

# Neurotraumatology

The undersupply and maldistribution of [neurosurgeons](#) coupled with the apparent abandonment of trauma care by a significant number of rank and file neurosurgeons, and perhaps an over demand for their services, has created a crisis in access to neurotrauma care across the USA <sup>1)</sup>.

[Regionalization](#) of trauma care across hospital systems is associated with a reduced mortality rate for patients with TBI, particularly for patients with a head AIS score of 3 or greater. Mortality decreased by 24% for all TBIs and by 28% for severe TBIs. These findings support regionalization of trauma care with collaboration and consolidation of care across health care systems <sup>2)</sup>.

The field of [neurotrauma](#) has witnessed significant advances, especially at the molecular, cellular, and behavioral levels. This progress is largely due to the introduction of novel techniques, as well as the development of new animal models of central nervous system (CNS) injury.

## Types

[Head Trauma](#)

[Traumatic intracranial hemorrhage](#)

[Traumatic brain injury](#)

[Spinal cord injury](#)

[Peripheral nerve injury](#)

Traumatic [intracranial aneurysm](#)

## History

Neurotraumatology has its roots in ancient history, but its modern foundations are the physical examination, imaging to localize the pathology, and thoughtful medical and surgical decision making.

The neurobiology of cranial and spinal injury is similar, with the main goal of therapies being to limit secondary injury. Brain injury treatment focuses on minimizing parenchymal swelling within the confined cranial vault. Spine injury treatment has the additional consideration of spinal column stability <sup>3)</sup>.

Berengario da Carpi was one of the most famous physicians of the 16th century, a recognized master of anatomy and surgery, an emblematic “Renaissance man” who combined his medical experience and engineering knowledge to design new surgical instruments, and effectively used the arts of writing and drawing to describe state-of-the-art medicine and provide illustrations of anatomical structures. His greatest contribution to medicine was to write the most important work on craniocerebral surgery of the 16th century, the *Tractatus de Fractura Calvae sive Cranei* (Treatise on Fractures of the Calvaria or Cranium), in which he described an entire set of surgical instruments to be used for cranial operations to treat head traumas that became a reference for later generations of

physicians. This was a systematic treatise covering the mechanisms, classification, and medical and surgical treatment of head traumas, and can be considered a milestone in the history of neurotraumatology <sup>4)</sup>.

Hieronim Marek Powiertowski (1915-1983)–founder of the Poznań neurosurgery centre and pioneer of Polish neurotraumatology <sup>5)</sup>.

## Scales

[Neurotrauma pediatric scales.](#)

## Goals

Improvement requires attention to three major issues: (1) prevention through infrastructure, traffic laws, mandatory licensing; (2) establishment of a prehospital care system; and (3) establishment of regional trauma centers and a trauma registry <sup>6)</sup>.

## Research challenges and opportunities

Traumatic injury to the brain or spinal cord is one of the most serious public health problems worldwide. The devastating impact of 'trauma', a term used to define the global burden of disease related to all injuries, is the leading cause of loss of human potential across the globe, especially in low- and middle-income countries. Enormous challenges must be met to significantly advance neurotrauma research around the world, specifically in underserved and austere environments. Neurotrauma research at the global level needs to be contextualized: different regions have their own needs and obstacles. Interventions that are not considered a priority in some regions could be a priority for others. The introduction of inexpensive and innovative interventions, including mobile technologies and e-health applications, focused on policy management improvement are essential and should be applicable to the needs of the local environment. The simple transfer of a clinical question from resource-rich environments to those of low- and middle-income countries that lack sophisticated interventions may not be the best strategy to address these countries' needs. Emphasis on promoting the design of true 'ecological' studies that include the evaluation of human factors in relation to the process of care, analytical descriptions of health systems, and how leadership is best applied in medical communities and society as a whole will become crucial <sup>7)</sup>.

## Forensic

Over the past 100 years forensic research in neurotraumatology was focusing on the genesis, e.g. biomechanis, and the origin of epidural, subdural, subarachnoidal, intracerebral and brain stem haemorrhage, particularly under aspects to enable the differential diagnosis of bleeding due to non-traumatic diseases. Moreover the estimation of the age of brain injuries has important criminological implications (survival time following traumatic forces to the head, alibi etc.) <sup>8)</sup>.

<sup>1)</sup>

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Rubiano AM, Carney N, Chesnut R, Puyana JC. Global neurotrauma research challenges and opportunities. Nature. 2015 Nov 18;527(7578):S193-S197. doi: 10.1038/nature16035. PubMed PMID: 26580327.

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