Breath-to-breath variability of exhaled CO2 as a marker of lung dysmaturity in infancy

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The concept of diffusional screening implies that breath-to-breath variations in CO2 clearance, when related to the variability of breathing, may contain information on the quality and utilization of the available alveolar surface. We explored the validity of the above hypothesis in a cohort of young infants of comparable post-menstrual age but born at different stages of lung maturity, namely, in term-born infants (N = 128), preterm-born infants without chronic lung disease of infancy (CLDI) (N = 53) and preterm infants with moderate/severe CLDI (N = 87). Exhaled CO2 volume (VE,CO2) and concentration (FE,CO2) were determined by volumetric capnography, while their variance was assessed by linear and non-linear variability metrics. The relationship between relative breath-to-breath change of VE,CO2 (∆VE,CO2) and the corresponding change of tidal volume (VT), was also analyzed. Non-linear FE,CO2 variability was lower in CLDI compared to term and non-CLDI preterm group (P<0.001 for both comparisons). In CLDI infants, most of the VE,CO2 variability was attributed to the variability of VT (R(2) 0.749), while in term and healthy preterm infants this relationship was weaker (R(2) 0.507 and 0.630, respectively). The ∆VE,CO2-∆VT slope was less steep in the CLDI group (1.06 ś 0.07) compared to non-CLDI preterm (1.16 ś 0.07; P <0.001) and term infants (1.20 ś 0.10; P <0.001), suggesting that the more dysmature the infant lung the less efficiently it eliminates CO2 under tidal breathing conditions. We conclude that the temporal variation of CO2 clearance may be related to the degree of lung dysmaturity in early infancy.
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