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Image Gallery

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2011 Cherry Blossoms at the Capital – Washington, DC

Submission by: Gregory Demetrious, DC

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Imaging Original Article

Imaging Case Challenge

Michelle A Wessely (1) and Timothy J Mick (2)

(1) Director of Radiology (Paris/Toulouse), Department of Radiology, Institut Franco-Europeen de Chiropratique (IFEC), 24 Boulevard Paul Vaillant Couturier, 94200 Ivry Sur Seine, France
mwessely@ifec.net

(2) Center for Diagnostic Imaging (CDI), and Imaging Consultants, Inc. 565 Arlington Avenue West, St Paul 55117, Minnesota, USA mickici@msn.com

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Clinical Information

A 37 year old male patient presented to the chiropractor with severe left sided suboccipital/neck pain for one week, with no report of trauma. The patient was currently on a course of antibiotics for a “severe strep infection,” diagnosed by his medical doctor. A cervical radiographic exam, to include a lateral cervical neutral view (Figure 1) was obtained by the chiropractor, who did not notice the key radiographic finding, an oval calcification inferior to the C1 anterior tubercle. On the basis of the clinical presentation, because of the severity of the pain and concern for the possibility of disc space infection or herniation, the chiropractor ordered MR imaging of the cervical spine. (Figure 2a and 2b).

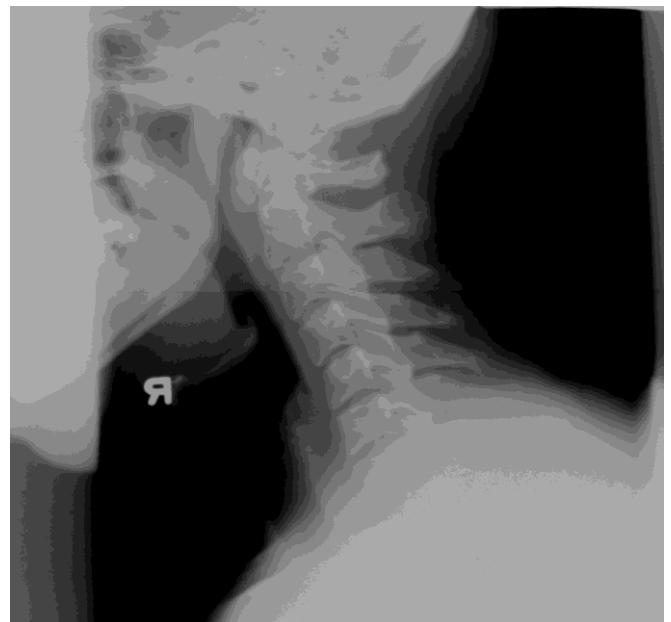


Figure 1. Lateral cervical neutral radiograph showing homogeneous, ovoid calcification inferior to the C1 anterior tubercle, the classic radiographic finding of longus colli calcific tendinitis. As in this case, there is often related widening of the pre-cervical soft tissues. Also, as in this case, these radiographic findings are often overlooked.

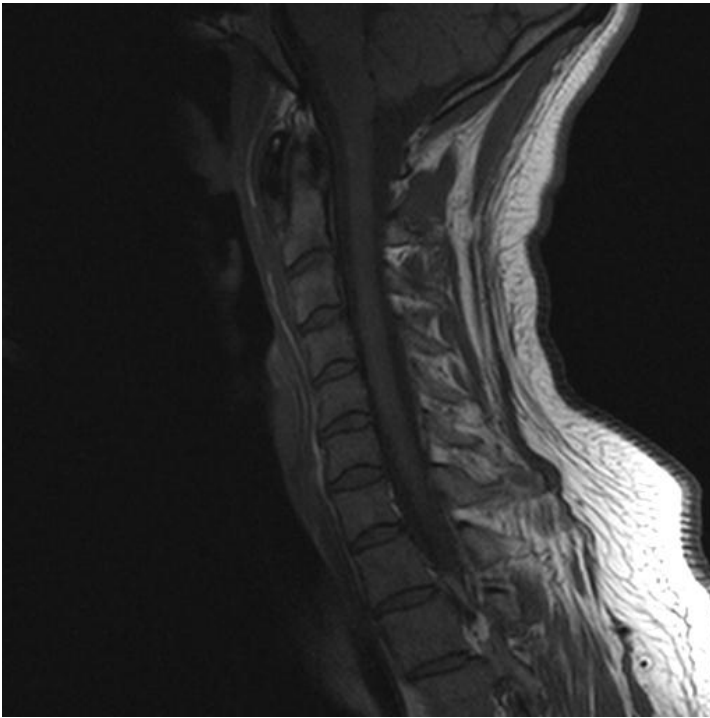


Figure 2a. Sagittal T1-weighted image the cervical spine, demonstrating markedly low signal of the globular calcification inferior to the anterior tubercle of C1 and fullness of the adjacent pre-cervical soft tissues.



Figure 2b. Sagittal fluid –sensitive STIR image of the cervical spine shows extensive bright signal in the pre-cervical soft tissues from the sphenoid bone

to C4, characteristic of soft tissue edema, in a pattern typical for longus colli calcific tendinitis. Note lack of abnormal signal extension from a disc or vertebral body, an important sign to distinguish this entity from disc space infection/osteomyelitis or soft tissue extension of neoplasm from a vertebral body.

Pertinent Imaging Findings

A fairly well circumscribed, ovoid region of low signal inferior to the C1 anterior tubercle, best seen on T1-weighted MR images, corresponds to the globular opacity seen on radiographs, typical of calcium hydroxyapatite deposition at the longus colli tendon attachment site. There is associated extensive precervical/retropharyngeal soft tissue edema from C4 to the sphenoid bone. These findings are diagnostic of acute longus colli calcific tendinitis with active inflammation involving the longus colli muscle and retropharyngeal soft tissues.

Pertinent Conclusions

Findings of acute longus colli calcific tendinitis. This condition is typically self-limiting, but with the history of strep infection, consultation with ENT may be warranted. In this case, one should question the diagnosis of “strep throat,” as longus colli calcific tendinitis may mimic other causes of pharyngitis and streptococci may be part of the normal flora, potentially producing a false positive throat culture.

Discussion

Most clinicians who see patients for musculoskeletal conditions are familiar with calcific tendinitis (calcium hydroxyapatite deposition disease or HADD) involving the peripheral joint

regions, such as the rotator cuff of the shoulder. Among the less common sites of calcific tendinitis or HADD is the longus colli tendon. This entity was first described in 1964 by Hartley (1) and in 1994, Ring et al, showed that the cause was that of crystal deposition (4). It is important that those who assess patients with neck pain and related complaints are familiar with longus colli calcific tendonitis, with its unique imaging and clinical findings, often overlooked or confused with other abnormalities. We present a case in a young adult male with history, clinical course and imaging findings not unlike those that are often encountered with this entity. While the literature emphasizes a relationship to hyperflexion-hyperextension injury, there is often no significant trauma. This condition is probably more common than the literature and experience might suggest, owing to under-diagnosis, which may largely relate to a lack of general awareness of the condition.

The typical patient with longus colli calcific tendonitis is between 30 and 60 years old, will present with persistent neck pain following hyperflexion-hyperextension injury, most often from motor vehicle accident or sports trauma (2, 3). There may be sense of fullness in the throat, dysphagia and/or pharyngitis, with significant muscle guarding, as was seen in this patient (4). The throat symptoms are due to the close proximity of the retropharyngeal space to the adjacent pharyngeal constrictors. Uniquely, this patient had no history of significant trauma over the past six weeks and presented to the chiropractor with neck pain for one week, having been diagnosed by his medical doctor with strep throat, for which he was on a course of antibiotics. The chiropractor did a thorough history, physical exam and radiographs, although the images were not reviewed by a radiologist. The characteristic globular calcific density inferior to the C1 anterior tubercle had not been noted on the radiographs, but this clinician with 30+ years of practice experience did not feel

comfortable adjusting the patient without further imaging and, therefore, ordered MRI.

The MRI reveals the typical findings of active/acute longus colli calcific tendinitis. In addition to confirming the presence of the globular calcification inferior to the C1 anterior tubercle, the MR images show extensive pre-vertebral (retropharyngeal) edema with bright STIR signal extending from the C2-3 level, cephalically to the clivus of the skull. This finding often corresponds to a widening of the precervical soft tissues on radiographs, a non-specific finding which may also be created by hematoma, prevertebral extension of tumor, such as metastasis, lymphoma or myeloma or discitis (disc space infection) (5). Importantly, there is no evidence of focal disc space narrowing, endplate erosion or other findings to suggest that the precervical abnormality has arisen from a disc or vertebral body.

Longus colli calcific tendinitis is considered to be a self-limiting condition, much like HADD involving peripheral sites, such as the rotator cuff. The symptoms may subside some time before the calcification resorbs and in some instances, the calcification persists and may even convert to organized bone, with no ongoing related symptoms. As with other forms of calcific tendinitis, both imaging and clinical findings may recur, typically after re-injury (6).

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Useful websites

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Original Article

C5-C6 and C6-C7 Disc Herniation with Stenosis Causing Nerve Root Impingement

James R. Brandt DC, MPS, FACO¹

¹ Chiropractic Private Practice, Coons Rapids, MN, USA

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ABSTRACT

Objective: Demonstrate how conservative management using flexion- distraction to multiple causes of neck complaints can successfully be treated with co-management and cooperation between healing disciplines.

Clinical Features: A 43 year old male patient returned to the clinic with left side neck pain, left arm numbness and numbness in the left thumb, index and middle finger. Imaging revealed a "C5-C6 broad based 1-2 mm AP 1-2mm left posterolateral foramina and mostly foraminal protrusion, superimposed upon an uncinate osteophyte, impinging upon the exiting left C6 nerve root in the severely stenotic left neural foramen. This is superimposed on an annular bulge-osteophyte that produces mild central canal stenosis to 10mm AP midline dimension, with no cord impingement. Left uncinate osteophyte and a 2mm soft herniation at the left foraminal entrance zone, with impingement upon the left C7 root, entering within the moderately stenotic left foramen. Mild right foraminal stenosis".

Outcome: The patient had been treated for neck pain in the past. Nevertheless he was counseled

about the presenting complaints and findings. Different chiropractic and medical treatment protocols were outlined for this condition. The treatment for these presenting complaints and findings included a course of flexion-distraction and a surgical consultation. The patient responded favorably and was dismissed from active care after 14 in office sessions. When the surgical consultation occurred, the patient had been responding to care and a "wait-and-see" strategy was employed by the orthopedic surgeon about the need for more aggressive treatment.

Conclusion: Cox© flexion-distraction provided a conservative treatment plan for a difficult case to manage. Referral for a surgical consultation was appropriate noting the extensive changes. Working with a surgeon who understands the flexion-distraction protocols was helpful in this case. The treating clinician was able to reduce patient anxiety about their condition by the patient understanding the team approach to care.

Case Study

The patient presented to the office with an insidious onset of neck pain on the left with discomfort and numbness into his thumb, index and middle finger. The discomfort also went into the upper back adjacent to the left scapula. He could not relate any one incident that brought on the current complaints. The patient was last seen in the office 3 years prior with a history of neck pain. He was treated then for two sessions and was able to go deer hunting. He had not been seen by any clinician for neck pain after that treatment. He was employed as a carpenter. Concern was expressed as it was starting to affect his activities of daily living (ADL). There is a sense of weakness in the left arm and his dexterity with the hand seemed less. He was a non-smoker. The pain was with him constantly and his Visual Analog Scale (VAS) was 5 out of 10. His cervical Oswestry index was 11 out of 50 or 22%. There was a family history of cancer. Over-the-counter (OTC) pain medication was being taken that included 400 mg of an Ibuprofen product.

On examination, he was noted to be a 43 year old Caucasian male with a height of 70 inches and a weight of 210 lbs. He is afebrile with a pulse rate of 86 per minute and a respiration rate of 16 per minute. The blood pressure on the left was 136/84 and on the right 132/82 at 1700 hours. A review of the HEENT was unremarkable and no lymphadenopathy was noted. Palpation produced +2 pain (0/+4 scale) on the left side C5-C7. Cervical distraction gave his neck relief. It also eased, but did not eliminate discomfort into the left arm. Cervical flexion (90) 55 degrees, extension (70) 45 degrees, left lateral bending (45) 20 degrees, right lateral bending 10 degrees, left rotation (90) 70 degrees and right rotation 75 degrees. Muscle stretch reflexes were +2/+2 with hypoesthesia noted in the C6 dermatome. It appeared to include the area of the 7th as well. To try and circumduct the neck was quite painful to him and he commented that looking up while working bothers him the most. Grip strength was slightly less on the left, but he is right hand dominate. He had a positive

Bakody sign on the left and Spurling's was positive with pain into the left upper arm. In-office imaging studies were deferred with prospects of advanced imaging if he does not respond quickly.

Diagnosis and Treatment

The working diagnosis was cervical radiculopathy, rule out cervical discopathy

He was started on a course of Cox© cervical-flexion-distraction following the protocol for radiculopathy. The pre-test was done without the use of the cervical restraint straps. He tolerated the pre-test well and gentle long-y- axis distraction followed by unrestrained flexion manipulation was performed. Pulsed (50%) ultrasound 1.25W for 6 minutes was applied to the C6 nerve root area followed by interferential current 4000Hz 10 minutes to the mid-cervical paraspinals (2 electrode pads) and at the wrist (2 electrodes pads). Cryotherapy was instructed q.i.d daily. He was instructed to remain off work for 5 days to start aggressive, non-surgical care. This care is supported by Simotas in Spine 2000;25(2) where he found non operative aggressive treatment for lumbar stenosis is reasonable. In that study he found 40 of 49 patients were treated non-surgically: 23 improved, 12 no change and 5 progressively go worse.(1)

After the first treatment, he felt better the remainder of the day. After the 2nd visit he noticed that the discomfort in the hand was less. When he completed the 3rd office session, the treatment had remained the same for the exception that the EMS electrodes were moved to just below the elbow because he had virtually no hand symptoms. I began the use of the cervical spine restraint straps on the 3rd session as he was progressing and had not adverse signs to treatment. It was my opinion that he was approaching 50% improvement. I switched to Cox© protocol 2 for this technique.

When he returned to see me for his 4th session he was markedly worse. ROM had decreased and he had numbness back in the hand and fingers. His neck pain had increased to 5-6/10. He had increased his ibuprofen to 800 mg q.i.d over the last 24 hours. I learned that he was an avid spear fishing participant and had been been spearing in northern Minnesota. The sudden action of throwing the spear and pulling in the big fish had aggravated his symptoms.

He was scheduled for advanced imaging and the MRI scan was read by a chiropractic radiologist. See Figures 1 and 2.

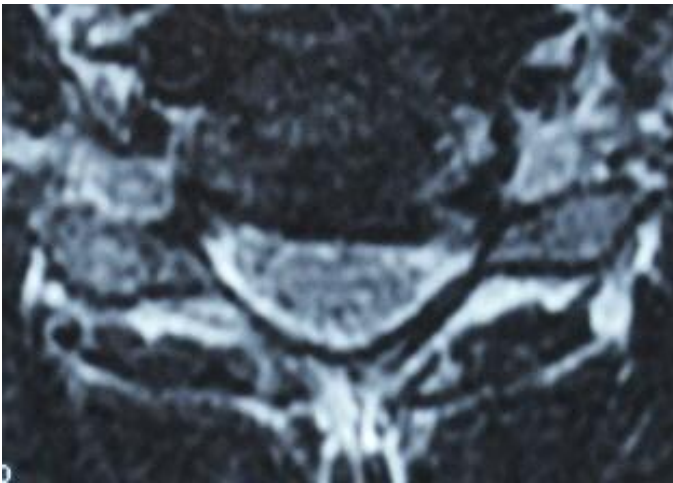


Figure 1. C5-C6 broad based 1-2mm AP left posterolateral and mostly foraminal protrusion, superimposed on uncinete osteophyte, impinging upon the exiting left C6 root in the severely stenotic left neural foramen. This is superimposed on annular bulge-osteophyte, with mild central stenosis to 10mm AP midline dimension, abutting the cord on the left, without deformation. Moderate right foraminal stenosis from uncinete osteophyte. No facet arthropathy.

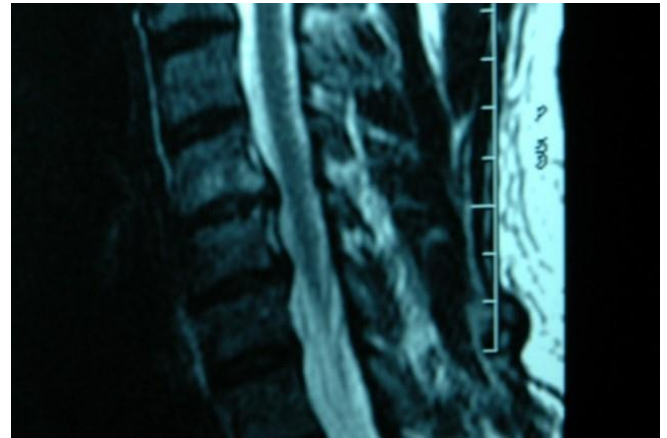


Figure 2. Annular bulge-osteophyte produces mild central canal stenosis to 10 mm AP midline dimension, with no cord impingement.

The radiologist reported further: Left uncinete osteophyte and a 2 mm soft herniation at the left foraminal entrance zone, with impingement upon the left C7 root, entering/within the moderately stenotic left foramen. Mild right foraminal stenosis. The average sagittal diameter of the cervical spinal cord ranges from 5-11.5mm (mean 10mm) as demonstrated on computed tomography (CT) and myelography. The average canal sagittal diameter of the canal from C3 to C7 ranges from 15 to 25mm (mean 17mm).

Debate exists regarding the absolute canal diameter that constitutes cervical stenosis. Absolute stenosis has been defined as a cervical sagittal canal diameter of less than 10mm, as seen on a lateral cervical spine radiograph. A canal of 10-13mm is considered to be relatively stenotic (6)

The patient was set up for a surgical consultation noting the increase in his symptoms. I have found co-management of potentially difficult cases eases the anxiety of the patient. Treatment in our office resumed and he was returned to the same acute care protocol that began the treatment of his condition. (Cox© Technique Protocol 1 for radicular patients). He did see the surgeon a few days later and he had two treatments within the interval from the flare-up to seeing the surgeon. I did talk to the surgeon

regarding the recommendation of continuing chiropractic treatment. I met with him and had information with me that explained the treatment that was used in this case and data that supports the use of the modalities.

The surgeon's report stated: "It does appear likely that his symptoms are stemming from the disc herniation and stenosis at C5-C7. He has marked improvement of his neck pain and triceps pain. He has only intermittent tingling in his hand at this time. We would recommend careful observation at this time and also use of good body mechanics. He can continue with chiropractic treatments but should avoid neck adjustments."

The patient was treated a total of 9 more sessions with the flexion-distraction adjustments. His neck was restrained each session. The patient continued improving with treatment and by the time he saw the surgeon he had accomplished 50% improvement of his flare-up. He had been given isometric exercises for the cervical spine after session 3 and was instructed to do these t.i.d (three times a day) daily. Cryotherapy was discontinued after his 6th session. He was prescribed an over-the-door traction unit beginning at 10 lbs. traction 5 minutes 3 times per day. The weight was gradually increased and by the last two sessions he was at 18 lbs. once daily.

Four weeks after the start of treatment, the flare-up, advanced imaging and surgical consultation, he was 80% improved. He had returned to work after missing 7 days and he also returned to spear fishing at this time. The patient had 3 more sessions of flexion-distraction in the clinic over the next 4 weeks and was dismissed with only fleeting tingling in the left thumb. He was performing his ADL without any encumbrances.

He is now nearly 10 months post treatment and in recent conversation with him, he has not had any increase in symptoms.

Discussion

This case of cervical spondylosis and cervical disc herniation was followed conservatively for a two month period of time. He was told of symptoms or activities causing him problems with the neck and arms that would necessitate a follow up visit. Cervical spondylotic myelopathy (CSM) is the most common progressive spinal cord disorder in patients more than 55 years old. This disease is also the most common cause of acquired spasticity in later life and may lead to progressive spasticity and neurologic decline. More than 50% of middle-aged patients show radiographic evidence of cervical disease, but only 10% have clinically significant root or cord compression. CSM is also the most common cause of acquired spasticity in later life and may lead to progressive spasticity and neurologic decline. (2,3,5) There are multiple symptoms of myelopathy, including motor and sensory disturbances, but the onset is usually insidious. Symptoms can include gait abnormalities, loss of coordination, upper and lower neuron signs and symptoms in the upper and lower extremities, bowel and bladder difficulties and the classic abnormalities of hand function. However, the symptoms can be much more subtle and may involve axial neck pain, scapular pain or a progressive broad-based gait. (4,5)

The history of CSM is not well known. There are static mechanical factors contributing to cervical spondylosis and CSM. These include the following (3):

- Acquired spinal stenosis and disc degeneration - The chemical composition of the nucleus pulposus and annular fibers deteriorate over time. During the aging process of the spine, the disc cannot bear or transfer load due to ongoing dehydration. With increased load, the uncovertebral processes become flattened, which alters the

load bearing function of the intervertebral joint. Osteophytic spurs develop at the margins of the end plates. Osteophytes stabilize adjacent vertebrae whose hypermobility is caused by the degeneration of the disc. The disc further calcifies, stabilizing the vertebrae and the osteophytes increase the weight bearing surface of the endplates, which decreases the effective force being placed upon them. Osteophyte over growth and ligamentum flavum buckling can cause direct compression of the spinal cord. Such a transformation can lead to compression of the spinal nerve and the vertebral artery. These are generators of chronic pain, as well as demyelination of ascending and descending spinal cord pathways.

- Ossification of the posterior longitudinal ligament (OPLL): - Ossification of the OPLL is a common multifactorial disease. This disorder can result in progressive myelopathy caused by compression of the spinal cord from ectopic ossification of spinal ligaments. The natural course of OPLL suggests progression with age, implying the contribution of environmental factors such as accumulate mechanical stress on the spine, and genetic factors.
- Ossification of the ligamentum flavum (OLF): - More frequently diagnosed in the thoracic and lumbar spine. Most common symptoms associated with OLF are neck pain and arm weakness.
- Congenital spinal stenosis: - A narrowed spinal canal is thought to cause the compression. A number of authors have identified the normal sagittal diameter of the spinal canal is approximately 17-18 mm between C3 and C7 variations 15-25 mm (6).

- Stenosis vs. dynamic mechanical factors: - Translation and angulations between vertebral bodies in flexion and extension can also transiently narrow the canal. Flexion and extension MRI can visualize this translation.
- Ischemia: - Considerable evidence exists to support ischemia as a major underlying pathologic event, which contributes to the etiology of myelopathy.

Past treatment for CSM has been primarily surgical intervention. Traction and soft collars have not been shown to alter the course of this disease. The success of non-operative modalities in altering the natural history of cervical myelopathy is largely unknown. (7) There have been several studies of patients treated conservatively and with laminectomy versus non-operative care, 67% of patients may deteriorate neurologically over time. (2) The conservative management consisted of a soft collar, nonsteroidal anti-inflammatory drugs (NSAIDs), and discouragement from high-risk activities. (6) The literature supports conservative management of mild CSM. (1) Manipulation and traction in extension (underline by the author) is contraindicated as it closes the foramina and decreases the size of the cervical canal. (7) Recognizing the signs and symptoms of myelopathy and referral for a surgical consultation is critical for patient care. The literature regarding flexion-distraction manipulation and its effectiveness is currently limited. This may be due to multiple factors, which include a lack of proper training and knowledge in the use of the treatment. Cervical flexion-distraction therapy is a relatively new procedure. (8)

Conclusion

Cox© cervical flexion-distraction adjustment was an effective treatment for cervical disc and stenosis.

It should be considered prior to cervical spine surgery for disc herniation or stenosis without myelopathy. Like all treatments, it is not the answer for all disc and stenotic problems, but there is clinical evidence that it can be effective. (9) Further research is needed in the area of flexion-distraction treatment of cervical spine injury and presenting complaints.

Competing Interests

The author does not have any conflicting or competing interests.

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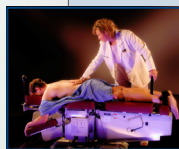
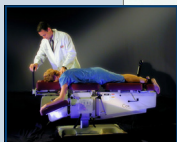
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Abstracts & Literature Review

A Systematic Review of Chiropractic Management of Adults with Whiplash Associated Disorders: Recommendations for Advancing Evidence-based Practice and Research

Lynn Shaw, Martin Descarreaux, Roland Bryans, Mireille Duranleau, Henri Marcoux, Brock Potter, Rick Ruegg, Robert Watkin, Eleanor White

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Authors' Abstract:

The literature relevant to the treatment of Whiplash Associated Disorders (WAD) is extensive and heterogeneous.

Methods: A Participatory Action Research (PAR) approach was used to engage a chiropractic community of practice and stakeholders in a systematic Review to address a general question: 'Does chiropractic management of WAD clients have an effect on improving health status?' A systematic review of the empirical studies relevant to WAD interventions was conducted followed by a review of the evidence.

Results: The initial search identified 1155 articles. Ninety-two of the articles were retrieved, and 27 articles consistent with specific criteria of WAD intervention were analyzed in-depth. The best evidence supporting the chiropractic management of clients with WAD is reported. For the review identified ways to overcome gaps needed to inform clinical practice and culminated in the development of a proposed care model: The WAD-Plus Model.

Conclusions: There is a baseline of evidence that suggests chiropractic care improves the cervical range of motion (cROM) and pain in the management of WAD. However, the level of this evidence relevant to clinical practice remains low or draws on clinical consensus at this time. The WAD-Plus Model has implications for use by chiropractors and interdisciplinary professionals in the assessment and management of acute, sub-acute and chronic pain due to WAD. Furthermore, the WAD-Plus Model can be used in the future study of interventions and outcomes to advanced evidenced-based care in the management of WAD.

Background

- Whiplash Associated Disorder (WAD) is a clinical condition that occurs with acceleration or deceleration of the head and neck in relation to other parts of the body. This typically occurs during motor vehicle collisions or other mishaps.
- There are major health concerns that have a disruptive effect on the daily lives of many

people around the world [1]. The chiropractic community has provided leadership with respect to interventions that support the clinical management of those suffering from WAD injuries [2, 3]. Over the past several years, there has been a paradigm shift in the body of knowledge that is used to guide management of WAD injuries. Evidence-based knowledge is being used more vehemently to guide treatment management and decision-making practices in the profession.

- The Clinical Practice Guidelines Task Force (CPGTF) and the Guidelines Development Committee (GDC) reviewed various evidence-based management and knowledge models to development protocols for treating Whiplash Associated Disorders. They also provided recommendations with respect to the management of WAD injuries in the acute, sub-acute and chronic phases, and the development of the WAD-Plus model guideline.
- This paper reviews the clinical definition of WAD and their grades. The definitions include - but are not limited to - the prevalence and/or severity of the following factors: neck pain, musculoskeletal signs (i.e., hyperalgesia, movement loss, stiffness, kinesthetic deficits, balance loss), deafness, dizziness, tinnitus, headache, memory loss, dysphasia, temporomandibular (TMJ) pain, radiating symptoms, neurological and orthopaedic sequelae [2, 4]. The most common intervention reviewed and discussed in the chiropractic community is the adjustment [5].

Results

- Chiropractic care has been shown to improve cervical range-of-motion (cROM) and pain management in WAD cases.

- Methods were identified to overcome deficiencies in the research and the current (traditional) WAD model
- Clinical practice guidelines and the development of a proposed care model (the WAD-plus Model)
- Development of the WAD-Plus Model to advance evidence-based care and the management of whiplash injuries that embodies critical contributory factors to recovery such as the ‘pain experience’ and the chronicity of injuries.

GDC (Guidelines Development Committee) Findings & Recommendations

- Acute Phase WAD Cases: The literature provided sufficient evidence to establish that acute WAD patients may benefit from a combination of the following modalities: early mobilization, education/instruction, unsupervised and supervised cervical ROM exercises with multimodal treatment regimens [6, 7, 8, 9]. The GDC recommends a balanced passive and active care as well encouraging the patient to resume normal daily activities at the earliest interval. Evidence does not support the use of collars or immobilizing devices to improve health outcomes in this (or any) phase of the WAD injury.
- Sub-acute Phase WAD Cases: Literature suggests in this stage the patient may benefit from multiple modalities including: posture instruction, mobilization, massage and cervical ROM exercise. Treatment that is less complex and less costly is recommended as well as the treatment that is least likely to contribute toward a propensity for chronic WAD. The exercise protocols varied greatly in the literature and should be prescribed based on clinical experience and the patient's own specific situation [10, 11]. GDC stated

that further investigation is required to evaluate the effects of treatment in sub-acute WAD cases. The GDC additionally advised that the practitioner should use a balanced approach of active and passive therapy, but should become increasingly more active during this phase of care.

- **Chronic Phase WAD Cases:** Health outcomes in this phase were expanded to include not only pain perception and cervical ROM improvement, but additionally: posture, perceived disability, coping resources and life satisfaction [12, 13, 14, 15, 16]. Best evidence suggests that in this stage a combination of unsupervised and supervised exercise, and cognitive behavioral therapy should be incorporated. Active intervention and independence is encouraged in this phase. The evidence suggests that health outcomes of chronic WAD is more likely to improve if the patient is actively involved in the care - characterized by active involvement and responsibility by both the practitioner and patient (i.e., independent exercise, self-directed applications of cryotherapy, portable TENS/IFC units, etc.) can maximize health outcomes. The GDC consensus is to balance active and passive care (as discussed in the earlier phases) in relation to the patient's clinical presentation.
- **GDC Recommendations for Improving the Literature:** In general the GDC advocates that efforts are required to improve the rigor and quality of studies evaluating the effect of chiropractic treatment in WAD cases. It was suggested that the WAD-Plus Model might enhance the comparison of studies relevant to advancing chiropractic management of WAD. Gaps in current evidence on WAD intervention acknowledge that their review does not provide a comprehensive review of all

chiropractic treatment modalities and techniques. Future WAD research should also utilize “active comparators,” non-treatment and/or placebo groups to enhance evidence-based research on WAD outcomes and patient management [17, 18]

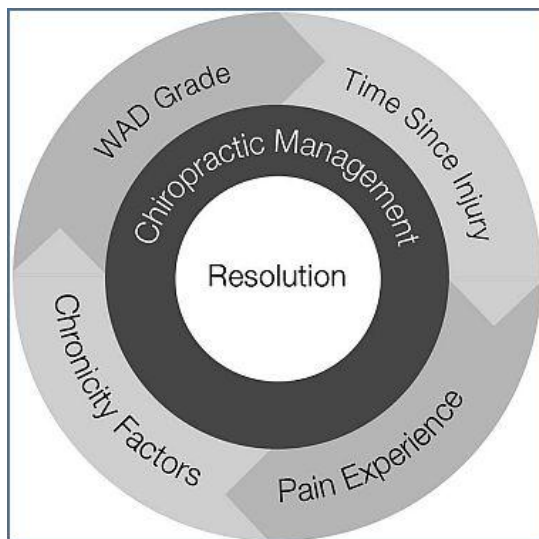
The WAD-Plus model

The GDC put forth the WAD-Plus Model to advance the management of whiplash associated disorders and improving consistency and clinical management. The model refers to the assessment and defining of a WAD injury using conventional methods (i.e., Standard WAD 1, WAD 2, WAD 3, and WAD 4 definitions). Plus, three additional important dimensions relevant for client care:

- i. **The Time Since Injury:** generally accepted stages of soft tissue injury are classified into the inflammation, repair and remodeling stages [19]. The GDC consensus is that the practitioner should identify the individual's phase of healing prior to starting care - as treatment intervention may vary depending on what stage of healing they are in.
- ii. **The Pain Experience:** This embodies psychosocial features of injury and pain experience. Individual's perception of pain, self-perceived disability, the meaning of their symptoms and how to best manage them are pertinent factors in the recovery process [20]. Pain perception can vary depending on: gender, belief in the effectiveness of treatment, strong emotional states, cultural, family and work factors [20, 21, 22, 23]. The GDC deemed the following evaluative measures were helpful in quantifying psychosocial pain and the need for multidisciplinary care: Bournemouth Questionnaire, McGill Pain Questionnaire, Self-Efficacy Scale

and Pain Catastrophizing Scale. The GDC recommends if the individual has a high degree of psychosocial pain, the focus should be on multidisciplinary management or behavioral components outside of chiropractic care.

- iii. Chronicity Factors: The GDC recommended that the practitioner should carefully consider the following criteria for potential chronicity factors [1]: socioeconomic factors; psychosocial factors, prior health status, symptom severity, compensation and legal factors, health behaviors, attitudes and interventions contemplated.



The GDC recommends that all four dimensions of the WAD-Plus Model should be considered as part of WAD care.

Conclusions / Clinical Applications

- The development of guidelines to improve the assessment of WAD grades prior to beginning treatment. This guide is available to all practitioners through the Canadian Chiropractic Association's website (see additional readings).
- The WAD-Plus Model was developed to identify clinical musculoskeletal signs &

symptoms described in the original WAD model. However, the WAD-Plus Model takes further steps to consider the elapsed time since the accident, the pain experience and potential chronicity factors.

- The WAD-plus model is an expanded model of care that includes the conventional dimensions of patient care plus three other important dimensions discussed earlier: time since injury, pain experience and chronicity factors. The practitioner should incorporate into his/her clinical management model the time since injury (i.e., acute, sub-acute and chronic), the pain experience (psychosocial factors, etc.); and potential chronicity factors (demographic, socioeconomics prior health status, symptom severity, compensation and legal factors, and health behaviors). The GDC advises that all of these factors have a bearing on the frequency, duration and scope of chiropractic intervention.

Study Strengths/Weaknesses

- Systematic review including literature search, review of evidence, selection for relevance, quality assessment, evidence synthesis, quantity/consistency of evidence and interpretation of knowledge for advancing the management of WAD. Systematic reviews are inherently weak in terms of study design. However it should be noted that for discussion of such a topic such as the creation of guidelines, this method would be considered appropriate.
- In my opinion the authors presented a balanced summary of the existing literature and integrated it quite well into a model for advancing the management of Whiplash Associated Disorders and further research in this area.

- This study method is generally used in guiding healthcare decision-making processes and considered a reasonable approach in developing best-evidence practice guidelines [24].
- The participatory action research (PAR) method used in this study embodied the process of systematic review and its application in general practice [25]. This incorporates the process of:
 - i. Defining the Problem - in this case the need to establish baseline evidence on chiropractic care in the management of WAD injuries
 - ii. Planning - the process for review and analysis of information using source evidence review and best evidence synthesis (including literature search, selection for relevance, quality assessment and synthesis) [26]
 - iii. Data Generation - by way of systematic review, data extraction and analysis
 - iv. Analysis and Interpretation - best evidence synthesis relevant to chiropractic treatment
 - v. Action - GDC recommendations and the WAD-plus model, and
 - vi. Evaluation - feedback from stakeholders and practitioners

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- Additional Readings:**
- Canadian Chiropractic Association - Practice Guide for the Management of Whiplash Associated Disorders in Adults (June 2010).
- <http://www.chiropracticcanada.ca/ecms.ashx/PDF/ClinicalPracticeGuidelines/WAD/WhiplashPracticeGuide2010.pdf>

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Abstracts & Literature Review

Does the Mind Map Learning Strategy Facilitate Information Retrieval and Critical Thinking in Medical Students?

Anthony V D'Antoni, Genevieve Pinto Zipp, Valerie G Olson, Terrence F Cahill

BMC Medical Education 2010,10:61

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Summary for JACO

The amount of information that health professional students are required to master during their years in professional school is voluminous and continually increases. The requisite to learn vast amounts of information is actually a proxy for clinical practice because as clinicians these students will have to continually learn in order to keep up with the peer-reviewed literature and practice using an evidence-based paradigm. Historically, educational research on how these students learn and think critically has been lacking due to various reasons. Additionally, research on which learning strategies facilitate information retrieval and critical thinking in the academic setting has been scarce.

Critical thinking is a metacognitive, nonlinear process of purposeful judgment that includes self-directed learning and self-assessment (APA, 1990). Chiropractic orthopaedists recognize the importance of critical thinking in clinical practice as demonstrated by their commitment to post-graduate education. Various instruments can be used to quantify critical thinking and for health professional students—such as chiropractic and medical students—the Health Sciences Reasoning Test (HSRT) is one such instrument.

A learning strategy that can be used by students and clinicians to organize and learn information is mind mapping. Mind maps are multi-sensory tools that use visuospatial orientation to help students integrate, organize, and retain information (Buzan & Buzan, 1993). Mind maps have been used in the education of a variety of health professional students and their specific use in chiropractic education was discussed in a publication several years ago (A. V. D'Antoni & Pinto Zipp, 2006). Examples of mind maps from health professional students have been published in the peer-reviewed literature (A. D'Antoni, Pinto Zipp, & Olson, 2009; A. V. D'Antoni & Pinto Zipp, 2006; Pinto Zipp, Maher, & D'Antoni, 2009).

Recently, my research group investigated whether mind mapping promoted critical thinking in medical students (A. V. D'Antoni, Pinto Zipp, Olson, & Cahill, 2010). We randomly assigned 131 first-year medical students ($N=131$) to a standard note-taking (SNT) group or mind map (MM) group during orientation. Subjects were given a demographic survey and pre-HSRT. They were then given an unfamiliar text passage, a pre-quiz based upon the passage, and a 30-minute break, during which time subjects in the MM group were given a presentation on mind mapping. After the break, subjects were given the same passage and wrote notes based on

their group (SNT or MM) assignment. A post-quiz based upon the passage was administered, followed by a post-HSRT.

We found no significant differences in mean scores on both the pre- and post-quizzes between note-taking groups. No significant differences were found between pre- and post-HSRT mean total scores and subscores. At first glance, these results seemed disappointing but they really are not in the context of the study. Subjects in the MM group had never been exposed to mind maps yet they scored similarly to subjects in the SNT group who wrote notes in their usual styles, which, undoubtedly, were honed over a period of many years. This demonstrates that medical students using mind maps can successfully retrieve information in the short term and future studies should investigate whether mind mapping facilitates long-term memory and critical thinking over time.

What relevance does this study have to the chiropractic orthopaedic community? Chiropractic orthopaedists have to continually learn for re-credentialing and other purposes. So the next time you find yourself having to learn something new and are tempted to write notes, consider mind mapping the information. You will be surprised how much more you retain by mind mapping and you might even enjoy creating them.

Further Reading

For detailed steps on how to create mind maps, see the paper by D'Antoni et al. (2006) available online at <http://archive.journalchirohumanities.com/Vol%2013/JChiroprHumanit2006-13-2-11.pdf>. See the paper

by D'Antoni et al. (2009) for information on how to score them using the Mind Map Assessment Rubric (MMAR).

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Abstracts & Literature Review

Transcriptional Regulation of Endochondral Ossification by HIF-2 α During Skeletal Growth and Osteoarthritis Development

Saito T, Fukai A, Mabuchi A, Ikeda T, Yano F, Ohba S, Nishida N, Akune T, Yoshimura N, Nakagawa T, Nakamura K, Tokunaga K, Chung UI, Kawaguchi H

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Authors' Abstract:

Chondrocyte hypertrophy followed by cartilage matrix degradation and vascular invasion, characterized by expression of type X collagen (COL10A1), matrix metalloproteinase-13 (MMP-13) and vascular endothelial growth factor (VEGF), respectively, are central steps of endochondral ossification during normal skeletal growth and osteoarthritis development. A *COL10A1* promoter assay identified hypoxia-inducible factor-2 α (HIF-2 α , encoded by *EPAS1*) as the most potent transactivator of *COL10A1*. HIF-2 α enhanced promoter activities of *COL10A1*, *MMP13* and *VEGFA* through specific binding to the respective hypoxia-responsive elements. HIF-2 α , independently of oxygen-dependent hydroxylation, was essential for endochondral ossification of cultured chondrocytes and embryonic skeletal growth in mice. HIF-2 α expression was higher in osteoarthritic cartilages versus nondiseased cartilages of mice and humans. *Epas1*-heterozygous deficient mice showed resistance to osteoarthritis development, and a functional single nucleotide

polymorphism (SNP) in the human *EPAS1* gene was associated with knee osteoarthritis in a Japanese population. The *EPAS1* promoter assay identified RELA, a nuclear factor-kB (NF-kB) family member, as a potent inducer of HIF-2 α expression. Hence, HIF-2 α is a central transactivator that targets several crucial genes for endochondral ossification and may represent a therapeutic target for osteoarthritis.

JACO Editorial Summary:

- The purpose of the study was to examine the role of HIF-2, a cellular transcription factor on the development of endochondral ossification which is a basic component of osteoarthritis (OA). HIF-2 causes downstream induction of genes involved in the production of metalloproteinases and endothelial growth factor. These factors result in the matrix degradation and ingrowth of vascular tissue which are basic histological changes involved in endochondral ossification.

- The study involved several phases testing *in vitro* with mouse chondrogenic cells and human HeLa cells which are an immortal cell line used in gene related research. Both cell lines were exposed to a large variety of transcription factors identified from typical chondrocytes. HIF-2 caused the greatest activation of genes involved in the production of metalloproteinases and endothelial growth factor in both cell lines. HIF-2 expression is the result of activation of the *EPAS1* gene, a gene which is associated with higher osteoarthritis risk.
- The study also examined other cellular transcription factors that induce HIF-2. The most significant was NF- κ B which is induced by inflammatory activation. This is significant in that it suggests that

inflammatory activation is therefore a predisposing factor to OA and not just a secondary product that results in many of the associated symptoms.

- While the interest in this research is undoubtedly to identify molecular targets for the development of preventative drugs, it also suggests that the spectrum of dietary phytonutrients such as resveratrol, turmeric and bromelain that inhibit NF- κ B are likely to be of benefit in the prevention of OA.

Announcements

American College of Chiropractic Orthopedists Annual Convention to be held in Las Vegas – April 28-30, 2011

The 2011 ACCO convention will be held April 28th-30th, 2011 at the new Tropicana in Las Vegas. The College has lowered the convention price. Some really great speakers have been scheduled including:

Timothy Mick, DC, DACBR, FICC
Clinical Radiology

Michael Schneider, D.C., Ph.D
Myofascial Pain Disorders

Anthony Hamm, D.C., F.A.C.O.
Quality Reporting Through PQRI

Steven Foreman, D.C., D.A.B.C.O.
Cerebral Vascular Accidents

ACA Council on Chiropractic Orthopedics (CCO)
General Membership Meeting

Anna Allen, R.N., M.S.N., C.L.N.C.*
Risk Management and Professional Boundaries

Ralph Kruse, D.C., D.A.B.C.O, D.A.B.C.C.
Cox Technic

Academy of Chiropractic Orthopedists, ‘Congress of Diplomates’
Papers Presentation

Please plan on joining us in Las Vegas. More information is available from the ACCO. Contact the ACCO for information and to register. Go to: <http://accoweb.org/>

Editorial Review Board Annual Meeting

The *Journal of the Academy of Chiropractic Orthopedists* will convene an ERB meeting during the American College of Chiropractic Orthopedists Annual Convention on April 28, 2011. All ERB members are cordially invited to this meeting. For more information, contact Dr. Gundersen.

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