

³He-MRI in a European Multicenter Trial in COPD and Emphysema "PHIL"

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Synopsis:

To investigate the usefulness of ³He-MRI in patients with COPD and pulmonary emphysema due to alpha-1-antitrypsin deficiency, a total of 160 individuals with and without these kinds of lung disease shall be included into the study in three European study centers. Spin density measurements, diffusion weighted and dynamic cine-imaging are acquired. So far, imaging has been successfully performed in 72 subjects. The evaluated individuals showed an average ADC of 0.181 in absence of lung disease, 0.279 in COPD and 0.264 in alpha-1-antitrypsin deficiency. Inclusion of patients as well as evaluation of data are ongoing.

Objective:

³He-MRI has been shown to be a highly sensitive method to demonstrate ventilation impairment in different kinds of lung disease, after lung transplantation and even in healthy smokers (1, 2, 3). However, most study samples were comparably small and studies focused on one of the four imaging modalities of ³He-MRI. To investigate the usefulness of ³He-MRI in patients with COPD and pulmonary emphysema due to alpha-1-antitrypsin deficiency, it is planned to include a total of 160 individuals with (n=130) and without (n=30) these kinds of lung disease in three European study centers. This work is part of a European Union Framework 5 project.

Methods and Materials:

In a prospective European multi-center trial, 98 patients (volunteers, n=32, COPD n=48, alpha-1-antitrypsin deficiency, n=18) were included having performed ³He-MRI, HR-CT and pulmonary function tests. The ³He-gas was polarized at a central institution and shipped to the two other partners via road-air-road courier. At ³He-MRI, spin density measurements, diffusion weighted and dynamic cine-images were acquired. All centers used 1.5 T clinical scanner systems (Magnetom Vision, Siemens Medical Solutions, Erlangen, Germany, and Eclipse, Philips Medical Systems, Cleveland, Ohio, respectively) which were tuned to the 3-Helium Larmor frequency of 48 MHz. A double resonant (³He/¹H) bird cage coil (Fraunhofer Institute, St. Ingbert, Germany) or a flexible twin saddle coil design (Medical Advances, IGC, Milwaukee, USA) was used for (transmission and) reception. Evaluation of spin density images was performed by visual consensus reading of four reviewers trained to read ³He and CT images. Diffusion weighted images were postprocessed for quantitative analysis, such as the apparent diffusion coefficient (ADC). Dynamic images were postprocessed for quantitative analysis of modified gas distribution parameters. High resolution CT and pulmonary functions tests were performed for comparison.

Results:

So far, imaging has been successfully performed in a total of 72 subjects (normal volunteers n=25, COPD n=33, alpha-1-antitrypsin deficiency n=14). The evaluated individuals showed an average ADC of 0,181 in absence of lung disease, 0,279 in COPD and 0,264 in alpha-1-antitrypsin deficiency. Inclusion of patients as well as evaluation of data are ongoing and will be shown in greater detail.

Conclusion:

A European network for distribution of hyperpolarized ³He for investigation of pulmonary disease in a large study population has been established. Patterns for visual evaluation as well as software tools for electronic quantification have been developed. An initial evaluation of the data has been performed.

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PHIL Polarised Helium to Image THE Lung
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