Grey and White Matter Health After mTBI

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Introduction

Mild Traumatic Brian Injury (mTBI) is a significant cause of disability globally and in New Zealand is estimated to occur 749 in 10000 person-years (1). While the majority of patients that suffer mTBI make a complete recovery between 3 and 12 months following the injury, approximately 15% of all mTBI will have ongoing symptoms one year after initial injury (2). This condition is known as Post Concussion Syndrome (PCS). In the majority of mTBI cases conventional radiological investigations (Computed Tomography or Magnetic Resonance Imaging (MRI)) are normal; diffusion MRI may provide more information to help understand development of chronic symptoms. Moving forward, injury prevention, early diagnosis, treatment and identification of people at risk of developing PCS would mean better patient education and resource allocation for rehabilitation; this in turn may ease the burden of this condition.

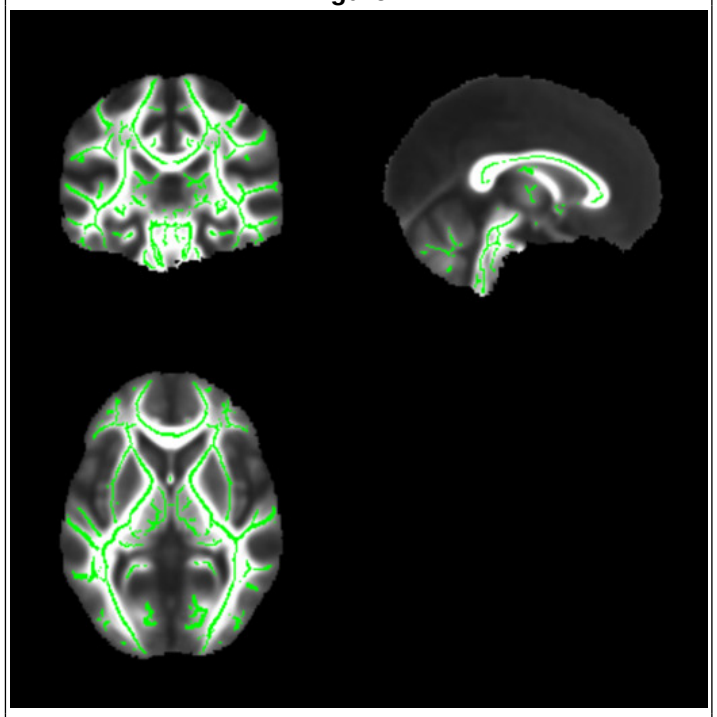
Methods

The study population of 114 patients included: 31 patients with full recovery following mTBI (Non-PCS), a group of 42 patients who have not recovered after 6 months (PCS), and a group of 41 normal controls (Controls). The participants have been matched on age, gender, injury severity (GCS, PTA: injury severity scores), education and ethnicity. Each patient completed neurocognitive testing and structural (T1- weighted) and diffusion tensor imaging (DTI) MRI scans. Voxel based morphometry was used to investigate differences in grey matter volumes between the groups, as well as to investigate correlations with neurocognitive outcomes. Cortical thickness was also calculated. Tract based spatial statistics (TBSS) were used to investigate differences and correlation with neurocognitive outcomes between diffusion metrics (fractional anisotropy, mean diffusivity).

Results

There were no significant differences in brain volume, cortical thickness, or DTI metrics along the centres of principal white matter tracts between the PCS and non-PCS groups, nor when these two mTBI groups were compared to controls.

Figure 1



Study specific Mean FA as a base with overlay of white matter skeleton mask in green. This shows good result with normal white matter tract anatomy.

Discussion:

In this study, we used structural and DTI to investigate grey matter atrophy, cortical thickness, and white matter integrity across four participant groups: PCS, non-PCS, and healthy controls.

As with this study, many previous studies report an absence of marked brain differences between mTBI patients and controls, or within mTBI. However, this negative finding does not support the majority of published literature on the topic. This may be explained by the heterogenicity of methodology, mTBI definition and timing of MRI scan relative to time after injury across the literature.

Conclusions

Our findings lack significance between non-recovered and recovered mTBI groups. There are mixed findings in the literature on this topic. A prospective study following mTBI from acute to chronic state with serial imaging or other more advanced imaging and sophisticated methods such as such as HARDI or diffusion kurtosis should be used in future research to evaluate mTBI.

References

1. Feigin VL, Theadom A, Barker-Collo S, Starkey NJ, McPherson K, Kahan M, et al. Incidence of traumatic brain injury in New Zealand: A population-based study. Lancet Neurol. 2013

2. Alexander MP. Mild traumatic brain injury: Pathophysiology, natural history, and clinical management. views Rev Neurol. 1995;45:1253–60.