

Rodent Models of Subconcussive Brain Injury

Colin M. Wilson¹, Russell Morton², Afshin A. Divani³, Kimberly Byrnes⁴, Reed Selwyn¹

1. Department of Radiology, University of New Mexico School of Medicine, Albuquerque, NM

2. Department of Neurosciences, University of New Mexico School of Medicine, Albuquerque, NM

3. Department of Neurology, University of New Mexico School of Medicine, Albuquerque, NM

4. Department of Anatomy, Physiology, and Genetics, Uniformed Services University School of Medicine, Bethesda, MD

Abstract:

Subconcussion has been defined as a cranial impact or rapid acceleration-deceleration that does not result in clinically observable neurological signs or symptoms that would typically indicate a diagnosis of mild traumatic brain injury (mTBI) or concussion.¹ Low-level subconcussive impacts due to soccer ball heading have been reported to cause an acute, transient dysfunction in vestibular processing, which returns to baseline levels within 24 hours.² Although one or even several subconcussive impacts may have no lasting effects, there is increasing evidence that repeated subconcussive exposure over an extended period has the potential to cause significant neurological deficits. Among former professional contact-sport athletes, repetitive head impact (RHI) exposure has been associated with increased rates of neurodegenerative disease, leading to chronic traumatic encephalopathy (CTE) dementia or death.^{3,4} Strong evidence of a causal link between RHI and the development of CTE has been established using a combination of human neuropathological examinations and animal models.⁵ While mild traumatic brain injury has been an active area of research for more than 20 years, relatively little is known about subconcussive brain injury. However, a growing body of literature suggests that it may also pose a health risk for the general public. Structural and functional alterations have been observed in amateur contact-sport athletes as young as adolescents, often with no concussion history. Neuroimaging studies have detected longitudinal white matter changes in athletes sustaining subconcussive head impacts that correlate with head impact exposure.⁶ Youth athletes exposed to repetitive head impacts demonstrate impaired cognitive performance, and cumulative impact exposure strongly predicts neurocognitive impairment and neuropsychiatric dysfunction later in life.^{7,8} In recent years, novel models of subconcussive brain injury have been developed to better understand this phenomenon. This presentation will provide an overview of emerging rodent models of subconcussive brain injury, including a summary of recent behavioral, histopathological, and biomarker findings.

References:

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Non-Expert Summary: Repetitive subconcussive head impact exposure has been associated with the development of neurodegenerative disease, posing a potential health risk for both professional and amateur contact-sport athletes. Rodent models of subconcussive brain injury have recently been developed in an effort to better understand this phenomenon. This educational exhibit will present data from published studies of subconcussive brain injury models with an emphasis on behavioral, histological, and biomarker findings.