

A Rare Combination of Unilateral Transient Vocal Cord, Soft Palate, and Tongue Palsies and Numbness following Chiropractic Manipulation to the Cervical Spine: A Case Report

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ABSTRACT

Background: Multimodal chiropractic therapies are well known to reduce pain, improve range of motion and assist with functional rehabilitation of cervical spine dysfunction syndromes. Amongst the critical known contributing risks associated with cervical spinal manipulation are injuries to the vertebral and carotid arteries. Osteoarthritis or rheumatologic arthritides with associated osteophytosis or syndesmophytosis are not considered major risk factors for adverse events such as neuropraxia or vascular dissection.

Case Presentation: A 59-year-old male presented to an outpatient chiropractic clinic with a chief complaint of daily headaches and numbness of the right hand at night. History and review of symptoms obtained by the chiropractor at the initial appointment were devoid of any pertinent red flags or relevant medical history. Physical examination indicated appropriateness of spinal manipulative therapy as management of neck pain and headaches. 10 minutes following treatment, the patient developed dysphasia and dysarthria and was evaluated in the emergency department. He underwent extensive CT, MRI, and laryngoscopy diagnostic procedures to rule out the possibility of a stroke, vertebra-basilar-insufficiency (VBI), or space occupying lesion. The imaging revealed a right sided vocal cord palsy, severe anterior vertebral osteophytosis, multiple levels of canal stenosis, disc disease, and post-traumatic vertebral end-plate degeneration likely caused by multiple neck injuries earlier in life. He was treated with IV corticosteroids as well as occupational and speech therapies, which improved his swallowing and speech except for mild hoarseness.

Conclusion: The risks for spinal manipulation especially in the cervical region should include osteophytosis and degenerative processes that may affect the surrounding neural and vascular soft tissues. Given the rarity and extremely low incidence of adverse effects related to cervical spine manipulation, it would be reasonable to assume that this type of adverse effect could have happened in association with any activity of daily living demanding a fast head or neck rotation. More research is needed on post-traumatic spinal and juxta-spinal degeneration and their effects on different soft tissues and function with the goal of improving clinical safety and practical procedures within chiropractic clinics.

Key words: chiropractic, manipulation, vocal cord palsy, recurrent laryngeal nerve, glosso-pharyngeal, vagus, hypoglossal, Tapia syndrome

INTRODUCTION

Different management strategies exist for neck pain and dysfunction syndromes and no single modality can address all issues. Instead, a multimodal patient-centered approach is recommended where modalities such as exercise and manual therapy can be used in addition to a thorough patient-specific explanation including possible underlying reasons for the condition and potential work practice and self-management strategies.¹

Neck pain has been defined based on anatomic landmarks, severity, or duration of pain as well as reason for onset such as trauma, work-related, or unknown/idiopathic.² Neck pain is a common complaint amongst adults globally.¹⁻⁴ Neck pain affects women more frequently than men; however, the prevalence in both sexes follows similar trajectories, with peak incidence around 50 years of age and declining thereafter.⁴ In 2017, the global age-standardized prevalence and incidence rate of neck pain were 3551.1 and 806.6 per 100,000, respectively.⁴ Like other painful spinal conditions, thoughts, negative emotion, and problems with sleeping can be related to persistent neck pain, and if present, may present yellow flags that should be considered in the management strategy.⁵

Cervical radiculopathy may include a component of neck pain and is a common clinical diagnosis classified as a disorder of a nerve root and most often is the result of a compressive or inflammatory pathology from a space-occupying lesion such as a disc herniation or spondylotic spurs, also known as cervical osteophytes.⁶⁻⁷ The average annual incidence rate of cervical radiculopathy is 83 per 100,000 for the population in its entirety, with an increased prevalence occurring in the fifth decade of life (203 per 100,000).⁸ The location and pattern of symptoms may vary, depending on the nerve root level affected, and can include sensory and/or motor alterations if the dorsal and/or ventral nerve root is involved.⁹

Although patients with cervical radiculopathy may have complaints of neck pain, the most frequent reason for seeking medical assistance is arm complaints. Patients usually present with complaints of pain, numbness, tingling, and weakness in the upper extremity, which often result in significant functional limitations and disability, as was the case with this patient.^{10,11}

Conservative therapies have been shown effective for alleviating pain and reducing disability when a multimodal approach is used such as manual therapy, traction, soft tissues release, stretches, and rehabilitation exercises.¹²⁻¹⁴

CASE PRESENTATION

A 59-year-old Caucasian male presented to an outpatient chiropractic clinic with a chief complaint of intermittent nocturnal numbness to the right hand, which prevented him from sleeping through the night. In addition, he complained of occasional daytime neck pain with radiation down his right arm. He also complained of occasional non-specific migraines. At intake, the patient denied previous injuries, trauma, or surgery to the cervical spine. Contributing social history factors included a highly stressful business management lifestyle and chronic and heavy smoking of one pack of cigarettes daily for 3 to 4 decades. He also reported being easily tired and experiencing fatigue.

Additional inquiries about the patient's past medical history at a hospital setting later revealed heavy drinking habits, borderline diabetes and hypertension, and that his history included an active sport lifestyle during adolescence and active military service as a combat airborne rescue member. The patient elaborated that his military service required intense physical activity such as lifting, pulling, and holding injured combat pilots and additional activities that required repetitive loading to the shoulder girdle, neck, and lower back.

Further inquiry about previous injuries, prior hospitalizations, and imaging also revealed a remarkable water-skiing accident 15 years prior to the chiropractic visit, which resulted in him being thrown onto the water at very high speed over his right side, where he felt a sudden physical blow and stretch to the right side of his back, shoulder, and neck. The patient further indicated that due to his past combat rescue experience that forced him to cope with pain and discomfort, he negated the accident's resultant discomfort and pain in his neck and back and did not seek any examination or treatments. Unfortunately, details of this later information were not disclosed by the patient at initial presentation to the chiropractic clinic.

Examination

Physical examination revealed a mesomorphic body type with anterior head carriage, robust neck musculature at the suboccipital region bilaterally, the upper trapezius regions, and the left sternocleidomastoid (SCM), in addition to hypotrophic right sided levator scapulae and splenius capitis. A slight head tilt to the right was noted along with an elevated right shoulder, a slight left curve of the cervical spine and a slight right sided curve of the thoracic spine between the shoulder blades were noted. Orthopedic and neurological examinations were unremarkable, and cervical spine range of motion was generally limited, most notably in bilateral lateral flexion, flexion, and extension. Numerous joint restrictions were revealed along the cervical spine.

Treatment

Informed consent was obtained and the patient was positioned supine on a chiropractic table. Light palpation and stretch were applied initially to the posterior aspects of the cervical spine and diversified adjustment of slight rotation posterior-to-anterior and right lateral to left medial vectors were applied to the right sided upper and middle cervical spine. The patient was made apprehensive by the noise produced from the numerous cavitations and asked the chiropractor about the necessity of such a maneuver. The rationale of improving biomechanics and function were explained by the chiropractor, and upon the patient's consent, further spinal manipulation in the opposite direction, left to right, was applied to the same dysfunctional segments. The patient sat and stood up independently post treatment without any difficulty.

Upon checking out at the front desk, he began feeling dyspnea, saliva accumulation in his mouth, dysphagia, and shortness of breath. Ten minutes later, when taking a taxi back to his business, he noticed dysarthria and hoarseness. He canceled his business schedule and went to the nearest hospital emergency room (ER). At the ER he was examined for suspected vascular brain injury, resulting in a head CT scan, the finding of which were unremarkable. He was given corticosteroid injections to reduce possible inflammation in the cervical region and released from care, with instructions to rest and return the next day for a follow-up examination (this practice is not uncommon in this small rural ER). Upon his return for the follow-up examination, his symptoms had worsened, including dysesthesia and deviation of the tongue to the right side. He was referred then to an ear nose and throat (ENT) specialist who performed laryngoscopy and diagnosed right vocal cord palsy, right deviated tongue, left deviated uvula and suspected injury of cranial nerves (CN) IX, X, XI, and XII post chiropractic treatment. The patient was then referred to a neurologist for further diagnosis, treatment, and rehab. As a part of the neurology examination, he underwent additional head and neck CT to include flair technique and subsequent MRI of the head to rule out intracranial hemorrhage, thrombus, or another space-occupying lesion. He was hospitalized for additional neurological evaluation and administered corticosteroids via IV infusion. His follow-up examination two days post chiropractic treatment revealed all the above and in addition, weakness of the right levator scapulae and upper trapezius, but no weakness of serratus anterior. The patient was also diagnosed with loss of gag reflex and softening of the soft palate on the right. He underwent a second opinion in another hospital neurology department which re-affirmed the injuries of CN IX, X, XI, and XII and termed it "palsy due to chiropractic manipulation".

Post treatment follow-up

At the several hospitals where he was examined and treated, the patient underwent extensive diagnostic studies of CT and MRI post chiropractic treatment. He received multiple intravenous (IV) corticosteroids, along with rehabilitation and training aimed at restoring ability to perform activities of daily living, with an emphasis on speech and swallowing therapy. His symptoms improved slowly over several months.

Post treatment imaging findings

X-rays of the cervical and thoracic spine revealed:

- Moderate bilateral acromioclavicular (AC) joint arthrosis, cervicothoracic rotatory scoliosis apexed right at T5 and left at C5-6, reversed lordotic curve of mixed traumatic and degenerative nature found at the levels of C3-C6 with resultant multiple level osteophytes, and anterior vertebral body traumatic wedge of C5
- The tracheal air shadow deviated to the left at C6-C7

Cervical spine CT and MRI axial, sagittal, and coronal views revealed:

- C1-2 moderate calcification of the transverse ligament (**Figure 1**)
- C1-2 right side 3-millimeter osteophytes at the lateral end plates of C2's superior articular facet and C1's inferior articular facet
- C1-2 posterior arch calcification and soft tissue buckling producing osseous and soft tissue canal stenosis of 11 millimeters (normal = 17mm) (**Figure 1**)
- C1 old partial compression fracture and arthrosis at right lateral mass at its medial section
- Hypertrophy of bilateral sub-occipitals, the left upper trapezius region, and the left sternocleidomastoid muscles
- Hypotrophy was noted at the right levator scapulae and splenius capitis
- C3-4 bilateral narrowed inter-vertebral foramen (IVF) and spinal canal stenosis of 8.7 millimeters (normal = 12mm), and traction osteophytes at the anterior right sided vertebral body 9 millimeters long (**Figure 2**)
- C4-5 canal stenosis of 9.6 millimeters (normal = 12mm) with a large right antero-lateral traction/traumatic induced 14 millimeter osteophyte just behind the epiglottis. Right vocalis muscle supporting the right vocal cord is laterally loosened at its front and buckled medially at its posterior origin (**Figure 3**)
- C5-6 severe disc degeneration with concomitant old calcified posterior disc protrusion and resultant spinal stenosis of 7 millimeters (normal = 12), bilateral IVF narrowing and multiple anterior osteophytes 7.5 millimeters long
- C6-7 moderate narrowing of IVF bilaterally, antero-lateral left 7 millimeter and right 9 millimeter long osteophytes
- Enlargement of the subclavian vein and iodized thyroid lobes



Figure 1
C1-2 transverse ligament calcification (white arrow) and stenosis due to soft tissue buckling and posterior arch calcification (black arrow)



Figure 2
Large C3-4 anterior osteophytes (arrow)



Figure 3
 Right vocal cord palsy (white arrow) and large osteophytes (black arrow)

DISCUSSION

Cranial nerves IX, X, and XI exit their respective nuclei at the brain stem below the pons, where they bend medially to exit the skull via the jugular foramen along with the jugular vein. CN XII exits the brain stem and bends medially into the hypoglossal canal where it exits the skull.² The canal is located 5 millimeters antero-lateral to the brim of the foramen magnum and the jugular foramen is located 10 millimeters lateral to it.

They descend in front of the C1 and C2 transverse processes and bundled with the internal carotid as the vagal bundle. This bundle is further protected between the internal carotid artery and the jugular vein. The vagal bundle is also protected by musculature from the front by the anterior and medial scalene, longus capitis, longus coli, sternothyroid, and sternohyoid muscles. From the front and sides, it is protected by the sternocleidomastoid, omohyoid, and the platysma. From the back, it is protected by the thickest layers of the posterior scalene, levator scapulae, upper trapezius, and splenius capitis and cervicis muscles. In addition, the bundle is protected by lymph node chains that travel along the large blood vessels of the neck.

CN XII crosses over the vagal bundle and travels under the mandible at the level of C2 to innervate the tongue. It gives off branches to the C1 and C2 anterior roots to form the ansa cervicalis (branches from C1,2,3) that innervate the inner cervical spinal musculature.

CN XI leaves the bundle at the level of C2 and travels posterior along the inner layer of the upper trapezius to innervate, along with the posterior efferent of the C1-C5 spinal nerves, the posterior neck musculature, and the serratus anterior. CN IX and X innervate the soft palate, esophagus, trachea, and the complex musculature of the epiglottis and vocal cords.¹⁵⁻¹⁷

The bilateral recurrent laryngeal nerves (RLNs) branch off the bilateral descending vagal bundles and enter the larynx just behind the cricoarytenoid joints. They supply the intrinsic laryngeal muscles and function to abduct the vocal cords, which affects the space for air passage while a person is attempting to speak or initiate vocalization.

The cricothyroid muscle is the only intrinsic laryngeal muscle not supplied by the RLN, with its motor neuronal supply coming directly from the superior laryngeal branch of the vagus nerve. Juxta to the intrinsic muscles are the posterior cricoarytenoid muscles, the main vocal cord abductors, innervated by the ipsilateral RLN.¹⁷

A literature search related to injuries of the vocal cord and/or soft palate and tongue revealed dozens of case reports and several studies.¹⁸⁻²² Unilateral temporary vocal cord paralysis due to an iatrogenic compressive force, also known as Tapia Syndrome, has been reported several times in the literature.¹⁸ This occurs while modifying the patient's airway when performing intubation or bending and laterally flexing the neck, resulting in mechanical compression of the RLN, entrapment of the anterior branch of the inferior laryngeal nerve (ILN) by the cuff of an endotracheal tube against the postero-medial part of the thyroid cartilage. Hypoglossal nerve damage could also be caused by stretching/compressing the nerve against the greater horn of the hyoid bone by a laryngeal mask or endotracheal tube or compression of the posterior part of the laryngoscope or oro-tracheal tube. Most reports pertain to iatrogenic injuries to the RLN due to surgical procedures. Vocal cord paralysis is the most common otolaryngologic complication after anterior cervical spine surgery with plating.²²

Other reports describe ipsilateral RLN effects following posterior cervical spine laminoplasty due to spinal stenosis and prone placement of the patient. In that surgical position, patients were anesthetized and endotracheally intubated with the patient's head and neck flexed, leading to RLN compression against the endotracheal tube (ET).¹⁹ Additional reports center around other interventions such as open-heart surgery, thyroiditis either from inflammation, neck trauma, or thyroid cancer, rhinoplasty operation, or radiation-induced cranial nerve paralysis in head and neck cancer.¹⁸⁻²² A 2007 cohort study found that over a 20 year longitudinal study, a unilateral RLN palsy occurred 2/3 of the time due to unilateral neck surgeries (66%), such as anterior cervical spine, external carotid aneurism, or carotid endarterectomy. Unilateral thyroid surgeries were found as the most common (33%) iatrogenic causes. Bilateral iatrogenic vocal fold palsy occurred most often after bilateral thyroidectomies.^{21,23}

Patient positioning during surgeries of the rotator cuff often use the upright beach chair position, which has resulted in neurapraxia of the RLN due to mechanical head and mandible flexion compression of the endotracheal tube (ET) and the laryngeal wall over the RLN, followed by an immediate temporary vocal cord palsy.²⁴⁻²⁶ In iatrogenic cases due to neck and shoulder surgeries, about 50% of patients were found to have a favorable prognosis of full recovery in about 6 months.³⁰ Yamada et al., reported recovery of vocal fold mobility in 13 of 19 patients.²⁸ In contrast, recurrent laryngeal nerve temporary paralysis (RLNTP) of unknown causes were found to have a less favorable prognosis with recovery rates of 29.5% unless they were actively engaged with ear, nose, and throat (ENT) follow-ups and speech rehab post-surgery.²⁹

Kawamura et al. reported that 33.3% (37 of 111 patients) followed over 6 months after onset, showed a certain degree of improvement in vocal fold movement within 3 months.²⁹ The rest of the patients with unilateral RLNTP required an appropriate treatment for hoarseness.

Additional literature review for different extra-spinal related nerve injuries indicated several cases resulting from spinal manipulation, motor vehicle accident, or other trauma.³¹ There were 4 cases of phrenic nerve injuries from 1985 to 2007 that occurred after or closely after cervical spine manipulation.³²⁻³⁶ Additional cases of nerve stretching injuries such as Neck-tongue Syndrome occur due to a traumatic stretch of the ansa cervicalis neural loop that encompasses portions of CN XII below the angle of the mandible. This syndrome has been reported to respond well to chiropractic care.³⁶⁻³⁷

The aforementioned 20-year study which examined reported cases of RLN palsy did not report even one case due to spinal manipulation.²¹ There was however, a relatively recent case study describing chiropractic rehabilitation of a patient suffering transient vocal cord palsy post rotator cuff surgery. This surgical patient's position allowed the persistent compressive load of the head and mandible over the hyoid bone and trachea, anterior neural bundles, and musculature while under anesthesia. The chiropractic rehab protocol consisted of soft tissue therapy such as light stretching and instrument-assisted soft tissue mobilization aimed at entrapment of the LGN bundle, as well as gentle passive spinal mobilization and gentle spinal manipulation. This study postulated a therapeutic effect resulting in complete symptom relief and functional resolution of the vocal cord palsy.³⁰

Considering the close proximity of the RLN to the large spinal osteophytes presented in this patient's cervical spine CT, it would be reasonable to consider the possibility of daily friction to nerve and muscle tissues resulting from his active lifestyle. Additionally, contributing factors such as past physical traumas, cigarette smoking, drinking habits, borderline diabetes, and hypertension in addition to stress may all have a possible contribution to weakening neural tissues and making them more susceptible to shearing/stretching injuries such as neuropraxia, even before and without the chiropractic manipulations. The rarity of such vocal cord injury under the realm of chiropractic care due to spondylotic changes in the cervical spine and myofascial syndromes can be attributed to other causative factors aside from shearing/stretching due to spondylotic osteophytes. Anatomically protective soft tissues and the lack of advanced imaging findings suggestive of soft tissue edema, or identifiable neural stretching injury sites, or clots, or thrombus, or tumors in this patient, may suggest a plausible conclusion of a shearing accident at the sites of osteophytic friction at C1 and C2, and/or C3 and C4 affecting the nerve bundles.

Moreover, the proximity of the paralytic event effecting the vocal cord, soft palate, and tongue shortly after the manipulation do raise a suspicion for a correlative relationship between treatment and the evolving tongue, soft palate, and right sided vocal cord paralysis.

CONCLUSION

Transient vocal cord palsy (TVCP) or in similar acronym as recurrent laryngeal nerve temporary paralysis (RLNTP) following spinal manipulation or physical treatment to the cervical spine is rare, and to the author's knowledge the case reported here is the first reported event.^{38,39} It mostly occurs in frontal-approach neck surgeries or in rotator cuff surgeries where anesthetized patients are positioned by the surgeon in an upright seated-beach position with their head and neck being flexed, with an occurrence rate of up to 50%.^{24,25,30} It may occur when the vagal and the recurrent laryngeal nerve bundles are compressed or sheared over a rigid element such as vertebrae or when the inserted endotracheal tube (ET) presses against the laryngeal wall, or when there is an extended physical stretch time period by utilization of a surgical retraction system during a frontal approach surgery.²² These nerve injuries scale in severity classification from neuropraxia to axonotmesis with relatively good prognoses.^{24,30}

In cases of known severe osteophytosis, consideration of utilization of a low force therapeutic approach can limit neck rotation and may reduce the likelihood of fast stretching and shearing effects of the neural bundle, soft tissues, and the cervical spine.^{2,30}

Many different management strategies exist for neck pain and no single modality can address all issues. Instead, a multimodal patient-centered approach is recommended where modalities such as exercise and manual therapy can be used in addition to a thorough patient-specific explanation including possible underlying reasons for the condition and potential work practice and self-management strategies.^{1-4,30} Due to the rarity of this condition and the presumed relationship to spinal manipulation, conclusions should be drawn cautiously.

Further studies of cervical manual multimodal therapies to patients with advanced spondylosis are needed to evaluate and examine the above-mentioned etiologies and therapeutic protocols. Amendment of the list of red flags when considering chiropractic manipulation in the accepted professional guidelines should be considered.

LIMITATIONS

There are several limitations of this case study. It is impossible to scientifically conclude causation between the manipulation of the cervical spine directly with this patient's symptoms. Further, the imaging findings from the radiologists' reports did not reveal evidence of anatomical injury to any nerve or vascular tissue, and as a result it is impossible to ascertain exactly what transient injuries such as neuropraxia may have occurred to the CN IX-XII neural tracts.

CONSENT

Written informed consent was obtained from the chiropractor and the patient for the publication of this case report and any accompanying images. Copies of the written consents are available for review by the Editor-in-Chief of this journal.

COMPETING INTERESTS

The author declares no competing interests.

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