Am J Respir Crit Care Med. 1996 Nov;154(5):1537-42.

Use of a magnified cardiac airflow oscillation to classify neonatal apnea.

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Abstract

Currently the classification of neonatal apnea relies upon an inference of airway closure based upon the presence of breathing efforts against such an obstruction. In this study we evaluate a new method of classification which utilizes the presence or absence of cardiac airflow oscillation to detect airway closure. Specifically, this evaluation consisted of an examination of the transmission characteristics of an artificially produced airflow oscillation through discrete airway narrowing in a model system; a confirmation that voluntary upper airway occlusion in adult volunteers uniformly induces complete loss of the oscillation; and a comparison of the cardiac oscillation method with the traditional method of apnea classification in a cohort of 4,309 apneas in 32 infants. We determined that the amplitude of the oscillation is negatively correlated with resistance ($r = 0.97$) and positively with the radius ($r = 0.98$) of narrowing in a model system, and that voluntary airway obstruction in adult subjects uniformly results in loss of transmitted cardiac oscillations. Moreover, although there was similarity in the frequency distribution of central, obstructive, and mixed apneas in our infants, there were statistically significantly greater obstructive events detected by the cardiac oscillation method. In addition, the cardiac oscillation method had the additional advantage of providing information regarding the timing of airway obstruction during apnea.