ATS 2026 Highlights

Respiratory Structure and Function Early Career Professionals

Get to know members of the RSF Assembly

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Is your research clinical, basic science or translational?

Basic science and translational.

Tell us about your research?

My research applies mathematical and computational methods to understand how tissue composition and structure changes affect lung function. During my PhD, I studied extracellular matrix remodeling in pulmonary fibrosis and how it drives disease progression. My postdoctoral training shifted me toward translational research in pulmonary physiology, focusing on developing more precise methods for measuring lung function. Currently, I am leveraging pulmonary function testing to optimize mechanical ventilation during surgery.

Where do you see yourself in 5 years?

In five years, I see myself establishing my own lab focused on refining clinical decision-making through patient-specific physiological models while training the next generation of quantitative scientists in medicine.

What do you find is the major benefit of RSF Assembly Membership?

The Assembly brings together experienced researchers in a welcoming, collegial atmosphere. I consistently make valuable new connections at the annual meetings that lead to productive collaborations.

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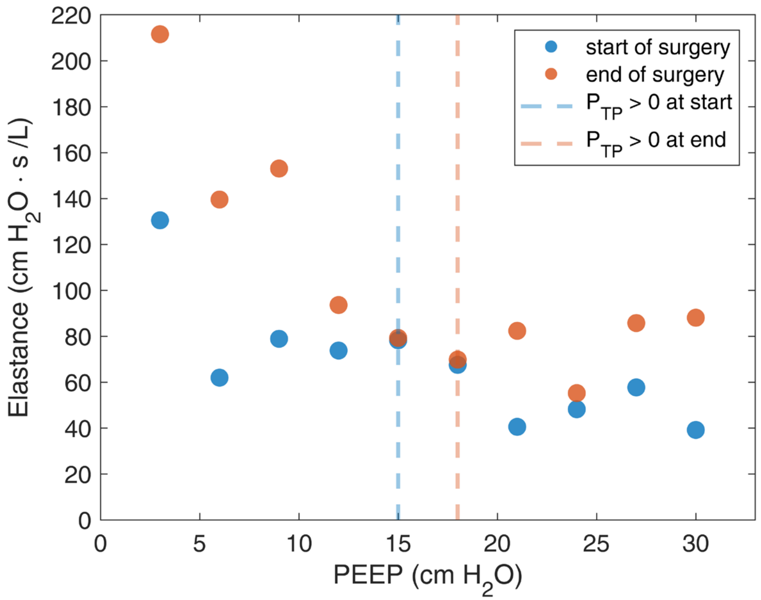

Figure 1: Elastances measured via oscillometry during decremental PEEP titration at start and end of surgery. Dashed lines represent PEEP selected by nonzero transpulmonary pressure at start and end of surgery.

An oscillometry system for monitoring intraoperative pulmonary mechanics

Objective: Optimizing positive end-expiratory pressure (PEEP) during surgery is critical for preventing lung collapse and overdistension, both of which can cause injury. Methodologies to individualize PEEP yield inconsistent values, making it difficult to determine the optimal setting. Factors such as body habitus, underlying pulmonary conditions, and duration of mechanical ventilation make this a dynamic and patient-specific problem. We hypothesize that optimizing PEEP requires understanding how it affects individual pulmonary mechanics. To employ the forced oscillation technique, we built an oscillometer compatible with mechanical ventilation and measured pulmonary mechanics during surgery.

Methods: A custom speaker-in-a-box was fitted with a cone compatible with ventilator tubing and transmitted a multifrequency flow signal. Together with flow and pressure sensors, the setup functioned as our oscillometer. The patient was a 76-year-old female with BMI 21.8 kg/m² and no history of pulmonary disease undergoing hysterectomy. The oscillometer was placed in circuit with a Dräger Perseus A500 ventilator and ran continuously from anesthesia induction to extubation. An esophageal balloon was placed to measure transpulmonary pressure (P_{TP}). After being placed in Trendelenburg, the anesthetist performed a decremental PEEP titration from 30 cm H_2O to 3 cm H_2O, in 3 cm H_2O increments. The procedure was repeated near the end of surgery, prior to repositioning to supine. Respiratory impedance was calculated from the pressure and flow signals for each step of the titrations. The data were fit to the lung equation-of-motion to get elastance (inverse of compliance).

Results: For every PEEP, elastance was elevated at the end of surgery, relative to the start (**Fig 1**). Elastances were higher at PEEP < 10 cm H_2O and the difference between the start and end of surgery were the largest. Respiratory elastance was minimized at a PEEP of 21 cm H_2O at start of surgery and this minimum increased to 24 cm H_2O at the end of surgery. Transpulmonary pressure became nonzero at PEEP of 15 cm H_2O at start of surgery and 18 cm H_2O at end of surgery.

Conclusion: We report worsening pulmonary mechanics over the course of surgery, which is exaggerated at PEEP levels commonly used in clinical practice. Choosing PEEP to optimize pulmonary mechanics by minimizing elastance requires higher PEEP than transpulmonary pressure alone would indicate. This study demonstrates the feasibility of monitoring respiratory system mechanics during mechanical ventilation using oscillometry and its value for optimizing PEEP.

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