

ORAL Testimony

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Mixed Martial Arts: Issues and Perspectives

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Mr. Chairman and Members of the Committee:

Thank you for the invitation to testify today on Mixed Martial Arts: Issues and Perspectives. My name is Dr. Ann McKee. I am a Professor of Neurology and Pathology at Boston University School of Medicine, I am [Chief of Neuropathology, VA Boston Healthcare System](#) and I am Director of the CTE Center at Boston University School of Medicine. My testimony today reflects my professional opinion; I am not speaking officially on behalf of the Department of Veterans Affairs or Boston University School of Medicine.

CTE or Chronic Traumatic Encephalopathy is a major problem in contact sports, such as boxing and football, and any other sport that involves a high number of head impacts, such as mixed martial arts. Even though there is not much research available on the long-term consequences of MMA, we do know it has a high concussion rate, and importantly, it also has a high subconcussive impact rate.

CTE is a neurodegenerative disease triggered by repetitive head trauma that causes buildup of an abnormal protein called tau in the brain, the abnormal tau is toxic to nerve cells and causes progressive brain deterioration over time. The symptoms of CTE are delayed, and often do not show up until the athlete has retired from the sport. Once the symptoms begin, they progress and become worse as the person ages. Symptoms of CTE include memory loss, confusion, impulse control problems, aggression, depression, anxiety and dementia. CTE was originally described in boxing, and now has been found in many other sports. We found evidence of CTE in the only one MMA fighter we examined, a 27 year old who took his own life, and there is good reason to believe that a significant portion of other MMA fighters are at risk for CTE. This is because exposure to repetitive head impacts is the major risk factor for CTE and MMA fighters

experience substantial head trauma during their fights, as well as during their training and sparring sessions.

There has been a primary focus on the role of concussions in the development of CTE - even the movie about CTE was named “Concussion” – yet all of our research to date points to the fact that CTE is associated with prolonged exposure to repetitive small impacts, the *subconcussive* hits that are asymptomatic. In sports like MMA, the risk for CTE is not directly related to the number of concussions – rather the risk for CTE is related to the cumulative exposure to subconcussions that occur with every blow to the head. The longer you play contact sports, the higher your exposure to repetitive head impacts, and the higher the risk for CTE. Starting a contact sport at a young age often leads to a longer playing career and greater exposure to head trauma, but another factor that contributes to enhanced risk for young athletes is that the developing brain is more susceptible to damage from repetitive head trauma.

There is a lot of skepticism regarding the significance of CTE. For years, some skeptics have said that CTE was not “a real disease”, they say there is confusion and debate amongst scientists and that CTE cannot be distinguished from Alzheimer’s disease or aging or epilepsy. But there is no scientific confusion about whether CTE exists. CTE not only exists, it is definitively diagnosed by neuropathological examination of brain tissue. In 2015 and 2016, a panel of expert neuropathologists convened by the National Institute of Neurological Diseases and Stroke determined that CTE was a unique disease that could be easily distinguished from other tau-based diseases. The experts even went on to say that there is a *pathognomonic* lesion for CTE – a lesion found in CTE that is specific for CTE and not found in any other disorder.

The other misinformation about CTE is that it is very rare, because it has only been diagnosed in a few hundred people and there are millions of people who have played contact sports. But

CTE is not rare, we would not be able to find 218 cases of CTE in 291 athletes ranging in age from 18 to 98 years over the past 8 years if it were rare. If you don't look for something, don't know how to look for something, and don't find it that does not mean that that something is rare; it means it is under recognized. You have to know how to look for CTE in order to find it. We have found CTE in 75% of brains of athletes donated to our brain bank, and while that does not represent the percentage of living athletes with CTE, it does indicate the disease is much more common than we previously thought. Recent brain bank studies looking for previously unrecognized CTE have found changes of CTE in 5% of the general autopsy population and in 1/3 of contact sport athletes in a neurodegenerative disease brain bank.

We have made a tremendous number of advances in understanding CTE over the last few years. For instance, we have published criteria for the pathological diagnosis, we have proposed criteria for a staging scheme of pathological severity, we have proposed criteria for the clinical diagnosis, we know what the earliest lesions of CTE are and how they affect the brains of young athletes, we know that inflammation plays a key role in the development of CTE and we have made significant inroads into diagnosing CTE in the living.

If you were to ask me how we limit risk for CTE in MMA, I would say:

1. Don't allow children and young adults to participate in full contact with head strikes
2. Educate fighters so they learn their greatest opportunity to limit exposure is to not allow head strikes in training and sparring exercises
3. Limit the number of head strikes in a match
4. Reduce the number of full-contact matches per season

CTE is a big problem for contact sports, and what we know today is very likely only the tip of the iceberg. While we recognize the importance of contact sports to an athlete's physical and

psychological well-being, CTE is a known and preventable consequence. There is great urgency for more funding for research on CTE and the risks for CTE associated with sports like MMA, football, boxing, and ice hockey, and military service. We need to dedicate significantly more resources to understanding and treating this preventable disease. We need to bring hope to the players and Veterans who are in the beginning stages of this disease and showing signs of memory loss, behavioral changes and depression. We need to develop effective interventions and treatments so that all individuals can continue to participate in the sports they love, but also live long, healthy, productive lives.