

TRAUMATIC BRAIN INJURY: THE OVERLOOKED DIAGNOSIS IN TRAUMATIC SPINAL CORD INJURY CASES

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The Medical Literature

A significant proportion of individuals who sustain a spinal cord injury (SCI) also sustain a concomitant traumatic brain injury (TBI).¹ Early studies report the incidence of TBI associated with SCI as low as 13 percent² to 25 percent.³ Later studies employing more sensitive assessment criteria for the diagnosis of a TBI report the incidence of concomitant TBI in spinal cord injured patients ranges from 40 percent to 58 percent.⁴

The cognitive, emotional and behavioral problems associated with many of the mild to moderate cases of TBI are often overlooked in dealing with the more devastating consequences of the SCI.⁵ This failure to diagnose a TBI can seriously affect the rehabilitation of an individual with a SCI and for this reason investigators have suggested that the medical profession should have a high index of suspicion that they are concomitant and should actively look for TBI in SCI cases:

The literature clearly points out the high co-concurrence rate of TBI with SCI. It is also clear that dual diagnosis is frequently missed, and that the effects of a head injury can have strong negative impact on rehabilitation outcome. The client with SCI may fail to reach optimal function unless these problems are identified and addressed by rehabilitation professionals. By understanding the impact of cognitive impairments on client functions, rehabilitation professionals will be better able to provide appropriate programming and treatment plans. Also, an awareness of the emotional effects of a TBI can allow us to more effectively work with the family as well as the person with SCI to facilitate positive rehabilitation outcome. Helping both the family and the individual identify and anticipate emotional shifts can encourage improved coping with the changes that occur due to injury. Finally, determining an accurate level of cognitive functioning is critical, because it may be associated with medical stability and with a person's ability to assimilate necessary post SCI survival and adaptation skills.⁶

In a mild TBI case, problems with memory, concentration, organizational abilities, depression, fatigue, mood swings, motivation, and temperament can significantly compromise the rehabilitation of the patient with a SCI. Clearly, if an individual occasionally forgets or doesn't have the energy, motivation, or organizational ability to consistently administer an appropriate bladder and bowel routine, then this individual will be at significant risk in an independent living environment.

In a recent article, "The paralyzed patient's overlooked mild or moderate traumatic brain injury" published in *Topics in Spinal Cord Injury Rehabilitation*, Harvard Medical School neurologist, Dr. William Singer, commented:

Clearly the patient with mild TBI suffers organic damage on the microscopic level, including diffuse axonal and excitotoxicity neuronal injuries, which the commonly used laboratory

diagnostic tools do not always identify. Cognitive deficits resulting from these undiagnosed TBIs may be of particular importance to the adjustment of spinal cord injury (SCI) patients as they attempt to acquire the skills necessary for self-reliance and reentry into school, the workplace, or society in general.

The catastrophic motor deficit resulting from the spinal cord injury may make the diagnosis of motor deficits of cerebral damage origin difficult or impossible. During the hospitalization, superficial mental status examinations or even a standardized mini mental status examination^â may not be sensitive to the cognitive and memory disorders, as well as the disorders of attention and concentration, that are the hallmarks of mild to moderate TBI. In addition, affective changes may be attributed to a reaction to the spinal-cord-induced paralysis and loss of function but may actually be the result of a mild to moderate TBI. As is often seen in TBI without SCI, neurodiagnostic tests may reveal no abnormalities. Abnormalities detected by a neuropsychological assessment may be the only indication of a brain injury accompanying SCI. Thus, a neuropsychological evaluation is essential in the thorough assessment of patients with SCI.

The diagnosis of mild to moderate TBI may require the supplementing of the interdisciplinary health care team with neurologists, neuropsychiatrists, and neuropsychologists who are attuned to the subtleties of this injury. The clinical neuropsychologist can significantly aid in evaluating and treating brain damage on this level. This may be of particular importance to the paralyzed patient.

In recovering from the injury, the patient must cope with the adjustment to his or her modified lifestyle. The problems span the areas of pain, adjustment to injury, health complaints, finances, transportation, sexuality, recreation, accessibility, and many other areas.⁷

An excellent overview of the relationship between TBI and SCI and the resultant effect on the rehabilitation process is provided in the chapter, "The Combination Injury: Spinal Cord Injury with Concomitant Traumatic Brain Injury" published in *Management of Spinal Cord Injury*. The following comments highlight the additional problems a mild TBI presents for a spinal cord injured patient:

Even following a mild diffuse brain injury, patients may experience difficulties with attention and concentration. In the rehabilitation setting, these patients may present with more than expected mental and physical fatigue. Their impairments in selective attention contribute to distractibility. They may display poor shifting of attention back and forth so that the patient frequently gets lost in a group conversation.

Disorders of initiation and planning of goal-directed activities are also common following diffuse injuries as well as more focal frontal-temporal injuries. These patients demonstrate an impairment in so-called abstract attitude. Patients thus frequently miss the point and can take information presented to them quite literally rather than symbolically. Additionally, they may have difficulties inhibiting actions before the desired action is required and present with impulsive and perseverative responses. Their overall initiation time is slowed. As a result, patients display confusion as to where to start and stop in solving a problem and consequently often use unrealistic problem-solving strategies. They may have difficulty

ordering or sequencing more complex information. Because patients who have these difficulties also have trouble learning from their mistakes and successes, they may have difficulty in knowing when, where and how to ask for help.

Disorders of judgment and perception are frequent following frontal/temporal and multifocal injuries. This may result in misperceiving or misinterpreting the actions or intentions of others. Patients may become easily confused by the presentation of multiple bits of information at one time. They may also be socially inappropriate in verbal communications. Usually, these patients have an unrealistic appraisal of self including their residual strengths and weaknesses.

Probably the hallmark of diffuse brain injury is disorder in speed of information processing. Thus, patients are extremely slow to react and in psychomotor activities (talking, writing, doing mechanical tasks, and so on). Processing time slowness frequently coincides with disorders of memory and new learning. It is important to understand that patients may experience specific, short-term memory deficits (verbal versus nonverbal information). Additionally, difficulties in organizing or processing important information affect learning new skills during SCI rehabilitation (weight shifts or catheterization schedule, for instance). These functional learning problems may affect future independent living and academic or vocational goals.⁸

A Recent Case of SCI with Concomitant TBI

In a claim for damages a concomitant TBI can result in a significant increase in the damages awarded for future cost of care for a SCI. The recent Supreme Court decision in *Terracciano v. Etheridge*⁹ is an example of a case where an undiagnosed mild TBI compromised the rehabilitation of the 16 year old plaintiff who suffered a SCI in a motor vehicle accident on March 16, 1994. The plaintiff had been ejected from the rear seat of a motor vehicle as it rolled down an embankment. She struck her head on the ground and was unconscious for several minutes, although her Glasgow coma scale at the scene of the accident was 15 out of 15.

At trial, the plaintiff contended that in addition to her spinal cord injury, she suffered long term sequelae of a mild TBI which limited her residual earnings capacity and increased her cost of future care. The defendants disputed the allegation of a mild TBI, saying that the many problems of the plaintiff caused by the accident were from her spinal cord injury and psychological responses to her dramatically changed situation. They also alleged that she failed to mitigate her damages by failing to rehabilitate herself.

The plaintiff was transported by ambulance to the Royal Columbian Hospital. She was assessed and identified as a spinal cord injury and immediately transferred to Vancouver General Hospital where she was admitted into the spinal cord injury unit. The plaintiff was discharged from Vancouver General Hospital on May 5, 1994 to the G.F. Strong Rehabilitation Centre for ongoing treatment. Throughout her stay at Vancouver General Hospital little consideration was given to the injury to the plaintiff's scalp or skull and, except for notes made two days after the accident stating that she showed no signs of a head injury, there is no indication that the medical staff explored the possibility that she had suffered a TBI. The Vancouver General Hospital discharge summary made no mention of a TBI:

Clinical History: This 16 year old female was involved in a motor vehicle accident which resulted in multiple injuries. These involved T3/4 fracture dislocation with complete T3 paraplegia, anterior dislocation of right shoulder, posterior dislocation of left elbow, some lacerations and abrasions as well as a fractured manubrium.

Upon admission to the G.F. Strong Centre, a team of people became involved in the plaintiff's care. The team included doctors, nurses, occupational therapists, physiotherapists, social workers, educational consultants and the plaintiff's family. The plaintiff was assisted in learning wheelchair use and management, transfers, independent dressing, management of her bladder and bowels, and maintenance and improvement of her lower limbs and upper limbs. The plaintiff experienced significant difficulty in progressing through the rehabilitation process at G.F. Strong, however, no consideration was given to the likelihood that her difficulty with the rehabilitation process was due in part to her having sustained a TBI. On October 14, 1994 the plaintiff was transferred to G.F. Strong Outpatient Services and returned to the family residence. Unfortunately, no arrangements had been made to renovate the residence to make it wheelchair accessible. Entry to the home was on the ground floor but her bedroom, bathroom, and the kitchen were on the second floor. Until renovations were completed in late Spring of 1995, she was unable to use the bathroom as the access was too narrow and it would not accommodate her chair. Whenever she went in or out of the house she had to go up and down the stairs on her buttocks with the assistance of family members.

In addition to all of the problems associated with her T3 paraplegia, the plaintiff experienced significant cognitive, emotional, and behavioral problems. She suffered from problems with her memory and concentration. Her family described how the plaintiff underwent a personality change. She became temperamental and suffered from significant mood swings and depression. She lacked motivation and initiative. There were no indications of any of these problems before the accident. Her friends described her before the accident as a fun-loving, active, teenager who loved to socialize. She was more of a leader than a follower.

The Court accepted the evidence of the plaintiff that soon after the accident she noticed flashing lights or spots, experienced hearing problems including ringing in the ears, was short of patience, suffered from headaches and had trouble expressing words. She smelled the odor of rotten cheese and noticed problems with her memory, particularly short term. Some of these problems she mentioned to her family, but not to her medical attendants. The medical staff did not make inquiries of the plaintiff in these areas. She testified that these problems were not of great concern to her right after the accident because her overriding concern was her spinal cord injury.

In addition to the collateral evidence from family and friends who attested to cognitive, emotional and behavioral changes in the plaintiff after the accident, the plaintiff relied on expert evidence from experts in psychiatry, neuropsychology, neurology and physiatry who were familiar with the recent literature in the field of mild TBI. The court made the following comments in reviewing this evidence:

[35] In addition to these problems, Ms. Terracciano alleges that she suffered a mild traumatic brain injury which, undetected until recently, has caused her to have focus, memory and attention problems and has accounted for at least a portion of her continued dependence on others. The defendants challenge this assertion, saying that any delay in

rehabilitation to independent living has been caused by Ms. Terracciano's psychological problems that flow from her spinal cord injury and her failure to maintain routines and a rehabilitative program. The defendants point to the dearth of recorded complaints of cognitive and sensory problems during her seven month treatment at Vancouver General Hospital and G.F. Strong Rehabilitative Centre, and during the nine months following treatment. It was not until July 1995 that Dr. Anderson, a psychiatrist, first recorded the complaints and postulated a mild traumatic brain injury.

[36] The clinical file of Ms. Terracciano reveals scant enquiry into ongoing effects of the obvious head injury which had been noted on her admission. The focus of the medical team, Ms. Terracciano and her family was her spinal cord injury and her rehabilitation. Although Ms. Terracciano's mood was frequently observed to be depressed, the depression, and sometimes anxiety or grief, was attributed to her spinal cord injury.

[37] The questions then, are whether Ms. Terracciano's complaints, as described to the Court, are real symptoms and, if so, whether they are symptomatic of a mild traumatic brain injury which now limits her ability to care for herself and which is likely to do so in the future.

[38] Diagnosis of a mild traumatic brain injury is made using a commonly accepted definition which requires at least one of the following: a period of loss of consciousness for 30 minutes or less; loss of memory immediately before or after the accident (post-traumatic amnesia not to exceed 24 hours); alteration in mental state at the time of the accident; or focal neurological deficits. Although presence of one or more of these features does not establish existence of a mild traumatic brain injury, absence of all features negates the diagnosis.

[39] In this case, Ms. Terracciano claims that she experienced a loss of consciousness at the time of the accident. The defendants deny this, thereby suggesting a mild traumatic brain injury was unlikely to have occurred.

[40] Ms. Terracciano herself recalled "flying out" the back window, and then being in the ditch with a lady calling to her, and then being in the emergency room of the Royal Columbian Hospital. She had no recollection of traveling to the emergency room, or from there to Vancouver General Hospital.

[43] The ambulance crew's report of attendance at the accident indicates that the ambulance arrived about thirteen minutes after the emergency call was received. Ms. Terracciano was then conscious and had a Glasgow Coma score of 15. The report indicated that loss of consciousness was unknown.

[44] The admission records of Royal Columbian Hospital noted a contusion of Ms. Terracciano's occipital scalp. The radiology report disclosed a fragment of bone on the left side at the margin of the skull, indicating it lay in overlying soft tissue.

[45] On all the evidence before me, I conclude that it is more likely than not that Ms. Terracciano suffered a loss of consciousness at the time of the accident, lasting less than five minutes, and that the defendants expert reports, in dismissing the assertion of loss of consciousness, are incorrect. I also conclude that the brief loss of consciousness was followed by a period of post-traumatic amnesia.

[46] I turn now to Ms. Terracciano's symptoms. She described a constellation of symptoms: reduced hearing, light sensitivity, headaches, the smell of rotten cheese, poor concentration, impatience, mood swings, temper explosions, blurry vision at times, difficulty from time to time finding words, tinnitus, dizziness and short term memory problems. Some of these problems were confirmed by members of her family, for example, irritability, concentration problems, forgetfulness and moments of apparent mental absence. Dr. Anderson noted that he was required to repeat questions to her. Friends testified that they observed her to be easily irritated.

[47] I am satisfied on a balance of probabilities that Ms. Terracciano has the symptoms she described to the Court. That these complaints were not documented before her visit to Dr. Anderson is reflective of the focused attention of the medical teams on her more dramatic problems from the spinal cord injury and is consistent with the experience of many spinal cord injury victims noted in medical literature. For example, Dr. Schmidt, a clinical psychologist and neuropsychologist in British Columbia, in his October 1995 report, wrote:

Although moderate or severe TBI [traumatic brain injury] is seldom missed following an accident of this type, subtle or "mild" TBI is frequently overlooked. This happens for a number of reasons. First, other, more obvious physical injuries or problems often become the focus of treatment and medical attention. Second, there are often no physical signs of brain damage, either specific (such as unequal pupil response) or general (such as coma). Sometimes, subtle TBI is followed by a period of Post-Traumatic Amnesia or PTA. During PTA, the individual may be "awake" and responsive, but will later remember nothing of that time period. Although PTA is common in subtle TBI, however, it is not always present, and recent studies have demonstrated significant deficits in functioning of post-TBI patients with no PTA. For this reason, unconsciousness or PTA is no longer required for a diagnosis of mild or subtle TBI to be made; there need only be some alteration of consciousness. A third fact that makes diagnosis of subtle TBI difficult is that the physical damage in subtle TBI tend to be diffuse (that is, spread across several areas of the brain) and microscopic (often involving tearing of many small strands of neural tissue known as axons) rather than focal and large, as might be the case with a tumor or stroke.

[48] The phenomena of late attention to symptoms of a traumatic brain injury in subtle or "mild" cases was affirmed by Dr. Anton, a specialist in physical medicine and rehabilitation and Chief of Medical Staff of B.C. Rehabilitation Society, the parent organization of G.F. Strong Rehabilitation Centre.

[53] In October 1996 Dr. Cameron, a neurologist, stated:

· she therefore fulfills the criteria for a diagnosis of mild traumatic brain injury, or a concussion as defined in "The Journal of Head Traumatic Rehabilitation" Vol. 8 (3) (1993). · These symptoms are as a result of microscopic organic brain injury sustained at the time of [the] motor vehicle accident. Exacerbation, or worsening of these symptoms has also resulted because of psychological disruption following this motor vehicle accident

[54] In October, 1996 Dr. Nairn Stewart, a specialist in physical medicine and rehabilitation, currently a consultant to the Head Injury Unit of the Workers' Compensation Board, opined:

Additionally, it is likely that she has sustained a mild traumatic brain injury. As both Dr. Schmidt and Dr. Anderson pointed out, brain injuries are often missed early on in the face of more obvious catastrophic injuries such as paraplegia. It is known that she sustained trauma to her head and she may well have had a brief period of loss of consciousness. Her memory is incomplete for events surrounding the accident and for several hours after the injury. The personality and behavioral changes in Ms. Terracciano described by her family are typical of someone who has sustained a traumatic brain injury. Although adolescents often have difficulty adjusting to spinal cord injury the persistence of this difficulty over time together with the presence of subtle intellectual deficits and a change in her personality and emotional responses all support a diagnosis of mild traumatic brain injury. The presence of this additional problem greatly increased her disability and diminishes her potential for eventual independence and employability.

[55] Lastly, in December 1996 Dr. Anton wrote:

Ms. Terracciano probably also has persisting cognitive impairments as a result of a mild traumatic brain injury. Her subjective complaints of impaired memory and concentration are consistent with the late effects of a traumatic brain injury.

[97] Ms. Terracciano claims significant costs for her future care of \$1,913,000. The defendants claim her cost of future care will be the modest sum of \$338,000. The difference between these positions lies in differing assessments of Ms. Terracciano's abilities and, in particular, their different positions concerning the incident of a mild traumatic brain injury with long term sequelae that impair her functioning.

[123] Ms. Terracciano seeks an allowance to permit her to retain a rehabilitation life skills worker to assist her to organize and structure her day. The request is based primarily on her contention that this assistance is required to redress the effects of the mild traumatic brain injury. The defendants, not accepting the allegation of a brain injury, have made no allowance for this assistance.

[124] I have concluded that Ms. Terracciano has suffered a mild traumatic brain injury. Based on the evidence before me, I find she continues to experience difficulties that are related to the injury and are in addition to symptoms experienced from depression. I consider a case is established for provision of consistent in-home support to assist Ms.

Terracciano. The confusion and disorganization she now experiences on a daily basis and the general lack of follow through which has been the subject of complaint by the defendants and which limits her community functioning, will be assisted by this support.

In the *Terracciano* case the diagnosis of a mild TBI made 15 months after the accident provided an explanation for the difficulties the plaintiff experienced with rehabilitation and established the evidentiary basis for the plaintiff's contention that she would require more than the usual amount of care in cases of a SCI resulting in paraplegia. In addition, the evidence documenting the cognitive, emotional, and behavioral problems experienced by the plaintiff as a result of her TBI, when superimposed on her SCI, supported the plaintiff's argument that she did not have any residual future earnings capacity and also enabled the plaintiff to defeat the defence claim that she had failed to mitigate her damages by not following through with her rehabilitation.

The finding by the Court of a TBI concomitant with the SCI resulted in an increase in the damages awarded for cost of future care from "the modest sum of \$338,000" suggested by the defence to \$1,210,000 and a similar increase in the damages awarded for loss of earnings capacity from the sum of \$350,000 suggested by the defence to \$950,000.

Conclusion

The medical literature and the decision in the *Terracciano* case illustrate the need to investigate whether a TBI has occurred in any traumatic SCI case. A concomitant TBI in a person who has sustained a SCI will affect not only the person's ability to follow a prescribed course of rehabilitation, but also the final level of functioning achieved. What may appear to be a case of reactive depression (with associated cognitive, emotional and behavioral changes) to the devastating consequences of having sustained a traumatic SCI, may in fact be symptoms of a TBI. From a medical perspective the diagnosis of a concomitant TBI will affect the rehabilitation of the SCI patient. From a legal perspective, the diagnosis will affect the damages awarded for cost of future care and loss of income earnings capacity to a plaintiff with a concomitant SCI/TBI. In cases where the diagnosis of a TBI has been overlooked in the face of the overwhelming consequences of a SCI, then it falls upon the lawyer to refer the spinal cord injured victim to appropriate experts who are attuned to the subtleties of assessing a TBI in the face of a SCI.

References

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