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Classifying Injury Severity and Predicting Neurologic Outcome after Acute Human Spinal Cord Injury with Cerebrospinal Fluid Biomarkers.

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Objectives

Neurologic impairment after spinal cord injury (SCI) is currently measured and classified by functional examination (i.e. the ASIA Impairment Scale (AIS) and ISNCSCI exam). These are gross measures of spinal cord pathology and imprecise predictors of neurologic outcome. *The objective of this study was to determine how well inflammatory and structural proteins within the CSF of acute SCI patients predicted their AIS grade conversion and motor score improvement.*

Method

Fifty individuals with acute SCI (29 AIS A, 9 AIS B, 12 AIS C) were prospectively enrolled at our level one trauma institution (32 cervical, 18 thoracic). Lumbar intrathecal catheters were inserted at the time of surgery to obtain CSF samples over 3 to 5 days. A bead multiplex array and ELISAs were performed for inflammatory cytokines and structural proteins: IL-6, IL-8, MCP-1, IL-16, IP-10, IL-16, TNF-R1, Tau, S100β, and GFAP. The 24-hour post-injury CSF concentrations were analyzed in relation to baseline AIS grade, AIS grade improvement ("conversion") over 6 months, and motor score improvement over 6 months.

Results

The 24-hour post-injury CSF levels of IL-6, tau, S100β, and GFAP were each strongly correlated with baseline AIS grade of A, B, or C. For both cervical and thoracic SCI, the IL-6, IL-8, MCP1, Tau, S100β, and GFAP concentrations strongly predicted AIS conversion at 6 months post-injury. Using locally weighted linear regression (Lowess) modelling, the combination of IL-6 and S100β clearly identifies cervical and thoracic SCI patients who will not spontaneously recover motor function.

Conclusions

The analysis of CSF can provide valuable biological information about injury severity after acute SCI. Such biological markers may be valuable tools for stratifying individuals in acute clinical trials where variability in spontaneous recovery requires large recruitment cohorts for sufficient power.