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Beyond Concussion: Repetitive Brain Trauma and Implications for Current SLP Practice

Alyssa Coreno

Financial Disclosure

- I am a paid employee of Case Western Reserve University.
- I am a paid employee of Villa Camillus Nursing Facility.
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Learner Objectives

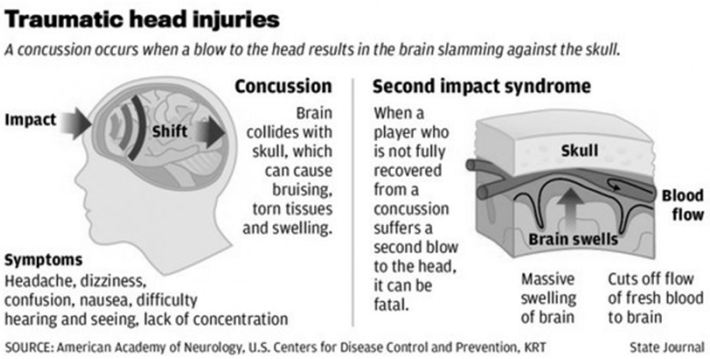
- 1) Define Chronic Traumatic Encephalopathy and describe associated cognitive communication characteristics.
- 2) Describe the cognitive communication and neurophysiological differences between Chronic Traumatic Encephalopathy and Traumatic Brain Injury and other Neurodegenerative diseases.
- 3) Identify assessment and treatment protocols to address cognitive communication deficits associated with probable Chronic Traumatic Encephalopathy.

What is Chronic Traumatic Encephalopathy?

1928: Dementia Pugilistica (DP)

- Discovered by Dr. Harrison Martland
- Neurodegenerative disease similar to Alzheimer's disease found in boxers.
- Caused by repetitive blows to the head.

Traumatic Brain Injury



Concussion Animation

https://www.youtube.com/watch?v=rGMu3BLzQxM

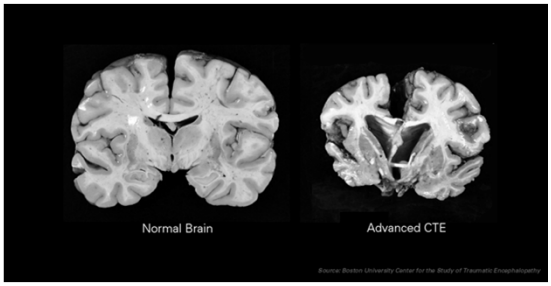
2002: Chronic Traumatic Encephalopathy

Mike Webster

Dr. Bennett Omalu

Chronic Traumatic Encephalopathy (CTE)

- "A progressive degenerative disease of the brain found in athletes (and others) with a history of repetitive brain trauma, including symptomatic concussions as well as asymptomatic subconcussive hits to the head" (McKee, 2003).



C.T.E. Is Found in an Ex-Giant Tyler Sash, Who Died at 27

Junior Seau Diagnosed With Disease Caused by Hits to Head: Exclusive

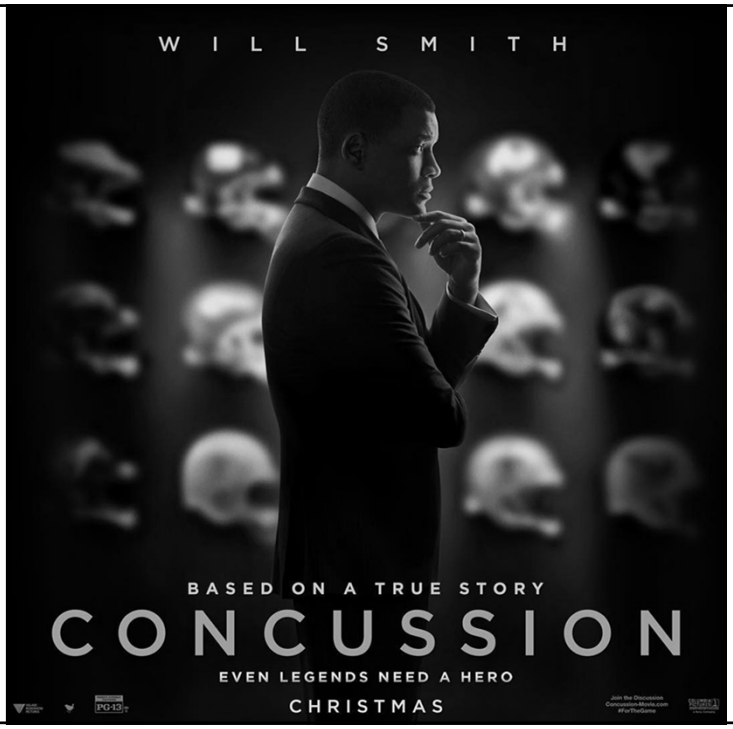
End youth football

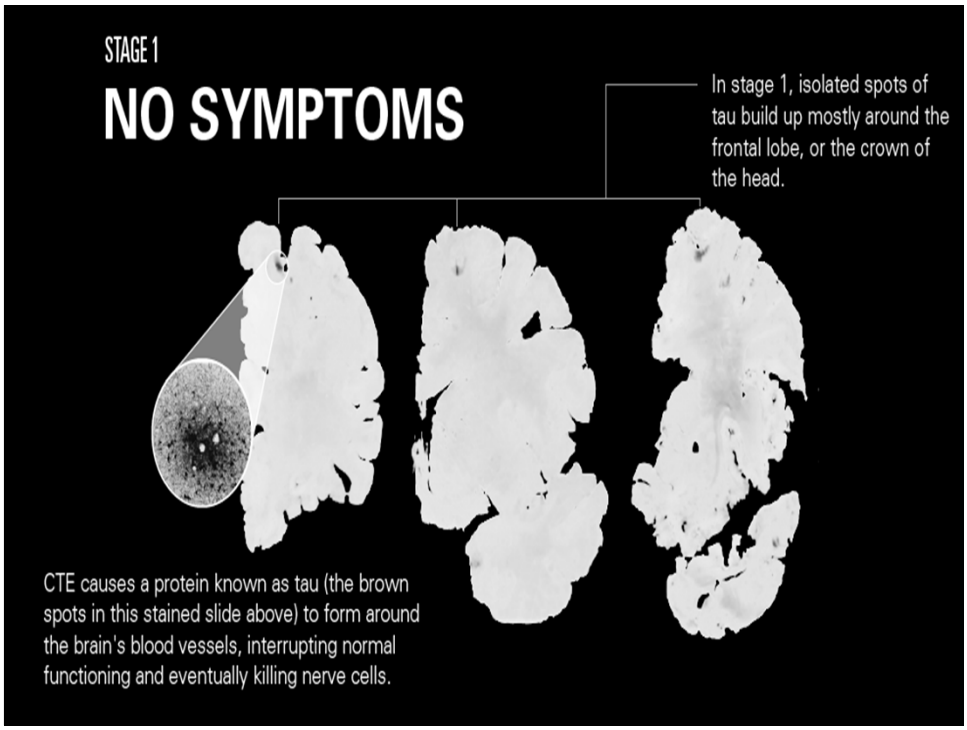
Dave Duerson's Suicide Note: "Please, See That My Brain Is Given To The NFL's Brain Bank"

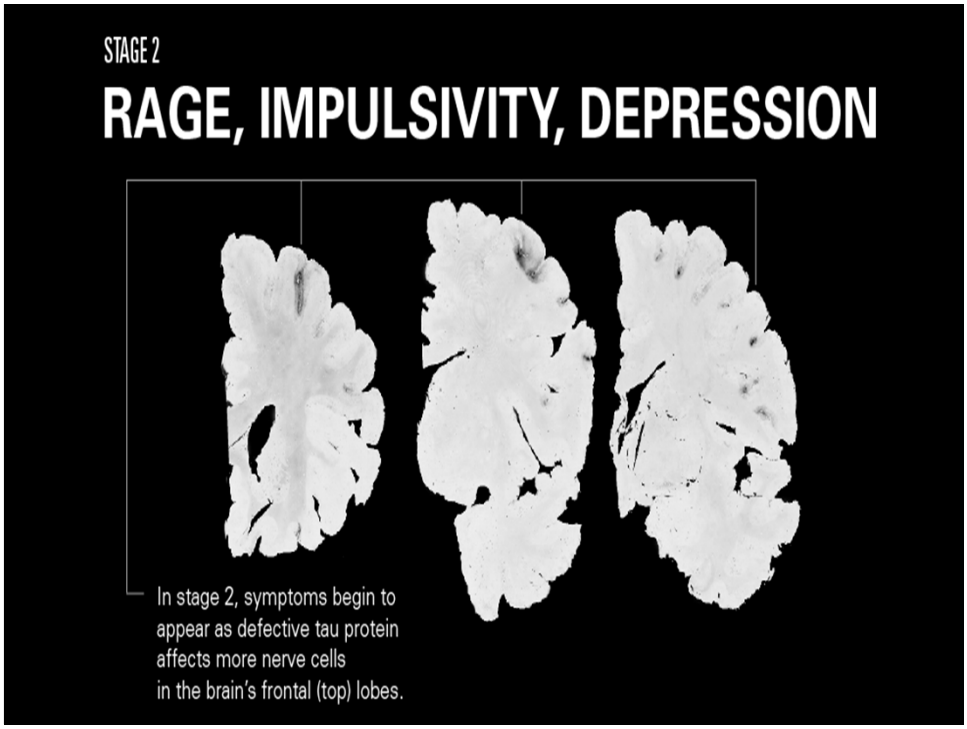
Lawrence Phillips' family to donate brain to CTE research

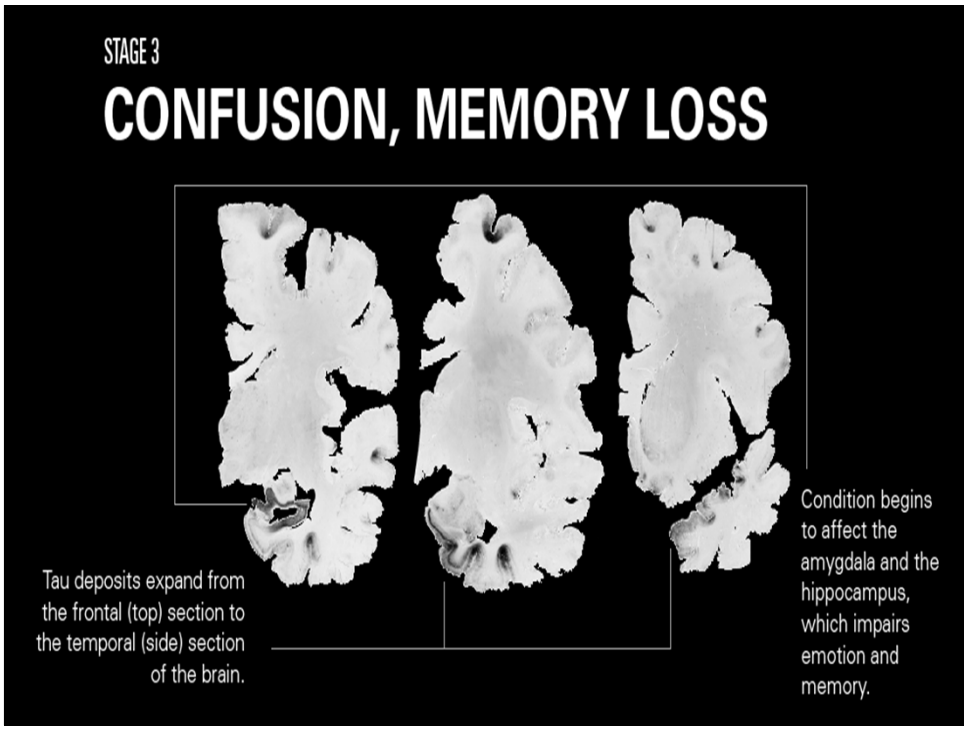
Raiders great Ken Stabler had Stage 3 chronic traumatic encephalopathy

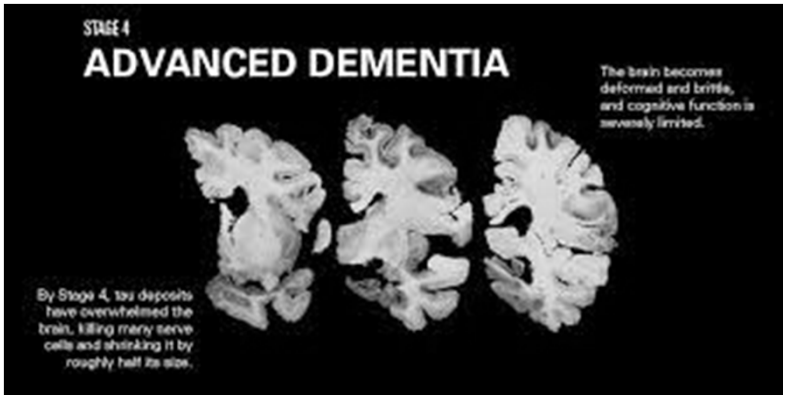
Dr. Bennet Omalu 'would bet my medical license' that O.J. Simpson has CTE


WILL SMITH
BASED ON A TRUE STORY
CONCUSSION
EVEN LEGENDS NEED A HERO
CHRISTMAS
PG-13


STAGE 1
NO SYMPTOMS
In stage 1, isolated spots of tau build up mostly around the frontal lobe, or the crown of the head.
CTE causes a protein known as tau (the brown spots in this stained slide above) to form around the brain's blood vessels, interrupting normal functioning and eventually killing nerve cells.


STAGE 2
RAGE, IMPULSIVITY, DEPRESSION
In stage 2, symptoms begin to appear as defective tau protein affects more nerve cells in the brain's frontal (top) lobes.


STAGE 3
CONFUSION, MEMORY LOSS
Tau deposits expand from the frontal (top) section to the temporal (side) section of the brain.
Condition begins to affect the amygdala and the hippocampus, which impairs emotion and memory.



Chronic Traumatic Encephalopathy Epidemiology

- 1.7-3.8 million traumatic brain injuries occur annually
- 17% will develop progressive symptoms such as CTE, which results in a cognitive-communication disorder
- 647,000 new cases each year
- 137,000 certified SLPs = 3-5 cases of CTE annually!

(Moilanen, 2014)

What is Cognitive Communication?

- "Difficulty with any aspect of communication that is affected by disruption of cognition" (American Speech-Language-Hearing Association, 2005).

Cognitive Communication Example

Muscle Weakness/ Tingling		Anomia	
Multiple Sclerosis (Progressive Degeneration)	Guillain-Barre Syndrome (Infection)	Aphasia (Language)	Traumatic Brain Injury (Cognition)
Medrol, Glatiramer, Fingolimod	Plasma exchange and immunoglobulin therapy	Semantic Mapping	Errorless Learning

SLPs Role in Cognitive Communication Tx

- Identification
- Assessment
- Intervention
- Counseling
- Prevention
- Advocacy
- Research

(American Speech-Language-Hearing Association, 2005)

Normal Aging

- Occasionally forgetting something like a name or date
- Sometimes making an adding error
- Sporadically making a careless error
- Forgetting what day it is but then quickly remembering
- Occasionally forgetting a word
- Losing things and then retracing steps to find them
- Sometimes skipping a social engagement

(Grundman et al., 2004)

Neuropathological and Clinical Differences Between CTE and TBI

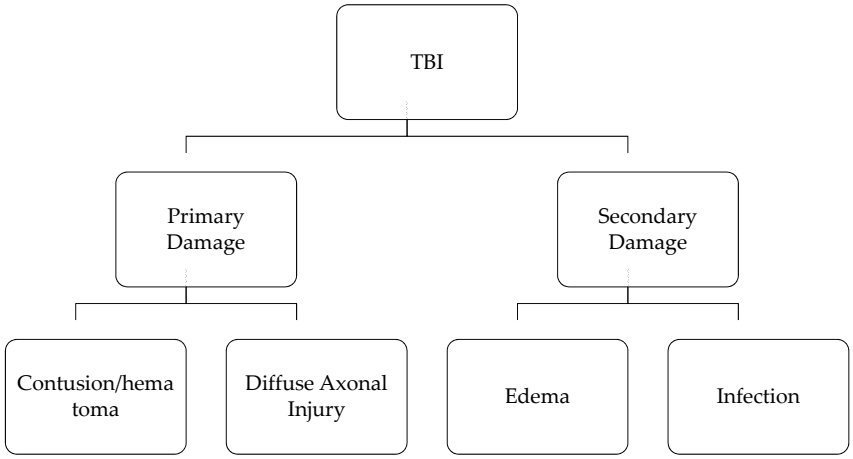
TBI

- Acute

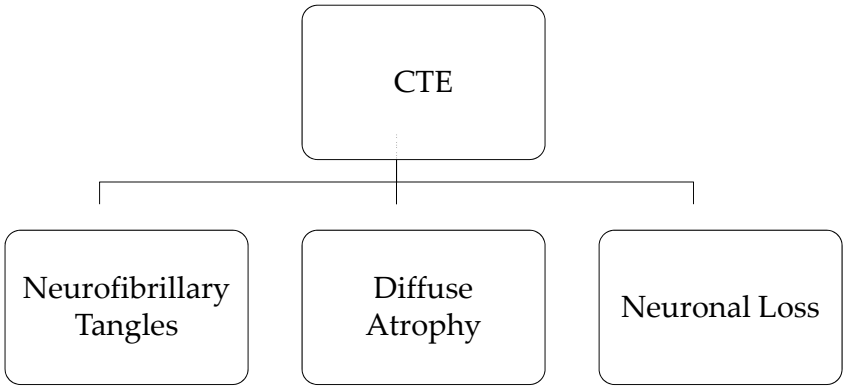
CTE

- Chronic

TBI: Neuropathology



CTE: Neuropathology



Clinical Characteristics/Cognitive Communication Deficits of TBI

- Attention
- Reasoning
- Problem solving
- Executive functioning (e.g., goal setting, planning, initiating)
- New learning, due to working memory deficits
- **Intact long-term memory**
- Pragmatics (turn taking)
- Inappropriate behaviors

Clinical Characteristics/Cognitive Communication Deficits of CTE

- Attention
- Concentration
- Short-term Memory
- Emotional Disturbances
- Cognitive Impairment
- Planning, Judgment
- Impulsivity
- Severe Dementia

(McKee, 2012)

	Chronic Traumatic Encephalopathy	Traumatic Brain Injury
Acute or Progressive?	• Progressive	• Acute
Neurophysiology	• Neurofibrillary Tangles • Diffuse Atrophy • Neuronal Loss	Primary Injury: • Contusion/hematoma • Diffuse Axonal Injury Secondary Injury: • Edema • Infection
Clinical Characteristics	• Attention • Concentration • Short-term Memory • Emotional Disturbances • Cognitive Impairment • Planning, Judgment • Impulsivity • Severe Dementia	• Attention • Reasoning • Problem solving • Executive functioning (e.g., goal setting, planning, initiating) • New learning, due to working memory deficits • **Intact long-term memory** • Pragmatics (turn taking) • Inappropriate behaviors

Neuropathological and Clinical Differences Between CTE and Alzheimer's disease

	Chronic Traumatic Encephalopathy	Alzheimer's disease
Acute or Progressive?	• Progressive	• Progressive
Neurophysiology	• Neurofibrillary Tangles • Diffuse Atrophy • Neuronal Loss	• Neurofibrillary Tangles • Diffuse Atrophy • Beta-Amyloid Plaques
Clinical Characteristics	• Attention • Concentration • Short-term Memory • Emotional Disturbances • Cognitive Impairment • Planning, Judgment • Impulsivity • Severe Dementia	• Mild-Severe Memory Loss • Cognitive Impairment • Planning, Judgment • Confusion • Deficits impact daily living

Tau Disposition Differences: CTE and AD

CTE

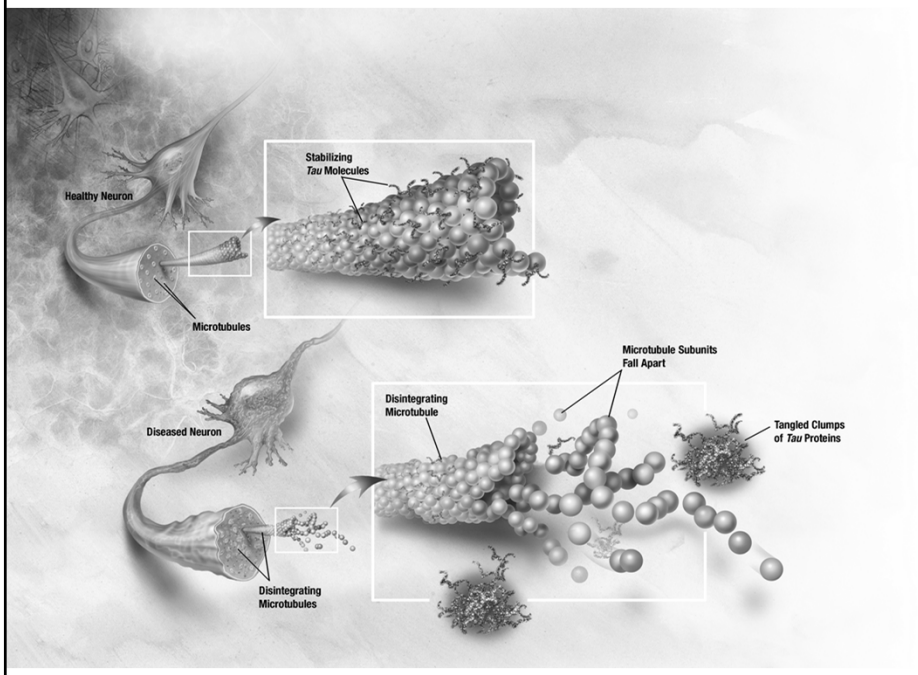
- Tau disposition in the superficial cortical laminae (II and III)
- Regionally, tau is extremely irregular.
- Larger densities of tau in medial temporal lobe.
- Typically perivascular.

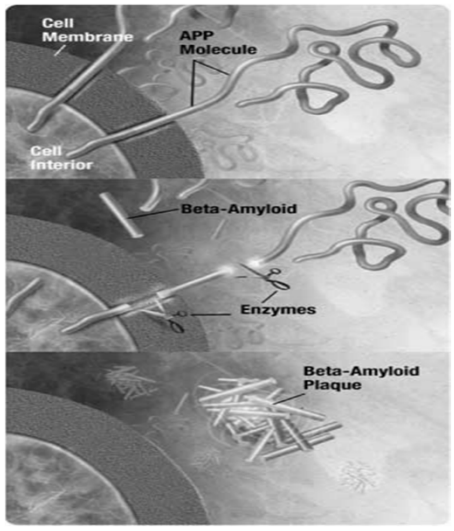
Tau Disposition

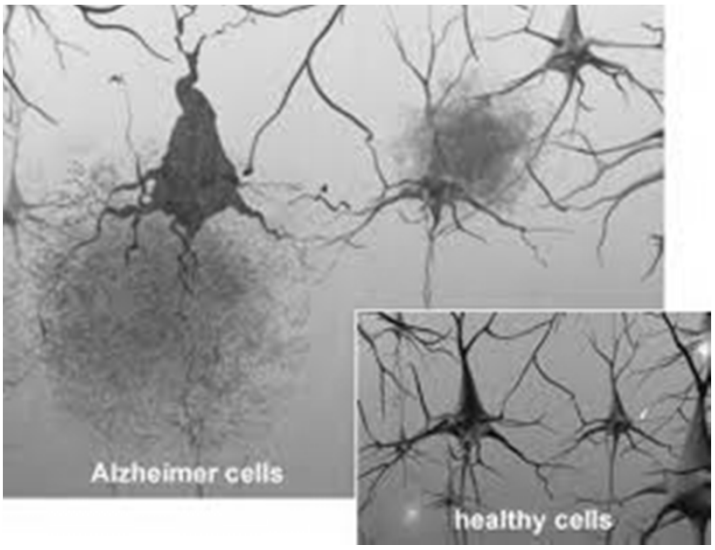
AD

- Tau disposition in large projection neurons in layers III and V.
- Regionally, tau is more uniform.
- Smaller densities of tau in the medial temporal lobe.

(McKee, 2009)


Healthy Neuron
Stabilizing
Tau Molecules
Microtubules
Microtubule Subunits
Fall Apart
Disintegrating
Microtubule
Tangled Clumps
of *Tau* Proteins
Diseased Neuron
Disintegrating
Microtubules

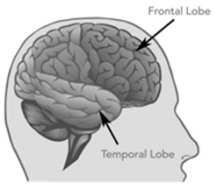

Cell
Membrane
APP
Molecule
Cell
Interior
Beta-Amyloid
Enzymes
Beta-Amyloid
Plaque



Neuropathological and Clinical Differences Between CTE and other Neurodegenerative Disorders

Frontotemporal Dementias

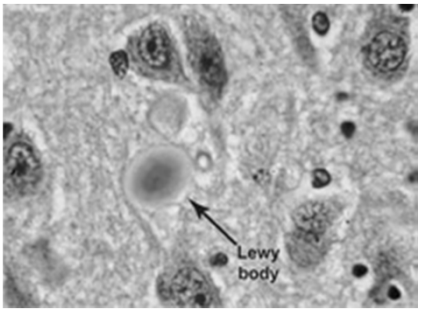
- A group of disorders caused by progressive nerve loss of in the brain's frontal and/or temporal lobes.
- Most common dementia under the age of 65.
- Three subtypes:
  - 1. Behavior variant frontotemporal dementia (bvFTD)
  - 2. Primary progressive aphasia (PPA)
  - 3. Disturbances of motor (movement or muscle function)



	Chronic Traumatic Encephalopathy	Frontotemporal Dementias
Acute or Progressive?	• Progressive	• Progressive
Neurophysiology	• Neurofibrillary Tangles • Diffuse Atrophy • Neuronal Loss	• Tau or TDP-43 accumulation in frontal and/or temporal lobes • Frontal and/or temporal lobe atrophy
Clinical Characteristics	• Attention • Concentration • Short-term Memory • Emotional Disturbances • Cognitive Impairment • Planning, Judgment • Impulsivity • Severe Dementia	• Behavioral changes • Anomia • Reading • Expressive Language • Receptive Language • Complete loss of language

Dementia with Lewy Bodies

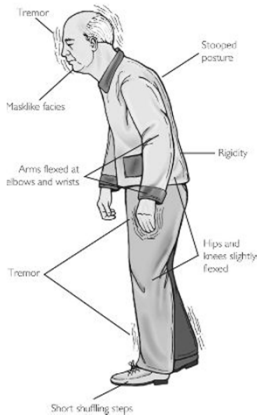
- A type of dementia closely related to Parkinson's disease



	Chronic Traumatic Encephalopathy	Dementia with Lewy Bodies
Acute or Progressive?	• Progressive	• Progressive
Neurophysiology	• Neurofibrillary Tangles • Diffuse Atrophy • Neuronal Loss	• Abnormal collections of alpha synuclein protein • No visual atrophy
Clinical Characteristics	• Attention • Concentration • Short-term Memory • Emotional Disturbances • Cognitive Impairment • Planning, Judgment • Impulsivity • Severe Dementia	• Visual hallucinations • Variations in attention and alertness • Parkinsonism • Confusion • Memory loss (less significant than AD)

Parkinson's disease

- Progressive disorder of the nervous system that primarily affects movement.

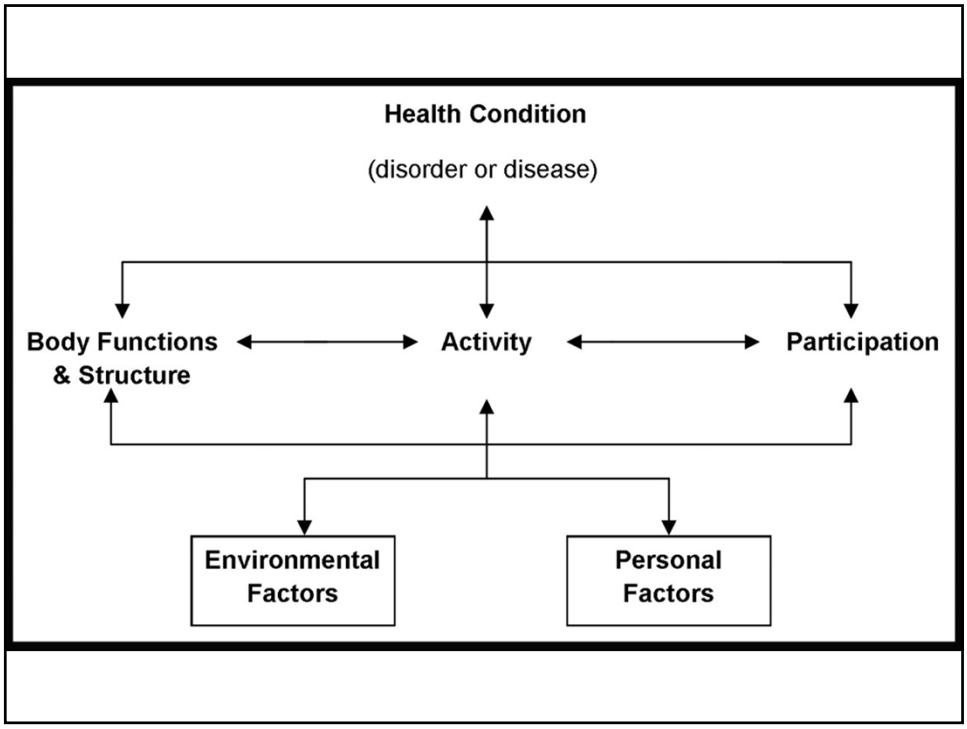


	Chronic Traumatic Encephalopathy	Parkinson's disease
Acute or Progressive?	• Progressive	• Progressive
Neurophysiology	• Neurofibrillary Tangles • Diffuse Atrophy • Neuronal Loss	• Dopamine degeneration in the substantia nigra
Clinical Characteristics	• Attention • Concentration • Short-term Memory • Emotional Disturbances • Cognitive Impairment • Planning, Judgment • Impulsivity • Severe Dementia	• Tremors • Slowness of movement • Shuffling gait • Hypokinetic dysarthria • Masked facial expression

CTE Assessment

Important!

- There is currently no evidence based treatment for CTE.
- Assessment and treatment is based on expert opinion.



Components of Assessment

- Case History and Observations
- Test Batteries
- Prognostic factors for cognitive outcomes
- Assessment of quality of life, participation, and activity

Bedside and Screening Tests of Cognitive Disorders

Instrument	Source
Alzheimer's Quick Test	Wiig et al. (2002)
Cognitive Linguistic Quick Test	Helm-Estabrooks (2001)
Dementia Rating Scale – Second Edition	Mattis (2001)
Kaufman Brief Intelligence Test – Second Edition	Kaufman & Kaufman (2004)
Mini-Mental State Examination	Folstein et al. (2010)
Montreal Cognitive Assessment	Nasreddine et al. (2005)
Parkinson's Disease – Cognitive Rating Scale	Pagonabarraga et al. (2008)

Cognitive Test Batteries

Instrument	Source	Area Assessed
Behavior Rating Inventory of Executive Function – Adult Version	Roth et al. (2005)	Executive Functioning
Delis-Kaplan Executive Function System	Delis et al. (2001)	Executive Functioning
Rivermead Behavioral Memory Test-Third Edition	B. Wilson et al. (2008)	Memory
Ross Information Processing Assessment-Second Edition	Ross-Swain (1996)	General Cognitive Functioning
Test of Everyday Attention	Robertson et al. (1994)	Attention
Test of Memory and Learning- Second Edition	Reynolds & Voress (2007)	Memory
Wechsler Memory Scale-Fourth Edition	Wechsler (2008)	Memory

Measures of Communication and Cognitive Function, Participation, and Quality of Life

Instrument	Source	Population
Functional Independent Measure	State University of New York (1993)	General Population
Satisfaction with Life Scale	Diener et al. (1985)	General Population
Quality of Life in Alzheimer's disease	Logsdon, Gibbons, & McCurrey (1999)	Alzheimer's Population
ASHA Functional Assessment of Communication	Frattali et al. (1995)	Individuals with Communication Disorders
Communication Disability Profile	Swinbourne & Byng (2006)	Individuals with Communication Disorders
Functional Communication Profile	Sarno (1969)	Individuals with Communication Disorders

CTE Treatment

Basic Assumptions

1. Eclectic management approaches may need to be adopted.
2. Neurological areas must be conceptualized.
3. A multidisciplinary approach is essential.
4. SLPs need to form partnerships with clients and their families.

Instructional Approaches for Memory

- PROMPT (Prospective Memory Process Training)
  - Sohlberg, White, Evans & Mateer (1992)
  - Goal: "To extend the amount of time a patient is able to remember to carry out specified tasks at specific times" (Murray & Clark, 2015)
- Spaced Retrieval
  - PROMPT with systematic cueing
- Errorless Learning
  - Errors are not allowed.
  - Patients are instructed to only answer if they are certain of the answer.
  - Errorless Learning allows for acquiring new information quickly.

Instructional Approaches for Attention

- Sohlberg, Mateer, and colleagues have developed three structured treatment programs for attention:

1. Attention Process Training (APT)
2. Attention Process Training – II (APT-II)
3. Attention Profess Training – III (APT-III)

Instructional Approaches for Executive Functions

- Environmental Adaptation
  - Reduce task demands.
  - Provide external support.
- Awareness Training
  - Education of deficits
  - Engage the patient in activities that help them experience their deficit.
- Goal Setting, Planning, and Problem-Solving Impairments
  - Teach task-specific routines
  - Goal Management Training (GMT)

CTE Resources

- The Brain Injury Association of America (BIAA)
  - www.biausa.org
- Brain Line
  - www.brainline.org
- The Brain Trauma Foundation
  - www.braintrauma.org
- The Concussion Blog
  - www.theconcussionblog.com/category/cte/
- HeadsUp! CTE
  - www.headsupcte.wordpress.com
- American Speech-Language-Hearing Association
  - www.asha.org

References

- Blaylock, R. & Maroon, J. (2011). Immunoexcitotoxicity as a central mechanism in chronic traumatic encephalopathy-a unifying hypothesis. *Surgical Neurology International*, *2*, 107.
- DeKosky, S., Ikonomovic, M. & Gandy, S. (2010). Traumatic brain injury—football, warfare, and long-term effects. *New England Journal of Medicine*, *363* (14), 1293–1296.
- Gavett, B., Stern, R., & McKee. (2011). Chronic traumatic encephalopathy: a potential late effect of sport- related concussive and subconcussive head trauma. *Clinics in Sports Medicine*, *30*, (1), 179–188.
- McKee, A., Stein, T., Nowinski, C., Stern, R., Daneshvar, D., & Alvarez, V. (2013). The spectrum of disease in chronic traumatic encephalopathy. *Brain, A Journal of Neurology, 136,* 43-64.
- McKee, A., Cantu, C., & Nowinski, C. (2009). Chronic traumatic encephalopathy in athletes: progressive tauopathy after repetitive head injury. *Journal of Neuropathology and Experimental Neurology*, *68* (7), 709–735.
- Omalu, B., Bailes, J., & Hamilton, R. (2011). Emerging histomorphologic phenotypes of chronic traumatic encephalopathy in American athletes. *Neurosurgery*, 69 (1), 173–183.
- American Speech-Language-Hearing Association. (2005). *Roles of speech-language pathologists in the identification, diagnosis, and treatment of individuals with cognitive-communication disorders: position statement* [Position Statement]. Available from wwww.asha.org/policy.
- Stern, R., Riley, D., Daneshvar, D., Nowinski, C., Cantu, R., & McKee, A. (2011). Long term consequence of repetitive brain trauma: chronic traumatic encephalopathy. *PM&R, 3*(10), S460-S467.