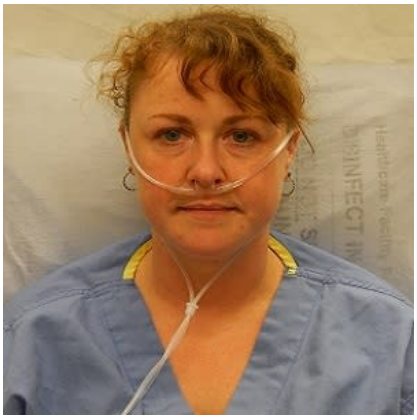
ICU
MANAGEMENT & PRACTICE

Clinical efficacy of high flow nasal cannula oxygenation



High flow nasal cannula (HFNC) oxygenation has become an increasingly popular therapy for hypoxaemic respiratory failure. Recent studies have illuminated the effects of this device on respiratory physiology, and its impact on clinical outcomes in adults. However, because many clinical indications have not been studied, clinicians and physiologists must have a thorough understanding of device titration to tailor therapy for specific clinical scenarios, according to a review paper to appear in Annals of the American Thoracic Society.

HFNC has distinct advantages over other oxygen devices due to its unique effects on respiratory physiology. "In particular, adjustable oxygen delivery and flow-dependent carbon dioxide clearance from the upper airway reduce work of breathing and can better match inspiratory demand during respiratory distress," writes report author Matthew G. Drake, MD, of the Division of Pulmonary and Critical Care, Oregon Health and Science University, Portland, Oregon.

Alveolar oxygen delivery depends on supplemental oxygen flow rate, the fraction of oxygen (FiO2) delivered in supplemental flow, the device's interface with the patient, and inspiratory demand. Conventional low flow devices (e.g., nasal cannula or simple face mask) provide 100% FiO2 at a maximum of 15 L/min. Even during quiet breathing, inspiratory flow rates are approximately 30 L/min, which exceeds supplemental oxygen flow. During respiratory distress, flows reach 100 L/min or more, resulting in entrainment of much larger volumes of room air that further reduce delivered FiO2.

Dr. Drake explains: "HFNC overcomes flow limitations of low and intermediate flow devices by delivering up to 60 L/min of heated, humidified gas via nasal prongs. An oxygen blender connected to the circuit enables precise titration of FiO2 ranging from 21-100%, independent of flow. To ensure stable FiO2 delivery to alveoli, device flow must meet or exceed the patient's inspiratory flow to minimise room air entrainment."

Unlike low flow nasal cannulas and masks that solely support oxygenation, HFNC produces flow-dependent carbon dioxide (CO2) clearance that reduces anatomic dead space, and leads to improved work of breathing and lower respiratory rates, the author explains. HFNC also improves gas transfer and increases lung volumes. "Since end expiratory lung volumes are a reflection of functional residual capacity, increases in volume suggest HFNC use results in alveolar recruitment. Thus more lung units are open and available to participate in gas exchange," the author says.

Non-invasive positive pressure ventilation (NIV) is also commonly used for alveolar recruitment. NIV provides pressure-targeted breaths by varying inspiratory flow throughout the respiratory cycle. The HFNC device interface however allows for better patient communication, less anxiety and claustrophobia, and superior

comfort compared to NIV and face masks.

Historically, few studies had evaluated whether the physiologic effects of these oxygen devices translated into clinical benefit. However, recent publications have begun to address this knowledge gap, Dr. Drake notes.

"High flow nasal cannula oxygenation has been shown to have similar, and in some cases superior, clinical efficacy compared to conventional low flow oxygen supplementation and non-invasive positive pressure ventilation in acute hypoxaemic respiratory failure," the author writes. "High flow nasal cannula oxygenation also prevents reintubations in medical and post-operative surgical populations, and has been used to provide pre-oxygenation for laryngoscopy and to support oxygenation during bronchoscopy."

Although NIV can prevent hypoxaemia during bronchoscopy, the author says mask intolerance and difficulty manipulating the scope through the mask limit its appeal. HFNC permits oral passage of the bronchoscope and may improve oxygenation during the procedure.

"Despite significant advances in our understanding of the effectiveness of HFNC, many areas of uncertainty remain that should guide future study design. In the current literature, wide variations in inclusion criteria, device flow rates, FiO2 settings and durations of therapy make comparisons between studies challenging. It remains unknown whether the benefits of HFNC require flows above a specific threshold," Dr. Drake points out.

In addition, clinicians would benefit from studies that identify early predictors of HFNC success, as well as an improved understanding of signs that constitute therapy failure. Methods for HFNC weaning also require examination, according to the author.

Source: Annals of the American Thoracic Society
Image Credit: James Heilman, MD

Published on : Tue, 28 Nov 2017