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The post-concussion syndrome revisited: four vestibular trauma syndrome cases

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Introduction

While the majority of mild traumatic brain injury (MTBI) patients recover quickly, returning to baseline functioning within 3-6 months, up to 15% of these patients has prolonged recoveries or never recovers completely.[1] Existing treatment paradigms have largely failed this population of MTBI patients.[2,3] Incomplete recovery in this group has been attributed to a variety of factors, including the residual effects of brain injury.[4] chronic pain.[5] emotionally-based symptoms.[6], and outright malingering.[7] The diagnosis of mild traumatic brain injury is always inferential, and our inferences are based solely on a patient's symptoms and neuropsychological test performances. We have no objective findings in MTBI because it is a syndrome diagnosis defined in part by an absence of findings on CT and MRI brain scans.[8] The presence of positive findings on a brain scan shifts the diagnosis into the moderate or severe brain injury category. Although an MTBI diagnosis implies physical damage to the brain, this damage must often be inferred from behavioral findings alone. These findings include the subjective symptoms of the post-concussion syndrome and credible patterns of disability found on cognitive testing. Many clinicians are uncomfortable making a physical diagnosis about the brain based solely on behavioral criteria. The post-concussion syndrome (PCS) diagnosis has now become generally accepted within the medical community despite initial misgivings. Although the non-specific symptoms that comprise this syndrome (headaches, dizziness, irritability, problems with attention and concentration) can be individually caused by a variety of emotional and physical conditions other than a brain injury, they commonly occur together following mild head injuries. Clinicians are comfortable with the PCS diagnosis as long as the symptoms are transient and resolve within weeks or months. When PCS symptoms persist beyond a few months and into years after a relatively minor injury, the brain injury etiology is less obvious. This has led to intense disagreement between experts in a forensic setting, and the legitimacy of the syndrome has often been debated by defense attorneys. Unfortunately, these debates become mired in conceptual confusion because the terms, definitions and implicit assumptions in the diagnosis of mild traumatic brain injury haven't been carefully differentiated.

Although the constellation of symptoms that comprise the post-concussion syndrome (PCS) are accepted as evidence of brain injury, most, if not all, of these symptoms can arise as part of a vestibular trauma syndrome (VTS). Symptoms of vestibular system trauma, estimated to occur in up to 65% of head injuries.[9], are seldom differentiated from PCS in the evaluation of minor head injury. Yet, three of the above PCS symptoms, dizziness, imbalance and nausea, are more likely to result from a traumatic vestibulopathy than from a mild brain injury. Four cases of minor head injury are presented in which a PCS diagnosis was made initially, and a significant vestibular trauma syndrome was not identified or treated until months or years later. These patients were then evaluated by a vestibular rehabilitation specialist using only clinical procedures and found to have evidence of either central or peripheral vestibular dysfunction. Their persistent PCS symptoms were more understandable and treatable when viewed as components of a vestibular trauma syndrome. All four patients showed a rapid remission of their symptoms with treatment even though one patient had gone more than six years before treatment was initiated.

The vestibular system and the VTS

The vestibular system is responsible for maintaining a stable perceptual frame of reference whenever we are in motion or when things around us are in motion. We are kept in balance and oriented in space through a complex feedback system that integrates the rate and angle of our motion into our positional adjustments and our perceptions so that we and our world remain stable.[10] This complex task is accomplished by 5 end-organs within the temporal bone-the three semicircular canals, sensing angular rotation, and the saccule and utricle, sensing gravity and linear acceleration. The central projections to the brain from these peripheral structures are complex and include both afferent and efferent connections from a variety of somatic areas, including eye muscles (oculomotor pathways), allowing for smooth tracking of eye movements, and neck and spinal muscles, keeping the body correctly oriented. Vestibular symptoms are destabilizing and disorienting. Acutely, many patients experience vertigo, but over time, this resolves into a more subtle sense of instability and imbalance. A car ride or a sudden turn may be sufficient to provoke a worsening of symptoms that persists for hours or even days. Dysfunction of the oculomotor reflex can result in visual distortions and photosensitivity, and it often has a disabling impact on sustained visual focusing and reading. These patients may experience the fatigue and secondary headaches commonly identified as components of a PCS. Despite the high incidence of vestibular dysfunction in head trauma cases, vestibular system symptoms are seldom recognized as such when they

arise within the context of a PCS diagnosis. A recent research study.[11] concludes that the miserable minority who suffer from prolonged post-concussion symptoms have a "pscychologic origin of symptoms" that is "strongly related to post-traumatic stress." In MTBI, persistent subjective symptoms like dizziness, imbalance, nausea, fatigue, and visual blurring are often dismissed as psychoneurotic. In this study, poor balance and dizziness, classic balance reflex symptoms, are reported by 44.4 and 33.3 percent of those who hadn't returned to work compared to only 7.6 and 4.5 percent of those who had been able to return. Blurred vision, the most common oculomotor reflex symptom, was reported by only 1.5 percent of those who returned to work compared to 11.1 percent of those who did not. Fatigue, often secondary to vestibular ocular reflex problems, was reported by only 12.1 percent of those who returned to work compared to 66.7 percent of those who did not.

Four clinical cases

Case 1

A 69 year old man sustained a head injury in a motor vehicle accident. He did not lose consciousness, CT scan was negative, and his Glasgow Coma Scale rating was 15. He reported headaches, dizziness, blurred vision and an unsteady gait, and he was given a PCS diagnosis. Persistent symptoms of dizziness, impaired balance and memory difficulty forced him to stop all work and leisure activities. Neuropsychological testing nineteen months later revealed difficulty with sustained visual focusing, attention span and mental tracking tasks. Vestibular rehabilitation used a head repositioning maneuver to clear one of his semicircular canals and to provide immediate relief of both his physical distress and cognitive symptoms.

Case 2

A 56 year old woman sustained a head injury in a rear-end motor vehicle accident. She reported "brain fog" and persistent symptoms of dizziness, nausea, blurred vision and fatigue, and she received a PCS diagnosis. She was unable to sustain her focus while reading because of fatigue and headaches or continue her career as an international consultant in shamanic healing. Neuropsychological testing 2½ years after the accident revealed problems with verbal fluency and mental tracking that undermined memory despite reasonably adequate learning ability. A single vestibular rehabilitation treatment cleared one semicircular canal through repositioning and relieved both her physical and cognitive symptoms as well as substantial, disabling secondary anxiety.

Case 3

A nine year old boy sustained a head injury after falling from a garage roof. He lost consciousness briefly but evidenced no other neurologic signs. Subsequently he struggled with headaches and impaired balance. His academic performance deteriorated, he became a behavioral problem at school, and a neuropsychological assessment was interpreted as showing permanent frontal lobe damage. A second neuropsychological testing six years after his injury revealed a full scale IQ of 81 and mixed results on memory tests. His symptoms of visual blurring, difficulty reading, headaches, fatigue, movement sensitive dizziness and nausea, initially diagnosed as PCS, were reinterpreted as a VTS. He was enrolled in twice weekly vestibular rehabilitation sessions for eight weeks with resolution of his dizziness, visual tracking problems and headaches. He stabilized emotionally and went on to succeed with honors in a college entrance high school curriculum.

Case 4

A brilliant 19 year old student sustained a head injury when he was hit by a car while riding a bicycle. There was no LOC, but he complained of mild confusion, repetitive questions and a brief period of post traumatic amnesia. CT head scan was negative. Six weeks later he reported dizziness, nausea, headaches and an inability to focus and read efficiently. He had difficulty with mental tracking tasks on cognitive testing. A vestibular rehabilitation specialist found central vestibular involvement and started adaptation and habituation exercises. He improved rapidly and returned to his courses within a few weeks.

Conclusion

It is not possible to understand patients who report persistent PCS symptoms without a close evaluation of vestibular system functioning. Standard neuropsychological assessments are not designed to differentiate vestibular symptoms from mild traumatic brain injury, and VTS symptoms often go undiagnosed and untreated. The identification of VTS symptoms is important because vestibular symptoms can often be successfully treated. Unfortunately, symptoms like dizziness, nausea, visual blurring, headache and fatigue are often thought to be psychogenic when the specific nature of the VTS is not recognized.

Three important implications can be drawn from these four cases:

I. Vestibular symptoms are often incorporated into a post-concussion syndrome diagnosis and neither recognized nor treated.

II. A traumatic vestibular syndrome, though not recognized for six years, may still be responsive to treatment.

III. Patients with intractable PCS symptoms can show dramatic improvement with vestibular rehabilitation.

Acknowledgments

None.

Conflicts of interest

None.

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