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Comprehensive Analysis of Diffusion Tensor Imaging in Spinal Cord Injury

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Introduction

We present a comprehensive analysis of diffusion tensor MR imaging (DTI) in spinal cord injury (SCI). Translational experiments were performed in rats and humans with SCI. DTI indices derived fron the SCI 'zone' and distal spinal cord segments are presented. A rationale for incorporation of DTI as a new noninvasive prognostic and diagnostic tool in SCI patients is discussed

Methods

Animal experiments used cohorts of rats imparted with moderate thoracic SCI using an NYU Impactor. Human studies were conducted on a cohort of SCI patients and controls. Animal imaging studies were performed using a Bruker 9.4T scanner. Human imaging was conducted using a 1.5T clinical scanner

Results

Aniaml studies showed a significant temporal and spatial correlation of DTI indices lADC, tADC and MD at the zone of injury. MD was also significantly reduced in the cervical spinal cord after injury. The change in DTI indices at the injury zone and in the cervical spinal cord correlated with postmortem histology. lADC was also noted to correlate significantly with changes in amplitude of spinal somatosensory evoked potentials after injury.

Human studies showed a characteristic pattern of FA throughout the normal spinal cord. As observed in animal studies, lADC, tADC and MD chaged in a predictable fashion both temporally and spatially at the injury zone. Further, MD was significantly lower in cervical cord after SCI

Conclusions

We present comprehensive data validating DTI as a novel method that may provide reliable biomarkers for tissue changes in the entire spinal cord after SCI. Further, we demonstrate that DTI indices correlate well with known measures of spinal cord function after SCI. We believe that DTI can be a valuable tool to better estimate prognosis in SCI patients. Further, we recommend based on these studies that DTI should be considered as an imaging paradigm in forthcoming transplantation studies for SCI patients.

Learning Objectives

At the conclusion of this presentation, participants should be able to 1)perceive the evolution of DTI as a new and clinically important tool to assess SCI prognosis as well as 2)a guide to noninvasively follow the effect of new transplantation therapies for SCI

References

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