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# Pressure Relationships of Inspired Air into the Human Lung Bifurcations

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## Abstract

Applied pressure on the human lung wall has a great impact on the mechanical behavior of the respiratory system particularly under mechanical ventilation. Finding a relationship that predicts pressure based on some determinable parameters could be useful for preventing injuries during mechanical ventilation. Many efforts have been made to study fluid flow through the human lung, but none of them have tried to find relationships for fluid pressure in terms of measurable parameters during breathing. The main purpose of this work is to find relationships that could predict pressure in specific positions of the human lung during inhalation and exhalation for normal breathing (NB) and mechanical ventilation (MV). In this study, a three-dimensional model of a defined structure from a healthy human lung MRI was computationally post processed and used for a curve fitting simulation to investigate properties of airflow induced by mechanical ventilation and normal breathing. Calculated area-average pressure and measured cross sections of predefined planes through different path-lines on the left and right sides of the lung under different breathing conditions plus breathing time and bifurcations' generation number were utilized for the curve fitting simulation to estimate pressure during inhalation and exhalation in NB and MV. The relationships for pressure obtained from this study are in good agreement with results from previous studies and suggest that airway resistance changes over generation numbers. Pressure relationships presented in this study therefore have important implications for preventing lung injury during mechanical ventilation. Future studies could incorporate the effects of air pressure on human lung wall based on additional parameters such as time and cross section and generation number at specific bifurcations.

**Key words:** Human lung, Curve fitting, Normal breathing, Mechanical ventilation

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