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Flow analysis of endotracheal tubes for the prevention of ventilator-associated pneumonia AARTHI SEKARAN, Texas A&M University — Respiratory illnesses in the recent past, including COVID-19, have led to an increased use of mechanical ventilators in severely affected patients. Long-term use of these ventilators (over 14-21 days) is linked to mortality rates of up to 50%, owing to the development of secondary infections. Ventilator-associated pneumonia (VAP) is a leading cause of these infections and is primarily caused by the pooling of mucus around the endotracheal tube (ETT) inserted in the upper trachea. Prediction and prevention of the pooling are challenging owing to the complex geometry and non-Newtonian flow interactions, thus requiring constant clinical monitoring of patients. This study aims at providing a prediction of the mucus behavior in intubated patients, via a flow analysis of an intubated upper trachea model. Large eddy simulations incorporating the respiratory cycle and mucus distribution are carried out and the effect of the ETT in mucus leakage is determined. A predictive model for the leakage is developed from this understanding of the primary flow physics in and around the ETT and its relation to patient-driven factors. The model will aid informed selection of the ETT, monitoring when needed, and thus reduced secondary infections in patients and reduced exposure for clinicians.

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