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Title: Within-breath changes in respiratory impedance in healthy neonates

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Body: There are limited data on respiratory impedance (Zrs) in healthy newborns and infants and the within-breath changes of Zrs are not known. We aimed to measure Zrs and the cyclic changes of resistance (R) and reactance (X) as functions of lung volume (V) and respiratory flow (V') in healthy term newborns. Neonates (n=37) were measured during natural sleep. Forced oscillations at 16 Hz were superimposed on breathing via the face mask. Zrs was estimated with the wave tube technique and V' was measured with a pneumotachograph. Steady-state breathing cycles were selected for the analysis of R and X which were compared at minimum (Vmin) and maximum volume (Vmax), peak inspiratory (V'in) and expiratory (V'ex) flow. The V' dependence of R was much more marked than the influence of V (see Figure). The difference between R at Vmin (29.0±10.9 $cmH_2O.s/l$) and Vmax (28.9±10.7) was negligible, whereas R at V'ex (53.3±22.4) and V'in (45.1±26.2) were far higher than the zero-flow values in the corresponding breathing phase ($P<0.001$). Interestingly, X at Vmax (-6.9±3.0 $cmH_2O.s/l$) was significantly more negative ($P<0.001$) than at Vmin (-5.1±5.0 $cmH_2O.s/l$). We conclude that the marked changes in Zrs during tidal breathing in healthy newborns are due to flow nonlinearities in the narrow nasal and glottal pathways. The absence of the V dependence of R may be a result of opposing changes in tissue resistance and airway resistance at Vmax.