THE EFFICACY OF PHYSICAL THERAPY INTERVENTION FOR LUMBOSACRAL RADICULOPATHY: A CASE STUDY

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U2002001

THIS THESIS IS PRESENTED IN PARTIAL FULFILLMENT OF THE DEGREE OF DOCTOR OF PHYSIOTHERAPY (DPT) IN NATIONAL UNIVERSITY OF MEDICAL SCIENCES, USA.

2020 - 2021

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ACKNOWLEDGEMENTS

With sense of great gratitude, I want to thank everyone whom without, this study would not have been possible:

- My supervisor, Dr. Shahin Pourgol (MBA, DC, DO, PhD) the president of NAO, NUMSS (Spain & USA) for his approval to carry out this thesis.
- To all the lecturers that took part in my DPT programs.
- To my brother; Dr. Adeola C Olaluwoye for his huge support.
- To my family; my wife and my wonderful four children; Emmanuella, Treasure, Daniel and Diva for their continuous support, patient and encouragement.
- Finally, to God almighty, in whom I live and have my being.

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ABBREVIATIONS AND ACRONYMS

ADL: Activity of Daily Living

ROM: Range of Motion

LSE: Lumbar stabilization exercise

PIVD: Lumbar prolapsed intervertebral disc

DEFINITION OF TERMS.

- **Radiculopathy** can be defined as the whole complex of symptoms that can arise from nerve root pathology, including anesthesia, paresthesia, hypoesthesia, motor loss and pain.

- **Radicular pain** and nerve root pain can be defined as a single symptom (pain) that can arise from one or more spinal nerve roots.

- **Lumbar sacral radiculopathy** is a disorder of the spinal nerve roots from L1 to S4.

- **Sciatica:** Sciatica is a debilitating condition in which the patient experiences pain and/or paresthesias in the distribution of the sciatic nerve or an associated lumbosacral nerve root**.**

- **Dermatome:** A dermatome is an area of skin that is mainly supplied by a single spinal nerve. There are 8 cervical nerves (note C1 has with no dermatome), 12 thoracic nerves, 5 lumbar nerves and 5 sacral nerves. Each of these spinal nerves relay sensation from a particular region of the skin to the brain.

- **Myotome:** The anatomical term myotome refers to the muscles served by a spinal nerve root. A myotome is, therefore, a set of muscles innervated by a specific, single spinal nerve. The term is also used in embryology to describe that part of the somite which develops into the muscles.

- **Pilates exercises:** Pilates is a system of exercises using special apparatus, designed to improve physical strength, flexibility, and posture and enhance mental awareness.

- **McKenzie exercise:** The McKenzie method (or mechanical diagnosis and therapy, MDT) is a system of diagnosis and treatment for spinal and extremity musculoskeletal disorders.

ABSTRACT

Background and Purpose: Lumbar radiculopathy is one of the most common orthopedic conditions. This occurs when there is damage to a nerve root in the area that it exits the spinal cord. This can be caused from a disc herniation, bone spurs, trauma, or a mechanical stretching event. There is not consistent evidence in current literature regarding rehabilitation interventions for this condition.

Aim: Therefore, this case study aimed to determine: a) to document the fast recovery of a patient experiencing lumbar radiculopathy in physical therapy rehabilitation. (b)To outline the physiotherapy treatment and management options available for lumbar radiculopathy

Case Description: This case study explores the clinical reasoning involved in the management of a 44-year-old man presented with acute, severe right lower back, buttock and postero-lateral thigh pain with radiculopathy at L4/L5/S1, and lateral shift to his left side. Using a biopsychosocial approach.

Physical Exam: The slump test, straight leg raise test, and femoral nerve stretch test were positive. Increased tone of the quadratus lumborum on the right side was observed. Radiating pain down the right LE was reported while standing and extending the back. Forward flexion at the spine relieved the pain.

Differential Diagnoses: Piriformis syndrome, Trochanteric bursitis and Spondylolisthesis.

Methods: Descriptive, qualitative, and explorative design was used for this study.

Outcomes: The patient responded well to treatment and significantly improved following two weeks of physical therapy rehabilitation. He reported minimal pain that was centralized to the low back. He demonstrated an increase in lumbar range of motion, strength, and mobility.

Discussion: The prevalence of lumbar radiculopathy has been estimated to be about 3-5% of the population, affecting both males and females, with a male preponderance in the general population. Age is considered a primary risk factor, with symptoms typically beginning for males in their 40s, while females tend to be affected in their 50s and 60s. Current medical literature is at a consensus regarding the common causes of L5-S1 radiculopathy, intervertebral lumbar disc herniation. More than 90% of herniated discs occur at the L4-L5 or L5-S1 disc space. Compression of these spaces tend to produce a radiculopathy into the posterior leg and compromise or limit ADLs. Current guidelines suggest approaching lumbar radiculopathy in a conservative manner by educating patients, manual therapy, modifying exercises, staying active, and administration of a non-steroidal anti-inflammatory drug.

Conclusion: This patient demonstrated a significant improvement in a short period of time. This case report may suggest intervention strategies for future research regarding physical therapy and lumbar radiculopathy

CHAPTER ONE: INTRODUCTION

1.1. INTRODUCTION AND PURPOSE

Lumbar radiculopathy is a common and disabling condition that often resolves within several weeks. A substantial group (30%) however still have pain and disability beyond 12 months [(1)]. Sound clinical reasoning is important in modern physiotherapy practice, particularly in back pain and radiculopathy, with symptoms influenced by a wide array of intrinsic and extrinsic risk factors[(1)]. Lumbosacral radiculopathy is a disorder that causes pain in the lower back and hip which radiates down the back of the thigh into the leg. This damage is caused by compression of the nerve roots which exit the spine, levels L1- S4. The compression can result in tingling, radiating pain, numbness, paraesthesia, and occasional shooting pain. Radiculopathy can occur in any part of the spine, but it is most common in the lower back (lumbar-sacral radiculopathy) and in the neck (cervical radiculopathy). It is less commonly found in the middle portion of the spine (thoracic radiculopathy) [(3)].

Overall, lumbosacral radiculopathy is an extraordinarily common complaint seen in clinical practice and comprises a large proportion of annual doctor visits. The vast majority of cases are benign and will resolve spontaneously, and thus, conservative management is the most appropriate first step in the absence of clinical red flag symptoms. In cases where symptoms fail to resolve, imaging studies, electromyography, and nerve conduction studies can assist in making a diagnosis.[(3)].

Physiotherapy is recommended as well as pain management as first line management in the absence of red flags, but due to the complex nature of the condition and the variety of causative factors and symptom presentations it can be difficult to treat [(1)].

This case study describes in detail the clinical reasoning utilised to treat a common presentation of lumbar radiculopathy highlighting the complex and systematic thinking and decision making required to provide effective individualised treatment, reducing the likelihood of persistent pain and disability.

Both conservative and surgical interventions are used for the treatment of lumbosacral radiculopathy. In the last decade, efforts have been done to minimize the need for spinal surgery. As per clinical guidelines of the "National Institute for health & care excellence 2016," first preference should be given to conservative treatment, such as medicine, support, advice, and exercise therapy [(6)]. Other interventions such as traction, taping, neural mobilization, and electrotherapy are also recommended for conservative treatment. [(6)].

Surgical intervention is required, when the patient does not respond to conservative treatment. Lumbar discectomy is the most commonly used surgical procedure. [(6)]. Surgical management has several complications and non-significant differences in long-term outcome. Discectomy, a standard surgical procedure for lumbar prolapsed intervertebral disc (PIVD), can have complications such as pain, dural tear, post-operative paralysis, and superficial wound infection. [(6)]. Recurrent or persistent herniation and reoperation at the same level are the complications of "Automated Percutaneous Discectomy. [(6)].

Conservative interventions like physiotherapy do not have such complications and are cost effective too. [(5)]. Keeping this in view, the present review evaluated the efficacy of physical therapy intervention such as electrotherapy, exercise therapy, lumbar traction, and manual therapy in management of lumbar PIVD.

This case study explores the clinical reasoning involved in the management of a middle aged man, with a complaint of severe pain with radiculopathy at L4/L5, down his left lower limb and

lateral shift to his right side. Using a biopsychosocial approach, several risk factors were identified as contributing to the complex nature of the case. Management was directed at addressing these factors, using a combination of manual therapy, education, office ergonomics and postural therapy and exercise to achieve a successful outcome

The purpose of this case report was to document the fast recovery of a patient experiencing lumbar radiculopathy in physical therapy rehabilitation. This may be a favorable group of interventions to guide future research regarding physical therapy and lumbar radiculopathy.

1.2. AIM AND OBJECTIVES

a) To document the fast recovery of a patient experiencing lumbar radiculopathy in physical therapy rehabilitation.

b) To outline the physiotherapy treatment and management options available for lumbar radiculopathy.

1.3. SIGNIFICANCE OF THE STUDY

This case study may be a favorable group of interventions to guide future research regarding physical therapy and lumbar radiculopathy.

1.4. STATEMENT OF PROBLEM

Lumbar radiculopathy is a common and disabling condition that often resolves within several weeks. A substantial group (30%) however still have pain and disability beyond 12 months [(1)]. Sound clinical reasoning is important in modern physiotherapy practice, particularly in back pain and radiculopathy, with symptoms influenced by a wide array of intrinsic and extrinsic risk factors[(1)].

Physiotherapy is recommended as well as pain management as first line management in the absence of red flags, but due to the complex nature of the condition and the variety of causative factors and symptom presentations it can be difficult to treat [(3)]. This case study describes in detail the clinical reasoning utilised to treat a common presentation of lumbar radiculopathy highlighting the complex and systematic thinking and decision making required to provide effective individualised treatment, reducing the likelihood of persistent pain and disability.

CHAPTER TWO

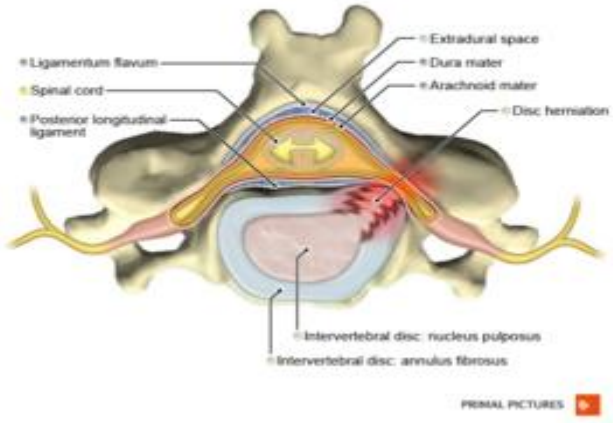
LITRATURE REVIEW OF LUMBOSACRAL RADICULOPATHY

2.1. INTRODUCTION

Radiculopathy is a set of neuropathic conditions caused by compressed nerves in the spine at or near the level of the nerve root [7]. The location of radiculopathy occurrence depends on which nerve root is affected. [7]. Common symptoms of radiculopathy include radicular pain, numbness, tingling, and weakness in the muscles. [7]. Cervical and lumbar radiculopathy can be induced by factors such as disc herniation, bone spurs, trauma, osteoarthritis, inflammation, and tumour or diabetes in some rare cases. [7]. Important risk factors associated with the incidence of radiculopathy include aging, race and hereditary factors, poor posture, and spinal abnormalities. Some studies have also shown that occupation is related to radiculopathy, for example, one study states that people involved in heavy labour, sports, or military service are more likely to develop radiculopathy than those who live a sedentary lifestyle[7]. The prevalence of lumbar radiculopathy was 3% to 5%8 while cervical radiculopathy showed an incidence of 83.2 per 100,000 persons annually. [7].

Lumbar and cervical radiculopathy can be diagnosed through physical examination, imaging, and electro diagnostics. Most patients with radiculopathy respond well to non-surgical, conservative treatment such as medication (corticosteroids, non-steroidal anti-inflammatory, tricyclic antidepressants, analgesics, and muscle relaxants), physical therapy, chiropractic treatment, spinal manipulation, traction, and corticosteroid injections. [7].

2.2. CLINICALLY RELEVANT ANATOMY



The lumbar nerve roots exit beneath the corresponding vertebral pedicle through the respective foramen. Since most disc herniation occur posterolaterally, the root that gets compressed is actually the root that exits the foramen below the herniated disc. So, a disc protrusion at L4/L5 will compress the L5 root, and a protrusion at L5/S1 will compress the S1 root.

Ninety-five percent of disc herniation occur at the L4/5 or L5/S1 disc spaces. Herniation at higher levels are uncommon. [3].

2.3. EPIDEMIOLOGY

While the literature lacks concise epidemiologic data, most reports estimate about a 3% to 5% prevalence rate of lumbosacral radiculopathy in patient populations. Moreover, the condition constitutes a significant reason for patient referral to either neurologists, neurosurgeons, or orthopedic spine surgeons. [3].

Lower back pain is severely common in the general population, but lumbar radiculopathy has only been reported with an incidence of 3 to 5%.[3] 5-10% of patients with low back pain have sciatica. The annual prevalence of disc-related sciatica in the general population is estimated at 2, 2 %.[3].

Prognosis is in most cases favorable, the pain and related disabilities resolving within two weeks. [3]. But at the same time, a substantial group (30%) continues to have pain for one year or longer. [3].

Lumbar radiculopathy is a disorder that commonly arises with significant socio-economical consequences. The discal origin of a lumbar radiculopathy incidence is around 2%. Out of a 12.9% incidence of low back complaints within working population, 11% is due to lumbar radiculopathy. [3]. The prevalence of lumbosacral radiculopathy has been situated from 9.9% to 25 %.[3].

Risk factors for radiculopathy are activities that place an excessive or repetitive load on the spine. Patients involved in heavy labour or contact sports are more prone to develop radiculopathy than those with a more sedentary lifestyle.

2.4. PATHOPHYSIOLOGY

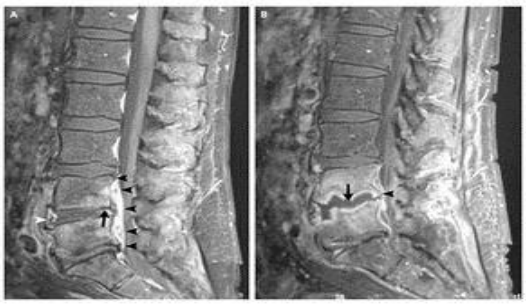
Lumbosacral radiculopathy is the clinical term used to describe a predictable constellation of symptoms occurring secondary to mechanical and/or inflammatory cycles compromising at least one of the lumbosacral nerve roots. The noxious stimulus on a spinal nerve creates ectopic nerve signals that are perceived as pain, numbness, and tingling along the nerve distribution.

Patients can present with radiating pain, numbness/tingling, weakness, and gait abnormalities across a spectrum of severity. Depending on the nerve root(s) affected, patients can present with these symptoms in predictable patterns affecting the corresponding dermatome or myotome [3].

2.5. CLINICAL PRESENTATION

Causes include

- Lesions of the intervertebral discs and degenerative disease of the spine, most common causes of lumbosacral radiculopathy. [3].
- Herniated disc with nerve root compression causes 90% of radiculopathy [3].



Osteomyelitis spine

- Tumors (less often)
- Lumbar Spinal Stenosis caused by congenital abnormalities or degenerative changes. Lumbar stenosis can be described as the narrowing of the spinal canal and compressing the nerve caused by the underlying causes as mentioned above. [3].

- Scoliosis can cause the nerves on one side of the spine to become compressed by the abnormal curve of the spine.
- Underlying diseases like infections such as osteomyelitis. [(3).]

In patients under 50 years, a herniated disc is the most frequent cause. After the age of 50, radicular pain is often caused by degenerative changes in the spine (stenosis of the foramen intravertebral). [(3).] Risk factors for acute lumbar radiculopathy are: [(3).]

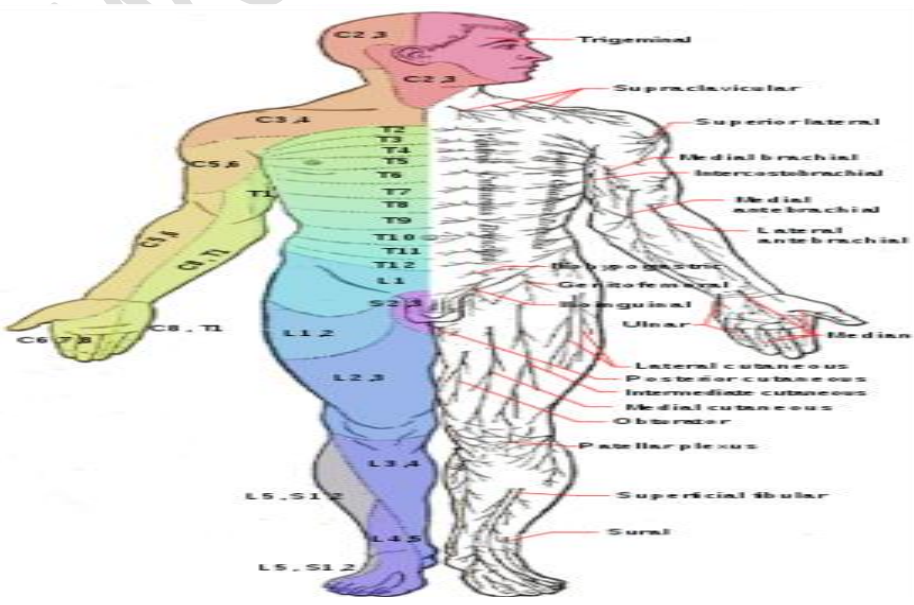
- Age (peak 45-64 years)
- Smoking
- Mental stress
- Strenuous physical activity (frequent lifting)
- Driving (vibration of the whole body)

Indication for sciatica/symptoms: [(3).]

- Unilateral leg pain greater than low back pain, leg pain follows a dermatomal pattern[3]
- Pain traveling below the knee to foot or toes
- Numbness and paraesthesia in the same area
- Straight leg raise positive, induces more pain

Clinical presentation depends on the cause of the radiculopathy and which nerve roots are being affected. Also important is the nature (sharp, dull, piercing, throbbing, stabbing, shooting, burning) and localization of the pain [(3).] Some patients report, besides radicular leg pain, also neurological signs such as paresis, sensory loss. or loss of reflexes. If not present, this is not radiculopathy.

2.5.1. CLINICAL PRESENTATION FOR RADICULOPATHY FROM EACH LUMBAR NERVE ROOT

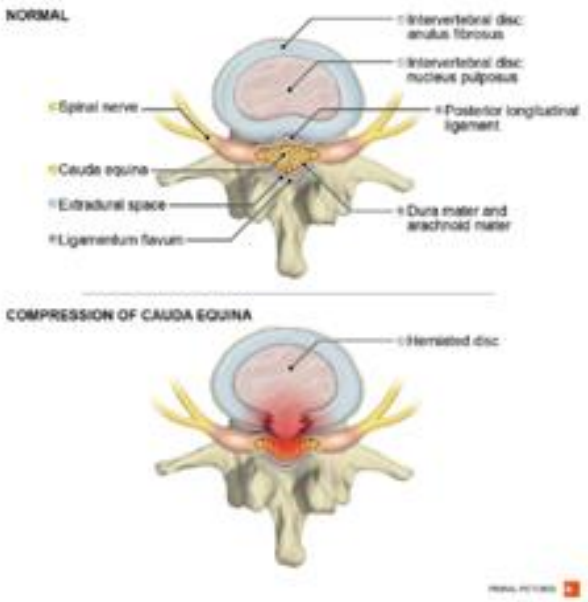


Tab.1

Nerve Root	Dermatomal area	Myotomal area	Reflexive changes
L1	Inguinal region	Hip flexors	
L2	Anterior mid-thigh	Hip flexors	
L3	Distal anterior thigh	Hip flexors and knee extensors	Diminished or absent patellar reflex
L4	Medial lower leg/foot	Knee extensors and ankle dorsiflexors	Diminished or absent patellar reflex
L5	Lateral leg/foot	Hallux extension and ankle plantar flexors	Diminished or absent achilles reflex
S1	Lateral side of foot	Ankle plantar flexors and evertors	Diminished or absent achilles reflex

2.6. DIFFERENTIAL DIAGNOSIS

Radicular syndrome/ Sciatica: a disorder with radiating pain in one or more lumbar or sacral dermatomes, and can be accompanied by phenomena associated with nerve root tension or neurological deficits. [3].



- Pseudoradicular syndrome
- Thoracic disc injuries
- Low back pain
- Cauda equina
- Inflammatory/metabolic causes: Diabetes, Ankylosing spondylitis, Paget's disease, Arachnoiditis, Sarcoidosis
- Trochanteric bursitis
- Intraspinal synovial cysts

2.6.1. DIAGNOSTIC PROCEDURES

Clinical evaluation:

- X-rays: to identify the presence of trauma or osteoarthritis and early signs of a tumor or an infection
- EMG: useful in detecting radiculopathies but they have limited utility in the diagnosis. In patients with clinical suspicion of lumbosacral radiculopathy and normal MRI findings, EMG may help in diagnosing nerve root involvement in patients with otherwise unexplained leg pain.
- MRI: used to see if disc herniation and nerve root compression are present in patients with clinical suspicion of lumbosacral radiculopathy. [(3).]

2.7. OUTCOME MEASURES

- Roland Morris Disability Questionnaire (RMDQ) - The Roland Morris Disability Questionnaire assess changes in functional status after treatment in patients with low back pain. The Questionnaire is widely used for health status. [(3).]
- Back Pain Functional Scale - A scale for self-report measure that evaluates functional ability in people with back pain.
- The Maine-Seattle Back Questionnaire - A 12-item disability questionnaire for evaluating patients with lumbar sciatica or stenosis.
- Fear Avoidance Belief Questionnaire (FABQ) - this questionnaire is developed by Waddell to investigate fear-avoidance beliefs among LBP patients in the clinical setting. [(3).]
- Oswestry Low Back Pain Disability Questionnaire - considered as 'the golden standard' to measure the permanent functional disability of the lower back. [(3).]
- The Quebec back pain disability scale (QBPDS) - used to measure the functional disability for patients with lower back pain.

2.8. EXAMINATION

Diagnosed by history taking and physical examination. Motor, sensory, and reflex functions should be assessed to determine the affected nerve root level.
If the patient reports the typical unilateral radiating pain in the leg and there is one or more positive neurological test result the diagnosis of sciatica seems justified. [(3).]

Clinical evaluation of lumbosacral radiculopathy begins with:

- **Medical history** (type, location, and duration of symptoms, presence of subjective weakness and dysesthesia, current therapy, dermatomal radiation, absence of work) and physical examination: dermatomal sensory loss, myotomal weakness, straight leg raise[3], Crossed Straight Leg Raise Test, Femoral Nerve Stretch Test and reflexes.

- **Straight Leg Raise test (Lasègue test):**
  The best known clinical test is the straight-leg raising test [(3).] The supine SLR is more

sensitive than the seated SLR when it comes to the diagnosis of lumbar disc herniation with radiculopathy. A pooled sensitivity for straight leg raising test was 0. 91 (95% CI 0.82-0.94), a pooled specificity 0.26 (95% CI 0.16-0.38) [3]. The test is based on stretching of the nerves in the spine [(3).]

- **Crossed Straight Leg Raise Test (Crossed Lasègue test):**
  A test for the containment and exclusion of lumbar radiculopathy. For the cross straight leg raising test a pooled sensitivity was 0.29 (95% CI 0.24-0.34), pooled specificity was 0.88 (95% CI 0.86-0.90). The test is based on stretching of the nerves in the spine.

- **Femoral Nerve Stretch Test:**
  For the Femoral Nerve Stretch Test, the patient lies prone with the knee passively flexed to the thigh. The test is positive if the patient experiences anterior thigh pain. This test causes a downward and slightly lateral movement of the femoral nerve, its nerve root, and the intradural rootlet. [(3).]

2.8.1. SPECIFIC VERTEBRAL LEVEL

- To diagnose L4 radiculopathy the clinician placed emphasis on the femoral nerve stretch test, the straight leg raise test, the knee reflex, sensory loss in the L4 dermatome, and the muscle power for the ankle dorsiflexion.
- To diagnose L5 radiculopathy, the clinician focused on the straight leg raise test, sensory loss in the L5 dermatome, and the muscle power for the hip abduction, ankle dorsiflexion, ankle eversion, and the big toe extension.
- For S1 radiculopathy the clinician emphasized the straight leg raise test, the ankle reflex, sensory loss in the S1 dermatome, and the muscle power for hip extension, knee flexion, ankle plantarflexion, and ankle eversion. [(3).]

2.9. MEDICAL MANAGEMENT

Treatment is varied depending on the etiology and severity of symptoms. Conservative management of symptoms is generally considered the first line.

- Medications are used to manage pain symptoms including NSAIDs, acetaminophen, and in severe cases, opiates. Radicular symptoms are often treated with neuroleptic agents. Systemic steroids are often prescribed for acute low back pain, although there is limited evidence to support its use. Nonpharmacological interventions are often utilized as well.
- Physical therapy, acupuncture, chiropractic manipulation, and traction are all commonly used in the treatment of lumbosacral radiculopathy. Of note, the data supporting the use of these treatment modalities is equivocal.
- Interventional techniques are also commonly used and include epidural steroid injections and percutaneous disc decompression. In refractory cases, surgical decompression and spinal fusion can be performed.

The international consensus says that in the first 6-8 weeks, conservative treatment is indicated. [(3).] Surgery should be offered only if complaints remain present for at least 6 weeks after a conservative treatment. [(3).] . By research the majority of radiculopathy patients respond well to this conservative treatment, and symptoms often improve within six weeks to three months.

Study results

- A 2016 study revealed that appropriate use of EI (= epidural injections) to treat sciatica could significantly improve the pain score and functional disability score leading to a decrease in surgical rate [(3).]
- A study evaluating the effect of non-steroidal anti-inflammatory drugs, or Cox-2 inhibitors reported that the drugs have a significant effect on acute radicular pain compared with placebo. [3] But other studies say that there are no positive effects on lumbar radicular pain. [3]
- Studies on the effect of acupuncture in people with acute lumbar radicular pain found a positive effect on the pain intensity and pain threshold. [3]
- Among patients with acute lumbar radiculopathy, oral steroids (prednisone) will relieve them from pain and improve function. [3]
- Another study concluded: short term there is no evidence in favor of traction when compared to sham (fake) traction or other conservative treatments[3]; short term there is no evidence in favour of physical therapy compared to inactive treatment (bed rest), other conservative treatments or surgery.[3]; At the short term, there is no evidence in favour of manipulation compared to other conservative treatments or chemonucleolysis.[3.] A recent systematic review concludes that vertical traction (VT) does not give additional benefits when combined with or compared with PT treatments due to insufficient data in patients with Lumbar Radiculopathy. Further research and new high-quality studies are needed to investigate VT's effectiveness, most effective delivery, treatment dosage, or the pain stage that could benefit more from this intervention. The review suggests that VT may be an effective treatment only for reducing pain for short-term and may be preferred to passive treatments as bed rest and medications; however, there was no positive effect on increasing physical activity. [3]

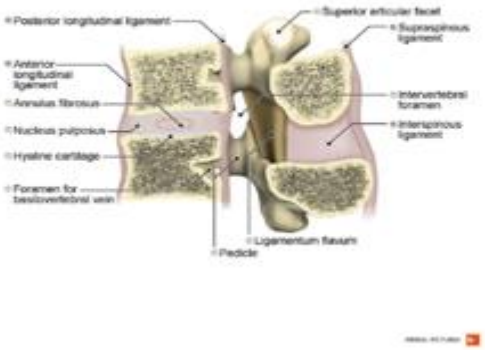
2.9.1. SURGICAL

Surgical intervention for sciatica is called a discectomy and focuses on the removal of disc herniation and eventually a part of the disc. Spinal fusion is another option. Next to simple discectomy and spinal fusion, there are 3 other surgical treatments which can be applied in patients with disc herniation: Chemonucleolysis, percutaneous discectomy and microdiscectomy.[3]

- 90% of all patients who have had surgery for lumbar disc herniation underwent discectomy alone, although the number of spinal fusion procedures has greatly increased.
- The complication rate of simple discectomy is reported at less than 1%.

2.9.2. PHYSICAL THERAPY MANAGEMENT

The main problem is that the nerve is pinched in the intervertebral foramen.

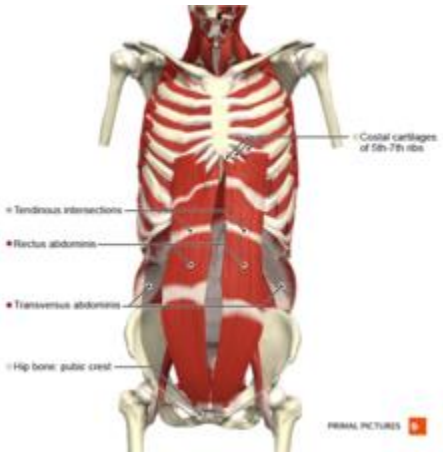


- In an acute phase, there is moderate evidence for spinal manipulation for symptomatic relief
- For chronic lumbar radiculopathy, only low-level evidence was found for manipulations[3] Because the pain is due to a narrowing of the intervertebral foramen normal traction of the lower spine will also relieve the pain[3]

Besides relieving the pain the patient also needs muscle training, more specific stabilization.

- The Pilates exercises are not only working for stabilization but also for the awareness of the body.[3] An exercise that is known to relieve the pain in the lower back is the McKenzie exercise.[3] The main goal of the therapy is reducing the pain. The first thing the patient needs to learn is the awareness of his body (back school) reduces the pain.
- Physical therapy can include mild stretching and pain relief modalities, conditioning exercise, and ergonomic program. A comprehensive rehabilitation program includes postural training, muscle reactivation, correction of flexibility and strength deficits, and subsequent progression to functional exercises. [3]

Exercise therapy is often the first line treatment. However, until now, evidential value for this is lacking. [3]



- In randomized study, they wanted to demonstrate what the effect was after a 52 week- rehabilitation program; first exercise therapy in combination with conservative therapy and on the other hand only the conservative treatment. (79% versus 56% Global Perceived Effect, respectively). A systematic review concluded that traction and exercise therapy are effective. [3]
- Moderate evidence favors stabilization exercises over no treatment, manipulation over sham manipulation, and the addition of mechanical traction to medication and electrotherapy. There was no difference among traction, laser, and ultrasound.[3]

When a patient complains about instability, core stability is really important. Core stabilization exercise (CSE) with the abdominal drawing-in manoeuvre (ADIM) technique is commonly used. These exercises activate the deep abdominal muscles with minimal activity of the superficial muscles. [3]

Core Stabilization Exercises:

- Isolated transversus abdominis and lumbar multifidus training
  1. Train transversus abdominis muscle activation in a prone lying position without spinal and pelvic movements for 10 seconds with ten repetitions. Keep respiration normal. You

gently draw in the lower anterior abdominal wall below the navel level (abdominal drawing-in maneuver) with supplemented contraction of pelvic floor muscles, control your breathing normally, and have no movement of the spine and pelvis while lying prone on a couch with a small pillow placed beneath your ankles. Train lumbar multifidus muscle activation in an upright sitting position. You raise the contralateral arm while performing the abdominal drawing-in maneuver in a sitting position on a chair.

- Integrated transversus abdominis and lumbar multifidus training light activities
  2. Perform co-contraction of transversus abdominis and lumbar multifidus muscles while sitting on a chair. You use the index and middle fingers to palpate the contraction of the transversus abdominis muscle and the opposite two fingers to palpate the contraction of lumbar multifidus muscle. This exercise progresses from 10- to 60-second holds of co-contraction for ten repetitions.
  Train co-contraction of these muscles with trunk forward and backward while sitting on a chair and keeping your lumbar spine and pelvis in a neutral position. The second exercise this week required 10-second holds with ten repetitions.

- 3. Perform co-contraction of the two muscles in a crooked lying position with both hips at 45 degrees and both knees at 90 degrees. Then you abduct one leg to 45 degrees of hip abduction and hold it for 10 seconds.
  Train co-contraction of these muscles in a crooked lying position with both hips at 45 degrees and both knees at 90 degrees. Then you slide a single leg down until the knee is straight, maintain it for 10-second holds and then slide it back up to the starting position.

- 4. Perform co-contraction of the two muscles while sitting on a balance board. You perform co-contraction of the muscles with trunk forward, backward, and sideways while sitting on a balance board and keeping your lumbar spine and pelvis in a neutral position. You perform each pose for 10-second holds with ten repetitions.

- Integrated transversus abdominis and lumbar multifidus training heavier activities
  5. Perform co-contraction of the two muscles while raising the buttocks off a couch from a crooked lying position until your shoulders, hips, and knees are straight. You sustain this position for 10 seconds and then lower the buttocks back down to the couch with ten repetitions. Train muscle co-contraction while raising the buttocks off a couch from a crooked lying position with one leg crossed over the supporting leg. You raise the buttocks off the couch until the shoulders, hips, and knees are straight. You sustain this position for 10 seconds and then lower the buttocks back down to the couch with ten repetitions.

- 6. Perform co-contraction of the two muscles while raising a single leg from a four-point kneeling position and keeping your back in a neutral position. You sustain this pose for 10 seconds and then return the leg to the starting position with ten repetitions.
  Train muscle co-contraction while raising an arm and alternate leg from a four-point kneeling position and keeping your back in a neutral position. You sustain this pose for 10 seconds and then return to the starting position with ten repetitions.

- 7. Perform co-contraction of the two muscles in a standing position while a mini ball is behind your upper back and against the wall. You flex the hip and knee of one leg to 90 degrees. Sustain this pose for 10 seconds and then return to the starting position with ten repetitions. Train the muscle co-contraction in a standing position with ankle movement.

Perform ankle movement in the forward-backward direction while keeping your lumbar spine in a neutral position. Sustain this pose for 10 seconds and then return to the starting position with ten repetitions.

- **Integrated transversus abdominis and lumbar multifidus training in pain aggravating activities**
  8–10. Perform muscle co-contraction while walking at normal, faster and fastest speed for 5 minutes at weeks 8, 9, and 10 respectively. In addition, choose two aggravating activities or tasks that you anticipate would cause pain or instability and perform muscle co-contraction while doing these activities or tasks without having pain. Each aggravating activity or task is performed for 2.5 minutes.

CHAPTER THREE

METHODOLOGY AND CASE DESCRIPTION

3.1. INTRODUCTION

This case study describes in detail the clinical reasoning utilised to treat a common presentation of lumbar radiculopathy highlighting the complex and systematic thinking and decision making required to provide effective individualised treatment, reducing the likelihood of persistent pain and disability.

This case study explores the clinical reasoning involved in the management of a 44-year-old man presented with acute, severe right lower back, buttock and postero-lateral thigh pain with radiculopathy at L4/L5/S1, and lateral shift to his left side. Using a biopsychosocial approach, some environmental risk factors were identified as contributing to the complex nature of the case. Patient's symptom aggravated during lumbar flexion, prolonged standing, sitting, driving, and walking. Symptoms alleviated when lying down.

Right straight leg raise neurodynamic test was limited and reproduced his pain and symptoms at the right parasternal muscles of the lower back, and gluteal muscles.

Clinical neuro-conduction testing revealed weakness of the big and other toe extensors, as well as eversion and plantar flexion of the right ankle, and a diminished right ankle reflex.

This indicated possible involvement of both the L5 and S1 nerve roots.

Physiotherapy management was directed at addressing these factors, using a combination of manual therapy, lumbar traction, patient's education, psychotherapy, office ergonomics, postural therapy and exercises in the form of McKenzie exercise, Core stabilization exercise, Stretching, to achieve a successful outcome.

The patient was symptom free, had full pain-free range of all lumbar movements, a full pain-free right straight leg raise neurodynamic test and normal neurological conduction six weeks after onset, following 15 physiotherapy sessions as described above.

Although the results of this case report cannot be generalized, it describes the successful outcome of a patient with severe radicular pain and neurological deficits, whose signs and symptoms had completely resolved following physical therapy intervention as described above.

Therefore, this case study aimed to document the fast recovery of a patient experiencing lumbar radiculopathy in physical therapy rehabilitation. This may be a favourable group of interventions to guide future research regarding physical therapy and lumbosacral radiculopathy.

3.2. STUDY DESIGN

Descriptive, qualitative, and explorative design was used for this study.

3.3. PARTICIPANT

Patients with primarily lumbosacral radiculopathy.

3.4. CASE PRESENTATION

This case study focused on a 44-year-old man, a naval officer who presented with acute, severe right lower back, buttock and postero-lateral thigh pain with radiculopathy at L4/L5/S1, and lateral

shift to his left side. He was referred to physical therapy by an Orthopaedic Spine Surgeon whom had inform him on both conservative and surgical options, but the patient opted out of the surgical option and preferred physiotherapy intervention.

Patient had a day history of a nerve block procedure done by the Spine Orthopaedic Surgeon who referred him immediately for a physiotherapy for further management.

He walked in to the clinic with support and assisted by his wife. He stated he couldn't walk before due to pain which he described sharp and very excruciating until the nerve block which has helped to subside his pain before coming for physiotherapy. He had been experiencing right buttock and leg pain upon arrival from a long journey, about 14 hours journey. The patient did not recall any specific incident or trauma that lead to the onset of these symptoms but stated he felt a dull ache at his low back and symptoms such as numbness or tingling down into his right lower extremities before the journey. He reported that his symptoms increased during the journey while seated in the plane and very difficult to get up from the plane due to pain.

The patient works in an office settings as an accountant and sits for approximately 80% of his workday. He described that his symptoms interfered with his ability to sit for long periods of time at his desk and complete his work.

My clinical impression for this patient was that he was appropriate for physical therapy and there was no any red flags signs or symptoms presented during the subjective history taking. The subjective history suggested a movement dysfunction, which is in the physical therapy scope of practice. The examination plans included the assessment of his range of motion (ROM), visual analogue scales (VAS) for pain, strength, mobility, and gait. These assessments along with palpation and special tests were performed to rule in or out other diagnoses including lumbar radiculopathy, piriformis syndrome, and trochanteric bursitis.

Prognostic factors that could have affected his recovery included his workstation, and nature of his work.

3.5. EXAMINATION

The patient filled out a Modified Oswestry Disability Index before the physical therapy evaluation. This questionnaire gives a subjective score that rates his level of disability inactivity due to low back pain. He scored a 43% on a 0-100% scale. 43% being the severe disability, pain remains the main problem in this group but activities of daily living are affected. The patients require a detailed investigation.

MRI and X-ray images revealed disc protrusion with compression at L4/L5 with foramina nerve root stenosis at S1, and disc spaces narrowing at L2/L3, L4/L5 respectively. Upon observation, poor posture with a lateral shift of his right hip to the left side, forward head and rounded shoulders were documented. The patient had an antalgic gait pattern with a decreased period of time in the stance phase with the right lower extremity.

All active ROM of the lumbar spine were limited and painful. His lumbar flexion range of motion also reproduced his symptoms in the right buttock and lower limb extremity. He also reported feeling tightness in the right low back with this motion.

During palpation, he had marked tenderness at his L4/L5/S1 and hypomobility over his lower lumbar vertebrae and over his right sacral base.

Palpation over his piriformis muscle and greater trochanter elicited no pain or reproduced symptoms.

Active and passive hip range of motion could not be determined due to the pain. Lower limbs GMP, hip abduction could not be determined due to the excruciating pain.

Provocative tests were done in the forms of;

- Femoral Nerve Stretch Test: the patient lied prone with the knee passively flexed to the thigh. The patient experienced anterior thigh pain. This test causes a downward and slightly lateral movement of the femoral nerve, its nerve root, and the intradural rootlet.

- The Slump Test is a neural tension test used to detect altered neurodynamics or neural tissue sensitivity. First, the patient sat in his natural posture with hands behind back to achieve a neutral spine. Then, when he was asked to slouch, he reported having symptoms in the right buttock and lower limb extremity.

- Straight Leg Raise test (Lasègue test) was a third special test performed to also determine if he had neural tissue involvement. This test is often positive in patients with sciatica and is often negative in patients with spinal stenosis. The patient laid on his back and each leg was passively flexed off the table with her knee extended. When his right leg reached about 45 degrees, he experienced a reproduction of his pain in the right buttock. His left leg was then passively lowered to 10 degrees, which eliminated his symptoms. A pooled sensitivity for straight leg raising test was 0. 91 (95% CI 0.82-0.94), a pooled specificity 0.26 (95% CI 0.16-0.38). The test is based on stretching of the nerves in the spine.

- Crossed Straight Leg Raise Test (Crossed Lasègue test):
  A test for the containment and exclusion of lumbar radiculopathy. For the cross straight leg raising test a pooled sensitivity was 0.29 (95% CI 0.24-0.34), pooled specificity was 0.88 (95% CI 0.86-0.90). The test is based on stretching of the nerves in the spine.

- The Bragard's sign (also: Braggard's test) was positive. This is used to evaluate whether lumbar and/or ischiadic pain originates from lumbosacral radiculopathy (e.g. disc herniation causing nerve root compression).

3.6. EVALUATION, DIAGNOSIS, AND PROGNOSIS

The initial evaluation indicated that his symptoms were coming from his low back and radiating down to his right buttock and right lower limb. The MRI investigation revealed disc protrusion at L4/L5 with L5/S1 nerve root compression. The patient was positive to all provocative special tests thus support this hypothesis along with the fact that his symptoms increased when he was sitting, standing and was relieved when he lies down. The piriformis muscle itself was not painful and did not reproduce his radicular symptoms during palpation. This finding, along with the positive slump test, helped to rule out the diagnosis of piriformis syndrome.

The primary rehabilitation goal created with the patient was to return to his prior level of functions, which included working at his workstation, and going about his activity of daily living (ADL) without stress or symptoms.

The short-term goals were to decrease and eliminate his pain and for him to demonstrate independence with ADL. These goals were to be met within 3 days to one week time frame.

The long-term goals were to increase lumbar spine range of motion, core muscles strengthening, flexibility and mobility. These goals were to be met within a four to six weeks' time frame after taking his possible barriers into consideration.

My initial clinical impression was confirmed after the examination, as I concluded this patient would benefit from physical therapy interventions so he could return to his prior activities without limitations. There were no findings that suggested this patient should be referred to another medical provider. If the patient did not progress after four to six physical therapy treatments, I would have re-examined and probably refer back to the Orthopaedic Spine Surgeon.

3.7. INTERVENTION /TREATMENT PLANS

The patient was seen in physical therapy every day for six days afterwards, his treatment was rescheduled twice a week for fourth-five minutes to one hour sessions. Interventions included manual therapy, lumbar traction, patient's education, psychotherapy, office ergonomics, postural therapy and exercises in the form of McKenzie exercise, core stabilization exercise, stretching, to achieve a successful outcome. A home exercise program was given to the patient after demonstration and practice of each of the exercises in the clinic to ensure that he understood them. He was consistent and adhere to all instructions during his treatment and he was responding well and was continually less symptomatic after every session. The patient was very compliant to his home exercise program.

Manual therapy was performed on his lumbar spine at every visit. Central and left Posterior-anterior grade 2 to 3 mobilizations were applied to lumbar levels of L2 to L5 and at the left sacral base to promote mobility. Another manual technique used was left lumbar rotation oscillations performed at a grade 3 while patient was in a right side-lying position to open up the intervertebral foramen and relieve pressure off the nerve roots. The patient responded well to this treatment.

Therapeutic exercise was provided to help strengthen, promote mobility, and increase his range of motion in the low back. These exercises included standing back extensions, pelvic tilts, straight leg raises, and supine bridging. Side-lying hip abductor strengthening was another exercise given to address his limited hip abductor strength. The patient was instructed to perform 1 set of 10 repetitions of each exercise 2-3 times a day. However, we discussed that performing 8 to 10 repetitions of the standing back extensions every 2 hours would be beneficia1.

Education was given to the patient and wife at every therapy session. After the initial evaluation, the patient was educated on his condition. He was also advised to avoid sitting for long periods of time and take time off duty to maximize his recovery. He was off duty for 3 weeks during the time he was having physiotherapy treatment. We advised him on standing workstation at his office and made some ergonomically workstation adjustment to eliminate some environmental factors as this would take pressure off his aggravated nerve roots. He was informed to apply ice to the low back to decrease inflammation and assist with pain when needed.

3.8. OUTCOMES

This patient made consistent and significant improvement in a two-week time frame. His symptoms had centralized to the low back and were less intense and less frequent. Education was given to the patient regarding centralization and how this was a positive symptom. His lumbar spine range of motion was measured after two weeks of treatment and was compared to her initial measurements. This is documented below in Table 2.

Table 2. Initial and Discharge Lumbar Spine Active Range of Motion Measurements (In Degrees)

DIRECTION	INITIAL	DISCHARGE
Flexion	**50**	**60**
Extension	**40**	**40**
Side Bend Left	**30**	**30**
Side Bend Right	**30**	**30**
Left Rotation	**30**	**30**
Right Rotation	**30**	**30**

During lumbar flexion, he reported feeling less stiff and denied any radicular symptoms into his right buttock. After 8 sessions of lumbar traction, SWD, manual therapy were performed on the patient's lumbar spine, his lumbar vertebrae had increased mobility with remarkably pain reduction. The patient's hip abductor strength increased from a 4/5 to 4+/5.

After two weeks of off duty leave, he returned back to work with mild to no pain. His workstation was assessed and recommendation was given. He compliance with all instruction given and able to work better without worsen his condition. As he made progress with his rehabilitation and was able to become more active again, her back symptoms resolve. The patient and his wife were very satisfied and reported that they were going to strive to live a more active lifestyle.

CHAPTER FOUR

4.1: DISCUSSION OF FINDINGS

This patient had a significantly fast recovery over four weeks and was able to return to work and carry out ADL without limitations. His fast recovery may have been accelerated by the following; accurate diagnosis, effectiveness of the physiotherapy intervention, eliminating other associated factors like personal and environmental factors that could slow down his recovery, his compliancy to his home programs, and his wife support.

A detailed subjective history taking and examination techniques including palpation, lumbar special/provocative tests, psychotherapy, workstation evaluation and ergonomics education.

Pre and post visual analogue scale and the Oswestry Disability Index functional assessment were useful when deciding on what level the patient was at functionally with his symptoms before and after physiotherapy intervention. The examination process helped to rule out other pathologies including piriformis syndrome and trochanteric bursitis. There was no trauma to the buttock area, no tenderness over the piriformis muscle, and no mass in the buttock, which are common findings in patients with piriformis syndrome. Common findings in patients with trochanteric bursitis that were not present with this patient included pain over the greater trochanter and increased pain with sit-to stand motions and walking up the stairs. Trochanteric bursitis can be caused from injury and overuse activities including running, walking upstairs, and standing for long periods of time. There were no signs of these causes during the subjective history-taking portion of the evaluation. The interventions chosen for this patient addressed predominantly pain management and control without the use of medication, stabilization exercises, core muscles strengthening and stretching, lumbar traction, manual therapy, and patient education.

In the systematic review discussed in the introduction regarding McKenzie directional preference exercises for patients with spinal pain, the evidence showed that patients had reduced short-term pain and disability. My patient also demonstrated these positive outcomes. Manual therapy was performed at every treatment in the side-lying position to open up the intervertebral foramen and relieve pressure off of the neural structures. This technique was used in a study discussed above that studied the effectiveness of spinal manipulation and mobilization for sciatica or radiating leg pain. The patients in this study responded favorably to the manual therapy, as well as my patient in this case study.

Patient's education on pros and cons of his condition, workstation evaluation and recommendation, office ergonomics on how he can make adjustments at work was important since he spends a large amount of time sitting during office work. The prognosis documented in the initial evaluation note was fair due to his age, occupation, and associated environmental factors.

He almost completely recovered in two weeks, which was unexpected. At this time, I would change his prognosis to good if he keeps up with the provided exercises and recommendations.

Lifestyle changes including weight management, back care exercises and exercising more often would take additional pressure off his spine and help to continue with recovery.

Manual therapy is often used with low back pain and lumbar radiculopathy. A well designed cohort study discussed the effectiveness of neural manual therapy interventions with patients experiencing low back and leg pain. The goal of these passive techniques was to mobilize the neural structures in the intervertebral foramen. This mobilization gradually desensitizes the peripheral nervous system. The majority of the subjects in the study responded favourably to this intervention. 20 Another study based on the conclusions from several systematic reviews and

randomized clinical trials looked at the effectiveness of manual therapy for the treatment of several musculoskeletal conditions including sciatica and radiating leg pain.

Conclusions from this study also discussed that there is a favourable level of evidence for spinal manipulation and mobilization for sciatica and radiating leg pain. The "favourable" level of evidence in this study means that the evidence does not support effectiveness but if other treatments are not effective, this intervention may be a treatment option.

4.2. EFFECTS OF PHYSICAL THERAPY MODALITIES IN THE MANAGEMENT OF LUMBOSACRAL RADICULAR PAIN

Ozturk *et al*. conducted a prospective RCT to investigate the effect of continuous lumbar traction on the size of herniated disc material measured by computer tomography (CT) in individuals with lumbar disk herniation. In this study, 46 patients with LDH were included and randomized into two groups as the traction group (24 patients), and the control group (22 patients). The traction group was given a physical therapy program (hot pack, continuous US, and diadynamic currents) and continuous lumbar traction. The control group was given the same physical therapy program without traction, for the same duration of time. [(4).]

Data for the clinical symptoms and signs were collected before and after fifteen treatment sessions together with calculation of a herniated index from the CT images that showed the size of the herniated disk material. In the traction group, most of the clinical findings (LBP, SLR angle, and motor/sensory deficit) significantly improved with treatment. Size of the herniated disk in CT decreased significantly only in the traction group. In the traction group the herniated index decrease from 276.6 ± 129.6 to 212.5 ± 84.3 with treatment ($P < 0.01$). In the control group, pre-treatment value was 293.4 ± 121.1, and it decreased to 285.4 ± 115.4 after the treatment ($P > 0.05$). Patients with greater herniation tended to respond better to traction.

In conclusion, lumbar traction plus conventional physical therapy are both effective in improving symptoms and clinical findings in patients with LDH and also in decreasing the size of the herniated disc material as measured by CT. Due to limited sample size and lack of sufficient follow‐up, this Level I study provided Level II therapeutic evidence that continuous lumbar traction in combination with physiotherapy is effective in the reduction of the size of the herniated disk material in patients with LDH.

4.3. EFFECTS OF PHYSICAL THERAPY EXERCISE IN THE TREATMENT OF LUMBAR DISC HERNIATION WITH RADICULOPATHY

A cohort study conducted by Svensson *et al* evaluated the effects of a structured physiotherapy treatment model (mechanical diagnosis and therapy [MDT]: The McKenzie method) for 41 patients who qualified for lumbar disc surgery by having severe, long‐standing pain and an MRI ‐verified LDH. The study protocol was divided into three phases. Phase 1 comprises MDT including side glide and trunk rotation in flexion during week 1 and 2. The second phase included home‐based stabilization exercises during week 3 of the study. The third phase included stabilization training with equipment at the physiotherapy department during week 4–9. The outcome of the study showed that the patients had already improved significantly 3 months after the structured physiotherapy treatment model in all assessments: Disability, leg and back pain, kinesiophobia, health related quality of life, depression and self‐efficacy. The improvement could

still be seen at the 2‐year follow‐up. The overall conclusion from this study was that a structured physiotherapy treatment model for patients with pain and disability due to a LDH should be recommended before surgery is considered. Due to limited sample size, this cohort study provided Level II therapeutic evidence. [4].

In another study, Bakhtiary et al. [21] reported the results of a prospective randomized controlled trial investigating the effects of lumbar stabilizing exercise in patients with LDH. Of the 60 patients included in this crossover design study, 30 were assigned to each treatment group. Patients in Group A received 4 weeks of lumbar stabilizing exercise, followed by 4 weeks of no exercise. Patients in Group B received 4 weeks of no exercise, followed by 4 weeks of lumbar stabilizing exercise. The lumbar stabilizing exercise protocol included four stages of stabilizing exercises from easy to advance. Outcomes were assessed at 4 and 8 weeks using VAS; range of trunk flexion; range of left and right SLR and time required to complete the following activities of daily living (ADL); laying prone on the floor from standing position, standing up from laying prone on the floor, climbing steps (five steps), 10 m walking (fastest pace possible, without pain). Significant differences between Groups A and B were seen in the mean changes on all outcome measures at the end of 4 weeks. After crossover, there were no significant differences between the groups in any of the outcomes measured at 8 weeks.

The authors concluded that a lumbar stabilizing exercise protocol may increase lumbar stability and improve ADL performance in patients who have suffered with a herniated lumbar disc for more than 2 months. The results of this study may encourage physiotherapists to use graded lumbar stabilization exercise (LSE) to treat patients with lumbar herniated disc. However, due to lack of sufficient follow‐up, this Level I study provides Level II therapeutic evidence that 4 weeks of LSE results in decreased pain and improved function in patients with LDHR. [4].

In another study, Ye *et al*. [4]. conducted an RCT to compare the effectiveness of general exercise (GE) and LPL therapy (LPLT). Sixty‐three young male adults aged 20–29 years with the diagnosis of LDH were enrolled and divided into lumbar spinal stabilization exercise (LSSE) group (n = 30) and a GE group (n = 33). Patients in both groups received LPLT during the 1st week of the onset of LDH. Patients in the GE group underwent a GE program. Patients in the LSSE received LSSEs followed by LPL program for 3 months. All of the patients were subjected to pain intensity and functional capacity evaluations four times: At pre‐ and post‐LPLT, and at 3 months and 1 year post exercise. Pain intensity of the lower back and legs was evaluated with the VAS, and functional capacity was evaluated with the Oswestry Disability Index (ODI). The results of this study showed that both groups have a significant reduction in VAS and ODI scores at 3 and 12 months post-exercise compared with before treatment ($P < 0.001$). The LSSE group showed a significant reduction in the average score of the VAS for LBP ($P = 0.012$) and the ODI ($P = 0.003$) at 12 months post-exercise compared with the GE group.

The authors concluded that LSSE is more effective than GE in individuals with LDHR. Due to proper randomization, sufficient sample size and follow‐up, this study provided Level I therapeutic evidence.

CHAPTER FIVE

5.1. CONCLUSSION AND RECOMMENDATION……..……26

The prevalence of lumbar radiculopathy has been estimated to be about 3-5% of the population, affecting both males and females, with a male preponderance in the general population. [(3)] Age is considered a primary risk factor, with symptoms typically beginning for males in their 40s, while females tend to be affected in their 50s and 60s. [(3)] Current medical literature is at a consensus regarding the common causes of L5-S1 radiculopathy, intervertebral lumbar disc herniation. More than 90% of herniated discs occur at the L4-L5 or L5-S1 disc space. Compression of these spaces tend to produce a radiculopathy into the posterior leg and compromise or limit ADLs. [(3)]

Current guidelines suggest approaching lumbar radiculopathy in a conservative manner by educating patients, manual therapy, modifying exercises, staying active, and administration of a non-steroidal anti-inflammatory drug.

Based on the fast recovery of this case study, literature review and other findings, it can be said that the patient presenting with lumbar radiculopathy had a significantly fast recovery following physical therapy rehabilitation. The interventions that were used included manual therapy, therapeutic exercise, and patient education. The patient had minimal symptoms after two weeks and her pain had centralized to the low back. This case report may suggest intervention strategies for future research regarding physical therapy and lumbar radiculopathy.

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APPENDIX I

Oswestry Low Back Pain Disability Questionnaire

Oswestry Low Back Pain Disability Questionnaire

Sources: Fairbank JCT & Pynsent, PB (2000) The Oswestry Disability Index. *Spine*, 25(22):2940-2953.

Davidson M & Keating J (2001) A comparison of five low back disability questionnaires: reliability and responsiveness. *Physical Therapy* 2002;82:8-24.

The Oswestry Disability Index (also known as the Oswestry Low Back Pain Disability Questionnaire) is an extremely important tool that researchers and disability evaluators use to measure a patient's permanent functional disability. The test is considered the 'gold standard' of low back functional outcome tools [1].

Scoring instructions

For each section the total possible score is 5: if the first statement is marked the section score = 0; if the last statement is marked, it = 5. If all 10 sections are completed the score is calculated as follows:

Example: 16 (total scored)

50 (total possible score) x 100 = 32%

If one section is missed or not applicable the score is calculated:

16 (total scored)

45 (total possible score) x 100 = 35.5%

Minimum detectable change (90% confidence): 10% points (change of less than this may be attributable to error in the measurement)

Interpretation of scores

0% to 20%: minimal disability:	The patient can cope with most living activities. Usually no treatment is indicated apart from advice on lifting sitting and exercise.
21%-40%: moderate disability:	The patient experiences more pain and difficulty with sitting, lifting and standing. Travel and social life are more difficult and they may be disabled from work. Personal care, sexual activity and sleeping are not grossly affected and the patient can usually be managed by conservative means.
41%-60%: severe disability:	Pain remains the main problem in this group but activities of daily living are affected. These patients require a detailed investigation.
61%-80%: crippled:	Back pain impinges on all aspects of the patient's life. Positive intervention is required.
81%-100%:	These patients are either bed-bound or exaggerating their symptoms.

Oswestry Low Back Pain Disability Questionnaire

Instructions

This questionnaire has been designed to give us information as to how your back or leg pain is affecting your ability to manage in everyday life. Please answer by checking ONE box in each section for the statement which best applies to you. We realise you may consider that two or more statements in any one section apply but please just shade out the spot that indicates the statement which most clearly describes your problem.

Section 1 – Pain intensity

- ☐ I have no pain at the moment
- ☐ The pain is very mild at the moment
- ☐ The pain is moderate at the moment
- ☐ The pain is fairly severe at the moment
- ☐ The pain is very severe at the moment
- ☐ The pain is the worst imaginable at the moment

Section 2 – Personal care (washing, dressing etc)

- ☐ I can look after myself normally without causing extra pain
- ☐ I can look after myself normally but it causes extra pain
- ☐ It is painful to look after myself and I am slow and careful
- ☐ I need some help but manage most of my personal care
- ☐ I need help every day in most aspects of self-care
- ☐ I do not get dressed, I wash with difficulty and stay in bed

Section 3 – Lifting

- ☐ I can lift heavy weights without extra pain
- ☐ I can lift heavy weights but it gives extra pain
- ☐ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently placed eg. on a table
- ☐ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned
- ☐ I can lift very light weights
- ☐ I cannot lift or carry anything at all

Section 4 – Walking*

- ☐ Pain does not prevent me walking any distance
- ☐ Pain prevents me from walking more than 1 mile
- ☐ Pain prevents me from walking more than 1/2 mile
- ☐ Pain prevents me from walking more than 100 yards
- ☐ I can only walk using a stick or crutches
- ☐ I am in bed most of the time

Section 5 – Sitting

- ☐ I can sit in any chair as long as I like
- ☐ I can only sit in my favourite chair as long as I like
- ☐ Pain prevents me sitting more than one hour
- ☐ Pain prevents me from sitting more than 30 minutes
- ☐ Pain prevents me from sitting more than 10 minutes
- ☐ Pain prevents me from sitting at all

Section 6 – Standing

- ☐ I can stand as long as I want without extra pain
- ☐ I can stand as long as I want but it gives me extra pain
- ☐ Pain prevents me from standing for more than 1 hour
- ☐ Pain prevents me from standing for more than 30 minutes
- ☐ Pain prevents me from standing for more than 10 minutes
- ☐ Pain prevents me from standing at all

Section 7 – Sleeping

- ☐ My sleep is never disturbed by pain
- ☐ My sleep is occasionally disturbed by pain
- ☐ Because of pain I have less than 6 hours sleep
- ☐ Because of pain I have less than 4 hours sleep
- ☐ Because of pain I have less than 2 hours sleep
- ☐ Pain prevents me from sleeping at all

Section 8 – Sex life (if applicable)

- ☐ My sex life is normal and causes no extra pain
- ☐ My sex life is normal but causes some extra pain
- ☐ My sex life is nearly normal but is very painful
- ☐ My sex life is severely restricted by pain
- ☐ My sex life is nearly absent because of pain
- ☐ Pain prevents any sex life at all

Section 9 – Social life

- ☐ My social life is normal and gives me no extra pain
- ☐ My social life is normal but increases the degree of pain
- ☐ Pain has no significant effect on my social life apart from limiting my more energetic interests eg, sport
- ☐ Pain has restricted my social life and I do not go out as often
- ☐ Pain has restricted my social life to my home
- ☐ I have no social life because of pain

Section 10 – Travelling

- ☐ I can travel anywhere without pain
- ☐ I can travel anywhere but it gives me extra pain
- ☐ Pain is bad but I manage journeys over two hours
- ☐ Pain restricts me to journeys of less than one hour
- ☐ Pain restricts me to short necessary journeys under 30 minutes
- ☐ Pain prevents me from travelling except to receive treatment

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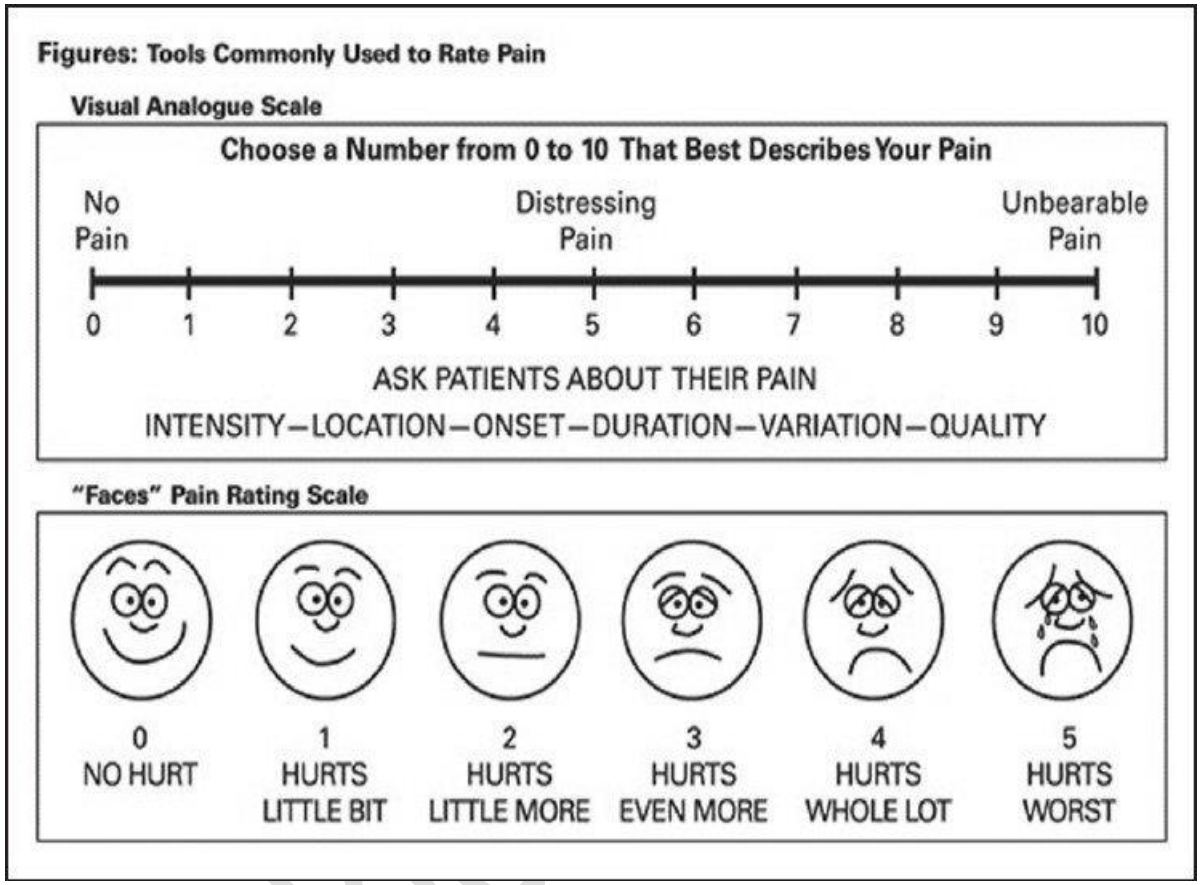
APPENDIX II

Visual Analogue Scale



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