High-Flow Nasal Cannula in the Pediatric ICU: Popular or Efficient?

High-flow nasal cannula (HFNC) delivers a heated and humidified gas mixture at a flow greater than patient inspiratory flow demand. Several physiological studies have evaluated HFNC in neonates, infants, children, and adults. These found that HFNC improves gas exchange, applies positive pressure, flushes anatomical dead space, and decreases work of breathing.^{1,2} In adults, the FLORALI trial³ was the first to provide evidence of HFNC superiority over noninvasive ventilation (NIV) and standard oxygenation, which places the HFNC as the primary respiratory support for adults with hypoxemic acute respiratory failure.⁴

HFNC is noninvasive respiratory support that is a simple and well-tolerated alternative to other forms of support, such as CPAP and NIV. In this issue of *RESPIRATORY CARE*, Coletti et al⁵ report their experience using HFNC in 620 children over 2 y, representing more than a quarter of children admitted to the pediatric ICU. HFNC was initiated as the first line therapy for various diseases (eg, asthma, bronchiolitis, pneumonia) and for all age groups. The failure rate (5.6% of the children required NIV, and 4.5% required intubation) was low, similar to that reported in previous studies.⁶⁻⁸ Although HFNC is an increasingly popular method to provide respiratory therapy with a clinical intuition of efficacy, the level of evidence in children has been slow to evolve.

The example of bronchiolitis is interesting. In the study reported by Coletti et al,⁵ almost one quarter of the population (23.7%) had bronchiolitis, which is consistent with other reports.^{6,9} However, recent randomized control studies failed to support the use of HFNC in children with bronchiolitis. The recent TRAMONTANE study⁷ concluded that the failure rate was lower in nasal CPAP compared with HFNC for initial respiratory support in severe viral bronchiolitis. Kepreotes et al⁸ concluded that the early use of HFNC did not reduce time receiving oxygen compared with standard oxygen in moderately severe bronchiolitis.

So why is there so much enthusiasm for the use of HFNC in children? Probably because of its good tolerance

and simplicity of use. As compared with NIV, HFNC is simpler to set up (no synchronization, single interface, only 2 settings [gas flow and F_{IO_2}]) and can be used in various clinical environments (eg, emergency department, inter-hospital transport, or ICU).^{1,6,10,11}

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HFNC is also well tolerated, as suggested by Coletti et al,⁵ who reported that only 2 subjects (0.3%) required discontinuation due to discomfort. Additionally, the main reasons for failure differed between the 2 groups in the TRAMONTANE study.⁷ In the HFNC group, failure was due to worsening of respiratory distress, whereas in the CPAP group, it was discomfort. Another reason that may explain why HFNC is attractive for use in pediatrics is the variable high flows that can be used.² In adults, the maximum flow is 60 L/min (about 1 L/kg/min), whereas in small children, the device allows flows that are 2 or 3 times greater.¹ The flow used in the most recent pediatric studies is heterogeneous, ranging from 0.7 L/kg/min for subjects with asthma to as high as 3 L/kg/min in the study reported by Coletti et al.⁵ The higher the flow, the higher is the level of support.¹² Hence, this single system seems to be able to provide various levels of support, determined by the flow, from oxygen supplementation to a CPAP effect. However, this range of flows leads to the question of what comparator to choose in controlled trials according to the HFNC flow used: standard oxygen, CPAP, or NIV?

The situation is probably best summarized in the study in preterm infants reported by Manley et al,¹³ who conclude that the equivalence of HFNC with nasal CPAP is based on a margin of non-inferiority of 20%. The controversial rationale was that many clinicians strongly prefer to use HFNC, and its use is widespread because of the perceived benefits over nasal CPAP. With greater comfort, simplicity, and probably effectiveness, HFNC has succeeded in finding a place in the hearts of pediatric intensivists and respiratory therapists. HFNC now requires a more convincing level of evidence from randomized control trials in the pediatric ICU.

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