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**DETERMINATION OF LUNG PATHOLOGY BY MULTI-FREQUENT ANALYSIS**

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**INTRODUCTION** Electrical Impedance Tomography (EIT) is an innovative technique that is capable of visualizing ventilation and changes in regional impedance distribution (1). Additionally, there are scientific evidences demonstrating that lung edema or atelectasis might be detected by measuring changes in thoracic impedance, using bioimpedance spectroscopy (BIS) (2). Therefore, multi-frequency EIT may be a proper candidate to combine both, advantages of EIT and BIS.

**OBJECTIVE** The aim of this study using lung segments from pig cadavers is to examine if multi-frequent impedance measurement is capable to differ between water and blood content in lung lobes.

**METHODS** In this study, we inserted either water or blood post-mortem into healthy lung lobes after anatomical partitioning. Lung lobes were taken from euthanized pigs after an unrelated animal trial that was performed in general anaesthesia followed by a spontaneous breathing period. Bioimpedance measurements were conducted in a self-made measurement chamber with a Precision LCR Meter (Agilent E4980A, Agilent Technologies) using a frequency range between 1 kHz and 1 MHz, before and after inserting water or porcine blood. Real and imaginary parts of the complex impedance Z were measured at 1 kHz, 10 kHz, 100 kHz and 1 MHz. Different indices, named α and β, were created to compare the slope of the curve (impedance over frequency). The α index is given by the equation \( \alpha = (Z(1 \text{ MHz}) - Z(10 \text{ kHz}))/ (Z(10 \text{ kHz}) - Z(1 \text{ kHz})) \), the β index is given by the equation \( \beta = (Z(100 \text{ kHz}) - Z(10 \text{ kHz}))/ (Z(10 \text{ kHz}) - Z(1 \text{ kHz})) \), for the real and the imaginary part of the complex impedance Re(Z) and Im(Z): \( \alpha_{\text{Re}}, \alpha_{\text{Im}}, \beta_{\text{Re}} \) and \( \beta_{\text{Im}} \). Statistical analysis was calculated using the Mann-Whitney-U-test, comparing air-filled, blood-filled and water-filled lung segments.

**RESULTS** For blood as compared to air, \( \alpha_{\text{Im}} \) and \( \beta_{\text{Im}} \) indices differed (p=0.048 and p=0.028); for water as compared to air \( \alpha_{\text{Re}} \) and \( \beta_{\text{Re}} \) did (p<0.001 both). Moreover, between blood- and water-filled lung segments, significant difference in \( \beta_{\text{Re}} \) occurred (p=0.002).

**CONCLUSIONS** In an experimental setting, a differentiation between intrapulmonal blood or water is possible by multi-frequency impedance analysis, regarding real and imaginary part of different indices. EIT using several discrete frequencies therefore should be able to detect specific lung pathologies.

**REFERENCES**