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Outpatient Physical Therapy Management of a Patient with Thoracic outlet Syndrome and Cervical Radiculopathy: A Case Report

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OUTPATIENT PHYSICAL THERAPY MANAGEMENT OF A PATIENT WITH THORACIC OUTLET SYNDROME AND CERVICAL RADICULOPATHY: A CASE REPORT

by

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This Scholarly Project, submitted by Morgan Burrer in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

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Signature Mary Beth Brown, SPT

Date 10/14/20

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ABSTRACT

Background and Purpose. Thoracic Outlet Syndrome is a condition that produces symptoms of pain, numbness, and weakness that may affect the arm, shoulder, or neck. Similarly, cervical radiculopathy is a condition resulting from the compression of cervical nerve roots. The purpose of this case report is to describe an appropriate outpatient physical therapy intervention program for a 69-year-old male who has the diagnoses of cervical radiculopathy, impaired cervicothoracic mobility, and thoracic outlet syndrome.

Case Description. The patient had a significant past medical history including coronary artery disease, chronic pain, and a C4-C5 fusion. His primary goal was to decrease his pain and neural symptoms.

Intervention. Treatment included manual therapy techniques including cervical distraction and mobilizations, therapeutic exercises and therapeutic activities focused on strengthening postural muscles.

Outcomes. The patient reported decreased pain, improved cervical range of motion, improved tolerance to activity, and decrease in neural symptom frequency, intensity, and duration.

Discussion. This case report may suggest a benefit of conservative physical therapy intervention for the management of Thoracic Outlet Syndrome and cervical radiculopathy.

CHAPTER I

BACKGROUND AND PURPOSE

According to the National Institute of Neurological Disorder and Stroke, thoracic outlet syndrome (TOS) is a condition that involves the compression of the nerves, arteries, and veins in the lower neck and upper chest area. Common symptoms affecting the arm, shoulder, or neck may include pain, numbness, paresthesia, headaches, weakness in the arm and hand, ischemia, and swelling.[1] TOS is typically caused by compression of the brachial plexus or subclavian vessels as they pass through narrow passageways leading from the base of the neck to the axilla and arm.[2] For more detail see Figure 1. There are many causes of TOS which may include but are not limited to: physical trauma, anatomical defects, tumors, poor posture, pregnancy, and repetitive upper body movements.[2]

Thoracic outlet syndrome is categorized into two specific clinical categories: vascular TOS and neurological/neurogenic TOS. Vascular TOS is further subcategorized into arterial and venous. Neurological TOS is further subcategorized into true, disputed, symptomatic, or nonspecific. It is estimated that over 90% of cases are neurogenic in origin, whereas 1% are arterial and approximately 3% to 5% are venous.[3] Arterial TOS is rare and involves structural abnormalities with compression of the subclavian or axillary artery. Venous TOS may involve acute thrombosis, effort thrombosis, or occlusion of the subclavian vein. True neurogenic TOS is rare and occurs with an anatomical abnormality such as an elongated C7 transverse process.[3]

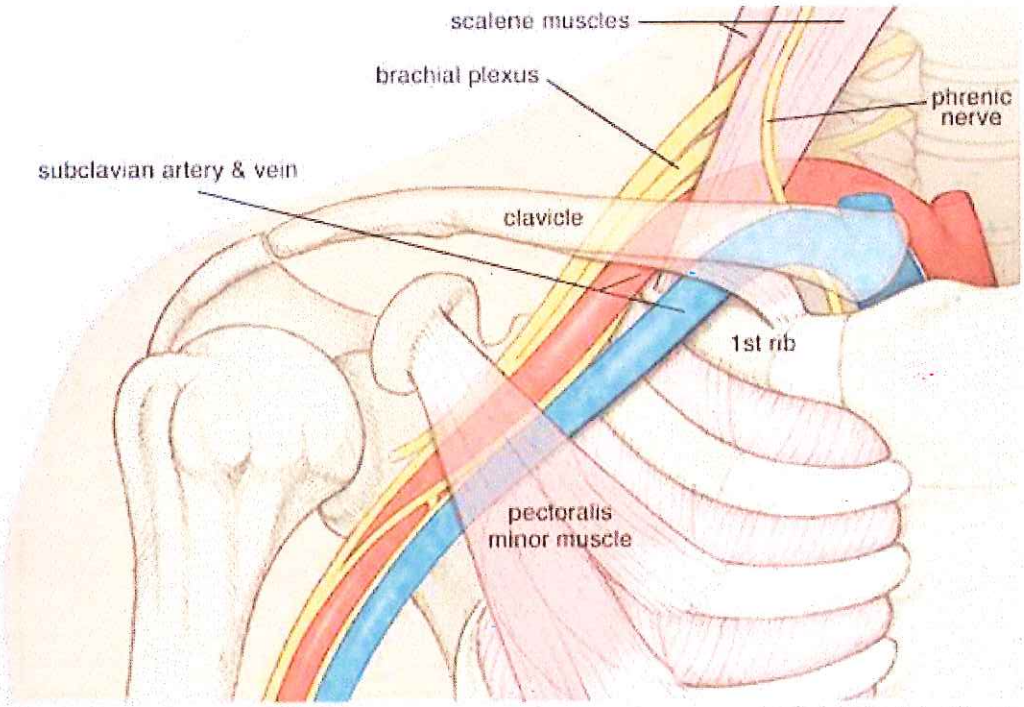

Figure 1. Thoracic outlet syndrome anatomical structures
Reprinted from: https://thepaintedlines.com/thoracic-outlet-yndrome-deep-dive/

Finally, nonspecific neurogenic TOS is the most common and involves no definitive radiologic evidence of bony anomaly. It may also involve intermittent compression of the neurovascular bundle with symptom aggravation dependent on movement, sustained activity, shoulder elevation or depression, or posture. The true number of TOS cases is difficult to figure due to the variability in symptoms and presentation. However, research has reported an incidence of 3-80/1000 with neurogenic TOS accounting for over 90% of these cases.[4]

For those who are affected by TOS, there are ways to manage and treat this syndrome. Conservative treatment has been shown to decrease the effects and symptoms of TOS in multiple research studies.[5,6,7] A systematic review by Chi-ngai et al. concluded that clinicians should consider exercises as a major part of conservative treatments.[5] Watson et al. also noted improvement in symptoms with exercises focused on stretching the levator scapulae, scalenes, lower trapezius, and pectoralis minor, and strengthening the sternocleidomastoid, upper

trapezius, levator scapula, and serratus anterior to assist in decreasing compression of various subclavian structures.[6] This evidence suggests that physical therapy has an effective and beneficial role in the treatment of TOS.

Another condition that is prevalent in patients with symptoms similar to TOS is cervical radiculopathy (CR). Instances occur where patient have both TOS and CR. Cervical radiculopathy is a clinical condition resulting from the compression of cervical nerve roots. The clinical manifestations of cervical radiculopathy are broad and may include pain, sensory deficits, motor deficits, diminished reflexes, or any combination of these.[1] Patients with cervical radiculopathy typically present with unilateral pain. This neck pain may be associated with radiation into the ipsilateral arm.[1] Cervical radiculopathy affects 107.3 per 100,000 men and 63.5 per 100,000 women in the United States.[1]

For patients with cervical radiculopathy, a general consensus exists within the literature that using manual therapy techniques in conjunction with therapeutic exercise is effective in increasing function, as well as active range of motion (AROM), while decreasing levels of pain and disability.[3] In continuing to look at the value and significance of conservative treatment, research has found that cervical traction, manual therapy, and deep neck flexor muscle strengthening may be beneficial in the management of cervical radiculopathy and produces short-term successful outcomes.[8]

The rehabilitation services and clinical knowledge provided by a physical therapist have been shown to decrease signs and symptoms of both TOS and cervical radiculopathy. This in turn may improve a patient's quality of life, increase social interaction and participation in the community, and improve functional outcomes. Further research, investigation, and case studies

will be valuable in determining outcomes for patients who have both TOS and cervical radiculopathy.

The purpose of this case report is to describe an appropriate outpatient physical therapy intervention program for a 69-year-old male who has the diagnoses of cervical radiculopathy, impaired cervicothoracic mobility, and thoracic outlet syndrome. This case study will also examine the interventions used for this patient over the course of 8 weeks of treatment and the results from these interventions. This will demonstrate that conservative physical therapy treatment can improve the symptoms related to both cervical radiculopathy and thoracic outlet syndrome without the need for an invasive procedure thus saving time, money, and resources.

CHAPTER II

CASE DESCRIPTION

The patient was a 69-year-old male who was referred to physical therapy for neck pain. He was retired and was living at home with his wife at the time of treatment. He stated that he enjoyed golfing, biking, and playing with his grandchildren. He was pleasant and talkative, 5'9" tall, and weighed about 170 pounds. During subjective questioning, the patient reported left anterior chest and left arm paresthesia that increased with cervical rotation. He reported constant paresthesia in his left hand and significant changes in sensation with certain movements. He also had neck and shoulder pain that affected his ability to lift or hold items and reach across his body. After completing physical yard work, including lifting tree branches, 6 weeks prior to the physical therapy initial evaluation, the patient stated that the paresthesia into his left arm had been progressively getting worse. This also caused significant neck pain, stiffness, and soreness. He reported the soreness had decreased but the altered sensation had gotten worse.

His past medical history included: coronary artery disease, cranial neuralgia, sleep apnea, degenerative joint disease in multiple sites, arthritis and chronic pain in left shoulder, major depressive disorder, a pacemaker, left shoulder hemiarthroplasty, rheumatoid arthritis, C4-C5 fusion 10 years prior to the current physical therapy evaluation, carpal tunnel syndrome, and cervical stenosis. He was also taking multiple medications and reported having skin sensitivity to pool chemicals which would inhibit his potential participation in aquatic therapy. See Appendix 1 for the patient's complete medication list. The patient's goal was to avoid surgery and reduce the numbness and tingling sensations he was experiencing.

A formal systems review was not performed as the patient was deemed medically stable and appropriate for physical activity by his physician prior to the start of physical therapy. He did not display any signs or symptoms of various red flag markers such as uncontrolled hypertension, uncompensated heart failure, or significant pulmonary disease. He did not have any obvious skin lesions or open wounds. Finally, he was consistently following up with his primary care physician and specialists for his other underlying medical conditions and his medical record indicated appropriate medical management.

Following the history and analysis of the subjective information provided by the patient, he was deemed appropriate for physical therapy. Many factors contributed to this decision to accept the patient care. He was medically stable following a review of his underlying medical conditions. The physical therapist had appropriate knowledge, education, and experience from prior patients with similar signs and symptoms. Based on clinical research, positive effects could be anticipated from this patient's participation in physical therapy.[3,5]

Finally, the patient had insurance coverage for physical therapy services, and the equipment required for treatment was available at the clinic. An examination plan was developed to assess the patient's musculoskeletal system and appropriate aspects of his nervous system. This examination involved range of motion (ROM), strength, functional mobility, and administration of special tests.

Examination, Evaluation and Diagnosis

Measurements were assessed with the patient seated on a plinth with his feet supported. Active range of motion (AROM) of right shoulder was within normal limits (WNL). AROM of his left shoulder was limited in flexion, abduction, and internal rotation. Cervical AROM was limited in rotation bilaterally, lateral flexion bilaterally, flexion and extension. Pain

in both right and left upper trapezius was reproduced with contralateral rotation. He had symptoms of paresthesia into his left upper extremity with left cervical lateral flexion and extension. See Table 1 for complete range of motion results.

Strength was tested using the standard resisted isometrics as specified in Magee's *Orthopedic Physical Assessment.*[9] The motions included shoulder flexion, extension, internal and external rotation, abduction, adduction, and elbow flexion and extension. All motions were found to be 4/5 bilaterally.

Table 1: Active Range of Motion at Initial Evaluation

Shoulder	**Left**	**Right**
Flexion	120° + pain	WNL
Abduction	150° + pain	WNL
Internal Rotation	Reach to T7 with pain	WNL
Neck	**Left**	**Right**
Flexion	chin to chest with pain	
Extension	12° + LUE	
Lateral Flexion	11° + LUE	22°
Rotation	45° with pain	53° with pain

+Denotes Numbness and Tingling Present
LUE: Left Upper Extremity
WNL: Within Normal Limits

Postural deviations and movement quality were assessed through observation. Postural deviations included increased right shoulder elevation and thoracic kyphosis. He also demonstrated forward head posture, rounded shoulders, and was often slouched forward while sitting. He demonstrated hesitation with movements that regularly reproduced pain.

Following the prior assessments, five special tests were completed following the standardized protocol found in Magee's *Orthopedic Physical Assessment.*[9] The selection of tests used were based on the patient's signs and symptoms as well as a working hypothesis of the patient's pathology. The tests included cervical compression and distraction, Adson's Test or

Maneuver, Wright's Hyperabduction Test or Maneuver, and the Military Brace Test (also known as the Costoclavicular Syndrome Test). The last three tests mentioned are considered positive for TOS if there is abolition of the palpated pulse. The cervical distraction test is considered positive for increased pressure on the nerve roots if there is a decrease in pain or symptoms while the cervical compression test is considered positive if there is an increase in pain or symptoms. See Table 2 for special test findings.

Table 2: Special Tests at Initial Evaluation

Test	**Left**	**Right**
Cervical Compression	Positive for radiating symptoms	
Cervical Distraction	Positive for relief of symptoms	
Adson's Test	Positive with decreased pulse and increased symptoms	Negative
Wright's Hyperabduction Test	Positive with decreased pulse and increased symptoms	Negative
Military Brace Test	Positive with decreased pulse and increased symptoms	Positive with decreased pulse and increased symptoms

Research has shown that TOS provocative tests including Adson's, Wright's Hyperabduction, Roo's, and Tinel's had mean sensitivity and specificity values of 72% and 53%, respectively, with better values for the Adson test (positive predictive value [PPV], 85%), the hyperabduction test (PPV, 92%), and the Wright test. Researchers have examined the effects of provocative testing compared to the results of a helical 3D CT angiography and found that specificity increased when several provocative tests were used in combination. The Adson's test seemed to be the most effective when used in combination with the Roos test, hyperabduction test, or Wright test.[10] Adson's test was found to have 79% sensitivity and 76% specificity on its own while Wright's test with symptom reproduction had 90% sensitivity and only 29% specificity.[10] See Table 3 for sensitivity and specificity correlations. Research has also shown

that cervical distraction demonstrated high specificity in the diagnosis of cervical radiculopathy.[11]

Table 3: Correlation between pairs of provocative tests and the final diagnosis of TOS from Gillard et al.

Provocative Tests	*SE*	*SP*
Adson + Ws	79	76
Adson + Roos	72	82
Adson + HAs	72	88
Adson + Wp	54	94
Ws + Roos	83	47
Ws + HAs	83	50
Wp + HAs	63	69

HAp: hyperabduction, considered positive if radial pulse abolished;
HAs: hyperabduction, considered positive if symptoms reproduced;
Wp: Wright test considered positive if radial pulse abolished; Ws:
Wright test considered positive of symptoms reproduced; SE: sensitivity;
SP: specificity.

After performing the special tests, the patient exhibited symptoms congruent with being positive for thoracic outlet, cervical radiculopathy, and foraminal compression. Upon evaluation, the patient demonstrated bilateral upper extremity (UE) weakness, signs and symptoms consistent with cervical radiculopathy, decreased left shoulder range of motion, and decreased cervical range of motion. He also had symptoms and positive special tests consistent with thoracic outlet syndrome with likely nerve impingement under pectoralis minor secondary to impaired posture and pectoralis tightness, scalene triangle impingement, and possible first rib impingement.

Prognosis and Plan of Care

Following examination and evaluation, it was indicated that the patient would benefit from skilled physical therapy to address his functional limitations, weakness, decreased ROM, and for symptom management. Physical therapy treatment was expected to include therapeutic exercises to address his ROM and strength deficits and therapeutic activities to improve his

ability to perform functional and household activities. Therapeutic intervention would also be used to facilitate the patient's return to recreational activities and to decrease compensatory movements. Manual therapy and modalities were to be utilized as needed to assist in soft tissue healing, joint mobility, and pain relief. Patient education was to be provided on proper posture, cervical traction, pain management, rehabilitation techniques and procedures, and related pathology. Physical therapy was recommended up to two times a week for a total of 16 visits.

A plan for re-examination or a progress update to assess changes was scheduled for the patient's seventh visit. At this time, the patient's established goals were reassessed along with subjective report of symptoms. Changes in pain and symptoms were also to be assessed at each visit.

CHAPTER III

INTERVENTION

The patient was seen for 12 visits over the course of 9 weeks and each session lasted about 45 minutes. The first visit consisted of the physical therapy examination and evaluation with education intervention provided on diagnosis, prognosis, and plan of care. Education was also provided on proper body mechanics and posture to decrease pain and radiating symptoms. All therapy visits were preceded by an upper-body ergometer warm up for about 6 minutes with alternating forward and backward cycling. Dynamic warm-up activities have shown multiple physiological benefits including increasing tissue temperature which leads to more oxygen provided to working muscles, increasing metabolic processes which results in smoother muscle contractions, increased blood flow, and injury prevention.[12] It has also been suggested increased temperature improves tissue extensibility. Resistance of the upper-body ergometer began at level one on the first visit and gradually progressed up to level five by the final visit.

Research has shown that conservative management of thoracic outlet syndrome and cervical radiculopathy is effective and beneficial in reducing symptoms.[5,6,13] Cervical radiculopathy treatment using manual therapy techniques in conjunction with therapeutic exercise is effective in increasing function, AROM, and decreasing levels of pain and disability.[13] Current guidelines for the management of TOS include patient education, correcting impaired posture, mobilizing restricted joints, connective tissue, and muscle, improving muscle performance, and progressing functional independence.[3] Cervical traction has been found to have

a positive effect in stretching the scalene muscles, improving patients' awareness for muscular tension and posture imbalance, and provides greater benefits than therapeutic exercise alone.[14]

The majority of therapy focused on evidence-based manual therapy techniques and stretching to reduce symptoms and decrease impingement of structures in the subclavian space including the brachial plexus nerves, subclavian artery, and subclavian vein.[3] Stretching activities included standing pectoralis stretch in a doorway, seated scalene stretch, seated upper trapezius stretching, and levator scapulae stretching. Manual therapy included soft tissue mobilization to upper cervical and thoracic paraspinals, suboccipitals, and upper trapezius. Trigger point release to left upper trapezius, levator scapulae, and grade 2-3 posterior/anterior mobilizations along the cervical spine were also completed. Manual cervical distraction, gentle side glides into progressive lateral flexion, and positional release techniques were utilized.

The second half of therapy incorporated manual therapy and progressive, selective postural correction and strengthening activities. Manual therapy progressed to include additional upper thoracic posterior/anterior mobilizations and distraction into varying degrees of cervical flexion and lateral flexion. Mechanical traction was also trialed. Strengthening activities included the use of the upper-body ergometer, bilateral shoulder extension with TheraBand, bilateral rows with TheraBand, wall slides, shoulder external rotation with TheraBand, standing horizontal abduction with TheraBand, and standing bilateral shoulder flexion with TheraBand. The detailed interventions per visit are outlined in Appendix 2.

Education on postural impairments and correction was provided as well as verbal cues for correct posture throughout the course of treatment. Verbal cues included phrases such as "keep your shoulders down and back," "engage your stomach muscles to sit up straight," and "try to tuck in your chin." Different cervical traction units and the benefits of these units were discussed

with the patient. Following the course of treatment, the patient elected to purchase a home cervical traction unit for continued use.

Education was provided on proper body mechanics and lifting techniques to facilitate proper movement patterns and decrease pain and symptoms with activities of daily living. Suggestions were provided on activity modification including limiting gardening and yard work, taking an increased number of rest breaks, and warming up prior to vigorous tasks to decrease tissue irritation. Activity modification, pacing, and activity scheduling have been shown to improve symptom management and psychological well-being, reduce fear of symptoms and activities, and improve cumulative activity levels.[15] Finally, throughout the course of treatment, instructions were given on how to correctly perform therapeutic exercises and his home exercise program (HEP). The patient demonstrated understanding through verbal recollection and active demonstrations of the various exercises.

The patient's response to treatment was assessed at the start of each visit. Typically, the patient would report that soreness from prior visits resolved within two days. However, if the patient reported soreness for longer than two days, the treatment interventions were adjusted for reduced exercise intensity. The patient responded well to physical therapy by noting improvement or stating tasks that he was able to now complete.

During this episode of care, the patient was also being seen by hand therapy at the same facility for carpal tunnel syndrome. He completed a total of 4 treatment sessions with the hand therapist. Communication with the patient's referring provider occurred via electronic medical records and notations and a phone call for approval of the plan of care, patient progress updates, and discharge documentation.

There were various therapy interventions that were excluded as they were deemed inappropriate for this patient or required a patient out of pocket cost. One intervention was the use of aquatic therapy which may have been utilized for cervical distraction in deep water. This was excluded due to the patient's skin sensitivity to pool chemicals. Dry needling was excluded as it was not covered by the patient's insurance plan and the physical therapists at the facility did not meet the requirements for performing this intervention per facility policy.

CHAPTER IV

OUTCOMES

Although the plan of care was originally for 16 visits, this was unattainable due to the patient traveling over the holidays to see his family. Other barriers to his recovery included occasional rheumatoid arthritis flare-ups. He was compliant with all of his scheduled appointments. He was also committed to the physical therapy program, actively engaged throughout his appointments, and was compliant with his home program. Factors that potentially improved his outcomes were his motivation to learn about his various diagnoses and his drive to improve.

Over the course of his therapy, the patient demonstrated increased cervical and left shoulder range of motion, improved tolerance to functional activity, and a decrease in neural symptom frequency, intensity, and duration. He also reported a decrease in overall pain but was unable to formally rate his pain levels. He was able to demonstrate improved posture with minimal cues required for keeping his mastoid process in line with his acromioclavicular joint. Bilateral upper extremity strength improved to 4+/5 or greater with bilateral thumb extension (4/5), left UE internal (4/5) and left UE external (4/5) rotation, and left shoulder flexion (4-/5) being the only exceptions. Also at the time of discharge, the patient demonstrated symmetrical cervical rotation, no significant increase in symptoms with left cervical rotation, and improved left shoulder flexion to 150°. See Table 4 for complete ROM at discharge. He continued to have complaints of mild altered sensation with mild neural symptoms and paresthesia with maximal

cervical lateral flexion to the left and maximal cervical extension. This was likely due to cervical facet joint narrowing and the cervical plate along his fusion.

Three special tests were completed at both initial evaluation and at discharge: Adson's Test, Wright's Hyperabduction Test, and the Military Brace Test. See Table 5 for final special test findings. Although the test findings yielded positive results for the LUE, the patient noted that his overall radicular symptom intensity and paresthesia had decreased since the beginning of therapy treatments.

Table 4: Range of Motion at Discharge

Shoulder	**Left**	**Right**
Flexion	150°	WNL
Abduction	160°	WNL
Internal Rotation	Reach to T7	WNL
Neck	**Left**	**Right**
Flexion	Chin to Chest	
Extension	20° + LUE	
Lateral Flexion	20° + LUE	25°
Rotation	55°	55°

WNL: Within Normal Limits
+Denotes Numbness and Tingling Present
LUE: Left Upper Extremity

Table 5: Special Tests at Discharge

Test	**Left**	**Right**
Adson's Test	Positive with decreased pulse and increased symptoms	Negative
Wright's Hyperabduction Test	Positive with decreased pulse and increased symptoms	Negative
Military Brace Test	Positive with decreased pulse and increased symptoms	Positive with decreased pulse

Throughout the duration of the patient's care, pain ratings were not formally assessed by using the Visual Analog Scale or other standardized measures. This was due to the tendency of the patient to ruminate on the pain number once he was asked to rate his pain from 0-10 with 0

being no pain and 10 being the worst pain imaginable. However, the patient voluntarily described the location and type of his pain during most treatment sessions. One study has found that by anchoring the numeric pain scale by providing a scenario of a concrete painful event, different corrective responses by patients with chronic pain were given.[16] It was also suggested that a simple application of a rating scale may not always be an accurate and reliable tool for assessing pain intensity in patients with chronic pain but utilizing an anchoring technique may be helpful in combating this.[16] One other future outcome measure for patients with chronic pain may include the Pain Catastrophizing Scale. This scale looks at rumination, magnification, and helplessness. There is a large body of research on the relationship between pain catastrophizing and functioning among individuals with chronic pain.

The patient made significant improvements throughout the course of treatment. He consistently attended his appointments, showed motivation and desire to improve, and was compliant with his home program. He was discharged after 12 visits due to leaving for the holiday season and traveling to see his family. Following discharge his plan was to attend a local gym and keep up with his finalized home program daily. His home program is denoted in Appendix 2. He also planned on purchasing a home cervical traction unit. At the conclusion of his final appointment, the physical therapist provided written copies of his home program as well as a handout for exercise progressions.

The patient was pleased with his overall progress and with his course of therapy treatment. He noted he was able to lie flat without cervical discomfort and could perform various overhead activities for a longer duration of time. There were no ethical issues or compliance issues during his care. He was thankful for the help, education, and guidance he had received

through the course of his treatment and verbally indicated that he would be willing to try physical therapy again if the need arose.

CHAPTER V

DISCUSSION

This case report explored the conservative outpatient physical therapy intervention program for a 69-year-old male with cervical radiculopathy, impaired cervicothoracic mobility, and thoracic outlet syndrome. Following physical therapy treatment, the patient showed improvement in cervical and upper extremity active range of motion, a decrease in frequency, intensity, and duration of symptoms, and reported overall improvement and less pain with daily tasks at the time of discharge. This improvement may suggest a benefit of conservative physical therapy intervention for the management of these conditions.

Throughout the duration of treatment, evidenced-based treatment and interventions based on physical therapist clinical experience were utilized. Recent research has discussed the effectiveness of surgery and conservative treatment on patients with TOS. Research has found that conservative treatments are likely to reduce the symptoms of TOS compared with surgery; however, there is no clear definition of the protocol within conservative treatments.[5] Future research could also focus on which therapeutic methods in conservative treatment are more effective in order to minimize treatment duration as much as possible, and researchers could also investigate which therapeutic strategies provide more long-term relief.[7]

For this case, the patient experienced the most effective relief of symptoms following manual therapy and manual cervical traction with varying degrees of rotation. Cervical stretching was also effective in symptoms reduction as it was hypothesized that by lengthening these

structures, it would decrease the impingement on the nerves and vasculature as they travel throughout the patient's upper extremities.

Various limitations impacted this case report. First, there was a lack of an objective functional outcome measure at initial evaluation, during the progress update, and at discharge. This would have provided greater objective information on the patient's progress or possible regression. Some questionnaires that could be used include the Cervical Radiculopathy Impact Scale, the Neck Disability Index (NDI), and the Focus on Therapeutic Outcomes (FOTO). The NDI has been found to be reliable, valid, and responsive in numerous patient populations, acute and chronic conditions, and those with neck pain associated with musculoskeletal dysfunction and cervical radiculopathy.[17] Because of the NDI's validity and reliability, it is suggested that the NDI could be used in the future for patients with both TOS and cervical radiculopathy to measure, monitor, and asses for best possible outcomes.

Further limitations included that the patient was seen over the course of only nine weeks therefore the long-term impacts and effects of this treatment are unknown. There was no follow-up scheduled to assess the patient's status following discharge. Finally, the patient was discharged early due to the holiday season and family commitments. It is unknown what further progress could have been made with more time.

Reflective Practice

Upon reflection, during the initial examination I would have asked more questions regarding activities that he enjoyed doing or would like to do. Through speaking to the patient over time, I learned that he was having a hard time picking up his grandchildren. This would have been a good personal goal for the patient and something that could have been practiced or addressed in physical therapy visits. I also would have had the patient complete a functional outcome measure such as the NDI or FOTO as discussed previously.

Regarding the plan of care, I would have like to have trialed additional cervical mechanical traction with the patient. Following one session of cervical mechanical traction, the patient experienced pain and symptom relief, however, the long-term effects were not able to be assessed. Research has shown a decrease in reports of both cervical pain and upper extremity numbness following cervical traction.[14] Additionally, research noted that regular application of cervical traction improved patients' awareness of muscular tension and postural imbalance. It also assisted patients to work more effectively on their breathing techniques. Additional options for mechanical traction treatment would have included dynamic traction and increased force. We were unable to discern how much force would be appropriate for optimal pain and symptom relief for this patient.

Regarding this case report, I would have like to have found research that addressed how cervical radiculopathy can affect thoracic outlet syndrome and vise versa. The implications of these diagnoses on one another are unknown. It was also difficult to discern which pathology had the greatest impact on this patient.

Prior to, and throughout the course of treatment, the patient was seen by various members of the interdisciplinary team. Hand therapy assisted with the patient's carpal tunnel syndrome

and sensation. He was also being seen by neurology and had a prior nerve conduction study. He was seeing a rheumatologist for his rheumatoid arthritis. Because of this, there were no additional referrals I would have made for this patient.

APPENDIX

Appendix 1: Complete Medication List

albuterol 90 mcg/puff inhaler	Inhale 2 puffs into the lungs every 6 hours as needed for Wheezing.
diclofenac (VOLTAREN) 1% GEL	Apply 4 g topically 3 times daily as needed. Prescribed by Rheumatology
folic acid (FOLVITE) 800 MCG tablet	Take 900 mcg by mouth Daily.
gabapentin (NEURONTIN) 300 mg capsule	Take 1 capsule by mouth 2 times daily.
hydroxychloroquine (PLAQUENIL) 200 mg tablet	Take 400 mg by mouth Daily. Prescribed by Rheumatology
meloxicam (MOBIC) 15 mg tablet	Take 15 mg by mouth Daily. Prescribed by Rheumatology
methocarbamol (ROBAXIN) 750 mg tablet	Take 750 mg by mouth every 8 hours as needed for Muscle spasms. Prescribed by Dr. Rojas
methotrexate 2.5 mg tablet	Take 2.5 mg by mouth every 7 days. Take 10 Tablets Every 7 days - Prescribed by Rheumatology
Multiple Vitamins-Minerals (MENS 50+ MULTI VITAMIN/MIN PO)	Take 1 tablet by mouth Daily.
omeprazole (PRILOSEC) 20 mg capsule	TAKE 1 CAPSULE BY MOUTH 1/2 HOUR PRIOR TO BREAKFAST & DINNER
predniSONE (DELTASONE) 1 mg tablet	Take 4 mg by mouth Daily. Prescribed by Rheumatology
predniSONE (DELTASONE) 5 mg tablet	Take 5 mg by mouth Daily.
ramelteon (ROZEREM) 8 mg tablet	Take 1 tablet by mouth nightly as needed for Insomnia.
ranitidine (RANITIDINE ACID REDUCER) 75 MG tablet	Take 75 mg by mouth nightly.
rosuvastatin (CRESTOR) 20 mg tablet	Take 1 tablet by mouth nightly.
sertraline (ZOLOFT) 100 mg tablet	Take 1.5 tablets by mouth nightly.
tocilizumab (ACTEMRA) 200 MG/10ML SOLN	Inject 600 mg into the vein.
tolterodine (DETROL LA) 2 mg 24 hr capsule	Take 1 capsule by mouth Daily.
zolpidem (AMBIEN) 10 mg tablet	1/2 - 1 at night PRN sleep must last 90days

Appendix 2: Intervention Techniques per Visit

Visit Number	***Therapeutic Exercise***	***Manual Therapy***	***Mechanical Cervical Traction***
1 *Initial Examination and Evaluation*			
2	Standing doorway stretch x2 minutes* Seated Scalene Stretch x2 minutes*	Cervical Traction in Supine Grade 3-4 in neutral head position x5 minutes with intermittent rests	
3	Seated UT stretch x2 minutes*	STM to cervical and upper thoracic paraspinals, suboccipitals, and UT TPR to L UT, levator scapulae PA along cervical spine Cervical traction in neutral x5 minutes Side glides with side bending	
4	All prior stretching	Cervical traction x5 minutes STM to UT, levator, pectoralis minor PR of UT and pectoralis minor x90 seconds B PA to lower cervical through T2	
5	All prior stretching Standing B pulldowns Level 2, 2x15* Standing B Rows Level 3, 2x15*	Cervical Traction x 8 minutes STM to levator scapulae, UT, pectoralis minor PA to lower cervical though T2 Side glides with progressive lateral flexion	
6	All prior pulldowns and rows Snow angels in supine x15 B Shoulder ER, Level 1, 2x10*	All Visit 5 manual therapy PR of UT and pectoralis minor x90 seconds B	
7 *Progress Note Goal Reassessment*		Cervical Distraction Grade 4 with forehead overpressure and varying degrees of flexion and lateral flexion Distraction with cervical rotation x10 Grade 3-4 PA in supine to thoracic spine T1-4	

8	Snow angels in supine with half foam roll, x15 B Shoulder ER, Level 1, 2x10 B shoulder horizontal abduction, level 1, 2x10	All Visit 7 manual therapy STM to cervical paraspinals, UT, levator scapulae	
9	Snow Angels in supine with half foam roll, x15 AAROM flexion in supine with a dowel, 10x10 seconds	All Visit 8 manual therapy Grade 2-3 inferior L shoulder mobilization	
10	Snow Angels in supine with half foam roll, x15 AAROM flexion in supine with dowel Shoulder Flexion, 3 pounds, 2x10	All Visit 9 manual therapy	
11	Cervical Book Exercise x5 minutes*	Grade 4 cervical distraction with forehead overpressure with varying degrees of flexion and lateral flexion x5 min Distraction with cervical rotation x10 Grade 3-4 PA in supine to upper thoracic spine	Static 10-20 pounds x15 minutes
12 *Discharge* *Goal Reassessment*	Review and Finalization of HEP B Shoulder ER Level 1, 2x10 Doorway Stretch x2 minutes B shoulder horizontal abduction Level 1, 2x10 Cervical Book Exercise x5 minutes	All Visit 11 manual therapy B side glides to cervical spine x10	

*Denotes exercise was added to the patient's home exercise program

STM-soft tissue mobilization
UT-upper trapezius
TPR-trigger point release
L-left
PA-posterior-anterior mobilizations
PR-positional release
B-bilateral
ER-external rotation
AAROM-active assisted range of motion

REFERENCES

1. Whitenack S. Brachial Plexopathies. In: Carp SJ. eds. *Peripheral Nerve Injury*. McGraw-Hill; Accessed June 21, 2020. https://fadavispt-mhmedical-com.ezproxylr.med.und.edu/content.aspx?bookid=1885&sectionid=139910387
2. Povlsen S, Povlsen B. Diagnosing Thoracic Outlet Syndrome: Current Approaches and Future Directions. *Diagnostics (Basel)*. 2018;8(1):21. Published 2018 Mar 20. doi:10.3390/diagnostics8010021
3. Kisner C, Armstrong C. Peripheral Nerve Disorders and Management. In: Kisner C, Colby L, Borstad J. eds. *Therapeutic Exercise: Foundations and Techniques, 7e*. McGraw-Hill; Accessed June 21, 2020. https://fadavispt-mhmedical-com.ezproxylr.med.und.edu/content.aspx?bookid=2262&sectionid=176762914
4. 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. doi:10.1007/s40122-019-0124-2
5. Chi-ngai C, Bukry S, Alsuleman S, Simon J. Systematic Review: the effectiveness of physical treatments on thoracic outlet syndrome in reducing clinical symptoms. *HK Physio J.* 2011;29(2):53-63. doi: 10.1016/j.hkpj.2011.06.005
6. Watson LA, Pizzari T, Balster S. Thoracic outlet syndrome part 2: conservative management of thoracic outlet. *Man Ther*. 2010;15(4):305-314. doi:10.1016/j.math.2010.03.002
7. Balakatounis K, Angoules A, Panagiotopoulou K. Conservative treatment of thoracic outlet syndrome: creating an evidence-based strategy through critical research appraisal. *Current Ortho.* 2007;21(6):471-476. doi: 10.1016/j.cuor.2007.11.006
8. Cleland JA, Fritz J, Whitman J, Heath R. Predictors of Short-Term Outcome in People With a Clinical Diagnosis of Cervical Radiculopathy. *J Phys Ther*. 2007;87(12):1619-1632. doi:10.2522/ptj.20060287
9. Magee DJ. *Orthopedic Physical Assessment*. 6th ed. Philadelphia, PA: W.B. Saunders Co and Elsevier Inc.; 2014.
10. Gillard J, Pérez-Cousin M, Hachulla E, et al. Diagnosing thoracic outlet syndrome: contribution of provocative tests, ultrasonography, electrophysiology, and helical computed tomography in 48 patients. *Joint Bone Spine*. 2001;68(5):416-424. doi:10.1016/s1297-319x(01)00298-6
11. Rubinstein SM, Pool JJ, van Tulder MW, Riphagen II, de Vet HC. A systematic review of the diagnostic accuracy of provocative tests of the neck for diagnosing cervical radiculopathy. *Eur Spine J.* 2007;16(3):307-319. doi:10.1007/s00586-006-0225-6
12. Woods K, Bishop P, Jones E. Warm-up and stretching in the prevention of muscular injury. *Sport Med.* 2007;37(12):1089-1099. https://link-gale-com.ezproxylr.med.und.edu/apps/doc/A200844877/EAIM?u=ndacad_58202zund&sid=EAIM&xid=a1cafc2c.

13. Boyles R, Toy P, Mellon, J, Hayes M, Hammer B. Effectiveness of manual physical therapy in the treatment of cervical radiculopathy: a systematic review. *J Man & Manip Ther*. 2011;19(3):135-142. doi:10.1179/2042618611y.0000000011
14. Taskaynatan M, Balaban B, Yasar E, Ozgul A. Cervical Traction in Conservative Management of Thoracic Outlet Syndrome. *J of Muscu Pain.* 2007;15(1):89-94. doi:10.1300/J094v15n01_10
15. Antcliff D, Keenan AM, Keeley P, Woby S, McGowan L. Survey of activity pacing across healthcare professionals informs a new activity pacing framework for chronic pain/fatigue. *Musculoskeletal Care*. 2019;17(4):335-345. doi:10.1002/msc.1421
16. Amir R, Eisenberg E, Leiba R. Anchoring the Numeric Pain Scale Changes Pain Intensity Reports in Patients With Chronic But Not With Acute Pain. *Pain Practice*. 2019;19(3):283-288. doi:10.1111/papr.12738
17. MacDermid JC, Walton DM, Avery S. Measurement properties of the neck disability index: a systematic review. *J Orthop Sports Phys Ther*. 2009;39(5):400–417. doi:10.2519/jospt.2009.2930