

# Serial diffusion tensor imaging demonstrates that the degree of prematurity at birth is associated with white matter microstructure at term equivalent age but not to white matter microstructure in the early neonatal period.

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## Introduction

Using tract based spatial statistics (TBSS)<sup>1</sup> analysis of diffusion tensor imaging (DTI) data, we have previously demonstrated a dose-dependent effect of prematurity on white matter (WM) integrity, as measured by fractional anisotropy (FA), at term equivalent age.<sup>2,3</sup> The aim of this study was to determine whether degree of prematurity at birth is associated with FA values in the early neonatal period.

## Methods

Inclusion criteria were preterm birth < 33 weeks gestational age (GA), serial magnetic resonance imaging (MRI) and DTI with first scan  $\leq$  33 weeks GA and second at term equivalent age. Infants with evidence of focal lesions on MRI or motion artefact on DTI were excluded from the study. 50 preterm infants, with a median (range) GA at birth of 28 ( $24^{+4} - 32^{+6}$ ) weeks, were included. DTI data were analysed using a TBSS protocol optimised for the neonatal brain.<sup>3</sup> Voxel-wise cross subject statistics were performed to assess the correlation between age at birth (in weeks) and FA values, adjusted for age at scan. Results were corrected for multiple comparisons and  $p < 0.05$  was considered significant.

## Results

Scan 1: 31 ( $25^{+2} - 33$ ) weeks GA. There were no significant correlations between GA at birth and FA in any WM region.

Scan 2:  $41^{+2}$  ( $38^{+6} - 44^{+1}$ ) weeks GA. GA at birth was significantly linearly correlated with FA values in the corpus callosum, internal and external capsule, optic radiation, cerebral peduncles, cingulum and inferior longitudinal fasciculus.

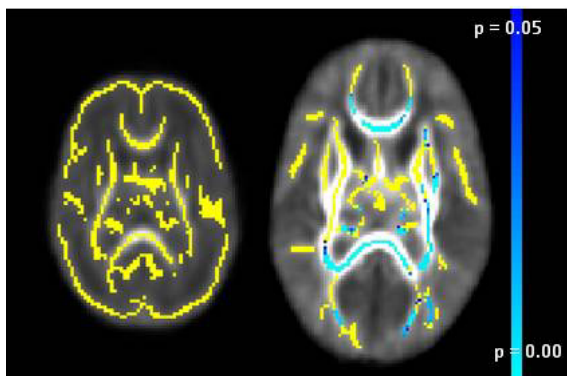


Figure 1. Mean FA skeleton (yellow) overlaid on the mean FA map for the preterm group (left) and at term equivalent age (right). Regions in blue show where FA correlates significantly with GA at birth, adjusted for age at scan.

## Discussion

We observed a dose dependent effect of prematurity on WM microstructure at term equivalent age, as described previously.<sup>2,3</sup> However, there was no relationship between degree of prematurity at birth and FA values in the early neonatal period. These data suggest that diffuse WM injury is not an inevitable consequence of preterm birth, and imply there may be a window of opportunity between birth and term equivalent age where intervention with appropriate treatments may ameliorate the adverse effects of prematurity on WM development.

## References

1. Smith et al. 2006
2. Anjari et al. 2007.
3. Ball et al. 2010