Relationship Between MEG and Diffusion Imaging Measured Changes Over a Season of High School Football

Monday 3:10-3:20 PM | SSE20-02 | Room: S102AB

PURPOSE

The purpose of this study is to characterize associations between Diffusion Tensor Imaging (DTI), Diffusion Kurtosis Imaging (DKI), and magnetoencephalographic (MEG) measure delta waves over a season of high school football in the absence of clinical concussion.

METHOD AND MATERIALS

Twenty-four players from a high school football team (mean age=16.9; no history of concussion) were instrumented with the Head Impact Telemetry System (HITs) during all practices and games. The biomechanical metric Risk Weighted cumulative Exposure (RWE) was computed. All players received pre- and post-season MRI. Whole-brain DTI images were acquired using a 2D single-shot EPI sequence. DTI-derived metrics were calculated using DTI-TK. DKI-derived metrics were computed using the Diffusional Kurtosis Estimator. Eight minutes of eyes-open, resting-state MEG data were acquired pre- and post-season for each subject and brain space delta wave power was computed. Changes (post-minus pre-season) of each metric were computed for each subject and then used to determine the total number of abnormal voxels (2 standard deviations above or below the group mean). We have previously shown changes in select DTI, DKI, and MEG metrics to correlate with RWE. Spearman's rank correlation analyses were performed to examine the relationships between MEG, DTI, and DKI data.

RESULTS

Spearman's rank correlation analyses revealed a statistically significant association between the number of abnormal SKI Tortuosity voxels and abnormally increased MEG delta power voxels. There was also a strong correlation between DTI axonal water fraction (AWF) and MEG delta power.

CONCLUSION

We demonstrate a significant correlation between the changes in tortuosity and MEG delta power over a season of high school football in the absence of clinical concussion. Fractional anisotropy (FA) was not significant, possibly because it is a less specific measurement. Tortuosity is expected to be sensitive to the myelinated axonal fraction where FA is a measure of general anisotropy. The relationship of Tortuosity with delta waves may indicate a correlation between the number of myelinated axons and delta waves.

CLINICAL RELEVANCE/APPLICATION

Both DKI and MEG may be more sensitive than current conventional imaging and they may provide information regarding physiological changes mediating sub concussive and concussive injuries.