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A Combination of Surgical and Conservative Management of a Patient with Evolving Cervical Radiculopathy Symptoms: A Case Report

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Abstract

Background: Cervical radiculopathy is a common neurological disorder. Patients with cervical radiculopathy typically present with neck or arm pain, sensory changes, weakness in the upper extremities, or a combination of the above. Currently, there is a lack of evidence demonstrating the evolution of symptoms in patients with cervical radiculopathy, both in those who undergo conservative or surgical treatment. The purpose of this case report was to describe the acute post-operative phase for a complicated patient case in which both surgical and physical therapy interventions were used in the management of the patient's evolving cervical radiculopathy symptoms. **Case Description:** The patient was a 56-year-old female who reported to physical therapy status-post C5-C6 anterior cervical discectomy and fusion (ACDF). Within one month of her first surgery, she underwent a second surgery, ACDF C5-C7, due to the persistence of symptoms. She returned to physical therapy following her second surgery. **Intervention:** The patient reported to physical therapy for three weeks after her first surgery and for four weeks after her second surgery. Treatment focused on strengthening, stabilization, range of motion (ROM), and pain management. **Outcome Measures:** At seven weeks post-operatively, the patient was pain-free, demonstrated full active cervical rotation ROM bilaterally, but continued to have difficulty with left overhead shoulder mobility, secondary to feelings of stiffness. She was still attending physical therapy two times per week to improve this deficit. **Discussion:** This case demonstrates how symptoms in patients with cervical radiculopathy can present and evolve differently, which requires an individualized treatment approach. Therefore, studying these patients is challenging. Little evidence exists regarding the most effective management of patients with cervical radiculopathy who have undergone a combination of surgical and physical therapy management. Case reports can help assist with the development of effective treatment approaches in these patients.

Keywords: Cervical radiculopathy; physical therapy; rehabilitation; orthopedics;

Background

Cervical radiculopathy comprises one of the largest neck and upper extremity clinical complaints, with 107.3 per 100,000 and 63.5 per 100,000 instances for men and women, respectively reported annually.¹ Cervical radiculopathy peaks during the fourth and fifth decades of life.^{1,2} Cervical radiculopathy results from compression of cervical nerve roots, such as by disc herniation, bony osteophytes, or most commonly, cervical spondylosis that causes impingement on the nerve root. The incidence of trauma causing cervical radiculopathy is relatively low.^{1,2} Radiculopathy can present as pain, sensory deficits, motor deficits, diminished reflexes, or a combination of the above.³ Unlike axial neck pain, cervical radiculopathy pain usually presents unilaterally.⁴ The most commonly affected nerve roots are C7, followed by C6 and C8,³ secondary to the increased motion at these segments.

In many cases, conservative management of cervical radiculopathy is both effective and the treatment of choice, with up to 90% of patients reporting excellent outcomes.⁵ Despite these high success rates, it has been reported that approximately 25% of patients will have persistent symptoms despite conservative management and require surgical intervention.¹ Even with surgery, patients often continue to have symptoms or require further intervention secondary to adjacent segment disease or other complications. A study by Veeravagu et al⁶ reported reoperation rates of 9.13% and 10.7% in patients who underwent single and multilevel anterior cervical discectomy and fusion procedures, respectively, due to ongoing or evolving symptoms. The comprehensive care of patients with cervical radiculopathy, with or without surgical management, is not well studied, likely secondary to the complex and widely varying nature of their symptoms. The purpose of this case report was to describe a complicated patient case in which a combination of surgical and physical therapy interventions was implemented as the patient's cervical radiculopathy symptoms evolved over time.

CASE DESCRIPTION

Patient History

The patient was a 56-year-old Caucasian female who woke up one morning with insidious right arm pain, numbness, and tingling into the first three digits of her right hand. The patient continued to have these symptoms for two weeks, prompting her to try chiropractic care. Following three weeks of three times per week chiropractic treatments, her symptoms did not improve. The patient then went to her primary care physician and underwent magnetic resonance imaging (MRI), which showed a herniated disc at C5, degenerative disc disease, and stenosis of the cervical spine. Due to the failed trial of conservative care, as well as the results of the MRI, it was decided the patient was a good candidate for surgical intervention.

Approximately three months after the onset of symptoms, the patient underwent a C5-C6 anterior cervical discectomy and fusion (ACDF) with allograft. Following the surgery, the patient continued to have the same symptoms of right arm pain, numbness, and tingling into digits one through three. Her chief complaints continued to be her neck pain and radicular pain down her right arm. Her goals were to get rid of her neck and arm pain so she could pick up her granddaughters and resume her hobby of making cards. The patient reported to outpatient physical therapy approximately 2.5 weeks after surgery for evaluation and treatment.

Clinical Impression #1

Based on the subjective history and the patient's primary complaints of neck and right arm radicular symptoms, the differential diagnoses included cervical radiculopathy and degenerative changes throughout the cervical spine, particularly at C5-C7 as shown on the patient's MRI. This patient was a good candidate for the purpose of this case report because of her ongoing symptoms despite conservative and surgical interventions, as well as her motivation to improve and reduce her level of disability. Based on the patient's history, examination focused on assessing range of motion (ROM), strength, sensation, and reflexes.

Initial Exam

Cervical and upper extremity (UE) portions of the top tier of the Selective Functional Movement Assessment (SFMA) were performed. The SFMA is a tool used to identify dysfunctions in movement patterns. It is based on the theory of regional interdependence in which all of the regions of the body are linked. The SFMA consists of 10 whole-body movements to assess functional movement patterns, which can be further broken down into “breakouts” to identify the source of the dysfunction.^{7,8} It is administered by having the patient perform a series of active movements. Each movement is graded as dysfunctional non-painful (DN), functional non-painful (FN), functional painful (FP), or dysfunctional painful (DP) based on the assessment’s written criteria. Movements can be further broken down into smaller components to identify if the source of the dysfunction is coming from an impairment in stability, joint mobility, or soft tissue extensibility. The SFMA has been shown to have moderate or better inter-rater reliability (ICC = 0.61) when performed by SFMA-trained raters.⁹ Baseline measurements of the cervical and UE portions of the top-tier of the SFMA are shown in **Table 1**.

The patient completed the patient-specific functional scale (PSFS) and rated being able to curl her hair as 2/10. The PSFS is a self-reported scale in which the patient lists up to three activities with which the patient is having difficulty as a result of the current problem/symptoms. The patient rates each item on a scale of 0 to 10, with 0 indicating unable to perform the activity and 10 as being able to perform the activity as well as he/she could before the onset of symptoms.¹⁰ The final PSFS score is determined from the average of the 1, 2, or 3 reported activities. The PSFS has previously been reported to be a valid and reliable measure, with a minimal clinically important difference (MCID) of approximately 2 points.¹¹

The initial exam revealed normal UE myotomes bilaterally via manual muscle testing performed in sitting, hypersensitivity at the C6-C8 dermatomes via brush testing with Q-tips, and normal biceps, brachioradialis, and brachialis reflexes bilaterally. The patient had a small (~2”) incision on the right anterior portion of her neck from approximately C5-C7. The patient was tender to palpation along the right upper trapezius, levator scapula, and posterior rotator cuff, but denied any changes in her referred pain with palpation or testing.

Table 1. Initial Evaluation SFMA Measurements

Top Tier Component	Measurement
Cervical flexion	DN – 2 fingerwidths
Cervical extension	NT
Rotation	DN (B): L: 48° R: 50°
UE 1 (IR)	FN (B)
UE 2 (ER)	L: DN R: DN *effortful

Abbreviations: DN: Dysfunctional Non-painful; NT: not tested; (B): bilateral; UE 1: upper extremity pattern 1; IR: internal rotation; FN: functional non-painful; UE 2: upper extremity pattern 2; ER: external rotation

Intervention

The patient reported to outpatient physical therapy (PT) 2.5 weeks post-operatively. In addition to her right-sided pain and radicular symptoms, approximately three weeks after surgery, she began experiencing sharp pain into the left side of her neck and upper arm, but denied left-sided radicular symptoms. She attended seven PT sessions over the course of 15 days. Interventions focused on radial nerve flossing, soft tissue mobilization to the upper trapezius, and scapular stabilization exercises in order to reduce her neck, arm, and right-sided radicular symptoms, as well as to improve her overall function and mobility. Exercises performed included scapular retraction and clocks, pendulums, supine active-assisted ROM flexion with cane, seated shoulder external rotation with resistance band, and standing rows with resistance band. The patient demonstrated slightly improved, but still limited cervical rotation bilaterally (left: 55°, right: 53°) compared to initial evaluation and continued to have her same symptoms, including numbness and tingling into the first three digits of her right hand. Following the

seventh PT visit, the patient had a follow-up appointment with her physician for further discussion and evaluation of her ongoing symptoms.

Less than one month following surgery, the patient elected to undergo a second ACDF surgery, from C5-C7 due to the persistence of her symptoms. Following the second surgery, the patient continued to have the same right and left-sided symptoms. In addition, she also experienced mild dysphagia, which she did not experience after the first surgery. Due to the persistence of symptoms, the patient had an epidural one-week after her second surgery and felt some pain relief five days after the injection, but continued to experience her radicular symptoms until about 2.5 weeks after her second surgery, when her right-sided radicular symptoms fully resolved. Approximately three weeks after the second surgery, the patient resumed physical therapy.

A re-examination revealed decreased strength (4-/5) with left shoulder external rotation (C5), wrist extension (C6), and wrist flexion (C7), as measured via manual muscle testing in sitting. Reflexes and dermatomes were normal, with no hypersensitivity noted and the patient denied radicular symptoms. However, the patient complained of pain in her left upper arm with left flexion and abduction above approximately 90 degrees. In addition, the patient was found to be hypomobile in her upper thoracic spine. Previous studies have shown that mobilization to the thoracic spine can improve neck and/or shoulder pain, mobility, and overall function.¹²⁻¹⁵ However, there is a lack of consensus regarding the use of joint mobilizations after ACDF. A study by Swanson et al,¹⁶ found that therapists with more fellowship or residency training are more likely to perform joint mobilizations than those who have less training following surgical interventions. To our knowledge, there are no studies contradicting the use of thoracic spine mobilizations following cervical fusion. Therefore, PT interventions focused on thoracic joint mobilizations (grades 3-4 central and unilateral posterior-anterior mobilizations) and stretching. Other manual techniques used included scapular mobilization and distraction, soft tissue mobilization, and leukotape for first rib depression and scapular retraction to reduce pain with overhead motions. In addition, exercises including prone shoulder horizontal abduction and extension, shoulder external rotation with resistance band, and supine active-assisted cane exercises into shoulder flexion and extension were used to facilitate range of motion, strength, and reduce pain.

Outcomes

Following the second surgery, the patient attended a total of eight PT sessions over the course of four weeks. Approximately 7 weeks after the second surgery, the patient was symptom-free on her right side, pain-free bilaterally, and was only having difficulty with left overhead motions, secondary to joint stiffness. However, within a single session involving joint mobilizations to the thoracic spine and shoulder flexion active-assisted range of motion exercises, the patient demonstrated a clinically significant improvement from 147 to 180 degrees of left active shoulder flexion. Active abduction also improved from 139 to 145 degrees, but continued to be limited by stiffness. According to a study by Muir et al,¹⁷ the MCID for standing active shoulder flexion is 16 degrees and 28 degrees for abduction. Similarly, cervical rotation improved significantly bilaterally between re-evaluation and the final visit. Cleland et al¹⁸ determined an improvement of at least 13.9 degrees represented a meaningful detectable change for cervical rotation ROM. In addition, left UE pattern 1 of the SFMA became functional. Manual muscle testing performed at seven weeks after the second surgery revealed improved strength compared to three weeks post-operatively for left shoulder external rotation, wrist extension, and wrist flexion. Comparisons between the re-evaluation three weeks following the second surgery and the final visit seven weeks post-operatively are shown in **Table 2**. Finally, the patient demonstrated a clinically meaningful improvement on the PSFS for curling her hair, improving to 4/10 compared to 2/10 at her initial evaluation.

Table 2. Comparison of re-evaluation and final session measurements

	Re-evaluation (3 weeks following second surgery)	Final session (7 weeks following second surgery)
Cervical flexion	DN (3 fingerwidths)	NT
L rotation	49°	80°
R rotation	59°	85°
UE 1 L	DN (T10)	FN (T6)
UE 1 R	DN (T8)	DN (T8)
UE 2 L	DN (occiput)	DN (occiput)
UE 2 R	DN (C7)	DN (T3)
L shoulder flexion	NT	180°
L shoulder abduction	NT	145° "stiff"
MMT L shoulder ER	4-/5	5/5
MMT L wrist flexion	4-/5	5/5
MMT L wrist extension	4-/5	5/5

Abbreviations: DN: dysfunctional non-painful; NT: not tested; L: left; R: right; FN: functional non-painful; UE 1: upper extremity pattern 1; UE 2: upper extremity pattern 2; ER: external rotation; MMT: manual muscle testing

Discussion

The purpose of this case reports was to describe the acute phase of physical therapy following surgical intervention for cervical radiculopathy in a patient with evolving symptoms. Thus, only her progress through seven weeks from her second surgery is included here. Initially, treatment focused on improving the patient's right arm symptoms with nerve glides, soft tissue mobilization, and gentle scapulothoracic range of motion and strengthening exercises. However, as the patient's symptoms evolved, interventions were adapted and modified to help minimize the patient's impairments and maximize function.

Patients with cervical radiculopathy often undergo at least six weeks of conservative management before insurance companies will approve surgery.^{12,19} There is no clearly established consensus regarding when patients with cervical radiculopathy should undergo surgery,²⁰⁻²² but, sooner indications for surgical intervention may include progressive neurologic deficits, myelopathy, cervical instability, ligamentous injury, or osseous destruction.²² While optimal timing remains controversial, better outcomes seem to occur when surgery is performed within one year of the onset of cervical radiculopathy symptoms. This is likely due to the timing of the ability of compromised nerves to recover.²³ The patient in this case report tried conservative treatment with chiropractic management, but her symptoms did not resolve, leading to her surgical intervention. It is unclear why the patient did not trial physical therapy prior to surgery.

When patients do require surgical intervention, ACDF is a widely accepted treatment option for cervical radiculopathy.^{24,25} In this procedure, the surgeon removes the problematic disc and inserts a bony graft (either autograft or allograft) into the disc space to facilitate bony fusion. Plates are often inserted to improve stability of the fusion. Based on a study examining ACDF procedures in 92,867 patients,⁶ multilevel ACDF (two or more levels) is most commonly performed, followed by single-level ACDF.

Despite the prevalence of surgical intervention for treatment of cervical radiculopathy, outcomes are mixed. Gornet et al²⁶ examined the seven-year outcomes of cervical disc arthroplasty versus ACDF and found the rate of overall success following ACDF to be 63.2%, with 10.9% of patients requiring a second surgery at the index level. Similarly, a study by Hilibrand et al,²⁷ found that 2.9% of patients who underwent ACDF developed adjacent segment disease annually, requiring additional surgery. Thus, according to these studies, many patients undergoing ACDF may require subsequent surgery due to complications or ongoing symptoms.

To our knowledge, this case is unlike any published cases describing the evolution of symptoms in patients with cervical radiculopathy who undergo both conservative and surgical interventions. This case highlights the importance of individualized patient planning and management, as symptoms can evolve over time. This case also calls attention to the importance of regional interdependence. As the patient's symptoms evolved over time and difficulty with left overhead motion became the chief complaint, thoracic mobilizations and stretching helped improve the patient's shoulder mobility. Without recognizing the interconnectedness of the body, the patient's symptoms may not have resolved. We are unable to say for certain what led to the patient's improvement, but it may have been the combination of surgical and physical therapy interventions, as well as the natural time course needed for healing to occur.

While this case report provides novel information, this topic is difficult to study due to the high variability in patient presentation. Due to this high variability, each patient requires an individualized treatment approach. Therefore, while future research is needed, case studies provide value in describing treatment that combines physical therapy and surgical interventions in which good outcomes are achieved. In addition, future studies should examine the evolution of cervical radiculopathy symptoms over time, with or without surgical intervention, to determine if patterns emerge in order to guide a more comprehensive treatment plan.

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