

Children With Bronchiolitis on High-Flow Nasal Cannula: To Feed or Not Feed, That Is *Not* the Only Question

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Bronchiolitis remains the single most common cause of hospitalization during the first year of life.¹ Although supportive treatment is the cornerstone of bronchiolitis therapy, with excellent recovery in the majority of children,² clinicians continue to search for new and better treatment strategies. As reflected in the most recent American Academy of Pediatrics clinical practice guidelines for bronchiolitis,¹ previously embraced treatment strategies such as ribavirin, chest physiotherapy, systemic glucocorticoids, epinephrine, and β -agonist therapy are not recommended for children with bronchiolitis. Even the stance emphasizing continuous pulse oximetry has been prudently revisited (clinicians may choose not to use it for patients who do not require supplemental oxygen or if oxygen saturation is $>90\%$). However, treatment guidelines have not yet confronted the putative benefits of high-flow nasal cannula (HFNC) in the more severely ill component of the population. There is also no consensus surrounding the propriety of enteral nutrition in infants with bronchiolitis being treated with HFNC.

Despite the absence of data showing the efficacy of HFNC in the context of bronchiolitis, the strategy is increasingly being used. For children with accelerating illness, and who display respiratory distress and hypoxemia despite nasal cannula support, HFNC is generally more well tolerated than nasal continuous positive airway pressure devices. In a small trial ($N = 14$), HFNC had a demonstrably favorable effect on diaphragmatic contraction in children with bronchiolitis, thereby decreasing the work of breathing.³ Although it is tempting to ascribe a lower rate of intubation^{4,5} with the use of HFNC, these studies involved historical control subjects, which confounds data interpretation. The first randomized controlled trial to include children with moderate bronchiolitis receiving HFNC compared with low-flow nasal cannula was recently published.⁶ It found no reduction in the duration of supplemental oxygen therapy between the 2 groups. Notwithstanding these constraints, use of HFNC continues to proliferate.

The issue of whether to feed infants who have bronchiolitis possesses significant clinical implications. In infants with bronchiolitis, caloric intake (either enteral or parenteral) correlates inversely with length of stay,^{7,8} arguably because providers are more hesitant to provide enteral nutrition to more symptomatic children.⁹ The hesitancy is likely derived from concerns regarding the risk of aspiration.

Whether and how to feed children with bronchiolitis while being treated with HFNC remains unknown. Practices diverge widely, both within and between institutions. The present issue of *Hospital Pediatrics* includes 2 articles that address the question of whether infants with bronchiolitis being treated with HFNC can be safely fed via an enteral route.

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In the first article, entitled “Oral Nutrition in Children With Bronchiolitis on High Flow Nasal Cannula Is Well Tolerated,” Sochet and October¹⁰ conducted a prospective observational cohort study at a single center over the course of 1 year (2015) in a university-affiliated PICU in children aged between 1 month and 2 years. Patients with a diagnosis of viral bronchiolitis receiving HFNC and concurrent enteral nutrition were included. The primary outcome measures were the incidence of aspiration-related respiratory failure and nutrition interruptions. Respiratory failure was defined as secondary to aspiration in the presence of clinical or radiographic evidence of aspiration and the initiation of invasive ventilation after introduction of either enteral feedings or clinician-observed emesis. Nutrition interruptions were defined as a pause in nutrition of >8 hours. A total of 132 children were included; 97% were fed by mouth and 3% by nasogastric tube, with HFNC flows between 4 and 13 L/min at onset of nutrition. One (0.8%) patient had aspiration-related respiratory failure, and nutrition was interrupted in 12 (9.1%) patients. The nutritional interruptions were primarily due to tachypnea, and not emesis, aspiration, or feeding intolerance.

The second article, written by Slain et al¹¹ and entitled “Nutrition and High Flow Nasal Cannula Respiratory Support in Children With Bronchiolitis,” addresses a similar issue by analyzing data derived from the medical records of children admitted to the PICU of an academic children’s hospital between September 2013 and April 2014. The hospital course of children aged <2 years with a primary diagnosis of bronchiolitis, who were treated with HFNC and enteral nutrition after initiation of HFNC, was reviewed to determine the incidence of feeding-related adverse events (AEs). Feeding-related AEs were defined retrospectively based on nursing and physician documentation of “respiratory distress” or “emesis.” Of the 70 children who met inclusion criteria, 89% received nutrition orally, 7% via nasogastric or nasoduodenal tube, and 4% by gastrostomy tube. HFNC flows at initiation of nutrition ranged between 2 and >7 L/min. The data

were analyzed in 8-hour epochs, with feeding-related AEs occurring in 29 (6%) of 501 shifts in 18 distinct patients. Of the 29 events, emesis comprised 20 and respiratory distress comprised 9. In this relatively small range of HFNC flow rates, the incidence of AEs did not differ with flow rates.

The notion of feeding infants while they are being treated with HFNC is highly compelling, and the present articles^{10,11} address a topic of meaningful clinical significance. Being able to safely feed severely ill infants who have bronchiolitis while receiving HFNC is especially attractive. Both articles carefully approach the issue and add meaningful information to the medical literature. Although the present articles argue in favor of the practice, there is considerable reason to view the evidence with some amount of skepticism.

First, both studies included relatively small sample sizes, which, as the authors note,^{10,11} limit the ability to make claims surrounding safety. Given that thousands of infants are hospitalized annually, the implications of a change in the commonly accepted practice of withholding oral feeding in infants with significant respiratory distress are significant. Hence, data derived from randomized controlled trials would be preferred before advocating for enteral feeding in this population. Indeed, a determination to alter practice should be tempered by the recognition that bronchiolitis is, in general, a self-limited illness, one from which the overwhelming majority make a full recovery.¹ Moreover, from a physiologic perspective, there is meaningful risk associated with feeding. Certainly, carefully balancing risk and reward, relative to feeding in children with respiratory distress wherein suck–swallow coordination is under some amount of duress,¹² is essential.

Interpretation of both of these investigations^{10,11} may be complicated by a component of selection bias. Neither study included an assessment of the respiratory severity of illness at baseline. The decisions to initiate HFNC, and the flow and fraction of inspired oxygen, were provider-determined

and not protocol-driven. Furthermore, criteria for the initiation of enteral feedings were subjective. Based on the study designs, it is possible that providers opted to initiate enteral nutrition in infants on HFNC with a less severe clinical presentation, while withholding nutrition in more overtly ill children.

Identifying aspiration in infants and children remains an important, albeit complicated, consideration. Clinical and radiographic features of bronchiolitis can mimic aspiration,¹³ both in acute aspiration events leading to respiratory failure or repeated small volume “microaspiration” episodes that increase airway inflammation. The definition of the primary outcomes of feeding-related AEs or aspiration-related respiratory failure each address severe acute aspiration events; they may not capture microaspiration events, which could have an impact on disease course.

Although it is important to consider the safety of feeding while on HFNC, it may be worthwhile to consider whether use of HFNC possesses clinical utility. With HFNC, infants are receiving an indeterminate amount of positive airway pressure. Airway pressure delivery varies widely between patients, contingent on factors such as size of nares, upper airway inflammation, mouth closure, and cannulae fit.^{14–18} The questions of whether HFNC alters hospital course, decreases length of stay, or influences the incidence of mechanical ventilation remain insufficiently addressed.^{6,19} Moreover, even the fundamental physiology of HFNC remains incompletely understood.

The incidence of bronchiolitis continues to motivate the search for novel treatments to mitigate the burden of illness. If HFNC proves effective in decreasing severity or length of stay, the questions asked in these investigations^{10,11} will need to be definitively addressed. These articles are an excellent first step in that direction. However, many previous therapies designed to improve care for children with bronchiolitis have been warmly embraced but failed to withstand the scrutiny of randomized controlled trials. Whether the therapeutic benefit of HFNC will be accepted or rejected has yet to be determined.

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