conclusion, this case report examined the use of the combination of IV lidocaine and oral ketamine for burn wound care of a 14-month-old female. While both lidocaine and ketamine have been choices used for burn wound care, this specific combination used in a patient of this age is not documented. In this case, the intended analgesia and sedation was achieved for the required daily wound care by the healthcare team without adverse effects to this pediatric patient. This is a case that represents the safety and efficacy of this institution's IV lidocaine and oral ketamine protocol for analgesia and anxiolysis in burn care.

Author Contributions

Conceptualization: AWP, DB, and JG. Writing original draft: AP and KK. Writing - review and editing: AP, KK, AWP, and, JG.

Conflicts of Interest

Dr. Pang has consulted for Excurso. Dr. Griswold is on the clinical advisory board for Excurso and a consultant for Medline on burn wound dressings. None of these disclosures affect this case. The other authors have no conflicts of interest to disclose.

Funding

There was no financial support for this case and no grants were obtained for this case.

Ethical Statement

The authors did not get an informed consent for this case report because the case was written retrospectively and the patient is not identifiable.

Data Availability

All relevant data are included in this manuscript.

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