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Title: Quantifying peripheral and central lung response to bronchodilator in asthma with hyperpolarised gas MRI

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Body: Background: Hyperpolarised gas MRI is sensitive to regional ventilation changes, which can be quantified as a percentage of total lung volume. Objective: To quantify lung ventilation response to bronchodilator in patients with asthma on a global and regional basis. Methodology: 24 asthmatic patients were scanned using synchronous hyperpolarised ³He and ¹H lung MRI before and after bronchodilator use. ¹H images were used to measure lung volume (LV) using a seed growing algorithm (Slicer 3D, Harvard). Ventilation volumes (VV) were calculated using manual thresholding on ³He images. Whole lung percentage ventilated volumes (%VV) were calculated by $VV \div LV$. The peel (peripheral 1/3 of the lung) and core (inner 2/3 of the lung) %VV were automatically segmented.

Results: Significant increase in %VV was measured (Wilcoxon rank) following bronchodilator when calculated globally ($p=0.001$) and for core ($p=0.007$) and peel ($p=0.004$). Ventilation improvement was greater in the peel than the core (Parametric t-test $p=0.024$). Conclusions: Hyperpolarised gas MRI measured increased ventilation following bronchodilator in a cohort of 24 asthmatics, with a greater response in the lung periphery than the central core suggesting a biasing towards small airway involvement both in the underlying asthma pathology and its response to bronchodilator. Research funded by Novartis and EU FP7 programmes: Airprom and PInet.