

Novel Pharyngeal Oxygen Delivery Device Preserves Oxygenation Longer than High Flow Nasal Cannula

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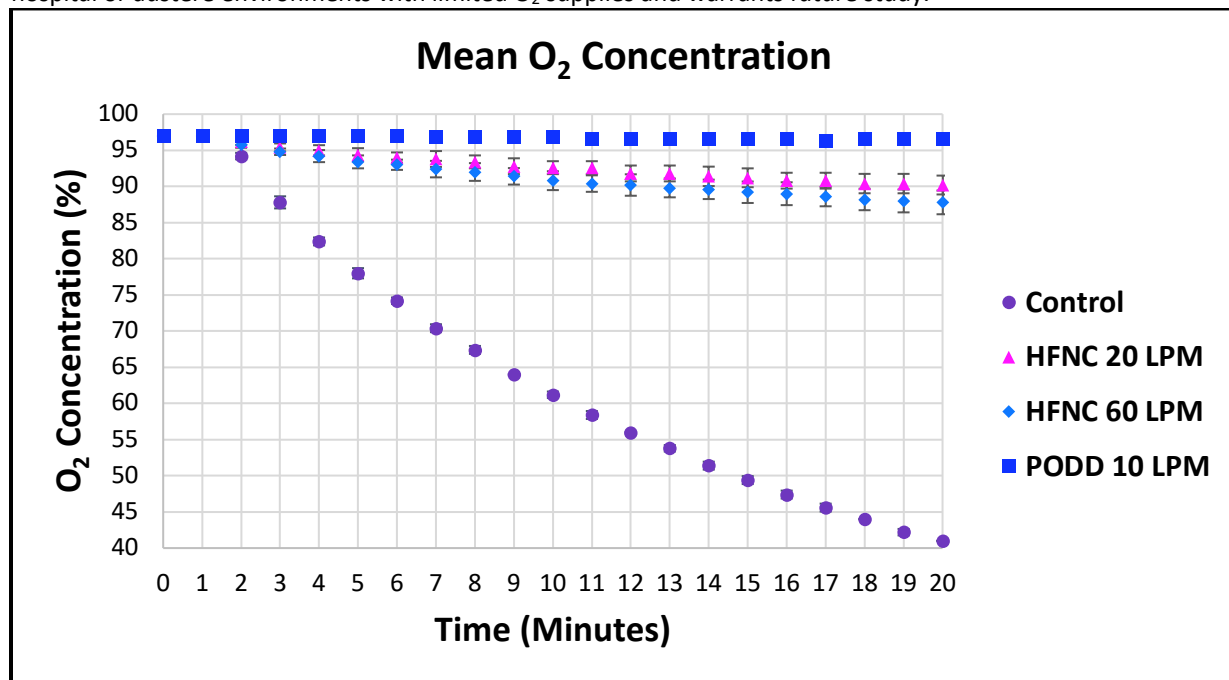
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Background: Hypoxemia during apnea and a failed airway scenario is life threatening. High flow nasal cannula (HFNC) prolongs the time to oxygen (O₂) desaturation during laryngoscopy and intubation in pre-oxygenated, apneic patients.¹ HFNC devices have disadvantages that limit routine use, including the need for specialized equipment and complex setup, which are expensive (both in equipment costs and O₂ resources).² Further, admixing air in the oropharynx may significantly reduce alveolar O₂ delivery. To mitigate these disadvantages, a novel pharyngeal O₂ delivery device (PODD) was developed to provide O₂ therapy directly above the glottic opening. The device is a curved, dual-channel plastic insert that couples to both O₂ supply and gas analyzer tubing. The PODD readily fits within a traditional oropharyngeal airway. These are easily placed in the patient's airway to provide supraglottic oxygenation. To facilitate intubation, the PODD is uncoupled from the traditional oropharyngeal airway and left in place to provide continuous O₂ delivery during laryngoscopy. We hypothesized that the PODD will provide apneic oxygenation as effectively as HFNC, yet at lower O₂ flow rates.

Methods: Using an airway manikin (Laerdal Airway Management Trainer) and a test lung that approximates an adult functional residual capacity (2.5L), we compared the efficacy of the PODD with HFNC at maintaining O₂ concentration in the pre-oxygenated, apneic lung. In each trial, the test lung was pre-oxygenated to 97% and a multi-gas analyzer measured the O₂ concentration each minute for 20 minutes. Four arms were studied: HFNC flow rates of 20 liters-per-minute (LPM) and 60 LPM, PODD flow rate of 10 LPM, and a control arm with no flow after the initial pre-oxygenation period. Five randomized trials were performed for each arm, for a total of 20 trials. Descriptive statistics and ANOVA were used with statistical significance defined as P<0.05.

Results: Mean O₂ concentrations decreased from 97% in the groups as follows: 41±0% for the control, 90±1% for the HFNC 20 LPM, 88±2% for the HFNC 60 LPM, and 97±1% (no change) for the PODD 10 LPM.

Conclusion: The PODD maintained O₂ concentration longer than HFNC in this apneic oxygenation manikin model. The PODD uses lower O₂ flow rates, is less expensive, is more compact, is easily placed, and requires no additional equipment as compared to HFNC. The PODD has potential applications in both controlled airway settings and pre-hospital or austere environments with limited O₂ supplies and warrants future study.



¹ Oliveira J E Silva L, Cabrera D, Barrionuevo P, et al. Effectiveness of Apneic Oxygenation During Intubation: A Systematic Review and Meta-Analysis. *Ann Emerg Med*. 2017;70(4):483-494.e11.

² Nishimura M. High-Flow Nasal Cannula Oxygen Therapy Devices. *Respir Care*. 2019;64(6):735-742.