

Changes in Oxygenation, Ventilation, and Chest Radiography with High Frequency Percussive Ventilation

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RATIONALE Few interventions significantly improve clinical outcomes in severe acute respiratory distress syndrome (ARDS). Different modes have not been significantly better and some may contribute to harm. We propose that high-frequency percussive ventilation (VDR-4, Percussionaire Corp, Sandpoint, Idaho)¹ is effective in improving lung aeration in patients with refractory severe ARDS who are failing conventional ventilation strategies. **METHODS** we conducted a retrospective chart review of 38 patients with severe ARDS treated at an acute lung injury tertiary referral center with VDR-4 between August 2018 and September 2019. Seventeen of those patients were also treated with extracorporeal membrane oxygenation (ECMO). Patients over 18 years of age treated for severe ARDS and who were treated with at least 24 hours of VDR-4 were included. The partial pressure of oxygen (PaO₂) and the ratio of PaO₂ to the fraction of inspired oxygen (PaO₂/FiO₂) were measured before use of VDR-4 and 48 hours later. Chest x-rays (CXR) were obtained in a similar fashion. The RALES2 method of assessing lung opacity in ARDS was calculated by two physicians. Data were compared using the Wilcoxon signed rank test. CXR scores were compared with the Pearson coefficient. Blood gas values are reported as mean ± standard deviation. RALES scores were averaged. **RESULTS** There was good concordance between assessment of CXR scores (Pearson coefficient of 0.88 and 0.87 for pre and post radiographs respectively). The RALES score significantly decreased between days zero and two (24.5 vs. 18.5, p<.001). Patients treated with ECMO and VDR-4 demonstrated a higher post treatment PaO₂/FiO₂ (124mmHg ± 52 vs. 188mmHg ± 97; p = 0.0045). Patients receiving VDR-4 treatment only also demonstrated a higher PaO₂/FiO₂ (95mmHg ± 49 vs. 175mmHg ± 136; p = 0.0140). The mean change was higher in the ECMO/VDR group. The FiO₂ requirements decreased in both the VDR-4 group (0.76 ± 0.22 vs. 0.55 ± 0.22; p = 0.0045) and the ECMO/VDR group (0.86 ± 0.20 vs. 0.64 ± 0.29; p = 0.022). **CONCLUSIONS** Use of VDR-4 led to improved lung aeration and improvement in opacities on chest radiographs after 48 hours. There was a 22% decrease in FiO₂ required through the ECMO circuit. In patients not requiring ECMO, FiO₂ decreased by 22% over two days. Both ECMO/VDR-4 and VDR-4 significantly increased the PaO₂/FiO₂ ratio. High frequency percussive ventilation is effective in improving gas exchange in patients with refractory severe ARDS with and without ECMO.

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