



H142 A Comprehensive Review of the Pathology of Blunt Traumatic Spinal Cord Injury (TSCI) Resulting in Early Fatality

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Learning Overview: After attending this presentation, attendees will understand the pathologic changes associated with blunt TSCI, as well as the connection between specific pathologic changes and underlying mechanisms of injury.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by establishing an epidemiologic profile for blunt impact spinal cord trauma in a large urban environment and by identifying patterns of injury that may be seen in spinal cord trauma due to blunt impact.

Introduction: TSCI is associated with significant neurologic morbidity and mortality. Although the annual incidence of TSCI is estimated at 54 cases per million people per year, data from the National Spinal Cord Injury Statistical Center do not typically include cases with a fatal outcome at the scene of injury.¹ Moreover, the pathologic features of blunt TSCI occurring at the moment of impact are less well-described than secondary changes as a complication of initial tissue disruption. Therefore, characterization of the pathologic changes associated with early lethality is needed to better understand the mechanisms of TSCI.

Methods: This study aimed to characterize the neuropathologic profile of blunt impact TSCI resulting in a fatal outcome at the incident location. An electronic database at the City of New York Office of Chief Medical Examiner was queried for all blunt force trauma deaths undergoing full autopsy between 2003 and 2018. All cases with spinal trauma, either in isolation or in combination with other blunt injuries, were identified. Autopsy reports were reviewed by two board-certified forensic pathologists. Exclusion criteria were: (1) any known survival period after injury, (2) any history of spinal disease, and (3) TSCI due to a non-blunt mechanism (e.g., sharp force or gunshot trauma).

Results: Two hundred twenty cases of blunt TSCI, resulting in a fatal outcome at the incident location, were retrospectively identified over a 16-year period. The median age was 46.5 years; 77.72% were male and 22.28% were female. Manners of death were accident (80.9%), suicide (10%), homicide (3.7%), and undetermined (5.4%). The most common mechanism of injury was motor vehicle collision (44.1%), followed by fall from standing height (29.5%), and descent from height (12.3%). Ethanol was the most frequent substance on toxicologic testing (33.6%). Atlanto-occipital dislocation was seen in 15.45% of cases and showed an association with transportation-related fatalities in young individuals. Most spinal fractures were single-level injuries (73.6%). Spinal cord findings were available in 83.6% of cases and included an admixture of contusions (32.65%), lacerations (51.7%), softening (31.29%), and crush injury (8.2%). Up to 20.1% of cases had a normal spinal cord on gross examination. Of the 55.9% of cases with available data on spinal hemorrhage, epidural (59.3%) and subarachnoid (25.2%) compartments were the most frequently affected.

Conclusion: Presented here is data from a large retrospective series of blunt impact TSCI in association with early lethality in a large urban setting. By broadening the TSCI population to include cases from a forensic setting, a spectrum of findings associated with primary TSCI, that are not typically captured by large TSCI registries, was identified. Also identified was a possible connection between specific mechanisms of injury and the resulting pathology. These findings highlight the role of forensic pathologists in characterizing the spectrum of TSCI with implications for the development of preventative strategies.

Reference(s):

¹. Jain N.B., Ayers G.D., Peterson E.N., et al. Traumatic spinal cord injury in the United States, 1993-2012. *JAMA*. 2015;313(22):2236-2243.

Spinal Cord, Blunt Impact, Trauma