

Diffusion Tensor and Susceptibility-weighted Imaging in Concussion Assessment of National Football League Players

Neal Luther MD, BS, BA; Sumit Niogi MD; Kenneth Kutner; Scott Rodeo; Teena Shetty; Russell Warren; Leigh Weiss; Ronnie Barnes; Robert Zimmerman; Apostolos Tsiouris MD; Roger Hartl MD

Introduction

Standard magnetic resonance imaging (MRI) is normal following the vast majority of concussions. Diffusion tensor imaging (DTI) and susceptibilityweighted imaging (SWI) are advanced MRI techniques hypothesized to be more sensitive in detecting subtle evidence of structural brain injury. Using DTI and SWI in National Football League (NFL) players, we aim to elucidate and localize the presence of such injury following concussions.

Methods

This ongoing prospective study has recruited active NFL players with and without history of concussion within six months prior to entry. Neurological and neurocognitive examination, DTI, and SWI were performed on each subject. Blinded neuroradiologists performed radiographic analysis. Fractional anisotropy (FA) values were measured for eleven distinct white matter tracts on DTI. A global FA value was calculated. SWI was utilized to assess for microhemorrhage. Statistical comparisons between players with and without recent concussion, and to civilian controls, were made.

Results

Seven of eighteen evaluated players to date had a concussion within six months of entry. On DTI, of the eleven tracts evaluated, a significant decrease in FA for concussed players was seen in one tract. There was no significant difference in global FA assessment between players with and without recent concussions. Civilian control comparisons are ongoing. SWI was negative in all players.

Conclusions

To our knowledge this is the largest prospective brain imaging study, and the first utilizing DTI and SWI to assess anatomical injury secondary to concussion, in NFL players. Minimal changes have been observed in players with recent concussion. The clinical significance of these findings remains under investigation.

Learning Objectives

By the conclusion of the session, participants should be able to 1) understand the role of DTI and SWI in the evaluation of mild traumatic brain injury 2) discuss to what degree long-term football play poses risk in terms of structural brain injury.

[DEFAULT POSTER]