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**Title:** Elastance bronchodilator response reflects asthma pathology

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**Body:** Introduction: Respiratory system resistance Rrs measured by the forced oscillation technique (FOT) and FEV1 measure airflow obstruction but are dominated by central airways. Respiratory system elastance Ers is thought to reflect the available compliant airspaces and increases with ventilation heterogeneity, and thus could be a good measure of peripheral airway closure, or opening in reversibility testing. We investigated the hypothesis that changes in Ers with bronchodilator (BD) are better able to assess peripheral airway disease in asthma. Materials & Methods: FOT was measured at 4-22Hz in 19 asthmatics and 18 controls pre and post BD (Salbutamol 200 mcg). We developed an anatomically based 26 generation airway tree model (Leary D et al., J Appl Physiol. 2012 112:167-75) and evaluated effects of heterogeneous peripheral airway closure and global airway narrowing for comparison to the in vivo data. Results: In asthma, Rrs and Ers showed a larger BD response (25%) than FEV1 (16%) and, while Rrs decreased in both groups (25%, 12%), only Ers decreased in asthma (p<0.5). Using the model, only global airway dilation reproduced the BD response in controls. To reproduce the asthma response with the model required opening 200 airways in the 9th generation to account for Ers changes and 11.7% dilation of the remaining airways to account for the remaining ½ of Rrs changes. Conclusion: In health, lack of changes in Ers are consistent with absence of baseline small airway constriction/closure while in asthma, Ers changes implied opening of previously closed airspaces. Thus, while Rrs changes arise from both central and peripheral airways dilation following BD, the similar Ers changes reflect only opening peripheral airways.