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Neonatal pain management

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ABSTRACT

Pain management in the neonatal ICU remains challenging for many clinicians and in many complex care circumstances. The authors review general pain management principles and address the use of pain scales, non-pharmacologic management, and various agents that may be useful in general neonatal practice, procedurally, or at the end of life. Chronic pain and neonatal abstinence are also noted.

Introduction

We will do everything we can to keep him comfortable.

This sentiment is often articulated by clinicians in an attempt to provide families with a sense of reassurance to patients and families at the end of life (EOL). However, a neonatal patient can pose unique challenges that may diminish the clinician's confidence in achieving this goal. The non-verbal nature of the neonate forces reliance on any of a multitude of semi-objective pain scales to interpret the degree of discomfort and provides no means for assessing other common EOL symptoms, such as air hunger or agitation. Even though today the majority of neonatal deaths occur after the withdrawal of life support[1] evidence-based literature regarding neonatal pain management at the EOL remains sparse.[2] Nonetheless, both provider and parental perception of pain control is a crucial component in their overall EOL experience.[3]

Pain management is certainly not reserved only for the dying neonate and many of the goals and principles of palliative care—including pain control—are universally applicable in the neonatal intensive care unit (NICU). We will broadly review neonatal pain management options and strategies for the NICU population as a whole, with discussion of assessment of pain, acute versus chronic pain, neonatal abstinence syndrome, and EOL care.

Pain assessment

Frequent, accurate, objective assessment of pain is the first fundamental step in achieving adequate pain control in any patient population. Since the Joint Commission on Accreditation of Healthcare Organizations released their 2000–2001 pain management standards,[4] great attention has been paid to pain assessment with many entities adopting pain as the fifth vital sign. The NICU was not exempt from this movement and a myriad of pain assessment tools have since been developed. Reliance on a quality pain assessment tool is desirable in caring for the uniformly non-verbal neonatal population. Multimodal assessments appear to be most informative. In these tools, facial expressions (grimace), physiologic measurements (vital signs such as heart rate and blood pressure, respiratory rate, and pulse-oximetry readings/oxygen requirement), and behavioral components (crying/consolability or motor activity), are often combined to develop a pain score. Commonly used pain assessment tools include as follows:

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- CHIPS: children's and infants' post-operative pain scale.
- COMFORT: alertness, calmness/agitation, respirations, physical movement, heart rate, blood pressure, muscle tone, and facial tension.
- CRIES: cry, requirement for more oxygen, increased vital signs, expression, and sleeplessness.
- FLACC: face, legs, activity, cry, and consolability.
- MAPS: multidimensional assessment of pain scale.
- N-PASS: neonatal pain, agitation, and sedation scale.
- NIPS: neonatal infant pain scale.
- PIPP: premature infant pain profile.
- VAS: visual analog scale.

A recent review of these neonatal pain scale from a palliative care perspective states that current evidence is insufficient to recommend one pain scale over another. All cited studies were able to demonstrate a statistically significant decline in pain scores following the administration of pain medication, likely indicating that all scales are valid for pain evaluation.[5] There may be added benefit to a scale that assesses not only pain/discomfort, but also the level of sedation (i.e., N-PASS). Ultimately, when choosing a pain assessment tool, buy-in from all disciplines as well as the clinician's comfort level and familiarity with scoring, is vital to ensuring standardized assessment and discussion of pain across all neonatal health care providers.

Importantly, assessment of pain, and decisions to act upon such assessment, are interactive phenomena laced with the potential for individual behavioral and social nuances (knowledge about pain and its expression, sensitivities to the patient, and attitudes or biases regarding pain and its validity), that may facilitate excellent pain assessment and management—or not. Such factors variably impact each context and episode of pain and a caregiver's predisposition to treat it by reducing environmental stressors and noxious stimuli, providing a supportive environment or employing the use of pharmacologic agents. Furthermore, an initial assessment of pain and provision of treatment must be met with a follow-up assessment that the pain has been sufficiently reduced.[6] Beliefs about pain at the EOL or upon the withdrawal of life-support technologies may be facilitators or barriers to the provision of comfort, the reduction of agitation, and the relief of pain.

Pain management

Infants born at less than 32-weeks' gestation are exposed to numerous painful procedures every day, especially in the first 2 weeks of life.[7] Unfortunately, in many of these painful procedure, pain is left untreated.[8,9] With the multitude of treatment options and modalities available, leaving pain untreated or under-treated is not clinically defensible and may be considered unethical.[10,11]

Opioids

Opioids can be used for a variety of pain management circumstances in the NICU, including procedural pain, operative and post-operative pain, chronic pain and during ventilation.[12] Choice of agent, dose, route of administration and continuous vs. intermittent dosing are all decisions facing the medical team when prescribing opioid analgesia and varying, limited degrees of evidence are available to guide them. Potential side effects must also be taken into account. Fentanyl and morphine, the two most commonly prescribed opiates in the NICU, have both similar and distinctive side effects. Compared to morphine, fentanyl is more potent and possesses a more rapid onset of action, but has a shorter half-life. Additionally, there is a recognized risk of chest wall rigidity with fentanyl that is not seen with morphine. Chest wall rigidity typically occurs in $<10\%$ of patients and tends to be seen with higher bolus doses.[13] Bolus fentanyl dosing may also be associated with an increase incidence of apnea compared to continuous infusions.[14] Intranasal fentanyl provides an additional route of administration for neonates that do not have established intravenous access. While empirical evidence is limited, intranasal administration appears to be an effective and safe means to provide palliative pain control.[15]

Respiratory depression is also a known side effect with morphine analgesia, but it has been reported far less frequently than with fentanyl. In a study by Bouwmeester,[16] only 11 episodes of respiratory insufficiency occurred in 204 patients receiving morphine. Continuous morphine infusions have not been shown to achieve better pain control than intermittent dosing in the neonatal population.[17,18] Nevertheless, when chosen for sedation in ventilated newborns, morphine is typically prescribed as a continuous IV infusion.[19] A small number of patients who have received continuous morphine infusion may develop hyperalgesia and even myoclonus, which can be treated with conversion to methadone and concomitant treatment with clonidine.[20]

In EOL care, both the clinical circumstance and logistics of administration must be taken into account when choosing a dosing regimen for particular patients. Morphine use is very common in the EOL care of newborns for whom life-support technologies are withdrawn[21–24] but is generally not felt to hasten death.[25,26] Its beneficial effects are both sedation and analgesia and among populations who are communicative—both children and adults—there is a reduction in apparent dyspnea.[27–29]

Sedatives/anxiolytics

Midazolam or lorazepam may be used as sedatives or as an adjunct to the analgesic effects of opiates both in everyday care and more specifically at the EOL in many newborns. Up to 10% of infant receiving midazolam, and potentially other benzodiazepines, may experience myoclonic jerking or pseudoseizures.[30] The myoclonic jerking seen with benzodiazepine use in neonates may be secondary to hypoxic injury or immaturity of the central nervous system.[30] Although benzodiazepines cannot be recommended as sole agents for routine sedation[31] in conjunction with opioids, they provide the added benefit of mitigating anxiety and agitation. While these symptoms are clearly reported in older patient populations, means to objectively assess anxiety in the neonate are often lacking. For this reason, the NICU clinician must first address