2017

CHARACTERISTICS OF AEROSOLS GENERATED DURING A COUGH. D.G. Frazer, W.T. Goldsmith, A.A. Afshari, N. Philips, K.C.Weber and E.L. Petsonk, PPRB, HELD and CIB DRDS, NIOSH, MORGANTOWN, W.V. 26505.

A system including a spirometer and LAS-X particle analyzer was designed to examine aerosols generated during a cough. The system was held at 37°C in a temperature controlled chamber . Air was pulled through a HEPA filter and the spirometer at a constant rate (5 l/min) so that aerosols introduced to the spirometer-aerosol analyzer system were continuously washed out. A subject breathing ambient air coughed into the spirometer, then breathed HEPA filtered air and coughed at 2 min intervals for 6 min. Background aerosol measurements were recorded prior to each cough. Preliminary experiments showed that the difference in the number of particles recovered from the spirometer with respect to background (NPD) was greatest following the first cough, was reduced during the second cough, but tended to increase following the third and fourth coughs. Particle diameters ranged between 0.1 and 5.0 µm after each cough, and more that 95% of the particles had diameters less than 1.0 µm. Results also showed that there was a significant variation in NPD (±300%) between subjects following each of the four coughs.

2018

CUMULATIVE GAS TRAPPING IN ASSOCIATION WITH INFLATION/ DEFLATION CYCLES IN EXCISED RAT LUNGS. G. N. Franz and D. G. Frazer. West Virginia Univ. School of Medicine, HSC-N, Box 9229, Morgantown, WV 26506-9229, and Division of Respiratory Disease Studies, NIOSH, Morgantown, WV 26505.

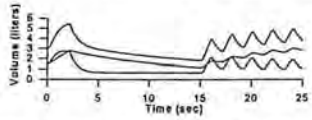
In the first case considered, inflation of excised rat lungs to 50% of TLC and subsequent deflation to an end-expiratory pressure of -5cm H_2O produces a new, higher residual volume due to the "trapping" of gas by previously inflated lung units. Re-inflating the lung to the previous end-expiratory volume *plus* the volume of the previously trapped gas produces a deflation curve very similar to the preceding one, except for a parallel upward shift. Successive re-inflations and deflations produce a family of volume-pressure curves with these characteristics: (1) the volume change upon inflation stays fixed as the end-inspiratory volume is always incremented by the gas volume trapped in the previous cycle, (2) re-inflation starts from ever higher end-expiratory volumes as the trapped gas volume cumulatively rises, and (3) deflation curves of nearly identical shape are shifted upward in a parallel manner as they start from an ever higher end-inspiratory volume.

In the second case considered, the lungs are inflated to TLC and then deflated to an end-expiratory pressure of -5cm H_2O. Successive re-inflation/deflation cycles generate cumulative additions to trapped gas volume. While the end-inspiratory volume stays at about TLC, end-expiratory volume rises as progressively smaller increments of trapped gas volume are revealed by successive deflations. The preceding phenomena are compatible with these notions: (1) gas trapping occurs during inflation. (2) the gas volume trapped in a lung unit is close to that unit's maximal volume, (3) peripheral units experience trapping before central units, and (4) gas trapping in some units makes it easier for other units to undergo gas trapping on a subsequent re-inflation.

2019

Computer Simulation of Ventilation After Lung Volume Reduction Surgery (LVRS) or Lung Transplantation (LT). S.H. Loring and D.E. Leith, Beth Israel Deaconess Medical Center, Boston, MA 02215.

LVRS and LT change the mechanical relationships among left and right lungs and chest wall for good or ill. We developed a computer model that simulates pre-operative and predicts post-operative ventilatory function using a patient's preoperative mechanical characteristics and assumed normal properties for transplanted lung or reduced lung compliance due to reduced lung mass after LVRS. Pressure-volume characteristics of each lung are represented by the coefficients of Salazar and Knowles, and pressure-flow characteristics are fitted to spirometric data. Expiratory flow limitation is simulated for each lung according to the equal pressure point formulation of Mead. The mediastinum is assumed to be compliant, and chest wall pressures are simulated during selected patterns of ventilatory muscle activity and relaxation. The Figure shows individual and summed volume-time plots of a native emphysematous lung and a normal transplanted lung during a forced vital capacity and forced hyperpnea. During hyperpnea, the native lung becomes progressively hyperinflated while the transplanted lung becomes progressively less inflated as average pleural pressures become more positive. (Supported by HL-52586.)



2020

DIAPHRAGM SHORTENING DURING PRESSURE SUPPORT VENTILATION.

J. Pierce, J. Trank, E. Gilliland, N. Smith-Blair and R. Clancy. University of Kansas Medical Center, Kansas City, KS 66160.

The aim of this study was to determine the effect of pressure support ventilation (PSV) on diaphragm shortening (DS) and other cardiopulmonary parameters. DS was measured using a single crystal ultrasonic transducer glued to the inferior surface of the right hemidiaphragm. DS is expressed as the change in diaphragm thickness during inspiration divided by diaphragm thickness at end expiration. This ratio is defined as fractional thickening (FT). In 15 anesthetized Sprague-Dawley male rats, PSV was increased from 0 to 10 cm H_2O in 2 cm H_2O increments every 2 mins. At each level of PSV the following parameters were measured: respiratory rate (RR), end-tidal CO_2 ($EtCO_2$), tidal volume (Vt), positive inspiratory pressure (PIP), intrathoracic pressure (ITP) and FT. Increasing PSV to 10 cm H_2O resulted in: RR ↓ by 25% and $EtCO_2$ ↓ by 9%. Whereas, increasing PSV to 10 cm H_2O resulted in: Vt ↑ by 5 cc, PIP ↑ by 9.4 cm H_2O, CVP ↑ by 98%, and ITP ↑ by 55%. All of the above changes were statistically significant at $p < 0.05$. Increasing PSV from 0 to 10 cm H_2O resulted in FT ↑ by 10%, however this was not statistically significant. In conclusion, the decrease in the work of breathing due to PSV was not associated with a decrease in diaphragm shortening as measured by FT. (NIH NINR KO7NR00059-03)

CONTROL OF BREATHING II (2021-2022)

2021

RESPIRATORY EFFECTS OF A PRENATAL DIETARY PROTEIN RESTRICTION ON MATURE RATS. P. Gressens, S. M. Muaku, L. Besse, E. Nsegbe, J. Gallego, B. Delpech, C. Gaultier, P. Evrard, J. M. Ketelslegers and D. Maiter.

Robert-Debré Hospital, Paris, Henri-Becquerel Center, Rouen, France, University of Louvain Medical School, Brussels, Belgium.

We studied the hypoxic response of ten rats exposed to a prenatal dietary protein restriction during the two first weeks of gestation. Breathing pattern was measured using a whole body plethysmograph. Each animal received 3 hypoxic tests consisting of a linear decrease in F_IO_2 from 21% to 8% in 3 min. Hypoxic responses were grossly similar in depleted and control rats. However, V_T and V_I increased during the 30 first seconds of hypoxia in the depleted rats, whereas V_T and V_I decreased in controls (interaction $P<0.017$).These changes were due to changes in V_T, not T_{TOT}. In the depleted rats, the time to peak V_T significantly decreased from 199±32 sec in the first test to 156±27 s in the third test, whereas it did not vary in controls (interaction $P<0.016$). Taken together, these data suggested that the hypoxic depression was slightly impaired in mature rats which have been exposed to protein restriction during gestation.

Supported by CRI INSERM

2022

HYPOXIA DOES NOT ALTER BREATHING PATTERN IN FLYING MAGPIES (*Pica pica*). D.F. Boggs, R.W. Bavis, D.L. Kilgore, Jr., P.M. Schmitt and K.P Dial. The University of Montana, Missoula, MT 59812.

Magpies and other birds tend to coordinate respiratory and wingbeat cycles to minimize the mechanical interference and to maximize the potential assistance of the wingbeat cycle to ventilation. We previously demonstrated that stimulating breathing with 5% CO_2 in flight did not disrupt this coordination. Because hypoxia is more likely than hypercapnia to alter respiratory frequency, we exposed 3 magpies to 12% O_2 (P_IO_2 = 82 torr, equivalent to an altitude of 5,200m) while flying in a wind tunnel at their preferred speed (6-7 m s^{-1}). We found that although this level of hypoxia significantly increased respiratory frequency in the resting birds (from 41.3 ± 1.4 (S.D.) to 55 ± 0.8 breaths min^{-1}) it had no effect on respiratory frequency in flying birds (164.2 ± 13.8 normoxia vs 166.8 ±18.5 hypoxia), and since the wingbeat frequency was also unchanged the ratio of flaps to breaths remained the same. Interclavicular airsac gas measurements indicate that there is a hyperventilation in flight:

	Rest		Flight	
	PO_2 (torr)	PCO_2 (torr)	PO_2 (torr)	PCO_2 (torr)
normoxia (n=3)	89.6 (±2.1)	33.9 (±3.1)	101.6 (±0.25)	27.3 (±1.65)
hypoxia (n=2)	44.7	27.3	58.5	20.8

Hyperventilation with flight may have raised PO_2 sufficiently to remove this moderate hypoxic stimulus to increase frequency, or the control mechanisms responsible for respiratory-locomotor cycle coordination may be more influential than chemoreceptor input in controlling breathing pattern.

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ABSTRACTS

SUNDAY MORNING
April 6, 1997

SUNDAY AFTERNOON
April 6, 1997

MONDAY MORNING
April 7, 1997