Comparison of CT-based Lobar Ventilation Models with 3He MRI Ventilation Measurements in Asthmatics

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Introduction

CT models of ventilation can be computed from expiratory and inspiratory scans by means of the relative lobar expansion. This ventilation model has previously been validated against SPECT [1].

Objective

To compare models of lobar ventilation from CT with ³He ventilation MRI using multi-modal image registration in a population of asthma patients.

Methods

29 patients with moderate-to-severe asthma underwent breath-hold CT at TLC and FRC. CT was used to segment the lobes at FRC and TLC by identification of major fissures and these were used to calculate percentage regional ventilation [1]. ¹H and ³He MRI were acquired in the same breath at FRC+1L [2], and the ¹H MRI to CT registration was applied directly to ³He MRI allowing direct comparison of lobar CT ventilation with ³He.
Results

$^3$He MRI was successfully warped to inspiration CT using the transform from the $^1$H MRI and CT registration. The mean absolute difference between CT and $^3$He MRI ventilation across lobes was 4.8% (mean±SD for each lobe: RUL+RML=6.1±4.6%; RLL=5.0±5.7%; LUL=4.0±4.1%; LLL=4.6±3.7%).

Conclusions

This study compares percentage regional ventilation per lobe from CT models with a direct measure of gas ventilation using $^3$He MRI. In so doing we validate the CT model of ventilation and also demonstrate that multi-modality image registration allows the regional interpretation of $^3$He MR images on top of the underlying anatomy of the CT.


Figure

Figure 1 Workflow of proposed method for $^3$He MRI lobar ventilation calculation and scatter comparison against CT-based calculations.