A Preliminary Variability Study Of Hyperpolarized 3He Specific Ventilation In Human
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PURPOSE: Hyperpolarized gas MRI represents one of the few noninvasive methods for assessment of lung function in a regional manner by means of measuring the specific ventilation in human. This work presents a preliminary short- and long-term reproducibility study of the specific ventilation SV-MRI and compares the repeatability of SV to that of Pulmonary Function Test (PFT) in human subjects with and without respiratory symptoms.

METHODS: Six human subjects underwent repeated SV imaging followed by a pulmonet function test (PFT). One healthy nonsmoker (HN), one asymptomatic smoker (AS) and four COPD subjects entered the study so far and the recruitment is still in progress. The short-term studies were performed back-to-back (~10min) and follow-up studies after one year. A nornoxic mixture of 3He:N2:O2 (3:1:1) based on subjects’ total lung capacity was administered in a multi-breath sequence, as shown in Figure 1, and images acquired during two end-inspiratory short-breath-holds (~1s) and a longer 12-sec end-inspiratory breath-hold. HP gas mixture was administered through a passive patient-driven delivery device described earlier [2] and is shown in Figure 2, which regulated the inspired lung capacity in a multi-breath sequence and images were acquired during six end-inspiratory short-breath-holds (~1s) and a longer 12-sec end-inspiratory breath-hold. The average global repeatability was calculated for assessing the global variability between repeated measurements. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility. The coefficient of variance (CV) was also calculated for assessing the regional reproducibility.

RESULTS: The middle slice SV-maps from the repeated measurements for two representative subjects along with pixel-by-pixel test-retest correlation. Subject’s demographics, smoking history (AS) and four COPD subjects entered the study so far and the recruitment is still in progress. One healthy nonsmoker (HN), one asymptomatic smoker (AS) and four COPD subjects entered the study so far and the recruitment is still in progress. One healthy nonsmoker (HN), one asymptomatic smoker (AS) and four COPD subjects entered the study so far and the recruitment is still in progress. One healthy nonsmoker (HN), one asymptomatic smoker (AS) and four COPD subjects entered the study so far and the recruitment is still in progress. One healthy nonsmoker (HN), one asymptomatic smoker (AS) and four COPD subjects entered the study so far and the recruitment is still in progress.

CONCLUSION: High global and regional repeatability of back-to-back imaging method to measure SV in Healthy and COPD subjects shows the reasonable technical variability of this measurement and indicates low physiologic changes in specific ventilation in minute’s time-scale. The differences between the short- and long-term regional and global repeatability of SV for the COPD subjects demonstrate the high variability in the latter can be explained by true physiological alterations, since the minute measurements are minimally affected by physiological variability. The observed decline in the yearly results of PFT (in COPD subjects) proves the physiologic nature of the observed variability in COPD subjects. The satisfactory repeatability of imaging technique and its greater variance over time suggests that it may be more sensitive to changes over time than routine PFTs.