

Assimilation of the atlas and occiput: a case report

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Assimilation of the atlas is an osseous abnormality which occurs at the base of the skull in the region of the foramen magnum. It is demonstrated by the union of the atlas with the occipital bone. This may be a partial or complete union. Assimilation of the atlas is the most common anomaly found at the cranio-cervical junction. Other terms describing this abnormality are atlanto-occipital fusion and/or occipitalization of the atlas. Of importance, is not that the diagnostician be aware of the varied terms given to this osseous anomaly – but that such anomaly may exist without any typical symptom presentation, and thus, serious consequences of upper cervical spinal manipulative therapy may arise without a complete and adequate clinical assessment. (JCCA 1988; 32(4): 195–198)

KEY WORDS: osseous anomaly, cervical-cranial junction, assimilation of the atlas, atlanto-occipital fusion, manipulation, chiropractic.

Introduction

Atlanto-occipital fusion is the most common anomaly found at the cranio-cervical junction^{1,2}. The prevalence ranges from 0.08–3 percent of the general population^{3,4}. Total or partial assimilation of the atlas may be noted^{1,3,5,6,7}, with the latter being the most common^{3,4}. Multiple variations of partial assimilation have been reported, and may involve any aspect of the atlanto-occipital articulation^{2,3,5,6}. The disorder results from faulty development between the occiput and the adjacent vertebra during the early embryonic weeks. During this early embryologic development, the first-through-fourth somites unite to form a basiocciput. The caudal regions of the fourth somite, undergoes fusion with the cranial half of the first somite⁸. Other malformations may commonly occur with cranio-cervical fusion^{2,3}. They are:

- 1 Pseudo or true basilar impression;
- 2 absence or malformation of the transverse ligament,
- 3 hyperplasia of the dens;
- 4 aplasia of the dens; and

L'assimilation de l'atlas est une anomalie osseuse qui se produit à la base du crâne au niveau du trou occipital. Elle se manifeste par une union de l'atlas et de l'os occipital. Cette adhésion peut être partielle ou totale. L'assimilation de l'atlas est l'anomalie la plus communément rencontrée au niveau de la jonction cranio-cervicale. On désigne également cette anomalie par les termes: fusion atlanto-occipitale, et/ou occipitalisation de l'atlas. Ce qui importe pour le diagnostiqueur, n'est pas tant de connaître les différents noms donnés à cette anomalie osseuse – plutôt qu'une telle anomalie puisse exister sans qu'apparaissent les symptômes caractéristiques. De ce fait, une thérapie manipulative des vertèbres cervicales supérieures, pratiquée sans une évaluation clinique préalable adéquate et complète, pourrait entraîner de graves conséquences. (JCCA 1988; 32(4): 195–198)

MOTS-CLÉ: anomalie osseuse, jonction cervico-crânienne, assimilation de l'atlas, fusion atlanto-occipitale, manipulation, chiropraxie.

5 anomalies of the vertebral artery due to the absence or malformation of the foramen transversarium.

Included with these many associated malformations, is a 70 percent chance that all patients with assimilation of the atlas, will also have a congenital fusion at the C2-3 level⁹. Multiple segmentation failures occurring above and below the atlanto-axial joint, may be subjected to added mechanical stress in order to compensate for the lack of motion at the other levels^{1,2,4,10}. This change of mobility, when combined with an anomalous transverse ligament, may lead to an atlanto-axial instability, which occurs in approximately 50 percent of cases and which has been recorded as a cause of sudden death^{3,6}. Although most posterior arch defects are discovered by the clinician on X-rays that are obtained for a history of an incidental traumatic insult or a chronic neck pain condition, symptomatic conditions directly related to the assimilation of the atlas do occur, and in this instance the size and shape of the odontoid process is of primary importance⁹. When the odontoid process projects superiorly into the foramen magnum, or is angled posteriorly into the spinal canal, compression of the anterior neurological elements may develop^{2,4,11}. Rothman and Simeon speak of a relative basilar impression which may develop due to a decrease in height of the atlas at the time of fusion with occiput. Basilar

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impressions may be determined in accordance with the clinical evaluation, by using the roentgenometrics proposed by Chamberlain¹², McRae¹³, and McGregor¹⁴, considered by many to be the most accurate of all the basilar impression evaluation lines. A brief, yet accurate, description of these roentgenometrics, has been reported by Droskeith¹⁵, and Yochum and Rowe⁸.

The following case report illustrates the importance of a complete investigation of head and arm pain, and how a hurried examination could have serious consequences.

Case report

A pleasant 51 year old female, presented complaining of left-sided headaches, left arm and hand tingling, and left leg pain of three years duration. The headaches are consistently unilateral, throbbing in nature, beginning with a stiff neck and proceeding from the left suboccipital region temporally to the left orbit. The nature of the headaches varies in intensity (mild to moderate), and has not been progressive since the onset. The headache frequency can be as often as four times per week, yet the patient reports that she can go for two weeks without pain. The duration is usually 3-4 hours, and does not wake her at night. The aggravating factors are long work hours as a Mail Coder, (one who separates mail according to postal code), standing four hours continuously followed by sitting for four hours, and anxiety. She gains minimal short-term relief from two Extra Strength Tylenol. The associated symptoms can be left arm pain and left hand numbness, tingling and stiffness. Also reported is tinnitus and low-grade fever. However, these do not always accompany the headaches. The patient reports the onset of menopause approximately two to three years prior to presentation.

The left leg pain originates at the left sacroiliac joint, spreads across the left buttock laterally, and descends into the posterior and lateral thigh to the knee. The pain is a dull ache and never goes distal to the left knee. The frequency is variable. The aggravating factors are extended hours standing or sitting at work. She lays supine with her legs elevated to relieve the ache. No associated symptoms were reported. No family history of headaches or LBP was reported. Medication was a one year course of LECTOPAM, which proved unsuccessful.

On examination, she presented with no discomfort. Cervical spine range of motion (ROM) was restricted in rotation to 45 degrees bilaterally and to 75 percent of normal in left lateral flexion. Left rotation and left lateral flexion gave pain in the left trapezius. Resisted ROM was unremarkable, as was passive ROM. Neurological testing demonstrated a diminished triceps reflex (+/++) on the left, with all other deep tendon reflexes normal. Motor testing of the left upper limb was rated a 5. Sensory testing was normal. The Doorbell Test was positive on the left at C5-C7.

Orthopedic tests, i.e. cervical compression and traction (Jackson's and Spurling's) were unremarkable. All thoracic outlet tests were negative. There was marked spasm and



Figure 1 Neutral lateral radiograph of the cervical spine.

hypertrophy in the scaleni, sternocleidomastoid, trapezius and levator scapular muscles bilaterally. These muscles were also very tender upon palpation. Palpation revealed posterior joint restrictions present at the levels of C5-7 bilaterally. Wallenberg's Test for vertebral basilar insufficiency was negative. (Note: Examiner was unable to locate atlas TVP's bilaterally.)

Radiographic examination revealed a near complete assimilation of the occiput and the atlas. The atlanto-dental interspace was within normal limits in the neutral position, (Figure 1), flexion (Figure 2) and extension radiographs (Figure 3).

The clinical impressions made were: atlanto-occipital fusion which was considered a non-symptomatic finding; a left brachial plexus traction syndrome with concomitant cervicogenic muscular contraction headaches; and a left piriformis syndrome. Without apparent instability of the atlanto-axial region and without gross neurological compromise, a conservative treatment regime of specific spinal adjustive therapy to the lower cervical spine, upper dorsals, and left sacroiliac, was instituted. The biomechanics were optimized within four



Figure 2 Flexion radiograph of the cervical spine.



Figure 3 Extension radiograph of the cervical spine.

weeks, and the symptoms reduced considerably – in particular the frequency, duration and severity of the headaches.

Discussion

Clinically there is a wide variety of signs and symptoms that may be associated with assimilation of the atlas. These include muscle weakness, muscle wasting, ataxia, muscular spasticity, and hyperreflexia. Less common symptoms such as diplopia, tinnitus or dysphagia have been recorded. As previously mentioned however, an assimilation of the atlas may be asymptomatic and thus found radiographically when other disease processes are being ruled out, such as multiple sclerosis, spinal cord neoplasms, or cerebellar disease. Physical examination may reveal a low hairline, short neck, or acute/chronic torticollis on an adolescent or young adult patient^{9,10}. Hensinger² and Rothman and Simeon¹, relate a 20 percent chance of congenital anomalies of the jaw, nasal cartilage, external ear, a cleft palate, or cervical ribs, associated with assimilation of the atlas patients.

Diagnostically, static palpation may indicate an osseous anomaly at the C1 region, however, diagnostic imaging studies are much more reliable¹⁶. Plain film examination to include linear tomograms of the upper cervical spine in neutral, flexed and extended positions, should be obtained in order to determine the stability of this region^{5,16}. The size and configuration of the foramen magnum should be evaluated to rule out osseous malformations which accompany cranio-cervical anomalies^{5,15}. As clinical signs and symptoms dictate, further diagnostic imaging, to include magnetic resonance and computed axial tomographic evaluations, should be considered.

Any form of treatment is dependant upon the extent of the anomaly and the severity of the associated neurological involvement^{4,5}. Conservative treatment such as immobilization, traction and cervical collar, have been found helpful in those cases associated with trauma or infection^{5,10}. Once the conservative therapeutic regime has been exhausted, surgical decompression or fusion should be considered^{1,2,4,5,6}. Methods of treatment utilizing soft tissue technique, may be quite helpful. However,

osseous manipulation of the mid-to-upper cervical spine should be considered cautiously. It is highly suggested that a very conservative approach towards therapy be taken, in order to diminish the chances of deleterious side effects.

Summary

Of importance, is that the skilled diagnostician be aware that atlanto-occipital fusion may exist without any typical symptom-ological presentation. The serious consequences of upper cervical manipulation with this type of osseous anomaly, reflects the importance and need for a thorough clinical assessment/evaluation, on every patient.

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