COMMENTARY

High-flow nasal cannula oxygen therapy in acute hypoxemic respiratory failure: Proceed with caution

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High-flow nasal cannula (HFNC) oxygen therapy is a relatively recent innovation in adult critical care units. It delivers warm humidified oxygen at high flow rates (between 15 and 60 L/min) through a small nasal interface. Humidification at high flow rates contributes to remarkably good tolerance. Because HFNC oxygen therapy is both relatively simple to apply and comfortable, its use has become almost routine without necessarily being subjected to careful clinical evaluation. The broad indication for HFNC oxygen therapy is acute hypoxemic respiratory failure. In a linked research article, Ou and colleagues[1] report on their meta-analysis of data from six randomized controlled trials (n = 1892) comparing outcomes of HFNC oxygen therapy for this indication with either conventional oxygen therapy or noninvasive ventilation. They found that the proportion of patients who required endotracheal intubation in the HFNC oxygen therapy group was significantly lower than the proportion in the conventional oxygen therapy group but similar to that in the noninvasive ventilation group.[1]

Conventional oxygen therapy cyclically increases the inspired oxygen concentration in the upper airway, which is then diluted by entrained air. In contrast, HFNC oxygen therapy offers (a) a gas flow rate closer to the patient's inspiratory flow rate, (b) flow-dependent continuous positive airway pressure with increased end-expiratory lung volume and (c) washout of upper-airway carbon dioxide to decrease physiologic dead space, with the last two mechanisms possibly contributing to reduce the work of breathing.[2–4]

Because the prevention of endotracheal intubation avoids or reduces the associated complications such as local trauma, ventilator-associated pneumonia, sedation and muscle weakness, this may be an important outcome. However, our understanding of the role of noninvasive ventilation for acute respiratory failure is now based on more robust outcome measures (e.g., hospital mortality) and target-specific patient cohorts, and an awareness of the possible adverse effects of delayed intubation.[5] Given the similarity of intent, we should subject HFNC oxygen therapy to the same scrutiny as noninvasive ventilation.

KEY POINTS

- Among patients with hypoxemic respiratory failure, high-flow nasal cannula (HFNC) oxygen therapy results in fewer patients requiring re-intubation when compared with conventional oxygen therapy.
- A high proportion of patients with *de novo* acute hypoxemic respiratory failure require intubation when managed with HFNC oxygen therapy.
- Delayed intubation is associated with increased ICU mortality.
- A skilled team and an appropriate environment are required to manage patients who have acute hypoxemic respiratory failure with HFNC oxygen therapy.

Delayed intubation in patients receiving HFNC oxygen therapy is associated with increased ICU mortality.[6] Possible mechanisms include risks associated with re-intubation itself, delays in diagnosis owing to a lack of definitive airway access (e.g., less definitive specimens for microbiology and cytology, poorer clearance of airway secretions and concern regarding stability for computed tomography), and uncontrolled lung stretch, with high transpulmonary pressure and hydrostatic pressure contributing to lung injury.[7] Without HFNC oxygen therapy, earlier intubation might allow better management of some of these otherwise covert problems.

Hypercapnic respiratory failure remains the primary indication for noninvasive ventilation in hospital. The role of noninvasive ventilation in acute hypoxemic respiratory failure is less certain,[5] including its use in immunocompromised patients, who were previously thought to be a target group.[8] This raises important questions when considering use of HFNC oxygen therapy. In the meta-analysis by Ou and colleagues,[1] was noninvasive ventilation an appropriate comparator? Also, when and in which specific cohorts should HFNC oxygen therapy be used?

For more than 80% of the patients analyzed by Ou and colleagues, the aim of the trial was to prevent re-intubation, which was

required in 10%–20% of the patients.[9–11] Only one study[12] examined a large cohort of patients with *de novo* acute hypoxemic respiratory failure. Although the study reported no reduction in the intubation rate with HFNC oxygen therapy, it did report an impressive improvement in both ICU survival and survival at 90 days; however, 38% of the participants in the HFNC group required intubation.

These findings underscore the importance of managing patients who have acute hypoxemic respiratory failure in an appropriate environment with rapid access to a skilled team and the need for further studies to help define the clinical circumstances in which to use or not use HFNC oxygen therapy. When endotracheal intubation is required, lung protective ventilation should be used immediately, along with appropriate diagnostic investigation.

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