ETCO2 Monitoring of Neonates During Conventional Ventilation

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Background: Monitoring of EtCO2 sampled from the carina (using double lumen ETT and Carinal VitaLine) may allow continuous, non invasive real-time assessment of CO2 as opposed to arterial PaCO2 which is sampled intermittently per the decision of the treating physician. Thus, carinal EtCO2 may improve the control of ventilation over time, and thus may protect infants from the complications of hypocarbia and hypercarbia throughout the period of mechanical intubation. Previous study1 demonstrated the correlation and agreement between carinal EtCO2 and PaCO2 and showed that it was more accurate than the standard mainstream EtCO2. Following this we would like to demonstrate that it could have clinical benefits in the care of ventilated infants.

Aim: The aim of this study was to compare the time spent within a defined safe range of carbon-dioxide (30 mmHg<PaCO2<60 mmHg), during conventional ventilation between infants monitored with carinal ETCO2 and those who are not.

Methods: A randomized, controlled multicenter study was conducted at 3 tertiary care university- affiliated NICUs. Sidestream ETCO2 was measured and recorded by a Microstream capnograph (Covidien) via the sampling port of a specialized endotracheal tube and Carinal Vitaline set. Enrolled infants were randomized to: 1. Open group: Data derived from the capnograph was displayed to the medical team and allowed to be used for patient care, 2. Masked group: The measurements were masked to the medical staff and hence were not available for patient care. ETCO2 was compared with PaCO2 drawn for patient care.

Results: Fifty-five infants (24 open, 31 blinded) participated in the study; groups were comparable. Analysis included 768 simultaneous measurements of ETCO2 and PaCO2, 13 [3-35] measurements per/patient, during 37.1 [5.3-132.0] hours per/patient. ETCO2 was in good correlation (r=0.73, p<0.001) and agreement (Bland Altman plot: mean difference± SD of the differences: 3.1±8.5 mmHg) with PaCO2. Infants in the masked compared to the open group spent significantly (p<0.01) more time at unsafe range of high (>60 mmHg: 8.8 vs. 3.7%, respectively) or low (<30 mmHg: 8.7 vs. 3.9%, respectively) levels of ETCO2. Arterial blood gas analysis results also show that the
monitored group had significantly larger rate of arterial blood gas sampling within the safe PaCO$_2$ range (p<0.05) and the safe pH range (7.25<pH<7.45, p<0.05). No adverse events occurred in the enrolled infants.

**Conclusions**: ETCO$_2$ monitoring was found to improve the control of CO$_2$ levels within a safe range during conventional ventilation. We speculate that this could decrease the sequel of hyperventilation and hypoventilation in these infants.