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Repeated head blows linked to smaller brain volume and slower processing speeds

Impact evident at relatively young age and linked to heightened risk of cognitive impairment

[Repeated head trauma is associated with smaller thalamic volumes and slower processing speed: the Professional Fighters' Brain Health Study Online First doi 10.1136/bjsports-2014-093877]

Repeated blows to the head sustained during serial boxing or martial arts tournaments are linked to smaller volumes of certain parts of the brain and slower processing speeds, reveals research published online in the ***British Journal of Sports Medicine***.

The researchers base their findings on 224 professional fighters (131 mixed martial arts fighters and 93 boxers), all of whom were taking part in the Professional Fighters Brain Health Study (PFBHS), and 22 people with no history of head trauma, but matched for age and educational attainment.

All of the PFBHS participants were athletes who were aged 18 to 44. Just over half had not progressed beyond high school, while just over half had at least some college level education.

The amount of time they had spent as professional fighters ranged from 0 to 24 years, averaging out at 4 years. Similarly, the total number of professional matches they had competed in ranged from 0 to 101, averaging out at 10 a year.

All participants underwent an MRI (magnetic resonance imaging) scan to assess brain volume at the start of the study and then annually for four years after that. Verbal memory, processing speed, fine motor skills and reaction times were also tested to measure their brainpower.

The researchers calculated the Fight Exposure Score, or FES, which combines duration and intensity of fight career.

Generally, the higher the score the smaller the volume, particularly of the thalamus and the caudate, with each increase in FES linked to reductions of 0.8% in both these structures.

The thalamus acts as a gateway to the cortex and can affect a wide range of neurological functions, say the researchers.

Smaller volumes and a higher FES score were associated with slower brain processing speeds, with an estimated 0.19% reduction in processing speed per fight and a 2.1% reduction for each increase in FES.

Fighters with an FES score of 4 were 8.8% slower in processing speed than those with an FES score of 0.

Furthermore, higher FES scores were associated with a heightened risk of cognitive impairment.

Boxers generally fared worse than martial arts combatants, irrespective of their age. The volumes of their brain structures were smaller than those of the martial arts combatants, and they were mentally slower.

"Perhaps the most obvious explanation is that boxers get hit in the head more," suggest the authors. "In addition to trying to concuss (ie knock out) their opponent, martial arts fighters can utilise other combat skills such as wrestling and jiu jitsu to win their match by submission without causing a concussion," they add.

There are several ways in which the thalamus and caudate could be vulnerable to volume loss, they add, including the rotational movement of the head as a result of punches delivered during a boxing match, for example.

"Not only does it appear that differences in MRI volumetrics associated with fight exposure can be detected in relatively young individuals, but these differences occur in particular subcortical structures," write the authors.

They go on to suggest that there do seem to be important indicators of brain damage linked to repeated blows to the head, which could be used to inform future regulations, while the FES could help to set criteria for required neurological checks or retirement from the sport.