

PROLAPSED INTERVERTEBRAL DISC

A prolapsed/herniated disc means displacement of the content of the disc beyond its boundaries into the intervertebral space. The disc is made up of 2 layers- thick outer layer called Annulus Fibrosus and the soft gel-like center called Nucleus Pulposus.

ANATOMY:

The intervertebral disc consists of three components –

- 1) *The cartilage end plates* – The cartilage plates are thin layers of hyaline cartilage between adjacent vertebral bodies and disc. The disc receives its nutrition from the vertebral bodies via these end plates by diffusion.
- 2) *Nucleus pulposus* – is a gelatinous material which lies a little posterior to the central axis of vertebrae. It is enclosed in annulus fibrosis.
- 3) *Annulus fibrosus* – is a structure composed of concentric rings of fibrocartilaginous tissue.

The nucleus pulposus is normally under considerable pressure and is controlled by the crucible (container) like annulus.

PATHOLOGY:

The term prolapse disc means the protrusion or extrusion of the nucleus pulposus through annulus fibrosus. Sequences of change occur in the disc which leads to prolapse. These changes consist of the following:

- **Nucleus degeneration:** Degenerative changes occur before displacement of nuclear material. These are: Softening of nucleus & its fragmentation and weakening and disintegration of the posterior part of annulus fibrosus.
- **Nucleus displacement:** The nucleus is always under positive pressure. When the annulus becomes weak due to disintegration or injury, the nucleus tends to bulge through the defect. This is called disc protrusion. Finally the nucleus comes out of the annulus and lies under the posterior longitudinal ligament though it has not lost contact with the parent disc. This is called disc extrusion. The posterior longitudinal ligament is not strong enough to prevent the nucleus protruding further. The extruded disc may lose its contact with the parent disc. This is called disc sequestration.
- **Stage of fibrosis:** This is the stage of repair. The nucleus pulposus becomes fibrosed. The extruded nucleus pulposus becomes flattened, fibrosed and finally undergoes calcification. At the same time new bone formation occurs at the points where the posterior ligament has been stripped from the vertebral body and spur formation occurs.

TYPES OF HERNIATION:

- *Posterolateral Disc Herniation* – This is more common protrusion & is usually posterolateral into vertebral canal. Protruded disc usually compresses next lower nerve as

the nerve crosses the level of disc in its path to its foramen. (Example: protrusion of L5 usually affects S1)

- *Central (posterior) Herniation* - It is less frequent. A protruded disc above 2nd vertebra may compress the spinal cord itself or may lead to Cauda Equina Syndrome.
- *Lateral Disc Herniation* - Nerve root compression happens above the level of herniation. L4 nerve root is most often involved.

CAUDA EQUINA SYNDROME:

-Cauda equina syndrome is a particularly serious type of nerve root problem that can be caused by a prolapsed disc. This is a rare disorder where the nerves at the very bottom of the spinal cord are pressed on.

-This syndrome can cause low back pain with bowel and bladder function (usually unable to pass urine), numbness in the 'saddle' area (around the anus), and weakness in one or both legs.

-This syndrome needs urgent treatment to preserve the nerves to the bladder and bowel from becoming permanently damaged.

STAGES OF HERNIATION: There are four stages of herniated discs: Bulging, Protrusion, Extrusion & Sequestration.

1. **Bulging:** At this early stage, the disc is stretched and doesn't completely return to its normal shape when pressure is relieved. It retains a slight bulge at one side of the disc.
2. **Protrusion:** At this stage, the bulge is very prominent and the soft jelly center has spilled out to the inner edge of the outer fibers, barely held in by the remaining disc fibers.
3. **Extrusion:** In the case of a herniated spinal disc, the soft jelly has completely spilled out of the disc and now protruding out of the disc fibers.
4. **Sequestration:** Here some of the jelly material is breaking off away from the disc into the surrounding area.

CAUSES OF PIVD:

- Some children may often suffer from prolapsed disc due to birth defect or injury.
- During adolescence, rapid growth may also be a contributing factor.
- Heavy manual labour.
- Sometimes playing sports like football, gymnastics, weightlifting and track and field may also cause your strain to over stretch and put stress on your lower back.
- Repetitive lifting and twisting.
- Postural stress.
- Obesity.
- Poor and inadequate strength of the trunk.
- Increasing age (a disc is more likely to develop a weakness with increasing age).

CLINICAL FEATURES:

The following symptoms are common:

Low back ache: The onset of backache may be acute or chronic. In acute the pain is severe with the spine held in rigid by muscle spasm & any movement of spine is painful. In chronic backache the pain is dull and diffuse usually made worse by exertion, forward bending, sitting or standing in one position for long time and is relieved by rest.

Sciatic pain: The pain radiates to the gluteal region, the back of the thigh and the leg. The pattern of radiation depends upon the root compressed.

Neurological symptoms: Sometimes the patient complains about paresthesia, most often described as pins & needles corresponding to the dermatome of the affected nerve root. There may be numbness in the leg or foot and weakness of the muscles. Sometimes cauda equina syndrome also results.

DIAGNOSIS: The diagnosis is mainly clinical. Investigations like X-rays, CT scan and MRI scan may be done to confirm the diagnosis.

X-rays: These are very accessible at most clinics and outpatient offices. This imaging technique can be used to assess for any structural instability. Narrowed disc space, loss of lumbar lordosis, complementary scoliosis can be observed.

CT scan: It is preferred study to visualize bony structures in the spine. It can also show calcified herniated discs, size, shape of spinal cord, contents surrounding it including soft tissue.

MRI: It is the preferred and most sensitive study to visualize herniated disc. MRI findings will help surgeons and other providers plan procedural care if it is indicated. Disc protrusion and nerve root compression can be identified.

Special tests for diagnosis:

- **Straight leg raising test (SLRT):** This test indicates nerve root compression. A positive SLRT at 40° or less is suggestive of root compression. More important is a positive contralateral SLRT.
- **Lasegue test:** This is a modification of SLRT where first the hip is lifted to 90° with the knee flexed. The knee is gradually extended by the examiner if nerve stretch present, it will not possible to do so and the patient will experience pain in the back of the thigh and leg.
- **Bowstring test:** The patient lies supine. Initially examiner performs Straight Leg Raise Test. Examiner raises the leg to the point where the patient perceives pain along the distribution lumbosacral dermatomal level. While performing SLR test at the point of maximum pain (positive SLR) the examiner will slightly flex the patient's knee approximately 20 degrees thereby reducing the pain. Then examiner applies pressure (via thumb) on the popliteal fossa on sciatic nerve (Posterior Tibial Nerve), If this elicits the same pain as the patient experiences during SLR, then Bowstring sign is said to be positive.

Neurological examination: A careful neurological examination is necessary to assess motor weakness, sensory loss or loss of reflex corresponding to the affected nerve root.

EMG: Findings of denervation, localized to the distribution of a particular nerve root is detected by EMG test but this test is rarely required.

TREATMENT:

Conservative treatment:

- **Rest:** Rest and Anti-inflammatory and analgesics.
- **Reduction:** Continue bed rest and traction for 2 weeks may reduce the herniation in over 90% cases. If no improvement with rest and traction, epidural injection of corticosteroid and local anaesthetic are given.
- **Chemonucleolysis:** In this technique an enzyme (chymopapain) with property of dissolving fibrous and cartilaginous tissue is injected into the disc under X-ray control. This leads to the dissolution and fibrosis of the disc and thus relief the symptoms.

Operative treatment:

Indications for operative treatment are:

1. Failure of operative treatment
2. Cauda equina syndrome
3. Severe sciatic tilt

The disc is removed by the following techniques:

- **Fenestration-** Ligamentum flavum bridging the two adjacent laminae is excised and spinal canal at affected level exposed.
- **Laminotomy-** In addition to fenestration, a hole is made in the lamina for wider exposure.
- **Hemilaminectomy/Partial laminectomy-** Part of the lamina and ligamentum flavum on one side is removed, taking great care not to damage the facet joint.
- **Laminectomy-** Laminae on both sides with spinous process are removed. Such wide exposure is required for big, central disc producing cauda equina syndrome.
- **Microdiscectomy-** done with an operating microscope. Exposure is very limited. Morbidity and hospitalisation is less.

PHYSIOTHERAPY TREATMENT:

Before planning the treatment, determine the position of comfort or symptom reduction i.e.

FUNCTIONAL POSITION. The patient may have,

1) **Extension bias:** Patient's symptoms are lessened in position of extension and provoked in flexion e.g. PIVD.

2) **Flexion bias:** Patient's symptoms are lessened in position of spinal flexion and provoked in spinal extension e.g. spinal stenosis, spondylolisthesis.

Spinal Extension is contraindicated if:

- when no position or movement decreases or centralizes the pain.
- when saddle anaesthesia and urinary incontinence is present (indicate spinal cord or cauda equina lesion due to large central disc herniation).
- when patient is in such extreme pain that he rigidly holds the body immobile.

Spinal flexion (bending forward) is contraindicated if:

- when extension relieves the symptoms.
- when flexion increases or peripheralises the symptoms.

ACUTE PHASE:

AIMS:

- To relieve patient from pain
- To promote muscle relaxation
- To reduce inflammatory sign
- Patient education
- Prevention

Controlled Rest:

- Postural correction by avoiding flexed posture prevent prolong / long time sitting with any back support
- Avoid heavy weight lifting object from the floor
- Advice the patient to use local support in form of corset: Lumbosacral belt, Abdominal binder, Tap etc.
- To prevent worsening of the symptoms, the patient is asked to take rest on a hard bed.
- Walking is advised to promote lumbar extension which will stimulate the fluid mechanism in the body to heal & reduce soft tissue swelling.
- If the patient present with inability to straighten up, make patient lie on prone position with 2-3 pillow under the abdomen. As the pain subside remove the pillow and place under the thorax, by this nucleus pulposus is shifted forwards and relieve pain and again lordosis.

Modalities:

Moist heat pack, Cryotherapy, UST, SWD, IFT, TENS and mechanical traction can be used to relief the symptoms.

Exercises: Extension exercises are useful in early treatment of disc related signs and symptoms.

Posterior or posterolateral protrusion:

1) Passive Extension- Patient is lying prone. If patient is in extreme pain, place pillows under the abdomen for support, gradually increase the amount of extension by removing pillows. Progress by having the patient prop himself up on the elbows, allowing the pelvis to sag. Wait for 5-10 minutes between each increment of extension.

2) Lateral shift correction- If patient has lateral shift, first correct lateral shift then start with extension exercises. Therapist stands on the side to which the thorax is shifted and places his shoulder against the patient's elbow which is flexed against the rib cage. Therapist wraps the arms around patient's pelvis and pulls pelvis towards him while pushing the patient's thorax away.

Self correction: Patient places the hand on the side of the shifted rib cage on the lateral aspect of the rib cage and place the other hand over the crest of opposite ilium. Then gradually push these regions towards midline and hold.

SUBACUTE PHASE:

-Same exercise in acute phase

-Cat and camel exercise: to emphasize on anterior pelvic tilt for maintaining extension of spine

-Back isometrics exercise

CHRONIC PHASE:

AIMS:

-Restore range of motion.

-Restore muscle strength, endurance and function.

-Retrain kinesthetic awareness and control of normal alignment.

-Patient involvement and education to manage posture to prevent recurrences.

1) Gentle active pain free ROM exercise

2) Stretching and flexibility exercise

3) Back strengthening exercise

4) Core stability exercise

- Bridging
- Plank
- Side plank
- Wall squats
- Leg lifts
- Crunches

5) Strengthening exercises

- Opposite Arm and Leg Extension

- Leg lifts
- Backward leg lifts in standing and lying
- Abdominal strengthening exercises: Isometric abs, knee to chest, bicycle exercises.

References:

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- 2) Dulebohn SC, Massa RN, Mesfin FB. Disc Herniation. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK441822/>
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