

# VASCULAR THORACIC OUTLET SYNDROME: A CASE REPORT

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## ABSTRACT

**Objective:** To discuss the chiropractic management of a patient with vascular thoracic outlet syndrome.

**Clinical Features:** A 30-year-old male reported sudden onset of intermittent numbness, tightness, and weakness in his right hand. He presented with skin flakes of his right upper limb, cyanosis in the right shoulder; and a cold and pale right hand. Exercise was identified as the provoking motion. Orthopedic examination revealed a positive Allen's test and modified Adson's tests. His motor strength of right elbow/wrist flexors and extensors were graded 4/5, and both flexors and abductor of his right 5th metacarpal were significantly weaker than his left. He had been previously diagnosed by a neurologist with arterial thoracic outlet syndrome and prescribed muscle relaxants, physiotherapy exercise, massage therapy, and acupuncture.

**Intervention and Outcome:** The treatment protocol included spinal manipulative therapy, thermal ultrasonography, instrument-aided soft-tissue mobilization, and extension-compression traction. His symptoms completely resolved, and his repeated orthopedic exams for thoracic outlet syndrome and cervical lordosis were normal.

**Conclusion:** A 30-year-old male with vascular thoracic outlet syndrome was successfully treated with chiropractic management. (*J Contemporary Chiropr* 2021;4:142-145)

**Key Indexing Terms:** Thoracic Outlet Syndrome, Conservative Treatments, Conservative Management, Chiropractic Manipulation

## INTRODUCTION

Thoracic outlet syndrome (TOS) is a complex condition affecting the neurovascular bundle located between the scalene triangle and the inferior border of the axilla. TOS can be classified into subgroups based on the structure affected: arterial TOS, venous TOS, or neurogenic TOS, and can be further sub-classified according to the causes (e.g. congenital, traumatic, function) (1). TOS can

present clinically in a number of different ways, including pain, numbness, paresthesia, or muscle weakness in the upper limb, swollen or cyanotic upper limb, large veins in the shoulder, chilly and pale hand, and pain during overhead arm motions. (2) Therefore, TOS can often be confused with other conditions with similar presentation such as cervical radiculopathy and brachial plexopathy.

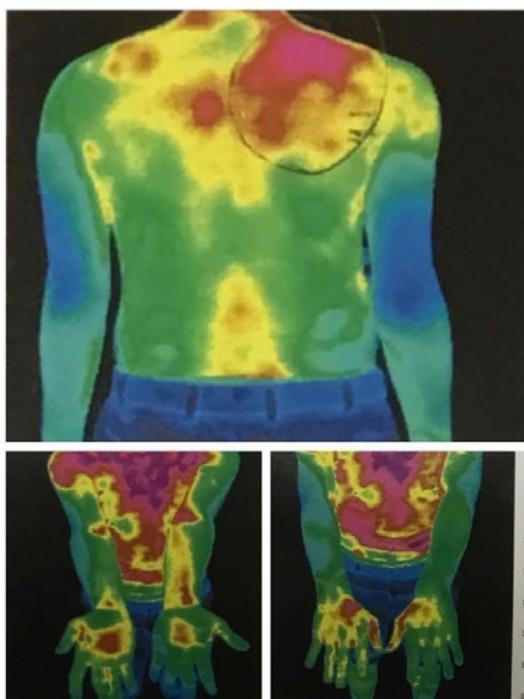
TOS has been most consistently diagnosed and classified when a complete history, clinical presentation, physical examination, and relevant radiographic and electrophysiological investigations are included. (3) Due to the non-specific nature of regularly used provocative tests such as Allen's and modified Adson's, there is no standard approach for establishing the diagnosis. (2,3) Although TOS is often treated conservatively, the evidence of its efficacy is weak due to the lack of publication on conservative TOS treatment. (4) This case report aims to add to the pile of evidence demonstrating conservative and chiropractic treatment can provide value in helping patients with TOS.

## CASE REPORT

### History

A 30-year-old male had a sudden onset of intermittent numbness, tightness, and weakness in his right hand. The paresthesia was primarily on the right, and he was unable to use his right thumb to operate a smartphone or pinch with his right first and last fingers due to the weakness. He stated that the symptoms began with a right shoulder separation injury, and he experienced swelling and a chilly sensation throughout his right upper arm. Exercise was identified as the provoking motion, and pain medicines were shown to be ineffective. He described the experience as a combination of pain, numbness, and tightness, which he assigned a rating of 6/10 on the Numerical Rating Scale (NRS). Due to his allergy to the contrast media, his neurologist ordered laboratory and diagnostic tests, including MRIs of the cervical, thoracic, lumbar, right shoulder, and right wrist; general blood work; EMG and nerve conduction studies of the upper limbs; and body thermography. His MRIs demonstrated negligible lumbar disc bulging and mild rotator cuff tendinitis, and thermography revealed unequal shoulder and hand temperatures (Figure 1). He was treated for Arterial TOS with muscle relaxants, physiotherapy

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**Figure 1.** Thermography revealed asymmetrical temperature on posterior shoulder, ventral and dorsal sides of hands

exercise, massage therapy, and acupuncture, but none of these treatments improved his symptoms. He opted out of surgery and sought chiropractic care.

#### Physical and Other Examinations

The patient had skin flakes of his right upper limb, cyanosis on the right shoulder (Figure 2); and a cold and pale right hand (Figure 3). Orthopedic examination revealed positive Allen's test on the right for radial artery insufficiency; and positive modified Adson's tests for bilateral upper limb numbness with right diminished



**Figure 2.** On observation, the patient presented with skin flakes of his right upper limb, cyanosis on the right shoulder.

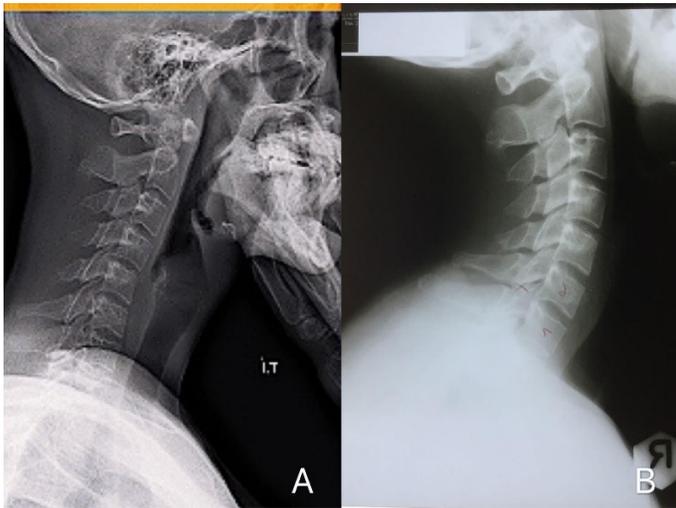


**Figure 3.** On observation, the patient's right hand was cold and pale compared to the left.

pulse. Muscular palpation indicated swelling along his right upper arm, hypertonicity on the right scalene muscles, and hypotonicity at right rhomboid and levator scapulae. His motor strength of right elbow/wrist flexors and extensors were graded 4/5, and both flexors and abductor of right 5th metacarpal were significantly weaker than left. (Figure 3). Spinal palpation revealed intersegmental dysfunction in C4/5, C5/6, T1/2, and T3/4 and his cervical spine X-ray revealed reduced cervical lordosis and forward head posture (Figure 4A). Based on the clinical presentation and no identifiable cervical ribs diagnostic images, our diagnosis was thoracic outlet syndrome (TOS).

#### Management

The treatment protocol for this patient included spinal manipulative therapy (diversified approach) and thermal ultrasonography to rehabilitate the cervical and thoracic regions' mechanical and nerve dysfunction. To rectify the posture deviation, instrument aided soft tissue mobilization (IASTM) (Strig<sup>®</sup>, IASTM Tool, Korea) was used on the scalene muscles at every visit, and strengthening exercises were prescribed for the trapezius, pectoralis, levator scapulae, and rhomboids. He received 24 treatments over a 6-week period and experienced complete remission of his upper arm symptoms and skin issues, but observed periodic tingling in his left hand. He resumed his treatment with the goal of correcting his posture. Extension-compression traction (Chiropractic Biophysics Technique<sup>®</sup>) was added to his treatment schedule twice weekly for an additional 3 months to improve his frontal head position. The patient reported that his symptoms had completely resolved, and his



**Figure 4.** Cervical hypolordosis on lateral X-rays. (A) Pre-treatment sagittal radiograph indicated loss of cervical lordosis, with neck curvature of  $-3^{\circ}$  (range:  $20^{\circ}$  to  $35^{\circ}$ ). (B) Five months later after treatment, the cervical curvature was restored, measured  $35^{\circ}$  by posterior tangent method

repeated orthopedic exams for TOS and cervical lordosis on radiograph were normal at progress review. (Figure 4B).

#### Follow-up and Outcome

At the 12-month follow-up, the restoration of craniocervical stability improved neck pain, cervical mobility, and overall quality of life. The patient did not complain of reappearance of TOS signs and symptoms, and expressed high satisfaction with the treatment. During the 12-month period of care, no adverse events occurred.

## DISCUSSION

TOS is a complicated condition that affects the neurovascular bundle sitting between the scalene triangle and the axilla's inferior border. Venous TOS only accounts for 5% of TOS and the compression of the subclavian vessels usually occurs at the scalene triangle, the costoclavicular space, and the subcoracoid space. In patients with arterial TOS, cervical rib represents 50%, followed by soft tissue anomalies in 33% of patients and post-clavicle fracture representing 5%, leading to impingement of the artery (5). Vascular obstruction causes signs include cyanosis, pallor, coldness, and early fatigability; therefore, clinical presentation becomes critical in making diagnosis of TOS. (6)

Due to the non-specific nature of TOS, the diagnosis of it should be accompanied with numerous possible differential diagnoses. For suspected TOS that has pain and numbness, cervical radiculopathy, brachial plexopathy or complex regional pain syndrome (CRPS)

should be considered based on the patient's history. Raynaud phenomenon and deep vein thrombosis are points of consideration if signs and symptoms indicate vascular involvement. One may also need to rule out other anatomical changes (e.g. cervical rib, abnormal tendon insertions etc.) and acquired anatomic anomalies such as muscle hypertrophy (7). Imaging tools such as MRI and EMG are useful in ruling out causes and reduce the list of differential diagnosis (8).

Our patient had both neurological and vascular signs and symptoms, supplemented with changes in thermal imaging. No anatomical anomalies were noted on plain-film X-ray investigation. Previous treatments prescribed by his neurologist, including muscle relaxants, physical therapy massage therapy and acupuncture, failed to help. Chiropractic treatment provided to this patient is similar to what was provided by his neurologist except the introduction of spinal manipulation into his management plan. Both neurological and vascular signs and symptoms were alleviated after 24 treatments over a 6-week period, with demonstrable recovery of cervical lordosis at the 12-month follow-up. This demonstrated the value in including chiropractic treatment in the TOS treatment plan.

Effective management of the TOS requires early recognition and elimination of other pathologies. Goals of chiropractic treatment include (i) alleviation of motor and sensory dysfunction, (ii) reduction of vascular symptoms and (iii) restoration of muscular and osteopathic dysfunction. Studies have confirmed the effectiveness of chiropractic spinal manipulation for alleviating cervical radiculopathy. (9) It also helps increase the lymphatic return from sympathetic responses, which can then help eliminate swelling. (10) IASTM was useful to improve soft tissue function, remove pain substrates of hypertonic muscle fibers, and reduce swelling. (11) Restoration of the hypolordotic cervical curvature may also help relieve the nerve tension, release its pinched nerve, and subsequently alleviate arm numbness and muscle weakness in this patient. (12) Cervical radiculopathy has been shown to respond to correcting a lateral head posture recently. (13) Lateral head posture may also influence TOS by increasing nervous tension, thus another point of entry in treating TOS.

Although several studies have shown improvement with conservative care, they are far and few between. The uncertain diagnostic criteria and the lack of a "gold standard" limit the generalizability and clinical utility of the studies. (14) Orthopedic provocative tests may be unreliable since ischemic symptoms vary depending on chronicity and duration of ischemia. (15) Full body thermography is a cost- and time- effective supplementary tool for assessment of temperature distribution associated with circulation disruption.

Electrophysiological assessment using EMG examination and nerve conduction studies are useful in identifying nerve injury. Arteriography is only meaningful to assist with planning blood vessels reconstruction. (16)

#### Limitation

Due to the nature of case study, this can only be served as a demonstration of association between treatment provided and the eventual resolve of the patient's symptoms. The lack of 'gold standard' limited generalizability of studies.

## CONCLUSION

We discuss the management of TOS in a 30-year-old male with who successfully responded to conservative and chiropractic management. This study will aid in adding to existing evidence where TOS respond to non-surgical treatment. A more standardized and cost-effective diagnostic approach is needed to more precisely differentiate the affected structures and diagnosis.

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## REFERENCES

- Jones MR, Prabhakar A, Viswanath O, *et al.* Thoracic outlet syndrome: a comprehensive review of pathophysiology, diagnosis, and treatment. *Pain Ther* 2019;8(1):5-18
- Sanders RJ, Hammond SL, Rao NM. Diagnosis of thoracic outlet syndrome. *J Vascular Surg* 2007;46(3):601-604
- Huang JH, Zager EL. Thoracic outlet syndrome. *Neurosurg*2004;55(4):897-903
- Lo CC, Bukry SA, Alsuleman S, Simon JV. Systematic review: The effectiveness of physical treatments on thoracic outlet syndrome in reducing clinical symptoms. *Hong Kong Physiother J* 2011;29(2):53-63
- Qaja E, Honari S, Rhee R. Arterial thoracic outlet syndrome secondary to hypertrophy of the anterior scalene muscle. *J Surg Case Rep* 2017;2017(8)
- Thompson JF, Jannsen F. Thoracic outlet syndromes. *Br J Surg* 1996;83(4):435-436
- Yuschak E, Haq F, Chase S. A case of venous thoracic outlet syndrome: primary care review of physical exam provocative tests and osteopathic manipulative technique considerations. *Cureus* 2019;11(6)
- Povlsen S, Povlsen B. Diagnosing thoracic outlet syndrome: current approaches and future directions. *Diagnostics* 2018;8(1):21
- Murphy DR, Hurwitz EL, Gregory A, Clary R. A nonsurgical approach to the management of patients with cervical radiculopathy: a prospective observational cohort study. *J Manipulative Physiol Ther* 2006;29(4):279-287
- Chu EC, Chan AK, Lin AF. Pitting oedema in a polio survivor with lumbar radiculopathy complicated disc herniation. *J Family Med Prim Care*.2019;8(5):1765-1768
- Kim J, Sung DJ, Lee J. Therapeutic effectiveness of instrument-assisted soft tissue mobilization for soft tissue injury: mechanisms and practical application. *J Exerc Rehabil* 2017;13(1):12-22
- Chu EC, Lim T, Mak K. Cervical Radiculopathy alleviating by manipulative correction of cervical hypolordosis. *J Med Cases* 2018;9(5):139-141
- Berry RH, Oakley P, Harrison DE. Alleviation of radiculopathy by structural rehabilitation of the cervical spine by correcting a lateral head translation posture (-TXH) using Berry translation as a part of CBP Methods. A case report. *Chiropr J Australia* 2017;45(1):63-72
- Hooper TL, Denton J, McGalliard MK, Brismée J, Sizer PS Jr. Thoracic outlet syndrome: a controversial clinical condition. Part 1: anatomy, and clinical examination/diagnosis. *J Man Manip Ther* 2010;18(2):74-83
- Sanders RJ, Pearce WH. The treatment of thoracic outlet syndrome: A comparison of different operations. *J Vasc Surg* 1989;10(6):626-634
- Jones MR, Prabhakar A, Viswanath O, *et al.* Thoracic outlet syndrome: a comprehensive review of pathophysiology, diagnosis, and treatment. *Pain Ther* 2019;8(1):5-18