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Age-dependent ventilator-induced lung injury

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Presenter Information

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A variety of inhaled pathogens prompt an immune response that results in inflammation of the lung tissues. Patients that develop complications from this inflammatory response are often treated with mechanical ventilation (MV) in severe cases. While MV is often a life-saving intervention, it can induce further lung damage called ventilator-induced lung injury (VILI). Experimental data has indicated an increased risk for VILI in elderly patients. This information along with the increased demand for MV caused by the novel coronavirus SARS-CoV-2 emphasizes the need for further research on the age-dependent aspects of VILI. This paper expands upon a previous ordinary differential equations model for MV (Minucci *et al.*, JTB 2021) by including more biologically realistic dynamics for cell and cytokine diffusion into the alveolar lung space following epithelial damage. Additionally, *in vivo* mouse data is utilized to create plausible parameter estimates associated with both the young and old mice experiments. Parameter sets were then analyzed using various classification methods to determine the important factors associated with severe or moderate responses to MV for both the young and old experimental groups. Representative parameter sets were also selected from the overall sample to best depict the average transient behavior for each response group. Using the representative sets we identify significant parameters and simulate potential interventions to improve the predicted response to MV.

Keywords: ventilator-induced lung injury, mechanical ventilation, epithelial damage, parameter estimation, classification