3-D computer simulation to aid treatment of collapsed lungs

July 26 2006

The treatment of premature babies and adults who suffer from Respiratory Distress Syndrome could be boosted by new research at The University of Manchester, as published in the *Journal of Biomechanical Engineering*.

The condition, often caused by a lack of surfactant in the underdeveloped lungs of prematurely born babies, can lead to blocked airways causing severe breathing difficulties. To reopen a blocked airway a pressurised finger of air has to be forced deep into the airway.

Dr Matthias Heil and Dr Andrew Hazel, of the University's School of Mathematics have created the first 3D computer simulation that mimics the complex process by which a propagating air finger reopens the collapsed airway. This process involves a complex interaction between fluid mechanics, the air pressure, surface tension and wall elasticity inside the airways.

Dr Heil said: "When the lung collapses you want to be able to reopen airways as quickly as possible but you do not want to damage the lung. There is a very fine balance between the amount of pressure you can apply and the potential damage you might cause.

"Currently this assessment has to be made by a medic solely based on experience. We hope that our simulation will help to inform and improve the medical treatment of infants and adults suffering from this condition."

In their paper, 'Finite-Reynolds-Number Effects in Steady, Three Dimensional Airway Reopening,' Heil and Hazel demonstrate the importance of 'fluid inertia' when assessing the pressure required to reopen a blocked airway.

They find that if 'fluid inertia' is not taken into account the estimated pressure required to reopen a blocked airway is too low. In addition, they find that the reopening pressure decreases as the level of airway collapse increases.

Source: University of Manchester