**Determining changes in patient respiratory mechanics using non-linear autoregressive models of pulmonary elastance**

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Patients in the intensive care unit (ICU) suffering from acute respiratory distress syndrome (ARDS) require mechanical ventilation (MV) as an essential therapy. Optimal MV algorithms that use patient specific respiratory models may mitigate ventilator induced lung injury (VILI). Improving model descriptions of patient dysfunction may enable optimal MV treatment. Mechanical properties of the lung such as resistance and elastance are important determining factors when creating these models. This study advances a model of respiratory elastance with 19 critically ill respiratory patients undergoing various MV strategies. The patients cover a range of critical illnesses pneumonia, lung contusion, and brain injury. Current models fail to capture the changes in patient behavior observed in the data sets. This research introduced model variables that allowed the changes in pulmonary mechanic properties that manifested over periods of hours to be captured by the model. This modelling approach is the first step toward a bank of patient changes and responses to therapy that can ultimately be used to power a stochastic model-based algorithm for decision support. If successful, this approach can reduce the cost of ICU admission and reduce the financial strain on health care systems.