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The Association Between Mean Arterial Blood Pressure Augmentation and Intraparenchymal Hemorrhage After Acute Spinal Cord Injury

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Objectives

Acute traumatic SCI results in microvascular disruption and intraparenchymal hemorrhage (IPH), which is viewed as a bad prognostic sign when seen on MRI imaging. Additionally, the blood itself (and its breakdown products) are deleterious to the neural tissue and may increase secondary damage. And so, approaches that increase such IPH may be deleterious for recovery. Mean arterial blood pressure (MAP) augmentation to maintain MAP between 85-90 mmHg for 7 days is a routine part of acute SCI management, as per the 2013 CNS/AANS Guidelines. The objective of this study is to evaluate the relationship between MAP augmentation and IPH during the first week post-injury in patients with acute cervical SCI.

Method

Patients with acute cervical SCI were enrolled at our Level-1 trauma center, and underwent a routine clinical MRI pre-operatively, and then four subsequent MRIs at 2,4,7, & 14 days post-injury. Axial and sagittal T2-weighted images were used to quantify the extent of IPH. MAP augmentation with a target maintenance of 85-90 mmHg was achieved with norepinephrine for 7 days post-injury, and all MAP recordings were captured. A "time-weighted" average of the MAP (TWA-MAP) over the period between the baseline MRI and the subsequent MRIs was calculated in order to assess the "MAP exposure" of the injured spinal cord between imaging studies.

Results

12 cervical SCI patients have been enrolled; at the baseline time point, all patients demonstrated IPH. On days 2 and 4, the extent of IPH progressed, followed by a reduction in the IPH area on days 7 and 14. During the first 48-96 hours after injury, TWA-MAP significantly correlated with change in IPH ($p < 0.05$), with MAP above ~86 mmHg associated with an increase in IPH.

Conclusions

By performing serial MRIs in the early post-injury period, we have established that patients who have signs of IPH at the time of their presentation may have worsening hemorrhage with MAP augmentation. These findings have important implications for acute SCI management and may help to tailor hemodynamic management recommendations.