Does High-Flow Nasal Cannula (HFNC) oxygen negate the need for CPAP in moderate to severe bronchiolitis?

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Background
Bronchiolitis has been the subject of intense investigation for many years with various treatment modalities failing to prove significant benefit. The mainstay of treatment is therefore supportive with oxygen and maintaining adequate hydration.

Infants who fail to respond to simple supportive care have historically escalated to continuous positive airway pressure (CPAP) in an attempt to avoid endotracheal intubation. CPAP has been shown to decrease the work of breathing, improve functional capacity and reduce regional atelectasis.

Due to the multiplicity of devices and techniques available, no consensus opinion about the optimal nasal CPAP system exists. CPAP delivery devices can cause nasal mucosal trauma, nasal deformity and patient discomfort. Other reported complications include laryngeal dysfunction, gastric distension and the practical difficulties of patient handling and correct positioning of prongs.

High-flow nasal cannula (HFNC) therapy is defined as delivery of gas flow rates at 2L/kg/min or above. There are many potential advantages to HFNC:
- Heating and humidifying the gas mixture reduces upper airway mucosa damage improving tolerance
- It is easy to set up
- Inspired oxygen can be titrated easily
- A continuous positive airway pressure has been reported
- Enhances washout of nasopharyngeal CO$_2$-rich dead space, improves muco-ciliary clearance and oxygen delivery compared to other systems
- Also maintains normal lung volumes preventing atelectasis
- Proven benefit in neonates treating apnoea of prematurity, post-extubation

Aims
To assess whether HFNC oxygen is as effective as CPAP in the management of acute to severe bronchiolitis. This should help establish where exactly HFNC belongs in the escalation and management protocols. If deemed comparable to CPAP, HFNC could replace it completely in the management of moderate to severe bronchiolitis.

Methods
A literature search was performed on OVID Medline 1946 – Present and Embase 1974 – Present with the following criteria:
1. Bronchiolit* AND
2. High flow OR Optiflow OR Airvo OR Vapotherm
All articles were reviewed and further references found from manual review of bibliographies.

Findings
Retrospective studies
The introduction of HFNC significantly reduced the need for mechanical ventilation, improved clinical and biochemical parameters, and reduced length of stay.

Randomised controlled trials & prospective studies
HFNC has been compared to standard care & hypertonic saline in RCT’s with a trend to improved clinical parameters but overall no significant difference in oxygen requirement or length of stay

Predictors of failure
Persistent tachypnoea, hypercapnia, acidosis & co-morbidities have been demonstrated to predict failure of HFNC & need for escalation of respiratory support

Safety profile
Superior to CPAP and conducive to a ward-based setting

Conclusions
• There is limited evidence directly comparing HFNC to CPAP in bronchiolitis but enough to suggest HFNC can be used safely as a first-line in moderate to severe bronchiolitis in a ward-based setting.
• Close monitoring of potential predictive parameters (respiratory rate, heart rate, pH) is essential to escalate respiratory support if necessary.

Limitations
• Treatment failure was poorly defined
• Current practice also varies widely in setting for HFNC (PICU/ward)
• Different years of bronchiolitis cohorts compared introducing potential confounders in terms of seasonal variation of viral strains

The future…
• To delineate exactly how HFNC compares to CPAP in bronchiolitis requires further large randomised controlled trials (3 trials currently registered with ClinicalTrials.gov)
• HFNC looks to be becoming a cornerstone in the management of bronchiolitis in the developed world
• There is improved tolerance and better safety profile compared to CPAP
• Cost-wise, it is cheaper than CPAP and when combined with a PEWS system, can be delivered safely in a ward setting alleviating demand on HDU and PICU beds
• HFNC may be of greatest benefit to the developing world whereby an easy to use, cheaper form of non-invasive ventilation could reduce respiratory deterioration and the need for invasive ventilation saving money and more importantly, lives. A stronger evidence base across a broad range of conditions is therefore required to support widespread implementation in resource-restricted areas of the world.

Full reference list available on request