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RESEARCH ARTICLE

HIGH-FLOW NASAL OXYGEN THERAPY: AN ALTERNATIVE TO PRE-OXYGENATION IN THE OPERATING ROOM

Farjia D¹, ezzahiri M¹, belgaout A¹, Chabar S¹, Faouji F¹, Mounir A¹, Kettani C¹, Barrou L^{1*}

¹Central surgical intensive care unit, ibn rochd university hospital, faculty of medicine and pharmacy of casablanca, Hassan 2 university, Casablanca, Morocco

*mehdimabchour001@gmail.com

ABSTRACT

High-flow nasal oxygen therapy (HFO) is a device that supplies warmed and humidified inspiratory gas through a nasal cannula at higher flow rates than conventional oxygen therapy, with an inspired oxygen fraction that can fluctuate from 21% to 100%. The primary aim of our study is to compare the efficacy of ONHD versus face mask. This trial was an experimental cohort study carried out at the Central Block of the Ibn Rochd University Hospital in Casablanca, over a period of three months, and involved 40 patients distributed into two groups: the face mask PO group (n=20) and the ONHD PO group (n=20). We evaluated apnea time without desaturation (SPO₂>95%), mean SPO₂ during pre-oxygenation and apnea time, ETCO₂ value after intubation and the frequency of complications during pre-oxygenation. The results show that ONHD compared with the face mask prolongs the duration of apnea without desaturation (SPO₂>95%), especially in high-risk patients, especially obese individuals.

Introduction

The primary objective of the anesthesiologist in perioperative medicine is to reduce both intraoperative and postoperative mortality and morbidity. According to the most recent data, over 10% of patients undergoing surgery develop at least one postoperative pulmonary complication.¹

The OHD, or high-flow oxygen therapy device, delivers heated and humidified inspiratory gas through a nasal cannula, with higher flow rates than those used in conventional oxygen therapy.²

This technique's potential mechanisms encompass generating continuous distending pressure and enhancing the washout of nasopharyngeal dead space.^{3,4}

The primary aim of our study is to compare the efficacy of ONHD versus face mask.

Material and method

We performed a randomized, controlled trial to compare nasal high-flow therapy with standard care (no nasal high-flow therapy or supplemental oxygen) on patients who underwent surgery under general anesthesia. The study was carried out in the Central Block of the Ibn Rochd University Hospital in Casablanca, comprising the gynecological and visceral surgery operations rooms. The study took place over a three-month period, from February to April 2022.

Results

For our study, there were 40 eligible patients, 20 patients benefited from pre-oxygenation

with OHND, and 20 patients with a high-concentration mask.

For group 1 (face mask n=20), the average age is 51.15 years, while for group 2 (ONHD n=20), the average age is 52 years, Series 1 is predominantly female (60%). Series 2 is predominantly female (70%). As regards the criteria for intubation or difficult ventilation, there was no difference between the first and 2nd groups in our series. There was no difference in the baseline SpO₂ before preoxygenation between the two groups.

In the first group, 45% of patients presented complications during face mask pre-oxygenation. Hypercapnia accounted for 58% of complications, while desaturation was noted in 42% of patients with complications, on the other hand, in the second group, complications were noted in 35% of cases. Hypercapnia and desaturation were the two complications noted.

Regarding ETCO₂ values after intubation, for our population (n=40), in general, there was no significant difference between the two groups. In our series, there was no difference between the groups in terms of procedure duration.

All participants in this study were transferred to general wards from the recovery room without any sedation-related complications.

Discussions

Pre-oxygenation, also known as denitrogenation, consists in replacing nitrogen from ambient air, which contains 78% nitrogen and 21% oxygen, with oxygen from pure oxygen breathing at 100% fiO₂ before any induction of general anaesthesia.⁵

The major benefit of PO is to prolong apnea without desaturation, by increasing oxygen reserves, which are generally localized in the body in different sites, including pulmonary, plasma and globular oxygen reserves, but which do not allow sufficient oxygenation to be maintained during apnea; this requires optimization of these reserves by $FIO_2=100\%$, which will multiply oxygen reserves 3-fold, more than two-thirds of which are located in the CRF, since these compartments are not equivalent in terms of kinetics. The CRF is therefore the main oxygen reservoir during pre-oxygenation.^{2,6}

David and all found that when comparing apnea time without desaturation $SPO_2 < 95\%$ between PO by face mask and ONHD, with PO in the proclivity position in both ONHD (fresh gas flow 40L/minute) and face mask (fresh gas flow L/minute) groups, PO by ONHD showed its advantage in terms of prolonging apnea time without desaturation, since it was longer in ONHD with an average of 261.4 seconds, compared with an average of 185.5 seconds with the face mask, so the minimum saturation value was higher with ONHD, with $SPO_2=91\%$, compared with 87% with the face mask, and there was no significant difference in the $ETCO_2$ value after intubation.⁷

The physiological effects and mechanisms of action of HFNO include the following: high and constant FiO_2 thanks to the elimination of ambient air entrainment, pharyngeal dead space washout, PEEP effect, reduced work of breathing and improved mucociliary clearance and patient comfort.^{3,8}

Studies shows that ONHD reduce the work of breathing because measures of inspiratory effort and metabolic work of breathing significantly decreased during HFNC therapy.⁹

Recently, ONHD has gained widespread and rapid adoption as a standard oxygen delivery system, particularly for patients with compromised oxygenation function. Recent randomized controlled trials indicate that HFNC, at the very least, is comparable to noninvasive ventilation.¹⁰

Studies carried out in intensive care settings have demonstrated an improvement in minimum oxygen saturation in the ONHD group compared with the face mask in peri-intubation and acute respiratory failure.¹¹

Conclusions

In conclusion, our analysis shows that ONHD can be an alternative to conventional pre-oxygenation in the operating theatre, especially for at-risk patients, mainly obese subjects.

ONHD enables apneic oxygenation during the apnea period, thereby prolonging apnea time.

Despite the small size of our population, it would seem that ONHD would be beneficial in the management of patients at risk of rapid desaturation during apnea.

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