

Changes of Heart Rate Complexity during Weaning from Mechanical Ventilation

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Introduction: Discontinuation of mechanical ventilation in critically ill patients is a challenging task and involves a careful weighting of the benefits of early extubation and the risks of premature spontaneous breathing trial. Only a few studies have explored indices derived from heart rate (HR) and breathing pattern variability analysis for the estimation of weaning readiness.

Purpose: To investigate heart rate variability in patients with weaning failure or success, using both linear and nonlinear techniques. **Materials and Methods:** Thirty-two surgical patients were enrolled in the study. There were 22 who passed and 10 who failed a weaning trial. Signals were analyzed for 10 minutes during two phases: 1. pressure support (PS) ventilation (15-20 cm H₂O) and 2. weaning trials with PS: 5 cm H₂O. Low and high frequency (LF, HF) components and Poincaré plots of HR signals, HR multiscale entropy (MSE) and 1 exponent derived from detrended fluctuation analysis (DFA) were computed in all patients and during the two phases of PS. **Results:** Weaning failure patients exhibited significantly decreased LF normalized units [n.u] (5.89±0.31 vs 6.62±0.10), HF n.u (4.65±0.30 vs 5.06±0.26, $p<0.001$), HR MSE (0.76±0.32 vs 1.09±0.29, $p<0.05$), and DFA 1 exponent (0.75±0.11 vs 1.27±0.16, $p<0.001$) compared with weaning success subjects. Their changes were opposite between the two phases, except for MSE that increased between and within groups, demonstrating different curve profiles ($p<0.001$). DFA A1 exponent and HR MSE predicted successfully weaning outcome. Areas under the curve were respectively: 0.791 (0.054) and 0.724 (0.082, $p<0.05$ for both predictors). **Conclusions:** We suggest that nonlinear analysis of heart rate dynamics has a prognostic impact upon weaning outcome in surgical patients.