

Validation of MRI for Volumetric Quantification of Atelectasis in the Perioperative Period: An Experimental Study in Swine

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Background: Impairment of pulmonary aeration is a frequent postoperative complication that is associated with adverse outcome. Diagnosis and quantification of impaired pulmonary aeration by CT scan is limited due to concern for exposure to ionizing radiation. Magnetic resonance imaging (MRI) represents a potential radiation-free alternative for this use. We undertook an experimental study to validate the use of MRI to quantify pulmonary aeration impairment.

Methods: Ten *large white* pigs were studied before intubation, after intubation, 2 h after non-protective mechanical ventilation and after intra-tracheal negative pressure suction to induce atelectasis. A lung CT scan immediately followed by a lung MRI were performed at all four time points. On the 40 CT images lung volumes corresponding to non-aerated, poorly aerated, normally aerated, and overinflated voxels were measured based on their radiodensity.

Similarly, on the 40 MRI images lung volumes corresponding to non-aerated and aerated voxels were measured based on their signal intensity. The correlation between non-aerated lung by MRI vs., CT scans, and with $\text{PaO}_2/\text{FiO}_2$ measured at each of the four time points was assessed with the Pearson' correlation coefficient, bias and limits of agreement.

Results: Pearson correlation coefficient, bias and limits of agreements between the CT non-aerated lung volumes and MRI abnormal lung volumes were 0.88, -16 ml, and (-108, 77), respectively. Pearson correlation coefficient between $\text{PaO}_2/\text{FiO}_2$ and abnormal lung volumes measured with MRI was -0.60.

Conclusion: In a preclinical swine model, quantitative measurements of pulmonary atelectasis by MRI-imaging are well correlated with the gold standard, i.e., densitometric scan CT measurements.