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Sedation in mechanically ventilated children: we are advancing

Sedação da criança submetida à ventilação pulmonar mecânica: estamos avançando

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Mechanic ventilation (MV) is an essential part of the support given to patients with respiratory failure, central nervous system injuries or undergoing postoperative care of adults, children or newborns.

This support, in conjunction with frequent invasive monitoring, may cause anxiety, agitation and pain.[1] Children admitted to intensive care units (ICUs) have fear and anxiety both from the absence of their relatives and from the stressful environment, in which they constantly undergo painful procedures.[2]

In particular, younger children have physiological responses to small stimuli, and they cannot appropriately verbalize their pain intensity or the location of their pain. Differentiating between sedation and analgesia is thus very difficult in young children.[3]

However, there is a consensus that sedation and analgesia are essential for the comfort and safety of MV patients. Indeed, sedation and analgesia are proven to reduce MV-associated discomfort, which in turn reduces the use of oxygen, modulates the response to stress intensity, reduces the risk of injury associated with agitation and the displacement of invasive devices, and therefore promotes a patient's safety and facilitates bedside care.[4-7]

Ventilation support has shown a marked evolution; currently, mechanical ventilation support is frequently provided as a complement to, rather than a full replacement of, spontaneous respiration.

Despite all of the technical advances in MV, procrastination on the part of caregivers to begin gradual weaning from mechanical ventilation may cause unnecessary discomfort to the patient and may increase tracheal intubation and MV risks. Because the weaning period accounts for up to 40% of a patient's total time on ventilation support[8] and because there are numerous ventilation modes and strategies for different diseases, ventilation weaning protocols have been developed, accordingly. While these protocols are employed with all ventilated patients, respiratory support weaning methods have never been accurately studied using children,[9] and these methods have mostly been extrapolated from trials in adults and premature children. Thus, these methods may be inappropriate for use with children.

The understanding that deep or prolonged sedation and analgesia may potentially increase morbidity and mortality led to the creation of a new model emphasizing the patient's comfort while keeping them interactive, oriented and able to follow instructions.[10] This new model is based

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on strategies to maintain an appropriate level of sedation,[11] to provide daily sedation interruptions [12] and to minimize the use of muscle relaxant drugs.[13]

Because the optimized sedation/analgesia level cannot be established before the regimen is initiated, monitoring the degree of sedation is essential to prevent hyper- or sub-sedation. To date, no optimal general method to assess sedation in critically ill children is available.[3] Scoring systems, such as the COMFORT system, have only been validated for severely ill MV children,[3] and these systems are useful mainly in children requiring moderate sedation/analgesia.[3] Moreover, little clinical experience is currently available for electroencephalogram (EEG) derived methods, such as the 'bispectral index' (BIS), and these methods have been validated only for anesthetized patients.[3]

Although analgesic/sedative medications are widely prescribed drugs,[14] in contrast to their use in adult patients, few protocols and guidelines for their use have been published in Pediatrics,[5,15] and only scarce data are available regarding the dosages, safety and efficacy of these drugs and their combinations.[16]

Regarding daily sedation interruptions, it was recently shown in a randomized controlled trial[17] that children on MV for longer than 48 hours who were awakened once daily by an interruption of the infusion of sedation drugs had shorter stays in the ICU, received less of the sedation drugs, and had lower hospital costs when compared with continuously sedated patients. These results are comparable to findings in adult patients.

While this new model of sedation-analgesia and MV for severely ill children is a significant development, there is still a long and hard way ahead[18] before we can say that ICU children are not with adequated therapeutic .[19]

REFERENCES

1. Puntillo KA. Pain experiences of intensive care unit patients. Heart Lung. 1990;19(5 Pt 1):526-33.
2. Uezono S, Mio Y. Monitoring consciousness in the pediatric patient: not just a small adult. Best Pract Res Clin Anaesthesiol. 2006;20(1):201-10.
3. Lamas A, López-Herce J. Monitoring sedation in the critically ill child. Anaesthesia. 2010;65(5):516-24.
4. Jacobs JR, Reves JG, Glass PS. Rationale and technique for continuous infusions in anesthesia. Int Anesthesiol Clin. 1991;29(4):23-38.
5. Buck ML, Blumer JL. Opioids and other analgesics. Adverse effects in the intensive care unit. Crit Care Clin. 1991;7(3):615-37.
6. Mehta S, Burry L, Fischer S, Martinez-Motta JC, Hallett D, Bowman D, Wong C, Meade MO, Stewart TE, Cook DJ; Canadian Critical Care Trials Group. Canadian survey of the use of sedatives, analgesics, and neuromuscular blocking agents in critically ill patients. Crit Care Med. 2006;34(2):374-80.
7. Anand KJ, Ingraham J. Pediatric. Tolerance, dependence, and strategies for compassionate withdrawal of analgesics and anxiolytics in the pediatric ICU. Crit Care Nurse. 1996;16(6):87-93.
8. Esteban A, Alía I, Ibañez J, Benito S, Tobin MJ. Modes of mechanical ventilation and weaning. A national survey of Spanish hospitals. The Spanish Lung Failure Collaborative Group. Chest. 1994;106(4):1188-93.
9. Randolph AG. Weaning from mechanical ventilation. New Horiz. 1999;7:374-85.
10. Kress JP, Pohlman AS, Hall JB. Sedation and analgesia in the intensive care unit. Am J Respir Crit Care Med. 2002;166(8):1024-8.
11. Ambuel B, Hamlett KW, Marx CM, Blumer JL. Assessing distress in pediatric intensive care environments: the COMFORT scale. J Pediatr Psycholol. 1992;17(1):95-109.
12. Schultz TR, Lin RJ, Watzman HM, Durning SM, Hales R, Woodson A, et al. Weaning children from mechanical ventilation: a prospective randomized trial of protocol-directed versus physician-directed weaning. Respir Care. 2001;46(8):772-82.
13. Shapiro BA, Warren J, Egol AB, Greenbaum DM, Jacobi J, Nasraway SA, et al. Practice parameters for intravenous analgesia and sedation for adult patients in the intensive care unit: an executive summary. Society of Critical Care Medicine. Crit Care Med. 1995;23(9):1596-600.
14. Zuppa AF, Adamson PC, Mondick JT, Davis LA, Maka DA, Narayan M, et al. Drug utilization in the pediatric intensive care unit: monitoring prescribing trends and establishing prioritization of pharmacotherapeutic evaluation of critically ill children. J Clin Pharmacol. 2005;45(11):1305-12.
15. Playfor S, Jenkins I, Boyles C, Choonara I, Davies G, Haywood T, Hinson G, Mayer A, Morton N, Ralph T, Wolf A; United Kingdom Paediatric Intensive Care Society Sedation; Analgesia and Neuromuscular Blockade Working Group. Consensus guidelines on sedation and analgesia in critically ill children. Intensive Care Med. 2006;32(8):1125-36.
16. Hartman ME, McCrory DC, Schulman SR. Efficacy of sedation regimens to facilitate mechanical ventilation in the pediatric intensive care unit: a systematic review. Pediatr Crit Care Med. 2009;10(2):246-55.
17. Gupta K, Gupta VK, Jayashree M, Singhi S. Randomized controlled trial of interrupted versus continuous sedative infusions in ventilated children. Pediatr Crit Care Med. 2011 Jan 28 [Epub ahead of print].
18. de Carvalho WB, Fonseca MC. Pediatric sedation: Still a hard long way to go. Pediatr Crit Care Med. 2006;7(2):186-7.
19. Shirkey H. Therapeutic orphans. J Pediatr. 1968;72(1):119-20.