The Amelioration of Symptoms in Cervical Spinal Stenosis with Spinal Cord Deformation Through Specific Chiropractic Manipulation: A Case Report with Long-Term Follow-Up

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Abstract

Objective: To describe the chiropractic management of a patient with paresthesia on the entire left side of her body and magnetic resonance imaging (MRI)-documented cervical spinal cord deformation secondary to cervical spinal stenosis.

Clinical Features: A 70-year-old special education teacher had neck pain, headaches, and burning paresthesia on the entire left side of her body. These symptoms developed within hours of being injured in a side-impact motor vehicle accident. Prior to her visit, she had been misdiagnosed with a cerebrovascular accident.

Intervention and Outcomes: Additional diagnostic studies revealed that the patient was suffering from cervical spinal stenosis with spinal cord deformation. Two manipulative technique systems (Advanced Biostructural Therapy and Atlas Coccygeal Technique) unique to the chiropractic profession and based on the theory of relief of adverse mechanical neural tension were administered to the patient. This intervention provided complete relief of the patient's complaints. The patient remained symptom-free at long-term follow-up, 1 year postaccident.

Conclusion: There is a paucity of published reports describing the treatment of cervical spinal stenosis through manipulative methods. Existing reports of the manipulative management of cervical spondylosis suggest that traditional manual therapy is ineffective or even contraindicated. This case reports the excellent short-term and long-term response of a 70-year-old patient with MRI-documented cervical spinal stenosis and spinal cord deformation to less traditional, uniquely chiropractic manipulative techniques. This appears to be the first case (reported in the indexed literature) that describes the successful amelioration of the symptoms of cervical spinal stenosis through chiropractic manipulation. More research into the less traditional chiropractic systems of spinal manipulation should be undertaken. (J Manipulative Physiol Ther 2004;27:e7)

Key Indexing Terms: *Chiropractic; Cervical Spine; Stenosis*

Introduction

Stenosis or narrowing of the central vertebral canal was originally described in the lumbar spine by Verbiest[1] in 1949. Although stenosis of the central canal can occur anywhere along the length of the spine, this condition is considered more ominous with greater potential for serious neurological sequelae when it occurs in the cervical spine.[2-4] Depending on the nature and location of the neurological insult, symptoms associated with cervical spinal stenosis (CSS) may be radicular or myelopathic. Any combination of upper and lower motor neuron syndromes and sensory symptoms ranging from unilateral, bilateral, or with a Brown-Sequard-like presentation have been described.[2] A neurological condition that is associated with impingement of the spinal cord secondary to CSS is cervical spondylotic myelopathy (CSM). There are several theories concerning the development of the neurological signs and symptoms associated with CSS. The most obvious would appear to be direct spinal cord compression.[5,6] Compression and deformation of the normal oval shape of the spinal cord can be readily visualized on axial computed tomography (CT) or magnetic resonance imaging (MRI) of the cervical spine.[5,6] However, there are other potential mechanisms that may explain neurological compromise and resultant signs and symptoms. In addition to direct nerve fiber compression, neural ischemia secondary to compression of neurovascular structures has also been proposed.[7,8] There are several studies which suggest that tensile forces transmitted

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Fig 1. *Axial T2-weighted MRI image at a relatively normal level. Note the bright white cerebrospinal fluid ring (CSF) surrounding the cord.*

Fig 2. *Sagittal T2-weighted MRI of the cervical spine. Note the areas of stenosis.*

to the cord through its dural and dentate ligament attachments play an important role in the generation of the neurological signs and symptoms seen clinically.[9-11] It is likely that all of these mechanisms play a role in the neurological compromise and that symptoms are generated through multifactorial pathophysiology.[6]

Given the lack of understanding about the cause and mechanisms that generate symptoms in CSS, it is not surprising that there is also controversy and a lack of data concerning the natural history of CSS, as well as the long-term benefits of treatment.[12-14] There are even fewer reports in the literature of the utility of manipulative management of CSS. A computer search of Medline and a hand search of the Chiropractic Research Archive Collection produced a paucity of data concerning the appropriateness of spinal manipulation for CSS. Several reports suggest that manipulation is contraindicated in patients demonstrating compromise of the neurological elements.[15-17] Another published report of 2 cases of cervical myelopathy suggested modest improvement following spinal manipulation.[18]

Imaging of Cervical Stenosis

Cervical stenosis is defined as a narrowing of the central canal of the vertebral column. This narrowing becomes clinically important when impingement of the neurological elements results. There are many grading systems designed to classify the neurological insult seen in cases of CSS.[5,6,13,19] One such system for the grading of neurological insult depends on the findings of the axial magnetic resonance (MR) image at the level of impingement (stenosis) visualized on the sagittal MR image.[19] In a normal axial image of the cervical spine, the cord appears ovoid and a bright ring of cerebrospinal fluid (CSF) can be readily visualized surrounding the neural tissue (Fig 1). If the CSF ring surrounding the spinal cord is broken or discontinuous, a finding of thecal sac effacement is suggested.[19] If the stenosis deforms the spinal cord but preserves the CSF ring on the posterior aspect of the spinal cord, spinal cord effacement is suggested.[19] A significant degree of spinal cord effacement will alter the appearance of the spinal cord on axial imaging, changing the normal cross-sectional appearance from ovoid to "banana-like."[6] Finally, if in addition to impingement of the CSF anteriorly and deformation of the cord proper, the CSF ring is broken on the posterior aspect of the axial image, actual spinal cord compression is suggested.[19] The degree of change seen in cross-sectional images of the spinal cord appears to offer some value in predicting both the development of neurological compromise and the response to decompressive surgical treatment.[5,13]

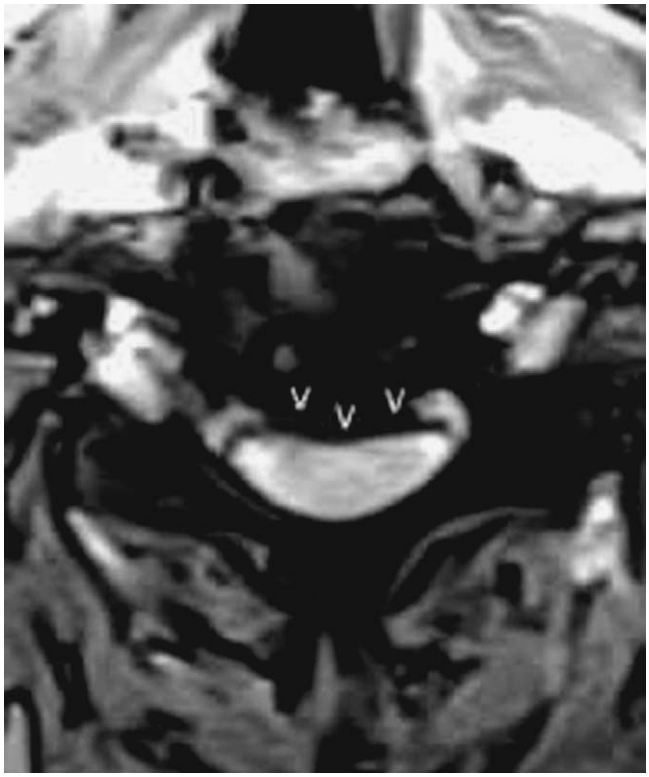

Fig 3. *Axial T2-weighted MRI image at a stenotic level. Note the loss of CSF signal (V V V) surrounding the cord. See text for more information.*

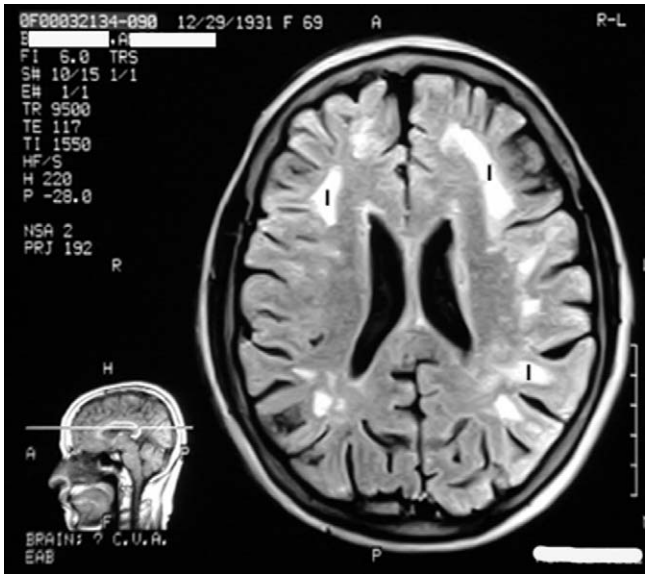

Fig 4. *Axial MRI slice demonstrating areas of ischemia* (i) *in the patient's brain that originally led to the diagnosis of CVA.*

I discuss a case of cervical spinal stenosis with frank spinal cord compression, treated with manipulative techniques that have several unique characteristics. Most notably, the manipulative treatment of this patient was limited to chiropractic techniques that are not generally seen in other professions that practice manual therapy. The manipulative methods employed in this case are derived from the chiropractic techniques known as Advanced Biostructural Therapy (ABT)[20] and Atlas Coccygeal Technique (ACT).[21] Additionally, the extent and nature of the spinal cord compression seen in this patient is well documented through magnetic resonance imaging (Figs 2 and 3).

The patient's MRI images in this case illustrate the concept of spinal cord compression described above.[19] The axial image in this case taken at the stenotic level clearly demonstrates loss of the normal CSF ring on both the anterior and posterior aspect of the spinal cord, with gross deformation of the neural elements into a "banana-like" shape (Fig 3). These 3 findings suggest a "pincher" effect on the spinal cord. Under these circumstances, the cord is thought to be migrated and deformed away from the anterior impingement, only to have secondary compromise and encroachment posteriorly.

Case Report

The patient is a 70-year-old female special education teacher who was injured in a side-impact motor vehicle accident (MVA) that occurred in July of 2000. Within hours of the accident, she developed headaches, neck pain, and a burning sensation on the left side of her face and the entire left side of her body, including her extremities. She was taken to the emergency room where an MRI of her brain was obtained. She was diagnosed with a cerebrovascular accident (CVA) based on her symptoms and areas of ischemia (marked i) as visualized on MRI (Fig 4). She was later seen by a neurologist who felt that her signs and symptoms did not correlate with the ischemic changes seen on the MRI scan of her brain. She had a magnetic resonance angiography (MRA) procedure that demonstrated that the arterial supply to her brain was not compromised. Figure 5 is a representative image of her MRA study demonstrating the patency of the distal ends of her vertebral arteries (VA), intact basilar artery (BA), circle of Willis (COW), and internal carotid arteries (ICA). An MRI study of the cervical spine was then obtained. This revealed significant spinal stenosis with spinal cord deformation as described above. Her diagnosis was changed from CVA to cervical myelopathy, and she was referred for surgical decompression.

She came to my office less than 2 weeks later. Her stated goal was to avoid spinal surgery. At that time, she complained of headaches, neck pain, and an "odd sensation like my left face, body, arm, and leg are hot and burning." Neurological assessment revealed normal gait and station. Her cranial nerves were intact, and she communicated well

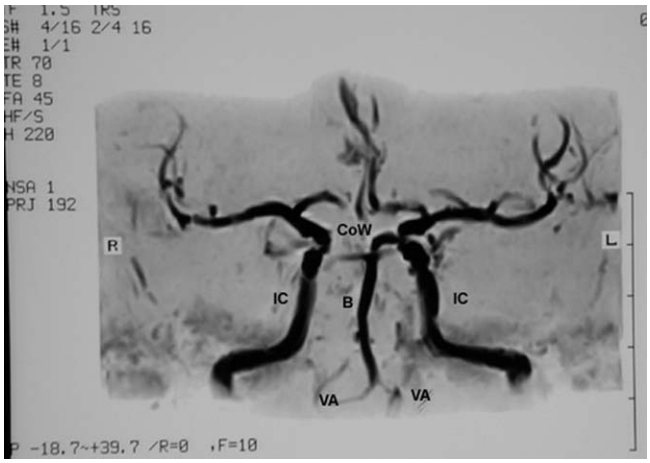

Fig 5. *MRA image that demonstrates relatively normal vascular anatomy of the patient's vertebrobasilar system.*

with no evidence of cognitive impairment. She did not exhibit dysphasia, dyslalia, dysphonia, or any other sign of CVA. Her deep tendon reflexes were globally and symmetrically reduced and rated 1 over 4. She had no weakness, no pathological reflexes, or other signs of an upper motor neuron syndrome. Her sensory complaints were subjective, but her orthopedic evaluation was remarkable in that cervical compression tests exacerbated her burning paresthesia and cervical spine distraction relieved these symptoms. She had the usual paracervical muscle spasms seen commonly in post-MVA patients. Chiropractic assessment was based on the clinical models of ABT and ACT manipulative systems.[20,21] From a chiropractic perspective, she had gross anterior head translation (sagittal plane subluxation) and a noticeable head tilt with the high side on her left (coronal plane subluxation).

Intervention

There are many styles and theories of application of spinal manipulative techniques. A number of generic spinal manipulative maneuvers are practiced across the various disciplines that make up the manual therapy professions. Many chiropractic, orthopedic, osteopathic, and physiotherapy spinal manipulative procedures are indistinguishable. Some are identical with only the theory of application differing. This case employed 2 systems of spinal manipulation (ABT and ACT) that are distinctly associated with the chiropractic profession. Part of the theory of their application is based on the concept that global spinal orientation (posture) is related to tension or insult within and along the neuroaxis.[20,21] One of the treatment goals of the ABT chiropractic technique system is to restore the patient to a more neutral resting head posture in the sagittal plane.[20] In the ACT technique, tilting of the head in the coronal plane (as visualized by a line representing the transverse plane of the foramen magnum) is believed to transmit tension to the spinal cord through dural attachments to the rim of the foramen magnum and upper cervical vertebrae.[21] ACT practitioners postulate that reduction of tension on the neuroaxis is accomplished by restoring the patient to a neutral head posture in the coronal plane. The mechanisms of both these chiropractic techniques are based on theoretical models derived from basic science studies of the biomechanics of the nervous system.

However, there is at least some evidence that suggests that changes in the posture of the cervical spine in the sagittal plane can alter the degree of compression of the spinal cord seen in some patients with CSS.[22-24] Muhle[22,23] demonstrated through dynamic MRI investigation that a neutral head posture can reduce the deformation of the spinal cord when compared with more flexed or extended postures. Muhle's[22,23] dynamic MRI studies offer at least some support to the theory that a neutral resting posture offers the greatest potential for cord decompression in cases of cervical spinal cord impingement.

Resting posture can be measured on radiographs or can be visualized as postural deviations from a plumb line. In the case presented here, head forward posture and head tilt were determined by plumb line assessment. This postural examination revealed a clinical presentation consisting of an anterior head translation (head forward posture/anterior translation subluxation) and head tilt, with the line representing the foramen magnum higher on the left (right lateral flexion subluxation of the head on the neck). The manipulative techniques were employed in such a way as to reverse the observed spinal distortions with the hope of reducing spinal cord insult.

Description of the Manipulative Techniques

The Advanced Biostructural Therapy approach to correcting head forward subluxation involves adjusting or manipulating the first rib.[20] The standard first rib adjustment utilized by practitioners of ABT was modified as follows. In this case, the patient was placed supine on an adjusting table equipped with an upper thoracic drop mechanism. The medial aspect of the first rib was palpated with the thumb. The thumb remained in contact with the first rib. The pisiform area of the opposite hand was placed over the palpating thumb. A thrust was directed inferiorly to superiorly and anteriorly to posteriorly. The thrust was high-velocity, low-amplitude and delivered with enough penetration to cause the drop mechanism of the table to release. This manipulative procedure was repeated 3 times each visit (a number of repetitions arbitrarily determined by the author) on both the right and left first rib. It is my experience that this maneuver causes a rapid reduction of abnormal head forward subluxation. This maneuver was

applied to the patient on each office visit for 18 sessions over 55 days at a frequency of 3 times per week for the first 2 weeks and then once per week for the duration of the treatment period.

The Atlas Coccygeal Technique adjustment is designed to reduce head tilt subluxation in the coronal plane. It consists of placing the patient in a side-posture position. The drop mechanism of the adjusting table was elevated slightly so the patient's head and neck were in a neutral position (no left or right lateral flexion). With the patient on her side, the inferior (low) side of the foramen magnum plane (as determined by upright postural assessment) was placed superiorly. The patient was placed in what resembles the left decubitus position. The region of the right mastoid process of the skull was palpated with the doctor's thumb. The mastoid process served as a landmark with which to identify (and remain in contact with) the transverse process of the C1 vertebra. Contact of the transverse process was maintained, while the pisiform region of the author's opposite hand was placed in contact with the palpating thumb. A thrust was delivered with a line of drive superior to inferior (right atlas transverse process toward the left atlas transverse process). The penetration was deep enough to cause the cervical drop mechanism to release. This procedure was repeated 3 times. The application of the ACT atlas adjustment was performed only on those visits where the patient demonstrated a head tilt in the coronal plane as observed by postural assessment using plumb line analysis. This varied from visit to visit.

Within 2 weeks of treatment utilizing the spinal manipulative methodologies described, the patient reported that her burning paresthesia had diminished by about 90%. The improvement in symptoms seemed to parallel her improvement in sagittal and coronal plane alignment, and her treatment frequency was reduced to 1 session per week. The patient did experience 1 episode of spontaneous exacerbation of her burning sensory symptoms. This rapidly returned to preexacerbation status with increased frequency of treatment (3 times per week for 1 week). Her associated muscular aches and pains also quickly resolved under this adjustive approach. The time frame from initial presentation to complete resolution of symptoms was just under 2 months and encompassed 18 manipulative sessions. She was discharged without residual signs or symptoms from the accident. The patient was most recently reevaluated 2 years later. She remained asymptomatic at this long-term follow-up evaluation.

Discussion

The exact mechanism by which the signs and symptoms in CSS are generated is controversial. The 2 most prominent theories are direct compression of the neural elements at the stenotic spinal level and tension within the neuroaxis transmitted from the spinal column to the neural tissues through various soft tissue supporting structures.[10] The clinical picture is further complicated because the neurological insult may be from direct pressure on the neural elements or produced indirectly through compression of vascular elements.[8] The emerging model is one of a multifactorial causation, with each patient having a unique combination of neural pressure and tension, as well as vascular compromise. The 2 manipulative procedures administered to this patient are based on theories derived from the known interrelationship between the bony spinal column (posture) and the response of the neural elements to these postures. Based on the MRI data of Muhle,[23] it does seem plausible that in at least some patients with CSS, an abnormal resting posture may increase compression of the neural elements. Unfortunately, without a posttreatment MRI in this case, it is impossible to determine if the chiropractic procedures employed actually reduced neural element impingement. Other explanations for the clinical recovery seen in this patient, such as effects of mechanoreceptor stimulation, are possible. Reflex pain inhibition following mechanoreceptor stimulation has been well documented.[25] However, unlike its known effects on pain modulation, it is unclear if mechanoreceptor stimulation can alter what appears to be, in this case, centrally generated paresthesia. Furthermore, it is doubtful that a short course of mechanoreceptor stimulation (if it can modulate paresthesia) could provide the long-lasting suppression of symptoms seen in this case. Spontaneous recovery is another possibility; however, even with surgical intervention, it appears that the long-term prognosis of patients with CSS is only modest. A large number of patients tend to deteriorate after an initial phase of improvement.[12,14] However, a controlled trial with a larger number of patients would be needed to rule out spontaneous recovery. The growing availability of weight-bearing and dynamic MRI studies like the ones described by Muhle[23] may provide the technology needed to better understand the pathophysiology of CSS. These imaging techniques may also provide a valuable tool with which to assess various chiropractic techniques. Further study utilizing emerging imaging and other noninvasive technology may help to explain the clinical improvement frequently reported in chiropractic patients and help to identify the mechanisms responsible for this improvement.

Conclusion

Resolution of the signs and symptoms of cervical stenosis with MRI-documented spinal cord compression through chiropractic techniques is reported. This case suggests the need for more research into the less traditional chiropractic techniques. More research is needed to identify the exact mechanisms of neurological insult seen in cervical spinal

stenosis. Better understanding of the pathophysiology of this condition may lead to novel conservative approaches to treatment.

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