Eye motility and auditory brainstem response dysfunction after whiplash injury.

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FROM ABSTRACT

The aim of this study was to identify the prevalence of brain/brainstem dysfunction after acute whiplash trauma (grades II and III according to the Quebec Task Force Classification on whiplash-associated disorders) and to investigate a possible correlation between the development of chronic symptoms and objective findings from auditory brainstem response (ABR) and eye motility tests.

We used ABR and oculomotor tests and a thorough clinical, subjective and psychological evaluation in a sample of prospective whiplash trauma patients who were followed up for 2 years after the trauma.

The initial test results did not reveal any prognostic clinical signs for the tested group as a whole, but we could discriminate some patients with clinical symptoms and signs paired with pathologic test results.

Over time, some patients normalized clinically and their test results improved while others deteriorated clinically and their test results were worse at the 2-year investigation.

Our findings of moderate derangements in the tests could be the effects of pain and/or changed cervical afferent activity at the brain/brainstem level, while eye motility dysfunction, in addition to pathological neuro-otological findings in a small proportion of the patients with severe symptoms, could be explained by lesions to the brain/brainstem.

THESE AUTHORS ALSO NOTE:

10%–40% of whiplash injury victims develop chronic symptoms.

The main whiplash symptoms are:

(1) neck pain
(2) neck stiffness
(3) headache
(4) numbness and radiating pain in the arms and hands
(5) visual disturbances
(6) dizziness
(7) tinnitus
(8) brain/brain-stem dysfunction
(9) emotional impairment
(10) cognitive impairment

“In the majority of cases, there is no correlation between the complaints and the objective findings, including the results of CT and MRI scans.”

Clinical and animal studies have documented brain and brainstem lesions after whiplash injury.

Oculomotor dysfunction has been found in both acute and chronic whiplash patients.

These authors used auditory brainstem response (ABR) audiometry and oculomotor tests in 34 prospective whiplash trauma patients over a 2-year follow-up period.

Grade II WAD have neck complaints and musculoskeletal signs.

Grade III WAD have additional neurological signs, such as altered deep tendon reflexes.

None of these patients were manipulated or received traction.

The patients were evaluated at 2 weeks, 6 weeks, 6 months, and 2 years.

RESULTS AT 2-YEAR FOLLOW-UP:

16/35 had recovered = 46%

10/35 had intermittent neck pain, headache, and radiating pain in one or both arms, but no objective neurological deficits = 29%

4/35 had neck pain radiating into one or both arms, and memory impairment, concentration problems, and neurological deficits such as sensory deficits, weakness, and reduced tendon reflexes = 11%

4/35 other patients were still on sick leave with multiple symptoms, continuous neck pain and headache requiring daily analgesics and showed neurological deficits = 11%

1/35 was on sick leave due to low back pain = 3%
This means that at 2 years after whiplash injury:
46% had recovered
54% had not recovered
25% had serious symptoms and/or signs
14% were disabled.

Psychological tests were normal for the entire whiplash group.

Auditory Brainstem response (ABR) audiometry was also normal for this entire whiplash group.

10/35 (29%) injured patients showed a worsening of the oculomoter smooth pursuit testing at the 2 year follow-up.

Serious smooth pursuit abnormalities were found in 8% of these injured patients at 2 years.

Because these patients showed no psychological abnormalities, “it seems unlikely that the symptoms were the expression of a premorbid personality.”

Clearly, in a minority of individuals, some test results (saccade velocities and the number of superimposed saccades) became worse.

“It is possible that degenerative and inflammatory processes in traumatized apophyseal joints, annular disc tears and possible damage to dorsal root ganglion neurons produce altered neuromuscular reflexes and increased pain which may interact with the vestibular, visual and proprioceptive reflexes, including the paramedian pontine reticular formation.”

Because the test results changed during the follow-up period, “initial test results are not static, and should be followed up prospectively.”

The authors found significantly lower pursuit velocity in WAD III. \textbf{[IMPORTANT]}

In this study and in other studies, there is a connection between patients with severe symptoms and pursuit abnormalities.

“It seems plausible that injury of the upper cervical joints, cervical discs or muscles could affect the tonic-neck reflexes and produce a sensation of dizziness.”

“In the present sample, we found two patients with pronounced pursuit abnormalities compatible with organic brain/brainstem lesions.”

“We know from other reports that the upper cervical afferent signals affect the activity of the vestibular and oculomotor nuclei in the brain/brainstem.”
“Overexcitation, or sensory mismatch of the cervical proprioceptors in joints and muscles, is thought to interfere with the posture control system in whiplash patients.”

“Our findings of moderate derangements in the tests could be the effects of pain and/or changed cervical afferent activity at the brainstem level, while eye motility dysfunction, in addition to pathological neurootological findings, in a small proportion of patients with severe symptoms could be explained by lesions to the brain/brainstem.”

KEY POINTS FROM DAN MURPHY

(1) This study continues to add to the evidence that some individuals injured in whiplash will suffer from chronic symptoms (54%), signs (25%), and disability (14%).

(2) X-rays, CT, and MRI are usually non-revealing in WAD grades II and III.

(3) Brain and brainstem lesions after whiplash injury do occur, and are best documented with smooth pursuit and saccade testing rather than auditory brainstem response (ABR) audiometry.

(4) Initial (2 weeks) normal tests can become abnormal with time, and therefore need to be re checked in future evaluations. [IMPORTANT]

(5) It is unlikely that chronic whiplash symptoms are caused by psychological abnormalities.

(6) Chronic whiplash symptoms are caused by injury to the facets, the disc, and/or to the dorsal root ganglion, producing altered afferent input to the vestibular, visual and proprioceptive systems [IMPORTANT]

(7) Upper cervical joints, discs and/or muscles can produce dizziness.

(8) Upper cervical afferents affect the activity of the vestibular and oculomotor nuclei in the brainstem. [IMPORTANT]

(9) Sensory mismatch of the cervical proprioceptors [chiropractic nerve interference] in joints and muscles interfere with the posture control system.

(10) Moderate derangements [chiropractic subluxations complex] can change cervical afferent activity to the brainstem. [WOW!]