

## Editorial

### Mild traumatic brain injury

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In 1997, the Brain Injury Association defined traumatic brain injury (TBI) as an insult to the brain which is not of a degenerative or congenital nature but caused by external physical force [1]. After this definition, brain injury may produce a disturbance of consciousness resulting in an impairment of cognitive abilities or physical functions, but can result in a disturbance of behaviour or emotional functioning. The disorders may be temporary or permanent and may cause partial or total functional disability or psychosocial maladjustment. The American Brain Injury Association recommends a classification into three degrees of TBI, mild, moderate, and severe [2]. Frowein [3] proposed, in addition, 'severest' as a fourth category. Generally, one must differentiate between open and closed brain injury.

Traumatic brain damage is caused by an impact on the head. The localization and the severity of the traumatic brain lesion depends on the direction, the intensity of the acting force and on the mobility of the head during the impact, with possibilities of defence movements. For the documentation of the acting force on the head, the impact scheme after SPATZ, adapted to the INNSBRUCK scheme [4], is useful.

A blunt impact on the head causes a certain pattern of brain lesions in connection with acting forces and the position of the head. Neuro-pathological findings and the documentation of clinical data allow one to differentiate between three types of TBI, the linear outer TBI [4], with four subgroups depending on the direction of the impact (Type I occipital, Type II frontal, Types III and IV lateral, and with more intensive damage at the contre-coup area) in the brain tissue, the linear inner TBI with the inner upper brain trauma (lesions around the lateral ventricles—butterfly lesions) [5], the lower inner brain trauma (lesions mainly in the upper brain stem) [6], and the rotational brain trauma (intra- and extracerebral hematomas, dilacerations of brain tissue) [7]. The neuropathological findings are fully confirmed by examinations with MRI [5, 6].

For mild brain trauma in the international literature, different terms are found [2]—minor head injury, mild head injury, traumatic head syndrome, post-brain injury syndrome, mild concussion syndrome, post-concussional syndrome, traumatic cephalgia, post-traumatic syndrome. In the continental European

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Literature, *Commotio cerebri* (Gehirnerschütterung) can be found [8, 9]. Recently, for light traumatic brain damage, the term mild traumatic brain injury (MTBI) has been most frequently used. There are several points in favour of using the term MTBI, as unconsciousness lasts only minutes or can not be recognized, and the typical range of symptoms with their corresponding complaints are mild and have only poor sequelae, in some of the cases the neurological and psychic deficits can not be discovered by routine clinical examination [2]. The neurological findings based on structural damage of brain tissue can be proofed by cerebral MRI and, in some patients, in light and mostly temporary EEG abnormalities [10].

For a definition of MTBI, it is suggested that one follows the guidelines of the Mild Traumatic Brain Injury Committee, which stated that a patient with MTBI is a person who has had a traumatically induced physiological disruption of brain functions as manifested by at least one of the following [2]:

- any period of loss of consciousness of ~30 minutes or less;
- any loss of memory for events immediately before or after the accident, i.e. post-traumatic amnesia (PTA)—retrograde and/or anterograde amnesia of the German literature which must not be longer than 24 hours;
- any alterations in mental state at the time of the accident (feeling dazed, disoriented, or confused); or
- focal neurological deficits(s) that may or may not be transient.

In addition, it is remarked that the initial Glasgow Coma Scale (GCS) after 30 minutes should be 13–15.

The Mild Traumatic Brain Injury Committee [2] stated that the acute symptoms may or may not persist for a varying length of time. Patients with MTBI may show 'persistent emotional, cognitive, behavioural and physical symptoms'. After the proposal of the Committee [2], three categories of acute symptoms have to be differentiated:

- (1) *Physical symptoms* (e.g. nausea, vomiting, dizziness, headache, blurred vision, sleep disturbance, quickness to fatigue, lethargia or other sensory loss) that cannot be accounted for by peripheral injury or other causes.
- (2) *Cognitive deficits* (e.g. involving attention, concentration, perception, memory, speech/language, or executive functions) that can not be completely accounted for by emotional state or other causes.
- (3) *Behavioural change(s) and/or alterations in degree of emotional responsivity* (e.g. irritability, quickness to anger, disinhibition or emotional lability) that can not be accounted for by a psychological reaction to physical or emotional stress or other causes.

In the guidelines [2], it is mentioned that 'some of the patients may not become aware of the extent of their symptoms until they attempt to return to normal functioning' and it is stressed that in such 'cases the evidence of a mild traumatic brain injury must be reconstructed'. A MTBI can be overlooked in the face of more dramatic physical injury like spinal cord injury or open fracture of extremities.

The term MTBI implies a damage of the brain tissue, which brings some changes in the pathophysiology of brain injury. In contrast, *Commotio cerebri* (Gehirnerschütterung) is based on the hypothesis that, after an impact on the head, a transient dysfunction of the brain takes place without any damage to

brain tissue [8, 9]. This opinion is disproved by the results of modern diagnostic methods [10].

Functional disturbances of the brain without morphological alterations would be considered to be a functional disturbance of a human organ, without brain damage of the tissue, with consequences at the forensic level and insurance issues. Legally, any damage to human tissue had to be accepted as a severe injury.

The following publications, presented at the 3rd EFNS Congress in Seville, 1998, give information about the European situation to the topic of MTBI and present results in clinical studies.

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