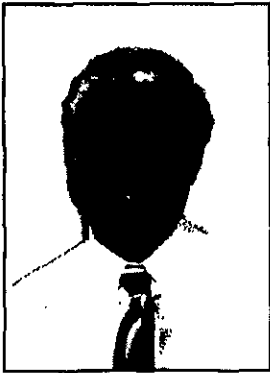




# TBI Update



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## THE SIGNIFICANCE OF PARTIAL SEIZURE-LIKE SYMPTOMS FOLLOWING MILD TRAUMATIC BRAIN INJURY

A lawyer interviewing a client in a traumatic brain injury case will likely

find that the client suffers from a fairly typical constellation of symptoms. The physical symptoms include dizziness, headache, sleep disturbance, and fatigue. Cognitive symptoms include deficits in attention, concentration, short-term memory or executive functions. Behavioral or emotional symptoms include irritability, quickness to anger, disinhibition or emotional lability.<sup>1</sup>

While these are the classic symptoms following traumatic brain injury, some clients report strange sensory experiences or hallucinations. These sensations or perceptions usually last only a few seconds and include illusions involving smell, taste, and vision. Objects suddenly move or change shape, or appear large and close, or small and far away. They hear a voice calling their name. They blank out for a few seconds, which may be followed by a brief period of confusion. They report feelings of sudden sadness, fear or happiness for no apparent reason. They display violent outbursts of temper. They may even report the experience of their mind becoming disassociated from their bodies.

These symptoms can occur following mild traumatic brain injury (MTBI) and are described as a form of "post-traumatic epilepsy" consisting of "partial seizure-like symptoms."<sup>2</sup> The presence of these symptoms may indicate that the brain has been damaged, particularly in cases where the person has not experienced similar symptoms prior to the traumatic event. Partial seizure-like symptoms are a potential factor contributing to unexpectedly poor clinical outcomes in the "miserable minority" of individuals who continue to manifest dysfunction following MTBI.<sup>3</sup>

An epileptic seizure is caused by the inappropriate discharge of cerebral neurons as a result of electrophysiological brain dysfunction.<sup>4</sup> In a normal brain, the spread of electrical activity between neurons is restricted. During a seizure, there is an abnormal discharge of electrical activity in the brain. The most noticeable form of seizure is a "general seizure" in which neurons throughout the entire brain (i.e., in both hemispheres) are activated inappropriately and give rise to convulsions. These are relatively rare following a MTBI. The majority of post-traumatic seizures are "partial seizures" in which there is a focal area or region of the brain with abnormal electrical discharge. In most cases of MTBI the partial seizures originate in the temporal lobe<sup>5</sup> which is the area of the brain involved with emotion, memory, olfaction, and hearing. The resulting seizures can affect each of these functions and are often colourful in their diversity and complexity.<sup>6</sup> Marsel Mesulam, former professor of neurology at Harvard Medical School, has adopted the term "temporolimbic epilepsy" to refer to seizures originating not only in the temporal lobe but in other cortical areas of the limbic system

as well. In his text, *Principles of Behavioral Neurology*, Dr. Mesulam states that the "temporolimbic network may reproduce or evoke virtually any stimulus, memory thought, or feeling state that the brain is capable of experiencing".<sup>7</sup> Some of the more common sensory alterations referred to by Dr. Mesulam include:<sup>8</sup>

- Staring, sometimes with a repetitive smacking of the lips;
- Repetitive movements of the arms or legs;
- A flushing or a "hot sensation";
- Shortness of breath or a feeling that the heart has stopped, is racing, or is pounding hard;
- Nausea or epigastric distress. This is usually experienced as a rising or sinking feeling, "like an elevator ride," or a feeling of a sudden urge to throw up;
- Visual phenomena such as patterns, geometric shapes, and flashing white or colored lights are common;
- Metamorphosis, the sudden distortion of a common object or person;
- Micropsia, the illusion that objects have become smaller, further away, or suddenly out of reach;
- Macropsia, the illusion that objects have become larger and are closer to or "towering over" the patient;
- Auditory hallucinations may consist of a ringing or buzzing sound or of a voice calling the patient's name;
- Gustatory (taste) hallucinations are usually of a metallic or foul taste;
- Uncinate or olfactory (smell) phenomena are similarly unpleasant and may include odors such as ammonia, burning rubber or garbage, garlic or fecal odor;
- Déjà vu, the sense that events, conversation, or location at the moment have all been experienced or witnessed previously by the patient;
- Jamais vu, where patients report that they intellectually know the place or people to be familiar but that they are unable to shake the feeling that they have never seen them before or that familiar events are strange or unfamiliar;
- Patients sometimes report the sense that someone is nearby, watching over their shoulder, or outside the house, without any accompanying visual hallucination;
- Mind-body dissociation, patients may experience the feeling that they step outside of their own body or hover above themselves and find they are watching their own actions from the perspective of a detached observer;
- Emotional manifestations of a temporolimbic seizure disorder are most often negative in content. The emotion occurs suddenly and unpredictable without apparent precipitant, is often out of context or inappropriate to the patient's activities at the time, and generally ceases as abruptly as it began. Emotional manifestations include: embarrassment, sadness, depression or sudden crying, explosive laughter usually without the feeling of happiness, peacefulness or serenity, and most commonly, fear (typically of personal injury or harm from some unknown source);
- Sudden anger or increased irritability. Patients may describe explosive but undirected aggressive behavior, such as throwing objects.

The onset of these symptoms can occur within the first week and are called "early seizures." These are considered to be the result of acute changes in the brain following injury, as a consequence of increased cranial pressure, intracranial hemorrhage, acidosis or hypoxia.

"Late seizures" occur after the first week of injury and are attributed to gliosis (scarring) of the brain following traumatic brain injury.<sup>9</sup> Although the risk of developing post-traumatic seizures decreases with the length of time following injury, the later the onset the more likely it is to be persistent. While the frequency and duration of these attacks

are variable, it appears that increased seizure frequency is associated with a higher likelihood of seizure persistence.<sup>10</sup>

The relationship between MTBI and partial seizure-like symptoms was explored in a 1992 study published in *Brain Injury*.<sup>11</sup> Researchers found that 17 patients who had sustained MTBI reported partial seizure-like symptoms. Significantly, in 12 of the patients there was either no loss of consciousness or it was momentary lasting no more than a few seconds. The researchers concluded that the brain injury was an etiological factor in the onset of partial seizure-like symptoms and that these should be recognized as a distinct component of the sequelae associated with MTBI. The authors noted:

*The clinical presentation of the type of patient included in the present sample can be extremely confusing and frustrating to practitioners unfamiliar with the sequelae of closed head injury. However, rather than clumping the plethora of symptoms and complaints described by such patients and their families under a broad and nonspecific rubric such as 'post-concussional syndrome', clinicians can produce significant improvement by evaluating and treating (if possible) the following components of the patient's presentation: (a) partial seizure-like phenomena; (b) residual mood complaints (e.g. organically based depressive disorder); (c) headache problems; (d) static cognitive deficits (e.g., poor nonverbal memory); and (e) frontal lobe dysfunction. In addition, there is generally a significant need for patient education and extensive consultation with family members, employers, school personnel, attorneys, and insurance carriers regarding the nature of a given patient's problems and long-term prognosis. Nevertheless, even where there is a significant reduction in symptoms, maximal treatment does not necessarily translate into a return to premorbid levels of social, vocational, or academic functioning. In this regard, it is typically the psychosocial deficits associated with damage or dysfunction in the frontal lobes which constitute the greatest challenge to competent functioning in daily life. Skepticism on the part of friends, family, and even health practitioners can pose another problem because the acute trauma sustained by many such patients did not appear life threatening at the time of injury, because such patients 'look so good' physically, because symptom onset may be gradual and temporally removed from the date of initial injury, because many symptoms are episodic rather than static, or because patients may be seeking financial compensation for their injuries.*

The above passage suggests that in cases of MTBI there may be multiple categories of injuries to the brain. Partial-seizure-like symptoms following MTBI suggest that there has been some damage or injury to the brain likely as a result of gliosis or scarring to the brain. This scarring occurs at a microscopic level and would not be apparent on a CT scan or MRI scan of the brain.

Partial seizure-like symptoms are episodic in nature and as such are extremely difficult to identify by electrophysiological tests like an EEG. Dr. Richard J. Roberts, a professor at the Veterans' Administration Medical Center in Iowa City, conducted a thorough review of the research into MTBI and partial seizure-like symptoms, which he refers to as "epilepsy spectrum disorder" (ESD). He noted that the variable nature of these symptoms may explain diverging test results in patients with partial-seizure-like symptoms.<sup>12</sup>

As is true of their affective and behavioral symptoms, many of the cognitive deficits and complaints of 'epilepsy spectrum disorder' patients are highly variable and

episodic in nature. Thus, within the same 3 to 4 hour testing session, cognitive efficiency may fluctuate extensively and even rather serve deficits (e.g. gross anomia) may be transitory in nature, depending on electrophysiologically based oscillations in cerebral function. This also may help to explain in part why the mental efficiency and test performances of some head injury patients appear substantially different to different neuropsychological evaluators on different days. Lack of consistency in performance over time is occasionally presumed to constitute evidence of malingering or "psychological overlay" in TBI patients undergoing forensic evaluations; however, if ESD is a major part of the actual clinical for certain TBI patients, "unexpected" fluctuations over time or within testing sessions may actually be a legitimate characteristic of the patient's "best" performance.<sup>13</sup>

Partial-seizure-like symptoms are often missed because they are overshadowed by the more obvious physical, cognitive, and behavioural deficits arising from a traumatic brain injury. They may also not be differentiated from the constellation of symptoms associated with "post-concussive disorder." The presence of partial seizure-like symptoms may help to explain inconsistent neuropsychological test results and may also provide evidence of the underlying damage to the area of the brain responsible for the distorted perceptions, particularly where the individual did not have partial seizure-like symptoms prior to the MTBI.

1. Kay T. Definition of mild traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, 1993, 8(3), 86-87.
2. Verduyn, W.H., Hill, J. et al. Multiple partial seizure-like symptoms following 'minor' closed head injury. *Brain Injury*, 1992, vol. 6(3), 245-260.
3. Roberts, R.J. Epilepsy Spectrum Disorder in the Context of Mild Traumatic Brain Injury. *The Evaluation and Treatment of Mild Traumatic Brain Injury*. Lawrence Erlbaum Associates, Inc., 1999, 209-248.
4. Simon H.N., North N., et al. Clinical Management of a Man with Complex Partial Seizures and a Severe Head Injury. *Brain Injury*, 1993, vol. 7(3), 257-262.
5. Dalmady-Israel, C. and Zasler Nathan D. Post Traumatic Seizures: A Critical Review. *Brain Injury*, 1993, vol. 7(3), 263-274.
6. Pryse-Phillips, W. and Murray, T.J. *Essential Neurology*, 3rd edition, Medical Examination Publishing Company, New York, 1986, 225-228.
7. Mesulam, M.M. *Principles of Behavioral Neurology*. F.A. Davis Company, 1985, 289-302.
8. *Supra*, n. 2
9. Generally, researchers speculate that the mechanical forces resulting in traumatic brain injury can produce subtle damage or dysfunction in one or in multiple loci in the brain and that the long-term effect of electrophysiological dysfunction eventually results in the clinical manifestation of partial seizure-like symptoms.
10. Giranner, M.A. Post-Traumatic Epilepsy, *Head Injury and Postconcussive Syndrome*, Churchill Livingstone, 1996, at 227-241.
11. *Ibid.* at 292.
12. *Ibid.* at 255.
13. *Supra*, n. 2.
14. *Ibid.* at 221.

