

Quantitative analysis of emphysema in mice by high resolution X-ray microtomography

Andrei Postnov, University of Antwerp

Emphysema has been defined as the permanent enlargement of air-spaces distal to the terminal bronchiole, caused by destruction of alveolar walls and without significant fibrosis. As emphysema is based on an anatomical derangement, imaging techniques can be considered as a useful tool for the detection of this disease in animals. For an in vivo assessment of emphysema non-invasive imaging techniques are required. Therefore, the major purpose of the present pilot study was to analyze whether high resolution X-ray microtomography is able to detect the degree of emphysema in living mice. Lungs of healthy mice were compared with lungs affected by different degrees of emphysema.

Sixteen male, 8-week-old, C57BL/6J mice (Charles River, Germany), mean bodyweight 22.3 g [\pm 0.3 (SE)], were assigned to four treatment groups. The four mice in each group were given intratracheally 50 μ l physiological saline alone (= control vehicle) or a solution of 0,75 (low dose), 1,5 (medium dose) and 3,0 (high dose) mg/kg porcine pancreatic elastase (PPE, 281 U/mg, Serva, Germany) in saline.

For scanning, an in vivo X-ray micro-CT system was used (Skyscan 1076, Aartselaar, Belgium) without gating for cardiac or respiratory motion. Both the X-ray source (focal spot size 5 μ m, energy range 20-100keV) and the detector (CCD camera 2.3kx4k) rotated around the animal. www.skyscan.be

A visual comparison was made between virtual cross-sections through the chest area in living mice suffering from emphysema and in control mice. The lungs with emphysema were markedly less dense with more void spots. Frequency distribution of the grey values in the whole dataset of the differently treated mice was estimated. 3D models were built. The volume of the lungs with emphysema proved to be larger than in the control lungs.

In conclusion, these preliminary results open broad perspectives for the detection and quantification of emphysema, especially in longitudinal studies of the pathogenesis and treatment of emphysema in live mice.