RELATIONSHIP BETWEEN HYSTERESIS AND CRACKLES IN CONTROL AND TWEEN 20-RINSED, EXCISED RAT LUNGS

D. G. Frazer[1], W. Cheng, and E. L. Petsonk[2]

[1] Engineering and Control Technology Branch,
Health Effects Laboratory Division
and
[2] Surveillance Branch
Division of Respiratory Disease Studies

National Institute for Occupational Safety and Health
Morgantown, WV
USA

We have examined the relationship between pulmonary hysteresis and the recruitment-derecruitment of lung units (Cheng et al., 1995). The recruitment process is represented by a sequence of discrete events, in which each event represents a configurational change in the lung tissue structure. There is evidence that energy is dissipated in the form of crackles during this process. The goal of this study was to record the energy dissipated as lung sounds, measured at the trachea for lungs inflated from different end-expiratory pressures, and correlate sound energy with the normalized hysteresis of individual pressure-volume (P_L-V_L) loops recorded for excised rat lungs. P_L-V_L curves were also recorded for lungs rinsed with Tween 20, a nonionic detergent, to estimate the role of alveolar surfactant on the recruitment-derecruitment process.

It was found that lung sound energy and P_L-V_L loop hysteresis were highly correlated and similarly related to end-expiratory pressure. In experiments involving Tween 20 rinsed lungs, the lung sound energy had nearly the same relationship with end-expiratory pressure as control lungs, while the hysteresis index had two distinct inflection points. One inflection point occurred at low end-expiratory pressures, similar to control lungs, while the second occurred at much higher end-expiratory pressures. These results indicate that there may be two populations of lung units, one which is altered by Tween 20 and another which is not. The population not affected by Tween 20 appears to be responsible for producing discrete lung sounds and may represent the opening of larger conducting airways. The second population, possibly within the respiratory zone, is affected by alterations in surface tension and contributes to pulmonary hysteresis but, apparently, does not contribute significantly to lung sound energy measured at the trachea.

The 24th INTERNATIONAL CONFERENCE ON LUNG SOUNDS

Presented by

International Lung Sound Assocation

October 6-8, 1999

Marburg, Germany

FINAL PROGRAM AND ABSTRACTS

24th INTERNATIONAL LUNG SOUNDS CONFERENCE

MARBURG, GERMANY - OCTOBER 6 - 8, 1999

Conference Location: Institute of Physiology,

Deutschhausstr. 1, 35033 Marburg

PROGRAM

Mit Unterstützung der Deutschen Forschungsgemeinschaft

und der

Deutschen Gesellschaft für Pneumologie