Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Relationship between Pulmonary Airflow and Resistance in Patients with Airway Narrowing Using An 1-D Network Resistance and Compliance Model[1] SANGHUN CHOI, JIWOONG CHOI, ERIC HOFFMAN, CHING-LONG LIN, The University of Iowa — To predict the proper relationship between airway resistance and regional airflow, we proposed a novel 1-D network model for airway resistance and acinar compliance. First, we extracted 1-D skeletons at inspiration images, and generated 1-D trees of CT unresolved airways with a volume filling method. We used Horsfield order with random heterogeneity to create diameters of the generated 1-D trees. We employed a resistance model that accounts for kinetic energy and viscous dissipation (Model A). The resistance model is further coupled with a regional compliance model estimated from two static images (Model B). For validation, we applied both models to a healthy subject. The results showed that Model A failed to provide airflows consistent with air volume change, whereas Model B provided airflows consistent with air volume change. Since airflows shall be regionally consistent with air volume change in patients with normal airways, Model B was validated. Then, we applied Model B to severe asthmatic subjects. The results showed that regional airflows were significantly deviated from air volume change due to airway narrowing. This implies that airway resistance plays a major role in determining regional airflows of patients with airway narrowing.

[1]Support for this study was provided, in part, by NIH Grants U01 HL114494, R01 HL094315, R01 HL112986, and S10 RR022421.

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Date submitted: 01 Aug 2016 Electronic form version 1.4