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Multi-plug instillation into a physiologically representative infant airway tree model - A computational study[1] CORY HOI, KEVIN RAGGIANI, MEHDI RAESSI, University of Massachusetts Dartmouth, HOSSEIN TAVANA, University of Akron, UNIVERSITY OF MASSACHUSETTS DARTMOUTH COLLABORATION, UNIVERSITY OF AKRON COLLABORATION — We present 3D multiphase flow simulations of liquid surfactant plug transport through a physically representative model of the human infant lung airway tree. Liquid surfactant instillation into the lung airways is used to treat respiratory distress syndrome (RDS) in preterm infants. The procedure, commonly known as surfactant replacement therapy (SRT), is used in the targeted delivery of surfactant plugs with the goal of achieving a uniform film distribution. SRT's effectiveness is tied to the successful plug propagation through each branching airway network. We previously investigated such plug dynamics in individual airways and Y-Tube models with comparisons made between other experimental, numerical and mathematical works. By expanding the airway model to include further airway generations with rotations, our simulations can capture the dynamical effects of upstream plug propagation on downstream plug behavior across multiple length scales. The simulations investigate the effects of multi-plug instillation, plug blockages, and plug rupture on plug splitting and film distribution, with the goal of improving our understanding of SRT.

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