1. **FAER Program ID - RSP-10-01-2022-Last Name (First Name)**

RSP-10-01-2020-Sutphin (Brittan)

2. **Full Name**

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3. **Abstract Title**

Monitoring of Functional Residual Capacity and Dead Space in Mechanically Ventilated Adults

4. **Author(s) and Affiliation(s)**

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5. **Abstract**

Introduction.

Functional residual capacity (FRC), the lung volume at the end of passive expiration, and physiological dead space (VD), the part of the tidal volume that does not participate in gas exchange, are two pulmonary function parameters whose semi-continuous measurements can provide important insight into underlying pathophysiologic processes and provide guidance for optimizing ventilatory parameters in individual patients. While current measurements of the FRC value can be accomplished through nitrogen washout available on some ventilators, the measurement is lengthy and requires a step-wise change in FiO2 which poses a risk for some patients. Dead space can also be measured on some ventilators through volumetric capnography coupled with arterial blood gas measurements. The current study aims to evaluate measurements of FRC and physiologic VD acquired from a novel, non-invasive, bedside VQm Pulmonary Health Monitor™ (PHM, Rostrum Medical Innovations, Vancouver, BC, Canada) in comparison to current clinical reference standards.

Methods.

VQm PHM™ estimates FRC using sequential gas delivery (SGD) technology by administrating 3-breath inspiratory boluses of CO2 at an FiCO2 of 10%. SGD splits the inhaled gas into two fractions of known gas concentrations which allows the clinician control of effective alveolar ventilation[1]. These measurements were compared to the FRC obtained using standard nitrogen washout methods on the GE Healthcare CARESCAPE™ ventilator, FRC INview™ software module. To measure VD, the VQm PHM™ utilizes volumetric capnography and arterial blood gas values, the same method used by the reference measurement on the GE Healthcare ventilator. Each patient served as their own control.

Results.

Physiologic VD measurements from 6 patients at various PEEP and FiO2 settings were included in this preliminary analysis for a total of 29 obtained VD values. The mean difference in paired

VD values was 0.01 L (Figure 1A) demonstrating little difference in the values measured by the two technologies. FRC data from 3 patients at various PEEP and tidal volume settings producing 13 FRC values reflected a mean difference between paired values of 0.72 L (Figure 1B) demonstrating substantial differences between the two technologies; however, analysis demonstrates excellent concordance between the two groups reflecting comparable trending ability (Figure 1C). This is an ongoing study with the end goal of acquiring data from 20 subjects in each group. Completion of the study is expected by September 2022 at which time analysis for statistical significance will be performed.

Discussion.

These results represent the first data of FRC and VD pulmonary function parameters as measured by a novel, non-invasive cardiopulmonary health monitor. Our preliminary results indicate good agreement between VD measured using VQm PHM™ and our reference value and good trending between FRC measured using VQm PHM™ and our reference value. While additional data needs to be obtained before determining its impact on clinical care, initial trends suggest this device can provide near real-time physiological insight into the effects of changes in lung mechanics during mechanical ventilation. Continued studies in clinical settings will provide insight into the usefulness of this device during operating room anesthesia, post-operative recovery and intensive care unit environments.

6. **References**
   Maximum of 5 references, separated by a semicolon.
   Ex. Reference 1; Reference 2; Reference 3.
   1. Fisher, Iscoe and Duffin, 2016, Sequential gas delivery provides precise control of alveolar gas exchange. Resp Physiol and Neurobio, 225:60-69.

7. **CONFLICT OF INTEREST DECLARATION** Conflict of Interest:
   Neal Fleming has active or pending contracted research with Masimo, Inc, Edwards LifeSciences, Rostrum Medical Innovations, Acacia Pharma, Tsumera Pharmaceuticals and Haisco Pharmaceuticals.
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8. **In the past 3 years, have you received funding from external sources relevant to the current study? If yes, identify the source and type of funding (e.g., consulting, honoraria, speakers' bureau, advisory board)**
   (e.g., manufacturers of the product studied or competing products)
   None

9. **Please briefly describe what role you as the resident played in the research. (1-3 sentences)**

I was involved in portions of data collection, performing data analysis, and writing of the abstract.