Mapping traumatic axonal injury using diffusion tensor imaging: correlations with functional outcome

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Introduction: Traumatic brain injury (TBI) is a major cause of morbidity and mortality. The extent and severity of TBI is greatly underestimated by CT and conventional MR sequences, and these appearances often correlate poorly with functional outcome. Diffusion tensor imaging (DTI) may offer insights into the extent and distribution of traumatic axonal injury (TAI) post TBI. The Glasgow Outcome Score (GOS) is the most widely used outcome measure post TBI. This analysis aimed to investigate how diffusivity parameters change in patients at least 6 months post injury with outcomes ranging from the vegetative state (VS) and minimally conscious state (MCS) spectrum (GOS 2) to good recovery (GOS 5).

Methods: 61 patients underwent MR imaging at a minimum of six months post injury using a 3 Tesla Siemens Magnetom Total Imaging Matrix (TIM) Trio system. Informed consent or assent from next-of-kin was obtained in all cases. Ethical approval was obtained from the Local Research Ethics Committee. 32 age matched controls underwent an identical imaging protocol which included a 3D T1 weighted structural sequence (MPRAGE) and diffusion tensor imaging. The DTI parameters were as follows: 12 non-collinear directions; 6 b values (0 to 1590 s/mm

Results: ADC, axial (A1) and radial diffusivity (A2+A3/2) all showed a significant trend for increasing values with worse clinical outcomes (Fig.1). We also observed a concordant significant trend for lower FA with worse outcome. These trends were confirmed by visual inspection of global tractography images (Fig.2).

Discussion: There was evidence of trends in DTI parameters in the central white matter with corresponding to the clinical severity of disease outcome in patients post TBI. The ability to detect the overall disease burden into groups may be important in allowing insights into disease progression and the pathophysiology of neurocognitive outcome.

References:
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