

# Autonomic Nervous System Monitoring of Patients With Penetrating Wounds

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## ABSTRACT

**Objective:** To describe and correlate the early effects of sympathetic (SNS) and parasympathetic nervous system (PSNS) activity on the heart rate (HR) with other hemodynamic variables in patients with severe penetrating trauma.

**Setting:** Penetrating trauma patients studied in a level 1 university-run trauma service.

**Methods:** We measured the sequential patterns of HR and respiratory rate (RR) variability immediately after admission to the emergency department (ED) by spectral analysis in severe penetrating injuries. The LFa is the area under the spectral analysis curve within the frequency range of 0.04 to 0.10 Hz. This area reflects primarily the tone of the SNS as mediated by the Vagal nerve. The high frequency or respiratory frequency area (RFa, also known as RFa) is a 0.12 Hz-wide frequency range centered around the fundamental respiratory frequency (FRF) defined by the peak mode of the respiratory power spectrum. It is indicative of vagal outflow reflecting PSNS activity. The LFa/RFa (Ratio), reflects the balance between the SNS and PSNS. The HR and RR variability were studied together with the noninvasive hemodynamic patterns after penetrating thoracic or abdominal injury. We measured cardiac index (CI) by bioimpedance, as well as HR, and mean arterial pressure (MAP) to evaluate cardiac function, pulse oximetry to reflect changes in respiratory function, and transcutaneous oxygen (PtcO<sub>2</sub>) to reflect tissue perfusion/oxygenation.

**Results:** Autonomic activity markedly increased in the nonsurvivors from normal baseline values to high values at 12 to 24 hours after admission. Nonsurvivors had low MAP, CI, and PtcO<sub>2</sub>/FiO<sub>2</sub> values associated with increased HR variability that reflect increased autonomic activity.

**Conclusions:** In nonsurvivors, hypotension, low flow, and decreased tissue perfusion, indicated by the decreased PtcO<sub>2</sub>/FiO<sub>2</sub> ratio, were associated with pronounced increases in autonomic activity. Survivors had relatively normal hemodynamic patterns and moderately increased autonomic nervous activity.