

Evaluation of Morphological Changes during Perfusion Fixation of Lung Tissue by 3D–Optical Coherence Tomography (OCT).

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The establishment of a model for flow mechanics of alveoli as a prerequisite for the development of strategies for protective ventilation requires 3D–geometric data of the alveoli. Central points for the generation of these data are the fixation of the lung tissue omitting artefacts and a high resolution imaging. The present study investigates changes in the lung morphology in isolated–perfused rabbit lungs during the course of perfusion fixation using OCT. In a previous study we showed that OCT is able to penetrate into lung tissue up to 500 µm and that this method provides a realistic image of the alveolar geometry (1).

Isolated–perfused rabbit lungs were fixed by perfusion under continuous positive airway pressure (10 mbar) using 1.5%glutaraldehyde + 1.5%formaldehyde in HEPES–buffer (pH 7.4).

During the course of the fixation process individual alveoli were visualized continuously by 3D–OCT. There was no change in the alveolar geometry during the fixation process. After immersion fixation (24h) the trachea was disconnected for spirometry without volume change. Also the volumetric analysis of the fixated lung did not reveal any shrinkage of the lung tissue before and after pressure release. The air leaving the lung during pressure release can be explained by the pressure adaptation without volume change. This study shows for the first time that OCT in a direct way allows the evaluation of changes in the morphology of lung tissue in the course of the fixation process. The results give evidence that perfusion–fixation using glutaraldehyde and formaldehyde does not lead to artefacts by tissue shrinkage. We conclude that the applied fixation protocol allows a post fixation microscopically imaging of alveolar parenchyma without shrinkage artefacts.

(1)Popp et al. JBO 2006;11(1):14

This abstract is funded by: German Research Fondation.