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Clinical Decision Making in a Patient with Poor Outcomes After Lumbar Fusion: A Case Report

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Abstract

Background: Lumbar fusion surgeries have increased significantly in the United States during the last two decades. However, patients undergoing lumbar fusion often continue to experience pain and disability for extended periods after surgery. Many factors may contribute to these poor outcomes. Rheumatoid arthritis (RA), an auto-immune disease characterized by destruction of synovial joints, is associated with significant pain and work-disability. Research regarding the implications of RA involvement in lumbar spine pathology, and the treatment of these pathologies, is relatively limited. The purpose of this case study is to examine the clinical decision-making process in physical therapy treatment for a patient with rheumatoid arthritis and poor outcomes post lumbar fusion, considering existing evidence. **Case Description:** A patient presented to physical therapy with a history of a T10-pelvis fusion, rheumatoid arthritis, and chronic pain with complaints of severe left-sided hip pain. At the time of evaluation, nineteen joints had signs of active RA involvement. **Intervention:** The patient presented with suspected involvement of multiple types of pain. Evidence for the patient's various components contributing to her pain were utilized to determine interventions for this case study. **Discussion:** Addressing multiple aspects of the patient's symptoms provided mild pain relief and improved patient's participation in functional and recreational activities. Given the chronic nature of the patient's pain, providing education, acute pain relief, and management techniques was an important aspect of the treatment plan.

Keywords: lumbar fusion, rheumatoid arthritis, pain, radicular pain, nociplastic pain

Background and purpose:

The number of spinal fusion surgeries performed in the United States has increased significantly over the last two decades. Between 2003 and 2012, the number of spinal fusion surgeries increased by more than 50%.[1] The rate of lumbar fusion surgery increased by more than the rate of cervical and thoracic surgeries,[2] representing the increased popularity of surgical interventions to stabilize lumbar vertebrae for degenerative disc disease, spondylolisthesis, and other pathologies. Between 2001 and 2010, the average age of patients undergoing lumbar spinal fusion increased from 52 to 57.[2] This increased age of patients also correlates with greater comorbidity burden[2]; more patients receiving this intervention have conditions that could potentially confound outcomes. Another concerning statistic is the increased cost of lumbar fusions: the average hospital bill for lumbar fusions increased from roughly $54,000 in 2001 to over $111,000 in 2010, despite a trend toward shorter hospital stay.[2] Overall, lumbar spinal fusions are increasing in popularity, are including older populations with more complications, are increasing significantly in cost, and are associated with shorter hospital stays. Although more patients are seeking lumbar fusion surgeries, it is estimated that 40% of patients still experience significant pain and disability one year after the lumbar fusion surgery.[3]

Rheumatoid arthritis (RA) is an autoimmune disease characterized by joint swelling and tenderness, and destruction of synovial joints.[4] An estimated 1.29 million Americans are diagnosed with RA, and women are nearly twice as likely as men to be affected.[5] The impacts of the disease vary by individual, but RA can have severe implications for quality of life and participation in meaningful activity. Within two years of diagnosis, up to 33% of persons with RA are unable to work due to the effects of the disease.[5] This statistic increases to 50% of individuals reporting work-disability within 10 years of RA diagnosis.[5] Patients score their pain higher than estimated by their physicians, illustrating the significant and often chronic pain associated with an RA diagnosis.[5]

Classification criteria for rheumatoid arthritis accounts for joint involvement, as RA most often attacks small joints in the body.[4] Specifically, RA attacks the synovium lining joint capsules, and the subsequent inflammation and synovial hyperplasia destroys cartilage and bone impairing the integrity of the joint.[5] RA often attacks the small joints in the hands and feet first, but is also well-documented to affect the cervical spine. Significant concern and research focuses on RA in the cervical spine causing atlantoaxial subluxation.[6] RA is also associated with pathologies in the lumbar spine. However, comparatively less research exists focusing on the impact of RA on low back pain, lumbar pathologies, and interventions being used to address this condition. Lumbar pathologies associated with RA include endplate erosion, disc space narrowing, facet erosion, spondylitis, degenerative spondylolisthesis, compression fractures and stenosis.[6,7]

As discussed earlier, lumbar fusion surgical interventions are being utilized at an increasing rate to address spinal pathologies associated with spinal instability and significant pain. There is conflicting, and limited, research addressing the efficacy and complications of lumbar fusion surgery in patients with rheumatoid arthritis.[7-9] Bodies of evidence regarding physical therapy interventions for patients with rheumatoid arthritis and post-lumbar fusion surgical pain exist separately. There is limited research investigating the ways in which rheumatoid arthritis contributes to outcomes post-lumbar fusion, and appropriate physical therapy interventions effective for treating this population. Therefore, the purpose of this case study is to examine the clinical decision-making process in physical therapy treatment for a patient with rheumatoid arthritis and poor outcomes post lumbar fusion, considering existing evidence.

Case Description: Patient History

A Caucasian 61-year-old female presented for physical therapy evaluation and treatment to address a significant increase in left-sided hip pain beginning eight months ago. Notably, the patient's orthopedic doctor cleared her left hip at an appointment three months prior to the beginning of physical therapy; this doctor referred her to physical therapy to address her symptoms. The patient was hospitalized for pain shortly after her appointment with the orthopedic doctor, and was unable to attend physical therapy for several months due to her inability to tolerate travel time required to attend therapy at a clinic. The patient was unable to qualify for home health services, as she was still able to drive

short distances. Therefore, the patient had not received any physical therapy for her hip pain prior to the evaluation and treatment described in this case study.

The patient verbally rated her pain as 10/10 with movement, and 5/10 at rest with the Numerical Rating Scale. The pain was described as sharp and shooting to her hip “like a hot knife,” and would present as “quick grabs” with even small movements. She was unable to sleep for more than three hours at time, as her pain increased without change in position. She slept on her right side, with the head of the bed elevated due to her husband’s preference. The patient was able to tolerate standing for less than thirty minutes at a time, and sitting for less than one hour at a time. She was unable to tolerate any kind of activity while standing due to increased pain levels. Pain had limited the patient’s participation in activities of daily living: she was unable to stand long enough to cook for herself. The patient’s goals were to experience less pain, “get back to what [she] was doing before,” and improve sleep.

She had a history positive for scoliosis, spinal stenosis, and rheumatoid arthritis, among other conditions not relevant to this case. The patient’s surgical history included a cervical spinal fusion from the second cervical through the first thoracic vertebrae (C2-T1) seven years ago due to significant displacement of vertebrae. Three years prior to beginning therapy, the patient had another spinal fusion involving the tenth thoracic vertebrae (T10) through the pelvis due to severe spinal stenosis with neurogenic claudication. The patient used a small-based quad cane for ambulation, but had not been ambulating outside the house on regular occasions over the months prior to seeking physical therapy. She reported her pain and limitations had caused a psychological burden, and that she had been diagnosed with depression. The patient had been taking the following medications for management of rheumatoid arthritis and pain: low-dose prednisone, baclofen, gabapentin, and hydrocodone.

The patient had imaging performed within the two months prior to starting physical therapy, including x-rays of her lumbar spine and pelvis. The recent images were concerning for loosening screws at the most proximal level of lumbar fusion. The patient also regularly followed up with rheumatologists. She reported that at the time of seeking physical therapy, nineteen joints were active with rheumatoid arthritis, where her “typical” presentation was in eight joints.

Clinical Impression

The patient demonstrated significant aggravations of pain with change in positions or prolonged positioning. She also reported significant increases in pain while moving her legs or trunk in standing position. Her strength of left hip flexors and bilateral ankle plantar and dorsiflexors was impaired, and testing was limited by pain. The patient’s symptoms were not reproduced with palpation of left hip; the patient did have some tenderness with light palpation of her paraspinal musculature, but this did not reproduce her symptoms. The patient reported increased pain with any slight extension bias of trunk, and decreased pain with flexion bias of trunk. Patterns of trunk motion and pelvis movement affecting pain indicated that the primary pain source was likely the pathological exit of nerve roots from the spinal canal. Descriptions of the pain as a “hot knife shooting into [the] left hip” further suggested the pain was neuropathic in origin. The patient reported she had long-standing pain due to her medical history. Figure 1 illustrates estimated contributing types of pain to the patient’s symptoms at her evaluation.

Functional Test Assessment

The patient had a primary goal of returning to physical activity. To accommodate for the patient’s significant pain and need for frequent breaks, the Dynamic Gait Index (DGI) and Timed Up and Go (TUG) were assessed. The patient achieved a 15/24 on the DGI and 23 seconds on the TUG on evaluation, with the use of a standard quad cane. The patient had significant increases in pain during both activities, requiring seated rest breaks to allow the pain to subside. The tests, while demonstrating deficits in the patient’s mobility, also provided insight as to how significantly the patient’s symptoms affected her safety and limited her participation.

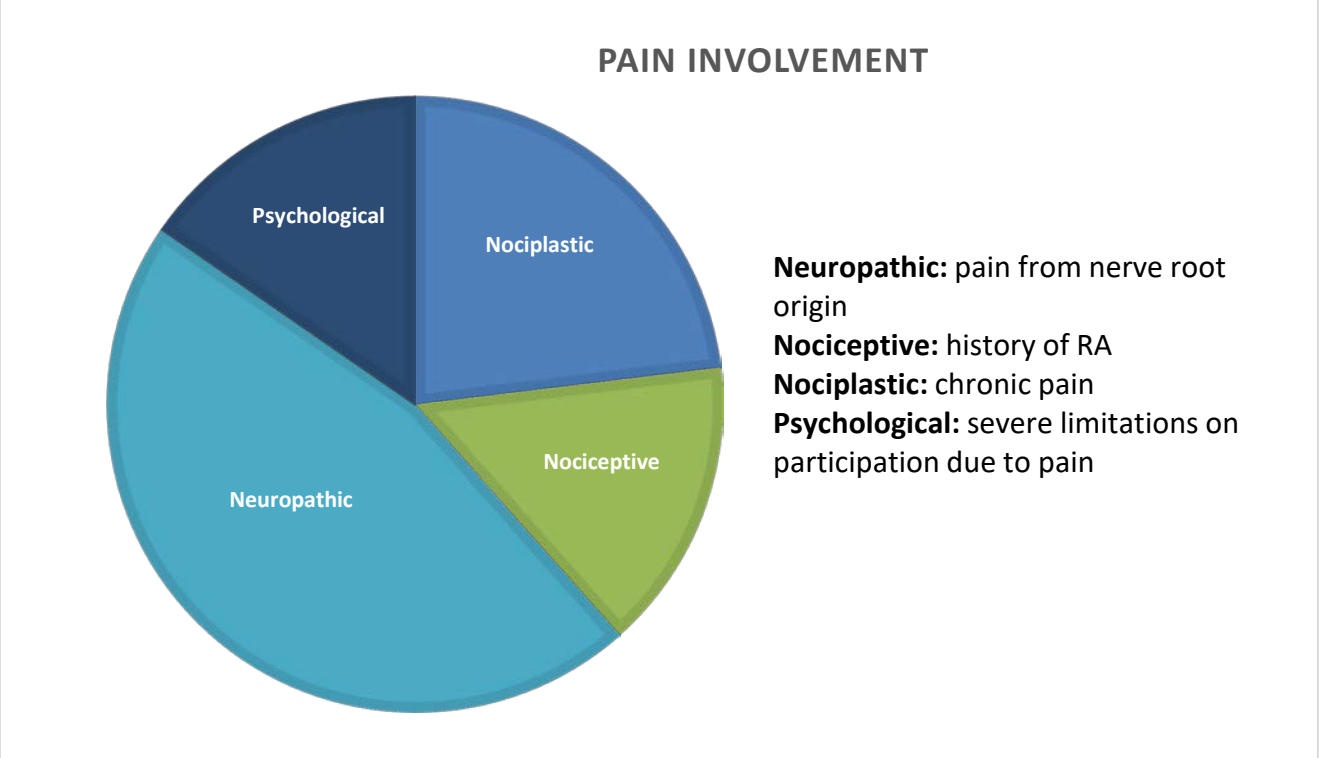

Figure 1: Diagram demonstrating estimated contributions to patient's pain profile

Interventions

The interventions in Table 1 were performed during physical therapy sessions over the course of one month to address patient goals and promote return to previous level of activity.

Table 1: Physical therapy interventions utilized during this case study.
Abbreviations: TA, Transverse Abdominis; UE, upper extremity; LE, lower extremity; IFC, interferential current.

Intervention	Description	Purpose/Reasoning	Patient Response
Pelvic positioning	Anterior/posterior small amplitude pelvic tilts in sitting with verbal, tactile cues and demonstration for core activation	To increase motor control of transverse abdominis (TA), and to determine position associated with least amount of pain. Minimal movement due to fusion.	Decreased pain with flexion bias. Patient able to demonstrate appropriate TA activation with tactile cues.
Dynamic Gait Index (DGI) Testing	DGI assessed: patient used cane to complete testing	Baseline objective measurement for function. Determined extent of gait instabilities.	15/24 scored; moderate impairment, risk for falls. Significant difficulty/increased symptoms with stair ascent/descent.

Functional mobility	Bed transfers and mobility assessed; patient instructed in log-roll technique with demonstration and verbal and tactile cueing for core activation	Significant pain reported with getting out of bed every morning, poor TA awareness demonstrated.	Patient had poor technique for bed mobility, had “sharp stabs” of pain during transfer without verbal and tactile cuing.
Positional Traction	Patient in right sidelying with pillow roll above iliac crest	Increased facet joint opening on left side of lumbar spine to improve complaints of pain, improve tolerance for laying down for resting	Patient noted relief of symptoms during activity.
Education	Education on suspected source of pain, core activation and control, importance of sleep for pain management, and the pain cycle	Improved self-efficacy and promote patient involvement in treatment decisions and plan of care	Patient stated understanding of concepts and was agreeable to continuing with plan of care.
Hip Flexor Assessment	Iliopsoas noted for increased tightness on left hip; release performed with patient in hooklying	Decreased tightness of hip flexor, to decrease tension being placed through the lumbar vertebrae	Patient reported short-term improvements in pain during session not lasting until next session
Functional TA training	TA activation in supine and sidelying with tactile cues. Progressed to seated UE exercises (overhead press 1#, horizontal abduction with TheraBand) and low amplitude leg movements (mini seated marches)	Activation of TA for spine control and decreased pain, with progression to maintain activation during UE and LE movement for “functional activity”	Patient performed exercises with TA activation maintained and no increase in symptoms with tactile and verbal cues
NuStep with electrical stimulation use	Level 2 resistance for LE strengthening and cardiovascular training. IFC sensory setting electrical stimulation bracketed over back.	Cardiovascular training established as beneficial for RA and general health; IFC for acute pain relief during activity	Patient reported no increase in pain levels during activity.

Outcome

After one month of physical therapy treatment, the patient was still experiencing 8/10 pain on the Numerical Rating Scale. However, she reported that her symptoms had generally been improving and she was better able to manage her symptoms. Therapy sessions often began with NuStep exercise combined with IFC to address the increased pain from driving to therapy; at arrival to therapy, pain was rated as high as 7/10. After NuStep exercise combined with IFC, the patient would rate her pain as low as 2/10, allowing increased participation in the remainder of the physical therapy session. Standing activity tolerance had improved to 15 minutes, where at evaluation she was unable to perform any functional activities in standing position.

Functional tests have also shown improvement. The Dynamic Gait Index (DGI) improved from 15/24 to 19/24. For a 61-year-old, the expected score would be between 21 and 24[10], illustrating deficits still present after one month of physical therapy treatment. However, the minimal detectable change for older community dwelling adults being assessed on the DGI is 2.9 points.[10] The 4 point improvement in DGI score indicated a significant functional improvement for the patient in this case study. The Timed Up and Go improved from 23 seconds to 14 seconds. For community-dwelling adults, the cutoff for fall risk is 13.5 seconds.[10] While the patient had not yet improved past the cutoff, she had made significant strides towards improved gait speed. Notably, the patient reported that she had increased her attempts for participation and engagement in community activities. She reported utilization of core activation with scapular retraction and slight right side-bending to manage her pain during activity. Previous to beginning physical therapy, the patient did not participate in community activities or leave her home due to the severity of pain. At the latest update on this case, the patient had established a new long-term goal of walking around the mall with less fatigue and pain, to return to doing her own shopping.

Discussion

The patient discussed presented with significant pain; the patient's pain profile was likely affected by multiple factors including her medical history of rheumatoid arthritis, poor results post lumbar fusion, and severe limitations in participation and activities of daily living creating an emotional and psychological burden. After several weeks of physical therapy interventions as discussed above, the patient was able to better control her pain and was participating in activities outside her home. This denotes an important improvement that aligned with the patient goals of returning to pre-fusion activity levels. Evidence-based practice was utilized to address the multiple contributors to her symptoms. However, limited research exists specifically on post-fusion outcomes in patients diagnosed with rheumatoid arthritis. Therefore, evidence for physical therapy for each contributing factor was considered while developing the treatment plan to address patient goals of reducing pain and returning to previous level of activity.

Evidence for Physical Therapy Treatment Post-Lumbar Fusion

Several systematic reviews examine physical therapy interventions status post lumbar fusion surgical interventions. Notably, all of the systematic reviews call for more high-quality studies focused on physical therapy treatment and efficacy for patients with lumbar fusion. Greenwood et al. (2016) found in their systematic review and meta-analysis that "complex rehabilitation" involving both exercise and cognitive behavioral therapy training can improve short- and long-term function in patients after lumbar fusion surgery.[3] Specifically, physical therapy improved physical function and fear-avoidance behavior.[3] A systematic review by Gilmore et al. in 2015 included only four studies, but notes that more patients were satisfied with their experience with lumbar fusion in terms of treatment and outcome with physical therapy before and after surgical interventions.[11] However, due to the limited nature of the studies involved, exact recommendations for physical therapy interventions with this population were not addressed in the Gilmore review. Madera et al. published a systematic review in 2017 which included twenty-one articles, and provided six recommendations for interventions appropriate and effective for treating patients after lumbar fusion, summarized in the Table 2 adapted from the article.[12]

Table 2: Summary of evidence for physical therapy interventions recommended for post-lumbar fusion care according to Madera et a. 2017.

Intervention	Grade	Recommendation
Cardiovascular exercise	B	Positive effects on long-term health
Soft-tissue mobilization	Insufficient	Decrease postsurgical pain, especially around incision site
Nerve mobilization	Insufficient	Improve ROM, decrease nerve tension and scar tissue adherence to nerve
Motor control and strengthening	B	Neutral spine exercises for core strength and function; improve disability scores
Joint mobilization	Insufficient	Thoracic spine and hip mobilizations to improve functional mobility and decrease strain on fusion site
Patient education	A	Pre- and post-fusion on expectations and process of rehabilitation; builds rapport, decreases anxiety and increases patient empowerment

Individual studies addressing rehabilitation for patients post-fusion also provide some insight and recommendations for successful treatment options. One case report demonstrates the use of transcutaneous electrical nerve stimulation (TENS) for eight hours a day to reduce pain in a post-fusion patient in conjunction with a walking program to promote return to regular cardiovascular exercise.[13] In this study, the use of TENS allowed the patient to progress their walking program, and resulted in reduced pain with increased activity level at the end of the study.[13] A study examining post-fusion rehabilitation for patients with excessive pain after surgical intervention concluded that rehabilitation should include lumbar stabilization exercises, neural flossing, and activity modification.[14] Tarnanen et al. recommends functional exercises with spine in neutral position to promote increased trunk muscle strength; specifically this study recommends sitting exercises with light upper extremity movement for core activation.[15] Use of electrical stimulation, activity modification, and lumbar stabilization with neutral spine were all considered when selecting interventions for this patient.

Evidence for Physical Therapy in Patients with Rheumatoid Arthritis

Research generally supports physical therapy intervention for patients with rheumatoid arthritis, as individualized treatment approaches are beneficial for pain, fatigue, and accomplishing regular physical activity.[16,17] Pain and fatigue are common symptoms for patients with rheumatoid arthritis, and are associated with disability and depressive mood as well as performance of activities of daily living and quality of life.[18] Physical therapy interventions are shown to improve pain, functional ability, health status, and fatigue in patients with RA.[16] Most studies advocate for individualized physical activity plans for patients with rheumatoid arthritis, to include cardiovascular and strength training. Patients with RA have higher risk of developing cardiovascular disease, which contributes to poor health and higher morbidity rates.[19] A long-term individualized home exercise program was correlated with reduced pain ratings in patients with RA.[19] Aerobic and resistance exercises for 60-180 minutes per week is associated with improved general health, reduced pain, improved muscle function, and delayed onset of disability in patients with RA.[17] Overall, physical therapy is appropriate for pain and symptom management in patients with rheumatoid arthritis.

Evidence for Physical Therapy in Patients with Chronic Pain:

Evidence regarding physical therapy interventions for nociplastic pain is expanding. A Cochrane Systematic Review from 2017 concluded that physical activity and exercise may improve pain severity, physical function, and quality of life in persons with non-specific chronic pain.[20] Pain neuroscience education for nociplastic pain is also supported by the literature: research demonstrates education on the mechanisms of chronic pain can contribute to enhanced physical function, decreased pain and disability, and improved psychological factors such as catastrophization.[21] Pain neuroscience education includes discussion on central sensitization, how the brain interprets pain, and different aspects of pain. Education on pain sources and types of pain is therefore appropriate and likely beneficial for patients with long-standing pain.

Combining the Evidence: Interventions Used for a Post-fusion Patient with RA

The patient discussed in this case study presented with severe pain to physical therapy, and had a recent history of hospitalization and self-limiting mobility to home due to her pain levels. Primary focus for the first several sessions was acute pain relief, patient education, and functional activity with reduced pain levels. Consideration was given to interventions supported by evidence, discussed in the sections above. The patient felt minimal pain relief with soft tissue interventions, but did report significant improvement in pain relief with slight right trunk side-bends. Positional traction improved her symptoms, and the patient was educated on how to implement this at home for use during flare-ups of acute pain. Significant patient education was performed regarding her pain, and the primary pain source presenting as neuropathic from the lumbar spine. Education also included the cycle of chronic pain and the importance of restful sleep for improved symptoms. This created a discussion regarding how the patient would often feel sharp increases in her pain while getting in/out of bed or the couch, or trying to reposition herself during the night. Functional movement training involved cues for core activation and appropriate breathing patterns during transitional movements between sitting, supine, and side-lying with the goal of decreased symptoms and improved sleep.

The patient's primary goals were pain relief and to return to previous level of activity. At evaluation, the patient was not walking outside her home except for medical appointments, and was often limiting in-home mobility due to her significant pain levels. The Dynamic Gait Index and Timed Up and Go were assessed at evaluation to provide insight into how the pain was impacting her performance during functional and gait-challenging tasks. These functional outcome measures have been valuable as the patient has progressed with therapy; her improvements in these tests correlate with her improved participation in community activities and functional mobility inside and outside of the home.

The patient was previously exercising regularly, and has a NuStep and TENS unit available for use. There is evidence for regular exercise as beneficial for rheumatoid arthritis, chronic pain, and general health. Due to the severity of the patient's pain, finding a way to perform exercise within tolerable limits of pain was important for compliance to and progression of treatment. Therefore, IFC sensory electrical stimulation was utilized for pain relief during NuStep use for cardiovascular training and lower extremity strengthening. The patient was educated on the evidence for regular exercise for pain management and improved function, and the goal of using electrical stimulation for pain relief during activity. Due to the patient's medical history, chronic nature of symptoms, and likelihood of having future flare-ups of pain, educating the patient on the sources of her symptoms and effective management strategies was important throughout her treatment sessions.

Conclusion

The patient from this case report presented to physical therapy with a history of lumbar fusion, rheumatoid arthritis, and chronic pain. All of these factors likely contributed to her main symptom of hip pain, her perception of her pain, and her limited participation in functional and recreational activities. As the patient had many contributing factors to her pain, interventions to address different aspects of her pain was appropriate. The use of electrical stimulation and NuStep was especially effective for pain relief for this patient: the patient would often choose to begin sessions with this combination for pain

relief after driving to therapy. Education on pain source and positional pain management skills also seem to have been beneficial for the patient, as she reports she is able to maintain lower pain levels and has improved control over acute flare-ups of pain. Ensuring that multiple aspects of the patient's pain were addressed with therapy interventions, and that the patient was able to implement appropriate techniques for pain management and relief in the future, both likely contributed to the positive outcomes experienced by the patient discussed in this case study.

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