

Abstract Submitted
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A Numerical Study of Muco-Ciliary Transport under the condition of Primary Ciliary Dyskinesia PAHALA GEDARA JAYATHILAKE, Singapore-MIT Alliance, National University of Singapore, WAN LUNG LEE, None, DUC VINH LE, Institute of High Performance Computing, Singapore, HEOW PUEH LEE, BOO CHEONG KHOO, National University of Singapore — Primary ciliary dyskinesia (PCD) is a disease due to the defects in motile cilia. A two-dimensional numerical model based on the immersed boundary method coupled with the projection method is used for a preliminary study of the flow physics of muco-ciliary transport of human respiratory tract under PCD conditions. The effects of the cilia beating amplitude, cilia beat pattern (CBP), cilia beat frequency (CBF), immotile cilia, and uncoordinated beating of cilia on mucus transport are investigated. As expected, the mucus velocity decreases as the beating amplitude and CBF decrease. The windscreen wiper motion and rigid rod motion, which are two abnormal CBPs owing to PCD, would greatly reduce the mucus transport. The mucus velocity decreases rather linearly if the number of uniformly distributed immotile cilia increases. The results further show that the mucus velocity would be slightly reduced when the uniformly distributed immotile cilia are rearranged as a cluster of immotile cilia. Furthermore, if the half of the cilia are immotile and uniformly distributed, the incoordination between motile cilia would not significantly affect the mucus velocity.

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