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Automation of oxygen titration in patients with acute respiratory distress at the emergency department. A multicentric international randomised controlled study

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Introduction

Oxygen therapy is commonly administered in critical care and emergency medicine. Its benefits are well known but potential side-effects may be underestimated. Compliance to recommendations remains dependent on staff workload. We developed $FreeO_2$, an innovative device that automatically titrates oxygen flow delivered through nasal cannulas or masks to maintain the patients in the SpO_2 target set by the clinician[1].

Objectives

To compare $FreeO_2$ with oxygen manual adjustment, in patient admitted to the emergency department (ED) for acute respiratory failure (ARF).

Methods

We conducted a multicentre randomized controlled study. Inclusion criteria were: admission to ED for ARF requiring $O_2 \geq 3$L/min. Main exclusion criteria were: $O_2 \geq 15$ L/min, immediate need for ventilatory support. After inclusion, patients were randomized to either $FreeO_2$ or conventional O_2 manual adjustment during 3 hours. The randomization was web-based and stratified for the type of respiratory failure (hypoxemia/hypercapnia) and for the centre. Primary outcome was the % of time with SpO_2 within the predefined target (92-96% for hypoxemic patients; 88-92% for hypercapnic patients). Secondary endpoints were: frequency of severe hypoxemia ($SpO_2 < 85\%$) and hyperoxia ($SpO_2 > 98\%$), partial or complete oxygen weaning at the ED, total O_2 duration, ventilator support use, ICU admissions, ICU and hospital LOS.

Results

187 patients were randomized (93 $FreeO_2$ and 94 Manual). Baseline physiological characteristics were similar in the 2 groups: age = 76 ± 12 yrs., 35% of COPD patients; mean O_2 flow at inclusion was 5.8 ± 3.1 L/min. No serious adverse events related to the protocol or device was recorded. The percentage of time within the SpO_2 target was 81 ± 21% in the $FreeO_2$ arm and 51 ± 30% in the Manual arm ($P < 0.001$). Percentage of time with severe hypoxemia and with hyperoxia were significantly lower with $FreeO_2$ ($P < 0.001$). The percentage of patients with O_2 flow reduction of more than 50% during the 3 hours of the study was 39% with $FreeO_2$ vs 19% in the Manual arm ($P = 0.011$). Percentage of O_2 weaning at the end of the study (3h) was 4.3% in the $FreeO_2$ arm vs. 14.1 % in the Manual arm; $p < 0.001$. Significantly less patients in the hypercapnic subgroup were transferred in the ICU, overall O_2 administration and hospital LOS were significantly reduced in the non-adjusted analysis (9.2 ± 6.9 vs 11.1 ± 7.0, $P = 0.01$).

Conclusions

The automation of oxygen therapy with $FreeO_2$ at the ED improves the oxygenation parameters with more time in the specified SpO_2 target, less desaturation and less hyperoxia. $FreeO_2$ may reduce staff workload and improve the compliance to recommendations for oxygen administration with potential related clinical benefits

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