

## **Laly Foundation:**

### Article : Traumatic Brain Injury: Characterizing the phenomenon

Traumatic brain injuries has been called “*the silent epidemic*” and remains a growing public health concern [1]. It has been estimated that worldwide approximately 69 million people per year experience a traumatic brain injury, which has devastating consequences for everyone involved [1, 2]. In western countries children, adolescents and elderly are most likely to experience a traumatic brain injury due to falls, being struck by an object, or motor vehicle incidents [2]. In the present essay we will discuss what lesions fall under the term traumatic brain injury, how its severity is typically characterized by clinicians, and what may be the potential consequences for the patient.

Traumatic brain injury is caused by an external force resulting in a change of brain function or any other form of brain disease [2]. Often clinicians classify a traumatic brain injury as either mild, moderate or severe based on an initial assessment using (1) the Glasgow Coma Scale (GCS) which reliably reflects a person’s level of consciousness after experiencing a brain injury and (2) structural images from computed tomography (CT scan).

The GCS score given to a patient can range from 3 (completely unresponsive) to 15 (responsive) and has been demonstrated to strongly correlate to the eventual outcome of the patient in terms of disability and mortality. To compute the total score, a separate score for “eye responsiveness” (score of 1, does not open eyes – score of 4, opens eyes spontaneously), “verbal responsiveness” (score of 1, makes no sound – score of 5, talks normally), and “motor responsiveness” (score of 1, makes no movements – score of 6, follows commands of clinician) are added up [3]. In addition, promising recent technologies allow clinicians to better characterize the patient – specific injuries using magnetic resonance imaging (MRI) in addition to the indispensable CT-scans, blood biomarkers (for example, in –or decrease of a certain molecule in the blood), and advanced signal processing tools that extract and process information from the physiological signals that are being monitored in the patient. However, most of these technologies still need to be refined for clinical use by additional research.

Mild traumatic brain injury (GCS score 13 – 15), largely overlapping with the older term a concussion, is the most prevalent among all traumatic brain injury cases and causes short – term neurophysiological brain dysfunction such as memory loss and loss of consciousness [2, 4]. Typical additional symptoms of mild traumatic brain injury are headache, dizziness, imbalance, and fatigue, among others, and should be monitored and followed up on by a healthcare provider so that secondary undesirable effects (such as depression) in case of prolonged symptoms can be managed early on [4]. Moreover, when a person experiences several subsequent mild traumatic brain injuries, as for example in the context of a contact sport such as boxing, this may have lifelong cognitive consequences and be associated with increased risk of dementia [2].

Moderate (GCS score 9 – 12) and severe (GCS score 3 – 8) traumatic brain injuries are

characterized by an initially longer and more profound loss of consciousness (moderate: 30 minutes – 24 hours, severe: > 24 hours), the presence of structural damage on imaging and may lead to long – term or life – long problems affecting all aspects of the patient’s life. A recent observational study in the United States indicated that among the survivors of moderate to severe traumatic brain injury after 5 years of the initial injury, only 26 % of the patients improved, 22 % of the patients remained the same, 30 % of the patients became worse, and 22 % died [5]. These patients experience physical symptoms (disability), problems with thinking and learning (concentration, remembering, understanding, communicating), changes in motor skills (coordination, balance), hearing, vision, emotions, and/or behavior [6]. Important factors that play a role in the recovery of the patient concern (1) the health of the patient before the injury, (2) the type and severity of the traumatic brain injury, (3) access to healthcare and specialized care such as rehabilitation, and (4) the presence of family and other social support [6].

In summary, traumatic brain injury is a life changing event for the patient and his/her family and friends. A patient’s brain injury is characterized as a mild, moderate, or severe trauma and optimal treatment is judged on a case by case basis with CT scan imaging as an essential clinical tool. Promising techniques, currently under development, may pave the way to offer increased personalized and improved precision care to patients.

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