Background  
High-flow nasal cannula (HFNC) oxygen therapy is a relatively new technology for treating hypoxemic respiratory failure and dyspnea. It can be used as an alternative in select patients who do not desire invasive ventilation or are intolerant to non-invasive ventilation (NIV; see Fast Facts #229 and #230). This Fast Fact reviews the limited clinical research data on HFNC.

Equipment  
The HFNC oxygen system consists of an air-oxygen blender, flow meter, heated humidifier, heated circuit, and nasal prongs, all of which are configured to deliver up to 60 L/min of humidified air flow (1). The air-oxygen blender allows precise delivery of fraction of inspired oxygen (FiO\textsubscript{2}) ranging from 0.21-1.

Physiology & Rationale for HFNC  
Traditional nasal cannula oxygen administration is used at flows of 2-6 L/min. At these low flows, there is significant mixing from room air limiting the maximal FiO\textsubscript{2} delivery to 0.4. Conversely, with the use of HFNC, there is little entrainment of room air due to the high gas flow, allowing for more precise and higher FiO\textsubscript{2} delivery. Additionally, the high gas flow flushes carbon dioxide from the upper airway reducing the anatomical dead space and impeding expiratory flow. Thus, HFNC can create continuous positive airway pressure, albeit less than NIV. These factors lead to a reduction in respiratory rate, hypoxemia and the sensation of dyspnea compared with traditional oxygen administration via nasal cannula or face mask (3,4). Whereas NIV can be claustrophobic and impede eating and talking, HFNC use can allow select patients to talk and eat while receiving adequate oxygenation.

Clinical Evidence  
HFNC can be used for severe hypoxic respiratory failure of any cause, including interstitial lung disease, cancer, and pneumonia. In a randomized controlled trial of eucapnic patients with severe hypoxic respiratory failure, HFNC was comparable to NIV in reducing need for invasive ventilation but was superior in relief of dyspnea and reduction in respiratory rate (5). Skin breakdown is less common with HFNC compared with NIV (6,7). In a small phase II randomized study involving advanced cancer patients with hypoxia and dyspnea, HFNC used in a non-ICU setting was able to improve dyspnea, oxygen saturation, and respiratory rate comparably to NIV (9). There are limited comparative studies with other modalities of higher flow oxygen delivery such as a venturi mask. Compared with a humidified face mask, HFNC is more expensive, but it appears to be more comfortable and associated with less mucosal dryness (1,2). The use of HFNC in hypercapnic respiratory failure is not well-studied and not recommended.

Limitations & Dilemmas  
In the hospital, the use of HFNC is not restricted to an ICU. While HFNC can provide many patients with terminal illnesses sufficient oxygenation to maintain wakefulness for weeks, there are no studies evaluating whether HFNC is beneficial in reducing the dose of opioids or anxiolytic medications used to treat dyspnea. Palliative care clinicians may encounter patients receiving HFNC while dying. Like any technology employed at the end-of-life, its use should be considered in the context of the patient’s care goals: it may prolong the dying process even as it improves dyspnea. Furthermore, the need for an advanced air compression system can create logistic barriers to providing HFNC outside the hospital, for example in hospice care settings. Anecdotally, this can lead to clinical dilemmas where a dying patient with a do-not-intubate order, who has severe hypoxic respiratory failure without any realistic hope of improvement (e.g., a patient with terminal interstitial lung disease who cannot receive lung transplantation) is treated with HFNC as a temporizing measure. Patients may not be agreeable with transitioning off HFNC, leading to dilemmas around care goals and disposition. In this respect, those considering its use should think of it as being more like invasive ventilation (a high-resource intervention that is challenging to offer outside the hospital) than typical nasal cannula oxygen therapy.

Using HFNC  
HFNC is often started at 50-60 L/min of flow and FiO\textsubscript{2} is adjusted to keep the saturation of O\textsubscript{2} > 90%. Once the desired effects are achieved, flows are maintained and FiO2 is decreased while assuring adequate oxygenation. For patients who are recovering, HFNC can typically be transitioned to regular nasal cannula at a FiO2 of 0.4. Like with any weaning of oxygenation or ventilation interventions in dying patients for whom alleviating suffering is the primary care goal (as opposed to restoration or life-prolongation), the potential benefits and harms of HFNC will need to be compared to use of regular nasal cannula oxygen therapy and medications. Similar to discontinuing invasive or non-invasive ventilation,
standard medications to relieve dyspnea should be introduced to keep patients comfortable as HFNC is being weaned (see Fast Fact #27), even if hypoxemia results.

Summary

- Humidified HFNC can provide adequate oxygenation and relieve dyspnea in carefully selected patients with hypoxemic respiratory failure.
- HFNC availability can vary outside the hospital. Social workers can help clinicians identify local resource availability.
- Data are scant on its use in patients nearing the end-of-life. Clinicians should be cautious about non-evidence-based use of HFNC in patients without a realistic path to recovery.

References:


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