White matter integrity

In the context of normal ageing, some individuals experience cognitive changes that affect their decision-making abilities. Timpe et al. investigated whether such cognitive changes could be related to the integrity of cortical white matter, as measured by diffusion tensor imaging (DTI). Participants were administered a well-validated laboratory decision-making task, and were subsequently grouped as either poor decision-makers (older-impaired, n = 9) or strong decision-makers (older-unimpaired, n = 7). Participants also underwent magnetic resonance imaging (MRI) that collected high-resolution structural images, including DTI of the brain. The key variable of interest to be contrasted between the groups was fractional anisotropy (FA), as calculated from the tensor images. They hypothesised that FA values would be lower (indicating poorer integrity of tracts) in the older-impaired participants. The results supported our hypothesis, indicating significant differences in FA values between the participant groups for the entire brain as well as several subregions. The results suggest that poorer decision-making abilities are associated with the integrity of cortical white matter across multiple regions of the brain, and support the call for additional research in this area ¹⁾.

In a prospective longitudinal design, Hirad et al. demonstrated there are reductions in midbrain white matter integrity due to a single season of collegiate football, and that the amount of reduction in midbrain white matter integrity is related to the amount of rotational acceleration to which players' brains are exposed. They then replicated the observation of reduced midbrain white matter integrity in a retrospective cohort of individuals with frank concussion, and further show that variance in white matter integrity is correlated with levels of serum-based tau, a marker of blood-brain barrier disruption. These findings mean that noninvasive structural MRI of the midbrain is a succinct index of both clinically silent white matter injury as well as frank concussion².

1)

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