Predicting Response to Polytrauma through Resolution of Immunologic Mediators

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Background/Objective: Traumatic injury can lead to hemorrhagic shock and hypoperfusion in patients precipitating multiple organ dysfunction. This study adopts a precision medicine approach to identifying biological markers in predicting patient response to polytraumatic injury. Clusters of cytokines can be used to model the immunologic response to traumatic injury. We hypothesized that analyzing the resolution of immunologic mediators in clusters would reveal differences among groups of patients identified to be sensitive/tolerant to hemorrhagic shock.

Methods: Patients were required to have a stay in the ICU, one surgical operation, and a lower extremity traumatic injury. Blood samples were collected on patients at 0, 1, 12, 24, and 48 hours after injury. Multiplex analyses of 33 immunologic mediators were performed. A square-root transformation was applied to Luminex data before calculating z-scores (scores > 3 eliminated). Z-scores were summed to calculate composite cluster scores. T-tests were conducted to determine statistical significance.

Results: High SHVL shows higher inflammatory cluster levels and lower orchestration than low SHVL. Low SHVL shows higher reparative cluster levels and lower orchestration than high SHVL. High SHVL shows higher proinflammatory 1 levels before 12 hr and at 48 hr than low SHVL. Low SHVL has higher proinflammatory 2 levels and less orchestration at 0, 12, and 24 hr. Low SHVL has higher type 2 cluster levels than high SHVL. SS shows higher lymphoid cluster levels at 0 hr and 1 hr than ST. SS has higher reparative cluster levels than ST, while ST has more orchestration. SS has higher proinflammatory 2 cytokine levels, while ST shows more orchestration. SS has higher type 2 cluster levels, while ST shows more orchestration.

Conclusions: Cumulative hypoperfusion at time of injury is correlated with higher inflammatory cluster and proinflammatory 1 and 2 cluster cytokine levels as shown by both high SHVL and SS groups. Sensitivity to hemorrhagic shock and lesser hypoperfusion correlate to higher reparative cytokine cluster levels. Proinflammatory 2 cluster cytokine levels can be used to predict organ dysfunction.

Clinical Impact and Implications: This work presents findings that can inform acute trauma care through immunologic mediators and patient characteristics.