ATS Highlights 2020:

Critical Care Assembly Early Career Professionals

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Tell us about yourself.

I am originally from Colombia! And I'm passionate about traveling-- there are countless reasons why, but perhaps the most important is "the people". My current position at the Mayo Clinic has provided me with the unique opportunity to take care of patients with complex medical issues and unique life stories.

How would you describe your academic work?

Clinical and Translational Research (Mechanical Ventilation and ARDS) and Continuing Medical Education (CME) curriculum development (mechanical ventilation –Mayo Clinic Mechanical Ventilation Conference).

Please describe your academic work.

I conduct both clinical and translational research in advanced mechanical ventilation, and in prevention and treatment of ARDS. Our group has investigated the effect of body positioning and intra-abdominal hypertension on pulmonary mechanics, and most recently the use of Mechanical Power, as the unifying variable integrating all the machine-derived factors contributing to ventilator-induced lung injury.

Where do you see yourself in 5 years?

I am passionate about research that will help us in developing a personalized approach of patient care delivery to further improve clinical outcomes. My vision is to create a hospital-affiliated center to facilitate longitudinal research studies to explore the physiology of adaptation to critical/acute illness –The INsTitute for Experimental Research in Physiology of Adaptation and CriTical Care Medicine (I.N.T.E.R.A.C.T).

What are you looking for in future collaborators?

The present and the future of Critical Care Medicine are multidisciplinary. Given the nature of clinical and research interests, I would like to collaborate not only with clinical researchers, but also with those in the field of biophysics and biomedical engineering.

How has the Critical Care Assembly contributed to your career?

The Critical Care Assembly provides a fruitful environment for very high quality and enriching networking in both clinical and research activities. The sense of fellowship in the Critical Care Assembly is outstanding.

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Mechanical Power in the Setting of Positive End-Expiratory Pressure (PEEP) Titrated by Esophageal Pressure

Rationale:

Mechanical power (MP) has been postulated as the unifying variable integrating all the machine-derived factors contributing to ventilator-induced lung injury (VILI) where tidal volume, pressures, flow and respiratory rate are considered components of the "energy load" applied to the respiratory system per units of time. We aimed to describe the behavior of both MP of the respiratory system (MPRS) and the lung (MPL) in patients with acute respiratory distress syndrome (ARDS) while setting positive end-expiratory pressure (PEEP) during mechanical ventilation guided by esophageal pressure.

Methods:

We retrospectively analyzed both the MPRS and MPL in 42 mechanically ventilated patients with ARDS in volume-controlled mode and PEEP titrated by esophageal pressure monitoring with the goal to achieve a transpulmonary pressure (PTP) of 0-10 cmH_2O at the end of expiration, while maintaining an end-inspiratory PTP of <20 cmH_2O. See figure 1 for equations. To estimate the energy load per units of time applied to the lung participating in the ventilation (baby lung), MPRS and MPL were normalized by the ratio of the estimated functional residual capacity (FRC) and the compliance of the respiratory system (CRS). Variables were sub-analyzed based on ARDS severity and mortality.

Results:

Among patients with moderate ARDS, non-survivors (n=9) compared to survivors (n=14) had a 30% increase in MPRS (104.9±30.1 vs. 79.7±41.7 J/min/L, respectively, p=.012), 50% increase in MPL (49.8±22.3 vs. 33±19.6 J/min/L, respectively, p=.014), and 35% increase in transpulmonary driving pressure (15.8±4.5 vs. 11.7±3.9 cmH_2O, respectively, p=.012). Compared to survivors (n=8), non-survivor patients (n=3) with mild ARDS had higher PEEP values (26±4 vs. 18.1±4.3 cmH_2O, respectively, p=.0049). Mortality occurred in 17.2% of the patients with mild, 39.1% with moderate, and 37.5% with severe ARDS.

Conclusions:

In our study population, mechanical ventilation with PEEP titrated by esophageal pressure monitoring resulted in unexpectedly high values of PEEP among with mild ARDS. Additionally, both MPRS and MPL seemed to track the higher mortality in the moderate ARDS group.

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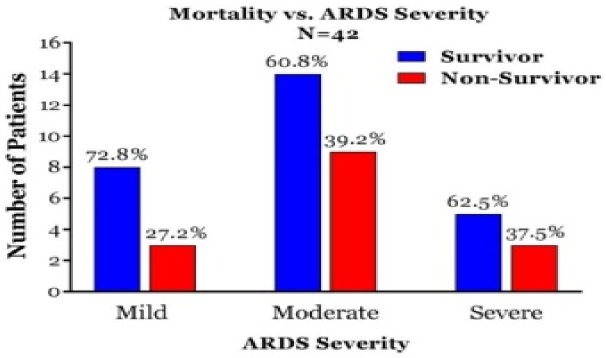
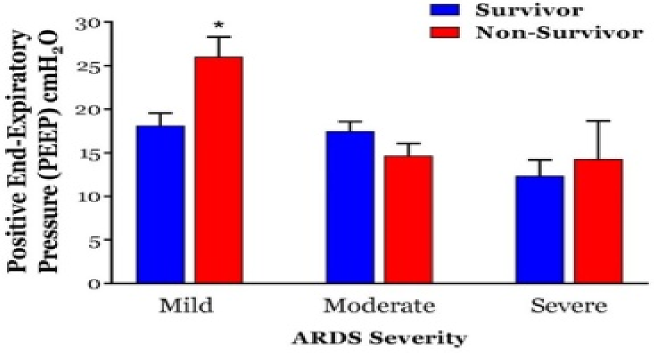
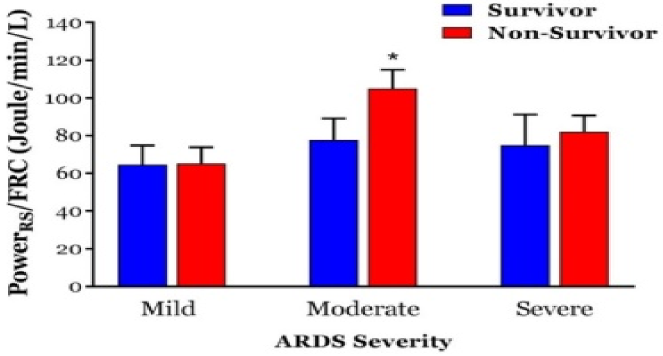
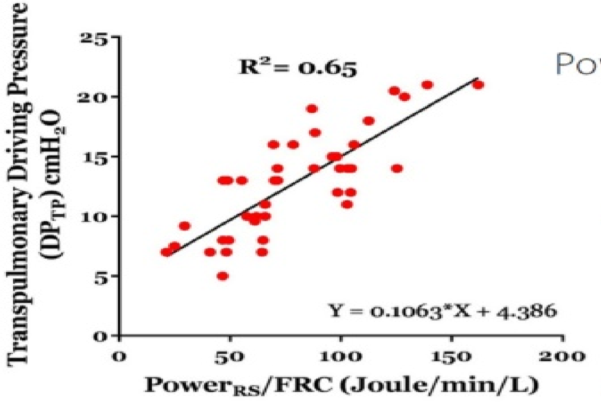




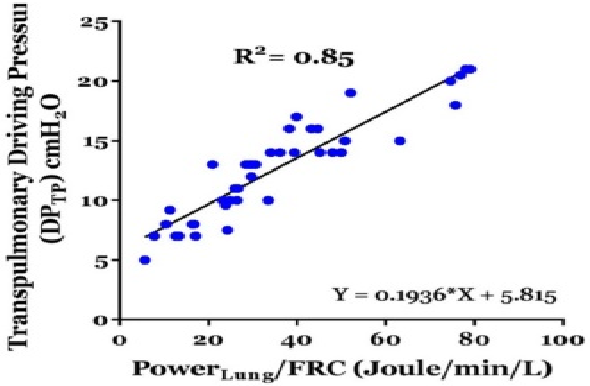




$$\text{Power}_{rs} = RR \cdot \left\{ \Delta V^2 \cdot \left[\frac{1}{2} \cdot EL_{rs} + RR \cdot \frac{(1 + I:E)}{60 \cdot I:E} \cdot R_{aw} \right] + \Delta V \cdot PEEP \right\}$$

Distend the Lung | **Move the Gas** | **Keep Lung Open**

Mechanical ventilation with PEEP titrated by esophageal pressure monitoring resulted in unexpectedly high values of PEEP among patients with mild ARDS. Additionally, both mechanical power of the respiratory system and the lung seemed to track the higher mortality rate observed in the moderate ARDS group.



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