

## Autonomic Activity in Acute Trauma Patients

William C Shoemaker MD, Charles CJ Wo BS, Payman Fathizadeh MD, Joseph Colombo PhD, Howard Belzberg MD

### ABSTRACT

**Objective:** To evaluate effects of sympathetic (SNS) and parasympathetic nervous system (PSNS) activity monitored in heart rate (HR) and respiratory rate (RR) variability in acute trauma patients. To compare these markers of autonomic activity (AA) with temporal hemodynamic patterns, cardiac index (CI), mean arterial blood pressure (MAP), HR, arterial hemoglobin saturation, and transcutaneous O<sub>2</sub> and CO<sub>2</sub> tensions.

**Setting:** 83 severely injured patients were non-invasively monitored, shortly after admission to the emergency department (ED) in a level-1, university-run, trauma service.

**Methods:** Studied the temporal hemodynamic patterns of 149 patients and compared the spectrum of HR variability patterns as markers of AA. The HR variability was measured by spectral analysis, evaluated the low frequency area (LFa) and the high frequency area (RFa). The LFa and the LFa/RFa, reflect SNS activity and RFa is indicative of PSNS activity. HR variability was studied concurrently with noninvasive hemodynamic monitoring consisting of: a) cardiac output bioimpedance, HR, and MAP to reflect cardiac function, b) pulse oximetry (SapO<sub>2</sub>) to reflect changes in pulmonary function, and c) transcutaneous oxygen (PtcO<sub>2</sub>) indexed to the FiO<sub>2</sub> as a marker of tissue perfusion.

**Results:** Non-survivors had higher RFa values than the survivors suggesting greater PSNS activity. These changes were more marked when measured before sedation and pain medication. In survivors, these patterns were associated with increased CI and HR as well as normal MAP, SapO<sub>2</sub>, and normal tissue perfusion indicated by PtcO<sub>2</sub>/ FiO<sub>2</sub> ratios. Non-survivors had hypotension, tachycardia, low tissue perfusion, relatively normal CI, SapO<sub>2</sub>, and reduced oxygen delivery and consumption. These patterns were seen in subsets of patients with head injuries, spinal chord injuries, and pelvic fractures.

**Conclusions:** Increased AA in the patients' shortly after admission to ED was associated with immediate increases in HR, MAP, and CI. Patients with high RFa values, indicative of excess PSNS activation, were more associated with mortality and morbidity than patients with normal RFa values.