Comparison of lung ventilation volume measurements made with single and separate breath-hold hyperpolarized 3-helium and proton MRI

Mr. Samuel 17120 Janoff sgjanoff1@sheffield.ac.uk 1, Dr. Helen 17121 Marshall h.marshall@sheffield.ac.uk 1, Dr. General 17122 Leung g.leung@sheffield.ac.uk 1, Dr. Juan 17123 Parra-Robles j.parra-robles@sheffield.ac.uk 1, Ms. Xiaojun 17124 Xu peggy.x.xu@sheffield.ac.uk 1, Dr. Salman 17126 Siddiqui salman.siddiqui@uhl-tr.nhs.uk MD 2, Dr. Chris 17127 Brightling ceb17@leicester.ac.uk MD 2 and Prof. Jim 17128 Wild j.m.wild@sheffield.ac.uk 1. 1 Academic Unit of Radiology, University of Sheffield, Sheffield, United Kingdom and 2 Institute for Lung Health, University of Leicester, Leicester, United Kingdom.

Body: Overview Hyperpolarized (HP) gas MRI can be combined with spatially registered proton (1H) images of the lung to calculate percentage lung ventilation (PV). However, any lung inflation difference between separate 1H and 3He breath-holds results in errors. Aim To increase PV accuracy using a novel single breath-hold 3He and 1H acquisition. Methods 10 asthma patients were scanned with 3He MRI. The protocol was repeated at baseline to assess short-term reproducibility. Patients inhaled 1L (35% 3He/65% N2) from FRC. Immediately following this (in the same breath-hold) 1H MRI was acquired. A separate breath-hold set of 1H images were also acquired at FRC+1L. Ventilated volume (vV), lung volume (LV) and PV(vV/LV) were calculated. PV_Single used 3He and 1H images from the same breath hold. PV_Separate used 1H images from the separate breath hold. Results Figure 1 shows how lung inflation variation between separate breath-hold 3He (a) and 1H (b) MRI affects PV (c). Acquisition of 3He and 1H MRI during single breath-hold (a,d) gave a more accurate PV measurement (e).

Mean baseline difference was 2.19±10.1% for PV_Single and 9.79±22.5% for PV_Separate, a significant difference (p<0.04). Conclusion Percentage lung ventilation measurements using single breath-hold 3He and 1H acquisition were more reproducible than measurements using separate breathhold 3He and 1H images. Funding AIRPROM FP7 and Novartis.