Primary objective: Chiari malformation is defined as herniation of the cerebellar tonsils through the foramen magnum, also known as cerebellar tonsillar ectopia.

Cerebellar tonsillar ectopia may become symptomatic following whiplash trauma. The purpose of the present study was to assess the frequency of cerebellar tonsillar ectopia in traumatic vs non-traumatic populations.

Methods and procedures: Cervical MRI scans for 1200 neck pain patients were reviewed; 600 trauma [whiplash] (cases) and 600 non-trauma (controls). Half of the groups were scanned in a recumbent position and half were scanned in an upright position.

Cerebellar tonsillar ectopia was found in 5.7% and 5.3% in the recumbent and upright non-trauma groups vs 9.8% and 23.3% in the recumbent and upright trauma groups.

Conclusions: The results described in the present investigation are first to demonstrate a neuroradiographic difference between neck pain patients with and without a recent history of whiplash trauma.

The results of prior research on psychosocial causes of chronic pain following whiplash are likely confounded because of a failure to account for a possible neuropathologic basis for the symptoms.

THESE AUTHORS ALSO NOTE:

Chiari Type I malformation is a caudal herniation of the cerebellar tonsils through the foramen magnum (tonsillar ectopia). It can be acquired, not congenital.

Chiari Type II (Arnold-Chiari malformation) is congenital, and associated with spina bifida, and includes downward displacement of the medulla, fourth ventricle and vermis of the cerebellum into the cervical spinal canal.

Typical Chiari type I malformation symptoms include occipital headache, neck pain, upper extremity numbness and paresthesias and weakness; occasionally there may be lower extremity weakness and signs of cerebellar dysfunction.
“Previously quiescent Chiari Type I malformations can become symptomatic as a result of exposure to traumatic injury.” Minor head and neck trauma can cause an asymptomatic Chiari I malformation to become symptomatic.

Acquired tonsillar herniation is radiographically indistinguishable from a pre-existing cerebellar tonsillar ectopia.

<table>
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<tr>
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<th>600 Controls Non-trauma but with Neck Pain</th>
<th>600 Chronic Whiplash Patients</th>
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<tbody>
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<td><strong>Supine MR</strong></td>
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<td># cerebellar tonsillar ectopia</td>
<td>5.3%</td>
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Patients with a history of motor vehicle crash-associated neck pain have a “substantially higher frequency” of cerebellar tonsillar ectopia than non-traumatic subjects; 4-times greater when evaluated with an upright MRI scan.

In the trauma group, cerebellar tonsillar ectopia was found 2.5-times more often in the upright MR scan vs the recumbent MR scan.

An upright MR scan may demonstrate increased caudal tonsillar ectopia as the brain will tend to sit lower in the skull than when in a supine position because of gravitational forces.

It is well established that Chiari type I can be acquired, and this study led the authors to suggest that the increased incidence of cerebellar tonsillar ectopia was caused by the whiplash trauma.

The incidence of cerebellar tonsillar ectopia was nearly identical (5.3% v 5.7%) in the control group in both the supine and upright MRI; but the incidence of cerebellar tonsillar ectopia was significantly greater (23.3 v 9.3) in the whiplash-injured group with the upright MRI. The authors suggest that this can be explained by reduced cerebral spinal fluid (CSF) as a consequence of a trauma induced leak.

“There is clinical evidence that dural leaks are associated with whiplash trauma and chronic symptoms.” 56% of chronic whiplash patients with headache, memory loss, dizziness and neck pain, had cerebral spinal fluid leaks, primarily in the lumbar spine at the dural sleeves. 88% of these patients enjoy substantial improvement in chronic whiplash symptoms with an epidural blood patch to seal the leak. [Epidural blood patch is an injection of one’s own blood into the epidural space; when the blood clots, it seals the dural leak.]

Cerebral spinal fluid leak is documented using radioisotope cisternography.
Studies show that there is a substantial and rapid increase in cerebral spinal fluid pressure during simulated whiplash trauma.

In this study, neuroradiographic abnormality (cerebellar tonsillar ectopia) was found in approximately 25% of upright whiplash trauma cases. This unrecognized definable pathology may account for a patient’s chronic pain complaints. This suggests that in these cases, chronic whiplash symptoms may not be ascribable to psychosocial factors or litigation status, but rather to organic neurological injury.

“Cerebellar tonsillar ectopia is substantially more prevalent in whiplash-injured neck pain patients than in neck pain patients with no recent history of trauma.”

“Nearly half of the population with chronic neck pain attribute the onset of their pain to a whiplash trauma-associated injury.”

Patients with fibromyalgia syndrome also have a higher than expected frequency of Chiari type I malformations. Thus, “cerebellar tonsillar ectopia has been found to be associated with both a history of whiplash trauma and fibromyalgia syndrome.” Therefore, both fibromyalgia syndrome and chronic whiplash injury may be secondary to cerebellar tonsillar ectopia, possibly secondary to dural leak.

This study is the “first to demonstrate a substantial neuroradiographic difference between neck pain patients with and without a recent history of motor vehicle crash trauma.”

“Upright position MR imaging appears to increase the sensitivity to cerebellar tonsillar ectopia over recumbent MR imaging by 2.5 times.”

“Clinicians may want to consider evaluating patients for cerebellar tonsillar ectopia (i.e. upright MRI of the neck and head) when there is a history of whiplash trauma and persisting suboccipital headache in combination with headache worsened by cough or bilateral sensory or motor deficits in the upper extremities.”

“In cerebellar tonsillar ectopia patients with headache that is relieved when supine it also may be appropriate to consider radionuclide cisternography to evaluate for the presence of a dural leak.”

KEY POINTS FROM DAN MURPHY

1) Chiari malformation is defined as herniation of the cerebellar tonsils through the foramen magnum, also known as cerebellar tonsillar ectopia.

2) Chiari type I malformation is a caudal herniation of the cerebellar tonsils through the foramen magnum (tonsillar ectopia). It can be acquired.
3) Typical Chiari type I malformation symptoms include occipital headache, neck pain, upper extremity numbness and paresthesias and weakness; occasionally there may be lower extremity weakness and signs of cerebellar dysfunction.

4) “Previously quiescent Chiari Type I malformations can become symptomatic as a result of exposure to traumatic injury.” Minor head and neck trauma can cause an asymptomatic Chiari type I malformation into becoming symptomatic.

5) Patients with a history of motor vehicle crash-associated neck pain have a “substantially higher frequency” of cerebellar tonsillar ectopia than non-traumatic subjects; 4-times greater when evaluated with an upright MRI scan.

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6) “Cerebellar tonsillar ectopia is substantially more prevalent in whiplash-injured neck pain patients than in neck pain patients with no recent history of trauma.”

7) In the trauma group, cerebellar tonsillar ectopia was found 2.5-times more often in the upright MR scan vs the recumbent MR scan. “Upright position MR imaging appears to increase the sensitivity to cerebellar tonsillar ectopia over recumbent MR imaging by 2.5 times.”

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9) The incidence of cerebellar tonsillar ectopia was nearly identical (5.3% v 5.7%) in the control group in both the supine and upright MRI; but the incidence of cerebellar tonsillar ectopia was significantly greater (23.3 v 9.3) in the whiplash-injured group with the upright MRI. This can be explained by reduced cerebral spinal fluid (CSF) as a consequence of a trauma induced leak.

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symptoms with an epidural blood patch to seal the leak. [Epidural blood patch is an the dural leak.]

12) The best method to document cerebral spinal fluid leak is using radioisotope cisternography.

13) Studies show that there is a substantial and rapid increase in cerebral spinal fluid pressure during simulated whiplash trauma.

14) In this study, neuroradiographic abnormality (cerebellar tonsillar ectopia) was found in approximately 25% of upright whiplash trauma cases. This unrecognized definable pathology may account for a patient’s chronic pain complaints. This suggests that in these cases, chronic whiplash symptoms may not be ascribable to psychosocial factors or litigation status, but rather to organic neurological injury.

15) “Nearly half of the population with chronic neck pain attribute the onset of their pain to a whiplash trauma-associated injury.”

16) Patients with fibromyalgia syndrome also have a higher than expected frequency of Chiari type I malformations. Thus, “cerebellar tonsillar ectopia has been found to be associated with both a history of whiplash trauma and fibromyalgia syndrome.” Therefore, both fibromyalgia syndrome and chronic whiplash injury may be secondary to cerebellar tonsillar ectopia, possibly secondary to dural leak.

17) “Clinicians may want to consider evaluating patients for cerebellar tonsillar ectopia (i.e. upright MRI of the neck and head) when there is a history of whiplash trauma and persisting suboccipital headache in combination with headache worsened by cough or bilateral sensory or motor deficits in the upper extremities.”

18) “In cerebellar tonsillar ectopia patients with headache that is relieved when supine it also may be appropriate to consider radionuclide cisternography to evaluate for the presence of a dural leak.”

COMMENTS FROM DAN MURPHY

In 2005, Tomlinson, Gargan, and Bannister prospectively evaluated whiplash-injured patients for 7.5 years. They found that 23% continued to suffer from intrusive and/or disabling symptoms that required ongoing treatment and investigations, 7.5 years after being whiplash-injured. This present study found 23.3% of the whiplash-injured group showed cerebellar tonsillar ectopia with upright MRI scans. These authors suggest that the 23% incidence in both groups may not be coincidental. This suggests that all chronic whiplash-injured patients should be examined with upright MRI scan to evaluate cerebellar tonsillar ectopia. [PJ Tomlinson, MF Gargan and GC Bannister. The fluctuation in recovery following whiplash injury: 7.5-year prospective review; Injury; Volume 36, Issue 6, June 2005, Pages 758-761].