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Long-Term Structural and Functional Brain Imaging Findings in American Football Players: Systematic Review and Meta-Analysis

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Introduction

- Lasting neurocognitive deficits after participation in football is a growing public health concern.
- Brain imaging studies have suggested that long-term neuroanatomical changes occur in football athletes, but the clinical importance of these findings remains unknown.
- Our objective was to summarize the brain imaging studies after long-term SRC in American football players.

Methods

- A systematic review was performed with the following inclusion criteria: football players, brain imaging at least 2 years from prior concussion or retirement, and sample size >5.
- Studies were assessed for methodology (selection of controls, type I error, recall bias, and baseline imaging) and imaging outcomes.
- Proportion tests were used to assess which methodologies were likely to lead to positive results.

Results

- Sixteen studies (all cross-sectional studies) met inclusion criteria.
- Highest level of play was high school (1), college (3), and professional (12).
- Thirteen of the 16 studies made a total 456 comparisons of brain activity, of which 171 were statistically significant (38%).
- Nine of 16 studies (56%) had appropriate controls.
- Five of 16 studies (31%) had appropriate control of type I error.
- All studies (16/16) had recall bias when obtaining player concussion history or had unclear methodology.
- Imaging outcome measures included patterns of connectivity on functional MRI (fMRI) (25%), metabolic changes on 1H-MR spectroscopy (6.3%), and white matter changes on diffusion tensor (DTI) imaging (31.2%).
- Zero of 16 studies (0%) had baseline imaging performed.

Conclusions

- Studies of long-term structural and functional brain imaging findings in American football players are heterogeneous in both methodology and findings.
- Understanding the clinical significance of statistically positive findings is complicated by methodological limitations and study design.
- Further research is required to correlate imaging findings with clinical outcomes.

References

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