

The Historical Origins of Chronic Traumatic Encephalopathy Through Case Study

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ABSTRACT TO BE CONSIDERED FOR AWARD:

Despite the rapid increase in media attention, chronic traumatic encephalopathy (CTE) remains poorly understood by both the medical community and population at large. This misunderstanding could lead to iatrogenic sequelae in those at risk, especially because the long-term consequences of sport-related concussion have become one of the most prevalent and serious issues germane to athletic training, sports medicine, and health care today.¹ By way of background, CTE is the medical term used to describe the neurodegenerative changes observed in those with a history of repetitive brain injuries, such as concussion.² To understand CTE and sport-related concussion we cannot solely rely on the paucity of modern evidence. Instead, we must study history and link concepts from other medical disciplines. By doing so, we can garner a more comprehensive understanding of the complex and systematic nature of CTE, which will allow us to identify directions for future study.

The historical origins of this disease are rooted in inductive reasoning and the processes by which relevant information is linked to create theoretical and applied knowledge. How we came to our current understanding of CTE has required systems thinking to begin completing the picture of a complex problem. The human brain is the most complex organ known to man, therefore injury cannot be reduced to generalization through reductionist means. Interrelated patterns made up of multiple systems of histology, biomechanics, and symptomatology have contributed to a more detailed clinical and pathological description. Through the course of medical history, each paradigm shift in our understanding of CTE has come from case study. The grounding theory being that it is through observation, not hypothesis, that we have come to interpret nature. When building upon the body of knowledge, one must first apprehend and describe what can be seen before forming conjectures on the unknown.

In this literature review, cases that represent significant contributions to the development of our modern understanding of CTE are linked to show the natural progression of knowledge. Articles were sourced from the PubMed database wherein reference lists were hand-searched to identify the earliest descriptions of the disease.

The first case of great importance does not have anything to do with concussion. In 1906 Alois Alzheimer put forth a discovery that changed how pathologists examined degenerative brains.³ Alzheimer most significantly linked the symptomatology of early emotional and cognitive disturbances to diffuse beta amyloid (A β) plaques and neurofibrillary tangles (NFTs) throughout the cortex. Alzheimer's seminal case was the first to follow a case of neurological symptoms to autopsy, setting a precedent for the

study of neurodegeneration.

In 1928 Harrison Martland introduced the colloquial illness “punch drunk” later coined “dementia pugilistica”. Martland described a variety of neurological symptoms marked by an extraordinarily young onset in boxers. He surmised that damage to the neuron’s vascularity was caused by repetitive head trauma.⁴ His hypothesis was not challenged for a half century.

Fifty years after Alzheimer identified his hallmark proteins, a case of dementia pugilistica was investigated using Alzheimer’s methodology. In 1954 the histological examination of a deceased boxer described by Brandenburg and Hallervorden identified A β plaques reminiscent of senile dementia or alternatively, Alzheimer’s psychosis.⁵ This link was strengthened 19 years later when traumatically induced dementia was examined systematically by Corsellis and colleagues. They conducted thorough autopsies on the brains of 15 retired boxers in 1973.⁶ Their histological findings were reminiscent of Alzheimer’s findings, but the pathology was clearly different.

The first time CTE was observed outside of boxing was in a retired NFL player. Bennet Omalu’s 2005 case thrust CTE out of the relative obscurity of boxing into the most popular American sport.⁷ Since then, research linking traumatic brain injury to CTE has gained great momentum in our nation, but remains in its infancy today.⁸

Perhaps the clearest way forward will come from those who remember to look back. Each pivotal breakthrough has involved divergent thinking and respect to other fields of medical literature. The only way to know where we are going is to deeply understand where we came from. The greatest discoveries yet to come may be hidden within the past, waiting for the next mind that will reach back and connect the cases.

Word Count: 688

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