Diffusion Tensor Imaging in Mild Traumatic Brain Injuries – Acute State and Short-Term Recovery

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Mild traumatic brain injuries (MTBI), in most cases, cannot be detected using imaging modalities like CT or MRI. However, diffusion tensor imaging (DTI) reveals subtle changes in white matter integrity as a result of head trauma and plays an important role in refining diagnosis and management of MTBI. We use DTI to detect the microstructural changes in collegial football players induced by axonal injuries and to monitor their evolution during the recovery process. Three players suffered a MTBI during play or practice and underwent scanning within 24h with follow-ups after one and two weeks. Scalar diffusion indices were derived from diffusion tensors and analyzed using tract-based spatial statistics (TBSS) and voxel-wise t-tests to detect brain regions showing significant group differences between the injured subjects and controls. Both analyses revealed overlapping regions in the corticospinal tract with significant increase in fractional anisotropy and decreases in transverse and mean diffusivity within 24h. In voxel-wise t-tests strong indications for recovery were found spatially and temporally. For mean and transverse diffusivity, regions showing significant differences shrunk between the first and the follow-up scans. Although the sample size is small, these findings are remarkably consistent across all subjects and scans.