Abstract Submitted
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Analysis of Inlet Velocity Profile Effects on Airflow Simulations in Patient-Specific Healthy Trachea BIPIN TIWARI, Department of Aerospace Engineering, Auburn University, TARUN KORE, Department of Chemical Engineering, Auburn University, ZHENGLUN ALAN WEI, Wallace H. Coulter School of Biomedical Engineering, Georgia Institute of Technology, SANDEEP BODDULURI, SURYA P. BHATT, Department of Medicine, University of Alabama at Birmingham, VRISHANK RAGHAV, Department of Aerospace Engineering, Auburn University — Expiratory Central Airway Collapse (ECAC), defined by greater than 50% collapse of the trachea during expiration, is a disorder associated with Chronic Obstructive Pulmonary Disease. Pathophysiology of ECAC is multifactorial and the biofluid mechanics of airflow in the trachea could be an important factor resulting in the progression of the disease. Using computational methodology, a comprehensive investigation of the biofluid mechanics in the healthy and diseased patient-specific trachea can be conducted. One of the key considerations for setting up computations is choosing correct boundary conditions (BC). Most common BCs used by previous studies are a) flat, b) parabolic, c) Womersley, d) parabolic with an extension, and e) real, patient-specific profile. This is the first step in that direction to explore the effects of different inlet BCs for patient-specific trachea flow simulations. We test for steady and tidal flow combined with the five aforementioned inlet velocity profile conditions. Metrics such as wall shear stress and time-averaged wall shear stress were used to quantify the differences among different inlet velocity profile condition. This will lay a solid foundation towards obtaining accurate computational results in modeling ECAC.

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