Journal of
Neuroinfectious Diseases
ISSN: 2314-7326

Gurpreet, J Neuroinfect Dis 2025, 16:2

Mini Review Open Access

Chronic Traumatic Encephalopathy (CTE): A Growing Concern in Brain Health

Gurpreet Kaur*

Department of Neuroimmunology, Savitribai Phule Pune University, India

Introduction

Chronic Traumatic Encephalopathy (CTE) is a progressive neurodegenerative disease linked to repeated head trauma. Once primarily associated with boxers, CTE has gained significant attention due to its prevalence among football players, hockey players, military personnel, and others exposed to repeated brain injuries. As awareness of CTE grows, researchers are working to better understand its causes, symptoms, prevention, and potential treatments. This article delves into the nature of CTE, its effects on individuals, and ongoing efforts to mitigate its impact. Chronic Traumatic Encephalopathy (CTE) is a progressive neurodegenerative disease caused by repeated head trauma. It is most commonly observed in athletes involved in contact sports, military personnel exposed to blasts, and individuals with a history of repeated concussions or sub-concussive impacts. CTE results from the accumulation of an abnormal protein called tau, which gradually spreads throughout the brain, disrupting normal function and leading to severe cognitive, emotional, and motor impairments. The symptoms of CTE do not usually appear immediately after head injuries but can develop years or even decades later. Early signs include mood swings, depression, impulsivity, and memory loss. As the disease progresses, individuals may experience severe cognitive decline, aggression, speech difficulties, and motor dysfunction similar to Parkinson's disease. In advanced stages, CTE can lead to dementia and significantly impact an individual's quality of life. One of the greatest challenges with CTE is that it can only be definitively diagnosed post-mortem through brain tissue analysis. However, ongoing research aims to develop reliable methods for early diagnosis using brain imaging and biomarkers [1,2]. While there is no cure for CTE, prevention strategies such as improved protective gear, rule changes in sports, and strict concussion management protocols can help reduce the risk. With increasing awareness of CTE's devastating effects, efforts are being made to enhance safety in sports and military training. Understanding the risks and taking proactive measures can help protect individuals from this life-altering condition while advancing research toward potential treatments [3,4].

Discussion

Chronic Traumatic Encephalopathy (CTE) is a complex and pressing issue that has gained significant attention in recent years due to its impact on athletes, military personnel, and others exposed to repeated brain trauma. Despite growing awareness, many aspects of CTE remain poorly understood, including the exact mechanisms that lead to its progression and potential treatment options [5]. A key challenge in addressing CTE is the difficulty in diagnosing it during a person's lifetime. Since CTE can only be confirmed post-mortem through brain tissue analysis, researchers are actively working on developing diagnostic tools such as advanced imaging techniques, biomarkers, and blood tests. Early diagnosis would allow for better management and preventive measures, potentially slowing down the disease's progression. Another critical issue is the lack of a cure. Current treatments focus on managing symptoms such as depression, anxiety, and memory loss rather than addressing the root cause. Research into neuroprotective therapies, stem cell treatments, and anti-tau drugs offers hope for future advancements [6]. Prevention remains the most effective approach to combating CTE. Sports organizations have implemented rule changes to minimize head impacts, and better protective gear is being developed. Concussion awareness programs emphasize the importance of proper recovery and limiting exposure to repeated brain injuries. The military has also adopted strategies to reduce blast-related head trauma in combat situations. CTE's impact extends beyond the individual, affecting families and communities. High-profile cases have sparked debates about the responsibility of sports organizations and military institutions in protecting individuals from long-term brain damage. Continued research, policy changes, and education are crucial to mitigating the risks associated with CTE and improving the lives of those affected by this debilitating condition [7].

Causes and Risk Factors

The primary cause of CTE is repeated head trauma, which can result from direct impacts or even sub-concussive blows—hits that do not cause immediate symptoms but contribute to long-term damage. The most at-risk populations include:

Athletes: Particularly those involved in contact sports like football, boxing, hockey, rugby, and soccer.

Military Personnel: Exposure to blasts and head injuries during combat increases the risk of developing CTE.

Victims of Domestic Abuse: Repeated blows to the head from abuse may contribute to brain trauma.

Workers in High-Risk Professions: Construction workers, stunt performers, and others exposed to frequent head impacts [8].

Diagnosis and Challenges

Currently, CTE can only be definitively diagnosed post-mortem by examining brain tissue for tau protein deposits. However, researchers are working on developing methods for diagnosing CTE in living patients using brain imaging, blood tests, and other biomarkers. Early detection is crucial for better management and prevention strategies [9].

***Corresponding author:** Gurpreet Kaur, Department of Neuroimmunology, Savitribai Phule Pune University, India, Email: gurupreet@kaur.in

Received: 03-Mar-2025, Manuscript No: JNID-25-162518, **Editor Assigned:** 07-Mar-2025, Pre QC No: JNID-25-162518 (PQ), **Reviewed:** 18-Mar-2025, QC No: JNID-25-162518, **Revised:** 22-Mar-2025, Manuscript No: JNID-25-162518 (R), **Published:** 29-Mar-22025, DOI: 10.4172/2314-7326.1000553

Citation: Gurpreet K (2025) Chronic Traumatic Encephalopathy (CTE): A Growing Concern in Brain Health. J Neuroinfect Dis 16: 553.

Prevention Strategies

While there is no cure for CTE, preventive measures can reduce the risk of developing the disease:

Improving Safety in Sports: Rule changes in contact sports, such as limiting head-on collisions in football, banning certain tackles in rugby, and enforcing strict concussion protocols, help reduce brain trauma [10].

Better Protective Gear: Advances in helmet technology aim to minimize the impact of blows to the head.

Education and Awareness: Athletes, coaches, and medical professionals must be educated on the dangers of repeated head injuries and the importance of concussion management.

Military and Workplace Safety: Implementing better protective measures for military personnel and workers in high-risk jobs can help mitigate repeated head trauma.

Current Research and Future Treatments

Scientists are actively researching potential treatments and early diagnostic tools for CTE. Some promising areas of study include:

Biomarkers for Early Detection: Researchers are investigating blood tests and imaging techniques to identify CTE in living individuals.

Therapies to Reduce Tau Accumulation: Experimental treatments aim to prevent or reduce the buildup of tau protein in the brain.

Neuroprotective Drugs: Some medications are being tested to slow cognitive decline and alleviate symptoms.

Regenerative Medicine: Stem cell therapy and neuroplasticity research could offer future treatment options.

The Human Cost of CTE

CTE has devastating effects on individuals and their families. Many former athletes and military veterans have suffered from severe cognitive decline, depression, and suicidal behavior due to the disease. High-profile cases, such as those of NFL players Junior Seau and Aaron Hernandez, have brought significant attention to the issue, sparking discussions about sports safety and brain health.

Conclusion

Chronic Traumatic Encephalopathy is a serious and irreversible condition caused by repeated head trauma. While research continues to uncover new ways to diagnose and treat the disease, prevention remains the best defense. Stricter safety measures in sports, military training, and workplaces are essential to protecting individuals from the long-term effects of brain injuries. As awareness grows, society must take proactive steps to minimize the risks associated with head trauma and support those affected by CTE.

References

1. Tappenden KA, Quatrara B, Parkhurst ML, Malone AM, Fanjiang G, et al. (2013) Critical role of nutrition in improving quality of care: An interdisciplinary call to action to address adult hospital malnutrition. Medsurg Nurs 22:147-165.
2. Kaur P, Dhiman P, Dhawan N, Nijhawan R, Pandit S (2010) Comparison of 1 week versus 4 weeks of albendazole therapy in single small enhancing computed tomography lesion. Neurology India 58:560.
3. White Jr AC, Coyle CM, Rajshekhar V, Singh G, Hauser WA, et al. (2018) Diagnosis and treatment of neurocysticercosis: 2017 clinical practice guidelines by the Infectious Diseases Society of America (IDSA) and the American Society of Tropical Medicine and Hygiene (ASTMH). Cli Infec Di 66:49-75.
4. Matthaiou DK, Panos G, Adamidi ES, Falagas ME (2008) Albendazole versus praziquantel in the treatment of neurocysticercosis: a meta-analysis of comparative trials. PLoS Negl Trop Dis 2:194.
5. Frigieri G, Guidi B, Zaccarelli SC, Rossi C, Muratori G, et al. (1996) Multicystic encephalomalacia in term infants. Childs Nervous System 12:759-764.
6. Fauci AS, Marston HD (2015) Ending the HIV-AIDS pandemic-follow the science. N Engl J Med 373: 2197- 2199.
7. Maschke M, Kastrup O, Esser S, Ross B, Hengge U, et al. (2000) Incidence and prevalence of neurological disorders associated with HIV since the introduction of highly active antiretroviral therapy (HAART). J Neurol Neurosurg Psychiatry 69: 376- 380.
8. DHHS Panel on Antiretroviral Guidelines for Adults and Adolescents. Guidelines for the use of antiretroviral agents in HIV-1 infected adults and adolescents. AIDS info.
9. The INSIGHT START study group (2015) Initiation of antiretroviral therapy in early asymptomatic HIV infection. N Engl J Med 373: 795- 807.
10. Antinori A, Arendt G, Becker JT, Brew BJ, Byrd DA, et al. (2007) Updated research nosology for HIV-associated neurocognitive disorders. Neurology 69: 1789-1799.