SHOCK VOLUME: A PRECISION MEDICINE BASED INDEX THAT PREDICTS TRANSFUSION REQUIREMENTS AND ORGAN DYSFUNCTION IN MULTIPLY INJURED PATIENTS

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Introduction: Multiply injured patients (MIPs) in hemorrhagic shock develop oxygen debt, which causes organ dysfunction and can lead to death. Clinicians monitor hypoperfusion by interpreting progression of traditional hemodynamic measures along with serum markers of hypoperfusion, which reflect current hemodynamic and metabolic status. However, these indices are sampled at discrete time points and poorly reflect cumulative hypoperfusion. Shock Volume (SV) is a novel, non-invasive, patient-specific index developed to quantify cumulative hypoperfusion. SV integrates the time and magnitude of shock index (Heart Rate/Systolic Blood Pressure) values above 0.9 (known threshold of hypoperfusion) using serial individual vital sign data. SV can be monitored in real time to assess ongoing hypoperfusion. The goal of this study was to determine how SV corresponded to transfusion requirements and organ dysfunction.

Methods: SV was measured in six hour increments for 48 hours after injury in a retrospective cohort of 74 MIPs (18-65; Injury Severity Score > 18). SV was compared to base deficit (BD) in predicting mass transfusions (MT) and critical administration transfusions (CATs). Presence of multiple organ failure (MOF) was determined using the Denver Organ Failure assessment score, while Sequential Organ Failure Assessment scores were used to determine magnitude of organ dysfunction.

Results: Patients who had accumulated 40 units of SV within six hours of injury and 100 units of SV within twelve hours of injury were at high risk for requiring MT or multiple CATs. SV measurements were equally sensitive and specific as compared to BD values in predicting transfusions. SV measurements at six hours after injury stratified patients at risk for MOF and corresponded to the magnitude of organ failure.

Conclusions: SV is a patient-specific index that can be quantified in real-time in critically injured patients. SV is a non-invasive surrogate for cumulative hypoperfusion and predicts high volume transfusions and organ dysfunction.