

Assessment of Effectiveness of Lung Recruitment and PEEP Setting by Vibration Response Imaging

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Introduction

Vibration response imaging (VRI) is a novel technology that measures vibration energy generated from airflow to create a real-time structural and functional image of the respiration process. This new imaging technique is performed quickly and non-invasively at the bedside by suction attachment of a bank of vibration sensors to the patient's back. It offers potential as a real time non-invasive method of adjusting ventilatory therapy.

Case

A 75-year-old male patient was admitted to the ICU with acute lung injury due to acute pancreatitis and mechanically ventilated with a PEEP setting of 5 cmH₂O and FiO₂ 1.0. VRI recordings were obtained before and after a recruitment maneuver (40 cmH₂O PEEP for 40 seconds) and increasing PEEP to 10 cmH₂O. Images were taken during 20-second periods of respiration and respiratory cycles for analysis selected based on predefined selection rules. Mechanical ventilator settings were the same before and after recruitment. The total areas were measured by using the Image-J program (Figure II). Arterial blood gases were obtained immediately before and after recruitment and in close proximity of VRI (Table II). Statistical analysis was performed using t-test.

Figures 1a and 1b are representative images before and after recruitment and PEEP elevation.

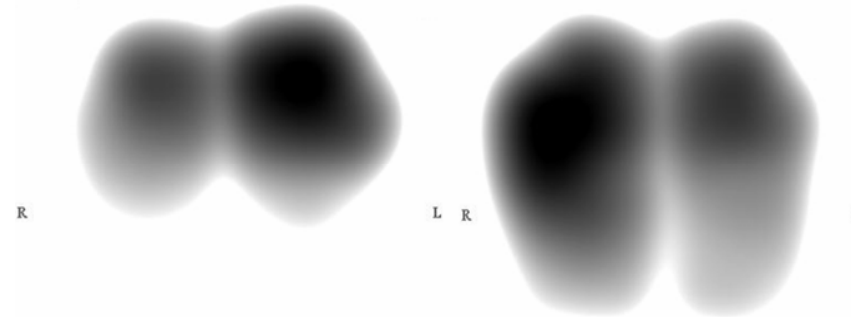


Fig. 1a. Peak Inspiration Vibration before recruitment maneuver with a PEEP level of 5 cmH₂O

Fig 1b. Peak Inspiration Vibration after recruitment maneuver with a PEEP level of 10 cmH₂O

	FiO ₂	pH	PaO ₂	PCO ₂
Pre-recruitment	1.0	7.29	76	23
After-recruitment	1.0	7.22	143	25

Table II. Arterial Blood Gases

Discussion

This case demonstrates a significant increase in the geographical area of vibration response images at peak inspiration after recruitment maneuver and a PEEP increase in early ARDS. This increase in VRI area correlates with improvement in oxygenation.

Conclusion

Increased spatial distribution of ventilation following effective recruitment has previously been demonstrated using computerized tomography. VRI may provide a rapid bedside assessment of the effectiveness of lung recruitment and PEEP setting as an alternative to computerized tomography.

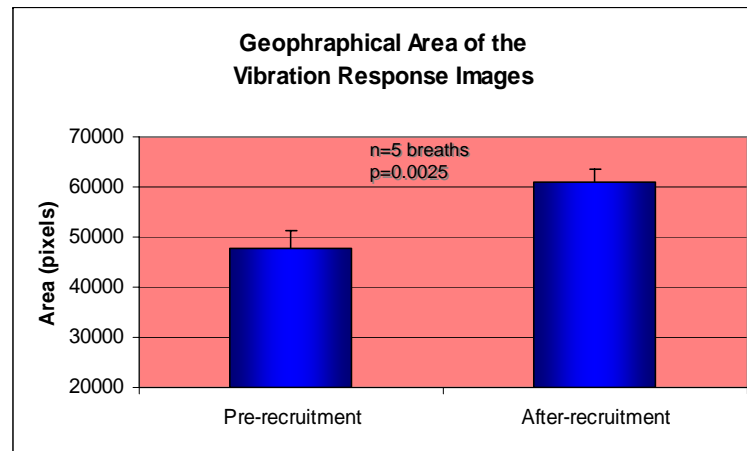


Figure II. Geographical area of the vibration response images.