

Abstract Title:

Accuracy of continuous end-tidal carbon dioxide monitoring in ventilated neonates in the cardiovascular intensive care unit

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Abstract Description:

Background: Continuous end--tidal carbon dioxide (ETCO₂) monitoring is routinely used in critically-ill adult and pediatric patients; however, it is not routinely used in the neonatal intensive care unit (NICU). Ironically, the neonatal population may be one that benefits most by tighter control of arterial pCO₂, as both hypercarbia and hypocarbia have been associated with adverse outcome (intraventricular hemorrhage (IVH) and chronic lung disease (CLD) respectively). Unfortunately arterial blood gas (ABG) sampling, the gold standard for assessing carbon dioxide levels in neonates, is invasive, intermittent, and requires taking blood from infants who have a small total blood volume reserve. At our institution, all ventilated patients, regardless of age or size, admitted to the cardiovascular intensive care unit (CVICU) are placed on ETCO₂ monitoring, while infants admitted to the NICU are not.

Objective: To assess the accuracy of ETCO₂ monitoring in neonates in the cardiovascular intensive care unit (CVICU).

Design/Methods: This was a retrospective, single center cohort study of ventilated neonates with an indwelling arterial catheter admitted to the CVICU from January 1, 2013 to August 8, 2018. Neonates were defined as patients of all gestational ages, 30 days or less. Using a electronic database warehouse, real-time data was abstracted on ETCO₂ measurement at the time of each ABG sampling. ABG PaCO₂ and simultaneous ETCO₂ measurements were analyzed for accuracy and correlation using linear regression analysis and mixed regression analysis.

Results: A total of 15,314 dyad measurements were obtained from 578 patients. In general, PaCO₂ was higher than ETCO₂ with an average difference of 10.4 mmHg (SD=7.3) and limits

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of agreement of 4.2 to 25.0mmHg. The correlation coefficient between the two measurements is 0.614. The difference between PaCO₂ and ETCO₂ (PaCO₂-ETCO₂) was greater in <30 week gestational age neonates than neonates with a gestational age ≥ 35 weeks (Diff+SD [n=x] vs. Diff+SD [n= y] respectively, p=0.015). PaCO₂ –ETCO₂ in 30-34 week gestational age neonates was not significantly different from those with a gestational age ≥ 35 weeks (p=0.769).

Conclusion(s): There is moderate agreement between ETCO₂ and PaCO₂ in ventilated neonates with cardiac conditions. Our study suggests that continuous ETCO₂ monitoring may provide useful trending information in the neonatal population, but may be less reliable in extremely preterm infants. Future studies will be focused on neonates of various gestational ages in the NICU to investigate its applicability in the patient populations without cardiac disease.