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Numerical investigation of pulmonary drug delivery under mechanical ventilation conditions[1] ARINDAM BANERJEE, Lehigh University, Bethlehem, PA, TIMOTHY VAN RHEIN, Missouri University of Science & Technology, Rolla, MO — The effects of mechanical ventilation waveform on fluid flow and particle deposition were studied in a computer model of the human airways. The frequency with which aerosolized drugs are delivered to mechanically ventilated patients demonstrates the importance of understanding the effects of ventilation parameters. This study focuses specifically on the effects of mechanical ventilation waveforms using a computer model of the airways of patient undergoing mechanical ventilation treatment from the endotracheal tube to generation G7. Waveforms were modeled as those commonly used by commercial mechanical ventilators. Turbulence was modeled with LES. User defined particle force models were used to model the drag force with the Cunningham correction factor, the Saffman lift force, and Brownian motion force. The endotracheal tube (ETT) was found to be an important geometric feature, causing a fluid jet towards the right main bronchus, increased turbulence, and a recirculation zone in the right main bronchus. In addition to the enhanced deposition seen at the carinas of the airway bifurcations, enhanced deposition was also seen in the right main bronchus due to impaction and turbulent dispersion resulting from the fluid structures created by the ETT.

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