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Proceedings Paper:

Weatherley, N. orcid.org/0000-0001-5589-2219, Chan, F., Stewart, N. et al. (7 more authors) (2016) Diffusion-weighted hyperpolarised gas MRI in idiopathic pulmonary fibrosis : reproducibility and clinical significance. In: European Respiratory Journal - ERS International Congress 2016 abstracts. ERS International Congress 2016, 03-07 Sep 2016, London, UK. European Respiratory Society .

<https://doi.org/10.1183/13993003.congress-2016.oa3504>

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Diffusion-weighted hyperpolarised gas MRI in idiopathic pulmonary fibrosis: reproducibility and clinical significance

Background

Diffusion-weighted magnetic resonance imaging (DW-MRI) of the lung with hyperpolarised helium (^3He) demonstrates increased intra-acinar Brownian gas diffusivity, related to micro-structural changes in emphysematous lungs (Swift AJ et al. *Eur Radiol* 2005;54:352-8.), but is relatively unexplored in idiopathic pulmonary fibrosis (IPF).

Aims

To investigate baseline reproducibility and clinical significance of ^3He DW-MRI metrics in patients with IPF.

Methods

Seven participants with IPF underwent PFTs and two identical MRI protocols on the same day. 3-Dimensional ^3He DW-MRI yielded coronal apparent diffusion coefficient (ADC) maps of the lungs and mean ADC for each participant.

Results

^3He ADC maps showed elevated diffusivity in basal and peripheral lung regions, particularly in posterior coronal slices, which was in qualitative agreement with the distribution of fibrosis on CT.

[figure1]

Mean ADC correlated with PFTs, in particular KCO ($r = -0.954$; $p < 0.001$ and $r = -0.952$; $p < 0.001$, for the paired scans) and showed excellent inter-scan reproducibility (ICC kappa 0.954 (95% CI: 0.727 – 0.992)).

Conclusions

^3He ADC MRI demonstrates reproducibility and correlation with anatomical and functional IPF features. These results indicate that alveolar microstructural changes

accompany interstitial thickening in IPF and that ADC may be a useful non-ionizing non-invasive regional marker of disease severity.