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(U*) POS-D20 – $^3\text{He}/^{129}\text{Xe}$ MRI as a Tool to Track Emphysema Progression in Alpha-1 Antitrypsin Deficiency Patients

Wednesday 9 June 2021 13:51 (2 minutes)

RATIONALE: Hyperpolarized gas MRI is a powerful tool to track lung progression using biomarkers (ADC and mean linear intercept estimate (Lm)). Sometimes, longitudinal observations can lead to problematic values, as the disease progression can lead to increasing unventilated lung areas, which likely excludes the largest ADC/Lm values. We hypothesize that this morphometry method can provide an accurate assessment of the progression. For this work, we used the SV & ADC/Lm data acquired using the traditional approach (^3He data, 2014) and our method (^{129}Xe data, 2018).

METHODS: 4 AATDs provided written informed consent to an ethics board approved protocol and underwent two visits, four years apart that included CT, spirometry, plethysmography, DLCO and MRI including anatomical ^1H , $^3\text{He}/^{129}\text{Xe}$ diffusion-weighted (DW) & SV imaging. 3D $^3\text{He}/^{129}\text{Xe}$ MRI-based ADC and lung morphometry maps were generated using the stretched-exponential-method4 which was extended and adapted for both $^3\text{He}/^{129}\text{Xe}$ to provide clinically-relevant biomarkers of emphysema.5

RESULTS: $^3\text{He}/^{129}\text{Xe}$ MRI-based lung morphometry data were converted to the VDP/ADC/Lm maps. The global VDP/ADC/Lm estimates for all subjects and both contrast agents (^3He (2014) and ^{129}Xe (2018)) were computed from the correspondent maps. The VDPHe/VDPXe & LmHe/LmXe values were compared directly.

DISCUSSION: Over the four-years, we showed that ADC/Lm can be used to estimate emphysema progression. These biomarkers showed decrease in lung health over the term. There was some notable decreases in ADC/Lm between 2014 and 2018, which would indicate an overall decrease in emphysema progression ($p < 0.01$) contradicting the human being physiology. To resolve this contradictory, one can normalize the ADC/Lm biomarkers by corresponding VDP values, taking into account decreased lung volume. The feasibility of such approach has been recently demonstrated using the ^3He SV & DW data. For future work, we plan to normalize the ^{129}Xe ADC/Lm estimates by ^{129}Xe VDP for an accurate assessment of the emphysema progression.

References

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