

Noninvasive motion ventilation (NIMV): a novel approach to ventilatory support.

非侵入式移動呼吸(NIMV): 一項新式的呼吸方法

Adams JA, Mangino MJ, Bassuk J, Inman DM, Sackner MA.

J Appl Physiol 2000; 89:2438-2446. A motion platform was developed that oscillates an animal in a foot-to-head direction (z-plane). The platform varies the frequency and intensity of acceleration, imparting periodic sinusoidal inertial forces (pGz) to the body. The aim of the study was to characterize ventilation produced by the noninvasive motion ventilator (NIMV) in animals with healthy and diseased lungs. Incremental increases in pGz (acceleration) with the frequency held constant ($f=4$ Hz) produced almost linear increases in minute ventilation (VE). Frequencies of 2-4 Hz produced the greatest VE and tidal volume (VT) for any given acceleration between ± 0.2 and ± 0.8 G. Increasing the force due to acceleration produced proportional increases in both transpulmonary and transdiaphragmatic pressures. Increasing transpulmonary pressure by increasing pGz produced linear increases in VT, similar to spontaneous breathing. NIMV reversed deliberately induced hypoventilation and normalized the changes in arterial blood gases induced by meconium aspiration. In conclusion, a novel motion platform is described that imparts periodic sinusoidal acceleration forces at moderate frequencies (4 Hz) to the whole body in the z-plane. These forces, when properly adjusted, are capable of highly effective ventilation of normal and diseased lungs. Such noninvasive ventilation is accomplished at airway pressures equivalent to atmospheric or continuous positive airway pressure, with acceleration forces less than ± 1 Gz.

一項由頭往腳方向(z平面)搖動動物的移動平台被研發出來了。此平台變更加速度的頻率及強度，傳遞周期性正弦慣性力量(周期性加速度)到身體。此研究的目的是將非侵入式移動呼吸(NIMV)運用在動物身上之健康與生病的肺時所產生的呼吸特點。周期性加速度以持續頻率($F=4\text{Hz}$)所產出的增量幾乎線性增加於每分鐘的呼吸量(VE)。2-4 Hz的頻率在 ± 0.2 及 $\pm 0.8\text{G}$ 的強度間產出最大的呼吸量(VE)及潮氣量(VT)。增加強度是因為所產生的加速度使得肺間壓以及肺泡與肋膜間的壓力等比例增加。以增加周期性加速度(pGz)來增加肺間壓，讓潮氣量(VT)線性增加，類似自發性呼吸。非侵入式運動呼吸(NIMV)徹底改變肺泡換氣不足，並讓因吸入胎便所導致的動脈血氣交換正常化。總之，所描述的新式移動平台以適當的頻率(4Hz)，在z-平面上將周期性正弦加速度力量傳遞到全身。這些力量，當適當調整，就可以讓健康或不健康的肺高效能呼吸。此非侵入式呼吸是以小於 ± 1 Gz的力量，在呼吸道壓力與大氣壓力或持續性呼吸道正壓等量時完成。