

Are Females at a Greater Risk for CTE?

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Chronic Traumatic Encephalopathy, CTE, is a degenerative brain disease that is caused by repeated head injuries. This is not limited to just concussions; minor hits are also a huge risk factor. The symptoms of CTE are very similar to Alzheimer's, and it is most common in athletes who played contact sports and military veterans. CTE is a challenging disease to diagnose because it can only be confirmed through brain tissue samples which can only be obtained after death. Currently, CTE has been studied much more extensively in males' brains than it has in females'. As of 2019, hundreds of deceased men had been diagnosed with CTE and only two deceased women had been diagnosed (McAlpine, 2019). There are sex differences when it comes to concussions which indicates that there could be sex differences when it comes to CTE.

Men have higher rates of concussions than females which is likely due to the fact that men are more likely than women to participate in contact sports like football, hockey, and boxing (Jones, 2018). The three sports with the highest rate of concussions are men's football, women's soccer, and men's ice hockey. However, when looking solely at concussions resulting from practice alone, the three sports with the highest risk are men's football, women's cheerleading, and men's wrestling (Howard, 2018). Therefore, in order to compare head injuries between males and females, sports with similar participation and rules between sexes must be examined. When compared in sports that fit these guidelines like soccer and basketball, it was discovered that women are up to two times more likely to receive a head injury than men (Covassin et. al., 2003). Not only are women more likely to sustain a concussion, but they are more likely to experience symptoms and usually have a longer recovery time. On average, females take 76 days to recover compared to 50 days for males (Robson, 2019).

The exact cause of this discrepancy has not yet been determined, but there are many theories as to why females are more prone to concussions. One theory is that men have larger and more muscular necks which allow them to better brace their head upon impact. Women also have smaller nerve fibers leading to the brain which makes them more susceptible to head injuries. Another theory is that it is related to differing hormone levels. One study found that women receiving a concussion in the first half of

their menstrual cycle, when estrogen levels are higher, had a longer recovery time compared to women who received a concussion in the second half of their cycle or were taking birth control pills, when progesterone levels are increased. A third theory is that the increased metabolism of female brains makes it more damaging when blood circulation is interrupted (Robson, 2019). While these theories are plausible, the exact cause is unknown.

Overall, there are widely accepted differences between sexes when it comes to other diseases, especially other brain diseases. Women make up more than $\frac{2}{3}$ of those diagnosed with Alzheimer's. It is believed that concussions affect women more commonly and more severely, so more research has to be done about the implications of CTE in females. There are an estimated 3.8 million concussions each year, and about half of them go unreported (Harmon et. al., 2013). Men are more likely than women to not report concussion symptoms. Studies indicate that more than $\frac{3}{4}$ of male athletes will lie about symptoms in order to continue playing (Jones, 2018). Concussions and other head injuries can have serious long-term effects which is why it is very important to recognize the symptoms and honestly report them.

References

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