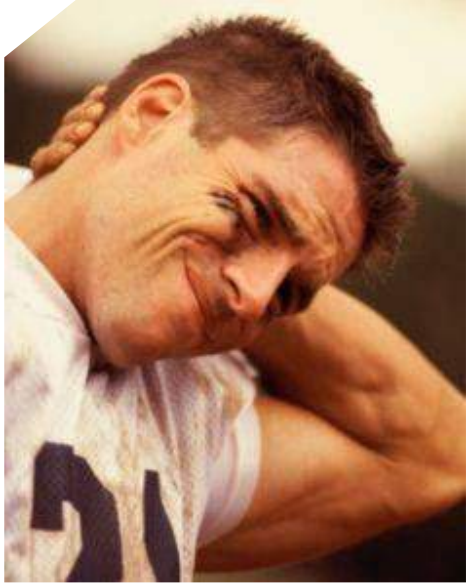


# Chronic Traumatic Encephalopathy



FEDERATION INTERNATIONALE  
DE CHIROPATIQUE DU SPORT

But, what if we're  
wrong...about  
concussion  
and CTE?

- ▶ Definition
- ▶ Mechanism of injury
- ▶ Histological Process
- ▶ Potential Problems

# Introduction

## Guest Instructor: Dr Robert Reid

- Diploma in Sports Medicine  
London Medical College
- Chief Medical Officer for a  
number of sports
- Sports Physician Australia  
Institute of Sport (AIS)
- Over 40 years experience  
working with athletes at all  
levels of sport.

Always works closely  
with professionals of all  
disciplines to develop  
the team approach

Sports Medicine is  
about the wellbeing of  
the athlete



*Internationally respected Sports Physician and currently working in private practice in Canberra, Australia, Dr. Reid is known for helping athletes from across a broad spectrum of sports and countries, and handles a lot of cases which other doctors need a second opinion.*

# Concussion Recap

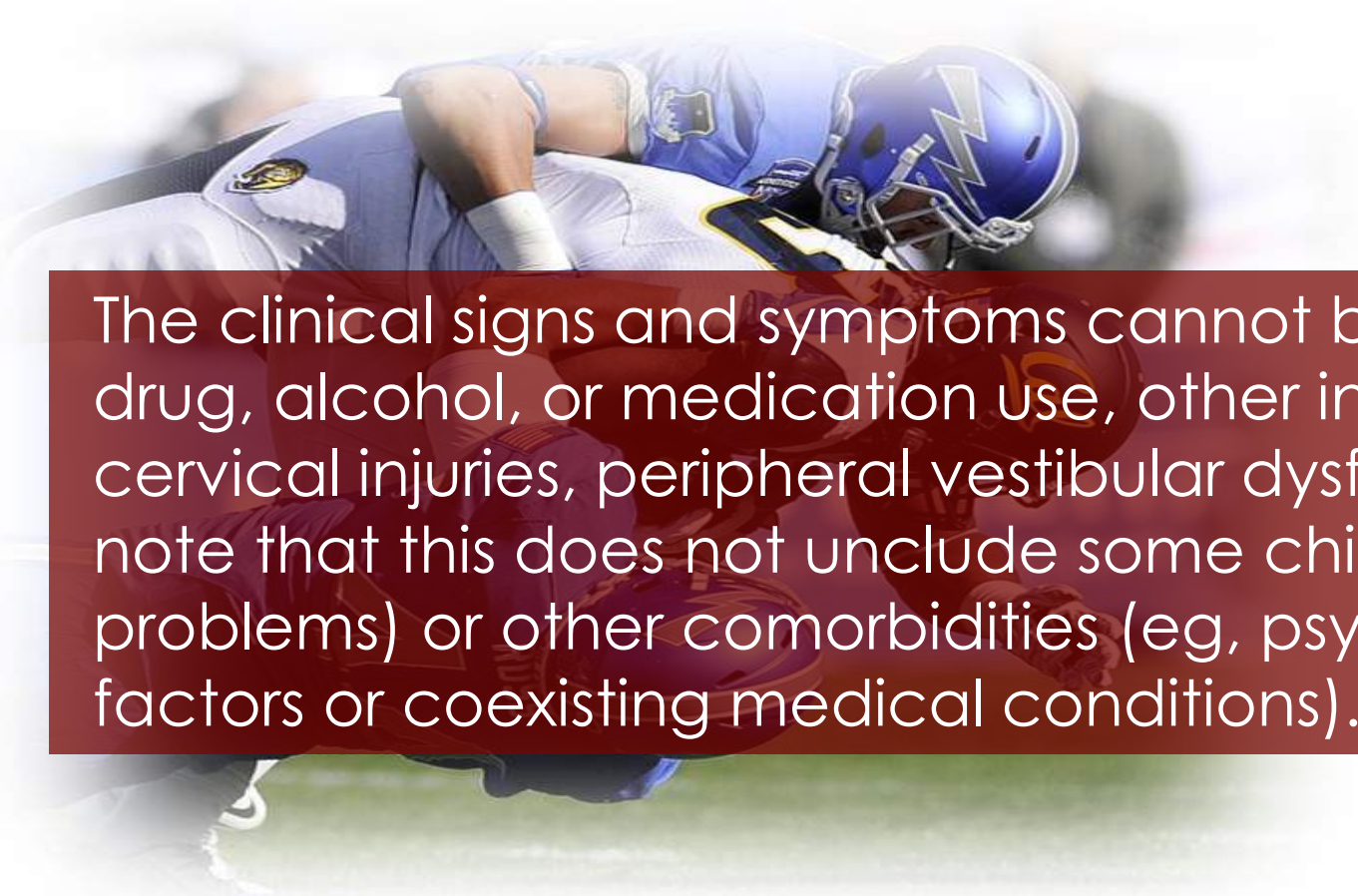


**Sport related concussion (SRC) is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilised in clinically defining the nature of a concussive head injury.**

- ▶ SRC may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head.
- ▶ SRC typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. (However, in some cases, signs and symptoms evolve over a number of minutes to hours.)

# Concussion Recap

*(Berlin Concussion in Sport Group, 2016)*

A photograph of a football player in a blue and white uniform lying on the field, possibly injured. The player is wearing a blue helmet with a white lightning bolt logo. The background is a blurred green field.

The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc - note that this does not unclude some chiropractic problems) or other comorbidities (eg, psychological factors or coexisting medical conditions).

# Concussion Recap



- ▶ SRC may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
- ▶ SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.

# Concussion



Only 10% of concussions are associated with a loss of consciousness.

# Definition

*(Zurich CISG 2016).*



Concussion is therefore defined as not having any associated structural abnormalities. This does not mean that there are no long-term sequelae of concussion. Concussion is the historical term representing low velocity injuries that cause brain 'shaking' resulting in clinical symptoms and that are not necessarily related to a pathological injury. Concussion is a subset of TBI and will be the term used in this document. It was also noted that the term *commotio cerebri* is often used in European and other countries.

# Definition

The CISG acknowledges that although the terms mTBI and concussion are often used interchangeably in the sporting context and particularly in the US literature, others use the term to refer to different injury constructs. These terms should not be used interchangeably.





# Definition

Concussion is a clinical diagnosis made or presumed at the time of the injury. There are other problems that can occur outside the brain at time of injury. So that it can have consequences and sequelae that are outside the true treatment of concussion.



Concussion can be over diagnosed , but a mild concussion may be under diagnosed as the symptoms are mild or can be delayed.

# Definition

"We need a higher level of competency in our clinicians to investigate deeper when an athlete presents with concussion-like symptoms."



"A good start would be to include a sports chiropractor as one of your opinions. This may be especially important when an athlete has a delayed recovery phase."

*Dr Tim Stark, USA Sports Chiropractor*

# Whiplash

*Whiplash; 2010 Ugeskr Laeger Jun 14;172(24):181-4.*

Whiplash has been defined as "... **a trauma caused by an acceleration-deceleration force transferring its energy to the cervical spine...**"

Therefore, some or all of the problems associated with "**concussion**" may be problems with the upper cervical spine or the cranio-cervical junction.

Although this is well recognised by sports chiropractors, it is not as well recognised by the wider medical community.



# Mechanism of injury

A blow to the brain sets off a flood of neurotransmitters such as glutamate. This prompts neurons to fire incessantly, causing an influx of calcium into the neurons and a release of potassium. To keep firing, the neurons demand extra energy, but the excess calcium reduces oxygen metabolism and thus the cells' ability to generate it. Meanwhile the wash of potassium constricts blood vessels, limiting the supply of brain fuel - glucose.

The high energy demand, restricted blood flow and oxygen debt create an energy crisis that exhausts the neurons leading to mental confusion and failed memory of concussion. The brain may take days to restore the chemical balance that constitutes full recovery.



# Chronic Traumatic Encephalopathy (CTE) Definition



Chronic Traumatic Encephalopathy (CTE) is a progressive degenerative disease of the brain found in people with a history of repetitive brain trauma (often athletes), including symptomatic concussions as well as asymptomatic subconcussive hits to the head that do not cause symptoms. CTE has been known to affect boxers since the 1920's (when it was initially termed punch drunk syndrome or dementia pugilistica).

*Boston University CTE Center*

# (CTE) Definition



*NIH CTE Consensus Conference  
Report, March 2015.*

“The neuropathology considered pathognomonic of CTE, and required for diagnosis, is abnormal accumulation of tau in neurons and glia in an irregular, focal, perivascular distribution at the depths of cortical sulci”

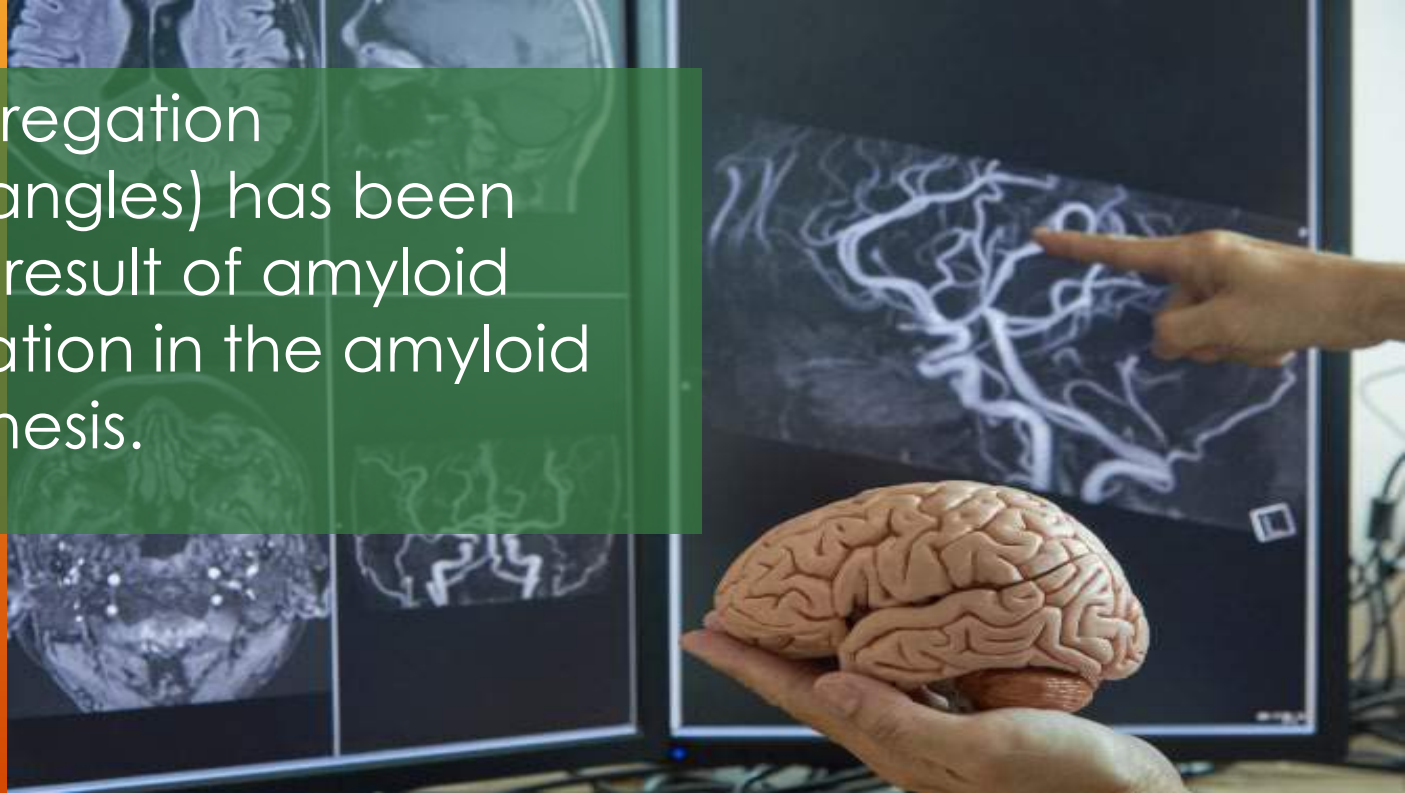
# (CTE) Definition

At this time CTE can only be diagnosed after death by postmortem neuropathological analysis. At present, there is no known way to use MRI, CT, or other brain imaging methods to diagnose CTE during life.

The Boston University CTE Center is actively conducting research aimed at learning how to diagnose CTE during life.

# (CTE) Mechanism of injury

Tau protein aggregation (neurofibrillary tangles) has been implicated as a result of amyloid protein aggregation in the amyloid cascade hypothesis.





# (CTE) Mechanism of injury

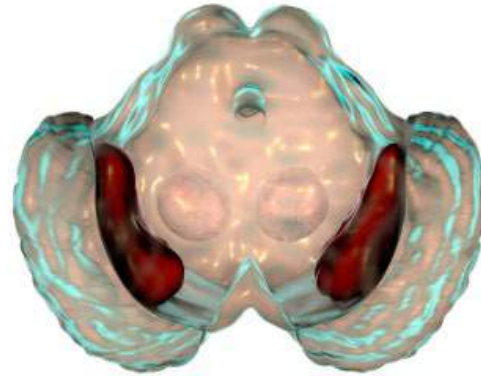
A cause-and-effect relationship has not yet been confirmed between CTE and SRCs or exposure to contact sports. However, the theory is that repeated brain trauma triggers progressive degeneration of the brain tissue, including the build-up of the abnormal protein - tau. These changes in the brain can begin months, years, or even decades after the last brain trauma or end of active athletic involvement.

At this time the number or type of hits to the head needed to trigger degenerative changes of the brain is unknown. In addition, it is likely that other factors, such as genetics, may play a role in the development of CTE, as not everyone with a history of repeated brain trauma develops this disease.

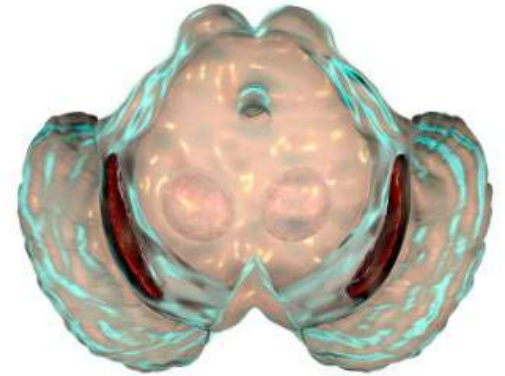
# (CTE) Signs and Symptoms

The brain degeneration is associated with common symptoms of CTE including headache, depression, increased irritability, decreased ability to concentrate, loss of short-term memory, suicidal behaviour, confusion, impaired judgment, impulse control problems, aggression, Parkinsonism, and eventually progressive dementia.

## SUBSTANTIA NIGRA



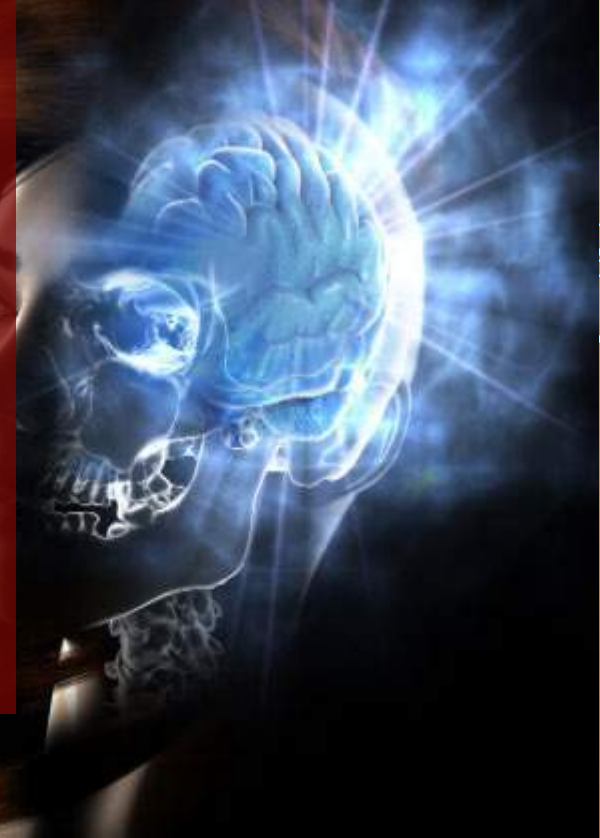
**Normal**



**Parkinson's disease**

# (CTE) Neuropathology

Postmortem analyses have indicated that the symptoms of CTE are associated with neuropathological changes in the brain that are specific to repeated head trauma. Such changes include the atrophy of certain brain structures, such as the cerebral cortex, diencephalon, and medial temporal lobe, as well as the degeneration of myelinated neurons.



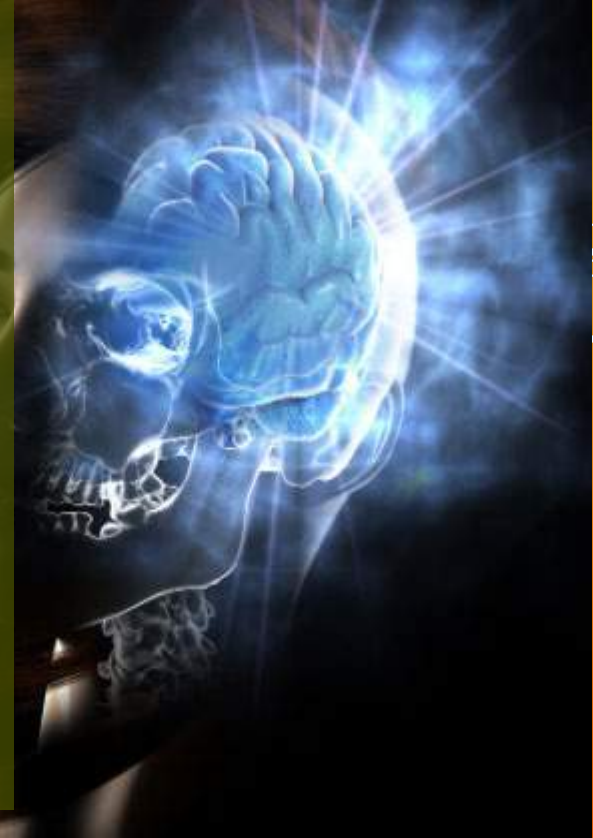
# (CTE) Neuropathology

Other changes include the enlargement of the lateral and third ventricles and cavum septum pellucidum (the formation of a small space between the left and right septi), typically with septal fenestrations (small openings in the septi).



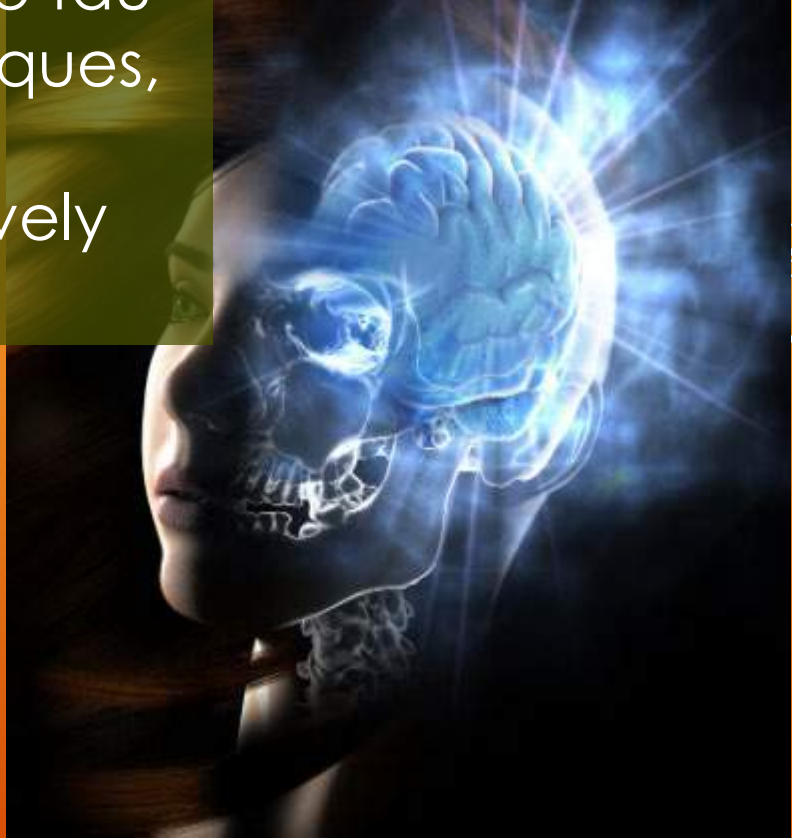
# (CTE) Neuropathology

Microscopically, CTE neuropathology is characterized primarily by the accumulation in neurons of tau protein. Tau-related abnormalities, which include aggregations and filaments known as neurofibrillary tangles, neuropil threads, and glial tangles, are most extensive around small cerebral vessels in the frontal and temporal lobes and are prominent in the basal ganglia, brainstem, and diencephalon.



# (CTE) Neuropathology

Alzheimer's disease is similar, but the tau distribution is different. Amyloid plaques, a major feature in Alzheimer's neuropathology are less and relatively diffuse in CTE.



# (CTE) Assessment

When assessing a person with possible CTE, the following areas need to be addressed :

- Difficulty thinking (cognitive impairment)
- Impulsive behavior
- Depression or apathy
- Short-term memory loss
- Difficulty planning and carrying out tasks (executive function)
- Emotional instability
- Substance misuse
- Suicidal thoughts or behaviour



# (CTE) Prevention



There is no treatment for CTE. But CTE may be prevented because it is associated with recurrent concussions.

- Individuals who have had one concussion are more likely to have another head injury.
- The current recommendation to prevent CTE is to reduce mild traumatic brain injuries and prevent additional injury after a concussion.





# References

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- <https://bjsm.bmj.com/content/51/11/837>
- <https://bjsm.bmj.com/content/bjsports/early/2017/04/26/bjsports-2017-097699.full.pdf>

# Reading Book

brukner and khan 5th edition reference

