Cerebral and splanchnic oxygenation during automated control of inspired oxygen (FiO_2) in preterm infants

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Background

The normal newborn controls his or her blood oxygen levels through continuous physiological feedback loops that adjust the rate and depth of respiration automatically as needed. The pulmonary system in the newborn preterm infant is often underdeveloped and less effective, sometimes requiring mechanical ventilation. The ventilator is typically adjusted by a clinician in response to fluctuations in the newborn's status. Fine control of ventilation requires excellent support equipment and a clinician to respond quickly and appropriately to the unstable pulmonary conditions seen in preterm infants. An overzealous adjustment in ventilator settings can result in hyperoxia, increasing the risk of retinopathy of prematurity and even bronchopulmonary dysplasia. An ineffective or delayed adjustment in the settings may allow hypoxia with its associated bradycardia.

Study methods

This was a randomized crossover clinical trial comparing 12-hour treatment phases of routine manual adjustments vs. automated adjustments of FiO_2. The target preductal SpO_2 was 90-95% during both phases. The authors enrolled 20 preterm (<32 weeks) infants in a tertiary care neonatal intensive care unit and measured cerebral (rSO_2C) and splanchnic (rSO_2S) oxygenation. From these values, cerebral and splanchnic oxygen extraction ratios were calculated. The primary endpoint of the study was the comparison of rSO_2C changes during the two phases of the study. Secondary endpoints included rSO_2S, oxygen extraction, and time spent with SpO_2 <80%, 90-95%, and >90%.

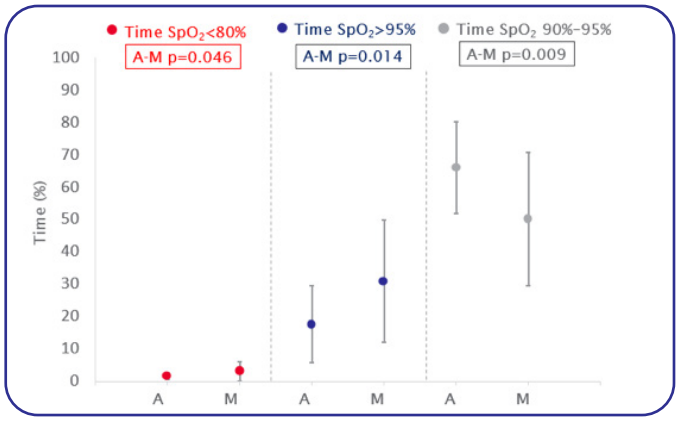

Figure 1 Comparison of the SpO_2 outcome measurement during automated (with PRICO) (A) and manual (M) control of FiO_2. Time spent with SpO_2 90%–95% was higher during the automatic than manual control of FiO_2, while time spent with SpO_2 <80% or>95% was lower.

Results

The mean gestational age of the infants was 27.6 weeks and average birth weight was 1027 ± 656 grams. rSO_2C and rSO_2S as well as oxygen extraction were similar during both phases. The time in the desired oxygenation range was significantly higher using PRICO vs. manual control (66% vs. 50%, p = 0.009). The amount of time in hyperoxemia was lower with PRICO vs. manual control (17.6% vs. 30.9%, p = 0.045) and the amount of time in hypoxia was lower in PRICO vs. manual control (1.6% vs. 3.0%, p = 0.014). While the results did not show significant differences in cerebral and splanchnic oxygenation during automated control of inspired oxygen (FiO_2), the results of this study showed a difference for the secondary endpoint with regards to time of both hypoxemia and hyperoxemia. The authors concluded that PRICO resulted in less hypoxia and hyperoxemia, decreased SpO_2 fluctuations, and improved SpO_2 stability in preterm infants.

What is PRICO

An automated system for controlling ventilator settings mimics the body's normal physiology, resulting in the diligence and responsiveness needed for vulnerable infants. PRICO (Predictive Intelligent Control of Oxygenation) by Vyaire is an intelligent closed-loop function that measured patient's oxygen saturation (SpO_2) and automatically adjusts the fraction of inspired oxygen (FiO_2). Together with SpO_2 sensors, PRICO performs FiO_2 adjustments automatically, quickly, and reliably.

PRICO is available on fabian™ HFO, fabian™ +nCPAP and fabian™ Therapy evolution.

PRICO

Take home message

By reducing fluctuations in SpO_2 and duration of both hypoxemia and hyperoxemia, PRICO has the potential to improve clinical outcomes and reduce risk of retinopathy of prematurity or bronchopulmonary dysplasia.

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