

**“A PROSPECTIVE STUDY OF OUTCOME OF  
SURGICAL MANAGEMENT OF PATIENTS WITH  
LUMBAR DISC HERNIATION BY  
MICRODISCECTOMY”**

**By**

**Dr. PAMMI KARTHIK REDDY**



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**In partial fulfillment of the requirements for the degree of**

**MASTERS OF SURGERY**

**IN**

**ORTHOPAEDICS**

**Under the Guidance of**

**Dr. NAGA KUMAR .J.S, M.S.,  
ASSOCIATE PROFESSOR**



**DEPARTMENT OF ORTHOPAEDICS, SRI DEVARAJ URS  
MEDICAL COLLEGE, TAMAKA, KOLAR – 563 101.**

**MAY - 2018**



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**Dr. PAMMI KARTHIK REDDY**  
Postgraduate in Orthopaedics,  
Sri Devaraj Urs Medical College,  
Tamaka, Kolar.

Date:

Place: Kolar.





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**Dr. NAGAKUMAR J.S, M.S.**

Associate Professor

Department Of Orthopaedics

Sri Devaraj Urs Medical College

Tamaka, Kolar.

Date:

Place: Kolar.





**SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION  
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**Dr. ARUN H. S.**

Professor & HOD

Department of Orthopaedics  
Sri Devaraj Urs Medical College  
Tamaka, Kolar.

Date:

Place: Kolar.





**SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION  
AND RESEARCH, TAMAKA, KOLAR, KARNATAKA**

**ENDORSEMENT BY THE HEAD OF THE DEPARTMENT  
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**Dr. ARUN H. S.**

Professor & HOD  
Department Of Orthopaedics,  
Sri Devaraj Urs Medical College,  
Tamaka, Kolar.

Date:

Place: Kolar.

**Dr. M. L. HARENDRA KUMAR,**

Principal  
Sri Devaraj Urs Medical College,  
Tamaka, Kolar.

Date:

Place: Kolar.





**SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION  
AND RESEARCH, TAMAKA, KOLAR, KARNATAKA**

**ETHICAL COMMITTEE CERTIFICATE**

This is to certify that the Ethical committee of Sri Devaraj Urs Medical  
College, Tamaka, Kolar has unanimously approved

**Dr. PAMMI KARTHIK REDDY**

**Post-Graduate student in the subject of**

**ORTHOPAEDICS at Sri Devaraj Urs Medical College, Kolar**

**to take up the Dissertation work entitled**

**“A PROSPECTIVE STUDY OF OUTCOME OF SURGICAL**

**MANAGEMENT OF PATIENTS WITH LUMBAR DISC**

**HERNIATION BY MICRODISCECTOMY”**

To be submitted to the

**SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION  
AND RESEARCH, TAMAKA, KOLAR, KARNATAKA,**

**Member Secretary,**

Sri Devaraj Urs Medical College,

Kolar – 563 101.





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**Dr. PAMMI KARTHIK REDDY**

# ABSTRACT

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## **Background :**

Lumbar disc herniation is the main cause of discogenic low back pain in patients between 24 and 45 years of age. It accounts for a majority of cases of low backache seen by an orthopaedician in clinical practice and is a major contributor of functional disability. There are many techniques available for treating lumbar disc herniation but microdiscectomy is the most acceptable method today. There are many prospective and retrospective reviews available which reported a favorable outcome in majority of the patients.

## **Aims & Objectives:**

To study the outcome of surgical management of lumbar Intervertebral disc herniation by micro discectomy.

## **Materials and Methods:**

30 Cases of lumbar disc herniation which have been treated by micro discectomy, satisfying inclusion and exclusion criterias, admitted in RL Jalappa hospital attached to Sri Devaraj Urs Medical College, Kolar from August 2015 to April 2017 were studied. Outcome was assessed using the Oswestry Disability Index Score.

**Results:**

The Mean ODI score of all 30 patients preoperatively in our study was 42.2 and the scores were 21.43 , 14.1 and 10.3 at 1 month, 3 months and 6 months followup respectively which is a significant outcome.

**Conclusion:**

There are many techniques for the treatment of lumbar disc herniation but microdiscectomy is the most acceptable method with less complications.

**Key Words:** Lumbar Disc herniation; MicroDiscectomy.



## **LIST OF ABBREVIATIONS**

|                |                                                  |
|----------------|--------------------------------------------------|
| AP             | Anteroposterior                                  |
| CT             | Computed Tomography                              |
| GD-DTPA        | Gadolinium Diethylene Triamine Penta Acetic Acid |
| LA             | Lumbar Artery                                    |
| LS             | Lumbosacral                                      |
| MRI            | Magnetic Resonance Imaging                       |
| NSAIDS         | Nonsteroidal Anti Inflammatory Drugs             |
| ODI            | Oswestry Disability Index                        |
| PET            | Positron Emission Tomography                     |
| SSEP           | Somatosensory Evoked Potential                   |
| T2             | Longitudinal Relaxation Time                     |
| TENS           | Transcutaneous Electrical Nerve Stimulation      |
| SLRT           | Straight Leg Raising Test                        |
| X <sup>2</sup> | Chi-Square                                       |





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# INTRODUCTION

Lumbar disc herniation is the main cause of discogenic low back pain in patients between 24 and 45 years of age. Previous studies indicated that about 60%-80% of patients would suffer back pain during their lifetime<sup>1</sup> and 2%-10% of them need the surgical treatment<sup>2</sup>. It accounts for a majority of cases of low backache seen by an orthopaedician in clinical practice and is a major contributor of functional disability<sup>3</sup>. The majority of lumbar radicular pain symptoms is the result of a disc herniation, defined as bulging of the nucleus pulposus through a fissure or tear within the annulus fibrosus<sup>4</sup>.

Although favorable outcomes have been demonstrated for both surgical and nonoperative treatment options, patients who underwent discectomy for lumbar disc herniation were shown to have better self reported outcomes than conservatively treated individuals<sup>5</sup>.

There are two main methods for intervertebral disc surgery. One is the lumbar discectomy which involved an extensive removal of lamina and the offending ruptured disc, which was first introduced by Mixter and Barr<sup>6</sup>.

The other is microdiscectomy first reported by Yasargil<sup>7</sup> and Caspar<sup>8</sup> that involved the use of an operating microscope for the surgical removal of the disc. They independently described microsurgical techniques that provided excellent lighting and magnification of the operative field. Compared with the standard open discectomy, the micro discectomy enabled the use of smaller incisions of the skin and fascia and facilitated a less traumatic surgical procedure.

Due to the postulated advantages of reduced tissue invasiveness, limited blood loss, shorter duration of surgery and a faster postoperative recovery, minimally

invasive microdiscectomy has been established as an alternative to traditional, more aggressive open approaches in the treatment of Lumbar Disc Herniations<sup>9</sup>.

The first follow-up report of Williams et al. showed encouraging results following lumbar microdiscectomy. Since that time this procedure had been considered the gold standard for the surgical treatment of lumbar disc herniation<sup>10</sup>. However, in various studies the outcome of lumbar micro disc surgery documents a success rate of 97%<sup>11</sup>.

## **AIMS & OBJECTIVES**

1. To study the age, sex distribution and the occupational factors involved in lumbar disc herniation.
2. To analyze the intra-operative and post-operative complications of microdiscectomy.
3. To study the outcome of surgical management of lumbar Intervertebral disc herniation by micro discectomy .

## **REVIEW OF LITERATURE**

### **HISTORICAL REVIEW**

Though humans have been tormented by back and leg pain since the beginning of recorded history, it astonishes that origin of disc related sciatica and clinical neurologic findings were not recognized until the 20<sup>th</sup> century. Lumbar disc surgery and intra discal therapy are relatively recent developments. The following is a brief review of the subject.

In the 5<sup>th</sup> century AD, Aurelianus clearly described the symptoms of Sciatica<sup>11</sup>.

In the 18<sup>th</sup> century Contugnio (Cotunnus) attributed the leg pain to the sciatic nerve<sup>11</sup>.

In 1881, Forst described the Lasegue sign. He attributed it to Lasegue, his teacher<sup>11</sup>.

Virchow (1857), Kocher (1906) and Middleton and Teacher (1911) described acute traumatic ruptures of intervertebral disc that resulted in death. These examiners did not appreciate the correlation between the disc rupture and sciatica<sup>11</sup>.

In 1909 Oppenheim and Krause performed the first successful surgical excision of herniated intervertebral disc. Unfortunately they did not recognize the excised tissue as disc material and interpreted it as an enchondroma<sup>11</sup>.

In 1911 Goldthwaite attributed back pain to posterior displacement of the disc<sup>11</sup>

In 1929 Dandy and Alajouanine reported removal of a “disc tumor”, or chondroma, from a patient with sciatica. The commonly held opinion of that time was that the disc hernia was a neoplasm<sup>11</sup>.

In 1932 Schmorl and Junghanns more fully described the pathology of the intervertebral disc in their comprehensive study of cadaveric spine<sup>12</sup>

Finally in 1934 Mixter and Barr published in the New England journal of Medicine, what is now regarded as a classical paper on ruptured intervertebral disc. They described disc protrusions and their relevance to sciatica and showed the effectiveness of operative treatment in 58 cases<sup>13</sup>.

In 1939 Semmes presented a new approach to remove the ruptured disc that included a subtotal laminectomy and retraction of the dural sac to expose and remove the ruptured disc<sup>11</sup>.

In 1964 Lyman Smith suggested a radical procedure in treatment of lumbar disc prolapse. That is enzymatic dissolution of the disc by injection of chymopapain and he coined the term “chemonucleolysis”<sup>14</sup>.

In a study in 1974 the author explored on the late results of laminectomy for lumbar disc prolapse in 204 patients. It was a long-term review after nearly 10 to 25 years of the operation. He made some important observations. Closed treatment should not be continued in the absence of detectable signs of improvement.

A central disc prolapse with cauda equina syndrome is an indication for urgent operations. He also concluded that operations give early and long lasting relief from sciatic pain and assist the patient to an early return to work. Operation does not affect the decision to change work. It is decided by the duration of symptoms and amount of disc degeneration. The need to change of work is the same whether the patient is treated by closed means or by surgery. He had 79% good to excellent results in his study<sup>15</sup>.

In late 1977, a new technology was introduced by Yasargil<sup>7</sup> and Caspar<sup>8</sup> that involved the use of an operating microscope for the surgical removal of the disc. They independently described microsurgical techniques that provided excellent lighting and magnification of the operative field. Compared with the standard open discectomy, the micro discectomy enabled the use of smaller incisions of the skin and fascia and facilitated a less traumatic surgical procedure. The first follow-up report of Williams et al. in 1978 showed encouraging results following lumbar microdiscectomy<sup>10</sup>. Since that time these two procedures have been considered the gold standard for the surgical treatment of lumbar disc herniation.

But Micro discectomy, which slightly contributes to a relatively smaller incision, less soft tissue damage, therefore reduced postoperative pain, early discharge from hospital and return to work compared to open discectomy.

Surgical discectomy produced better clinical outcome than chemonucleolysis with chymopapain, and chemonucleolysis produced better clinical outcomes than placebo. Their study was based on analysis of data collected upto 31-12-1999 from various sources like Cochrane Controlled Trials Register, Medline, Embase, Biosis and Index to UK thesis. Totally 27 trials have been found. Out of this, 16 trials were of some form of chemonucleolysis and 11 trials compared different surgical techniques. 3 trials showed no differences in clinical outcomes between micro discectomy and standard discectomy.<sup>16</sup>

A study consisting of 196 patients with large herniation of lumbar nucleus pulposus was followed over 3 years period. They were subjected to either epidural steroid injection or discectomy. The authors concluded that epidural steroid injection was not as effective as discectomy with regard to reducing symptoms and disability associated with large herniation of lumbar disc.<sup>17</sup>



In 1984 the author reported 12 cases of lateral disc herniations, which were diagnosed by CT scanning and were confirmed surgically. He concluded that CT scan was able to provide accurate diagnosis in these cases and it prevented unnecessary exploration of uninvolved levels<sup>18</sup>.

In 1984 the author conducted a study on the magnetic resonance imaging in intervertebral disc disease. Comparing to radiographs, high resolution CT scans and myelograms with MRI, he concluded that MRI was the most sensitive investigation for the diagnosis of disc space infection, separating the normal nucleus pulposus from the annulus and degenerated disc<sup>19</sup>.

In 1985 the author reported early results of discectomy by fenestration technique in lumbar disc prolapse. They found that this technique was extremely satisfactory, as they reported 93.3 percent good to excellent early results<sup>20</sup>.

In 1986 the authors reported the results of microsurgical lumbar discectomy in 485 patients. They had 39% excellent, 34% good, 19% satisfactory and 8% poor results. They concluded that the results obtained with microsurgery were attained with standard techniques only by highly experienced surgeons. Following microsurgery a uniformly high percentage (88 to 98%) of results were reported as satisfactory, whereas with the standard technique it was 40 to 98%<sup>21</sup>.

In 1986 the authors proposed a rating scale based on economic and functional status of the patient before and after lumbar spine operations. They stated that the scale was easily applicable and can delineate pre and postoperative conditions of patients on a semi quantitative basis<sup>22</sup>.

In 1987 the authors evaluated the factors predicting the result of surgery for lumbar disc herniation. They found that the best results were achieved when the patients were operated within two months duration of disabling sciatica. The

operative findings were graded as predictors for the result. The social and psychological factors influenced the outcome, more than the findings in preoperative physical examination or the operative gradings<sup>23</sup>.

In 1987 the author reported a long-term prospective study of 100 patients who underwent microdiscectomy. They found that the preoperative factors found to be significantly associated with outcome at 1 year postoperatively, than with the outcome 5 to 10 years later. They also found that surgical outcome was favourable<sup>24</sup>.

In 1988 the author compared 270 patients treated with standard discectomy with 270 patients treated with micro lumbar discectomy. He found 98% success rate in the microsurgical group as compared to 95% success rate in the standard laminectomy group. The postoperative hospital stay and the time before return to work was significantly shorter in patients undergoing microdiscectomy<sup>25</sup>.

In 1988 the author evaluated 30 patients with failed back surgery syndrome to know the effectiveness of MRI with gadolinium- diethyl triaminepenta-acetic acid (Gd-DTPA) in differentiating between postoperative epidural fibrosis (scar) and recurrent disc herniation. They found that pre contrast and early post contrast T1 weighted spin-echo studies were highly accurate in separating epidural fibrosis from herniated disc<sup>26</sup>.

In 1989 the author reported on surgery in lesions of lumbar intervertebral disc degeneration, and they had 85.2% good to excellent results. There was one case of superficial wound infection and 4 cases of failed back surgery syndrome<sup>27</sup>.

In 1990 the author evaluated an objective scoring system for assessment of patients who had persistent low back pain and sciatica. They concluded that use of their scoring system reduced the incidence of negative findings at exploration and improved the clinical result after elective discectomy<sup>28</sup>.

In 1991 the author compared microsurgical with conventional standard lumbar disc procedure. They found that results in the microsurgical group were significantly favourable. There was less blood loss and fewer levels were explored. The time to full ambulation, discharge and return to work was faster<sup>29</sup>.

In 1991 the author published the results of lumbar discectomy study. They found that on analysis of unsatisfactory outcomes, there were two patterns of failure; one as a result of mechanical back pain and another as a result of radiculopathy. Factors predictive of outcome had no influence on the type of failure<sup>30</sup>.

In 1992 the author reported their outcome analysis in 654 patients surgically treated lumbar disc herniations by microdiscectomy. They reported 80% good outcome. Professionals with legal concerns and labourers with industrial insurance had good outcome<sup>31</sup>.

In 1993 the author reported a randomized prospective study on 60 patients with single level lumbar disc herniation with the aim to see if there was any difference between the microscopic removal of a disc herniation and the standard procedure. They concluded that the decision to use the microscope is good and recover fast and go early for their work<sup>32</sup>.

In 1993 the author published a study on percutaneous nucleotomy. They found that the 73% success rate in patients who underwent percutaneous nucleotomy was not satisfactory in comparison with that of microdiscectomy surgery which was about 88%<sup>33</sup>.

In 1994 the author in his paper on long term follow up study of 984 patients surgically treated for herniated lumbar discs found a 89% good outcome .The recurrence rate was 6% and complication rate was 4%<sup>34</sup>.

In 1995 the author evaluated the predictors of good and bad outcomes that influenced the lumbar disc surgery. 51.5% of patients had good outcome and 20.1% had bad outcome. The predictor score gave an overall appropriate prediction of 80%<sup>35</sup>.

In 1996 the author stated that outcome of surgery for lumbar disc herniation depends on patient selection. Short term results were excellent when there was agreement between clinical presentation and imaging studies. Long term results were only slightly better than conservative methods and natural history of disc herniation. The outcome did not seem to be affected by the use of a microscope and depends more on patient selection than on surgical technique<sup>36</sup>.

A study conducted in 1998 consisted of a group of 88 patients who underwent surgery by microdiscectomy. Assessment at 10 years after surgery was obtained in 79 (90%) of the cases. The initial outcome was assessed retrospectively by an independent observer at 6 months after surgery using the Macnab classification. A successful outcome at 6 months was achieved in 91% of the cases. At 10-year follow-up, this result declined slightly to an 83% success rate. However, there was no statistically significant difference between these outcome results. The long-term Macnab classification results correlated well with disability, as measured by the Roland-Morris score. Patient satisfaction with the results of micro discectomy 10 years later was high<sup>37</sup>.

In 1999 the author analysed the outcome in 1072 surgically treated lumbar disc herniations. They stated that there were many new techniques for the treatment of lumbar disc herniations, but the microdiscectomy was “Gold standard” for operative intervention in patients with herniated lumbar disc. Surgery depends not only upon the degree of neurological impairment, operative technique and skill, but also upon the correct selection of cases<sup>38</sup>.

In 2003 the author presented a review of 553 patients who underwent micro discectomy for lumbar intervertebral disc prolapse out of which 42 patients subsequently required a second operation for recurrent sciatica (7.9% revision rate). They concluded that a contained disc protrusion was almost three times more likely to need revision surgery compared with extruded or sequestered discs. Also they had a significantly greater straight leg raise and reduced incidence of positive neurological findings. Therefore a more enthusiastic conservative treatment programme should be implemented in treating these patients<sup>39</sup>.

In 2003 the author evaluated 40 patients of lumbar disc herniation with myelography and CT scan. Myelography had a sensitivity of 89.6% as compared to 100% sensitivity with CT scans. Myelogram supplements CT scan by limiting the number of scans to the level of interest and reduces radiation exposure. However CT scan is superior in the diagnosis of lumbar disc herniation<sup>40</sup>.

In 2004 the author evaluated the efficacy of epidural steroid injection in patients suffering from lumbar disc herniation. 169 patients with a large herniation of lumbar nucleus pulposus were followed up for a period of 3 years. The author concluded that epidural steroid injection was not as effective as discectomy with regard to reducing symptoms and disability associated with large herniation of lumbar disc<sup>41</sup>.

In 2006 the author reported a retrospective study of 25 years outcome and functional assessment of lumbar microdiscectomy for lumbar disc herniation. The author concluded that patients who have undergone lumbar discectomy a minimum of 25 years earlier have a satisfactory self reported health related quality of life and less pain than nonsurgically treated patients<sup>42</sup>.

In 2008 the author reported a study conducted on patients with lumbar disc

herniation to know the the effect of level of disc herniation on outcome after lumbar microdiscectomy. The combined randomized and observation cohorts of the Spine patient Outcomes Research Trial were analyzed by actual treatment received stratified by level of disc herniation. Overall 646 L5-S1 herniations, 456 L4-L5 herniations and 88 upper lumbar herniations (L2-L3 or L3-L4) were evaluated. Primary outcome measures were the short form-36 bodily pain and physical functioning scales and the modified Oswestry disability Index assessed at six weeks, three months, six months, one year, and two years. Treatment effects (the improvement in the operative group minus the improvement in the nonoperative group) were estimated with use of longitudinal regression models, adjusting for important covariates. The author concluded that the advantage of operative compared with nonoperative treatment varied by herniation level, with the smallest treatment effects at L5-S1, intermediate effects at L4-L5, and the largest effects at L2-L3 and L3-L4. This difference in effect was mainly a result of less improvement in patients with upper lumbar herniations after nonoperative treatment<sup>43</sup>.

In 2008 the author reported a prospective longitudinal clinical study to investigate the clinical outcomes with type and level of disc herniation in a young, active population undergoing lumbar microdiscectomy and concluded that microdiscectomy for symptomatic lumbar disc herniations in young, active patients with a preponderance of leg pain who have failed nonoperative treatment demonstrated a high success rate based on validated outcome measures, patient satisfaction, and return to active duty. In their study, patients with disc herniations at the L5–S1 level had significantly better outcomes than those at the L4–L5 level. Patients with sequestered or extruded lumbar disc herniations had significantly better outcomes than those with contained herniations<sup>44</sup>.

In 2010 the author reported a study which evaluated the effectiveness among open discectomy and microdiscectomy surgical groups and found that sufficient decompression was done in both surgical groups, as the health-related quality of life parameters (Oswestry, VAS and SF-36) were defined as clinically improved in both surgical groups<sup>45</sup>.

A study reported in 2012 concluded that microdiscectomy and lumbar decompression not only reduce disability and pain but also improve depressive symptoms and overall quality of life for patients<sup>46</sup>.

A retrospective study reported in 2014 to assess the reoperation rate after microdiscectomy for the treatment of lumbar disc herniation in patients with more than 5-year follow-up concluded that microdiscectomy for the treatment of lumbar disc herniation results in a favorable longterm outcome in the majority of cases<sup>47</sup>.

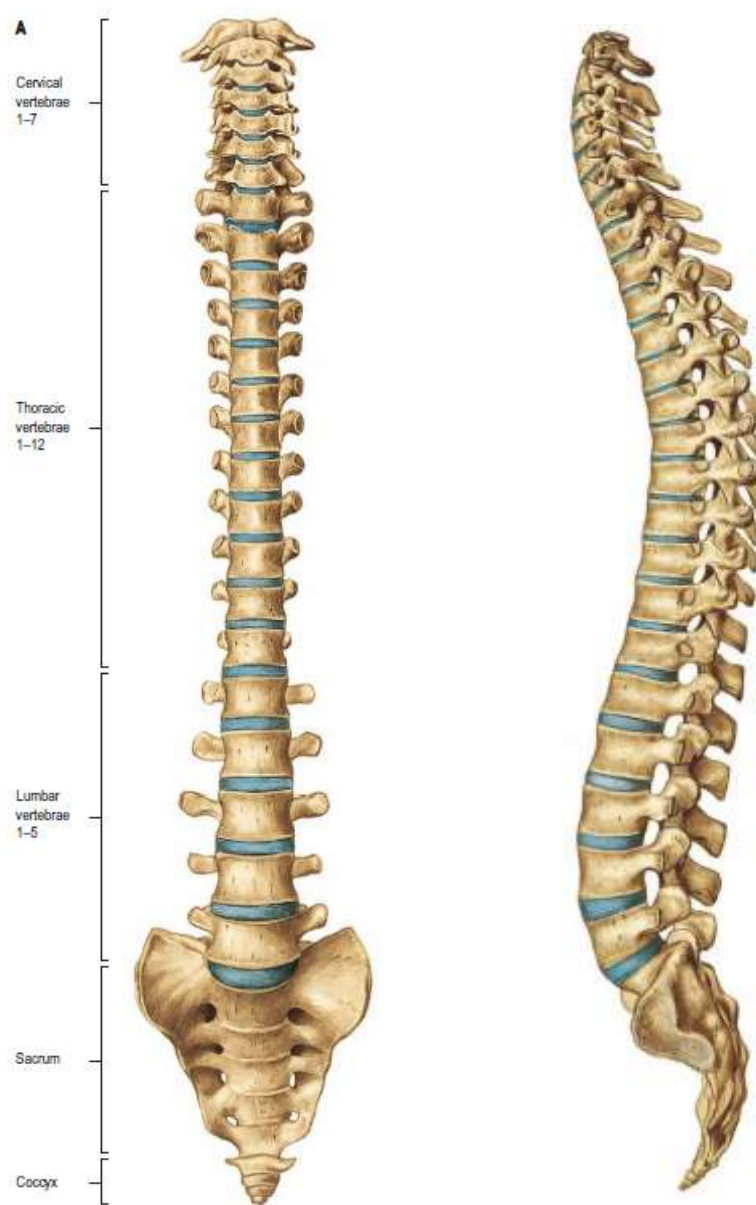
The author reported a study in 2017 on long term results after microdiscectomy for lumbar disc herniation in a large adult cohort treated at a tertiary care centre. They concluded that better outcomes were achieved with early surgical treatment. Time limits for conservative treatment should be set to avoid progression of acute to chronic pain and the worse overall outcomes that go along with belated surgery<sup>48</sup>.

## ANATOMY

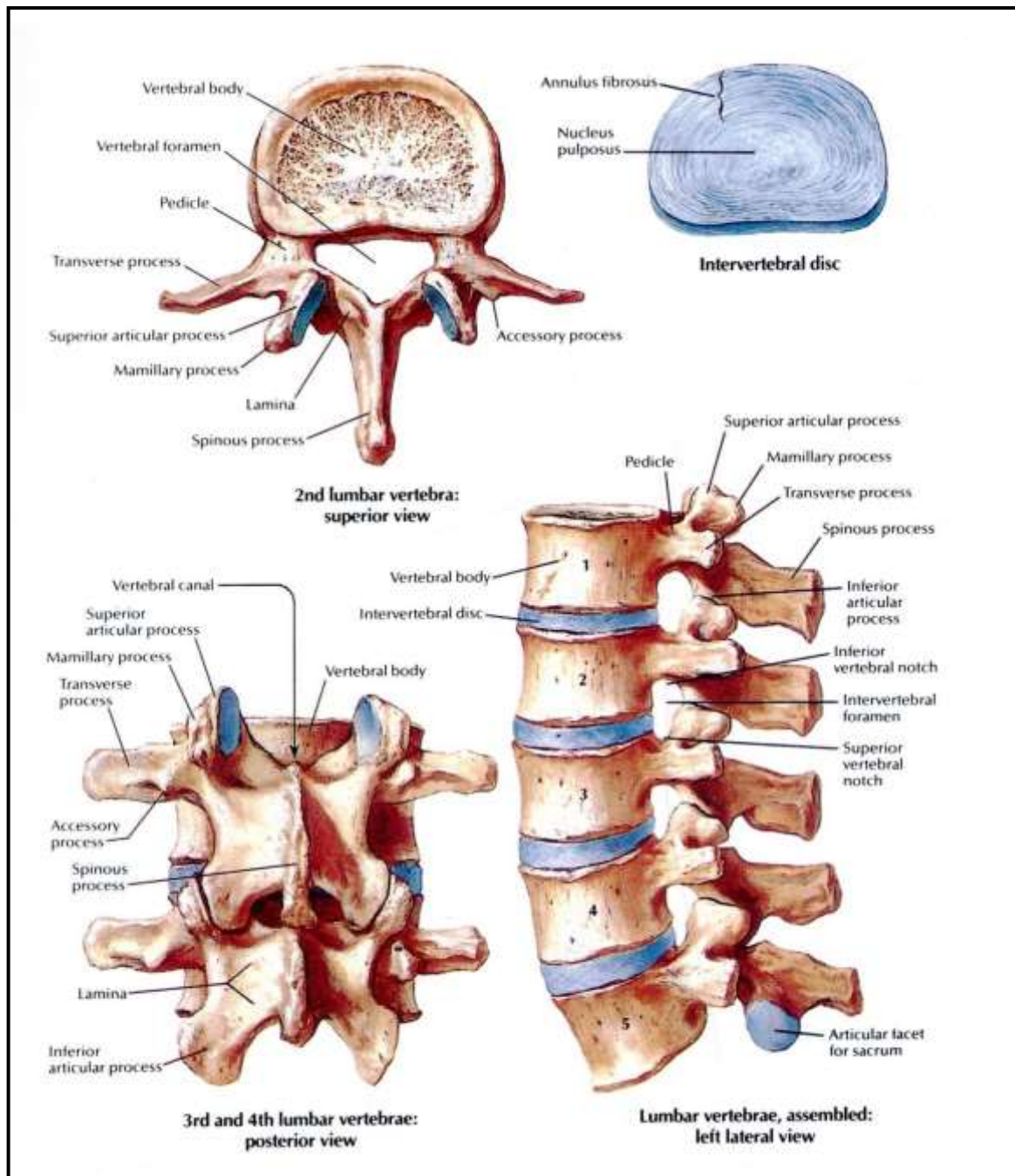
The human spinal column is an articulated segmental structure that serves the purpose of protection. Thirty-three vertebrae segmentally connected with one another, form a protective housing for the spinal cord and nerves<sup>49</sup>.

It is made up of 7 cervical, 12 thoracic, 5 lumbar, 5 sacral and 4 coccygeal segments<sup>50</sup>.

**Figure 1: Lumbar Vertebrae and How they Appear in the Vertebral Column**



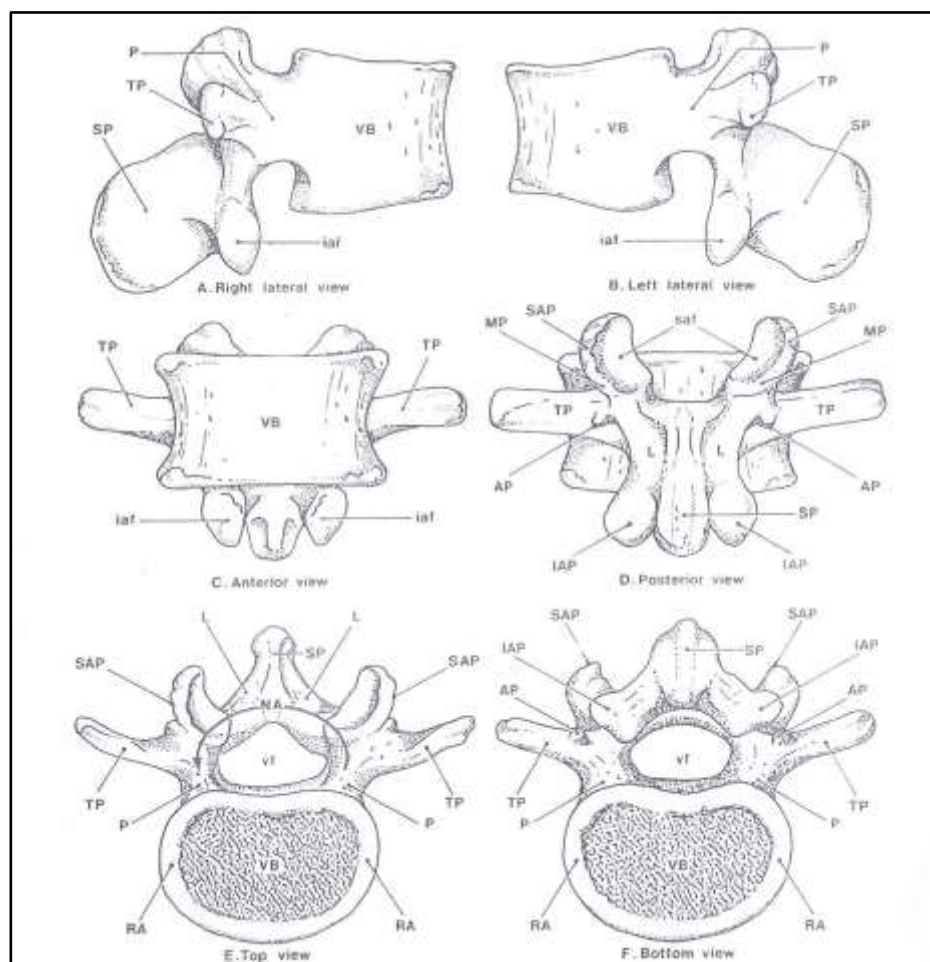




**Figure 2: Lumbar Vertebrae and Intervertebral Disc**

The parts of a typical lumbar vertebra VB-VERTEBRAL BODY, P- PEDICLE, TP-TRANSVERSE PROCESS, SP- SPINOUS PROCESS, L – LAMINA, SAP- SUPERIOR ARTICULAR PROCESS, IAP-INFERIOR ARTICULAR PROCESS, SAF- SUPERIOR ARTICULAR FACET, IAF- INFERIOR ARTICULAR FACET, MP- MAMILLARY PROCESS, AP- ACCESSORY PROCESS, VF- VERTEBRAL FORAMEN, RA- RING APOPHYSIS, NA- NEURAL ARCH,

**FIGURE 3 : PARTS OF A TYPICAL LUMBAR VERTEBRA**



## **Embryology:**

The development of the spine begins in the 3<sup>rd</sup> week of gestation. Formation of the primitive streak marks the notochordal process. This process includes neurectodermal, ectodermal and mesodermal differentiation. Somites form in the mesodermal tissue adjacent to the neural tube (neurectoderm) and notochord. They number 42 to 44 in humans. They begin to migrate in the process of preparation and formation of skeletal structures. At the same time, the cephalad portion of the somite around the notochord separates into a sclerotome with loosely packed cells and caudal portion as densely packed cells. There will be migration of loosely packed cells of cephalad sclerotome into the densely packed cells of subsequent caudal sclerotome. The space between the sclerotomes eventually forms the intervertebral disc. Vessels that were positioned originally between the somites supplies the portion of the vertebral body adjacent to the disc. As the vertebral bodies form, the notochord that is in the centre degenerates. The remaining notochordal remnant forms the nucleus. The chordal cells disappear by early childhood<sup>11</sup>.

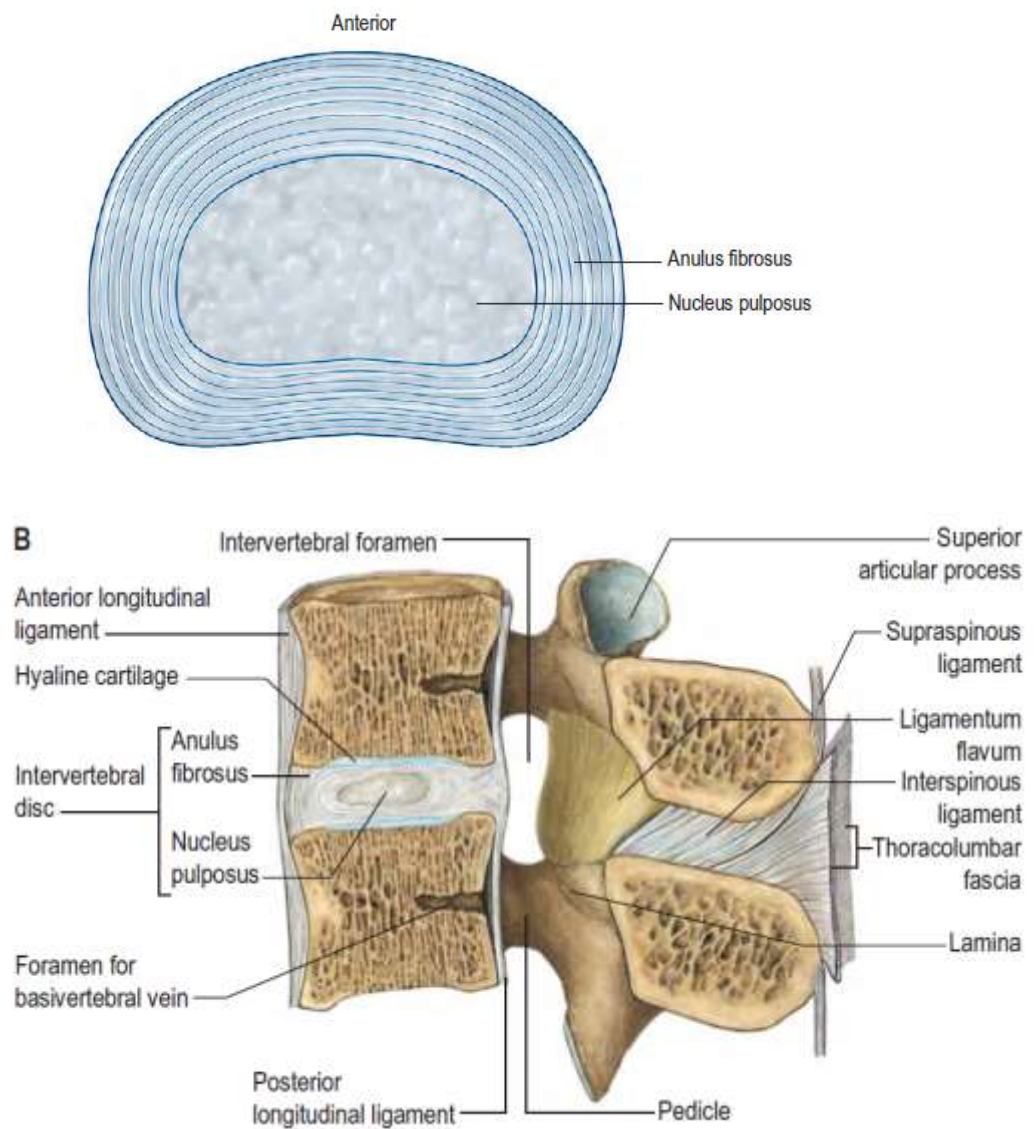
**The vertebral column:** There are 33 vertebrae in the human body. The complete column of vertebral bodies and discs forms a strong but flexible central axis of the body supporting the full weight of the head and trunk. It encloses the spinal canal, which is occupied by the spinal cord, meninges and their vessels<sup>51</sup>.

The vertebral column possesses two primary curvatures, thoracic and sacral. They are convex posteriorly which were present during fetal life and retained after birth.

There are two secondary or compensatory curvatures-cervical and lumbar. They are convex forwards. The cervical curvature becomes well pronounced by the 3<sup>rd</sup> to the 9<sup>th</sup> month when the child is able to hold its head up and sit upright. The

lumbar curvature appears by 12-18 months after birth when the child begins to walk so that the centre of gravity of the trunk is brought over the legs<sup>50</sup>.

**The intervertebral disc:** In the lumbar spine it constitutes up to 33% of the vertebral height<sup>52</sup>. The intervertebral disc is composed of three histological different components.



**Figure 4 INTERVERTEBRAL DISC**

## STRUCTURE OF LUMBAR INTERVERTEBRAL DISC

They are:

- a) Nucleus pulposus
- b) Annulus fibrosus
- c) The cartilage end plates<sup>53</sup>.

Normally 23 discs exist throughout the spine being absent only at the atlanto axial articulation. They are thinnest in the thoracic and thickest in the lumbar region<sup>54</sup>, discal outlines correspond to the bodies, which they connect. The thickness varies in different parts and regions of the same disc. They are thick anteriorly in the cervical and lumbar regions, contributing to the anterior convexity<sup>51</sup>.

### **a) Nucleus pulposus:**

It lies little posterior to the central axis of the vertebrae. It is composed of whitish, glistening, mucoid semi fluid material, which is composed of thin fibrils of type-two collagen, glycosaminoglycans, water and salts. At birth it contains a few multinucleated notochordal cells. As the age advances the number of notochordal cells will be reduced and the glycosaminoglycans will undergo degeneration. With these changes the nucleus pulposus becomes amorphous and discolored, its water binding capacity and elasticity diminish as these properties are due to its mucopolysaccharide and protein components<sup>51</sup>.

Microscopically, it shows fine fibrillar structure with clear stroma, mucin, fibroblastic cartilage and rarely notochordal cells. The borders of the nucleus are not distinct, as they gradually merge into the annulus fibrosus.

The turgor of the disc is dependent on high osmotic pressure of the nucleus pulposus, which draws fluid from the spongiosa of the vertebrae. The nucleus, being non-compressible, transmits the pressure against the cartilage plate and annulus

fibrosus. Diurnal variations in height being up to 1.5 cm taller in the morning than in the evening are mostly due to alterations in water content of the nucleus<sup>53</sup>.

**b) The annulus fibrosus:**

It has a narrow outer collagenous zone and a wider inner fibrocartilagenous zone. It is composed of numerous concentric rings of fibrocartilagenous tissue. Fibres in each ring cross radially and the rings attach to each other by additional diagonal fibres. The outer rings or lamellae are attached to the epiphysial ring by Sharpey's fibres. The rings or laminae, convex peripherally, are incomplete collars connected by fibrous bands overlapping one another. Posteriorly, laminae or lamellae join in a complex manner. Fibres in the rest of each lamina are parallel and run obliquely between vertebrae; fibres in contiguous laminae criss cross, thus limiting rotation in both directions. Predominantly vertical posterior fibres have been described as predisposing zone for herniation<sup>51</sup>.

**c) Cartilage plates:**

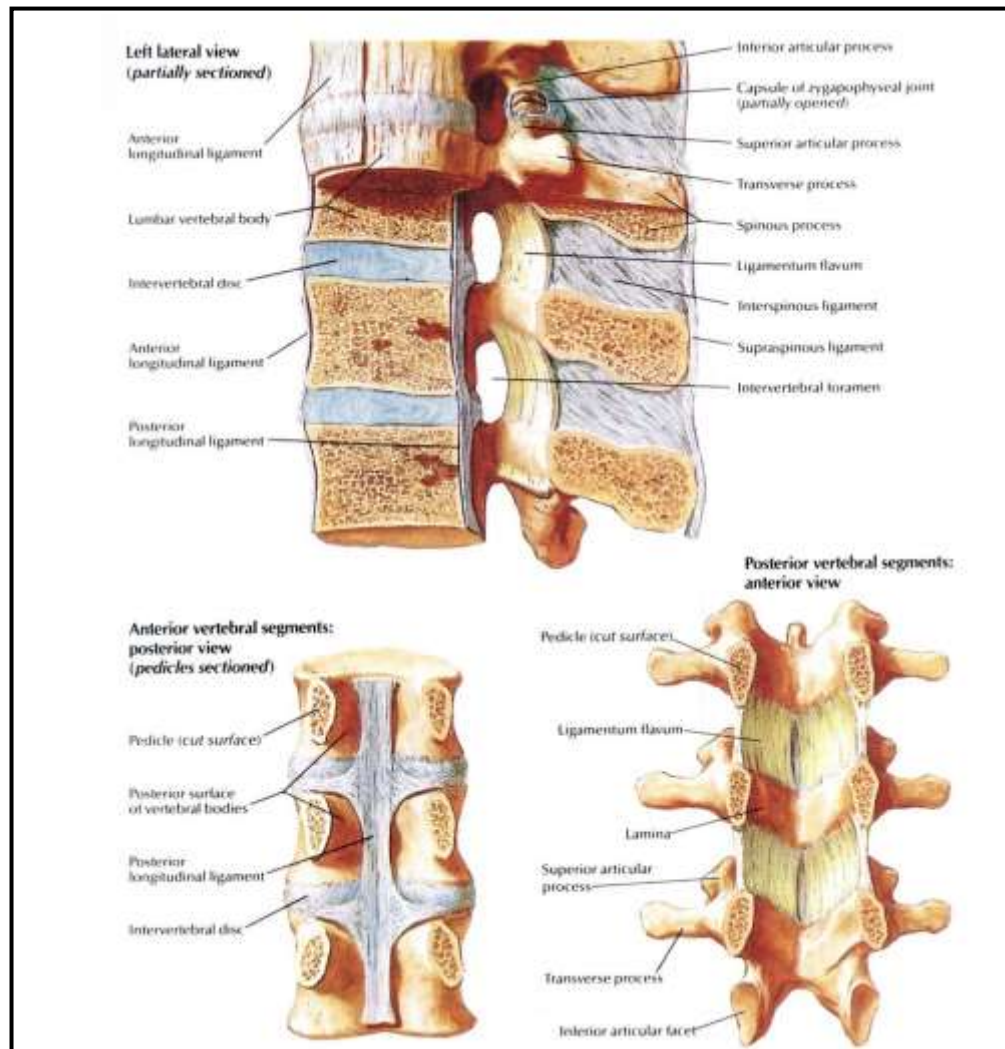
These are layers of hyaline cartilage adherent to the trabeculae of cancellous bone of the vertebral body through a thin layer of calcified cartilage at the junction. Thus the cartilage plate comes into contact with marrow, from which it receives nutrition. Vascular channels are said to be present in the cartilage plate extending from the marrow but disappear before the third decade. The cartilage plate fades peripherally into the annulus fibrosus<sup>53</sup>.

**Applied anatomy:**

Intervertebral discs form one fifth of the vertebral column. In young adults the discs are so strong that the violent injuries damage bones when compared to the intervertebral discs. After the second decade, degenerative changes in discs may result in necrosis, sequestration of nucleus pulposus, softening and weakening of the annulus



fibrosus, then comparatively minor strains may cause internal derangement with eccentric displacement of the nucleus pulposus. It then bulges or bursts through annulus fibrosus, usually posterolaterally<sup>51</sup>.



**Figure 5: Vertebral Ligaments: Lumbar Region**

#### **Anterior longitudinal ligament:**

It is a strong band extending along the anterior surfaces of the vertebral bodies. Cranially attached to the basilar occipital bone, it extends to the anterior atlantal tubercle, thence to the front of the body of the axis and then it extends along the anterior surface of the entire vertebral column in to the sacrum. At various levels the ligamentous fibres blend with the peripheral fibres of the annulus fibrosus.

**Posterior longitudinal ligament:**

It is in the vertebral canal on the posterior surfaces of the vertebral bodies, attached to the body of the axis and continued to the sacrum. Its smooth, glistening fibres are attached to the intervertebral discs and adjacent margins of the vertebral bodies. Its superficial fibres bridge 3 or 4 vertebrae, the deeper fibres extending between adjacent vertebrae as perivertebral ligaments and in adults fused with annulus fibrosus of the intervertebral discs<sup>42</sup>. The lateral expansions over the intervertebral discs are rather weak and form a vulnerable point for disc herniations compared to the strong central band.

The other ligaments of the vertebral column are the intertransverse ligaments, the supraspinous, interspinous and ligamentum flavum. The ligamentum flava are yellow coloured ligaments attached inferiorly to the superior edge of inferior lamina and superiorly to the anteroinferior surfaces of the superior lamina.

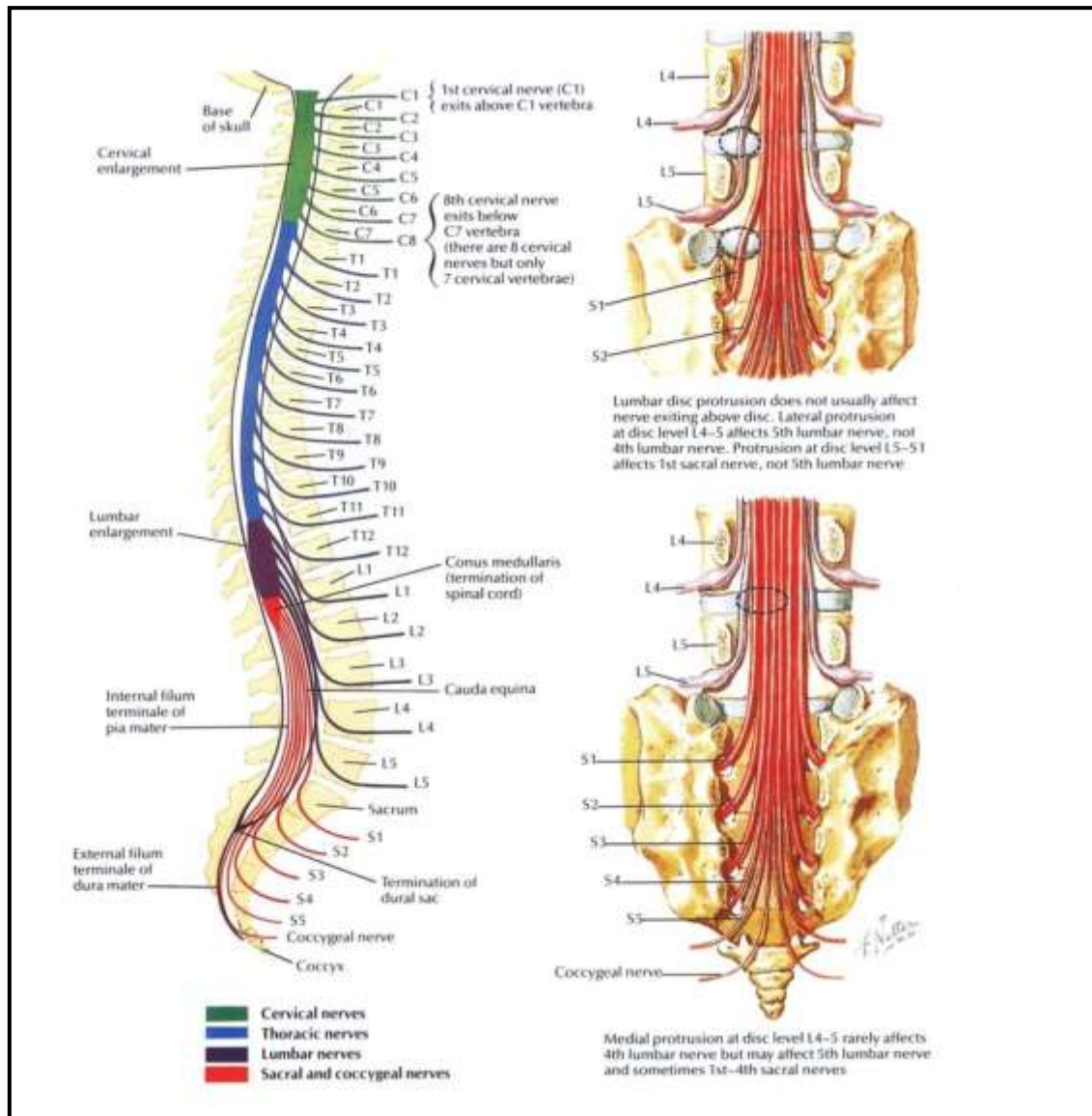
Denticulate ligament runs like a band on either side of the spinal cord and by means of strong tooth like processes it will anchor the spinal cord to the dura in between successive nerve roots<sup>50</sup>.



Figure 6:

## Relation of Spinal Nerve Roots to Vertebrae

## Nerve Disc Relationship



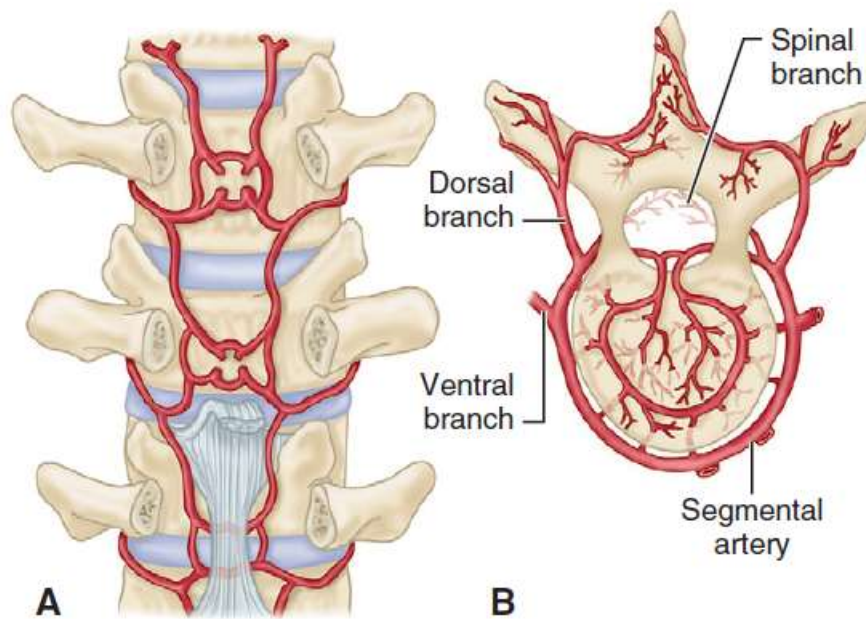
## NERVE ROOT EXITING BENEATH PEDICLE

The lumbar nerves emerge from the intervertebral foramen below the corresponding numbered vertebrae. The lumbar nerves exit sufficiently high in the intervertebral foramen above the disc and hence will not be affected by a degenerated disc at the same level.

For example disc herniation between L<sub>3</sub> and L<sub>4</sub> usually will compress the fourth lumbar root as it crosses the disc at this level. Thus in the lumbar spine, each root crosses the disc above the vertebral body but not the one below the vertebral body<sup>11</sup>.

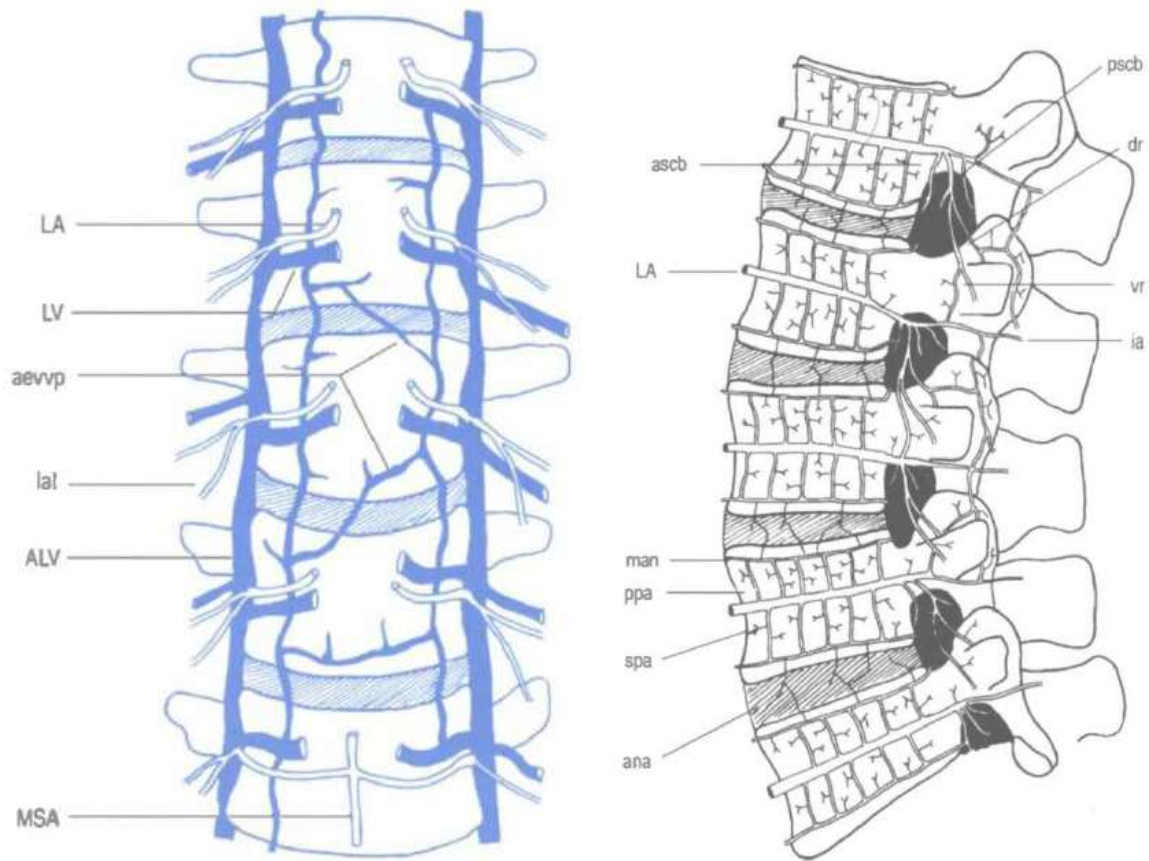
**Blood supply:**

**Figure 7**



**A**, Posterior view; laminae removed to show anastomosing spinal branches of segmental arteries.

**B**, Cross-sectional view; anastomosing arterial supply of vertebral body, spinal canal, and posterior elements.



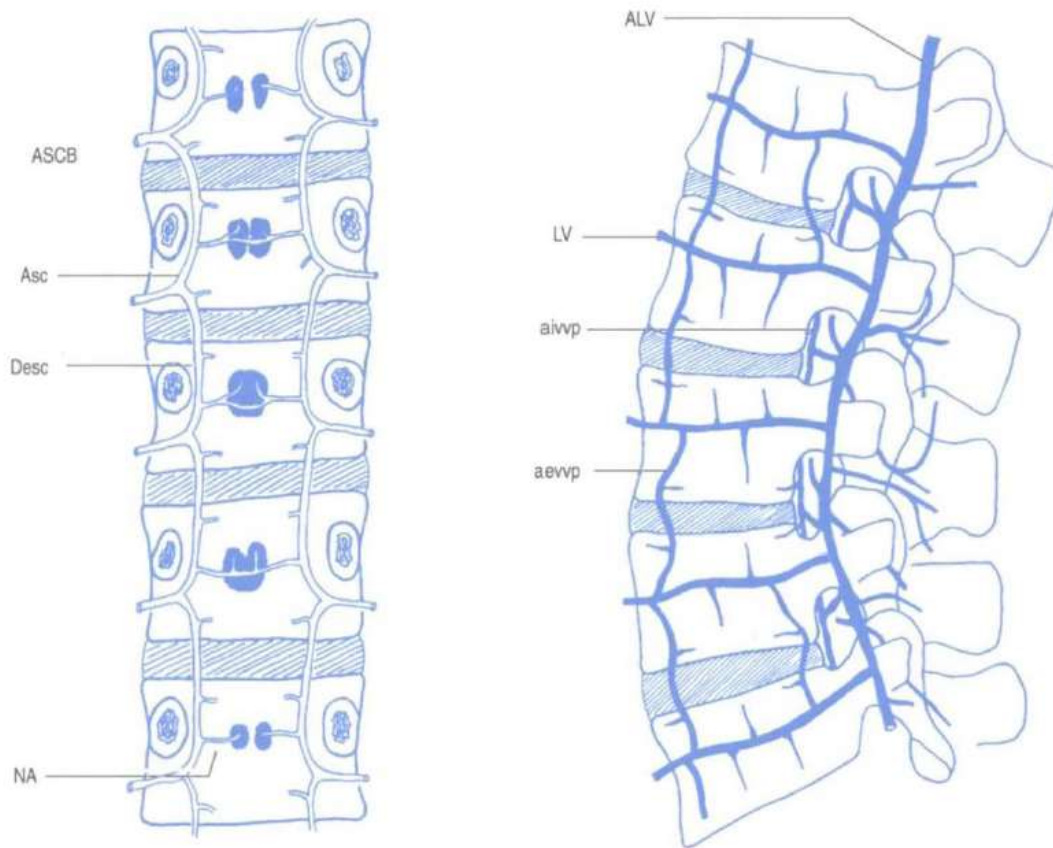
**Figure 8 : ARTERIAL SUPPLY OF LUMBAR VERTEBRAE**

### **LUMBAR ARTERIES AND THEIR BRANCHES**

LA-lumbar artery, ASCB-anterior spinal canal branch,

PSCB-posterior spinal canal branch, VR-branches along ventral RAMI, DR-branches along dorsal RAMI, ia- posterior branch relates to the pars interarticularis of the lamina, MAN-metaphyseal anastomosis, PPA- primary periosteal artery, SPA – secondary periosteal artery, ANA- anastomoses over the intervertebral disc.

**Figure-9 :VENOUS SUPPLY OF LUMBAR VERTEBRAE**



**ALV-ascending lumbar vein, LV- lumbar vein, AEVP- element of anterior external vertebral venous plexus**

### **LUMBAR SPINE SHOWING LUMBAR VEINS**

The intervertebral disc in the adult is avascular. The cells within it are survived by diffusion of nutrients into the disc through the porous central concavity of the vertebral end plate, as the trabecular bone of adjacent vertebrae are in direct contact with it. Motion and weight bearing are believed to be helpful in maintaining this diffusion<sup>11</sup>.

The sinu-vertebral nerve is a recurrent branch of the spinal nerve, which originates just distal to the dorsal root ganglion and re-enters the neural foramen. It divides into superior and inferior branches, which arborise to supply the periosteum, the posterior longitudinal

ligament, the dura and outer most layers of the annulus fibrosus. The nucleus pulposus and innermost layer of annulus fibrosus have no nerve supply<sup>49</sup>.

**Functions of the lumbar spine are:**

1. It transfers the weight from head and trunk to the pelvis.
2. It allows physiologic motion between head, trunk and pelvis.
3. It protects the spinal cord from potential damaging forces<sup>52</sup>.

**The Motion segment:**

It is the basic functional unit of the spine. It comprises of adjacent halves of 2 vertebrae, the interposed disc and facet joints with supportive ligaments. Its primary functions are weight bearing, protection of neural elements and provide motion to the spinal column.

The intervertebral disc with corresponding facet joints are termed as three joint complexes. The disc plays a crucial role in shock absorption, allowing smooth motion between vertebral bodies in various planes<sup>55</sup>

## **PATHOGENESIS OF DISC DEGENERATION AND NATURAL HISTORY OF DISC DISEASE**

Kirkaldy – Willis, Hill and others have studied the natural process of spinal aging through observation of clinical and anatomical data. A theory of spinal degeneration has been postulated, which assumes that all spines degenerate and our current methods of treatment are for symptomatic relief and not for cure<sup>11</sup>.

The process of spinal degeneration has been described by Kirkaldy – Willis and Hill with regard to the three joint complexes.

**The degenerative cascade proceeds through 3 phases or stages.**

1. Stage of dysfunction
2. Stage of instability
3. Stage of stabilization

The disc and corresponding facet joints will follow one another in the degenerative process. At any given time, different parts of the same segment may show different phases of degeneration.

The patients may be symptomatic intermittently or suffering from long time, some patients may not show any clinical suffering during their life time<sup>54</sup>.

**1) Stage of dysfunction:**

It is usually found in the age group of 15 to 45 years. It is characterized by circumferential and radial tears in the disc annulus and localized synovitis of the facet joints<sup>2</sup>. The natural aging process, with or without repeated minor trauma, which produce end plate failures, leads to nutritional deprivation, failure to resynthesize the degraded proteoglycans, failure of collagen linking and disturbed water exchange across the disc. This lead to loss of nuclear jelly and weakening of annular support, leading to annular tears. At this stage there may be symptoms of pain, muscular spasm and hypomobility<sup>54</sup>.

**2) Stage of instability:**

This is found in 35 to 70 years old patients and is characterized by internal disruption of the disc, progressive disc resorption, degeneration of facet joints with capsular laxity, subluxation and joint erosion<sup>2</sup>. With advancement of degenerative changes there is fragmentation of the nucleus pulposus, tears in the annulus or a break in the hyaline cartilage end plate. The disc now loses its structural integrity. The

movement between adjacent vertebral segments becomes uneven and irregular. Excessive degree of sagittal translatory movements, flexion – extension and rotation movements occur<sup>54</sup>.

### **3) Stage of stabilization:**

Seen in patients older than 60 years, this stage is characterized by progressive development of hypertrophic bone around the disc and facet joints, leading to segmental stiffening or frank ankylosis<sup>2</sup>. Progression of degenerative changes, both in discs and facet joints leads to progressive reduction in the mobility of the segment. The reduction in disc height reduces angular motions. The enlargement and osteophytic bridging of the facet joints may also stabilize the segment<sup>54</sup>.

Disc herniation in this stage is considered as complication of disc degeneration in the stages of dysfunction and instability<sup>2</sup>. Annular protrusion or bulging is common and are natural sequelae in disc degeneration. But disc extrusion is not natural sequelae in disc degeneration. Other precipitating factors like trauma must co exist for the nucleus to extrude<sup>54</sup>.

Miller, Schmatz and Schultz noted that disc degeneration progresses as age increases. Males were found to have more degeneration than females. L<sub>4-5</sub> and L<sub>3-4</sub> disc levels showed the greatest degree of disc degeneration. The natural history of disc disease is one of recurrent episodes of pain followed by periods of significant or complete relief<sup>1</sup>.

Back pain can be expected to precede the onset of radicular symptoms by approximately 6 to 10 years. The initial low back pain episode is of acute onset, whereas subsequent recurrences tend to occur insidiously. The radicular component originates insidiously and recurs in a similar manner. Although neurologic deficits including motor weakness are helpful diagnostically, they are not necessarily

compelling as factor for surgical outcome because residual weakness is not markedly different in patients treated surgically and those treated non operatively. Bowel and bladder dysfunction affects a relatively smaller percentage of patients, but assumes greater significance in terms of surgical urgency<sup>56</sup>.

Weber in 1983 conducted a comparative study to treat lumbar disc herniations by conservative and surgical treatment. The short term results were best for the patients treated surgically compared to the long term results(4 years later), where the outcome was indistinguishable between the patients treated conservatively and surgically. Neurological recovery was noted in both operative and nonoperative group who had neurological deficits at the beginning of the study<sup>15</sup>.

In general low back pain is self –limiting condition. Sciatica tends to have a more protracted course, but 50% of patients with sciatica recover within a month. Although low back pain represents a continuum of symptoms, it is useful to categorize it in to acute (0-6 weeks), sub acute (6 to 12 weeks), chronic (>12 weeks) and recurrent phases<sup>57</sup>.

## **PATHOLOGY**

The function of the disc may be disturbed by alteration of the water content of the nucleus pulposus or by “wear and tear” changes in the annulus fibrosus leading to partial or complete extrusion of its nuclear material. Then there will be diminution in the disc space which is followed by proliferation of collagenous tissue of the annulus fibrosus and calcification at the edges of the vertebrae and osteophyte formation.

The fibres in the lamellae of the annulus may give way gradually. And the name protrusion or herniation is given to the lesion in which some fibres of annulus are intact to prevent complete flow of nuclear material. The term prolapsed or ruptured disc means that the nucleus has ruptured completely and the extruded



material lies freely in the epidural space.

In patients over the age of 60 years, changes in the annulus fibrosus were more extensive in prolapsed discs than in protruded discs. Changes seen were myxomatous degeneration, fibrosis and swollen annular fibres with cyst formation. There will be reversal of orientation of the inner fibre bundles of the annulus fibrosus and accumulation of bizarre giant cells. These changes are less pronounced in younger patients whose age group between 20 and 59 years<sup>53</sup>.

## **BIOMECHANICAL FACTORS AND BIOCHEMICAL FACTORS ASSOCIATED WITH DISC PROTRUSION**

A supine patient weighing 70 kg has a load of 20 kg on his L<sub>3</sub> disc. This increases to 100kg on standing with 20 kg in his hand, and to 270 kg when sitting and leaning forward with 20 kg weight in his hands.

Intradiscal pressures, myoelectric activity and intra abdominal pressure measurements have shown that distance between the weight and the position of body influences the stress on the back.

Disc pressures and myoelectric activity are highest in an anterior unsupported sitting and lowest when sitting straight. They are decreased on adding a backrest.

Disc degeneration is characterized by:

- 1) Reduction in the amount of glycosaminoglycans
- 2) Increase in the low molecular weight glycoproteins.
- 3) Increase in fibrillation, fissuring and precipitation of collagen.

In nuclear herniation the changes seen are:

- 1) Fall in total protein polysaccharides, with increased fibrillation and precipitation of collagen content.
- 2) Increase in the less mature and degraded collagen
- 3) Increase in the low molecular weight glycoproteins<sup>53</sup>.

#### **TYPES OF DISC PROLAPSE**

##### **1) Intradiscal-nuclear herniation:**

Nucleus migrates from the central region of the disc into the inner annular fibres but does not cause any change in the configuration of the outer most annular fibres.

##### **2) Protrusion:**

The displaced disc material causes a bulging of the outermost annular fibres.

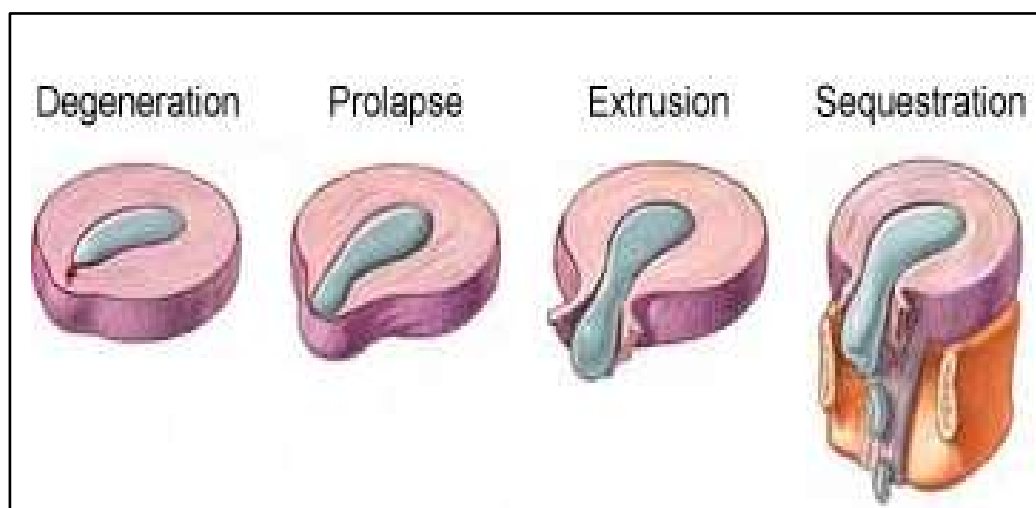
##### **3) Extrusion:**

The nuclear material escapes through all the annular fibres but still remains connected to the nuclear material within the disc.

##### **4) Sequestration:**

Nuclear material has extruded through the fibres of the annulus fibrosus and lies in the canal as a free fragment<sup>58</sup>.

**Figure-10**



## **TYPES OF DISC PROLAPSE**

The site of disc prolapse is important clinically and operatively.

The disc protrusion may be-

- a) Central type- rare
- b) Para median type- Often affects 2 nerve roots one in its extra dural course and the other intradurally.
- c) Lateral type- May affects 2 nerve roots both extradurally.

Lateral to the posterior longitudinal ligament is the commonest site of disc protrusion. Depending on its size, the root may be compressed backwards and medially, or backwards and laterally.

Intermittent herniation of Falconer or Concealed disc of Dandy is a herniation that is not obvious from the position of flexion on the operating table. The abnormality may be betrayed by the softness of the annulus fibrosus and bulging can be reproduced by hyperextension of the spine<sup>53</sup>.

## **INCIDENCE**

Hult estimates that up to 80% of people are affected by back pain at some time in their lives. Svenson and Anderson noted that the incidence and prevalence of low back pain was about 61% and 31% respectively in a random sample of 40 to 47 years old men. In women between 38 to 64 years of age, the incidence was 66% and prevalence was 35%.

Kave estimated the incidence of lumbar discectomy in USA, it was approximately 70/100,000 patients. In most reports, the average age of patients who undergone surgery for lumbar disc herniation is 38 years and twice the number of men are affected as compared to women<sup>59</sup>.

The age incidence of lumbar disc prolapse is fairly evenly distributed in 3 decades, between 20 and 50 years<sup>53</sup>.

The average age of patients undergoing lumbar discectomy is 42 years. The lifetime prevalence of sciatica is 40%, but only 3 percent of patients with acute back pain have nerve root symptoms<sup>59</sup>.

Horat noted that 35 percent of patients with low back pain will at some time develop sciatica. Nachemson in his review indicated that, 4.8 percent of male population and 2.5 percent of female population beyond the age of 35 years will at some time in their life experience sciatica. Hakelius reported that, 75 percent of patients with acute lumbar radiculopathy will experience improvement within 10 to 30 days of onset of their symptoms and less than 20 percent of these will eventually become surgical candidates<sup>60</sup>

## **CLINICAL FEATURES**

### **HISTORY:**

#### **Back pain:**

Most patients with degenerative disc diseases have low back pain as the earliest symptom. The usual history of lumbar disc herniation is of repetitive episodes of lower back and buttock pain, relieved after a short period of rest. Most people relate their back pain to a traumatic incident, but close questioning reveals that the patient as had intermittent episodes of back pain for many months or years. Pain is often brought on by heavy exertion, repetitive bending, and twisting or heavy lifting<sup>1</sup>. Trauma is a precipitating rather than a causative factor<sup>56</sup>.

Pain from disc herniation is usually intermittent increasing with activity especially sitting, straining, sneezing or coughing. Pain can be relieved by rest, especially in the semi-fowler position.

**Referred Pain:**

Pain begins in the lower back and is referred to the sacroiliac region and buttocks or in some cases to the posterior aspect of thigh. Back and posterior thigh pain of this type can be produced from many structures of the spine like facet joints, longitudinal ligaments and periosteum of the vertebrae.

The above-mentioned structures are mesodermal structures which when irritated give rise to referred pain to the sacroiliac joints, buttocks etc. This pattern of referral into the area-designated sclerotome, which has the same embryonic origin is called as referred pain<sup>56</sup>.

**Radicular pain:**

This should be differentiated from the above-mentioned referred pain. Radicular pain usually extends below the knee and follows the dermatome of the involved nerve root. Both the above mentioned types may be present concurrently. Pressure on an inflamed nerve root by the disc fragment or bulging annulus produces pain and motor and/or sensory symptoms/signs along the dermatome of the involved nerve root. These are called radicular symptoms<sup>56</sup>.

In most cases of disc herniation there is leg pain equal to or much greater than the back pain.

**Sciatica:**

The onset of leg pain may be insidious or extremely rapid and dramatic, the former being more common. This leg pain is pathognomonic of disc herniation. Valsalva maneuver or any activity that increases the intradiscal pressure, CSF pressure and neural irritation accentuates this leg pain. The patient in acute cases may

list usually away from the side of the sciatica or occasionally towards the side of sciatica depending on the site of disc herniation, whether the herniation is lateral or medial to the nerve root. Some patients may have isolated areas of pain, rather than the typical dermatomal involvement, with asymptomatic areas between the painful foci<sup>56</sup>.

#### **Motor and sensory symptoms:**

Some patients with disc herniation have weakness and paraesthesia. Weakness is usually variable and localized to the neurological level of involvement. Paraesthesia or sensory involvement is also limited to the dermatome of the involved nerve root<sup>11</sup>.

#### **Cauda equina syndrome:**

A large midline or a huge disc herniation may compress several roots of the caudaequina. (Raff found an incidence of 2 percent in 624 patients with protruded discs, Spangfort reported 1.2% in 2500 cases).

Symptoms include numbness and weakness in legs, rectal pain or numbness in the perineum and paralysis of sphincters. Difficulty with urination, frequency or overflow incontinence, develop early, in males there may be a history of impotence. Perianal numbness, saddle dysaesthesia and loss of anal reflex or diminished rectal tone are characteristics of advanced caudaequina syndrome<sup>56</sup>.

#### **Bladder symptoms:**

1. Total urinary retention
2. Chronic, long standing, partial retention
3. Vesicular irritability
4. Loss of desire to void associated with unawareness of the necessity to void<sup>56</sup>.

## **SIGNS/ PHYSICAL EXAMINATION:**

### **Inspection:**

The gait and stance of patients with acute disc syndrome is characteristic. The patient holds the painful leg in a flexed position and is reluctant to place the foot flat on the floor. While walking, the patient has an antalgic gait, putting as little weight as possible on the extremity and there is also a significant loss of lumbar mobility.

Loss of lumbar lordosis and paravertebral muscle spasm are seen in acute phase of the disease.

In acute cases the patient may list away from the side of the sciatica (“Sciatic Scoliosis”), when the disc herniation is lateral to the nerve root and vice-versa in an attempt to decompress the nerve root<sup>56</sup>.

### **Palpation:**

There is tenderness on palpation of the lumbar spine at the level of the symptomatic degenerative disc. Paraspinal muscle spasm may be felt, sometimes unilaterally.

Patients with symptoms of radiculopathy have tender motor points in the myotome corresponding to the probable segmental level of nerve root involvement. These points represent the main neuro-muscular junction of the involved muscle groups.

### **Neurological examination:**

A meticulous neurological examination yields evidence of nerve root compression and suggests the level of the disc. Most commonly involved levels are L<sub>4-5</sub> and L<sub>5</sub>-S<sub>1</sub> followed by L<sub>3-4</sub>. For example disc herniation at L<sub>3-4</sub> will compress the L<sub>4</sub> nerve root, and produces tibialis anterior weakness. Compression of motor

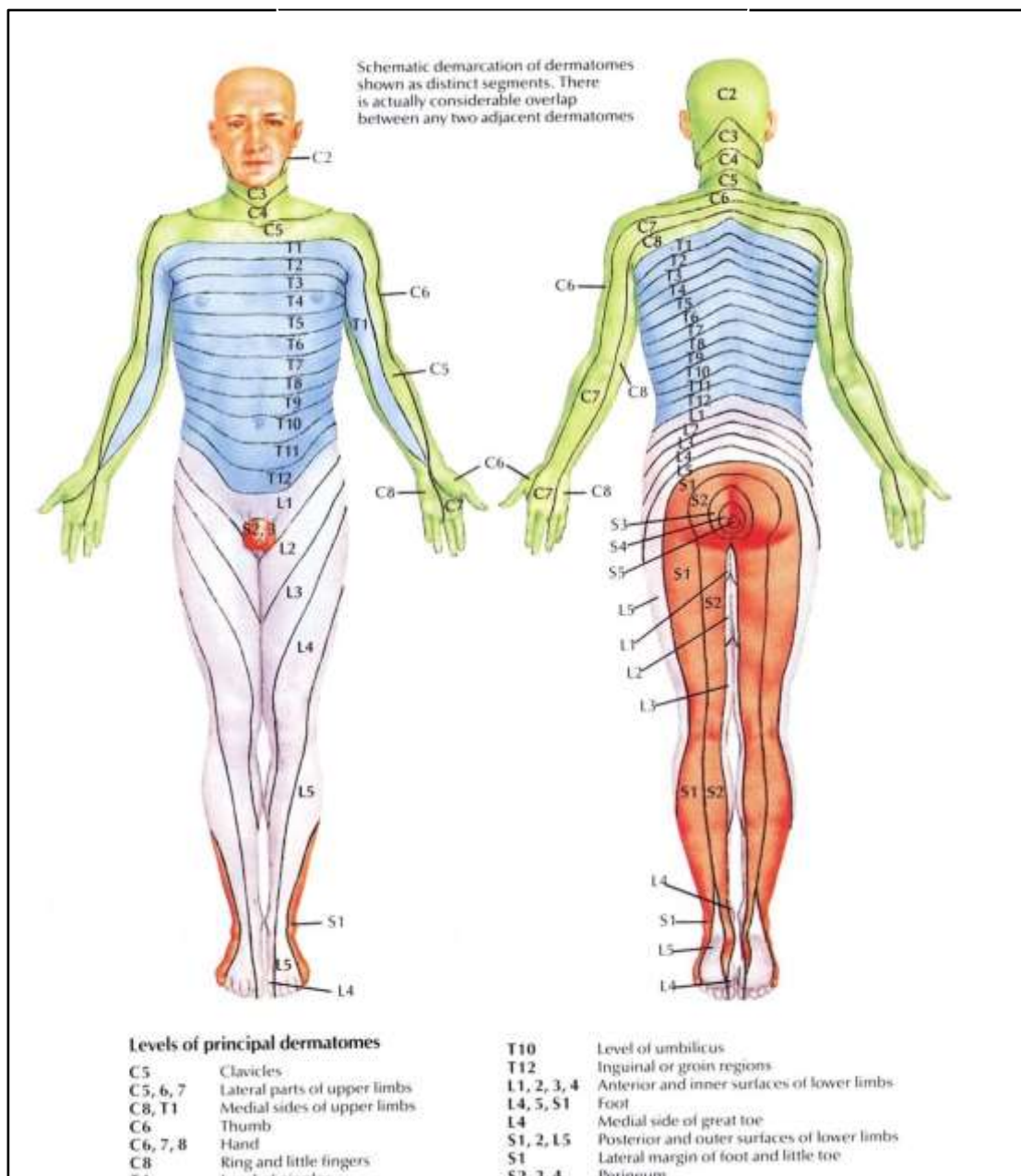
nerve fibres of the nerve root results in weakness or paralysis of the muscle group in its distribution and reduction in tone and wasting or atrophy of the muscle belly. Reflexes may be diminished or lost.

| <b>Disc Level</b> | <b>Root Involved</b> | <b>Deep Tendon Reflex</b> | <b>Key Muscle</b>                      | <b>Sensation</b>               |
|-------------------|----------------------|---------------------------|----------------------------------------|--------------------------------|
| L3 – L4           | L4                   | Patellar                  | Tibialis Anterior                      | Medial leg and foot            |
| L4 – L5           | L5                   | None                      | Extensor<br>Hallucis longus            | Lateral leg and dorsum of foot |
| L5 – S1           | S1                   | Ankle                     | Peroneal longus and<br>Peroneus Brevis | Lateral foot                   |

#### **Sensory involvement:**

The pattern of involvement follows the dermatome of the affected nerve root. For example: S<sub>1</sub> radiculopathy usually involves posterior aspect of the calf and lateral aspect of the foot and sole. Sensations should be checked in the corresponding autonomous zones for the involved nerve roots.





**Figure 11 : Keagan's Dermatomes**

### Diagnostic tests:

#### Sciatic tension signs:

The inflamed nerve root against a herniated lumbar disc. They are:

**Valsalvamanoeuvre:** During an acute episode of backache alone or associated with sciatica, mechanism such as coughing, sneezing and straining may produce a sudden increase in the intra discal pressure and thus stretch pain.

**Straight leg raising test:** It is positive in 90% of the cases. Younger patients have a marked propensity for limitation in the SLRT. After the age of 30 years, a negative SLRT may occur in the presence of a herniated disc. The straight leg raising test is performed with the patient supine with the head flat or on a pillow. One of the examiner's hands is placed on the ilium to stabilize the pelvis & the other hand slowly elevates the leg by the heel with the knee straight. The patient should be questioned as to whether this produces leg pain. Only when leg pain or radicular symptoms are produced is this test considered positive. Back pain alone is not a positive finding in this maneuver.

**The contralateral straight leg raising test:**

It is performed in the same manner as the SLRT except that the non painful leg is raised. If this produces sciatica in opposite extremity the test is positive. This is very suggestive of a herniated disc & also is an indication of the location of extrusion. At surgery the disc will be noted usually medial to the nerve root in the axilla. Michael A edgar found in his series, that in patients with central protrusion SLR induced mainly back pain. In patients with intermediate protrusion, lying in contact with both dura and nerve root, a combination of

back and leg pain predominated. Patients with lateral protrusion usually experienced only pain in the leg. This correlation was found in 80% of cases. He said that production of pain in leg by SLR is of practical significance in lateral protrusions where myelography may be normal &



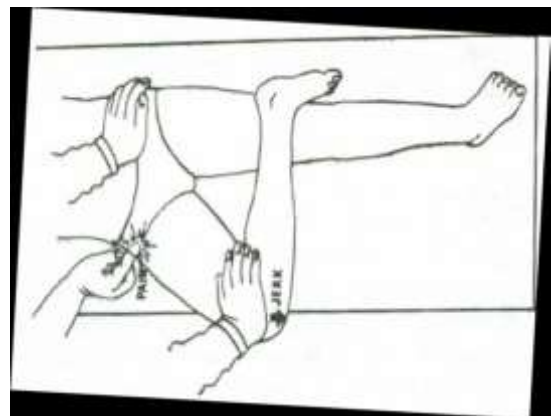
pain in the back & pain in the leg on straight leg raising may be related respectively to dural& nerve root sensitivity.

#### **Bowstring sign:**

Macnab feels that the most reliable test of root tension is the **bowstring sign**; The straight leg raising test is performed as usual until pain is elicited. At this point, the knee is flexed, & this will significantly reduce symptoms. Finger pressure is then applied to the popliteal space over the terminal end of the sciatic nerve, & this will reestablish the painful radicular symptom

#### **Figure of '4' test:**

Ask the patient to lie supine. Flex, abduct and externally rotate the lower limb of the suspected side at the hip. Flex the knee to the extent which allows the lower part of the leg to rest on the opposite lower thigh. Now give a jerky pressure over the medial aspect of the knee.



Pain occurs at the greater sciatic notch and along the sciatic nerve in case of sciatic root affections

#### **Contra lateral femoral traction sign:**

When the roots of femoral nerve are involved, they are tensed not by the straight leg raising test but by the reverse straight leg raising test, that is by hip

extension and knee flexion. This is usually performed while the patient is prone or laterally with unaffected side down.

**Lasegue's Test:**

With the patient supine, the hip and knee are gently flexed to 90°, the leg is then gradually extended which reproduces the symptoms of sciatica.

**Circumduction test:**

It helps to define the relationship between the nerve root & the disc protrusion (Whether medial or lateral to nerve root).

**Braggards sign:**

Here after a SLRT is done the limb is slightly lowered and the foot is dorsiflexed. Stretching of the sciatic nerve will cause intense pain.

**WLRT - (Frajersztagn test):**

Here the uninvolved limb is raised (SLRT). The patient complains of pain over the involved (Other) limb.

**The femoral nerve stretch test:**

This is seen in cases of disc prolapse at higher levels ie, when roots of the femoral nerve are involved. It is also called the reverse SLR test. The patient is placed prone and the knee is flexed and hip extended. Pain will be produced over the



anterior thigh area.

**Cross-over test:**

Is an important determinant of compression of lumbosacral roots in the midline. The test is done by gently raising the affected leg and this produces symptoms down the asymptomatic contralateral extremity. When positive, usually indicates a large central disc protrusion.

**The femoral nerve stretch test:** This is seen in cases of disc prolapse at higher levels i.e., when roots of femoral nerve are involved. It is also called as reverse SLR test. The patient is placed in prone and the knee is flexed and hip extended, pain will be produced over the anterior aspect of thigh<sup>56</sup>

## **INVESTIGATIONS**

### **1) Roentgenography:**

Anteroposterior and lateral X-rays of the lumbosacral spine are useful. They have a two-fold value – to exclude the presence of bone pathology, and in diagnosis of disc related disorders. Disc degeneration is seen as narrowing of the disc space. Early narrowing is usually seen in anterior disc space. When extensive disc degeneration has occurred, total loss of disc height will be noted. Narrowing of the disc may be associated with adjacent end plate changes, which most commonly appears as a radiodense bands across the end plate. As degeneration progresses, formation of osteophytes and facet joint changes become prominent<sup>61</sup>.

### **2) Myelography:**

It is good in the diagnosis of lumbar herniated discs and has been the gold standard against CT and MRI. The materials employed in this procedure are water-

soluble contrast compounds (e.g. Omnipaque). 3-5 ml solution is slowly injected into the subarachnoid space, followed by X-ray screening is done on a tilting table. In positive films there will be defects in the radio opaque shadows in the thecal sac. Filling defects in subarachnoid pouches at and below the origin of the nerve root is of diagnostic significance. This procedure is also useful in the diagnosis of multiple disc protrusion.

The typical myelographic appearances of disc lesions are:

- a) Lateral indentation and deformation of the contrast column by a posterolateral disc.
- b) Hourglass deformity from a midline herniation.
- c) Root-pouch filling defects.
- d) Complete or partial block at the level of the disc or rarely opposite the vertebral body<sup>53</sup>.

### **3) Computed Tomography:**

CT scan is an extremely useful tool in the evaluation of spinal disease. A high resolution CT scan with multiplanar reformations (CT-MPR), transforms the standard axial CT examination of the spine into a more complete evaluative imaging study. The optimum delineation of spinal anatomy and pathologic processes is obtained by studying the spine in complementary orthogonal planes. Optimal reformatted CT should include enlarged axial and sagittal view with clear notation as to laterality and sequence of cuts.

The reformatted views allow an almost three-dimensional view of the spine and its structures. The views can be further enhanced when it is done after doing water contrast myelography or with intravenous contrast medium injection. It also

helps to delineate focal asymmetric lumbar disc herniation which is dorsolateral in position and which is lying directly under the nerve root and causing nerve root compression or displacement.

The greatest advantage of this technique is the ability to see beyond the limits of the dural sac and root sleeves. Thus the diagnosis of foraminal encroachment by disc material can be made.

Disadvantages of CT scan is that it cannot differentiate between scar tissue and new disc herniation and it does not have sufficient soft tissue resolution to allow differentiation between annulus and nucleus. Therefore it is difficult to differentiate accurately between a contained disc herniation and a non-contained one<sup>61</sup>.

#### **4) MRI SCAN:**

In 1977, the first magnetic resonance imaging (MRI) scans of the human anatomy were created in the laboratory of physics department in Nottingham<sup>11</sup>. This technique uses the interaction of nuclei of a selected atom with an external oscillating electromagnetic field. Present MRI techniques concentrate on imaging the proton (hydrogen) distribution<sup>2</sup>. The contrast between the tissues is demonstrated by the main imaging sequences of T1 (spin-lattice) and T2 (spin-spin) relaxation times and the proton density of individual tissues. T1 images provide a good anatomic display of cord, nerve roots, and highlight fat and marrow space. T2-weighted sequences highlight fluid, producing a myelogram like defects in the lumbar dural sac in disc herniations and helps in differentiation of nucleus and annulus fibrosus of intervertebral disc.

The MRI scan can be enhanced further with the use of intravenous

gadolinium labelled diethylenetriaminepentaacetate (Gd-DTPA) material to do a more accurate sub grouping of the disc prolapse according to the classification. The non-contained extruded disc can often be defined separately from the contained protrusion. It also helps in demonstration of sequestered disc prolapse<sup>48</sup>. MRI is superior in the diagnosis of disc degeneration. They allow evaluation of complete spine (cervical or lumbar etc.) and also to view clearly areas in the intervertebral foramen<sup>11</sup>.

#### **OTHER DIAGNOSTIC TESTS:**

Numerous diagnostic tests have been used in the diagnosis of disc prolapse. The primary advantage of these tests is to rule out diseases other than primary disc herniation.

1. Electromyography – to rule out peripheral neuropathy.
2. Somatosensory evoked potentials (SSEP) – to identify the level of root involvement.
3. Positron emission tomography (PET).
4. Injection studies
  - a. Differential spinal.
  - b. Root infiltration or root block.
  - c. Discography<sup>11</sup>.

#### **TREATMENT**

##### **CONSERVATIVE TREATMENT:**

An overwhelming variety of nonoperative therapies for back and leg pain are present. The majority of patients with disc prolapse respond well to conservative therapy. Treatment ranges from simple bed rest to traction



application.

The essence of treatment in the acute stage is bed rest, analgesics, muscle relaxants and physiotherapy.

**a) Bed rest:**

Strict bed rest is required. A minimum of 3 weeks of bed rest is usually necessary. Mobilisation is gradually instituted once the patient has substantial relief from pain and muscle spasm. Biomechanical studies indicated that lying in a semi-fowler position or on the side with both hips and knees flexed with a pillow between the legs should relieve most of the pressure on the disc and the nerve roots. Use of pelvic or skin traction is disputed.

As the pain diminishes, the patient should be encouraged to begin isometric abdominal and lower extremity exercises, walking within limits of comfort are encouraged. Sitting, especially riding car or bike are discouraged<sup>11</sup>.

**b) Drug therapy:**

Bed rest is supplemented with non-steroidal anti-inflammatory drugs (NSAIDS), muscle relaxants and night sedation<sup>55</sup>.

**c) Physiotherapy:**

It should be used judiciously. The exercises should be according to the symptoms. Patients with acute back pain are relieved by passive extension of the spine. Exercises should not be forced in the presence of severe degrees of pain. Lower extremity exercise can increase strength and relieve stress on the back.

Education to maintain proper body posture and body mechanics should be given. This education can be in the form of instruction given to the individual

person or to the group of people. This type of education is usually referred as “back school”.

Some patients respond well to transcutaneous electrical nerve stimulation (TENS), skin traction in bed with 5 to 8 pounds of weight. Back braces or corsets may be helpful. Ultrasound and diathermy are also used in conservative treatment<sup>11</sup>.

**d) Epidural steroids:**

The epidural injection of a long acting steroid with epidural anaesthetic is an excellent method for symptomatic treatment of discogenic pain. It won't have curative role, but provide prolonged pain relief without excessive intake of narcotics. The local effects of steroids have been shown to last for about 3 weeks<sup>11</sup>.

**CHEMONUCLEOLYSIS:**

Lyman Smith first described enzymatic dissolution of the disc using chymopapain in 1963. This is a useful alternative for patients who are candidates for laminectomy and discectomy<sup>14</sup>.

**SURGICAL TREATMENT**

**Indications:**

- 1) Paraplegia or acute bladder paralysis due to cauda equina compression
- 2) Severe peripheral neurological defects, ex. foot drop
- 3) Failure of conservative treatment to relieve pain and neurological symptoms and signs.
- 4) Severe, persistent pain.

**Surgical options available are –**

- 1) The posterior approach: -
  - ☐ Lumbar micro discectomy
  - ☐ Standard laminectomy and discectomy
  - ☐ Fenestration operation – limited laminotomy
  - ☐ Endoscopic discectomy
- 2) Anterior approach with or without interbody fusion.
- 3) Percutaneous approach – suction or laser or arthroscopic discectomy<sup>62</sup>

**General principles Microlumbar discectomy:**

It is usually performed under general anesthesia; Patient is positioned in the prone or modified kneeling position or on a specialized or custom frame. This allows the abdomen to hang free, minimizing epidural venous dilation and bleeding.

Radiographic confirmation of the proper level is necessary. Care should be taken to protect neural structures. Epidural bleeding should be controlled with bipolar electrocautery. Any sponge, pack, or cottonoid patty placed in the wound should extend to the outside. Pituitary rongeurs should be marked at a point equal to the maximal allowable disc depth to prevent injury of viscera or great vessels.

Micro lumbar discectomy has replaced the standard open laminectomy as the procedure of choice for herniated lumbar disc. This procedure can be done on an outpatient basis and allows better lighting, magnification, and angle of view with a much smaller exposure. Because of the limited dissection required, there is less postoperative pain and a shorter postoperative stay.

Micro lumbar discectomy requires an operating microscope with a 400-mm

lens, a variety of small-angled Kerrison rongeurs of appropriate length, microinstruments, and preferably a combination suction–nerve root retractor. The microscope can be used from skin incision to closure. The initial dissection can be done under direct vision, however a lateral radiograph is taken to confirm the level.

## **COMPLICATIONS**

The complications associated with micro lumbar discectomy are –

### **1) Infection**

Superficial wound infection

2) Dural tear (cerebrospinal fluid leak) -- this occurs in 1% to 2% of these surgeries, does not change the results of surgery, but post-operatively the patient may be asked to lay recumbent for one to two days to allow the leak to seal.

3) Nerve root damage

4) Bowel/bladder incontinence

5) Bleeding

6) Postoperative cauda-equina lesions

7) CSF fistula

## METHODOLOGY

30 patients with lumbar intervertebral disc herniations in whom surgery was indicated and who were admitted to RL Jalappa Hospital attached to Sri Devaraj Urs Medical college, Kolar were selected for the study after obtaining their informed written consent.

This is a prospective study from August 2015 to April 2017.

### **Inclusion criteria:**

Patients of age 20 to 70 with lumbar intervertebral disc herniation in whom surgery is indicated due to:

- a. Neurologic signs: motor weakness, impaired bladder and bowel function, evidence of increasing impairment of nerve root conduction.
- b. Failed conservative treatment: those in whom the degree of pain and incapacitation warrants surgery.

### **Exclusion criteria:**

Patients with failed back surgery syndrome.

Patients were assessed clinically, a thorough history and clinical examination was carried out, the subjective symptoms and objective signs were recorded in a proforma. Radiological investigations (plain x-ray, and CT/MRI) were carried out to confirm the diagnosis and to know the level of the lesion. Functional assessment was done using Oswestry Low Back Pain Disability Questionnaire<sup>63,64</sup>.

All patients underwent micro discectomy surgery in the prone position.

The level and type of disc protrusion was observed preoperatively under fluoroscopy and level of disc is marked and confirmed intraoperatively under image intensifier.

Postoperatively the patients were followed up in the immediate post-operative period, 1 months , 3 months and 6 months after the surgery.

The improvement in pain and neurological deficit were recorded. Peri and postoperative complications if any were noted. Significance of postoperative changes was assessed using Chi-square test.

#### **OPERATIVE PROCEDURE:**

##### **Micro lumbar discectomy**

Preoperative preparations:

- 1) Patient was kept nil orally, from the night prior to the day of operation.
- 2) Entire back was prepared by shaving the part and thorough wash was given with soap and water.
- 3) under fluoroscopy the level of disc was marked
- 4) Preoperative antibiotics were administered thirty minutes before surgery.

##### **Anesthesia:**

General anesthesia was used.

##### **Position of the patient:**

The patient was placed in prone position. The abdomen was kept free, so as to keep the respiration free and prevent engorgement of the epidural veins and to reduce bleeding.

**Approach:**

Make the incision from the mid spinous process of the upper vertebra to the superior margin of the spinous process of the lower vertebra at the involved level of about 2.5 centimeters. Maintain meticulous hemostasis with electrocautery as the dissection is carried to the fascia. Infiltrate the operative field with 30 mL of 0.25% bupivacaine with epinephrine.

Incise the fascia at the midline using electrocautery. Insert a periosteal elevator in the midline incision. Using gentle lateral movements, elevate the deep fascia and muscle subperiosteally from the spinous processes and lamina, on the involved side only.

Obtain a lateral radiograph with a metal clamp attached to the spinous process to verify the level.

Using a Cobb elevator, gently sweep the remaining muscular attachments off in a lateral direction exposing the interlaminar space and the edge of each lamina. Meticulously cauterize all bleeding points. Insert the micro lumbar retractor into the wound, and adjust the microscope. Identify the ligamentum flavum and lamina. Use a pituitary rongeur to remove the superficial leaf of the ligamentum flavum.

Detach the lateral portion of the ligamentum flavum from the caudal edge of the superior lamina and the cephalad edge of the inferior lamina. A blunt dissector may be used to lift the edge of the ligamentum so that it can be excised with a Kerrison rongeur. Care should be maintained to orient the Kerrison rongeur parallel to the nerve root as much as possible. Removal of some bone, particularly from the superior lamina, usually is necessary. This depends in part on patient positioning and on individual anatomy. The lamina, facet, and facet capsule should

remain intact. Remove the ligamentum flavum and bone from the lamina as needed, to identify the nerve root clearly.

When the nerve root is identified, carefully mobilize the root medially; this may require some bony removal. Gently dissect the nerve free from the disc fragment to avoid excessive traction on the root. Bipolar cautery for hemostasis is very helpful. When mobilized, retract the root medially. When identified, the nerve root can be gently mobilized and retracted medially.

Insert the suction–nerve root retractor, with its tip turned medially under the nerve root, and hold the manifold between the thumb and index finger. With the nerve root retracted, the disc is visible as a white, fibrous, avascular structure. Small tears may be visible in the annulus under the magnification.

Enlarge the annular tear with a Penfield No. 4 dissector, and remove the disc material with the microdisc forceps. Remove the exposed disc material. Remove additional loose disc or cartilage fragments. Suction and cottonoid patties were used to control bleeding. They are removed before closure. Close the fascia and the skin using absorbable sutures. Sterile dressing is applied.

#### **After care:**

Neurological function is closely monitored after surgery. The patient is allowed to turn in bed at will and to select a position of comfort, such as a semi-Fowler position. Postoperative antibiotics were administered. Pain was controlled with oral medication. Bladder stimulants can be used to assist voiding. The patient was allowed to stand with assistance after surgery to go to the bathroom. Discharge was permitted when the patient was able to walk and void. Sutures were removed



after 6-8 days.

The patient was instructed to minimize sitting and riding in a vehicle to comfort. Increased walking on a daily basis was recommended. Lifting, bending, and stooping are limited for the first few weeks. As the patient's strength increases, gentle isotonic leg exercises and stretching are started.

Between postoperative weeks 1 and 3, core strengthening is resumed or started, provided that pain is minimal. Lifting, bending, and stooping are gradually restarted after the third week. Increased sitting was allowed as pain permits, but long trips are to be avoided for at least 4 to 6 weeks. Patients with jobs requiring much walking without lifting are allowed to return to work within 2 to 3 weeks. Patients with jobs requiring prolonged sitting usually are allowed to return to work within 4 to 6 weeks

Regular follow up was done at the end of 1 month, 3 months, 6 months post operatively. At every follow up the status of the pain, radiation, SLR test, detailed neurological assessment was done and recorded.

Patients were assessed preoperatively and postoperatively with Oswestry Disability Index Score<sup>63,64</sup> for analysis of outcome.

#### **Oswestry Low Backache Disability Questionnaire<sup>63,64</sup>**

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. It is a patient-completed questionnaire which gives a subjective percentage score of level of function (disability) in activities of daily living in those rehabilitating from low back pain.

Method of use: Questionnaire examines perceived level of disability in 10 everyday activities of daily living.

The 6 statements are scored from 0 to 5 with the first statement scoring 0 through to the last at 5.

For example:

#### Section 1 - Pain intensity

- I have no pain at the moment. Score = 0
- The pain is very mild at the moment. Score = 1
- The pain is moderate at the moment. Score = 2
- The pain is fairly severe at the moment. Score = 3
- The pain is very severe at the moment. Score = 4
- The pain is the worst imaginable at the moment. Score = 5

If more than one box is marked in each section, take the highest score.

The ODI score (index) is calculated as:

**Formula:** 
$$\frac{\text{Patient's Score}}{\text{No. of sections completed} \times 5} \times 100 = \text{ \% DISABILITY}$$

**Example:**

If 9 of 10 sections are completed, divide the patient's score by  $9 \times 5 = 45$ .

|                               |                                              |
|-------------------------------|----------------------------------------------|
| Patient's Score               | 22                                           |
| Number of sections completed: | $9 (9 \times 5 = 45)$                        |
|                               | $22/45 \times 100 = 48\% \text{ disability}$ |

For example:

If all 10 sections are completed the score is calculated as follows:

If 16 (total scored) out of 50 (total possible score)  $\times 100 = 32\%$

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

If 16 (total scored) / 45 (total possible score)  $\times 100 = 35.5\%$

The questionnaire takes 5 minutes to complete and less than 1 minute to score. The ODI has been modified over the course of its existence so that the burden of selection is placed upon clinicians. The authors of the ODI have addressed this dilemma by offering an updated version (Version 2.0) of the questionnaire. Omitting one section does not alter the psychometric characteristics of the questionnaire, and scoring can easily be adjusted for the absence of that information. Interpretation of the ODI is good.

The scoring system includes a description of degrees of disability relating to scores on the ODI. Scores from 0% to 20% indicate minimal disability; 20% to 40% moderate disability; 40% to 60% severe disability; 60% to 80% crippled; and 80% to 100% bedbound or exaggerating. Changes in scores can infer meaning because of the well-defined responsiveness and to assess response to treatment. A limitation to the ODI's interpretability might be the lack of superior responsiveness compared with general health questionnaires. Compared to the other questionnaires, the ODI seems to have a slight advantage in the assessment of chronic and more severely disabled clients and is more sensitive for patients showing improvement compared with unchanged clients. Interpretation of scores is as follows:

|                                       |                                                                                                                                                                                                                                                                                                       |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>0% to 20%: minimal disability:</b> | The patient can cope with most living activities. Usually no treatment is indicated apart from advice on lifting sitting and exercise.                                                                                                                                                                |
| <b>21%-40%: moderate disability:</b>  | 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. |
| <b>41%-60%: severe disability:</b>    | Pain remains the main problem in this group but activities of daily living are affected. These patients require a detailed investigation.                                                                                                                                                             |
| <b>61%-80%: crippled:</b>             | Back pain impinges on all aspects of the patient's life. Positive intervention is required.                                                                                                                                                                                                           |
| <b>81%-100%:</b>                      | 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 realize 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 2 kilometres
- ☐ Pain prevents me from walking more than 1 kilometre
- ☐ Pain prevents me from walking more than 500 metres
- ☐ 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 3 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



Instruments used in micro lumbar discectomy



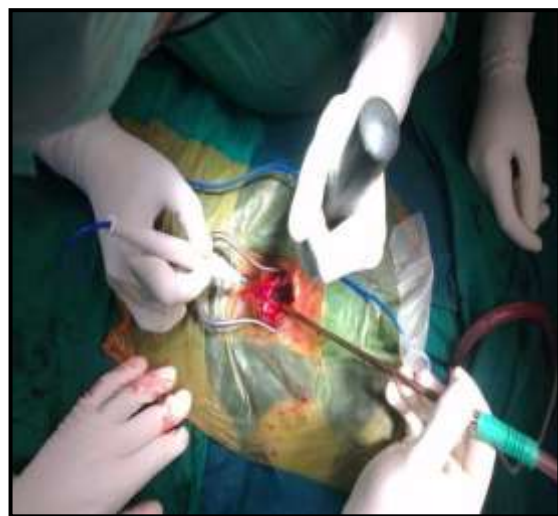
Patient in prone position



**Local infiltration with 30 mL of 0.25% bupivacaine with epinephrine**



**Painting and draping done**



**Midline skin incision taken skin, fascia incised retracted, spinous process exposed, muscles elevated**





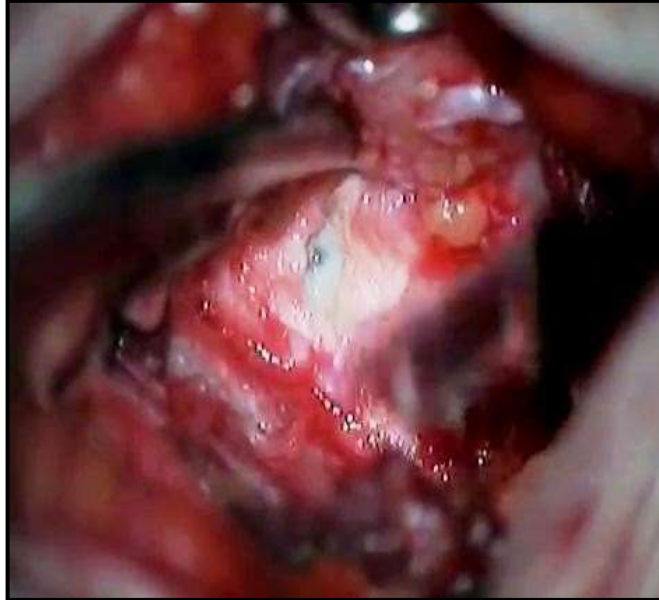
**Micro lumbar retractor fixed**



**Level is confirmed under image**



**Ligamentum flavum and lamina is identified**



**Superficial leaf of the ligamentum is removed**

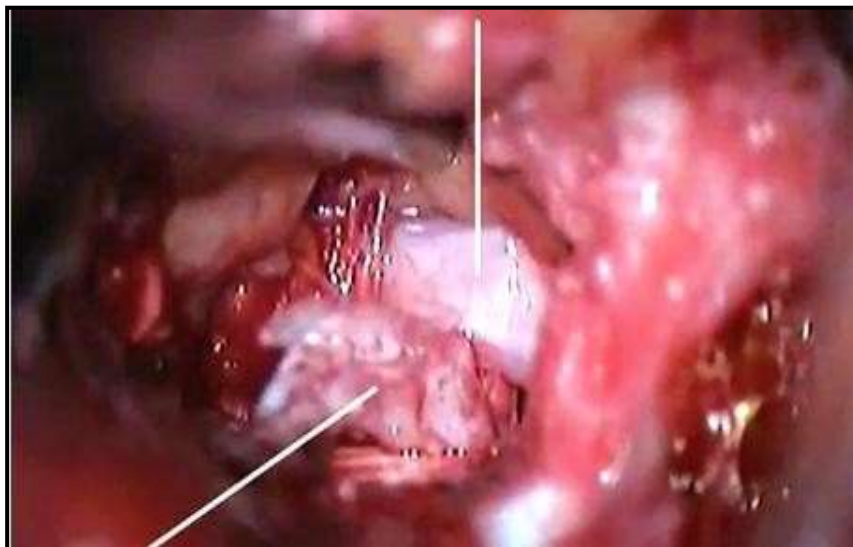


**Small piece of lamina is removed and nerve root identified**



**Nerve root retracted medially and disc identified**

**Nerve root**



**Herniated Disc**



**Exposed disc material is removed**



**Fat was kept and incision closed**



**Skin Closed**



**Operating microscope used**

## RESULTS

This study consists of 30 cases of lumbar disc herniation treated by micro lumbar discectomy between August 2015 and April 2017. The mean follow up period was 6 months. The age of these patients range from 22 to 65. years with an average of 43.8 years.

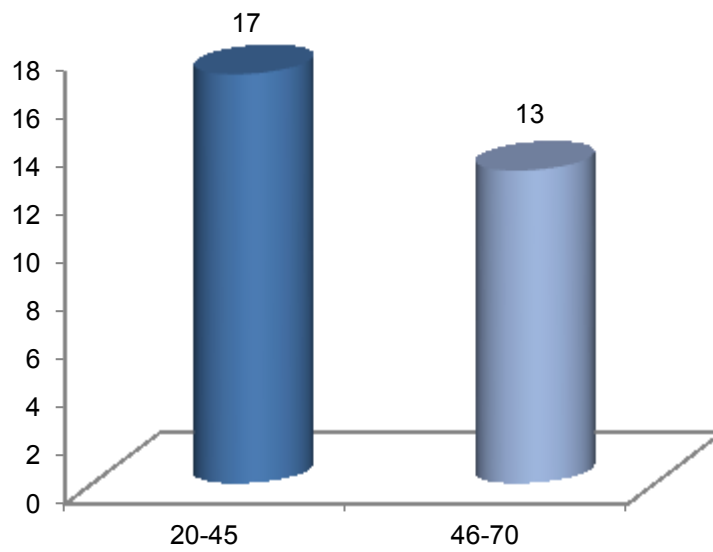
**Table 1: Age Distribution**

| <b>Age</b>   | <b>No. of Cases</b> | <b>Percentage</b> |
|--------------|---------------------|-------------------|
| 20 – 45      | 17                  | 56.67             |
| 46 – 70      | 13                  | 43.33             |
| <b>Total</b> | <b>30</b>           | <b>100</b>        |

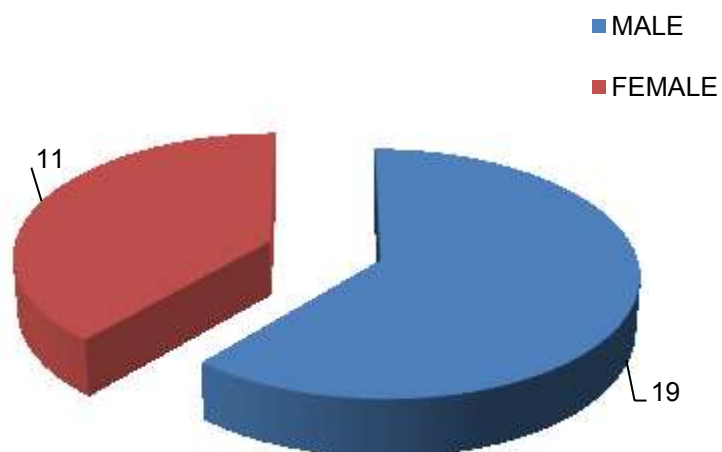
**Table 2: Sex Distribution**

| <b>Sex</b>   | <b>No. of Cases</b> | <b>Percentage</b> |
|--------------|---------------------|-------------------|
| Male         | 19                  | 63.3              |
| Female       | 11                  | 36.7              |
| <b>Total</b> | <b>30</b>           | <b>100</b>        |

**GRAPH 1: AGE DISTRIBUTION**



**GRAPH 2 : SEX DISTRIBUTION**





### **DISTRIBUTION OF OCCUPATION :**

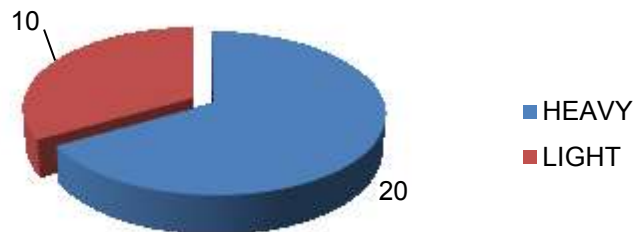
Patient's occupation was classified as light or strenuous work.

Light work was defined as lifting or pulling or pushing weight up to 8-10 kgs, occasionally lifting objects within this weight limit, walking or standing for 2 hours in an eight hour work day and retirement activities. Heavy work was defined as lifting, pushing or pulling 30 to 40 kgs weight or greater and/ or carrying weights up to 20 kgs during an 8 hour work day<sup>34</sup>.

**Table 3: Distribution of Occupation**

| <b>Occupation</b> | <b>No. of Cases</b> | <b>Percentage</b> |
|-------------------|---------------------|-------------------|
| Light             | 10                  | 33.33             |
| Heavy             | 20                  | 66.67             |

**GRAPH 3 : OCCUPATION DISTRIBUTION**



Events which precipitated the onset of pain were analyzed. History of lifting heavy weights was present in 33.33% (10 cases), insidious onset was present in 66.66% (20 cases).

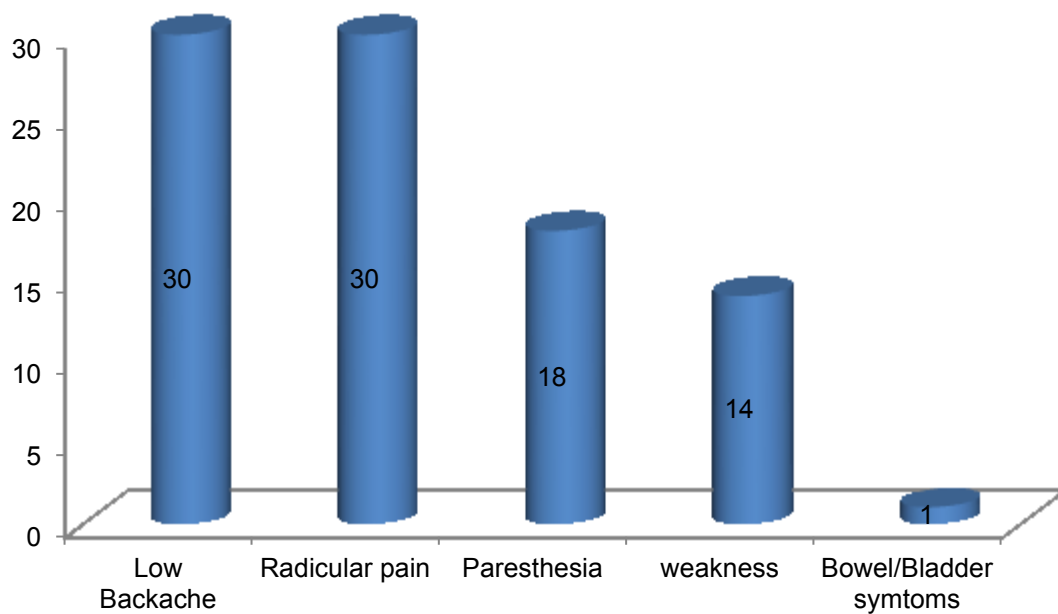
Average duration of symptoms before surgery was 9 months, ranging from 2 months to 5 years. Majority of cases came with complaints of low backache and radicular pain.



**Table 4: Distribution of Symptoms**

| Symptoms               | No. of Cases | Percentage |
|------------------------|--------------|------------|
| Low backache           | 30           | 100        |
| Radicular pain         | 30           | 100        |
| Paraesthesias          | 18           | 60         |
| C/O Weakness           | 14           | 46.67      |
| Bladder/Bowel Symptoms | 1            | 3.33       |

**GRAPH 4 : SYMPTOM DISTRIBUTION**



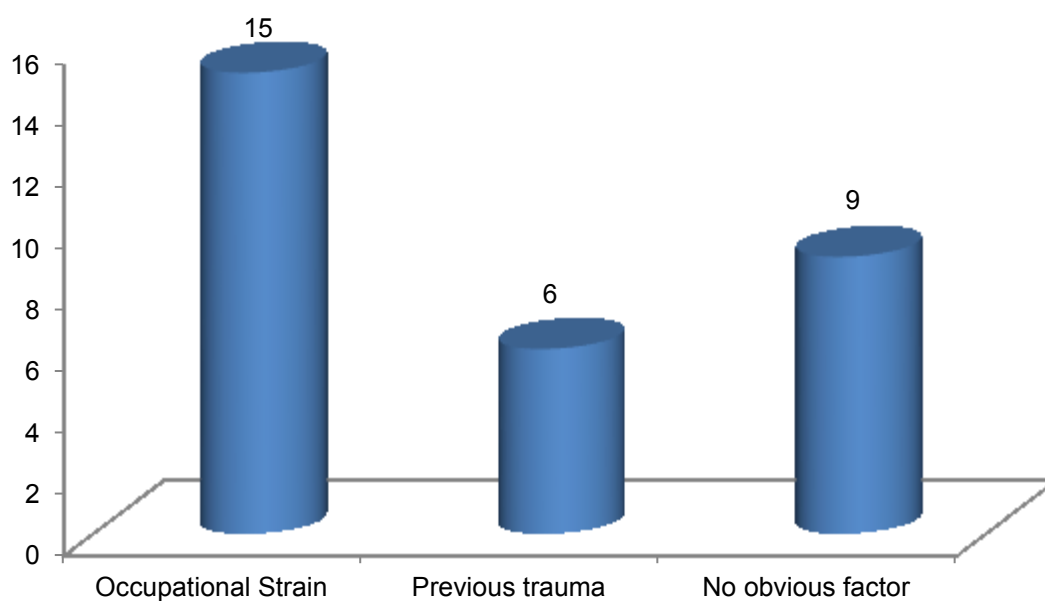
All patients had received a trial of conservative treatment in the form of bed rest and physiotherapy with no significant improvement.

**Precipitating factors:**

In this series, about 15 patients (50%) were found to be involved in occupations requiring strenuous manual activity. In about 6 patients (20%), there was a previous history of trauma to the back whereas 9 patients (30%) had no obvious precipitating factors.

**TABLE 5: PRECIPITATING FACTORS DISTRIBUTION**

| <b>Obvious precipitating Factors</b> | <b>No. of Cases</b> | <b>Percentage (%)</b> |
|--------------------------------------|---------------------|-----------------------|
| <b>Occupational Strain</b>           | 15                  | 50                    |
| <b>Previous trauma</b>               | 6                   | 20                    |
| <b>No obvious factor</b>             | 9                   | 30                    |
| <b>Total</b>                         | 30                  | 100                   |

**GRAPH 5 : PRECIPITATING FACTORS DISTRIBUTION**

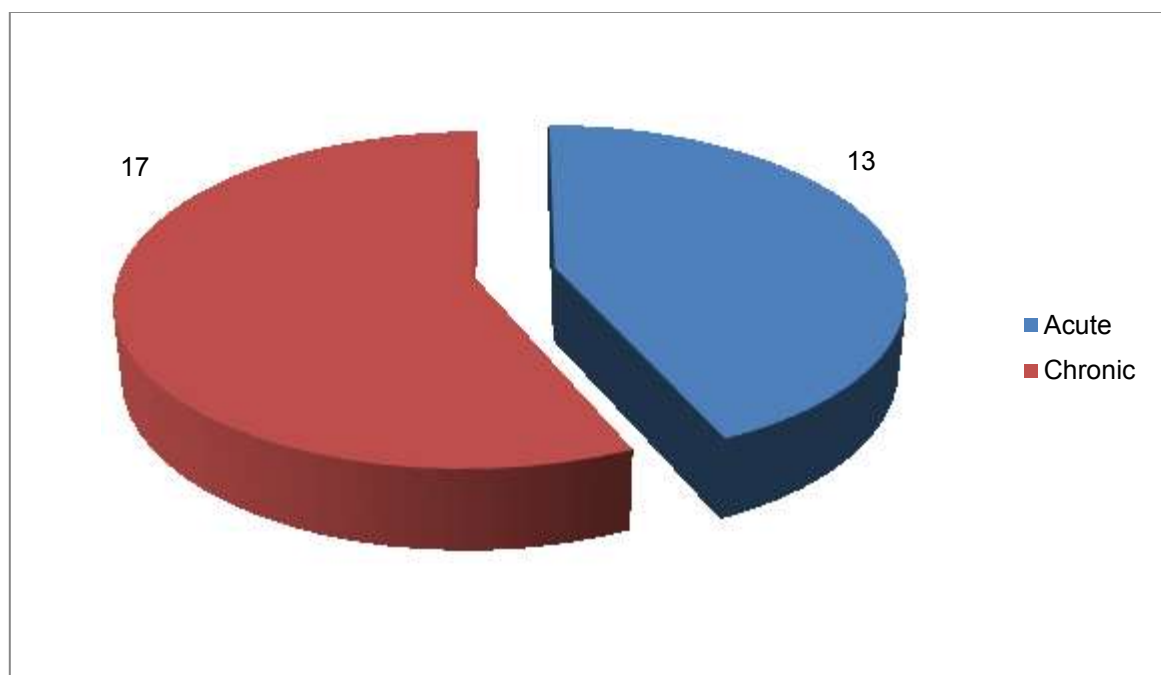
### Duration of Symptoms:

Acute onset of symptoms (less than 6 months) was seen in 13 patients (43.33%) and chronic onset (more than 6 months) was seen in 17 patients (56.66%). The number of patients divided according to their duration of symptoms is given in the following table:

**TABLE 6. DURATION OF SYMPTOMS**

| <b>Duration</b> | <b>Frequency</b> | <b>Percent</b> |
|-----------------|------------------|----------------|
| <b>Acute</b>    | 13               | 43.33%         |
| <b>Chronic</b>  | 17               | 56.66%         |
| <b>Total</b>    | 30               | 100.00%        |

**GRAPH 6 : DURATION OF SYMPTOMS**

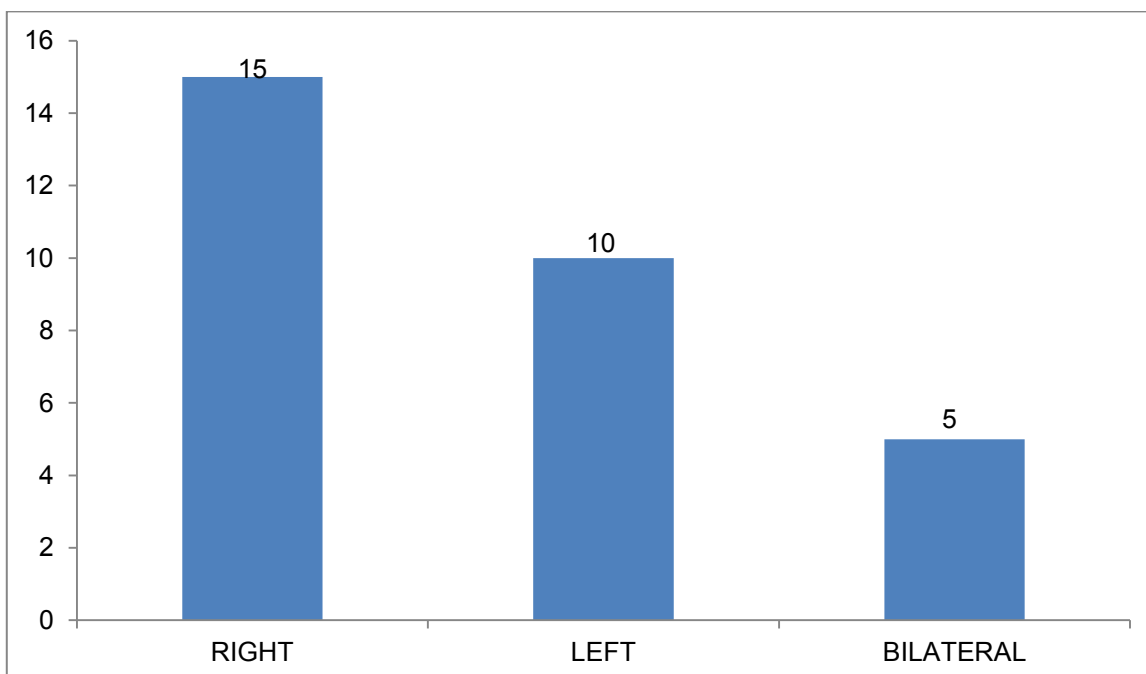


**Side Involved in Sciatica:**

In this series, 15 patients (50%) had right sided sciatica and 10 patients (33.3%) had left sided sciatica, whereas 5 patients (16.7%) had sciatica in both lower limbs as tabulated below:

**TABLE 7. SIDE INVOLVED IN SCIATICA**

| Sciatica involvement | Frequency | Percentage |
|----------------------|-----------|------------|
| Right side           | 15        | 50         |
| Left side            | 10        | 33.3       |
| Bilateral            | 5         | 16.7       |
| Total                | 30        | 100        |

**GRAPH 7 : SCIATICA SIDE DISTRIBUTION**

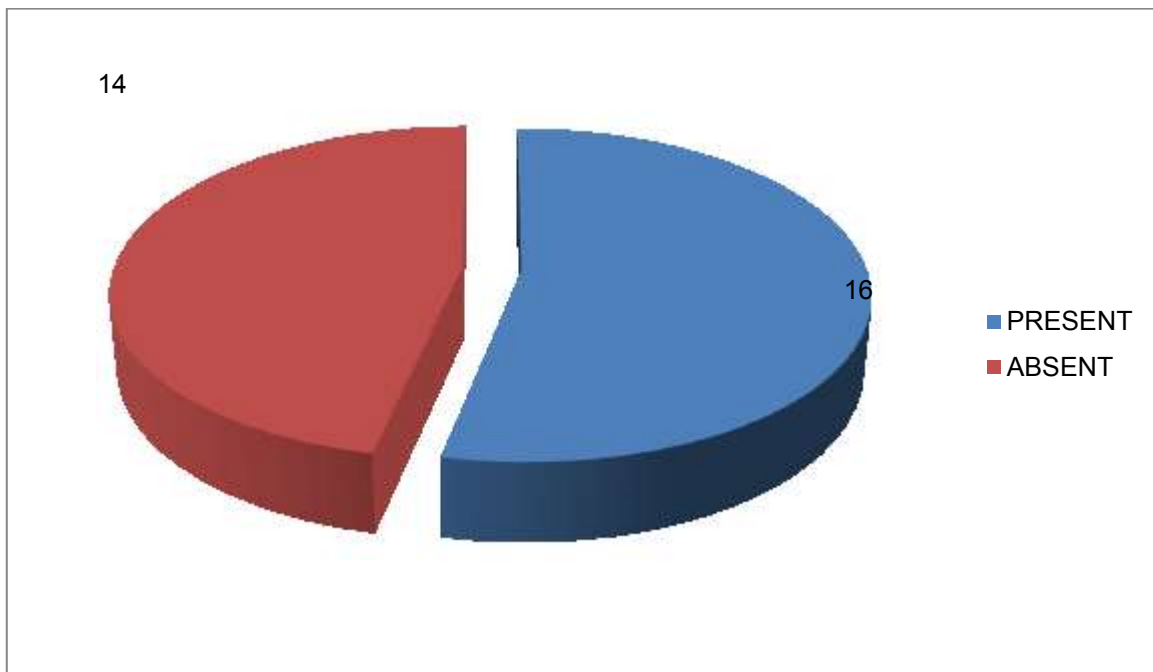
### **Obliteration of lumbar lordosis:**

In our study, 16 patients (53.33%) had obliteration of lumbar lordosis as tabulated below:

**TABLE 8. OBLITERATION OF LUMBAR LORDOSIS**

| <b>Obliteration of lumbar lordosis</b> | <b>Frequency</b> | <b>Percent</b> |
|----------------------------------------|------------------|----------------|
| <b>Present</b>                         | 16               | 53.33%         |
| <b>Absent</b>                          | 14               | 46.67%         |
| <b>Total</b>                           | 30               | 100.00%        |

**GRAPH 8 : OBLITERATION OF LUMBAR LORDOSIS**

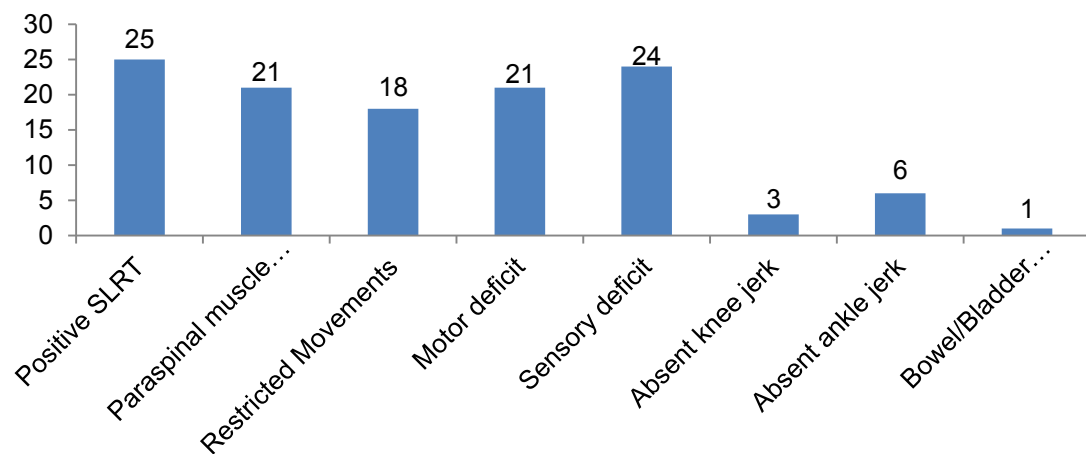


On examination a positive SLRT was the most common finding followed by neurological deficits.

**TABLE 9: DISTRIBUTION OF SIGNS**

| <b>Signs</b>              | <b>No. of Cases</b> | <b>Percentage</b> |
|---------------------------|---------------------|-------------------|
| Positive SLRT             | 25                  | 83.33             |
| Para spinal muscle spasm  | 21                  | 70                |
| Restricted movements      | 18                  | 60                |
| Motor deficits            | 21                  | 70                |
| Sensory deficits          | 24                  | 80                |
| Absent knee jerk          | 3                   | 10                |
| Absent ankle jerk         | 6                   | 20                |
| Bladder/Bowel involvement | 1                   | 3.33              |

**GRAPH 9 : DISTRIBUTION OF SIGNS**



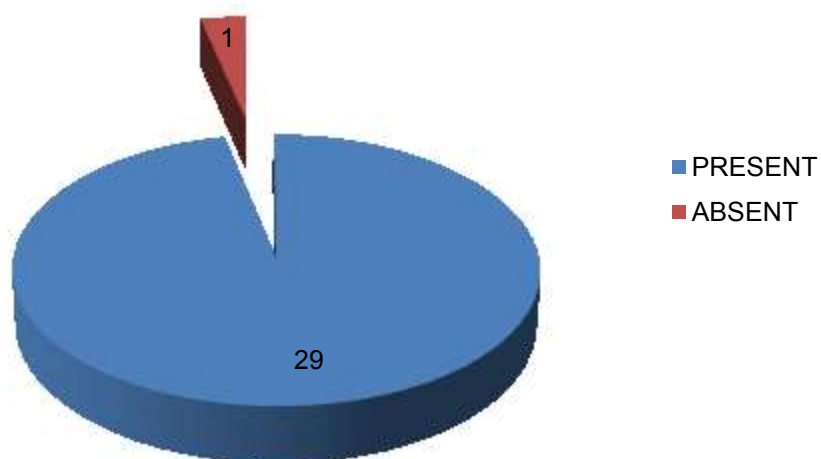
### **Tenderness and Reduced mobility of the spine:**

There were 29 (96.67%) patients with tenderness around the affected spine as tabulated below:

**TABLE 10. TENDERNESS OVER AFFECTED SPINE**

| <b>Tenderness</b> | <b>Frequency</b> | <b>Percent</b> |
|-------------------|------------------|----------------|
| <b>Present</b>    | 29               | 96.67%         |
| <b>Absent</b>     | 1                | 3.33%          |
| <b>Total</b>      | 30               | 100.00%        |

**GRAPH 10: TENDERNESS OVER AFFECTED SPINE**

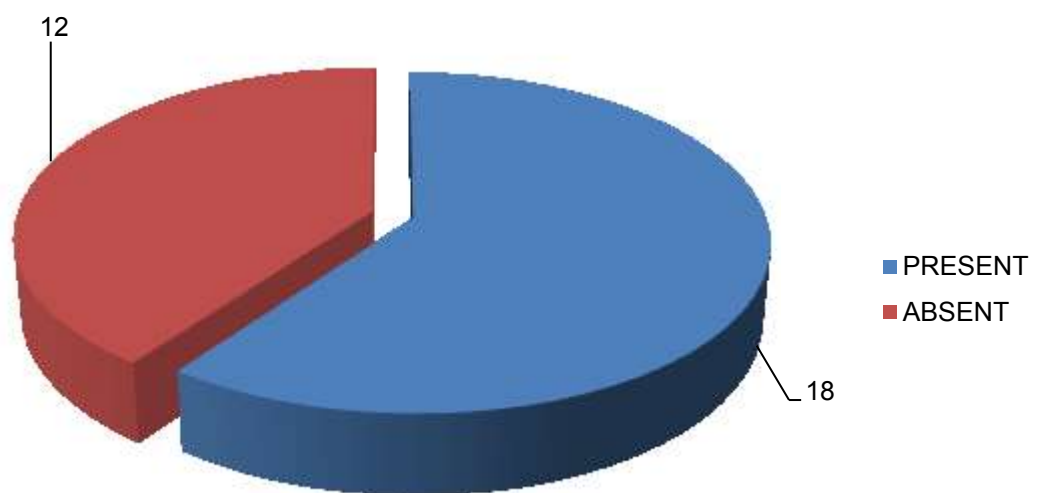


Reduced mobility of the spine was seen in 18 patients (60%) out of the total 30.

**TABLE 11. REDUCED MOBILITY**

| Reduced Mobility | Frequency | Percent |
|------------------|-----------|---------|
| Present          | 18        | 60%     |
| Absent           | 12        | 30%     |
| Total            | 30        | 100.00% |

**GRAPH 11 : REDUCED MOBILITY**



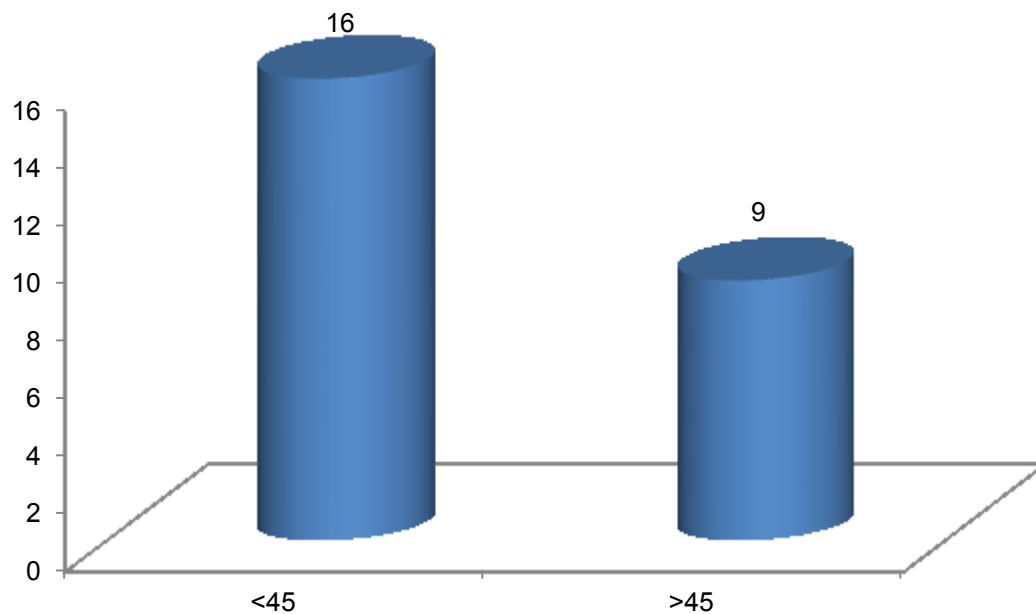


**Straight Leg Raising Test (SLRT):**

In our series SLRT was positive in 25 out of 30 patients. In 12 patients (63.15%) it was less than 45 degrees and in 7 patients (36.85%) it was more than 45 degrees.

**TABLE 12. STRAIGHT LEG RAISING TEST**

| SLRT  | Number of Patients | Percentage (%) |
|-------|--------------------|----------------|
| <45   | 16                 | 64             |
| >45   | 9                  | 35             |
| Total | 19                 | 100            |

**GRAPH 12 : DISTRIBUTION OF SLRT**

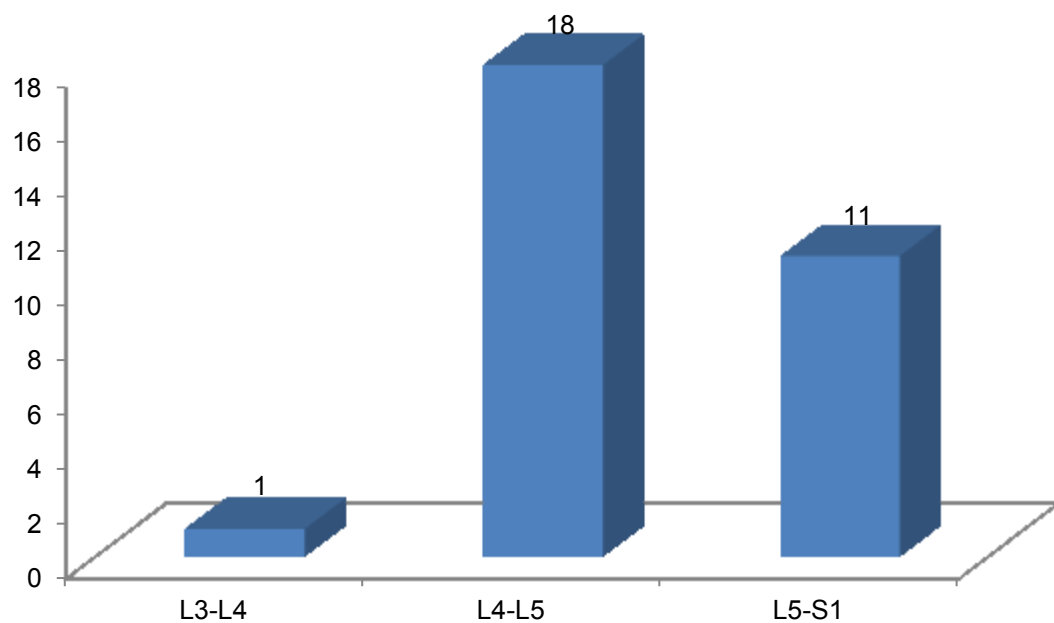
**Level of Disc Herniation:**

L4-5 disc herniation was the commonest in our study with 60 % of the herniation occurring at this level, followed by L5-S1 (36.67%).

**TABLE 13: DISTRIBUTION OF LEVEL HERNIATION**

| Level of Herniation | No. of Cases | Percentage |
|---------------------|--------------|------------|
| L3 – L4             | 1            | 3.33       |
| L4 – L5             | 18           | 60         |
| L5 – S1             | 11           | 36.67      |

**GRAPH 13 : DISTRIBUTION OF LEVEL OF HERNIATION**



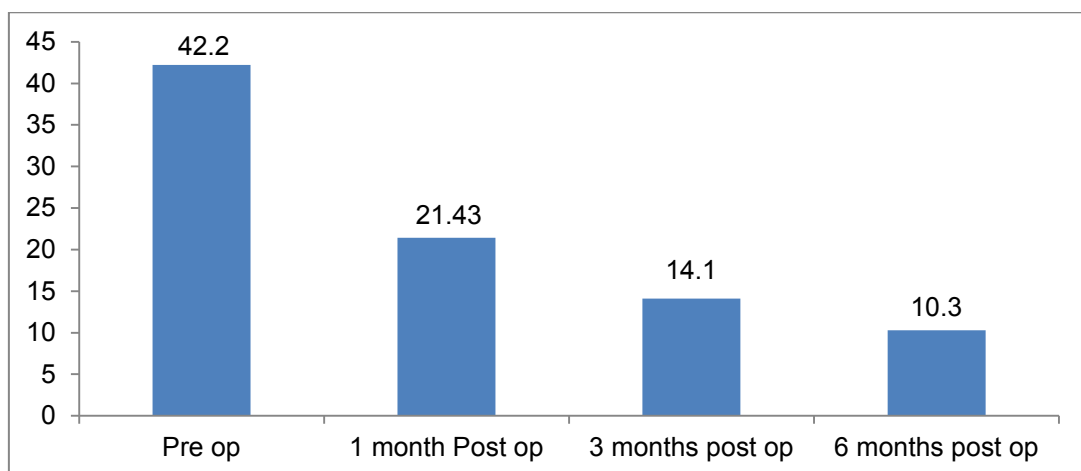
### OSWESTRY DISABILITY INDEX SCORE:

The mean ODI score of all 30 patients pre operatively in our study was 42.2. The mean ODI score for 19 male patients pre operatively was 42.63 . The mean ODI score for 11 female patients pre operatively was 41.45. The mean ODI score of patients in age group of 20 – 45 years was 42.41 . The mean ODI score of patients in age group of 46 – 70 was 41.92. In patients with L4-L5 disc herniation , the mean ODI score preoperatively was 42.52 and in patients with L5-S1 disc herniation the mean ODI score preoperatively was 41.91.

**TABLE 14 : DISTRIBUTION OF MEAN ODI SCORE**

| PERIOD           | MEAN ODI |
|------------------|----------|
| Pre op           | 42.2     |
| 1 month post op  | 21.43    |
| 3 months post op | 14.1     |
| 6 months post op | 10.3     |

**GRAPH 14 : DISTRIBUTION OF MEAN ODI SCORE**

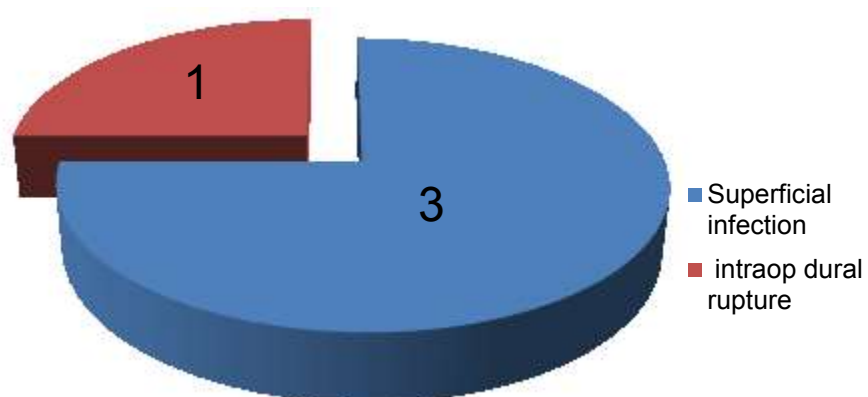


Complications encountered in our study were

**TABLE 15: DISTRIBUTION OF COMPLICATIONS**

| Complications               | No. of Cases | Percentage |
|-----------------------------|--------------|------------|
| Superficial wound infection | 3            | 10         |
| Intraop dural rupture       | 1            | 3.33       |

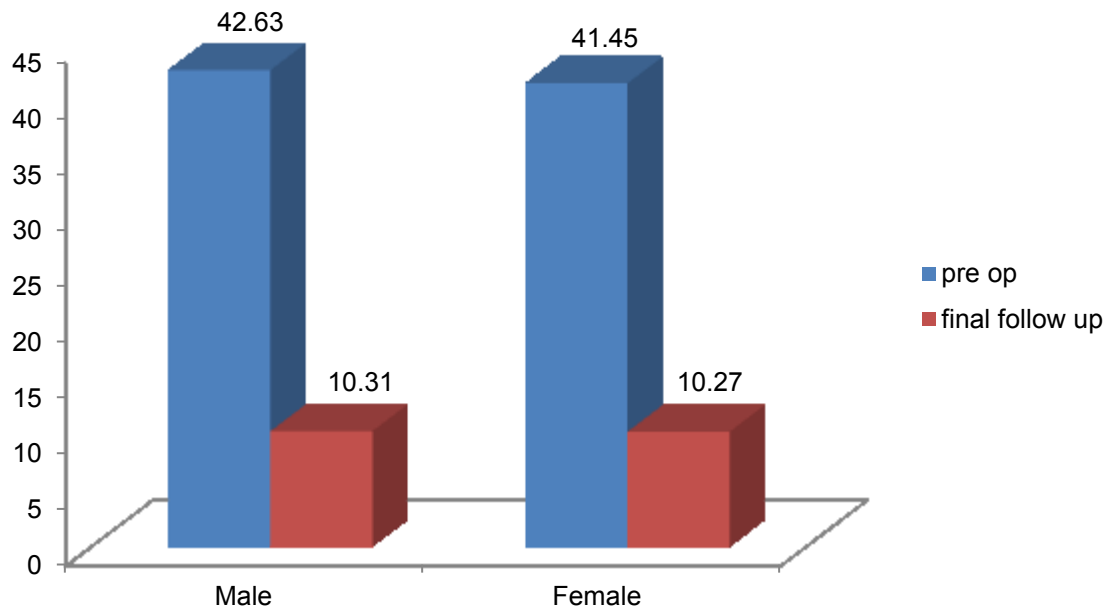
**GRAPH 15 : DISTRIBUTION OF COMPLICATIONS**



**TABLE 16: GENDER DISTRIBUTION OF MEAN ODI SCORE**

| <b>GENDER</b> | <b>PRE OP</b> | <b>FINAL FOLLOW UP</b> |
|---------------|---------------|------------------------|
| MALE          | 42.63         | 10.31                  |
| FEMALE        | 41.45         | 10.27                  |

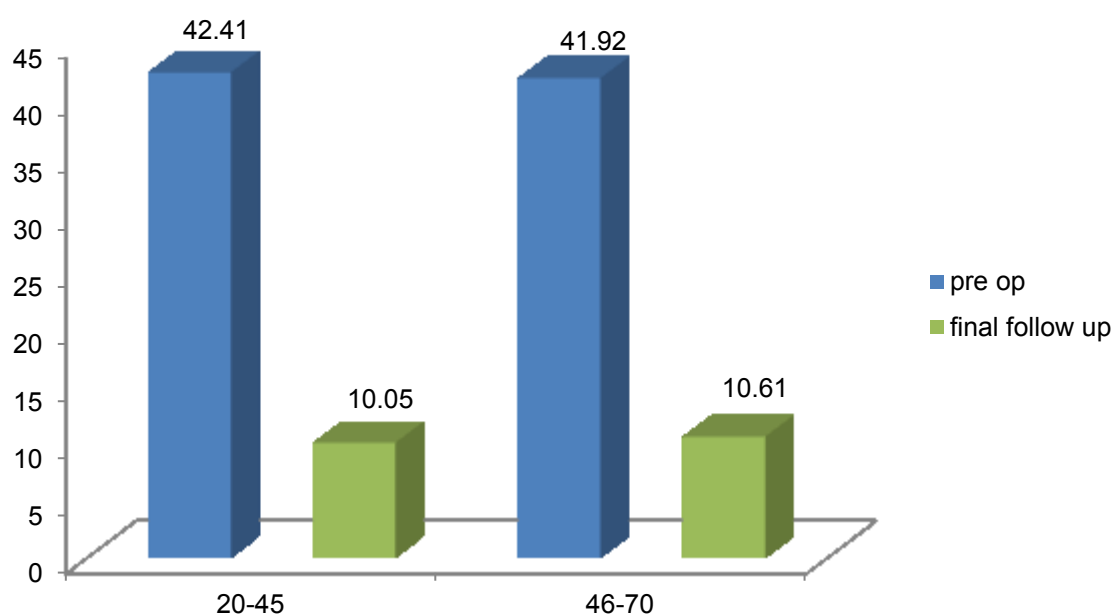
**GRAPH 16 : GENDER DISTRIBUTION OF MEAN ODI SCORE**



**TABLE 17 :AGE DISTRIBUTION OF MEAN ODI SCORES**

| AGE GROUP | PRE OP | FINAL FOLLOW UP |
|-----------|--------|-----------------|
| 20 -45    | 42.41  | 10.05           |
| 46-70     | 41.92  | 10.61           |

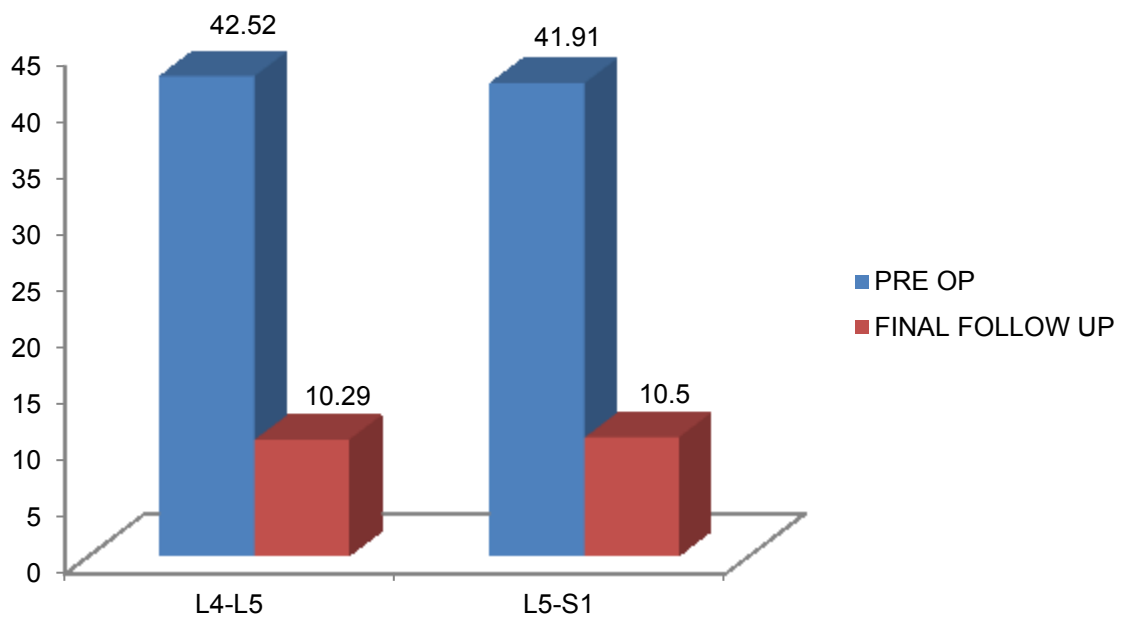
**GRAPH 17 : AGE DISTRIBUTION OF MEAN ODI SCORES**



**TABLE 18 : DISTIBUTION OF MEAN ODI BETWEEN DIFFERENT LEVEL OF HERNIATION**

| LEVEL OF HERNIATION | PRE OP | FINAL FOLLOW UP |
|---------------------|--------|-----------------|
| L4 – L5             | 42.52  | 10.29           |
| L5-S1               | 41.91  | 10.5            |

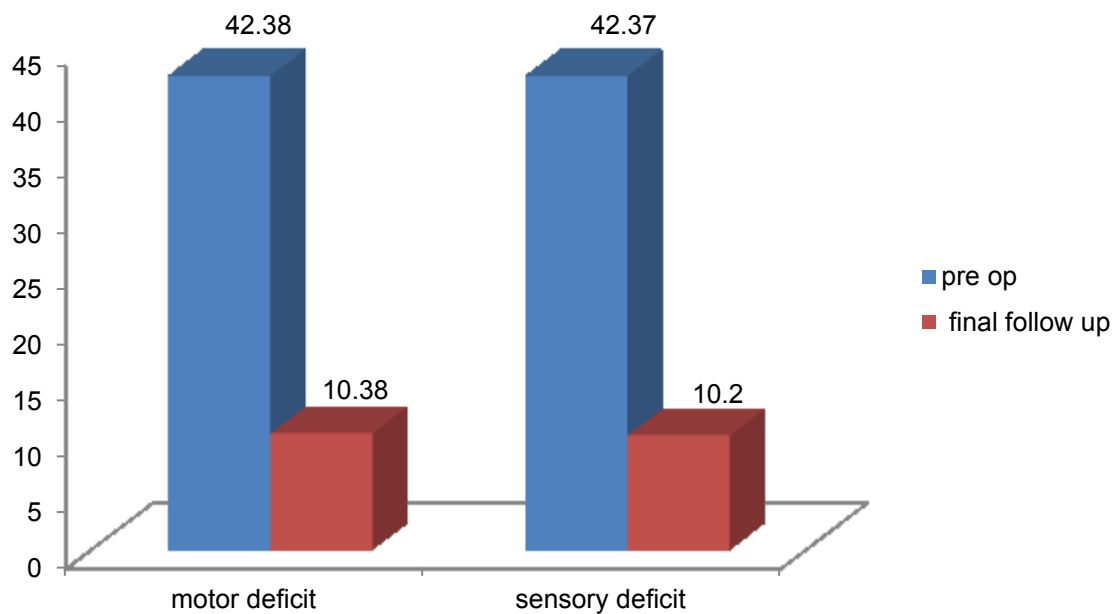
**GRAPH 18 : DISTIBUTION OF MEAN ODI BETWEEN DIFFERENT LEVEL OF HERNIATION**



**TABLE 19 : DISTRIBUTION OF MEAN ODI IN PATIENTS WITH NEUROLOGICAL DEFICITS**

| DEFICIT | PRE OP | FINAL FOLLOW UP |
|---------|--------|-----------------|
| MOTOR   | 42.38  | 10.38           |
| SENSORY | 42.375 | 10.2            |

**GRAPH 19 : DISTRIBUTION OF MEAN ODI IN PATIENTS WITH NEUROLOGICAL DEFICITS**





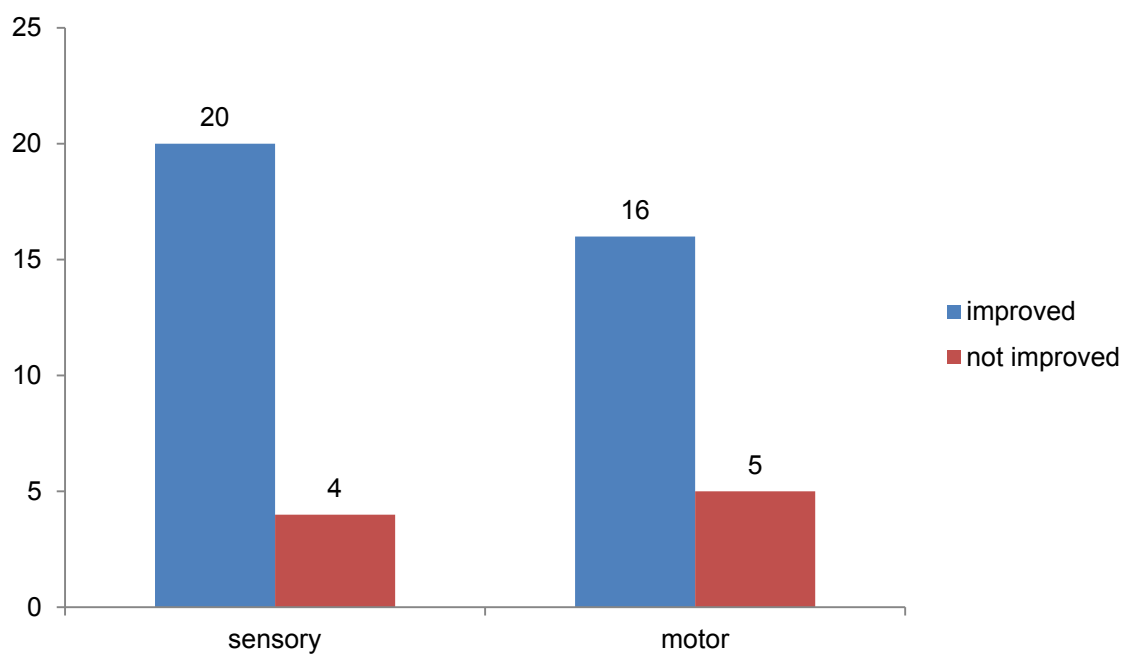
16 out of 21 patients with motor deficits improved after surgery.

20 out of 24 patients with sensory deficit improved after surgery.

**TABLE 20: OUTCOME OF NEUROLOGICAL DEFICIT**

| Neurological Deficit | Total No. of Cases | Improved | Not Improved |
|----------------------|--------------------|----------|--------------|
| Sensory              | 24                 | 20       | 4            |
| Motor                | 21                 | 16       | 5            |

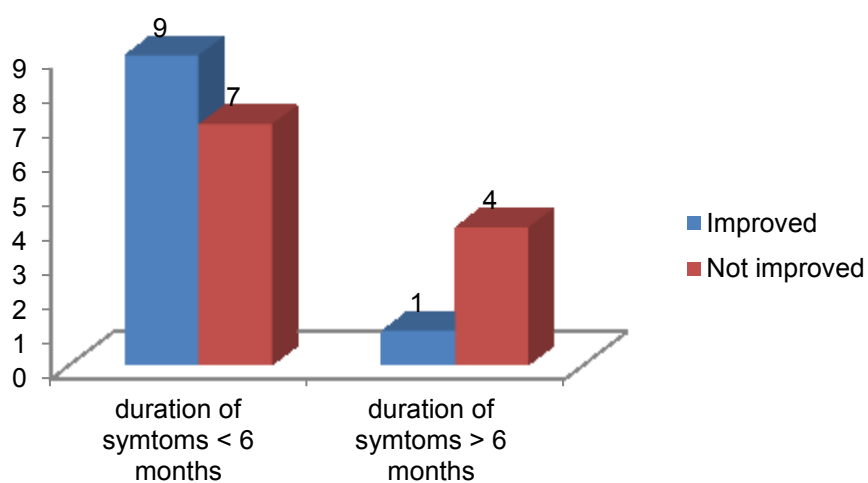
**GRAPH 20 : OUTCOME OF NEUROLOGICAL DEFICIT**



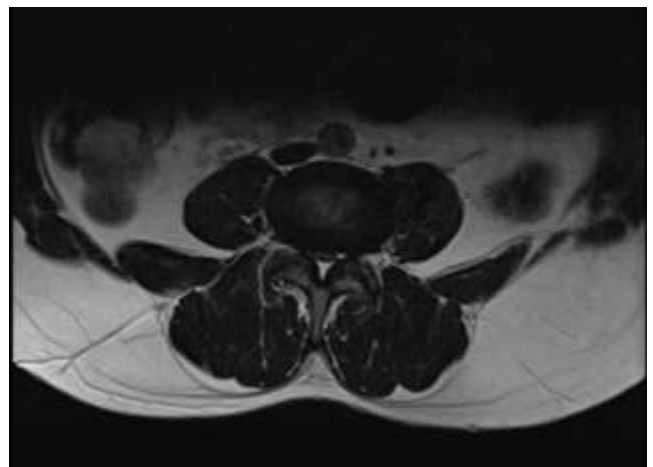
**Table 21: Outcome of Neurological Deficit in Relation to Duration of Symptoms**

| <b>Neurological Status</b> | <b>Duration of Symptoms &lt; 6 months</b> | <b>Duration of symptoms &gt; 6 months</b> | <b>Total</b> |
|----------------------------|-------------------------------------------|-------------------------------------------|--------------|
| Improved                   | 9                                         | 7                                         | 16           |
| Not improved               | 1                                         | 4                                         | 5            |
| <b>Total</b>               | <b>10</b>                                 | <b>11</b>                                 | <b>21</b>    |

**GRAPH 21 : OUTCOME OF NEUROLOGICAL DEFICIT IN RELATION TO DURATION OF SYMPTOMS**



**CASE NO: 4**



**MRI showing L4-L5 disc herniation**

### **PATIENT'S PREOP SLRT**



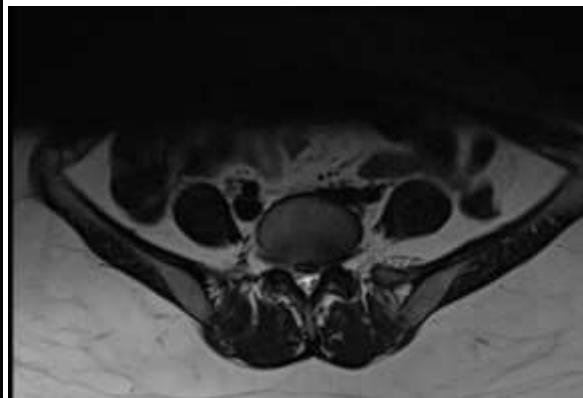
### **PATIENT'S IMPROVED SLRT POST OPERATIVELY**



**CASE NO :6**



Xray LS Spine Lateral View



**MRI showing L4-L5 disc herniation**

**PATIENT'S PRE OP PASSIVE SLRT**



**PATIENT'S IMPROVED POST OP PASSIVE SLRT**

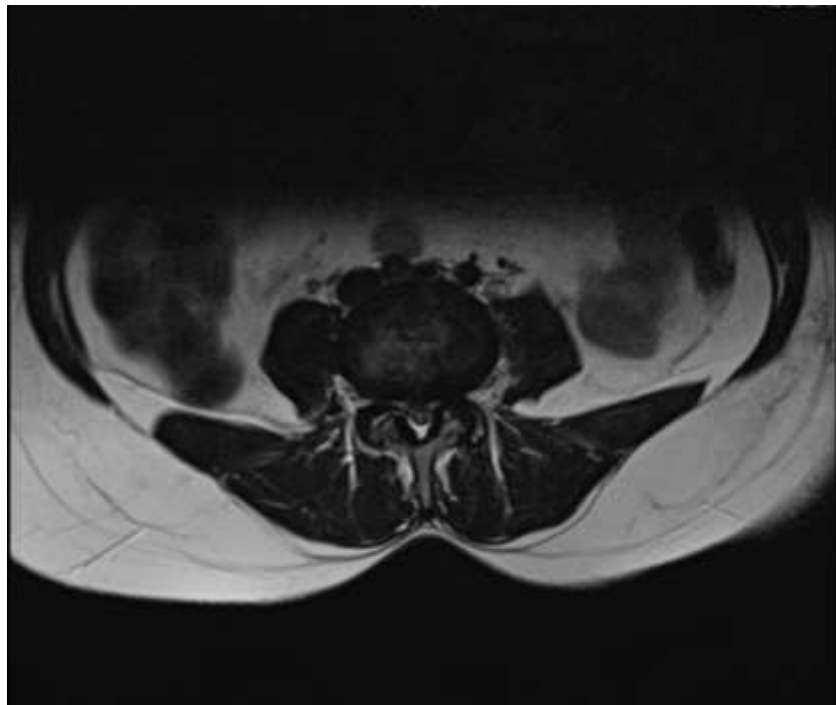


**CASE NO :17**



X-Ray LS Spine Lateral View    MRI SAGITTAL view showing L4-L5 disc

herniation



**MRI showing L4-L5 disc herniation.**



PRE OPERATIVE PHOTO



PREOPERATIVE PASSIVE SLRT  
PASSIVE SLRT



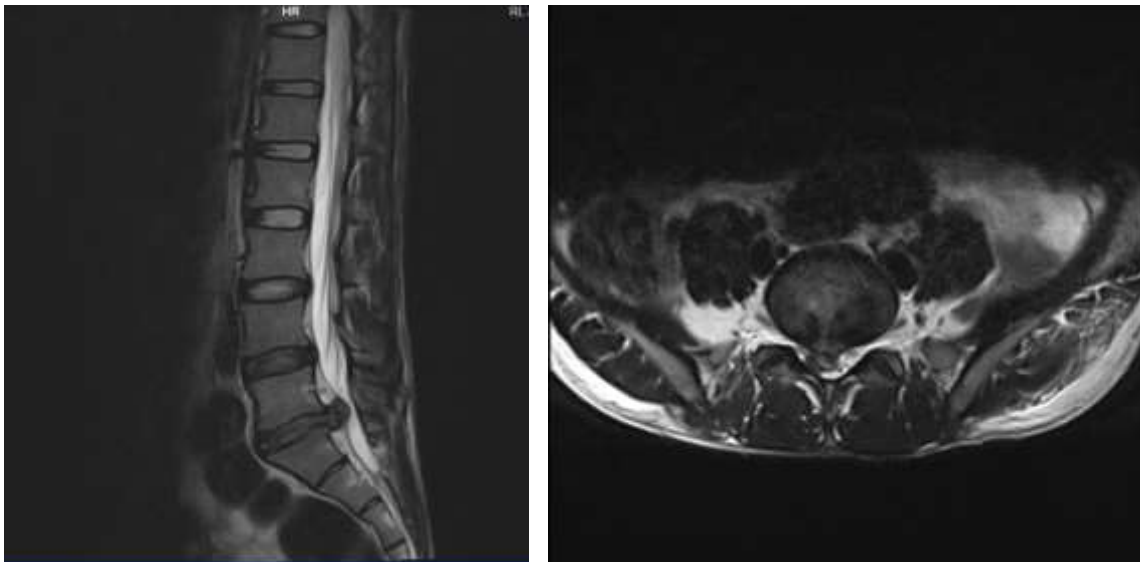
IMPROVED POSTOPERATIVE



**CASE NO : 19**



Xray LS Spine AP and Lateral



**MRI SHOWING L5-S1 DISC HERNIATION**



**PREOPERATIVE SLRT**



**IMPROVED POSTOPERATIVE SLRT**

## DISCUSSION

Although lumbar disc herniation almost always occurred by the degeneration of the nucleus pulposus and annulus fibrous, lifting injuries or trauma can be other causes<sup>65</sup>. Bulging out of nucleus pulposus and annulus fibrous from the intervertebral disc, especially when they compress on the nerve root, is the major cause for lower back pain. It characteristically radiates to the lower legs and causes numbness<sup>66</sup>. Microdiscectomy has been established as an alternative to traditional, more aggressive open approaches for the treatment of lumbar disc herniation, which is based on proposed advantages including reduced tissue invasiveness, limited blood loss, a shorter duration of surgery, and a faster postoperative recovery.<sup>9,10,67,68,69</sup>

However the results of outcome after micro lumbar disc excision vary in various studies from 46 to 97%<sup>10,21,25,29,37</sup> and there is considerable number of failed back surgeries too, which may require revision surgery. The recurrence rate for lumbar disc excision varies from 6 to 11%<sup>31,34,39</sup> in various studies. This implies that there are many factors which influence the outcome of micro lumbar disc surgery. Therefore emphasis should be on proper patient selection. For great majority of patients with sciatica due to disc prolapse conservative treatment provides satisfactory relief from symptoms. In evaluating the disc disease, the natural history should be taken into account, which reveals that surgery plays only a palliative role in its management.

Response to conservative treatment is favorable in many cases. Hence any surgical intervention without appropriate conservative therapy leads to unnecessary surgery and also a poor outcome<sup>60</sup>. However a protracted conservative regimen in the presence of severe radicular symptoms should be avoided, since this increases morbidity and reduces the chances of successful outcome. A longer preoperative interval in patients with chronic sciatica was associated with less predictable outcome<sup>15</sup>.

In Our study results were evaluated using a spine specific tool Oswestry Disability Index<sup>63,64</sup>.

In Our study, 19 were male(63.3%) and 11 were female(36.7%).

| <b>Sex</b> | <b>Ahmadi SA<sup>48</sup></b> | <b>Righesso<sup>70</sup></b> | <b>Silverplats<sup>71</sup></b> | <b>Present Study</b> |
|------------|-------------------------------|------------------------------|---------------------------------|----------------------|
| Male       | 52%                           | 53%                          | 56%                             | 63.3%                |
| Female     | 48%                           | 47%                          | 44%                             | 36.7%                |

Males were affected more commonly than females in our study, which were in accordance with studies, by Ahmadi SA<sup>48</sup>, Righesso<sup>70</sup> and Silverplats<sup>71</sup> who also had male preponderance. The reason for higher incidence in males may be linked to the nature of their occupation.

Mean age in our study was 43.8 years ranging from 22 to 65 years. Ahmadi<sup>48</sup> had a mean age of 58 years, ranging from 25 to 89 years; Righesso<sup>70</sup> had a mean age of 47.6 years, ranging from 21 to 77 years.

The Right side was affected in 50% of patients, left side in 33.3% and bilateral in 16.6% in our study . However in the study done by Righesso<sup>70</sup> 58% of the cases were affected on the left side.

Most commonly involved disc in our study was L4-L5( 60% ) followed by L5-S1 (36.7%), L3-L4 (3.3%). This is comparable to the studies done by Ahmadi<sup>48</sup> and Righesso<sup>70</sup>.

| <b>Level of Disc Prolapsed</b> | <b>Ahmadi SA<sup>48</sup></b> | <b>Righesso<sup>70</sup></b> | <b>Present Study</b> |
|--------------------------------|-------------------------------|------------------------------|----------------------|
| L1 – L2                        | 2%                            | -                            | -                    |
| L2 – L3                        | 4%                            | 1.3%                         | -                    |
| L3 – L4                        | 12.2%                         | 6%                           | 3.3%                 |
| L4 – L5                        | 48.5%                         | 50.7%                        | 60%                  |
| L5 – S1                        | 33.3%                         | 42%                          | 36.7%                |

Events which precipitated the onset of pain were analyzed. History of lifting heavy weights was present in 33.33% (10 cases), insidious onset was present in 66.66% (20 cases). In a study done by Silvers<sup>25</sup> lifting weight was the precipitating event in 31.4% of cases followed by falls (10%), sports injuries (10%) and automobile accidents(6.1%).

In our study, preoperative motor deficits of the lower extremities were present in 21 cases(70%) which were comparable to the study done by Ahmadi SA<sup>48</sup> where 60.8%

of the patients were having motor deficits and 88.8% of the patients were having motor deficits in a study reported by Righesso<sup>70</sup>. In our study, motor deficits were typically related to weakness of foot and toe dorsiflexion, corresponding to the most frequently affected levels of L4/5 and L5/S1.

In our study, complication rate was 13% (4 cases) with three cases of postoperative superficial wound infection and one case of intraoperative dural tear, which were treated with antibiotics based on culture and sensitivity and bed rest respectively.

| <b>Complications</b> | <b>Ahmadi<sup>48</sup></b> | <b>Righesso<sup>70</sup></b> | <b>Present Study</b> |
|----------------------|----------------------------|------------------------------|----------------------|
| Wound Infection      | 5 (1.64%)                  | 3 (2%)                       | 3 (10%)              |
| Dural Tear           | 10 (3.3%)                  | -                            | 1 (3%)               |
| Haemorrhage          | 2 (0.66%)                  | -                            | -                    |

The mean preoperative ODI score in our study was 42.2. ODI scores for patients undergoing lumbar microdiscectomy in the past decade in various other studies are listed below.

| Study                      | Mean ODI reported |
|----------------------------|-------------------|
| Present Study              | 42.2              |
| Ahmadi SA <sup>48</sup>    | 24.04             |
| Dewing <sup>44</sup>       | 21.22             |
| Veresciagina <sup>45</sup> | 33                |
| Righesso <sup>70</sup>     | 48                |

The Postoperative ODI scores in our study at 1 month follow up was 21.43, at 3 month follow up was 14.1 and at 6 month follow up was 10.3. There was a statistically significant difference between the mean ODI scores preoperatively and postoperatively at each point of follow up. This is consistent with the study done by Righesso<sup>70</sup> where postoperative mean ODI scores at 1,3 and 6 months follow up were 12, 10 and 10 respectively.

Various factors were correlated with the outcome

- 1) **Sex:** In our study, though the mean ODI scores were higher in females preoperatively, we found that there was no significant correlation between outcome and sex. This is consistent with the study done by Ahmadi SA.

$$X^2 = 18$$

$$P = 0.262(\text{Not significant})$$

- 2) **Age:** In our study, patients less than 45 years of age were having low mean ODI scores than patients with age more than 45 years and this difference is found statistically significant. Significant correlation between outcome and age has

been reported by Ahmadi SA and Silverplats.

$$X^2 = 27$$

$$P = 0.0287(\text{Significant})$$

- 3) **Duration of symptoms:** In our study, patients with preoperative duration of symptoms of less than six months had better outcomes than more than six months duration of symptoms and this difference was statistically significant. A. Naylor<sup>15</sup> in his study found that a longer preoperative duration of symptoms was associated with less favorable outcome following surgery.

$$X^2 = 27$$

$$P = 0.0287(\text{significant})$$

- 4) **Neurological deficit:** Surgical outcome was not significantly affected with absence or presence of neurological deficit in our study.

$$X^2 = 24$$

$$P = 0.0651(\text{Not significant})$$

Overall in our study we had a favorable outcome following lumbar microdiscectomy for lumbar disc herniation.



## CONCLUSION

In conclusion, according to our findings, the lumbar micro discectomy is an extremely useful and an effective surgery for the treatment of lumbar disc prolapse. In our study, we found a statistically significant correlation between duration of symptoms with the outcome. So, time limits for conservative treatments should be set to avoid the progression of acute pain to chronic pain and the worse overall outcomes that go along with belated surgery. Particularly in those with acute onset of pain, good outcomes are common and surgical treatment appears best if indicated early.

In our study, we found statistically significant correlation between age and outcome. However, a long term follow up is required. There were no serious complications in our study. Serious complications can be avoided in this procedure and recurrent disc herniations reduced if the above guidelines are strictly followed.

The Oswestry Disability Index (ODI) score appears to be a useful tool for evaluation of disc surgery. Improvements in postoperative score as well as the difference between the pre and postoperative scores are useful indicators of outcome. The only limitation of our study was sample size.

Lumbar micro discectomy is the safest minimally invasive procedure providing direct 3-D vision; maximum comfort to the patient and early return to work.

## **SUMMARY**

We studied 30 patients with lumbar intervertebral disc herniation surgically treated with microdiscectomy.

- 1) Age of the patients ranged from 22 to 65
- 2) Male patients (63.3%) outnumbered female patients (36.7%) in incidence.
- 3) Low backache and radicular pain were the most common symptoms.
- 4) Positive SLRT was the most common sign.
- 5) Neurological deficits were present in 80% of cases.
- 6) L4 –L5 was the most common disc to be herniated.
- 7) The average duration of hospital stay was 7.2 days.
- 8) Mean preoperative ODI score is 42.2
- 9) Mean postoperative ODI score at final followup is 10.3
- 10) Complications were superficial wound infection in three cases (10%) and dural puncture in one case (3.34%).

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**ANNEXURE - I**  
**PROFORMA FOR PATIENT EVALUATION**

**NAME:**

**AGE:**

**SEX:**

**HOSPITAL NUMBER:**

**DATE OF ADMISSION:**

**DATE OF SURGERY:**

**DATE OF DISCHARGE:**

**ADDRESS:**

**OCCUPATION:**

**HISTORY OF PRESENTING ILLNESS**

Pain in low back region-

Onset:

Duration:

Event related to onset-

Trivial fall

Inappropriate lifting of weight

Direct trauma

Uneventful

Nature:

Intensity:

Radiation: Unilateral or Bilateral

Aggravating factors:

Relieving factors:

Numbness in lower limbs: (Y/N)

If yes, site of numbness:

Weakness in lower limbs: (Y/N)

If yes specify:

H/o previous similar episodes and duration:

Bowel and bladder disturbances:

Limitation of daily activity:(Y/N)

If yes specify:

**TREATMENT HISTORY:**

Bed rest:(y/n)

If yes,duration:

Physiotherapy:(y/n)

If yes,duration:

Massage:(y/n)

Traction:(y/n)

Epidural steroid:(y/n)

If yes,drug given and time:

Surgery:(y/n)

If yes,specify

**OTHER MEDICAL ILLNESS:**

**MENSTRUAL HISTORY:**

**HABITS:**

Smoking(y/n):

Alcohol intake(y/n):

**PHYSICAL EXAMINATION**

**CVS:**

**RS:**

**ABDOMEN:**

**MUSCULO SKELETAL EXAMINATION OF SPINE:**

Gait:

Attitude:

Inspection:

Palpation:

Tenderness-

Spasm-

Deformity-

Movements:

Flexion-

Extension-

Lateral flexion-

Rotation-

Others:

**Special Tests:**

SLRT:

Active:

Passive:

Cross SLRT:

Lasegue test:

Femoral nerve stretch test:

Bow string test:

**Neurological Examination:**

HMF:

Cranial nerves:

Sensations:

Pain-

Temperature-

Fine touch-

Crude touch-

**Motor:**

Bulk- Thigh

**Rt**

**Lt**

Calf

Tone-

Power-

Hip:

Flexion

Extension

Abduction

Adduction

Knee:

Flexion

Extension

**Rt**

**Lt**

Ankle:

Dorsiflexion

Plantar flexion

EHL

EDL

Inversion

Eversion

**Reflexes:**

Superficial:

Plantar

Cremasteric

Deep tendon:

Knee jerk

Ankle jerk

**Pre-operative Oswestry Disability Index(ODI) Score:**

1. Pain Intensity
2. Personal Care(washing, dressing etc.)
3. Lifting
4. Walking

5. Sitting
6. Standing
7. Sleeping
8. Sex life(If applicable)
9. Social life
10. Travelling
11. Previous treatment

**Total score:**

% Disability:

**VAS:**

**Investigations:**

Routine Blood Tests:

Hb(gm%):

BT:

HIV/HbsAg:

CT:

Plain X-ray LS Spine-AP&Lateral:

MRI findings:

**Operative findings:**

**Intraoperative complications:**

**Postoperative complications:**



**Postoperative status:**

### Pain/Radiculopathy:

Degree of improvement (VAS):

Radiation/Numbers:

Ability to walk:

Sensory status:

Motor function:

### Follow up:

ODI Score at 1 month-

% Disability:

SLRT:

ODI Score at 3 months-

% Disability:

SLRT:

ODI Score at 6 months-

% Disability:

SLRT:

**Formula:**

$$\frac{\text{Patient's Score}}{\text{No. of sections completed} \times 5} \times 100 = \text{\% DISABILITY}$$

**ANNEXURE -**

**II CONSENT**

**FORM**

**FOR OPERATION/ ANAESTHESIA**

I \_\_\_\_\_ in my full  
senses hereby give my complete consent for \_\_\_\_\_, to  
perform any procedure deemed fit, which is a diagnostic procedure / biopsy /  
transfusion / operation on me / my son / my daughter / my ward \_\_\_\_\_  
age \_\_\_\_\_ under any anesthesia deemed fit. The nature and  
risks involved in the procedure have been explained to me, to my satisfaction. For  
academic and scientific purpose, the operation/procedure may be televised or  
photographed.

Date:

Signature/Thumb Impression of

Patient/Guardian

## KEY TO MASTER CHART

1. OP NO. : Patient hospital number.
2. HS : Hospital Stay in days
3. DOS : Duration Of Symptom : A- acute , C – chronic
4. LBA : Low BackAche.
5. RAD : Radiating pain
6. SD : Sensory Deficit
7. MD : Motor Deficit
8. BB : Bowel and Bladder abnormality
9. SLRT : Straight Leg Raising Test
10. OLL : Obliteration Of Lumbar Lordosis.
11. LH : Level Of Herniation.
12. OS PRE : Mean ODI score preoperatively.
13. OS P1 : Mean ODI score 1 month postop period
14. OS P3 : Mean ODI score 3 months postop period.
15. OS P6 : Mean ODI score 6 months post op period.

### MASTER CHART

| S.No. | NAME                | AGE | SEX | OP. NO. | HS | DOS | LBA | RAD | SD | MD | BB | SLRT | OLL | LH    | OS PRE | OS P1 | OS P3 | OS P6 |
|-------|---------------------|-----|-----|---------|----|-----|-----|-----|----|----|----|------|-----|-------|--------|-------|-------|-------|
| 1     | Neelamma            | 35  | F   | 130266  | 9  | C   | +   | +   | +  | +  | -  | -    | +   | L4-L5 | 43     | 24    | 15    | 11    |
| 2     | Vinod Imanuel       | 47  | M   | 210198  | 3  | C   | +   | +   | +  | +  | -  | +    | +   | L4-L5 | 45     | 26    | 15    | 12    |
| 3     | Venkataramappa      | 60  | M   | 386206  | 8  | C   | +   | +   | +  | +  | -  | +    | +   | L5-S1 | 41     | 20    | 12    | 10    |
| 4     | Ramesh Babu         | 32  | M   | 216459  | 9  | A   | +   | +   | +  | -  | -  | +    | +   | L4-L5 | 46     | 22    | 13    | 10    |
| 5     | Chinnappa           | 55  | M   | 280820  | 8  | A   | +   | +   | +  | +  | -  | +    | -   | L4-L5 | 44     | 21    | 13    | 11    |
| 6     | Kalavathamma        | 42  | F   | 373719  | 9  | A   | +   | +   | +  | +  | -  | +    | -   | L4-L5 | 42     | 24    | 12    | 9     |
| 7     | Pramila MV          | 37  | F   | 219934  | 7  | C   | +   | +   | -  | -  | -  | -    | +   | L4-L5 | 40     | 19    | 12    | 10    |
| 8     | Venkataramappa      | 45  | M   | 241750  | 7  | A   | +   | +   | +  | +  | -  | +    | -   | L5-S1 | 45     | 22    | 11    | 9     |
| 9     | Venkatalakshmi      | 43  | F   | 210927  | 6  | C   | +   | +   | +  | +  | -  | +    | -   | L5-S1 | 47     | 24    | 15    | 11    |
| 10    | Mufir Ulla          | 26  | M   | 358905  | 9  | C   | +   | +   | -  | +  | -  | +    | +   | L4-L5 | 41     | 20    | 12    | 10    |
| 11    | Chandrappa          | 40  | M   | 247524  | 6  | A   | +   | +   | -  | -  | -  | -    | -   | L3-L4 | 40     | 18    | 11    | 8     |
| 12    | Bychappa            | 50  | M   | 226366  | 8  | C   | +   | +   | +  | +  | -  | +    | +   | L4-L5 | 43     | 24    | 13    | 10    |
| 13    | Jayanthi            | 44  | F   | 381646  | 9  | A   | +   | +   | +  | +  | -  | +    | +   | L4-L5 | 47     | 23    | 16    | 11    |
| 14    | Anjanamma           | 43  | F   | 207989  | 6  | A   | +   | +   | -  | -  | -  | +    | +   | L4-L5 | 44     | 22    | 15    | 10    |
| 15    | Suresh              | 35  | M   | 253363  | 6  | A   | +   | +   | -  | +  | -  | +    | +   | L5-S1 | 42     | 24    | 16    | 11    |
| 16    | Manjunath           | 31  | M   | 383554  | 8  | A   | +   | +   | +  | +  | -  | +    | -   | L4-L5 | 40     | 19    | 13    | 9     |
| 17    | Jayaramappa         | 50  | M   | 301254  | 8  | C   | +   | +   | +  | +  | -  | -    | -   | L4-L5 | 41     | 20    | 14    | 10    |
| 18    | Moula khan          | 30  | M   | 30052   | 9  | A   | +   | +   | +  | +  | -  | +    | -   | L4-L5 | 46     | 24    | 16    | 9     |
| 19    | Krishnappa          | 52  | M   | 241265  | 6  | C   | +   | +   | +  | +  | -  | +    | +   | L5-S1 | 39     | 18    | 14    | 10    |
| 20    | Venketesh           | 48  | M   | 399094  | 7  | A   | +   | +   | +  | +  | -  | +    | -   | L4-L5 | 45     | 22    | 15    | 11    |
| 21    | Muniyappa           | 50  | M   | 245607  | 7  | A   | +   | +   | -  | -  | -  | -    | +   | L4-L5 | 42     | 21    | 16    | 12    |
| 22    | Mangamma            | 35  | F   | 254619  | 6  | C   | +   | +   | +  | -  | -  | +    | +   | L5-S1 | 38     | 20    | 15    | 11    |
| 23    | Kuppamma            | 65  | F   | 224130  | 8  | C   | +   | +   | +  | +  | +  | +    | -   | L4-L5 | 37     | 18    | 15    | 10    |
| 24    | Anand Reddy         | 65  | M   | 63671   | 7  | C   | +   | +   | +  | -  | -  | +    | +   | L5-S1 | 45     | 23    | 16    | 11    |
| 25    | Anjappa             | 35  | M   | 403711  | 7  | C   | +   | +   | +  | +  | -  | +    | +   | L4-L5 | 40     | 19    | 14    | 10    |
| 26    | Somarama Reddy      | 50  | M   | 246224  | 6  | C   | +   | +   | +  | +  | -  | +    | -   | L5-S1 | 42     | 23    | 17    | 12    |
| 27    | Sashikala Rathnamma | 52  | F   | 248053  | 7  | C   | +   | +   | +  | -  | -  | +    | -   | L4-L5 | 41     | 20    | 14    | 10    |
| 28    | Mahesh              | 22  | M   | 421455  | 8  | A   | +   | +   | +  | +  | -  | +    | +   | L5-S1 | 43     | 24    | 16    | 11    |
| 29    | Fazl unnisa         | 50  | F   | 239736  | 8  | C   | +   | +   | +  | -  | -  | +    | -   | L5-S1 | 40     | 20    | 13    | 9     |
| 30    | Rahib Unnisa        | 45  | F   | 281401  | 6  | C   | +   | +   | +  | +  | -  | +    | -   | L5-S1 | 37     | 19    | 14    | 11    |