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Clinical Decision-Making in a Patient with Cervical Radiculopathy and Cubital Tunnel Syndrome: Double Crush Syndrome

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CLINICAL DECISION-MAKING IN A PATIENT WITH CERVICAL RADICULOPATHY AND CUBITAL TUNNEL SYNDROME: DOUBLE CRUSH SYNDROME

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This Scholarly Project, submitted by Taylor Nord 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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ABSTRACT

Background and Purpose: Double crush syndrome (DCS) is pathology involving the association between proximal and distal nerve lesions. It is often difficult to diagnose due to the variety of possible sources of tissue involvement and, therefore, is difficult to treat effectively. The purpose of this case report is to describe the physical therapy diagnosis and treatment of an older adult with DCS consisting of cervical radiculopathy (CR) and cubital tunnel syndrome (CuTS).

Case Description: 74-year-old female with a diagnosis of CR was referred to physical therapy. The physical examination confirmed this diagnosis. Due to the patient not responding well to initial treatment, the PT decided to perform additional special tests, the results of which indicated possible L CuTS. A DCS, consisting of L CuTS as well as C7 CR was then confirmed by EMG/NCS results.

Intervention: The patient's treatment consisted of manual therapy, cervical strengthening, neurodynamic mobilizations, patient education, activity modification, and a home exercise program.

Outcomes: The patient attained all of her therapy goals and was able to return to full participation of her normal activities without the limitation of pain.

Discussion: This report highlights the successes and difficulties regarding the PT diagnosis and treatment of a patient presenting with DCS. Based on this case report, utilization of nerve mobilization tests are suggested to differentiate the likelihood of peripheral nerve involvement versus CR. Further research regarding the diagnosis of DCS and the conservative treatment of its potential components, especially CuTS, would be beneficial in improving the outcomes and the overall healthcare experience of patients with this diagnosis.

CHAPTER I

BACKGROUND AND PURPOSE

Double crush syndrome (DCS) is characterized as the associated compression at two or more locations along the course of a peripheral nerve.[1] The term "double crush syndrome" was first coined in 1973.[2] Since then, there has been much debate around the accuracy of the term's description of the diagnosis. However, due to the lack of a better alternative, it will be referred to as DCS throughout the rest of this report. The incidence of DCS in the general population is still unclear. It has been found to be anywhere from 1%[3,4] to 76% [2]. This disparity is, in part, due to the lack of objective diagnostic criteria.[4] Other factors to consider when trying to determine the cause of the large spread of incidence rates is that, due to the common symptoms between the multiple pathologies that make up the diagnosis, the clinical findings of one syndrome may be misinterpreted by the clinician. This may lead to misdiagnosis and, oftentimes, the failure to provide proper treatment to the patient.[5] While DCS can occur equally in the upper extremity (UE) and the lower extremity, the literature relating to DCS focuses mainly on the larger nerves of the UE such as the radial and median nerves. Common combinations of syndromes precipitating DCS include cervical radiculopathy and carpal tunnel syndrome, or, cervical radiculopathy, and cubital tunnel syndrome.[3,4]

Cervical radiculopathy (CR) is a relatively common neurological disorder resulting from nerve root compression. Based off of a population-based analysis done in Rochester, MN, the prevalence of CR is 83.2 per 100,000.[6] It is usually caused by some sort of mechanical compression to the nerve root (i.e. disc herniation, chronic spondylosis, osteophytes, hypertrophied facet joints, decreased disc height, etc.)[7] but also can be caused by chemical irritation of the nerve.[8] A patient presenting with CR typically presents with upper extremity

pain, weakness, impaired sensation, and diminished reflexes.[6,7,8] However, these symptoms do not always follow a typical dermatomal/myotomal pattern associated with the affected nerve roots. Patients with CR typically respond well to conservative treatment and improve over time. Physical therapy (PT) is a common form of conservative treatment and usually consists of patient education on activity modification, mechanical traction, postural exercises, and manual therapy. Conservative treatment is usually completed for the first 4-6 weeks following the onset of symptoms in the absence of red flags or myelopathy.[8,9] If the patient is not responding to treatment in this time frame, or if symptoms persist, it is important to thoroughly evaluate the differential diagnosis, such as DCS, which would be characterized by another peripheral nerve injury.[8]

Cubital Tunnel Syndrome (CuTS) is a peripheral nerve injury characterized by the compression and traction of the ulnar nerve at the elbow.[10] It is considered to be the second most prevalent peripheral neuropathy with a prevalence of 1.8 to 5.9% following only Carpal Tunnel Syndrome.[11] The ulnar nerve can become compressed at multiple sites around the elbow that can lead to the diagnosis of CuTS. The most common site is just posterior to the medial epicondyle where it can become entrapped underneath the Osborne ligament (Fig. 1).[10] Possible causes of CuTS include traction force at the elbow, presence of a longstanding valgus deformity of the elbow, prolonged elbow flexion, and chronic pressure over the cubital tunnel such as leaning on the elbow while sitting. Patients with CuTS often present with pain/tenderness at the elbow, numbness/tingling, weakness along the ulnar nerve distribution, loss of coordination, and popping and snapping at the elbow.[11,12] The treatment approach to CuTS varies depending on the severity of the entrapment. The most widely used system for determining the severity of CuTS is the McGowan grading system (Fig. 2). McGowan classifies CuTS into 3 levels of severity: mild,

moderate and persistent, and severe symptoms. According to this system, conservative treatment is recommended for patients with mild-moderate symptoms.[13] Dellon et al. reported that conservative treatment was shown to be beneficial in approximately 90% of patients in their study with mild symptoms and 38% of patients with moderate symptoms.[13,14] Patients with severe symptoms, or those who do not experience relief of their symptoms after 3-6 months of conservative treatment, will often undergo surgical decompression of the ulnar nerve at the cubital tunnel. Conservative treatment can include a multitude of different interventions consisting of ergonomic modifications, activity modification characterized by avoidance of aggravating movements or postures, night splints, nonsteroidal anti-inflammatory medications (NSAIDs) and/or PT.[12,13] PT can include all of the aforementioned interventions as well as additional patient education, neurodynamic mobilizations, manual therapy, and resistive exercises.

Before the treatment of any pathology, it must first be diagnosed accurately and efficiently. This is an area of difficulty for physical therapists, or any medical professional for that matter when it comes to the diagnosis of DCS. CR and CuTS share several common symptoms including upper extremity pain, weakness, and impaired sensation. This comes as no surprise due to the nature of DCS. It is also important to note that the imaging that is often done before PT referral (i.e. standard radiographic imaging and magnetic resonance imaging) is known to often show signs of degenerative changes or areas of compression in asymptomatic patients meaning that there is a relatively high chance a false-positive finding.[4,15,16] In conclusion, the combination of potential false-positives on imaging and the common symptoms between syndromes can lead to difficulties in properly diagnosing the patient with DCS as the

clinical findings may be misguided or misinterpreted leading to the misdiagnosis and ultimately mistreatment of the patient.[5]

While it is obvious why the vast majority of DCS cases warrant an initial trial of conservative, non-surgical treatment due to the indication and efficacy of conservative methods in treating its components, the method of developing that plan of care is not as straight forward. It has been recommended in the literature that the non-surgical management of DCS should likely consist of the individual treatment of each of its components. Keeping in mind to provide these treatments in the proper order which will be different from patient to patient.[4] When you combine this with the fact that the efficacy of conservative treatment methods for CuTS is not well represented within the literature[17], it presents a very unique challenge in treating a patient with the aforementioned diagnosis. Herein lies the focus of this report.

A review of the current literature concluded that there is very little evidence regarding the diagnosis and treatment of DCS, especially when it is consisting of CR and CuTS. This gap in the literature is broadened by the fact that there is also little evidence related to the efficacy of conservative treatment of CuTS alone. The purpose of this case report is to describe the physical therapy diagnosis and treatment of an older adult with DCS consisting of cervical nerve root radiculopathy (CR) and cubital tunnel syndrome (CuTS). This case report focuses on the implementation of diagnostic strategies and interventions, supported by the evidence that exists in the literature, with the intention of bridging the gap that is present.

CHAPTER II

CASE DESCRIPTION

The patient was a 74-year-old female retired schoolteacher who was referred to physical therapy by her primary physician for evaluation and treatment of cervical radiculopathy. She presented to PT with severe left-sided neck and upper extremity pain (7/10, 10 is maximal pain and 0 is no pain) that she had been experiencing on and off for a total of three months. She denies any traumatic event that might have caused her symptoms. The pain originated in the cervical region, traveled down her left (L) UE from her shoulder to her 4th and 5th digits. The patient reported that the pain was the worst from the elbow to the fingers. The patient initially sought treatment from her chiropractor shortly after the onset of pain. She stated that her chiropractor used a variety of cervical manipulations and mechanical traction which greatly helped to reduce her pain. Her pain was relieved for approximately two months until she "overdid" herself a few weeks before the initial visit to PT and the pain returned. Following the recurrence of symptoms, she was unable to do anything to relieve the pain. Although, she did report that heating pads helped in dulling the pain. The patient had received a cervical epidural injection a few days before her initial visit but still did not experience any symptom relief. Following the recent onset of pain, she had trouble sleeping. She reported that she would wake up multiple (3-4) times throughout the night due to pain. Her aggravating factors included lifting heavy objects off the ground, turning her head while driving, walking, and generalized movements of the head and neck.

The patient reported being unable to perform activities of daily living (ADLs) such as driving, grooming, washing the dishes, and carrying heavy items with her L UE without the limitation of pain. At the time of the initial treatment, she was living by herself in a one-level

home. The patient's daughter lived nearby and would occasionally come help with ADLs when necessary. Notable co-morbidities included fibromyalgia, which was currently being controlled by medications.

The patient's goals were to decrease her pain and weakness in order to be able to return to playing with her grandchildren as well as to be able to complete all ADLs without the limitation of pain to continue to live independently. The patient was also looking forward to returning to walking, reading, and doing yoga. The results from the systems review can be seen in Table 1. Upon completion of the initial examination, a list of differential diagnoses was formulated which included thoracic outlet syndrome, peripheral ulnar neuropathy, and complex regional pain syndrome.

Throughout the initial 2 weeks (visits 1-5) the patient was not responding well to treatment and, on multiple occasions, informed the PT that she had made multiple trips to the emergency room (ER) due to increased pain. Her first visit to the ER was following the initial examination. She reported that she was having increased pain in her L UE from her elbow to her 4th and 5th digit. She also noted that she was occasionally dropping pieces of paper due to weakness in her fingers. She was not given any medications or further treatment, likely due to her additional diagnosis of fibromyalgia. During the next therapy session (visit 3), the patient reported that she again had to visit the emergency room for the same reasons as previously described. This time she was prescribed oral steroids which she stated, "helped immensely". Upon the next visit, she explained that her pain had slowly started to increase again and that the oral steroids no longer seemed to be working. She informed the therapist that she had an appointment scheduled with a neurosurgeon the following day. This warranted re-examination using Tinel's tap sign over the cubital tunnel as well as the upper limb tension test (ULTT). Both

of them proved to be positive indicating possible L CuTS. A DCS, consisting of L CuTS and C7 CR was then confirmed by EMG/NCS results.

EXAMINATION

Prior to the examination, the patient completed the Neck Disability Index (NDI). The NDI is a 10-item questionnaire that measures a patient's self-reported neck pain-related disability. The NDI was based on the Oswestry Low Back Pain Disability Questionnaire and includes questions related to ADLs such as personal care, lifting, reading, work, driving, sleeping, recreational activities, pain intensity, concentration, and headaches. A higher NDI score means the greater a patient's perceived disability due to neck pain.[18] The patient scored a 27 out of a total 50 points which indicated that the patient had a perceived disability of 54%.

The examination was based on the Park Nicollet Clinical Practice Guidelines for patients with cervical spine pain.[19] Through initial observation, the patient was observed to have forward head, rounded shoulders posture. The patient was in visible discomfort and, therefore, very guarded. Examination procedures included a peripheral joint scan, cervical artery screen, cervical range of motion (ROM) measurements, myotome testing, dermatome testing, deep tendon reflex assessment, special tests to rule in/out CR, palpation, and joint play. The peripheral joint screen was performed for the thoracic spine and the shoulder. The thoracic spine tested within normal limits (WNL) for flexion and rotation. Thoracic extension was not performed due to recent epidural injection. The shoulder screen showed that the patient was within functional limit (WFL) for all shoulder motions, however, all L shoulder motions increased symptomatic pain. Cervical ROM (Table 2) was measured with a standard goniometer. The patient was found to be limited by pain in her L UE for all cervical motions except for cervical extension which was not

assessed. UE manual muscle testing (MMT) was performed with the patient in a seated position with feet on the ground (Table 3). UE dermatomes (Table 4) were also performed with the patient in a seated position with her feet touching the ground. The patient's sensation was painful over dermatomes C5 (deltoid), C7 (2nd and 3rd digits), C8 (4th and 5th digits), and T1 (medial forearm). All other dermatomes were intact and non-painful. The patient's biceps (C6) and triceps (C7) deep tendon reflexes tested 1+ bilaterally which is characterized by a slight but present response.[20]

The physical examination of the cervical spine was based on the Park Nicollet Clinical Practice Guideline.[19] The results of all the special tests can be viewed in Table 5. First, the alar ligament test and the Sharp-Purser test [Specificity (Sp)-96% and Sensitivity (Sn)-69%][19] produced negative results, indicating that the structural integrity of the alar and transverse ligaments were not compromised. Next, a cluster of special tests was performed to rule in/out CR. This cluster included Spurling's Maneuver (Sp-88%, Sn-50%)[11], manual cervical distraction (Sp-97%, Sn-44%)[21], cervical rotation less than 60 degrees on the symptomatic side, and the ULTT. Three out of four positive tests equal a likelihood ratio of 6 indicating the presence of CR. Spurling's test and the ULTT both produced positive results.

Manual cervical distraction performed in supine increased the patient's symptoms in their L UE and was, therefore, negative. Next, palpation and joint play were assessed with the patient in supine and in sitting. The patient was found to be tender to palpation of the left cervical facet of C7, L upper trapezius, as well as her L rhomboids. The patient was also found to have increased tone in her L upper trapezius. Following a joint play assessment, the patient was found to be hypomobile and have increased symptomatic pain throughout the entire cervical spine with the worst being found at the cervicothoracic junction.

EVALUATION & DIAGNOSIS

The findings from the initial examination data revealed signs and symptoms consistent with the initial diagnosis of L cervical radiculopathy (ICD 10 code: M54.12). This diagnosis was reached by positive myotome and dermatome testing, impaired cervical ROM with peripheralization of symptoms, and three out of four positive CR cluster tests.

In the following weeks, a second and third diagnosis of L cubital tunnel syndrome (ICD 10 code: G56.22) and Double Crush Syndrome (ICD 10 code not available) were made by the neurologist. These diagnoses were confirmed by positive Tinel's tap sign over the L cubital tunnel region as well as a positive ULTT. A DCS, consisting of L CuTS and C7 CR was then confirmed by EMG/NCS results.

PROGNOSIS

Based on the patient's past medical history, comorbidities, family support, and motivation to return to pain-free functional activities and hobbies, her prognosis was determined to be good. The patient presented with comorbidities of fibromyalgia, which was controlled by medication and, therefore, was determined not to be a hindrance. The patient's positive prognostic factors included motivation to become pain-free so that she could play with her grandchildren again, good family support, her financial situation, her social involvement, her desire to remain independent, and compliance with PT and home exercise program. The patient's negative prognostic factors included her previous experience with medical professionals, apprehension, and her age.

PLAN OF CARE

The plan of care was for the patient to be seen in PT twice a week for 45-minute sessions for 7-8 weeks. Before the diagnoses of CuTS and DCS were made, the initial plan of care involved cervical ROM exercises, postural strengthening, neurodynamic mobilizations, traction (both mechanical and manual), manual therapy, and modalities as necessary. Following the diagnoses of CuTS and DCS, the revised plan of care involved all of the interventions listed above as well as patient education/activity modification, stretching, and an increased emphasis on neurodynamic mobilizations. In addition to the exercises performed at the clinic, the patient was encouraged to perform a HEP twice a day on the days that she was not in PT. The patient was re-evaluated periodically to measure functional improvements using ROM measurements, dermatome testing, myotome testing, and the visual analog scale (VAS). The NDI was not used during re-evaluation due to the second diagnosis of CuTS and the nature of the patient's symptoms; it was decided that the NDI would not provide an adequate description of patient progress.

CHAPTER III

INTERVENTION

PROCEDURAL INTERVENTIONS

Interventions for this patient were chosen to assist in improving pain, ROM, and her ability to perform ADLs. In alignment with the patient's individual goals, she agreed to a set of goals for PT treatment which can be seen in Table 6. Neurodynamic mobilizations were performed to improve neural tissue mobility and, therefore, decrease the patient's pain and ultimately improve her ability to perform ADLs. Patient education and activity modification were performed to limit the amount of stress placed onto the affected nerve and decrease the patient's pain as well as her chances of further aggravating the nerve in the future. Manual therapy, such as manual stretching, massage, and joint mobilizations were also chosen to improve the patient's ROM and ability to perform ADLs, such as driving, without the limitation of pain.

During the first few weeks of the patient's episode of care, manual therapy to the cervical region was the most frequently used intervention to address the patient's largest impairment which was her decreased cervical ROM. Given the initial findings of increased tone of her L upper trapezius, the first manual therapy interventions provided included soft tissue massage as well as manual stretching to the area. The soft tissue mobilizations included a combination of techniques such as effleurage (stroking) and petrissage (kneading) to attain the intended result of relaxing the patient and providing her with some pain relief. With that in mind, this intervention was implemented at the beginning of every session as it was found to not only decrease the patient's pain during the rest of the session, but it also improved her overall mood and attitude towards therapy. The other form of manual therapy implemented early in the episode of care was

joint mobilizations of the cervical and thoracic spine. The joint mobilizations performed included grade I-II posterior-anterior (PA) glides of the cervical spine in supine, as well as grade III PA glides to the cervicothoracic junction and thoracic spine in prone. Following the diagnosis of CuTS, the increased cervical ROM (Table 7), and an overall decrease in pain and symptoms in the cervical region, the focus of manual therapy treatment shifted towards the patient's L UE, specifically her L elbow region.

Manual therapy continued to be a large portion of treatment during this time with the goal primarily moving towards patient relaxation and providing her with short term pain relief to the area which improved her compliance during the rest of the session. Most of the manual therapy intervention now consisted of soft tissue massage to the structures around her L medial elbow and forearm, including her triceps, brachialis, anconeus, and the flexor-pronator group originating from the medial epicondyle.

Along with manual therapy, postural strengthening was another focus of treatment within the first few weeks of the patient's episode of care. These exercises were included to improve the patient's pain and encourage the use of proper posture which would act to decrease the amount of stress on the cervical spine and, therefore, act to prevent further injury or compression. One of the main exercises included was strengthening of the deep neck flexor (DNF) group.

In accordance with the study performed by Kim and Kwag,[22] DNF training included supine cervical retraction with a blood pressure cuff placed on the back of the head and inflated to 20 mm Hg. The patient was then instructed to reverse the cervical lordosis until the cuff read 30 mm Hg. Meanwhile, the PT would provide the patient with biofeedback by observing the patient's sternocleidomastoid (SCM) and the anterior scalenes to ensure that they were being kept relaxed. The contraction would be maintained for 10-15 seconds and was repeated 10 times.

To progress this exercise, the patient was instructed to perform the cervical retraction and then to lift her head 1-2 cm off of the table. The PT provided the patient with biofeedback to ensure the relaxation of the SCM and anterior scalenes. The patient held this position for as long as possible while maintaining proper form (typically around 5 seconds) and repeat the exercise 10 times. This then progressed further by increasing the amount of time the patient holds the position. Following the diagnosis of CuTS, and the decrease in cervical symptoms, this area of treatment was continued independently by the patient with her HEP. The focus of the procedural interventions in the clinic was then shifted towards interventions relating to CuTS including neurodynamic mobilizations performed by the PT as well as various educational interventions including patient education, activity modification, and home exercises.

Following her second diagnosis of DCS involving CuTS, neurodynamic mobilization was chosen to be a main focus of the patient's plan of care moving forward. The patient was first treated with passive neurodynamic mobilization of the ulnar nerve in supine (Figure 4).[23] Due to a positive patient response during this intervention, the patient was instructed on how to perform neurodynamic mobilization of the ulnar nerve at home. It was decided to only include this one mobilization right away to more accurately observe the patient's response to this specific intervention. In the following session, the patient reported a slight decrease in pain upon the completion of the ulnar nerve mobilization at home. Therefore, it was decided to introduce more neurodynamic mobilizations into the patient's plan of care.

Passive neurodynamic mobilizations to the patient's L UE were again performed by the therapist with the patient in supine, however, this time, both median and radial nerve glides were mobilized (Figures 5 & 6)[23] in addition to the ulnar nerve. The patient again reported a slight decrease in pain following the completion of these mobilizations by the therapist, therefore, it

was decided to instruct the patient on how to complete the median and radial mobilizations independently at home so that they could be added to her HEP in addition to them being performed passively by the therapist during her visits to the clinic.

EDUCATIONAL INTERVENTIONS

Patient education was an integral part of the patient's POC from the very beginning of treatment and, unlike other facets of the POC, this remained true throughout the addition of CuTS as a diagnosis. The patient was instructed on a HEP at the end of the first treatment session and adapted as the course of treatment progressed. This program was to be completed once daily every day that the patient did not attend therapy. All exercises were first completed during PT so that the patient could be informed on how to properly perform each exercise. She was then given a handout of the exercises with written directions including the exercise description (with visual aid), frequency, sets, and reps. She was also given a virtual access code for MedBridge (online exercise bank resource) where she was able to access the exercises as well as additional videos in an online and mobile format to help ensure that the patient always had access to her HEP. The exercises would then be reviewed in the following sessions to ensure that she was completing them with the proper form. If the patient required further explanation or cueing from the therapist, they would be given at this time as well.

Although patient education was an important component throughout the patient's POC, the nature of its implementation changed a fair amount following the addition of the CuTS diagnosis. Initially, patient education was utilized to increase her understanding of her diagnosis and the purpose of the interventions that were performed. Following the second diagnosis, patient education was utilized as a way to modify the patient's daily activities outside of therapy.

The purpose of including this as an intervention was to decrease the amount of time that the patient spends in compromising elbow positions that put excess stress on the ulnar nerve. The main two areas of focus for this particular patient included avoiding elbow flexion greater than 90 degrees for prolonged periods and to avoid resting her elbow on surfaces, such as the arm of a chair.

Another large area of focus for the educational interventions were the active neurodynamic mobilizations that the patient was instructed on in order for her to complete them independently at home. The first mobilization that the patient was instructed on was for the ulnar nerve of the L UE. The patient was instructed to start in either a standing or seated position with her L arm at 90 degrees of abduction and her palm facing the ceiling. Next, the patient was instructed to pronate her wrist so that her palm was now facing the ground. The patient then performed simultaneous shoulder abduction, elbow flexion, and wrist and finger extension in one smooth motion until her palm rested on her face and she was able to look through a ring formed by touching the tip of her 1st and 2nd digits (Figure 3). The patient was told to repeat this exercise fifteen times, twice a day. Due to the positive response that the patient had with this mobilization, the patient was then taught how to perform active neurodynamic mobilizations for both the median and radial nerves of her L UE. For the median nerve mobilization, the patient was instructed to begin in either a seated or standing position with elbows flexed and hands in midline. The patient was then instructed to extend her L elbow and wrist with her forearm in a supinated position providing a slight overpressure into wrist extension with her R hand. (Figure 7) The patient was instructed to hold this position for a second and then return to the starting position. For the radial nerve mobilization, the patient was instructed to begin in a standing position with arms in the anatomical position. The patient then performed forearm pronation and

wrist flexion followed by shoulder depression and finally lateral flexion of her neck towards the opposite side (Figure 8). Again, the patient was instructed to hold this position for one second and then return to the starting position. The patient was told to repeat both exercises fifteen times, twice a day in addition to the ulnar nerve glide that she was given previously.

COORDINATION, COMMUNICATION, AND DOCUMENTATION

The patient was highly motivated during every session. This was especially true as soon as she was able to notice an improvement in her symptoms. During the patient's visits to the clinic, it was clear that she was performing her HEP. This was obvious through the taking of the subjective history at the beginning of each session as she was able to tell the PT what was working for her, what wasn't, and what she needed clarification on.

The patient was seen by two therapists during her episode of care. This included one student physical therapist (SPT) as well as a supervising PT. Before the beginning of each session, the therapist discussed the patient's current status and progression towards established goals were discussed. Documentation was performed after every visit by the SPT and was reviewed by the supervising PT

CHAPTER IV

OUTCOMES

Throughout treatment, the patient reported decreased pain and improved ability to complete ADLs. Her pain improved from a 7/10 on the VAS at rest to a 0/10 at rest and an occasional 2/10 during aggravating activities such as prolonged flexion of her elbow and when lifting heavy items. In addition, Tinel's Tap sign was negative at the cubital tunnel and the L ULTT indicating an improvement in CuTS symptoms. Improvement was also noted in cervical radiculopathy testing as she demonstrated decreased symptoms with Spurling's Maneuver, cervical distraction, and had increased her cervical rotation to <60 degrees towards the L, indicating the absence of cervical radiculopathy. The patient's final cervical AROM measurements can be found in Table 8. UE MMT testing was found to be strong (Grade 5/5) and pain-free. UE dermatomes were found to be intact bilaterally at discharge. Areas that were found to be tender upon palpation previously were no longer reported by the patient to be painful at discharge. The patient's activities and participations including the ability to sleep throughout the night, the resumption of all ADLs, the ability to drive, the ability to sit for longer than 1 hour, and the ability to interact with her grandchildren were all without the limitation of pain. All PT goals (Table 6) were met by discharge. Upon discharge, the patient would complete a 2-week trial period of independent HEP completion and symptom management. Following the end of these 2 weeks, the patient was set to have a phone follow-up to discuss her symptoms and assess the possible need for further treatment. During this call, the patient reported no exacerbations or return of symptoms as well her full return to ADLs and activities of enjoyment such as playing with her grandchildren, walking, yoga, and reading. Therefore, it was decided that the patient

was no longer in need of further treatment and would continue with independent HEP completion and symptom management indefinitely.

CHAPTER V

DISCUSSION

Throughout her episode of care, the patient demonstrated improvements in all objective and subjective outcome measurements. The patient's plan of care was established for 7-8 weeks. This proved to be the correct amount of time as the patient was discharged at the end of the seventh week due to improvement in all objective outcome measures, subjective reporting, and completion of PT goals. In this time, she demonstrated a decrease of 5 points in the measurement of pain using the VAS. This exceeds the minimally clinically important difference (MCID) for this scale which he found to be 10-20 points on a 100-point scale (i.e. 1-2 points on a 10-point scale).[24]

Based upon these results, the combination of both procedural and educational interventions seemed to be effective in treating this patient with double-crush syndrome consisting of cervical radiculopathy and cubital tunnel syndrome. Interventions such as general soft tissue massage and stretching of the patient's neck and L upper trapezius muscle as well as strengthening of the patient's deep neck flexor group were chosen based on evidence that indicates their ability to decrease pain and recover functional mobility in the patient's cervical spine.[22,25] Patient outcomes suggest that these interventions indeed proved to be helpful in reducing the patient's cervicogenic pain which then worked to improve her cervical ROM. In addition to these, interventions that targeted the patient's pathology at the elbow also needed to be added. These interventions included patient education and activity modification as well as active and passive neurodynamic mobilizations. Patient education and activity modification alone has been shown to improve outcomes in patients with ulnar neuropathy at the elbow[26] while the aim of neurodynamic mobilization is to improve neural tissue mobility which will then

aid in decreasing the patient's pain and improving their functional abilities.[12] Again, patient outcomes suggest that these interventions were useful in decreasing the patient's pain in her elbow, wrist, and hand as well as her overall function.

Even though this patient did eventually show a drastic improvement in her symptoms and functional abilities, her initial incomplete diagnosis, and therefore incomplete management of her diagnosis, indicates that there is still more research that needs to be done to increase the speed and accuracy of the diagnosis of DCS. Physical therapists can identify the diagnosis of cervical radiculopathy with relative ease as the cluster of special tests that were used in this case are simple to perform are accurate.[18] Provocative testing for CuTS such as Tinel's and the Scratch-Collapse Test have also been shown to be reliable.[27,28] However, as discussed previously, DCS can present in many different ways with a multitude of possible compression sites. That is why, as we currently stand, there is no absolute test to confirm the diagnosis of DCS.[1] Instead, the component diagnoses must be identified separately. Therefore, further literature reviews and randomized controlled trials (RCTs) are warranted in order to determine a more streamlined way of diagnosing DCS. The same can also be said with the conservative treatment of this diagnosis.

As was mentioned before, the little evidence available in the literature relating to the conservative treatment of DCS indicates that the treatment should consist of the management of each lesion respectively.[1] This case report outlined the utilization of a combination of interventions including manual therapy, cervical strengthening, neurodynamic mobilizations, patient education, activity modification, and a HEP, each of which is effective in the treatment of different aspects of the involved lesions.[12,13,22,23,25,29] The outcomes of this patient indicate that this combination of interventions has the possibility of being further utilized in the future with

patients who are presenting with DCS consisting of CR and CuTS. However, no definite conclusion can be made from one case report alone. Therefore, further investigation including additional case studies and RCTs should be performed on DCS characterized by these two areas of lesion and on DCS as a whole.

A possible limitation of this study includes the patient's use of oral steroids that she was prescribed following a visit to the ER between the second and third visits to PT. Following the prescription of these medications, the patient showed an immense decrease in pain accompanied by an increase in cervical AROM which is consistent with the numbers presented in Table 7. Shortly after the patient stopped taking the oral steroids, she reported an increase in pain once again. It is a possibility that this improvement in ROM and short improvement in pain were in fact due to the medication rather than the treatment provided in PT. However, given the temporary nature of her symptom relief, it is unlikely that the medications had any effect on the patient's long-term outcomes.

In conclusion, this case report highlights the success and difficulties regarding the physical therapy diagnosis and treatment of a patient presenting with double crush syndrome consisting of cervical radiculopathy and cubital tunnel syndrome. Based on this case report, utilization of upper limb neural tension testing and nerve mobilization or gliding are suggested to differentiate the likelihood of peripheral nerve involvement versus cervical radiculopathy. Understanding the differential diagnosis of these conditions is essential in identifying the best treatment options and plan of care. Quantitative research regarding the diagnosis of DCS and the conservative treatment of its potential components, especially CuTS, would be beneficial in improving the outcomes and the overall healthcare experience of patients with this diagnosis.

REFLECTIVE PRACTICE

Through the completion of this case report, the author has gained a better understanding of how to properly proceed with a patient with double crush syndrome. This improved understanding is a result of hands-on experience with this patient as well as reviewing the literature. In future history taking sessions, the author would plan on further delineating the cause of the pain and ruling out potential differential diagnoses. Questions that would potentially lead the patient to confirm my suspected diagnosis will not be asked. When performing future examinations with patients who present with neurologic pain in the upper extremity, the author will make sure to perform a thorough peripheral joint scan to rule out differential diagnoses, especially peripheral neuropathies. Some tests that should be utilized include the Scratch Collapse Test, Tinel's Tap test, and Phalen's test to investigate the possibility of carpal or cubital tunnel syndrome. These tests will be performed during the initial examination even if other tests have confirmed the diagnosis of cervical radiculopathy and vice versa. As far as the plan of care goes, no changes will be made to the interventions utilized with a patient with DCS as the interventions utilized in this case are all supported by the literature. However, interventions related to CuTS should be provided sooner than seen with this patient as she would have likely benefited from these interventions earlier.

When considering the movement towards pay for performance for PT services, it is important to consider the financial impact on the patient. Through a cost-benefit analysis, it was decided that the total cost of the PT services provided was $887.47. This is based on the APTA billing calculator and through discussion with the patient. This should be considered a reasonable price being that the patient left therapy with minimal-no pain. This is made even more reasonable when you consider the likely alternative of surgical intervention which at the very least would cost the patient around $350 and would need to be followed up by a visit to PT for rehabilitation

anyways. This would bring the alternative total to approximately $1000 meaning that the conservative treatment provided by PT was, in fact, worth it. However, that is not to be said that optimal patient care was provided as there were areas where patient costs could have been reduced. The biggest area that costs could have been reduced cost would be in the timeframe of the first 3-4 visits being that the patient's full diagnosis was unknown. Had the patient's diagnosis of cubital tunnel syndrome been identified during this time, treatment in this area could have been initiated which likely would have decreased the number of times that she had to come into therapy.

APPENDIX

LIST OF FIGURES

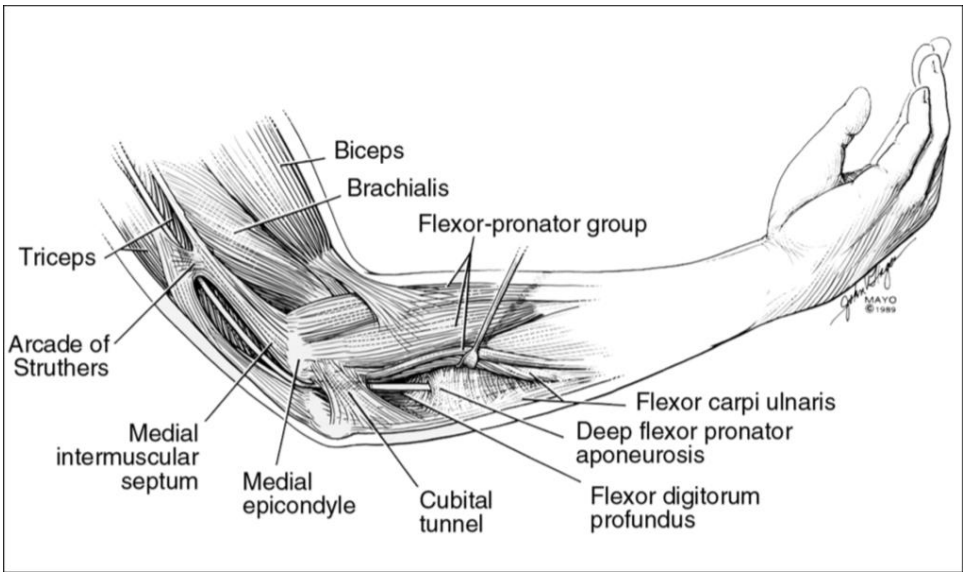


Figure 1. Path of the Ulnar nerve about the elbow[1]

Grade 1: mild symptoms
- Intermittent paresthesia
- Minor hypoesthesia
- No motor change

Grade 2: moderate and persistent symptoms
- Paresthesia
- Hypoesthesia
- Mild weakness of ulnar innervated muscles
- Early signs of muscular atrophy

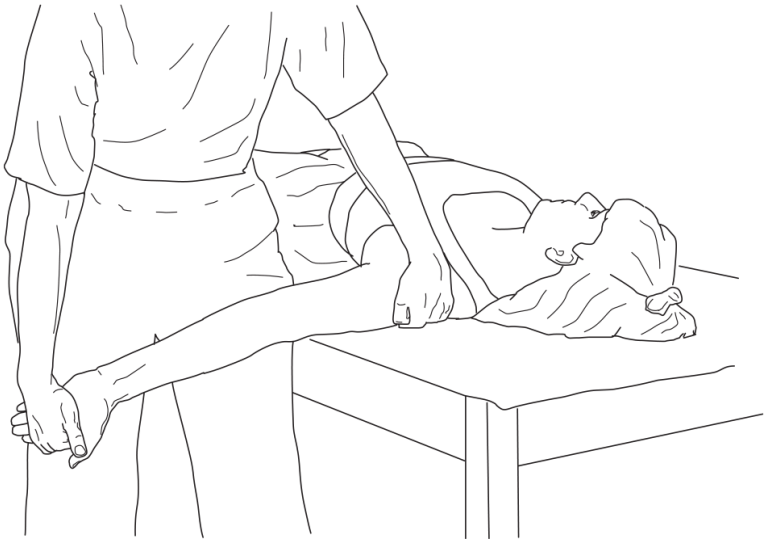
Grade 3: severe symptoms
- Paresthesia
- Obvious loss of sensation
- Significant functional and motor impairment
- Muscle atrophy of the hand intrinsic
- Possible digital clawing of 4th and 5th digits

Figure 2. McGowan Grading System for CuTS[13]

Figure 3. Self-Neurodynamic Mobilization of the Ulnar Nerve

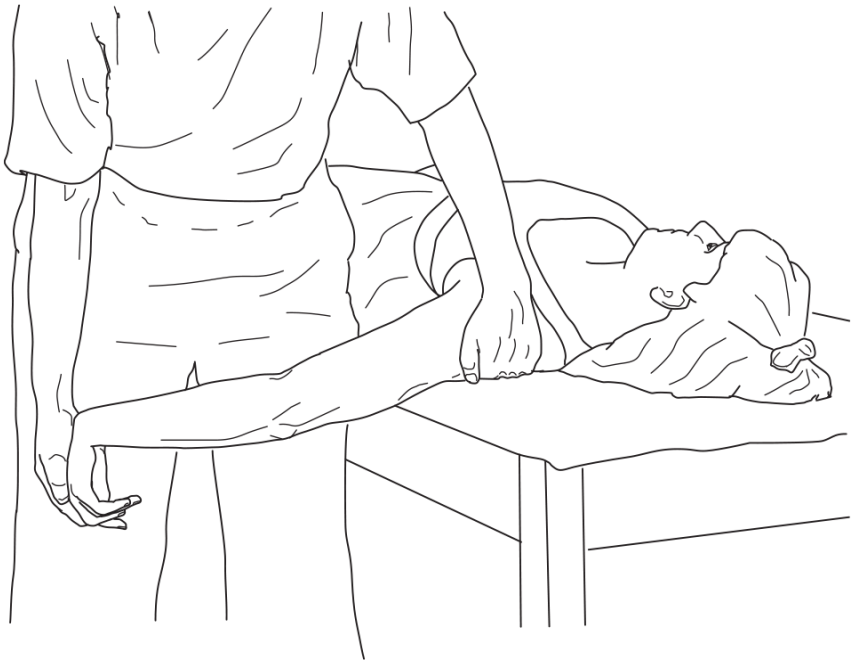
Position of maximum stretch on the ulnar nerve includes shoulder girdle depression; shoulder external rotation and abduction; elbow flexion; forearm supination and wrist extension; and finally contralateral cervical side flexion.

Figure 4. Passive Neurodynamic Mobilization of the Ulnar Nerve in Supine[24]



Position of maximum stretch on the median nerve includes shoulder girdle depression; shoulder abduction; elbow extension; shoulder external rotation and supination of the forearm; wrist, finger, and thumb extension; and finally contralateral cervical side flexion.

Figure 5. Passive Neurodynamic Mobilization of the Median Nerve in Supine[24]



Position of maximum stretch on the radial nerve includes shoulder girdle depression; shoulder abduction; elbow extension; shoulder medial rotation and forearm pronation; wrist, finger, and thumb flexion; wrist ulnar deviation; and finally contralateral cervical side flexion.

Figure 6. Passive Neurodynamic Mobilization of the Radial Nerve in Supine[24]

Figure 7. Self-Neurodynamic Mobilization of the Median Nerve

Figure 8. Self-Neurodynamic Mobilization of the Radial Nerve

LIST OF TABLES

Table 1. Systems Review

Results of Systems Review	
Cardiovascular/Pulmonary	HR: 76, RR: 16 breaths/minute, BP: 128/84 mm Hg, Edema: none
Musculoskeletal	Gross strength impairments of the L UE due to increased pain ROM impairments of the neck Gross strength of neck not tested due to pain and apprehension
Neuromuscular	Balance: Not impaired Gait/locomotion: Impaired. Patient presented with shortened stride length and reduced arm swing L > R. Motor Control: Not impaired Sensation: Impaired Increased pain with light touch over deltoid, entire hand, and medial forearm. Transfer/Transitions: Not impaired
Integumentary	Skin integrity: Normal Skin color: Normal
Communications	Intact and Appropriate
Affect, Cognition, Language Learning Style	The patient was a 74-year old female who was reserved and defensive due to increased levels of pain. The patient communicated in English. The patient learned best through demonstration and active participation.

Table 2. Initial Cervical ROM Measurements

	Right	**Left**
Flexion	20 (Increased L UE pain)	N/A
Extension	NT due to epidural injection	N/A
Lateral Flexion	23 (Increased L UE pain)	20 (Increased L UE pain)
Rotation	64 (Increased L UE pain)	33 (Increased L UE pain including numbness and tingling. Pt stated that this was the most painful motion)

Table 3. UE MMT

Motion Assessed (Associated nerve roots)	Right	Left
Cervical Flexion (C1-2)	NT due to patient pain and apprehension	N/A
Cervical Lateral Flexion (C3)	NT due to patient pain and apprehension	NT due to patient pain and apprehension
Shoulder Elevation (C4)	5/5; Pain-free	4/5; Symptomatic pain reproduced
Shoulder Abduction (C5)	5/5; Pain-free	4/5; Symptomatic pain reproduced
Elbow Flexion (C6)	5/5; Pain-free	4/5; Symptomatic pain reproduced
Elbow Extension (C7)	5/5; Pain-free	4/5; Symptomatic pain reproduced
Thumb Extension (C8)	5/5; Pain-free	4/5; Symptomatic pain reproduced
Finger Adduction (T1)	5/5; Pain-free	4/5; Symptomatic pain reproduced

Table 4. UE Dermatomes

	Right	Left
Top of Head (C2)	Intact	Intact
Above Ears (C3)	Intact	Intact
Upper Trapezius (C4)	Intact	Intact
Deltoid (C5)	Intact	Painful
Lateral Forearm (C6)	Intact	Intact
2nd and 3rd Digits (C7)	Intact	Painful
4th and 5th Digits (C8)	Intact	Painful
Medial Forearm (T1)	Intact	Painful

Table 5. Special Tests (Performed on L)

Special Test(s)	**Result**	**Indication**
Alar ligament test		
Sharp-Purser Test		

Cervical Radiculopathy Cluster Tests Spurling's Manual cervical distraction Cervical rotation <60 degrees towards symptomatic side ULTT	 Positive Negative Positive Positive	¾ tests positive = likelihood ratio of 6 that cervical radiculopathy is present
Tinel's Tap Sign at the Elbow (Performed during 4th visit to PT)	Positive	Peripheral neuropathy of the ulnar nerve at the elbow

Table 6. Goals for Physical Therapy

Short Term Goals (To be met in 4-6 weeks)
1. Following PT intervention, the patient will decrease the amount of times that she wakes up due to pain to 0 times/night in order for her to achieve restful sleep. 2. Following PT intervention, the patient will be able to sit for greater than 1 hour with minimal/no symptoms to allow for her to travel out of town to visit grandchildren.
Long Term Goals (To be met in 7-8 weeks)
1. Following PT intervention, the patient will be able to achieve cervical rotation AROM of 60 degrees bilaterally without increase in pain or radicular symptoms to allow for her to drive safely.[30] 2. Following PT intervention, the patient will decrease her pain experienced with activity to a 2/10 on the VAS to allow her to interact with her grandchildren without the limitation of pain.

Table 7. Updated Cervical AROM Measurements

	Right	**Left**
Flexion	60	N/A
Extension	35 (guarded, pain reproduced in cervical spine, no change in L UE)	N/A
Lateral Flexion	27	29
Rotation	68	50(Intermittent increase in L forearm symptoms)

Table 8. Final Cervical AROM Measurements

	Right	**Left**
Flexion	60	N/A
Extension	50	N/A
Lateral Flexion	34	36
Rotation	68	61

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