Acute Presentation of Cervical Myelopathy Following Manipulation Therapy

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ABSTRACT: Spinal manipulation therapy (SMT) is commonly used as an effective therapeutic modality for a range of cervical symptoms. However, in rare cases, cervical manipulation may be associated with complications. In this review we present a series of cases with cervical spine injury and myelopathy following therapeutic manipulation of the neck, and examine their clinical course and neurological outcome. We conducted a search for patients who developed neurological symptoms due to cervical spinal cord injury following neck SMT in the database of a spinal unit at a tertiary hospital between the years 2008 and 2018. Patients were assessed for the clinical course and deterioration, type of manipulation used and subsequent management. A total of four patients were identified, two men and two women, aged 32–66 years. In three patients neurological deterioration appeared after chiropractic adjustment and in one patient after tuina therapy. Three patients were managed with anterior cervical discectomy and fusion while one patient declined surgical treatment. Assessment for subjective and objective evidence of cervical myelopathy should be performed prior to cervical manipulation, and suspected myelopathic patients should be sent for further workup by a specialist familiar with cervical myelopathy (such as a neurologist, neurosurgeon, or orthopedic surgeon who specializes in spinal surgery). Nevertheless, manipulation therapy remains an important and generally safe treatment modality for a variety of cervical complaints. This review does not intend to discard the role of SMT as a significant part in the management of patients with neck-related symptoms, rather it is meant to draw attention to the need for careful clinical and imaging investigation before treatment.

IMAJ 2019; 21: 542–545

KEY WORDS: anterior cervical discectomy and fusion, cervical myelopathy, chiropractics, neck pain, spinal manipulation therapy

Manipulation therapy consists of multiple therapeutic modalities applied to a wide range of musculoskeletal disorders, without a clear definition [1-3]. Spinal manipulation therapy (SMT) is widely and increasingly used in the management of neck and back pain with many reports demonstrating its efficiency. The common element in all SMTs is manual maneuvers on the spine and paravertebral structures, which are meant to stretch and release joint capsules. Biomechanically, cervical manipulation can be described as having a long or short lever-arm and a high or low velocity thrust [4,5]. Spinal mobilization entails a passive low velocity movement that can be stopped by the patient. The main difference between mobilization and SMT is the velocity rather than the amount of force applied. It has been demonstrated that disc pressures increase during such maneuvers [6].

Examples of manipulation therapy include chiropractics, physical therapy, massage, and osteopathy. The efficacy and clinical benefit of SMT has been proven in pain relief from a variety of etiologies (e.g., cervical spondylosis, radicular pain) [7,8].

SMT may be associated with complications, usually mild and transient, but severe and permanent disabilities and even death have also been reported [9-11]. The main feared complication is vertebral artery dissection, yet that too is a rare incidence [12]. As SMT is such a heterogenous group made up of different modalities, no universal guidelines exist regarding premanipulation assessment and contraindications, with each discipline defining its own limitation [13-16]. Due to the prevalence of neck, back, and other musculoskeletal symptoms, some patients are treated with SMT even before appropriate assessment by a relevant medical professional and without their baseline neurological status determined [3]. in addition, there are no clear indications for surgeon referral and for advanced imaging.

Cervical myelopathy is a syndrome characterized by spastic gait impairment, upper limb dysfunction, and sphincter disturbances. The pathomechanism involves a combination of mechanical compression and ischemic processes, most commonly associated with narrowing (stenosis) of the vertebral canal [17]. The second-hit phenomenon describes neurological deterioration of myelopathic patients following further mechanical insult to their spine, and its prevention may be considered as an indication for prophylactic surgical decompression and fusion [18]. Magnetic resonance imaging (MRI) is the modality of choice, with the hallmark finding being compression of the spinal cord due to disc herniations or degenerative changes, with or without spinal cord signal changes.

*The first and second authors contributed equally to this study

The aim of this review was to present a series of patients with cervical spinal myelopathy following manipulation of their cervical spine, and to consider possible contraindications and required assessment prior to manipulation. This review did not intend to discard the role of SMT as a useful tool in the management of patients with neck related symptoms, but rather, to draw attention to the need for careful clinical and imaging assessment prior to SMT.

Spinal manipulation is an effective modality for cervical symptoms

PATIENTS AND METHODS

We performed a retrospective search in the database of the spinal unit in the neurosurgical department of a tertiary hospital between the years 2008 and 2018. The inclusion criteria included any patient over 18 years of age who was admitted for spinal cervical injury following physical manipulation of their cervical spine, regardless of the modality conducted. The search did not include patients who presented with vertebral artery dissection. Surgical treatment was not an inclusion criterion as not all patients underwent surgery.

CASE EXAMPLE

A 32-year-old male complained for 3 weeks of neck pain and progressive altered sensation in his lower limbs (left more than right). He was treated with two sessions of chiropractic adjustments to his neck. After the second session the patient complained about increased numbness and weakness in the lower limbs, which then ascended to the trunk. Computed tomography of his lumbar spine was within normal limits.

The patient was referred to the neurological department, where he was found to have spastic paraparesis. Initial working diagnosis was of a demyelinating disease vs. myelitis. Empiric systemic corticosteroids were initiated without improvement. Lumbar puncture, as well as brain and thoracic spine MRI, were all normal. Cervical spine MRI was then performed and the patient was transferred to our department.

On admission to our spinal unit, the patient reported previous neck pain and episodes of transient hand numbness during the last year, initially interpreted as carpal tunnel syndrome. Neurological examination on admission demonstrated distal weakness of 4/5 in his left upper and lower limbs and sensory level at D10, also more prominent on the left side. Reflexes were brisk with bilateral Tromner, Hoffman, and Babinski signs.

Review of the cervical spine MRI demonstrated a large herniated disc at C5–C6 and a thick yellow ligament at the same level with severe spinal cord compression and increased cord signal on T2 [Figure 1]. Surgical management was indicated and was performed during the same admission. Using an anterior approach to the neck, discectomy at the involved level was performed with decompression of the spinal cord and fusion with an interbody device. Surgery and postoperative course were uneventful. The patient was transferred to a rehabilitation facility with gradual, significant, yet incomplete improvement of his neurological deficits. At the last follow-up appointment, the patient still complained of mild gait instability yet he walks without aids. The function of the hands is almost normal and has no sphincter disturbances. MRI of the cervical spine shows normal alignment without cord compression, with the old signal changes [Figure 2].

Figure 1. Magnetic resonance imaging in sagittal T2-weighted **[A]** and axial T2-weighted **[B]** sequences demonstrate disc herniation at the C5–C6 level with significant cord compression with intramedullary T2 high signal intensity (as evidence of myelomalacia)

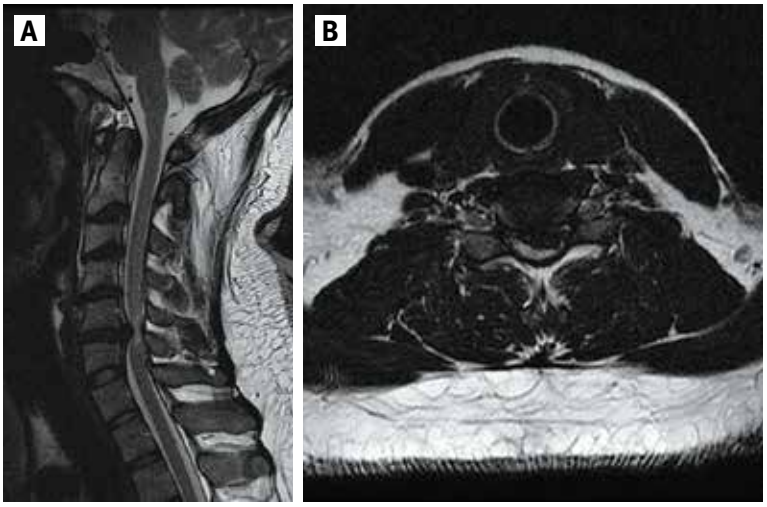
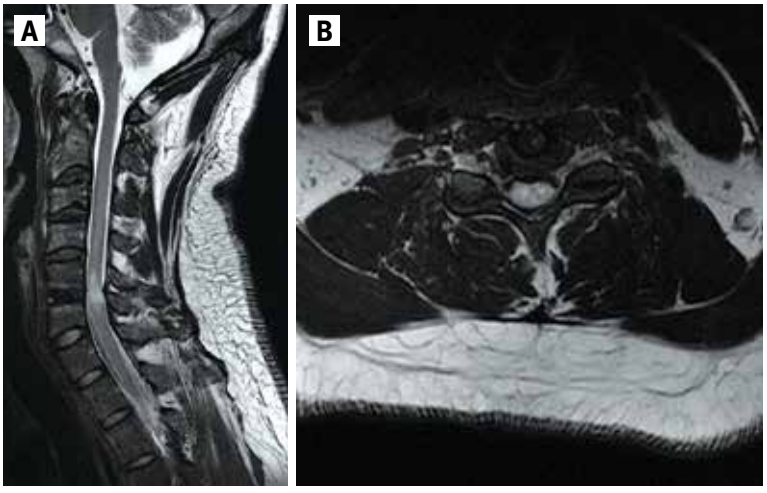


Figure 2. Magnetic resonance imaging in sagittal T2-weighted **[A]** and axial T2-weighted **[B]** sequences obtained 21 months postoperatively. Adequate decompression is demonstrated without cord compression. Spinal cord changes consistent with myelomalacia persist. Lordotic alignment is maintained



RESULTS

The search identified four patients who presented with myelopathic manipulation injuries. Patient were 32 to 66 years of age, two females and two males. Neurological deterioration was discovered from one day to one week following the manipulation, with one of the patients having three manipulation sessions, another patient having two sessions, and the others only one. Three patients had chiropractic treatment while the fourth received tuina (a form of Chinese physical therapy consisting of relaxing manipulation and joint regulation). The diagnosis was delayed in two patients with an initial working diagnosis of myelitis. Workup included lumbar puncture and initial treatment was with steroids.

Manipulation may be associated with neurological worsening in cases of pre-existing severe cord compression or spinal instability

Clinically one patient presented with central cord syndrome, two with spastic quadriparesis, and the fourth with radiculopathy and radiological evidence of myelomalacia.

MRI was performed for diagnosis in all cases. The levels of spinal cord involvement were C4–C5 in one patient, C5–C6 in two, and contiguous over C4 to D1 in one. Patient characteristics are presented in Table 1.

DISCUSSION

SMT is a popular and useful modality for treatment of various cervical pathologies. While generally safe, various mechanisms of neurological injuries have been reported including vertebrabasilar artery dissection, fractures, hematomas, and herniated discs causing radiculopathy or myelopathy [19-21]. There is no clear data regarding the incidence of such injuries, as it is too rare to be noted by randomized controlled trials [10,22]. The largest group of myelopathic complications in the literature is of 11 patients [20] with small numbers of patients even in nationwide surveys performed in California, USA and the United Kingdom [18,19].

As there are no universal guidelines and contraindications for SMT, each discipline has its own literature regarding contraindications. Chiropractics is the most common modality in use does mention myelopathy as a contraindication for SMT [16]. In a previous study, our group found that cervical myelopathy can be a challenging diagnosis and frequently delayed in the community setup [22].

The cases we present demonstrate the risk of myelopathic injury by cervical SMT in patients with baseline cervical spinal instability or cord compression. We were unable to find a documented neurological examination before the manipulation for any of the patients. It is therefore impossible to know whether spinal cord dysfunction existed before and was exacerbated following SMT or whether this dysfunction appeared only after SMT due to a newly herniated disc. Limitations of the present work include the small number of cases and its retrospective nature.

We suggest that both subjective and objective myelopathic findings should alert the general practitioner/manipulation therapist to possible neurological injury and should lead to assessment by a spinal surgeon and to consideration of MR imaging prior to SMT. Strict adherence to known contraindications should be maintained [13]. With these considerations, SMT can remain a meaningful and safe non-surgical intervention for various cervical pathologies.

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Table 1. Patient characteristics and clinical course

	Age, years/ gender	Premanipulation symptoms	Spinal manipulation therapy	Presenting symptom	Neurological exam	MRI of the cervical spine	Management and outcome
Patient 1	37/ male	Right shoulder and low back pain	Chiropractics, three sessions in 2 weeks	Electric sensations in neck, right sided weakness, gait instability	Signs of UMN lesion in four limbs, with significant weakness and hypoaesthesia on the right side	Herniated C4-C5 disc with severe spinal cord compression and signal changes. Mild degenerative changes at C5-C6-C7	ACDF C4-C5, remained with spastic quadriparesis, underwent C3-C4 ACDF for ASD after 3 years
Patient 2	66/ female	Long standing cervicalgia	Chiropractics single session	Bilateral shoulder pain, loss of hand dexterity and right leg weakness, inability to pass urine	Severe upper limbs spastic weakness (proximal 4/5 and distal 0-1/5), diminished sensation, mild left leg weakness	Disc protrusions at C5-C6-C7, mild-moderate compression of the spinal cord with T2 hyperintense signal from C4 to D1 levels	Initial trial with steroids for suspected myelitis, followed by two level ACDF C5-C6 and C6-C7 with significant neurological improvement after rehabilitation
Patient 3	46/ female	Left sided shoulder and radicular pain	Tuina single session	Exacerbation of pain, hand numbness and diminished function	Full ROM, motor and sensory intact, positive spurling	Hyperintense T2 signal at the level of C5-C6 with a small foraminal disc at C5-C6	Declined surgical decompression
Patient 4	32/ male	Neck pain, hand numbness	Chiropractics, two sessions	Progressive altered sensation and weakness in his lower limbs	Spastic tetraparesis	Herniated C5-C6 disc with severe cord compression	Trial with steroids for suspected myelitis, followed by ACDF C5-C6 with significant neurological improvement after rehabilitation

ACDF = anterior cervical discectomy and fusion, ASD = adjacent segment disease, MRI = magnetic resonance imaging, UMN = upper motor neuron

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Capsule

Association between thyroglobulin polymorphisms and autoimmune thyroid disease: a systematic review and meta-analysis of case control studies

Emerging evidence revealed that thyroglobulin contributes to the development of autoimmune disease, and the relationship between thyroglobulin and autoimmune thyroid disease (AITD) is still controversial. The aim of this study was to quantify the association between *rs*2076740, *rs*853326, *rs*180223, and *rs*2069550 thyroglobulin polymorphisms and risk of AITD using a meta-analysis approach. **Zhang** et al. identified all studies that assessed the association between thyroglobulin polymorphisms and AITD from PubMed, Embase, and Web of Science databases. A total of 3013 cases and 1812 controls from 10 case control studies were included. There was no significant associations found between *rs*2069550, *rs*180223, and *rs*853326 polymorphisms and AITD risk. The association between the *rs*2076740 polymorphism and AITD risk was significant in the codominant model ($P = 0.005$), suggesting the *CC rs*2076740 genotype might be a protective factor for AITD. Sensitivity analysis by removing one or two study changed the results in dominant *rs*2076740 and *rs*853326 and *rs*2069550 allele models ($P = 0.016, 0.024, 0.027$, respectively). Latitude and ethnicity significantly affected the association between *rs*2076740 and *rs*2069550 polymorphisms and AITD, indicating their protective effects in allele or dominant model ($P = 0.012, 0.012, 0.012, 0.009, 0.009$). The association between *rs*2076740, *rs*2069550, and *rs*853326 polymorphisms and AITD risk is significantly affected by study characteristics.

Genes & Immunity 2019;20:484

Eitan Israeli

"The most difficult thing is the decision to act, the rest is merely tenacity. The fears are paper tigers. You can do anything you decide to do. You can act to change and control your life; and the procedure , the process is its own reward"

Amelia Earhart (1897–1939), American author, women's rights advocate, and aviation pioneer; the first female aviator to fly solo across the Atlantic Ocean