

"Detection of Pulmonary Insufficiency with Thoracic Impedance in Patients with Rib Fractures"

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Severe chest trauma outcomes in patients with rib fractures and pulmonary contusion may range from painful inconvenience to mortal insult. Current methods of assessing adequacy of respiration include clinical impression, intermittent spirometry and physiologic monitoring such as pulse oximetry and blood gas monitoring. Clinical impression of a patient's respiratory status has not been demonstrated to be optimal at determining both need for and discontinuation of mechanical ventilation. The bedside measurement of pulmonary vital capacity (incentive spirometer) has been found to correlate with the patient's hospital course and even destination after discharge.¹ Unfortunately, it can only be done intermittently and with the cooperation of the patient. Assessing oxygenation and ventilation are also useful but late signs of pulmonary insufficiency and their derangement indicates pulmonary failure. Currently, there is no technology available that accurately & conveniently determines respiratory volumes and that does not require active cooperation in non-mechanically ventilated patients.

Noninvasive continuous monitoring of thoracic expansion can be achieved using a bioimpedance method. Thoracic impedance has been well characterized in normal spontaneously respiring subjects²; however, data are limited in patients with thoracic injuries and critically ill patients. Thus, our objective is to assess the performance of thoracic impedance in critically ill patients and to identify signal characteristics that are associated with development and resolution of pulmonary insufficiency and failure.

We will perform a prospective, observational study utilizing Respiratory Variation Monitoring (RVM) to measure respiratory metrics including respiratory rate, volumes and minute ventilation to respiratory curve slopes and patterns of variability and complexity. These measurements will be correlated with outcomes including length of stay, complications, need for mechanical ventilation, development of pulmonary complications and mortality.

At the conclusion of the study, we hope to determine correlations and associations between the continuous respiratory signal and pulmonary insufficiency in patients with blunt chest trauma. In the future, we expect that we will be able to use this to allow for prompt intervention before pulmonary failure with a goal of decreasing morbidity and mortality.

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 2. Ernst J, Lirvack D, Lozano D, Cacioppo John, Berntson G. Impedance pneumography: Noise as signal in impedance cardiography. *Psychophysiology*. 1999; 36:333-338