

# LUMBAR PROLAPSED INTERVERTEBRAL DISC & ITS MANAGEMENT

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**Abstract:** Prolapsed Intervertebral Disc (PIVD) is a major cause of disability in developing countries. A herniated nucleus pulposus is most common in those aged below 40 years, whilst degeneration of discs tends to affect those aged over 40 years, with the prevalence increasing with advancing age. Initial management should include rest as indicated, physical therapy, and appropriate use of pain medication. In most instances, radicular symptoms will abate or resolve within six weeks.

**Keywords:** PIVD, Herniated nucleus, Pain, Sciatica, Numbness, LBP.

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## 1. INTRODUCTION

The term “Prolapsed disc” means the protrusion and extrusion of the nucleus pulposus through a rent in annulus fibrosus. It is the sequence of changes in the disc which lead to prolapsed and these changes are.[1]

- Nucleus degeneration.
- Nucleus displacement.
- Stage of fibrosis.

Herniated nucleus pulposus is most common in those aged below 40 years, whilst degeneration of discs tends to affect those aged over 40 years, with the prevalence increasing with advancing age. Disc lesions of the lumbar spine are more common than the cervical spine and disc lesions of the thoracic spine are rare. The term sciatica is used for the pain, tingling, and numbness that arise due to nerve root entrapment in the lumbo-sacral spine. The symptoms may be felt in one or more of the lumbar nerve roots. About 90% of cases of sciatica are caused by a herniated intervertebral disc. This most commonly occurs at the L5/S1 level.[2]

Herniation of disc or nucleus pulposus is the main cause of low back pain.[3] The back pain is a major public health problem in western industrialized societies. It causes suffering and distress to patients and their families, and affects a large number of people. The prevalence rates in a number of studies ranged from 12% to 35% with around 10% of sufferers becoming chronically disabled.[4] Low back pain affects about 80% of the population at some time in their lives and is one of the most frequent reason for consulting a primary care physician.[5]

It may cause 20% - 35% of low back pain creating a public health burden of considerable socioeconomic cost.[6] The prevalence rate of low back pain in a number of studies ranged from 22% to 65% in one year and the lifetime prevalence ranged from 11% to 84%.[3] Approximately 5% of adult population, low backache becomes a persistently disabling condition. It affects men and women equally, with onset most often between ages of 30-50 years. In the state of Uttarakhand and adjoining states, the combination of low backache and radiculopathy is a very common orthopedic presentation and in this the reason may be hilly terrain with difficult work and living conditions.[7]

Degenerative disc diseases should be applied to a degenerate disc that is also painful.[8] The choice of investigation for suspect the intervertebral disc prolapsed is.[9]

Plain X-rays- These are usually taken to rule out any fracture or malalignment.

Plain X-rays don't give any information on nerve root or spinal cord compression.

CT L-spine- it gives some information on bony alignment and occasionally, it is combined with myelogram to demonstrate any functional compression or obstruction. MRI lumbar spine- this is a gold standard in looking for lumbar disc prolapsed and to delineate the degree of nerve root or cauda equina compression.

Classification of lumbar disc herniation could be based on the clinical staging of the disease [10]:

Stage1: low back pain ± radiating pain; no objective sign.

Stage2: low back pain ± radiating pain; segmental pain; muscle spasm.

Stage3: low back pain ± radiating pain; signs of dural or radicular irritation.

Stage4: low back pain ± radiating pain; neurologic deficit.

In conservative treatment corticosteroids can be used for relief of disc symptoms.[11] The Chymopapain injection helps to relief back pain or sciatica. In surgical treatment we should performed discectomy to relief severe and persistent symptoms of back pain or disc herniation and to improved function.[12]

## 2. EPIDEMIOLOGY

Disc herniation can occur in any disc in the spine, but the two most common forms are lumbar disc herniation and cervical disc herniation. The former is the most common, causing low back pain (lumbago) and often leg pain as well, in which case it is commonly referred to as sciatica. Lumbar disc herniation occurs 15 times more often than cervical (neck) disc herniation, and it is one of the most common causes of low back pain.[13]

## 3. CAUSES/RISK FACTOR

The causes of disc compression can be divided into external and internal types:

- The external cause includes trauma which is a common feature in athletes, workers, porters, trekkers etc.
- Smoking and increased rates of disk degeneration, with animal models showing increased proinflammatory markers, alterations to annular structure, vasoconstriction, and altered nutrient distribution to the disc.[13]

## 4. BIOMECHANICS

The lumbar spine normally has 5 vertebrae, while the sacrum consists of usually five fused sacral vertebrae. Together this lower portion of the vertebral column is referred to as the lumbosacral spine, an important biomechanical region of the body [14].

### Kinetics:

The 3 movements in the spine are flexion, extension, rotation and lateral flexion. These movements occur as a combination of rotation and translation in the planes of motion: sagittal, coronal and horizontal [15]. These movements result in various forces acting on the lumbar spine and sacrum: compressive force, tensile force, bending moment and torsional moment [16].

### Shear and Compression:

When a load is applied along the spine, "shear" forces occur parallel to the intervertebral disc as a compression of the nucleus results in a lateral bulging of the annulus [17].

## 5. PATHOPHYSIOLOGY

### Changes in the Disc due to Aging:

During growth and skeletal maturation, the boundary between annulus and nucleus becomes less obvious, and with increasing age the nucleus generally becomes more fibrotic and less gel-like.[18] with increasing age and degeneration, the disc changes in morphology, becoming more and more disorganized. Often the annular lamellae become irregular, bifurcating, and interdigitating and the collagen and elastin networks also appear to become more disorganized. There is frequently cleft formation with fissures forming within the disc, particularly in the nucleus.

Nerves and blood vessels are increasingly found with degeneration. Cell proliferation occurs, leading to cluster formation, particularly in the nucleus.[19,20] Cell death also occurs, with the presence of cells with necrotic and apoptotic appearance.[21,22]

- Loss of proteoglycan
- Loss of Collagen Fibers
- Increase in Fibronectin

## **6. STAGES OF PIVD**

The term prolapsed disc means the protrusion or extrusion of nucleus pulposus through a rent in the annulus fibrosis. It is not a one-time phenomenon the herniation may develop suddenly or gradually over weeks or months. There are four stages in disc herniation:

1) **DISC DEGENERATION:** Degenerative changes occur in the disc before displacement of the nuclear material. These changes are:

- Softening of the nucleus and its fragmentation.
- Weakening and disintegration of the posterior part of the annulus fibrosis.

2) **PROTRUSION:** When the annulus becomes weak, either because a small area of its entire thickness has disintegrated spontaneously or because of injury, the nucleus tends to bulge through the defect. This is called as disc protrusion.

3) **EXTRUSION:** The nucleus comes out of the annulus and lies under the posterior longitudinal ligament, though it has not lost contact with the parent disc, called as disc extrusion.

4) **SEQUESTRATION:** The extruded disc may lose its contact with parent disc and is called as sequestered disc.[1]

## **7. CLINICAL FEATURES**

1. Acute disc prolapse may occur at any age, but is uncommon in the very young and the very old.
2. The patient is usually a fit adult aged 20-45 years.[1]
3. Typically, while lifting or stooping he has severe back pain and is unable to straighten up.
4. Either then or a day or two later pain is felt in the buttock and lower limb (sciatica).
5. Both backache and sciatica are made worse by coughing or straining.
6. Later there may be paraesthesia or numbness in the leg or foot, and occasionally muscle weakness.
7. Cauda equina compression is rare but may cause urinary retention and perineal numbness.
8. The patient usually stands with a slight list to one side ('sciatic scoliosis').
9. Sometimes the knee on the painful side is held slightly flexed to relax tension on the sciatic nerve; straightening the knee makes the skew back more obvious.
10. All back movements are restricted, and during forward flexion the list may increase.
11. There is often tenderness in the midline of the low back, and paravertebral muscle spasm.
12. Straight leg raising is restricted and painful on the affected side; dorsiflexion of the foot and bowstringing of the lateral popliteal nerve may accentuate the pain.
13. Sometimes raising the unaffected neck causes acute sciatic tension on the painful site ('crossed sciatic tension').[12]

## **8. EXAMINATION**

**PHYSICAL EXAMINATION: ATTITUDE:**

- The disc between L5 and S1 is most commonly involved, followed in order by L4-L5, and that between L3-L4.
- The lumbar spine is flattened and flexed in typical cases, along with tear of annulus fibrosus allowing, the nucleus pulposus to herniated through.

- Pain, Tenderness are present .
- Muscle spasm leads to loss of normal lordotic curve[23]

Special tests for PIVD

1. Straight leg raise test (SLRT)

PATIENT POSITION:Supine lying

PROCEDURE:Hip is flexed, knee extended in order to passively stretch the sciatic nerve and ankle is in dorsiflexion. Test is positive, if pain in sciatic nerve produced between 30°--70° passive flexion of straight leg.

2. Lasegue's test

PATIENT POSITION:Supine lying

PROCEDURE:Hip and knee flexed at 90° and gradually, extend the knee keeping hip flexed. Test is positive, if pain radiates down into the back of the thigh. [24]

### Investigation

- X-ray: It does not show any positive sign in a case of acute disc prolapse. In a case of chronic disc prolapse, the affected disc space may be narrowed and there may be lipping of the vertebral margins posteriorly.
- CT scan: The posterior border of a disc appears concave in a normal individual. In a case where there is disc prolapse, it will appear flat or convex. There will be loss of pre-thecal fat shadow normally seen between the posterior margin of disc and theca. The herniated disc material can be seen within the spinal canal, pressing on the nerve roots or theca.
- MRI scan: It helps to detect the intraspinal lesion, helps to examine the entire spine and identifies degenerative disc. It shows the prolapse disc, theca and nerve roots very clearly.
- Myelography: It consists of injecting radiopaque dye into the spinal canal and taking radiograph of the back. It is helpful in detecting the intraspinal lesions, spinal stenosis and cases of previously operated backs. It is also indicated when the diagnosis is in doubt.[1]

## 9. PHYSIOTHERAPY MANAGEMENT:

The main aim of physiotherapy is the recovery and stabilization of the functions of the lumbar-sacral section of the spine and patient's rehabilitation.

**COMPREHENSIVE REHABILITATION:** The main purposes of the comprehensive rehabilitation are as follows:[25]

- 1.Improving and enhancing the psycho-emotional status of the patient
- 2.Reducing the spasm and reflex rigidity of the paravertebral muscles
- 3.Releasing the compressed nerve root and reducing lumbar pain (low back pain)
- 4.Improving muscular balance
- 5.Preserving muscle tone and preventing muscle atrophy
- 6.Eliminating any residual functional blockage
- 7.Developing a healthy muscle corset
- 8.Improving coordination and balance
- 9.Developing correct posture and sitting stance while working
- 10.Prophylaxis of recurrences

**COMPLEX REHABILITATION THERAPY:** It is based on the main symptoms such as pain symptoms, dynamic disturbances in the lumbar section of the spine according to the stage and duration of the disease. Analysis of the patient is based on functional and physical status with manual muscle testing (MMT) and diagnostic tests and trials aimed at determining the rehabilitation potential.[25]

(1) Acute stage: During the acute stage, the main objective of the therapy is to reduce and eliminate the pain syndrome.[26]

Physiotherapy techniques used for treatment include:

- a) Electrophoresis with Novocain
- b) Interferential currents (IFT) initially with a frequency of 0-100 Hz for dynamogenic, trophic, spasmolytic and analgesic effect
- c) Dynamic currents (DC) -the modulations DF-2', CP and LP 2-5' is used
- d) Ultra-sound therapy with an intensity of 0.2-0.5 W/cm<sup>2</sup>.
- e) Kinesitherapy uses lighter techniques such as positional therapy, mechanical therapy named the McKenzie method, respiratory and relaxing exercises
- f) Strengthening exercises are only meant for the extremities without engaging the spine at this stage
- g) Isometric contractions are also added

(2) Sub-acute stage: During sub-acute stage, objective is to mobilize the lumbar-sacral section of the spine.[26] The aims include as follows:

- a) Relieving pain
- b) Maintaining the muscle trophics
- c) Relaxing and extending the contracted muscles
- d) Developing a sound muscle corset by boosting the abdominal and paravertebral muscles
- e) Training patients how to carry out correctly everyday activities

Physiotherapy treatment include in this stage are as follows:

Massage which aims at releasing the nerve root, relaxing the paravertebral muscles and reducing the reactive inflammatory process around it.[27]

Functional blockage of the intervertebral joints leads to degenerative changes of the spine. Manual therapy is recommended as an efficient method of treatment in sub-acute stages. Soft-tissue techniques, post-isometric relaxation, mobilization technique can be applied to release the compressed nerve root from the herniated disc. It gives better result when combined with extension therapy and manual traction techniques.[28]

Reduced motor function is improved with the application of electro-stimulation over damaged nerves and the respective innervated muscles. In partial degeneration needed dosage frequency is 10-30 Hz and in complete degeneration, needed dosage frequency is 0.5-10 Hz.[29]

Pain syndrome can be effectively relieved through TENS with impulse of 300 $\mu$  and frequency of 50-100 Hz given for the duration of 15-20 minutes.

IFT can also give positive results in case of pain syndrome. It can be given with a frequency of 90-100 Hz.[28]

**McKenzie Approach:** This method is beneficial for rehabilitation of patients with PIVD. With McKenzie approach, physiotherapy and exercise, therapist can extend the spine to centralize the pain of patient by moving it away from the extremities (leg or arm) to the back. Long-term goal of the McKenzie Method are as follows:

- 1.To teach patients suffering from neck pain and/or back pain to treat and manage their own pain using exercise and other strategies.
- 2.Reduce pain quickly
- 3.Return to normal functioning in daily activities
- 4.Minimize the risk of recurring pain

## TECHNIQUE AND METHOD TO PERFORM McKenzie EXERCISES FOR LUMBER SPINE:

1. Lying prone: In this position the lumbar spine falls automatically into some degree of lordosis.

Effects:-

- In derangement with some degree of posterior displacement of the anterior content of the disc, the adoption of this position causes the reduction of derangement.
- In dysfunction, there is loss of extension movement or reduced lordosis, in these cases lying prone is enough to regain the lordosis.

2. Lying prone in extension: Patient is in prone supported on the elbows, pelvis & thighs remain in contact with couch.

Effects:-

- Progression of procedure 1
- Enhances on increasing extension
- In this position maximum extension should be tried
- Once obtained the spine should be allowed to relax
- This causes intermittent extension stress, having a pumping as well as a stretching effect.
- Effective in case of derangement as well as dysfunction

3. Extension in lying with belt fixation: A belt is used as an external aid to enhance the maximum extension Effects:-

- This procedure creates a greater & more localised passive extension stress
- It is particularly suitable for stretching in case of extension dysfunction

4. Extension mobilisation: In this external force is applied by the therapist who enhances the effects on derangement & dysfunction.

5. Extension in standing: This procedure is very important in the prevention of the onset of low back pain during or after prolonged sitting activities.

6. Effects of lying in flexion:

- Flexion causes stretching of the posterior wall of the annulus, posterior longitudinal ligaments, capsule, facet joints
- This procedure should be performed following stabilization of a reduced posterior derangement

7. Effects of standing in flexion:

- Here the gravitational & compressive forces act differently when compared with lying position.
- The lower lumbar & lumbo-sacral joints are placed on full stretch.
- Used to stretch the scarring in an adherent nerve root or in nerve root entrapment.
- Important treatment for anterior derangement case

8. Effects of step standing in flexion:

- Causes asymmetrical flexion stresses on the affected segments.
- It is applied when there is a deviation in flexion.
- In dysfunction asymmetrically shortened structures are stretched by flexion in step standing.

In kinesiotherapeutic methods, exercises are used to improve the general development in combination with:

Respiratory exercises

Coordination and balance exercises

Analytical exercises in combination with isometric contractions and dynamic exercises to improve posture and gait

Underwater exercises, everyday chores and special exercises for the paravertebral muscles are highly recommended.[30]

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