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03) Detection of the Changes in the Lungs of People who had High Exposure to Secondhand Cigarette Smoke Using Long-time-scale Global 3He Diffusion MRI

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PURPOSE

To determine whether the effects of secondhand cigarette smoke in the lungs can be detected using long-time-scale (LTS) global hyperpolarized 3He (GH3He) diffusion MRI.

METHOD AND MATERIALS

LTS GH3He diffusion MRI was performed in 38 subjects: 33 healthy subjects who never smoked (17 subjects with low exposure to secondhand smoke: 7 M, 10 F, age: 46-73 yrs; and 16 with high exposure: 4 M, 12 F, age: 41-79 yrs) and 5 active smokers (3 M, 2 F, age: 48-71 yrs, FEV1%pred: 58%-92%) using a 1.5T scanner (Sonata, Siemens). In all subjects, global LTS ADC values were obtained after inhalation of 50 ml of H3He mixed with 950 ml of N2. ADC values were calculated at multiple diffusion times (20ms ~ 2.5s, interval: 62ms), however for the sake of brevity only the ADC values at a diffusion time of 1.54s are presented below.

RESULTS

Global ADC values for smoking subjects (mean±SD: 0.0327±0.0086 cm²/s) were significantly greater than those for low exposure healthy subjects (0.0184±0.0033 cm²/s), p=0.02. ADC values for subjects with high exposure (0.0201±0.0068 cm²/s) were more variable than those of low exposure subjects but mean values were similar, p=0.38. Five (31%) high exposure subjects, but only 1 (6%) with low exposure had ADC values greater than 0.0230 cm²/s; 1 (6%) high exposure subject, but 9 (53%) with low exposure had ADC values between 0.0185 cm²/s and 0.0230 cm²/s; and 10 (63%) high exposure subjects, but 7 (41%) with low exposure had ADC values less than 0.0185 cm²/s, p<0.01. Thus, the high exposure group tended toward ADC values that were either higher or lower than the low exposure group.

CONCLUSION

Only a fraction (15-30%) of active smokers develop emphysema (structural damage to the lung) while a larger fraction develop chronic bronchitis (chronic airway inflammation). A decrease in ADC values may reflect airway narrowing possibly from early chronic bronchitis, and an increase may be indicative of structural lung damage/sub-clinical emphysema. Our findings suggest that the effects of secondhand smoke in the lungs can be detected using LTS GH3He diffusion MRI.

CLINICAL RELEVANCE/APPLICATION

The effects of secondhand smoke in the lungs can be detected using long-time-scale global hyperpolarized He3 diffusion MRI.

Disclosures:

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Questions:

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