"CORRELATION BETWEEN CLINICAL AND MRI FINDINGS WITH INTRAOPERATIVE FINDINGS IN LUMBAR INTERVERTEBRAL DISC PROLAPSE"

BY

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DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

In partial fulfillment of the requirements for the degree of

MASTER OF SURGERY

IN

ORTHOPAEDICS

Under the Guidance of

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ABSTRACT

Background

Low Back Pain is a musculoskeletal condition that arises in the lumbar area as a result of significant stress. Disc herniation is a complex diagnosis since it involves not only finding the specific structural abnormality causing the patient's pain, but also comparing the individual's complaints and signs with scanning findings. Since MRI units have surpassed older investigative procedures, they have become the gold standard for diagnosing herniated discs. It is now considered to be the benchmark in herniated disc diagnosis.

Aim and Objective

To describe the clinical, MRI, Intra operative findings in Lumbar intervertebral disc prolapse among the study patients and to find out the correlation between these findings.

Methodology

This prospective observational study included 47 patients hospitalized in BL Jalappa hospital from September 2022 to December 2023, diagnosed with Lumbar Intervertebral disc prolapse and having had unsuccessful conservative therapy for a maximum of eight weeks in the Orthopaedics department. The clinical criteria that were used included LBP spreading to leg and presence of

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DR. NAVIN BALAJI. R

CORRELATION BETWEEN CLINICAL AND MRI FINDINGS WITH INTRA OPERATIVE FINDINGS IN LUMBAR INTERVERTEBRAL DISC PROLAPSE

ABSTRACT

Background

Low Back Pain is a musculoskeletal condition that arises in the lumbar area as a result of significant stress. Disc herniation is a complex diagnosis since it involves not only finding the specific structural abnormality causing the patient's pain, but also comparing the individual's complaints and signs with MRI findings. Since MRI tests have surpassed older investigative procedures, they have become the gold standard for diagnosing herniated discs. It is now considered to be the benchmark in herniated disc diagnosis.

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Methodology

This prospective observational study included 47 patients hospitalized to RL Jalappa hospital from September 2022 to December 2023, diagnosed with Lumbar Intervertebral disc prolapse, and having had unsuccessful conservative therapy for a minimum of eight weeks in the Orthopaedics department. The clinical criteria that were used included LBP radiating to lower limb and presence of neurological deficit. The MRI findings that were recorded included

location, type, migration, level of prolapse, high intensity zone along with presence of lateral recess and foraminal stenosis. Patients who met both the clinical and MRI criteria were selected for surgical treatment. Then intraoperative findings were correlated with Clinical and MRI findings among patients.

Results

The average age of patients diagnosed as LIDP was 43.66 ± 9.38 yrs. The study found that 78.7% of the subjects were male, while the remaining 21.3% were female. Among the study participants with LIDP, bilateral radiculopathy was found in 14.9% of them. Left radiculopathy was seen in 53.2% of the samples, while right radiculopathy was observed in 31.9% of the patients. The MRI results indicate that 59.6% of the subjects exhibited intervertebral disc prolapse at the L4-L5 region. About 38.3% of the research participants had lumbar disc herniation in the central position, the central and left paracentral location were the second most frequently seen (21.3%), followed by the right paracentral location (12.8%). A annular tear was seen in the MRI results of 59.6% of the individuals included in the research. The MRI results indicate that among the study samples, 36.2% exhibited LRFS on the left side, whereas 21.3% showed these conditions on the right side. Among the study's samples, the most prevalent kind of lumbar disc herniation observed after surgery was extrusion, accounting for 57.4% of cases. The operative findings revealed that 34% of the

research samples had a lateral recess on the left side, whereas 21.3% of the study participants had it documented on the right side. The research samples exhibited bilateral presence in approximately 31.9% of cases. Operative findings revealed that 25.5% of the research samples had foraminal stenosis on the left side, whereas 48.9% of the studied samples exhibited bilateral presence. An 87.2% correlation was reported between the clinical, MRI, and surgical data among the research participants in this investigation. The study found that the most frequent occurrence of nerve root compression among the patients was identified at the left Traversing L5 level.

Conclusion

The accurate representation of morphometric features in MRI scans makes them a useful tool for preparing for surgery, and there is a robust positive correlation between IOF and MRI results. Nevertheless, the choice to have surgery should only be taken when a thorough examination of clinical evidence, together with MRI results, enables a precise identification of the specific fragment causing the problem and the sources of discomfort.

Keywords: Lumbar Intervertebral disc prolapse, Low back pain, Magnetic Resonance Imaging, Correlation study, Straight Leg Raising Test

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

S. No	Abbreviation	Explanation
1	LBP	Low Back Pain
2	YLD	Years Lived with Disability
3	MRI	Magnetic Resonance Imaging
4	IV	Intervertebral
5	NP	Nucleus Pulposus
6	AF	Annulus Fibrosus
7	LDH	Lumbar Disc Herniation
8	CT	Computed Tomography
9	HIZ	High Intensity Zone
10	SLRT	Straight Leg Raising Test
11	LIDP	Lumbar Intervertebral Disc Prolapse
12	LRFS	Lateral Recess and foraminal stenosis
13	HD	Herniated Disc
14	IOF	Intra-operative findings
14	MRIF	Magnetic Resonance Imaging Findings
15	DP	Disc Prolapse

INTRODUCTION

INTRODUCTION

Low Back Pain (LBP) is a prevalent issue in the healthcare sector, affecting 70-80% of individuals at some point in their life. [1] Over the past several decades, it has emerged as a prominent factor in the increase of years lived with disability (YLD). The existing literature reports a prevalence that varies between 1.4% and 20% contingent upon the specific definition of low back pain (LBP) that is employed.[2]

LBP, or low back pain, is a condition affecting the musculoskeletal system in the lower back area, resulting from the application of strong pressures. Mechanical tension leads to muscular strain. LBP can also arise from psycho-social variables and faulty biomechanics. The degradation of the spinal structure alters the cellular milieu of the disc, leading to cell-mediated degeneration and subsequent development of low back pain. [3,4]

The intervertebral disc facilitates limited movement between the vertebrae, provides ligamentous support to the vertebrae, and acts as a shock absorbent for the spine. [5] The disc can be readily ruptured due to several underlying diseases, including degeneration as well as discitis. But DP is the disc disorder that affects most people. [6] A DP occurs when the NP manages to penetrate the AF layers. Discs prolapse is the result of an impact or tension on the spine, particularly on the disc, caused by factors such as trauma, improper posture, and

long-term damage. [7,8] There is a higher incidence of DP at the L4-L5 and L5-S1 levels.

Lumbar HD is a commonly detected abnormality that is often associated with lower back pain (LBP). [9] The clinical manifestation of this condition may encompass LBP, muscle weakness, sensory complaints, or radicular discomfort. These manifestations often follow the distribution of the affected nerve roots. LBP often manifests as a widespread discomfort in the lower back area, perhaps extending to the buttocks or upper thighs. [10]

The clinical symptoms exhibited by people with disc prolapse exhibit significant variability. Disc herniation of identical dimensions may exhibit minimal symptoms in one individual while causing significant compression of the nerve root in another individual. [11] In addition to comparing MRI findings with clinical indications and signs, pinpointing the specific anatomical abnormality causing the person's discomfort can make disc herniation a difficult diagnosis to make. [12] Since MRI tests have surpassed older investigative strategies, they have become the gold standard for diagnosing HD. It is now considered to be the benchmark in HD diagnosis. [13] We offer MRI tests at a variety of magnetic area intensities, the most popular of which is 1.5 Tesla. The superior accuracy of this visual method has been demonstrated by numerous investigations. [14–16]

MRI can reveal a range of pathoanatomical abnormalities in lumbar disc prolapse. Nevertheless, there is ongoing debate over the clinical importance of MRI results. Although MRI is commonly performed on patients with suspected intervertebral disc prolapse, it remains uncertain if specific MRI findings are clinically significant and have both diagnostic and prognostic value. [16]

In 2001, Borenstein et al definitively stated that MRI results cannot be used to forecast the occurrence or duration of low back pain. They emphasized the need of clinical correlation. [17] Therefore, there are inquiries that require responses. Is magnetic resonance imaging (MRI) necessary for all individuals with lumbar disc prolapse? Which MRI results are clinically meaningful and essential for treatment purposes? While several research have shown a correlation between MRI scans and clinical results, as far as we are aware, none of these studies have incorporated intraoperative information as well. The purpose of this research was to identify any correlations between LIDP patients' clinical variables, MRI findings, and IOF. The aim was to understand the relevance of this correlation in guiding treatment decisions.

AIMS & OBJECTIVES

OBJECTIVES

1. To describe the clinical, MRI, Intra operative findings in Lumbar Intervertebral disc prolapse.

2. To determine the correlation between clinical and MRI findings with intra operative findings in Lumbar Intervertebral disc prolapse.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Intervertebral Discs

The intervertebral discs are situated between the vertebral bodies, connecting them. The underside of the upper vertebral body connects with the upper surface of the lower vertebral body via intervertebral (IV) discs. The major joints of the spinal column, which make approximately one-third of its height, are referred to as the primary joints. The primary function of the spinal column is to mechanically transmit stresses that result from body weight and muscular action. They offer versatility by enabling bending, flexion, and torsion. In the lumbar area of the spine, they have a thickness of around 7 to 10 mm and a width of 4 cm. [18]

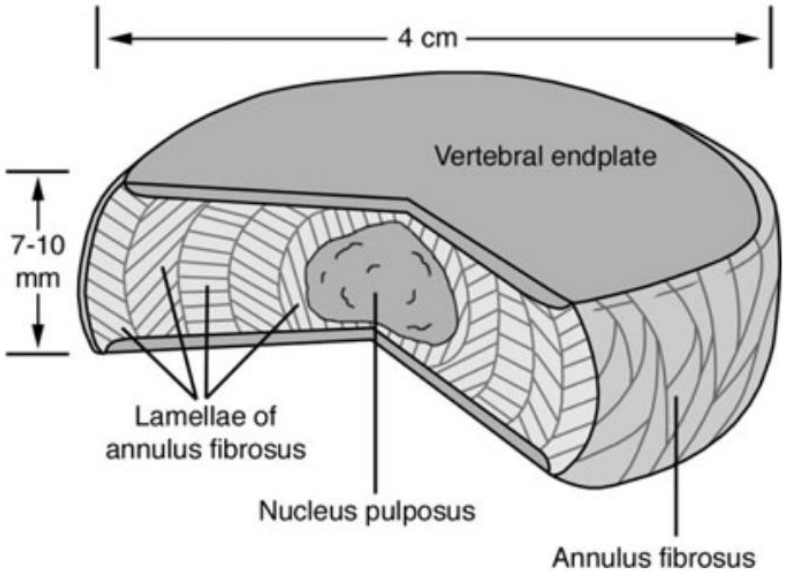


Figure 1: Section of a intervertebral disc. [18]

The 25 discs that make up the spine account for about 25–33 percent of its entire length. They are listed below:

- Cervical discs - 7,
- Thoracic discs - 12,
- Lumbar discs - 5,
- Sacral disc – 1

They enable the spine to maintain flexibility while retaining a significant amount of strength. Additionally, they offer a cushioning effect within the spinal column and hinder the gnashing of the vertebrae.

They consist of three major components:

1. the inner or nucleus pulposus (NP),
2. the outer or annulus fibrosus (AF), and
3. The cartilaginous endplates serve as anchors, connecting the discs to the neighbouring vertebrae. [19]

The intervertebral discs are intricate formations of a dense outer layer of fibrous cartilage called the annulus fibrosus, which encloses a softer, gel-like center called the nucleus pulposus. The nucleus pulposus is situated between cartilage endplates both above and below.

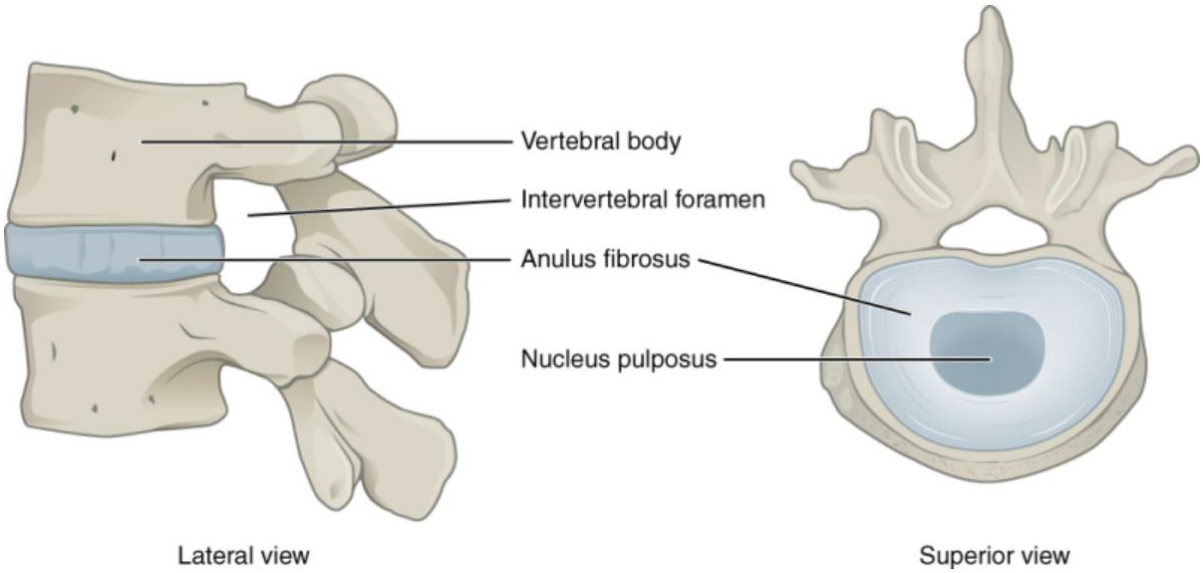


Figure 2: Intervertebral Disc. [19]

The lateral view displays the intervertebral disc situated between two adjacent vertebrae. The superior perspective reveals the annulus fibrosis located in the outer layer and the nucleus pulposus situated in the inner layer.

Low Back Pain

Low back pain (LBP) is a significant issue in both public and work environments, causing substantial professional, financial, and social challenges. [20] On average, LBP affects nearly eighty percent of human beings at some point.[21] Sick days were taken off in 20% of cases due to LBP. Back pain is responsible for 30% of all sick days that last more than six months and 20% of all work crashes. [20] Chronic deteriorating disc disease as well as LBP are both caused by intervertebral deterioration, the main cause of which is commonly

LDH. [21] LBP is an indication of an underlying condition, rather than a specific diagnosis. Without establishing a specific pathoanatomical reason, there is insufficient justification for intervention.

LDH

It is the tearing of the tough outer layer of the intervertebral disc, which causes the inner gel-like substance to protrude and put pressure on the spinal nerve and cauda equina, resulting in an inflammatory reaction. [22] The patient has clinical manifestations including pain and neurological impairment. Due to shifts in work and lifestyle patterns, there has been a significant rise in the number of LDH patients, particularly among younger individuals. This has resulted in detrimental effects on both the physical and emotional well-being of patients, making it a prominent health concern. [23] Hence, it is crucial to get a precise diagnosis of the illness in order to administer specific treatment.

For a long time, researchers have studied LIDP and the sciatic pain it causes. It is still a mystery to many doctors what causes sciatica, even though Mixter and Barr suggested invasive disc removal as a treatment for radiculopathy pain in their 1932 paper and linked bulging discs to the condition. They attribute radicular symptoms to a bulging disc but are unable to locate a clear herniated fragment during surgical examination. The occurrence is due to physicians neglecting other observations on the MRI scan that might also manifest clinically in a manner that resembles sciatica, as seen in figure 3.

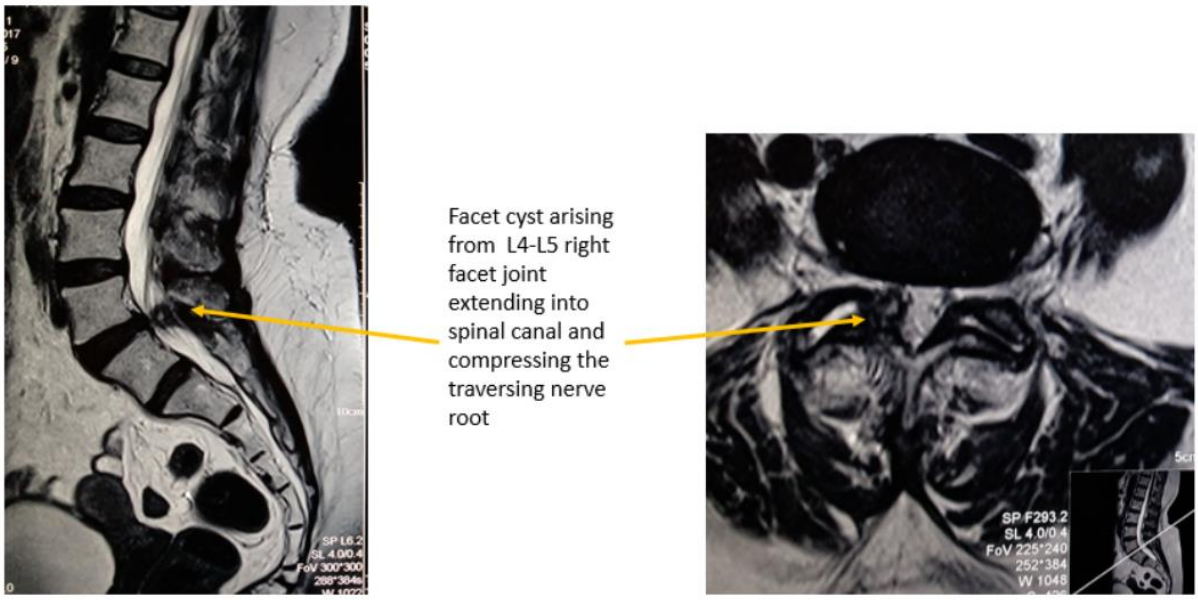


Figure 3: An older male patient is exhibiting a facet cyst at the L4-L5 level, in addition to a disc bulge at the same level. The patient presented with radiculopathy in the right leg. [24]

Aetiology of lumbar disc herniation [24]

- Elderly age
- Male have higher risk than female.
- Overweight and obesity
- Diabetes Mellitus
- High cholesterol levels
- Family history of disc herniation
- Physical Trauma

- Prolonged driving and sitting, heavy manual work,
- Mobility of lumbar spine compared to thoracic spine.
- Chain smoking.

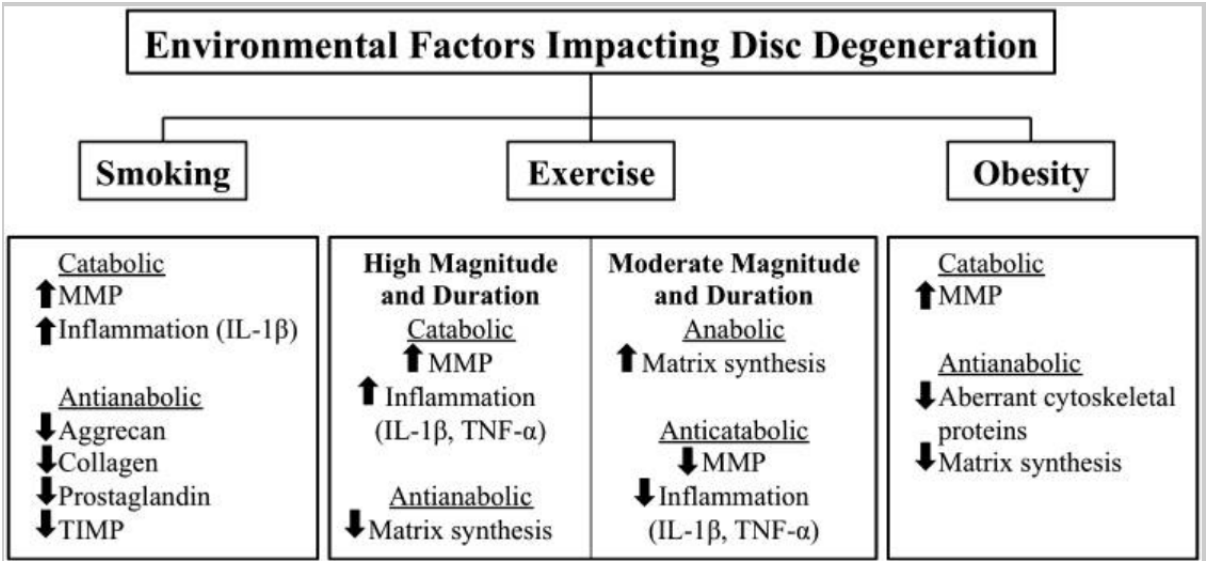


Figure 4: Environmental variables influence disc degeneration by modifying the balanced internal environment of the IVD. [25]

Pathology of LDH

The central NP is a location where collagen is released and includes many proteoglycans (PG), which help retain water, generating hydrostatic tension to counteract the axial squashing of the spine. [25]

The main component of the NP is predominantly comprised of type II collagen, which constitutes 20% of its total weight when completely dehydrated. On the other hand, the annulus fibrosus (AF) has the role of keeping the nucleus pulposus (NP) in the middle of the disc with a little quantity of proteoglycans

(PG). About 70% of its weight when it's dry consists mostly of concentric type I collagen fibers. [25,26] In lumbar disc herniation (LDH), the narrowing of the space around the thecal sac can occur due to three primary factors: protrusion of the disc through an intact annulus fibrosus (AF), extrusion of the nucleus pulposus (NP) through the AF while still retaining a connection with the disc space, or complete loss of connection with the disc space and sequestration of a free fragment. LDH is believed to be influenced by several alterations in the biology of the intervertebral disc.

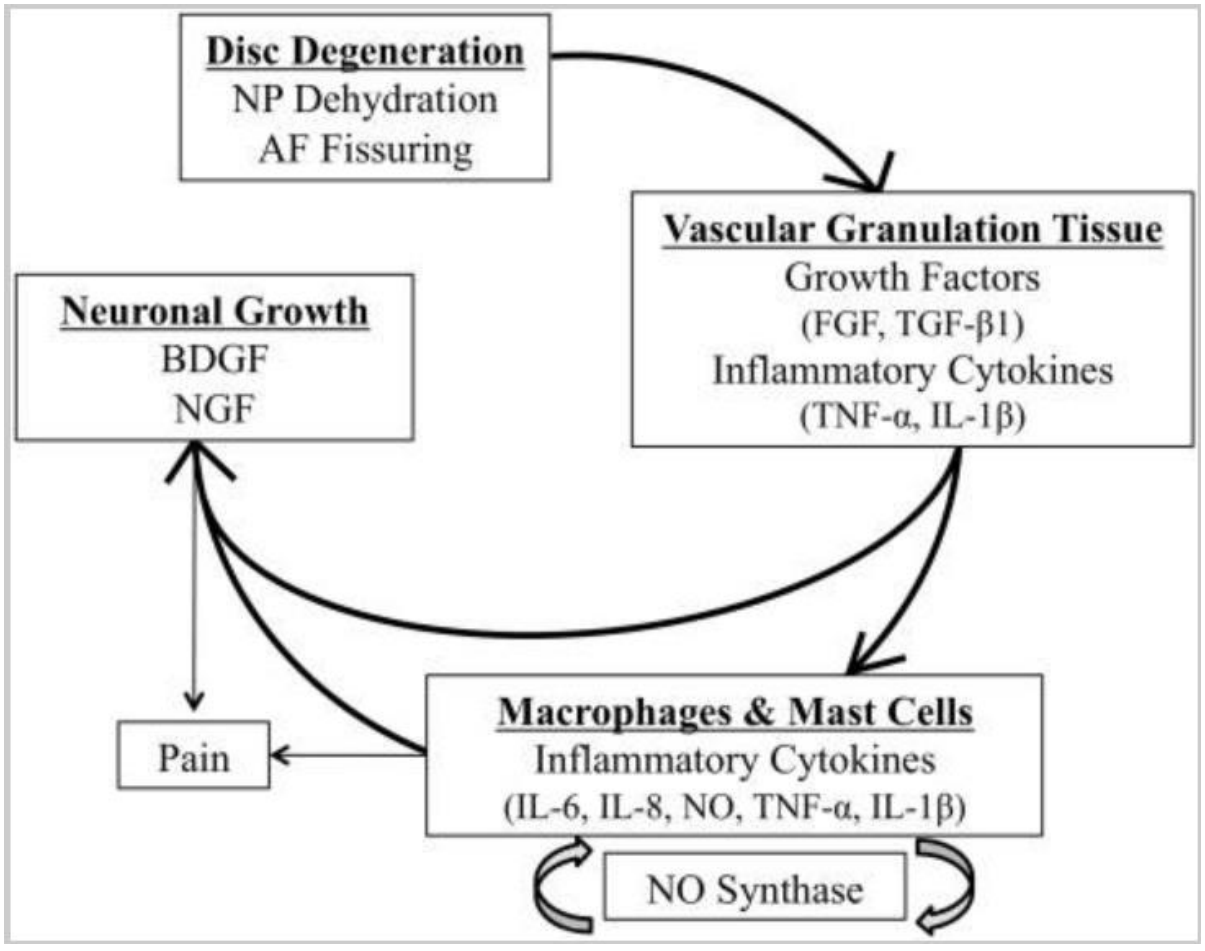


Figure 5: Disc degeneration gives rise to a sequence of events that are believed to be responsible for discogenic pain. [25]

While a direct connection between intervertebral disc and pain has not been conclusively shown, the alterations in blood supply and structural integrity of the disc that happen during the degenerative process indicate a potential association between these alterations and the occurrence of back pain.

Classification of LDH

LDH can be categorized into three categories (central, paramedian, and foraminal) based on the specific area of protrusion. The damage can be characterized as bulging, protrusion, or extrusion in accordance with the degree of protrusion. Furthermore, there are non-ruptured, ruptured, and sequestered classifications depending on surgical Patho morphism. [27]

The LDH was evaluated using T2-weighted axial MRI slices, according to the Michigan State University (MSU) classification. Here, "1, 2, 3" mean the severity of the condition, while "A, AB, B, C" mean the location of the herniated portion, which typically corresponds to "central," "paracentral," "lateral," as well as "far lateral" in this class.

The subgrouping techniques rely on an intra-facet line that is drawn horizontally across the lumbar canal, connecting the medial borders of the facet joint articulations on both the right and left sides. "1" and "2" refer to situations where the LDH (lumbar disc herniation) reaches less than or more than 50% of the distance from the non-herniated posterior portion of the disc to the intra-

facet line. On the other hand, "3" indicates that the LDH extends beyond the intra-facet line.

To determine the position of the LDH, three points are positioned along the intra-facet line, splitting it into four equal sections. Subsequently, three vertical lines are drawn between these points, resulting in the creation of four quadrants. The letter "A" denotes the left and right central quadrants, while "B" symbolizes the left and right lateral quadrants. The letter "C" signifies the region that extends beyond the boundary of the lateral quadrants. Lastly, "AB" indicates that the farthest protrusion is located on the right and left lateral vertical lines. The level with the most significant herniation was chosen for assessment. [28]

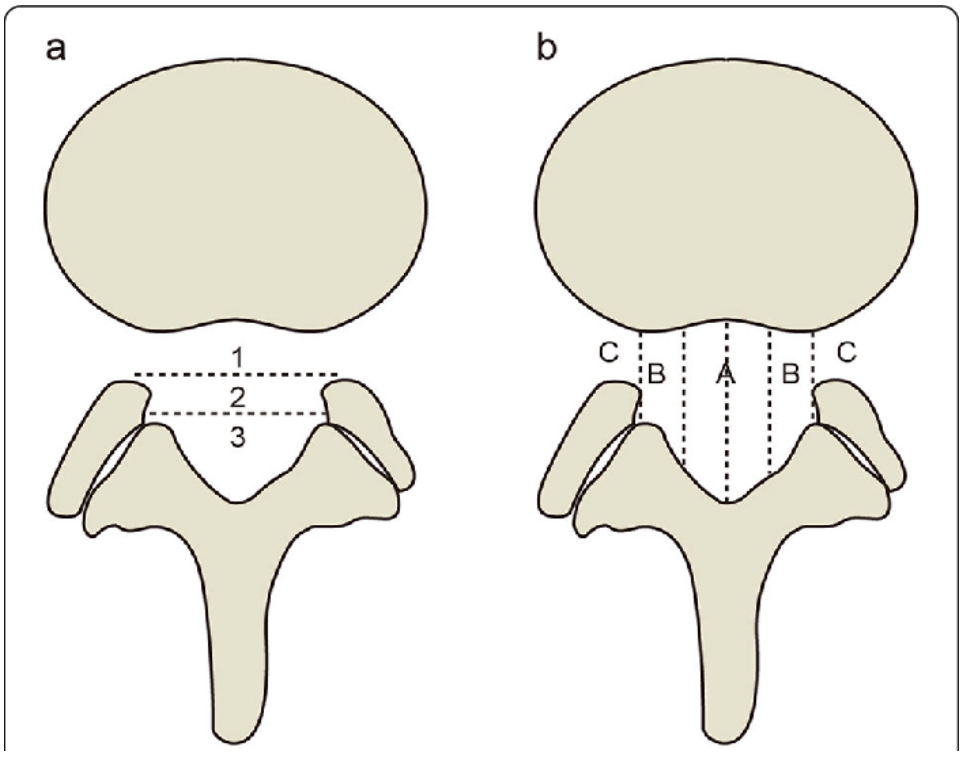


Figure 6: Michigan State University classification for LDH. [28]

Clinical Presentation

The main indications of LDH include radicular discomfort, sensory abnormalities, and weakening in the area covered by one or more lumbosacral nerve roots. [29] Additional signs of focal paresis, limited bending of the trunk, and heightened leg discomfort during activities such as straining, coughing, and sneezing are also suggestive. [29] Patients often experience heightened discomfort while sitting, a condition that is associated with a roughly 40% rise in disc pressure. [30] The dermatome affected varies depending on the extent and kind of herniation. Paracentral herniations mostly impact the nerve root that passes through, while far lateral herniations primarily harm the nerve root that exists. For instance, a paracentral herniation at the L4-5 level would result in L5 radiculopathy, whereas a far lateral herniation at the same level would lead to L4 radiculopathy.

Evaluation

Radiographs – X-ray

Plain radiographs are the primary imaging method used to evaluate low back pain. Aside from anteroposterior (AP) and lateral pictures, flexion and extension sequences are acquired to assess the impact of instability on the patient's symptoms. Indications of LDH in this technique consist of compensatory scoliosis, reduced intervertebral space, and the existence of traction osteophytes.[21] These are readily available at the majority of clinics and

outpatient centers. If x-rays indicate the presence of an acute fracture, further examination is required using a CT scan or MRI.

Computed Tomography

Recent developments, such as MDCT, have brought CT's diagnostic skills up to par with MRI's, despite the fact that CT was previously thought to be technically disadvantaged compared to MRI in identifying LDH. [31] CT myelography is recommended by the North American Spine Society as a suitable diagnostic method for verifying suspected LDH, serving as an alternative to MRI. [32] CT myelography is preferred over MRI in some conditions, such as when MRI is neither accessible or feasible, and when patients would experience significant discomfort.

Role of MRI in diagnosis

Magnetic Resonance Imaging (MRI) is considered the most reliable method for confirming suspected Lumbar Disc Herniation (LDH), with a diagnosis accuracy of 97% and a high level of agreement among different observers. [32] MRI is the most crucial radiological inquiry because it accurately outlines the soft tissue formations, as seen in picture 4.

Extraordinary, featured MRI of 1.5 Tesla make easier to:

1. Validate the identification of DH and exclude alternative pathological conditions.

2. Displays the dimensions of the herniated disc.

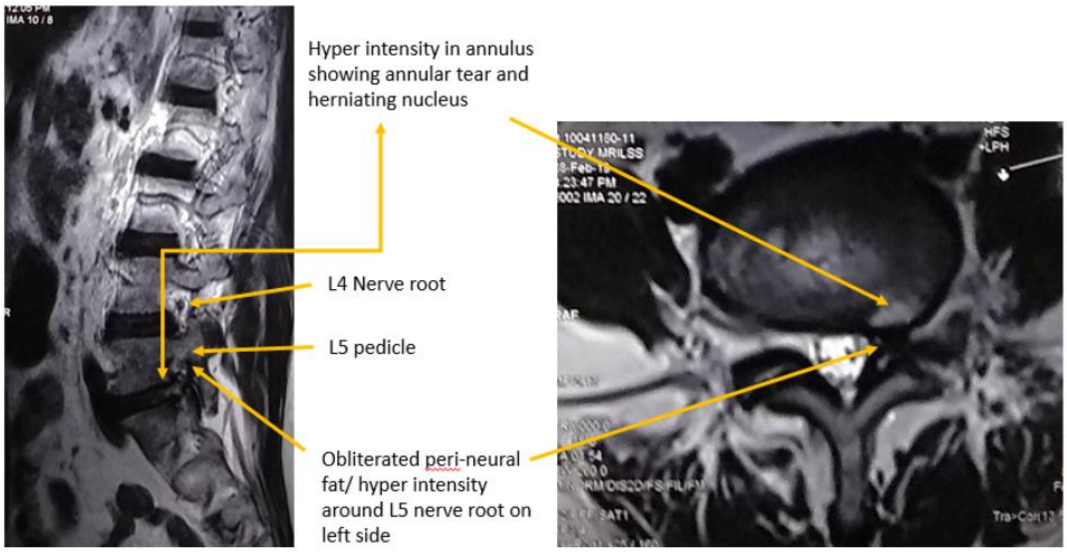


Figure 7: The patient was a 67-year-old woman who complained of left L5 radiculopathy and shown DH at L5 and S1 level. [24]

3. Illustrates the anatomical structure of herniation.
4. Indicates the precise position of herniation: centrally, paracentral/subarticular, foraminal, extraforaminal.
5. Indicates if the disc herniation is confined or not confined.
6. Illustrates the movement of fragments: superior, inferior, axillary, intradural.
7. Evaluate the degree of nerve root impairment.
8. Evaluate the overall condition of the remaining disks.
9. Evaluate the dimensions of the intervertebral neural foramina.

10. Find out if decompression is required or if conservative treatment options are viable for an individual.
11. Determine the surgical methodology for the surgery.

Uncertainty of MRI findings

It may be necessary to use diagnostic procedures like MRI or CT scan to determine the root cause in circumstances where patients with DP have substantial complaints. When it comes to diagnosing DP, the MRI is the gold standard because of how precise it is. However, in certain cases, it may reveal additional abnormalities in individuals who do not have any symptoms.. [33,34]

MRI is a non-invasive imaging technique that does not employ ionizing radiation.[16] It has superior sensitivity in detecting soft tissues compared to a CT. The MRI technique is a useful investigation because it can differentiate between disc tissue as well as the spinal cord, precisely measure the amount of protrusion, and evaluate the amount of water that is contained inside the disc on both sagittal and axial drawings.

In spite of the fact that MRI is extremely sensitive, its specificity is still up for debate because it can occasionally detect aberrant findings even when there are no symptoms or indicators present. The link between imaging findings of disc illness and the presence of complaints is minimal, despite the fact that MRI is

valuable in understanding the structure and chemical composition of disc disease.[1]

Multiple studies have demonstrated that MRI possesses a high level of sensitivity when it comes to the identification of LDH. Nevertheless, there is a lack of strong association between the clinical symptoms and MRI results in individuals with LDH. Asymptomatic patients may exhibit MRI alterations that seem to be LDH.[10] MRI investigations conducted on specific individuals have revealed a 36% occurrence of disc protrusion along with extrusion in individuals who do not have any symptoms. This emphasizes the limited ability of these findings to accurately forecast the onset of back and leg pain. [17,35]

Management of LDH

The majority of symptomatic manifestations of LDH are temporary and typically disappear within a period of six to eight weeks. As a result, initial management usually involves conservative measures, unless there are red flag symptoms that indicate the possibility of urgent conditions like progressive neurologic deficit or cauda equina syndrome. Studies conducted in recent times have demonstrated that conventional medical care and operative procedures have comparable outcomes in both the short and extended term.

Conservative Treatment

The initial therapy of choice for individuals with indications of acute LDH is this method. Doctors at PHC level may start treatment by prescribing a brief period of rest, if necessary, along with providing relevant patient education, suggesting physical activities, and prescribing pain medicines and physical therapy. Typically, symptoms will show improvement after a few weeks. Therefore, it is not advisable to undergo physical therapy until at least three weeks after the symptoms first appear. Initiating pain treatment may involve the use of modest nonsteroidal anti-inflammatory medicine. If this approach proves ineffective, the next course of action would be the use of opioid analgesics. Nevertheless, it is crucial to carefully examine and openly address the potential hazards and adverse effects associated with opioids with the patient. Furthermore, it is advisable to prescribe opioids for the shortest feasible period of time.

In cases when symptoms continue for more than six weeks, doctors may consider using corticosteroid injections to provide temporary agony relief lasting 2 to 4 weeks for patients with LDH along with sciatica. Using contrast-enhanced fluoroscopy is advised for achieving more precise administration of epidural steroid injections. Medical and interventional therapy can enhance functional results in the majority of cases with LDH along with sciatica that do not require surgical intervention. [32,36]

Surgical Treatment

Although surgical intervention is often seen as a last resort, discectomy as well as laminotomy are procedures that are commonly carried out in order to treat sciatica that is brought on by LDH. Surgery is recommended for individuals who have chronic debilitating symptoms that do not improve with conservative and medicinal treatment. The performance of operations within a period ranging from six months to one year for a patient who is experiencing complaints that necessitate surgical attention is associated with a more rapid recovery and improved outcomes over the long run.

When it comes to doing an operating execution, there are a few different approaches that can be taken, such as an open method as well as a less-invasive approach. The open approach refers to the surgical technique known as open microsurgical discectomy. Spinal surgery has increasingly relied on the minimally invasive method during the past twenty years. The procedure can be performed using minimally invasive techniques including minor incisions along with tube access. It may be categorized into two primary innovations: endoscopic and microsurgical. The surgical team selects the approach strategy for treating a herniated disc depending on its form and location.

Minimally invasive methods are associated with shorter operational time, less blood loss, and no significant differences in complications, reoperation rates, or wound infections compared to open discectomy. Nevertheless, there is no

discernible disparity in the long-term patient-centered results between open and minimally invasive operations. [32,37]

Lumbar disc replacement has been employed as a substitute for lumbar fusion in cases with degenerative disc degeneration. The utilization of this method for lumbar disc herniation has not gained popularity due to its lack of superiority compared to the open approach or the minimally invasive technique. [38]

Differential Diagnosis [39]

A. Vertebral body
Osteophytes
Metastasis
B. Intervertebral discs
Discal cyst
C. Intervertebral foramen
Neurinoma
D. Interapohyseal articulation
Synovial cyst
E. Epidural space
Epidural hematoma
Epidural abscess

Relevant articles

Wittenberg et al. conducted a prospective study in Germany in 1997. The study included 54 patients who had been experiencing sciatic pain for a mean of 12 months. The patients had MR imaging before microdiscectomy, and the researchers found a correlation between imaging results and the patients' clinical complaints both before and after the surgery. [40] They noted that there

was no association between a neurological deficiency and the amount of the prolapse. There was a direct relationship between the severity of canal blockage and the extent of disc degeneration as detected by imaging for extrusions, subligamentous disc sequestrations, and free sequestrations. 36% of the pictures showed inflammation and swelling of the nerve root, which matched the surgical result of 32%. The researchers determined that MR imaging might be a valuable diagnostic tool prior to surgery, since it can reveal structural alterations in the disc and accurately identify the location and extent of the disc sequestration. However, they found no connection between the imaging results and the clinical complaints.

Janardhana et al conducted a research in India in 2010 among 119 individuals who had been clinically diagnosed with lumbar disc prolapse.[16] Clinical complaints, DP extent, and neurological symptoms were cross-referenced with the MRI findings. The occurrence of centro-lateral protrusion or extrusion, together with significant narrowing of the foramen, is associated with clinical signs and symptoms. However, central bulges and disc protrusions have a weak correlation with patients' complaints. The significance of neural foramen impairment is greater in defining the patients' complaints, but the relationship between the kind of DH and patients' complaints is weak.

Dutta et al conducted prospective research in India in 2016. The study comprised fifty participants with LDH during a 2-year period. [41] The researchers found that the MRI scan had a sensitivity of 100% and a specificity

of 94.94% in accurately identifying surgically significant levels. The SLR test yielded positive results in 74% of samples, along with paracentral, central, and foraminal levels showing rates of 85%, 43%, and 75% respectively. Among the MRI parameters, only foraminal impairment showed a significant correlation with neurological abnormalities. Individuals who had a high-intensity zone (HIZ) detected on their MRI experienced a notable escalation in their back pain. Furthermore, 63% of these individuals displayed observable annular rupture after the surgical procedure. The anatomical results observed during the surgery closely matched the findings from the MRI scan. Based on their observations during surgery, the researchers concluded that MRI scan results correlate well with clinical features. This suggests that MRI scans might be a valuable tool for surgeons when planning a surgical procedure, since they provide an accurate representation of the morphological traits.

In 2016, **Thapa et al** performed prospective analytical research in Nepal. The study comprised 57 instances with lumbar disc prolapse that were presented to the Department of Orthopaedics at Tribhuvan University Teaching Hospital. [42] Radicular leg discomfort was present in 71.9% of patients, specifically along a particular dermatome. The magnetic resonance imaging revealed the presence of 104 lumbar discs at the degree of prolapse. There is an 85.5% occurrence of DP at the L4 plus L5 as well as L5 plus S1 levels. The physical signs of radiating discomfort and motor dysfunction were found to be associated with the constricting of the neural foramina along with compression

of the nerve roots, according to the MRI results. The study's authors concluded that LIDP symptoms were somewhat associated with the findings of MRI. However, it is important to note that not all imaging abnormalities have a clinical meaning.

In 2019, **Lakshmeesha et al** did research in India including 58 individuals who presented with symptoms of sciatica at the orthopaedic OP. These individuals were diagnosed with prolapsed intervertebral disc and the diagnosis was subsequently confirmed using MRI. [43] The patients received conservative treatment consisting of bed rest and analgesics for a duration of 6 weeks. Patients who did not get relief from conservative therapy for a duration of 6 weeks were chosen for surgical surgery. They found a good association between the clinical, MRI results, and intraoperative findings in 55 out of 58 patients.

Saleem et al conducted a cross-sectional research in Pakistan in 2012, which comprised 163 individuals with lumbar disc degeneration.[44] The prevalence of disc degeneration was highest at the L4-L5 level, observed in 105 (64.4%) individuals. The study found that of the six degenerative characteristics, HD was the most common (109 cases, or 66.9%). Spondylolisthesis was often observed in the L5-S1 level, with a prevalence of 10 cases (6.1%). It was mostly related with lumbar spinal stenosis, which was found in 7 cases (18.9%).

Berry et al. discussed the diagnosis and management of Lumbar Radiculopathy in the United States in 2019 in their review. [45] The most effective imaging technique for assessing radiculopathy is non-contrast MRI of the lumbar spine, which can reveal nerve root compression. Contrast-enhanced MRI is beneficial or recommended in situations including the presence of a tumor, infection, or previous surgical procedure. If MRI is neither accessible or feasible, a CT myelogram serves as a viable substitute.

In 2021, **Banjade et al.** did descriptive cross-sectional research in Nepal with 68 individuals with LBP. They established a correlation between the anomalies found on MRI scans as well as the patients' symptoms of LDH.[46] Neurological symptoms were observed in 26 individuals, accounting for 38.23% of the total. The MRI revealed a disc bulge in 48 cases (45.28%), protrusion in 46 cases (43.39%), and extrusion in 10 cases (11.32%). Most of these cases were observed at the L5-S1 level, accounting for 66.11% of the total. The clinical extent of pain distribution had a strong correlation with the level observed in MRI scans. However, it is important to note that not all disc bulges resulted in the manifestation of symptoms.

Sahil Singla and his colleagues conducted a descriptive cross-sectional research including 60 individuals diagnosed with lumbar disc prolapse. [47] They noted that 90% of the patients had radiculopathy, and in 82% of the cases, the straight leg raise (SLR) test yielded positive results. All patients had aberrant

MRI results, with the most frequent finding being disc bulge (53.3%). The most levels in which LDH noticed were L4 plus L5 as well as L5 plus S1. Disc degeneration and neural canal impairment were also seen. This study has found a significant correlation between MRI results and clinical symptoms in most patients. However, it is important to note that not all MRI findings are associated with clinical symptoms in patients.

Zafar et al performed a research in Pakistan in 2022 with 266 individuals who either had or did not have Low Back Pain, with or without radiculopathy. [48] The researchers observed that MRI was highly precise in identifying many diseases, including Disc Degeneration, Disc Herniation & Bulges, and Spinal Canal Stenosis & Nerve Root Compression. The researchers determined that MRI diagnosis is both meaningful and precise, hence eliminating the need for additional interventional procedures. Of the degenerative alterations in the discs, LBP is the highly prevalent symptom, radiculopathy is less common.

In 2009, **Kamal et al.** conducted a research in Dhaka including 40 individuals who had suspicions of having lumbar disc herniation. [49] The perioperative observations were subsequently compared with the MRI results. Most of LDH were observed in the L4 plus L5 level (57.5%) and the L5 plus S1 level (25%). The sensitivity of the MRI was 94.28%, indicating its ability to correctly identify positive cases. The specificity was 60%, indicating its ability to correctly identify negative cases. The overall accuracy of the MRI was 90%,

reflecting its overall performance in correctly classifying cases. This study confirmed the utilization of MRI as the radiological modality for identifying lumbar disc herniation.

Vroomen et al conducted a research in the Netherlands in 2000, which had 274 individuals experiencing discomfort spreading into the leg. [50] An analysis was conducted on the correlations between patient features, clinical symptoms, and the compression of lumbosacral nerve roots on MR imaging. Results from history-related questions have previously provided the majority of the medical data used in the physical checkup, according to statistical analysis. The researchers determined that there were many clinical observations that were linked to nerve root compression on magnetic resonance imaging (MRI).

Huang et al conducted a comprehensive study and meta-analysis in China up till 2022. [51] Their aim was to conduct a comprehensive assessment of the clinical use of three imaging techniques, "Magnetic Resonance Imaging, Computed Tomography, and myelography," in diagnosing LDH. The researchers determined that the three imaging exams have significant diagnostic value. Furthermore, as compared to myelography, Magnetic Resonance Imaging shown superior diagnostic efficacy.

Van der Graaf et al conducted a comprehensive analysis of MRI scans to identify and establish the correlation between several observable aspects and lower back pain (LBP) in the Netherlands by 2023. [52] The collective searches

yielded a total of 4472 results, out of which 31 articles were included. The researchers determined that the diagnostic lumbar MRI imaging characteristics exhibit the highest likelihood of a robust correlation with low back pain (LBP).

Saini et al conducted a prospective observational research in 2022 in India, focusing on 201 patients with Lumbar Disc Herniation. [10] Among the 53 patients who did not have radiculopathy, 79.2% had a bulge, 18.9% had a protrusion, 1.9% had extrusion, and none of the patients with sequestration had radicular symptoms. Out of the 148 patients diagnosed with radiculopathy, 61.5% had a protrusion, 21.6% had a bulge, 13.5% had extrusion, and 3.4% had sequestration. None of the individuals included in this research had sequestration without radicular discomfort. Most of our patients exhibited radiculopathy that was strongly associated with MRI findings. Nevertheless, it was discovered that 26.4% of individuals exhibiting MRI disc alterations did not have radicular discomfort. The majority of individuals without radiculopathy had Schizas grade A2, while a majority of patients with radiculopathy had Schizas grade A3.

MATERIALS & METHODS

MATERIALS AND METHODS

STUDY DESIGN:

This prospective observational study was carried out in patients with Lumbar Intervertebral disc prolapse who required discectomy.

STUDY AREA:

The study focused on patients with Lumbar Intervertebral disc prolapse who required discectomy and were admitted to the Orthopaedics department of RL Jalappa hospital. This hospital is a teaching hospital affiliated with Sri Devaraj Urs Medical College, which is an affiliated institution of Sri Devaraj Urs Academy of Higher Education and Research, located in Kolar.

STUDY PERIOD AND DURATION:

The study was done from September 2022 to December 2023, spanning a duration of 1 year and 4 months.

STUDY POPULATION:

All patients hospitalized to RL Jalappa hospital from September 2022 to December 2023, diagnosed with Lumbar Intervertebral disc prolapse, and having had unsuccessful conservative therapy for a minimum of eight weeks in the Orthopaedics department. This treatment regimen consists of a well-

organized schedule of rest, accompanied by analgesic medication, and then followed by physiotherapy.

SAMPLE SIZE CALCULATION

According to the study by Shumayou Dutta et al [41], Given a minimum correlation coefficient of 0.4, we are considering the relationship between clinical and radiological results and MRI findings specifically related to disc protrusion. Given an alpha level of 5% (corresponding to a 95% confidence interval) and a power of 80% (equivalent to a beta value of 0.20). The following formula was used to get the sample size.

$$n = \frac{\left(Z_{1-\beta} + Z_{1-\frac{\alpha}{2}} \right)^2}{\left(\frac{r^2}{1 - r^2} \right)}$$

Where,

r : Correlation coefficient.

$Z_{1-\alpha/2}$: Desired confidence level

1-β : Power

The study requires a minimum of 47 participants.

INCLUSION CRITERIA:

- Individuals aged 20-65 who have lumbar intervertebral disc prolapse.
- Chronic pain that does not respond to non-invasive therapy for a minimum of eight weeks.
- Deteriorating neurological symptoms
- Cauda equina syndrome.

EXCLUSION CRITERIA:

- Those individuals who had previously undergone surgery at the same surgical location as the current study.
- Those individuals with any other associated conditions like,
    - Congenital abnormality
    - Scoliosis
    - Post traumatic spine deformity
    - Infection
    - Tumor

SAMPLING METHOD:

Between September 2022 and December 2023, all consecutive patients who were diagnosed with lumbar intervertebral disc prolapse and required

discectomy were admitted to the Orthopaedics department of the RL Jalappa hospital.

DATA COLLECTION PROCEDURE

After obtaining their written and informed consent, patients who were eligible for participation in the trial were recruited based on the requirements for inclusion and exclusion that were established. They were told about the type of intervention and therapy, as well as the potential outcomes and consequences.

Only in the event that a conservative treatment lasting at least eight weeks had been failed was a patient believed to be qualified for surgical intervention. In the course of this investigation, a methodical regimen consisting of rest, pain medicine, and physical therapy is followed by the administration of the drug.

A comprehensive physical examination, including a thorough assessment of the abdomen, hips, and sacroiliac joints, was conducted to rule out any potential sources of discomfort and other symptoms. Lumbar spine radiographs were obtained to exclude the conditions.

The **clinical criteria** that were used to evaluate these patients are:

- Low backache with radiation to the lower limb
- Radicular pain along a specific dermatome
- Straight leg raising test (SLRT) for nerve root tension.

- Presence of a neurological deficit

Patients who met these clinical criteria underwent MRI scanning. The **MRI findings** that were recorded are the following:

- Prolapse level.
- Location (central, paracentral, foraminal, and extraforaminal)
- Type (bulge, protrusion, extrusion, and sequestration)
- Migration (superior and inferior)
- Annular tear
- Lateral recess
- Foraminal stenosis (thecal sac compression, nerve root contact, and nerve root compression).

An MRI with 1.5 Tesla was performed on each and every patient. Both the axial and sagittal planes were scanned in order to obtain the results. It was possible to get axial sections by capturing them in parallel to each lumbar disc as well as the superior and inferior endplates of the lumbar vertebrae. We utilized a slice thickness of three millimeters. The magnetic resonance imaging (MRI) revealed a significant amount of disc prolapse in cases where there was compression of the thecal sac and the nerve root that was next to it, in addition to clinical

symptoms. An individual radiologist performed a painstaking analysis of each and every MRI scan that was carried out for the entirety of the study.

Patients who met both the clinical and MRI criteria were selected for surgical treatment. The indications for surgery were the following,

- Persistent pain unrelieved by conservative treatment at least eight weeks.
- Deteriorating neurological symptoms

Intraoperative findings that were noted are the following,

- Type
- Position of the fragment
- Migration
- Annular tear
- Lateral recess and foraminal stenosis.

Subsequently, these observations were contrasted with the MRI findings.

ETHICAL CONSIDERATION

In compliance with ethical norms, the Institutional Ethics Committee has given its clearance. The researchers have maintained the privacy and confidentiality of the participants by making sure that the data they have obtained is used exclusively for the research aims that have been indicated throughout the study.

DATA ANALYSIS

- The data were imported into Microsoft Excel and subsequently analysed using SPSS 23.0.

- To characterizing the data, descriptive statistics for discrete variables were utilized. These statistics included frequency analysis and percentage analysis. When dealing with continuous variables, the statistical measurements of mean, median, along with S.D were utilized.

RESULTS

RESULTS

Table 1: Age distribution of study participants

Age in years	
Mean	43.66
Std. Deviation	9.386
Range	31
Minimum	27
Maximum	58

The average age of enrolled samples diagnosed with LIDP was 43.66 ± 9.38 years.

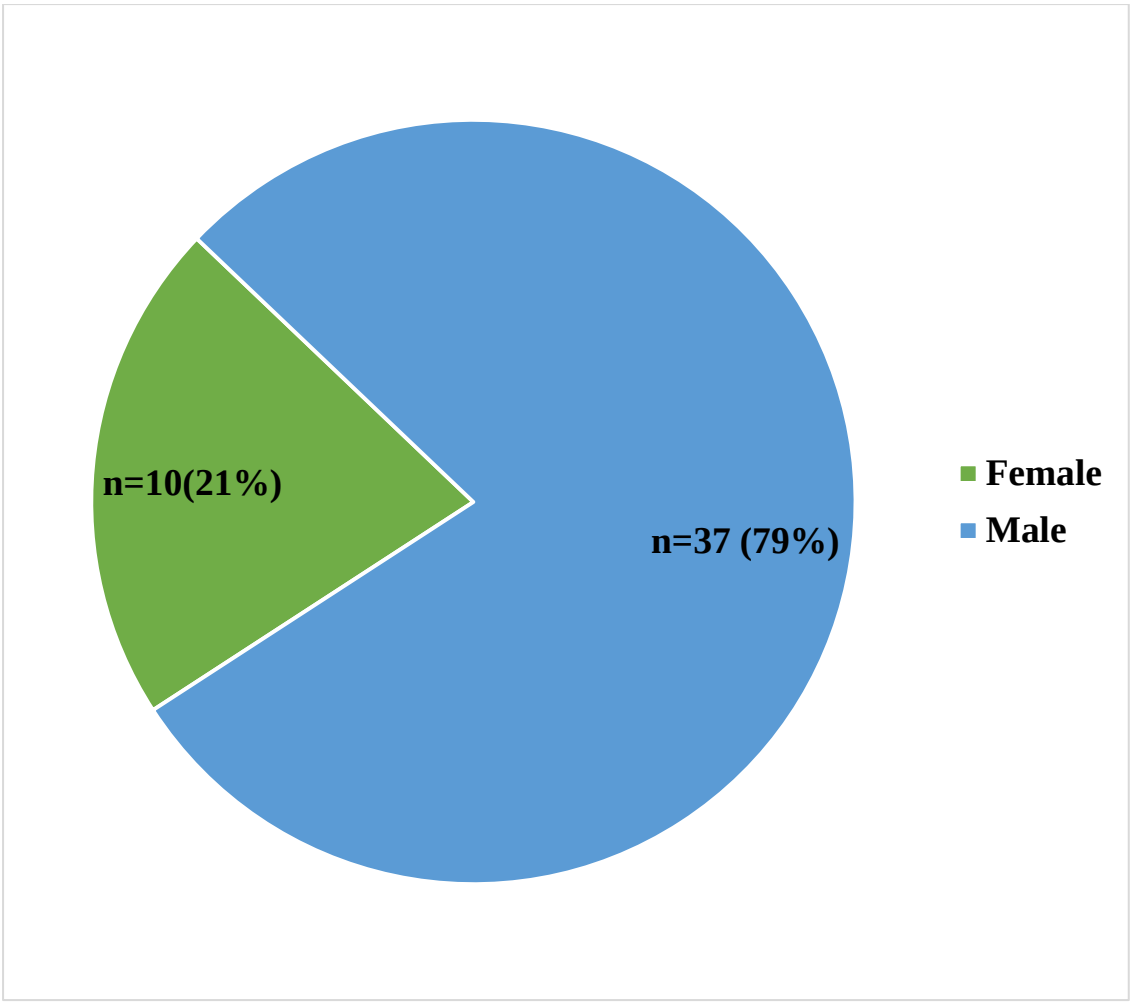
Figure 8: Age distribution of study participants.

Table 2: Gender distribution

Gender	Frequency	Percent
Female	10	21.3
Male	37	78.7
Total	47	100

The study found that 78.7% of the subjects diagnosed with Lumbar Intervertebral disc prolapse were male, while the remaining 21.3% were female.

Figure 9: Gender distribution of study participants.



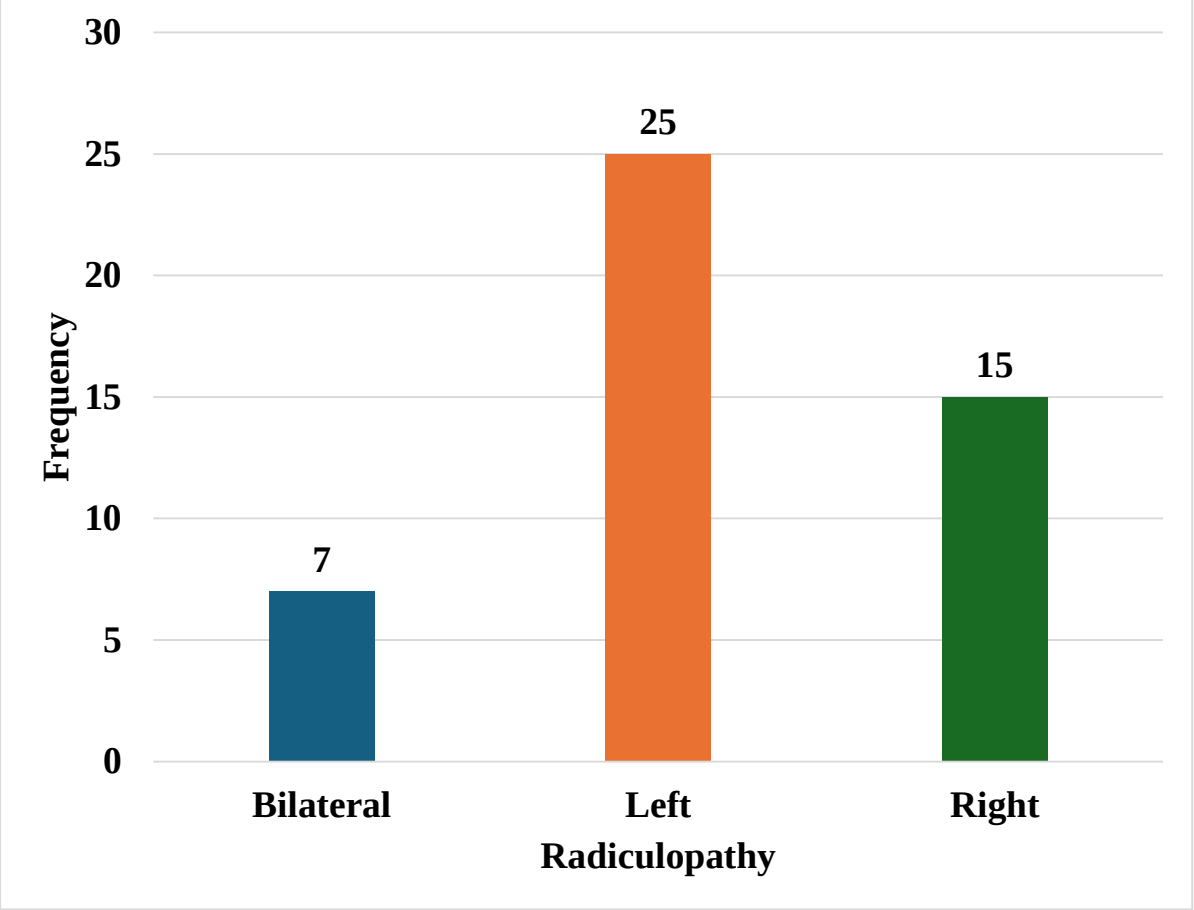
Clinical Findings

Table 3: Assignment of enrolled samples based on the presence of radiculopathy.

Radiculopathy	Frequency	Percent
Bilateral	7	14.9
Left	25	53.2
Right	15	31.9
Total	47	100.0

Among the study participants with LIDP, bilateral radiculopathy was found in 14.9% of them. Left radiculopathy was seen in 53.2% of the samples, while right radiculopathy was observed in 31.9% of the patients.

Figure 10: Assignment of enrolled samples based on the presence of radiculopathy.



MRI findings

Table 4: Assignment of enrolled samples based on level of lumbar intervertebral disc prolapse as documented in MRI.

Level of lumbar intervertebral disc prolapse shown in MRI	Frequency	Percent
L4-L5	28	59.6
L5-S1	19	40.4
Total	47	100

The MRI results indicate that 59.6% of the subjects exhibited intervertebral disc prolapse at the L4-L5 region. The remaining 40.4% was detected specifically at the L5-S1 level.

In our study we did not come across L2-L3, L3-L4 Level Disc bulge.

Figure 11: Assignment of enrolled samples based on level of lumbar intervertebral disc prolapse as documented in MRI.

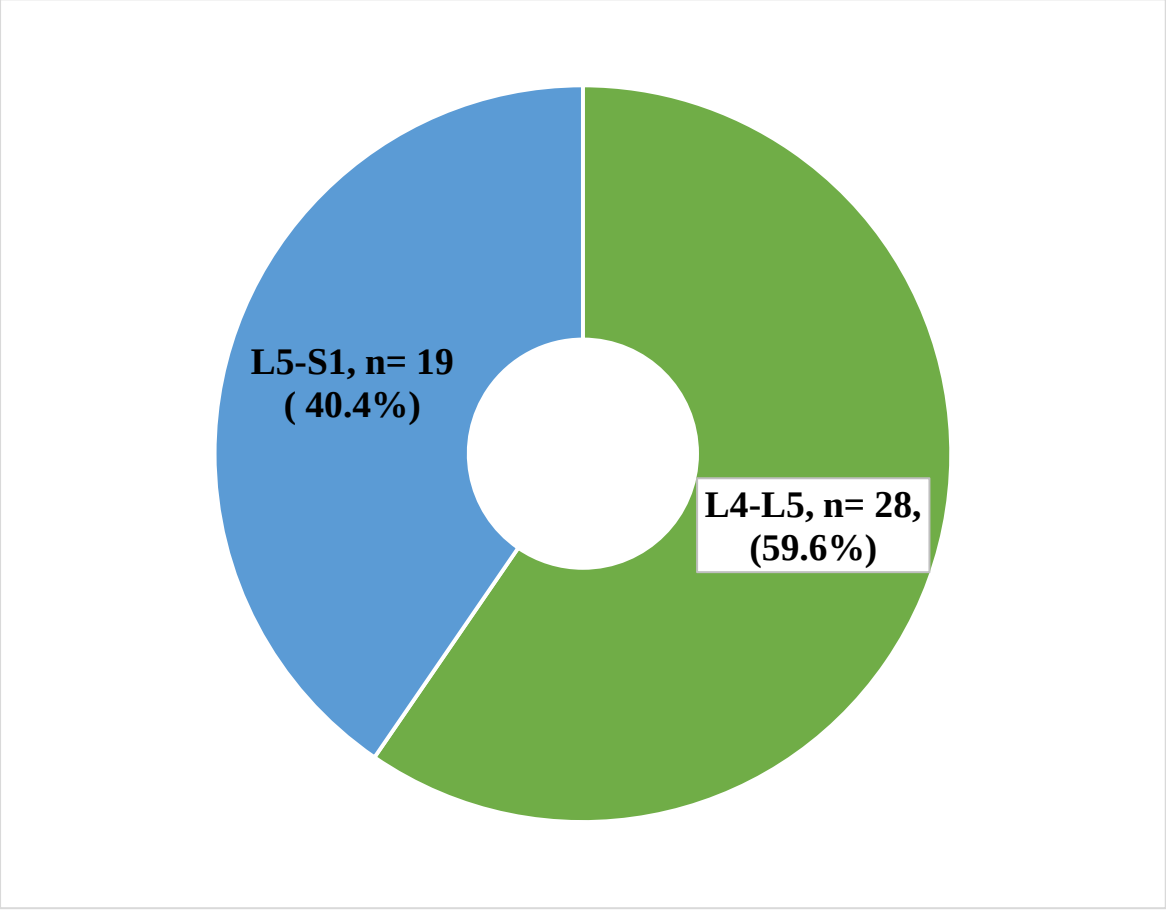


Table 5: Assignment of enrolled samples based on lumbar disc herniation as documented in MRI.

Location of lumbar disc herniation shown in MRI	Frequency	Percent
Central	18	38.3
Central And Bilateral Paracentral	4	8.5
Central And Left Paracentral	10	21.3
Central And Right Paracentral	1	2.1
Left Paracentral	8	17
Right Paracentral	6	12.8
Total	47	100

Approximately 38.3% of the research participants had lumbar disc herniation in the central position, which was the most frequently seen site in the MRI findings. The central and left paracentral location were the second most frequently seen (21.3%), followed by the right paracentral location (12.8%).

Figure 12: Assignment of enrolled samples based on lumbar disc herniation as documented in MRI.

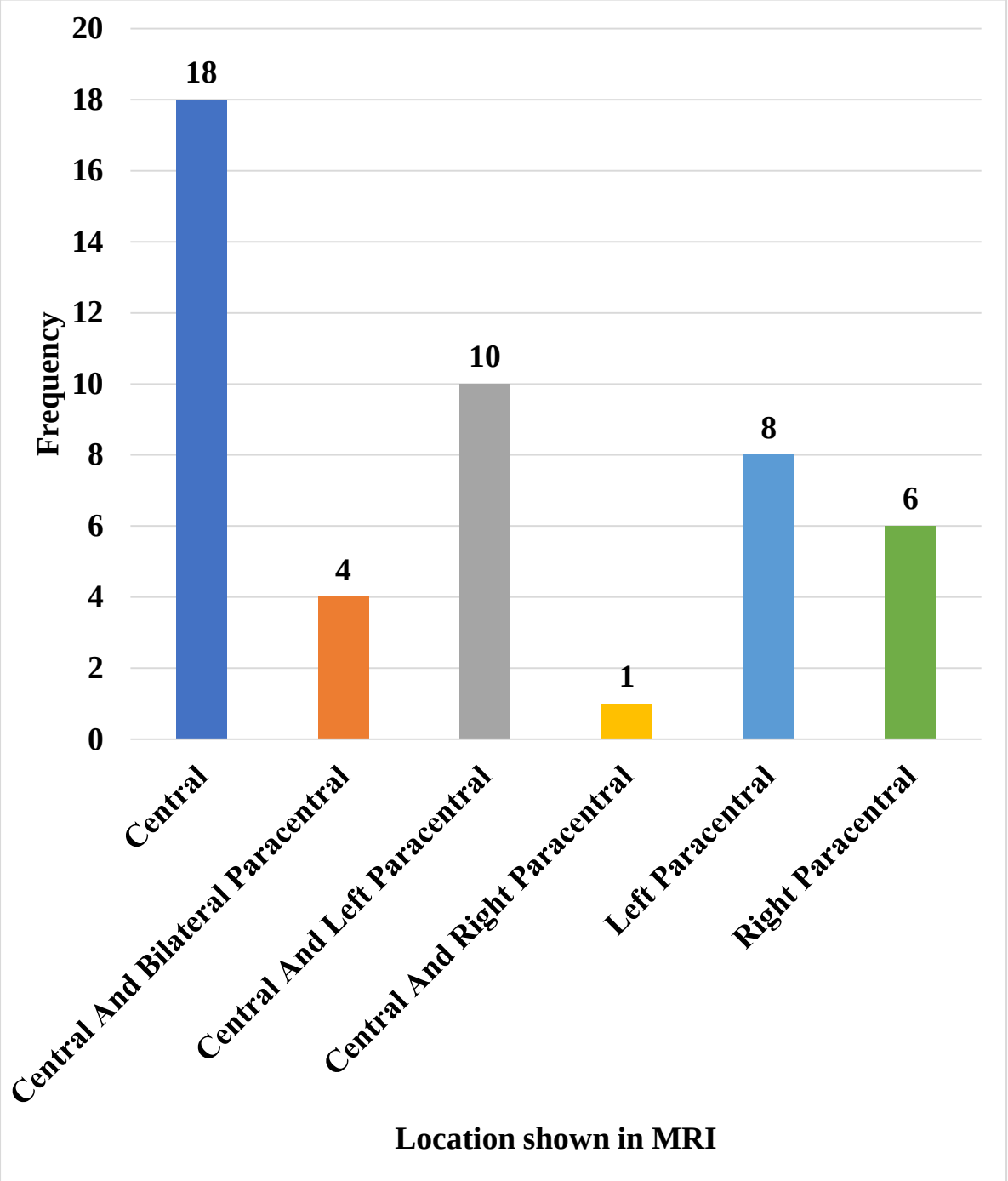


Table 6: Assignment of enrolled samples based on type of lumbar disc herniation as documented in MRI.

Type of lumbar disc herniation shown in MRI	Frequency	Percent
Extrusion	23	48.9
Protrusion	19	40.4
Sequestration	5	10.6
Total	47	100

The MRI results of the study participants showed that extrusion LDH was the most common type, accounting for 48.9% of the total.

Figure 13: Assignment of enrolled samples based on type of lumbar disc herniation as documented in MRI.

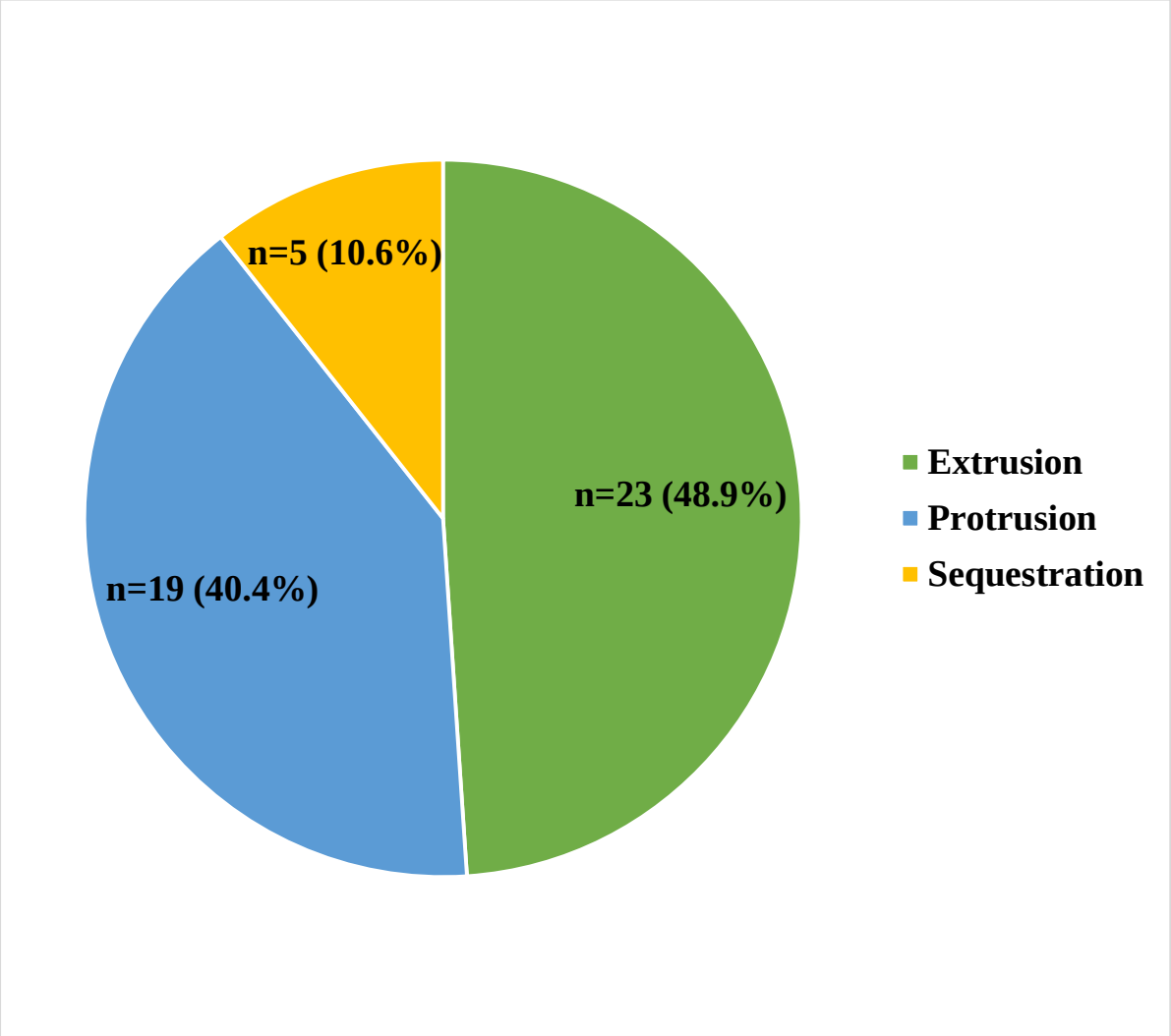


Table 7: Assignment of enrolled samples based on migration of herniation fragments as documented in MRI.

Migration shown in MRI	Frequency	Percent
Caudal	3	6.4
Cranial	2	4.2
No	42	89.4
Total	47	100

Among the research samples, the caudal side was the most frequent location for migration of herniation fragments, as evidenced in MRI results (6.4%). Among the research patients, the migration of herniated fragments to the cranial side was the second most prevalent, accounting for 4.2%.

Figure 14: Assignment of enrolled samples based on migration of herniation fragments as documented in MRI.

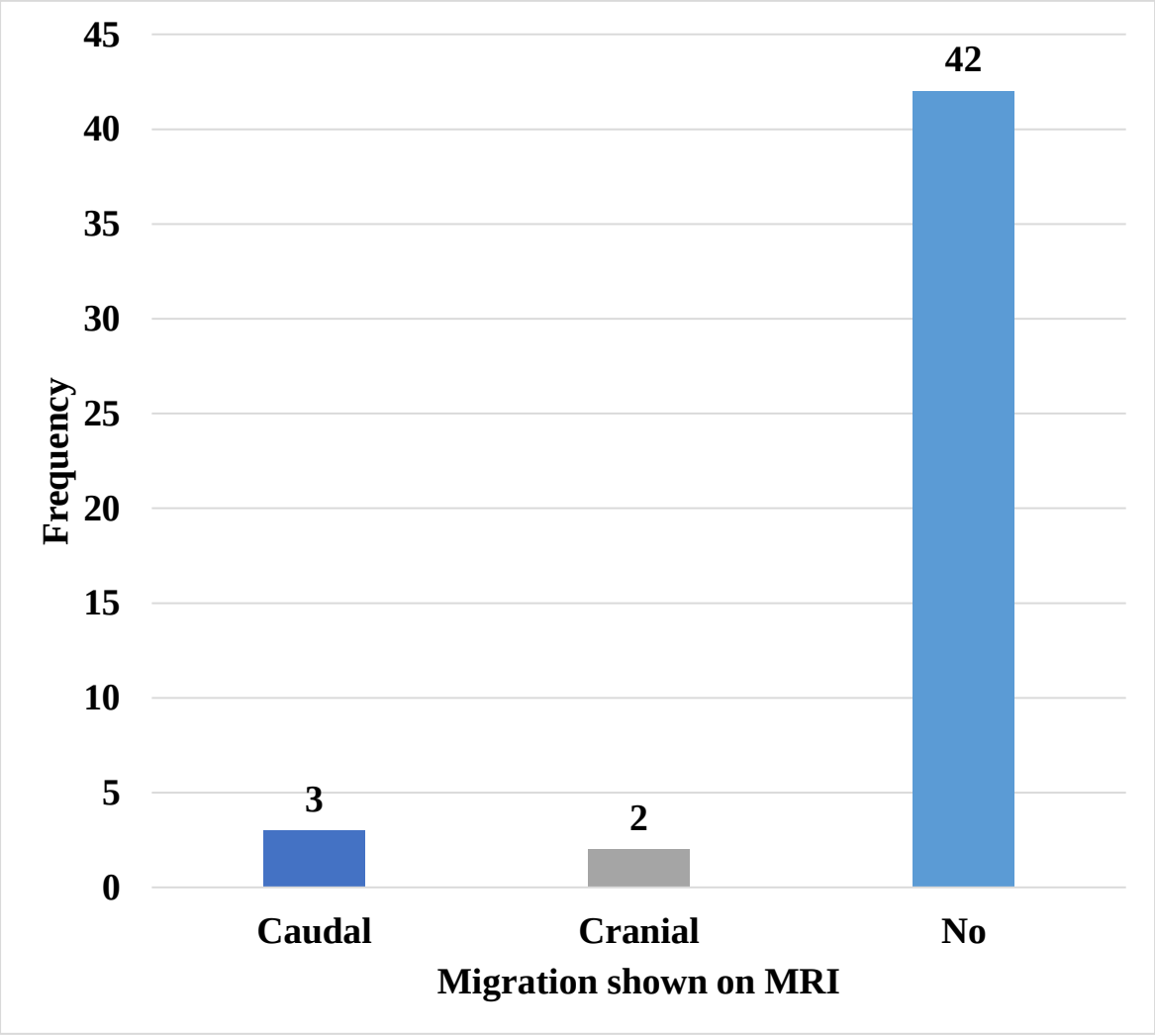


Table 8: Assignment of enrolled samples with respect to Annular tear as documented in MRI.

Annular tear in MRI	Frequency	Percent
Present	28	59.6
Absent	19	40.4
Total	47	100

Annular tear was seen in the MRI results of 59.6% of the individuals included in the research.

Figure 15: Assignment of enrolled samples with respect to high intensity zone as documented in MRI.

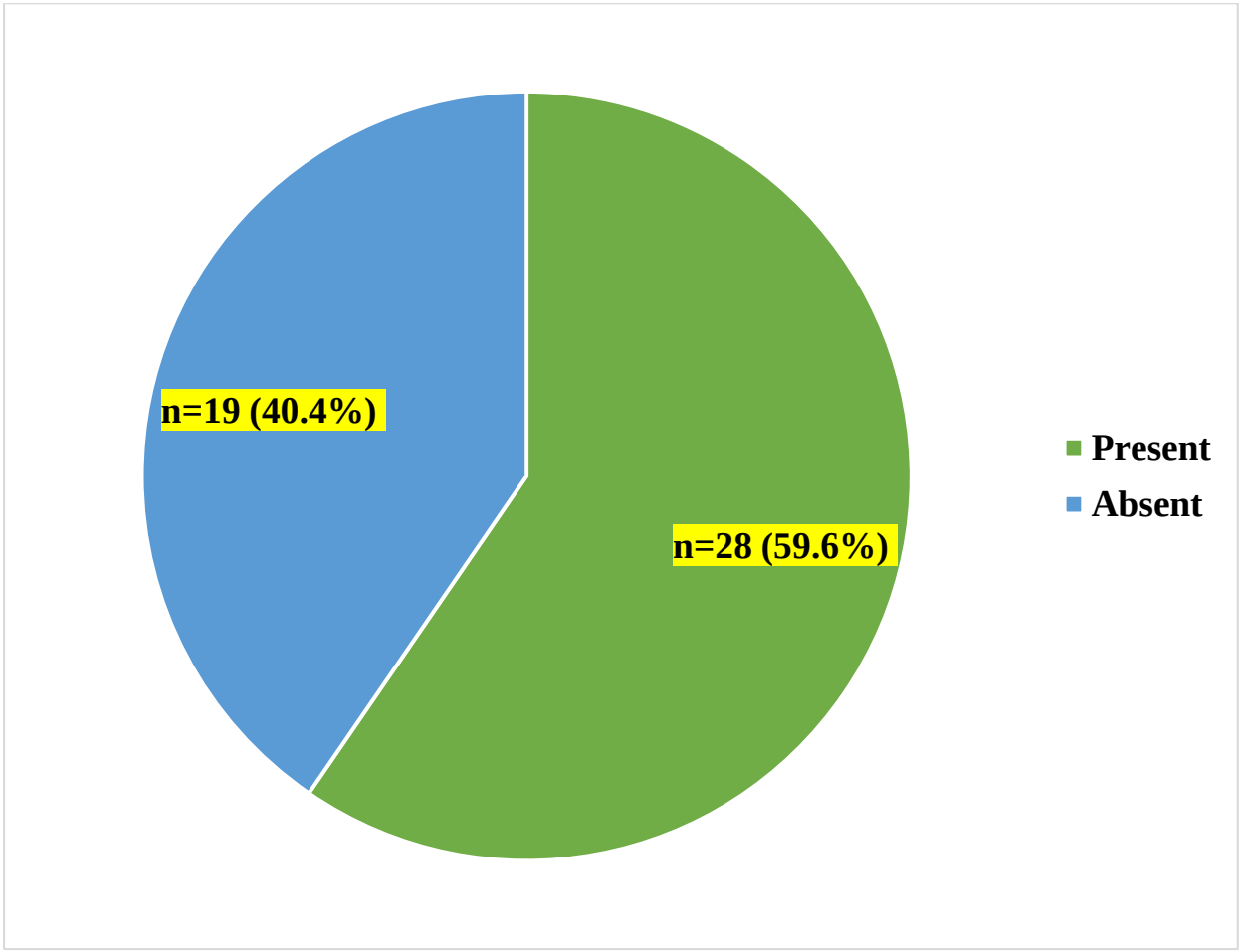
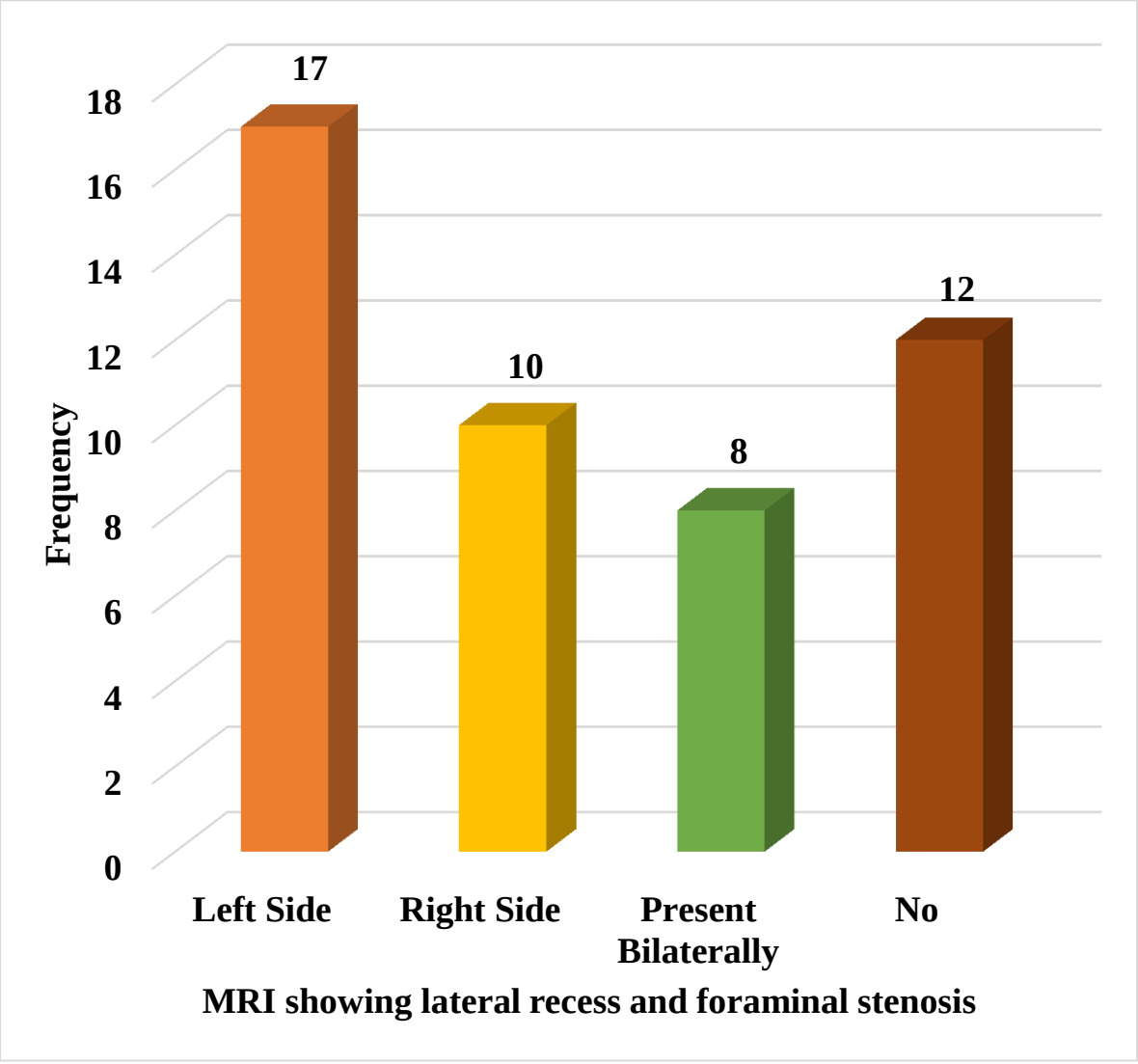


Table 9: Assignment of enrolled samples with respect to LRFS as documented in MRI.

MRI showing LRFS	Frequency	Percent
Left Side	17	36.2
Right Side	10	21.3
Present Bilaterally	8	17
No	12	25.5
Total	47	100

The MRI results indicate that among the study samples, 36.2% exhibited LRFS on the left side, whereas 21.3% showed these conditions on the right side. Only 17% of the research samples exhibited bilateral presence.

Figure 16: Assignment of enrolled samples with respect to LRFS as documented in MRI.



Operative Findings

Table 10: Assignment of enrolled samples with respect to type of lumbar disc herniation as documented in operative Findings.

Type of lumbar disc herniation as documented in operative Findings	Frequency	Percent
Extrusion	27	57.4
Protrusion	14	29.8
Sequestration	6	12.8
Total	47	100

Among the study's samples, the most prevalent kind of lumbar disc herniation observed after surgery was extrusion, accounting for 57.4% of cases. Protrusion was the second most prevalent form, accounting for 29.8% of the patients in the study.

Figure 17: Allotment of enrolled samples with respect to type of lumbar disc herniation as documented in operative Findings.

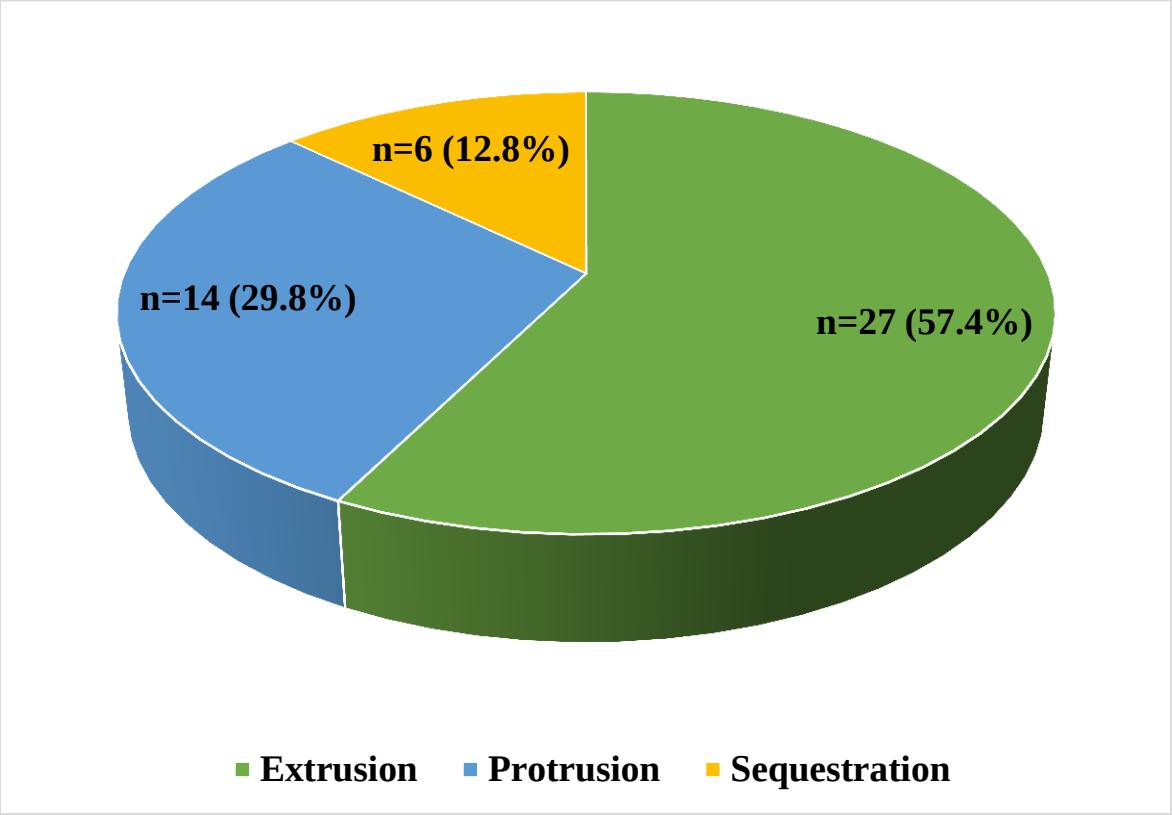


Table 11: Allotment of enrolled samples with respect to migration of herniated fragments as documented in operative Findings.

Migration of herniation fragments as documented in operative Findings	Frequency	Percent
Caudal	4	8.5
Cranial	2	4.3
No	41	87.2
Total	47	100

Among the research samples, the caudal side was the most frequent location for migration of herniated fragments, as indicated in operational results (8.5%). Among the research patients, the migration of herniation fragments to the cranial side was the second most prevalent (4.3%).

Figure 18: Allotment of enrolled samples with respect to migration of herniated fragments as documented in operative Findings.

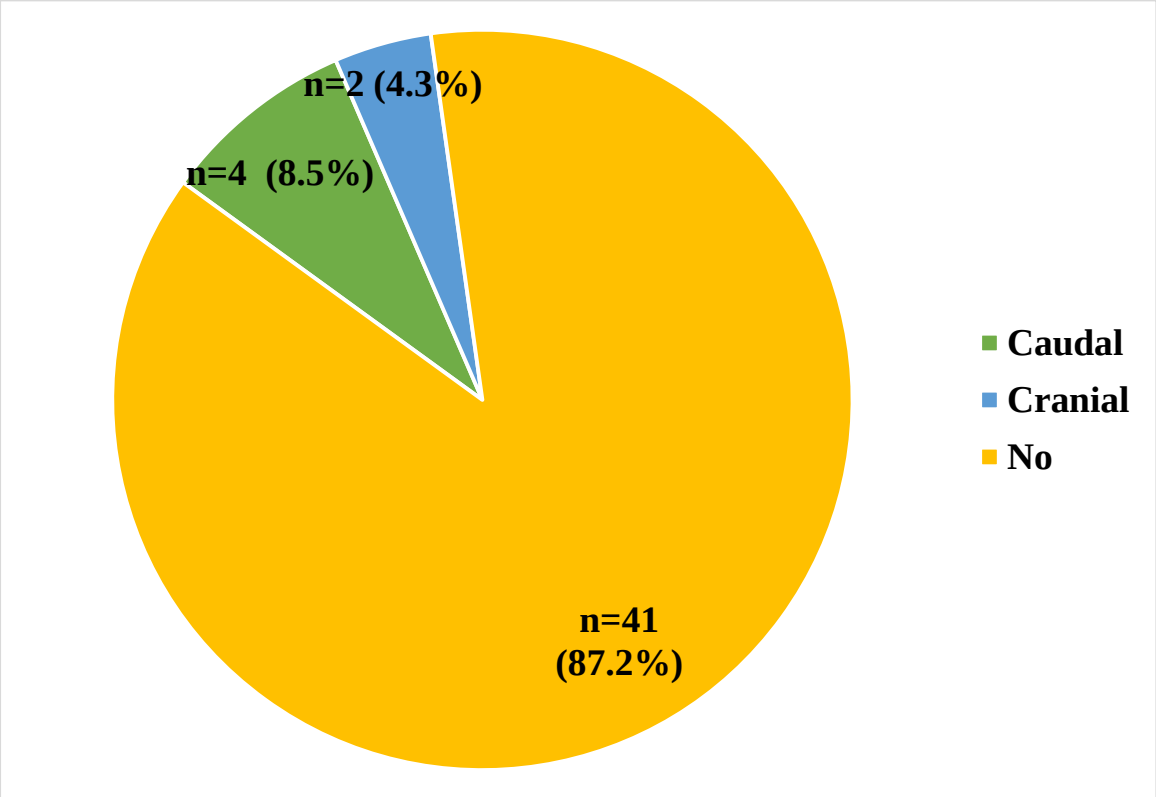


Table 12: Allotment of enrolled samples with respect to the presence of annular tear as documented in operative Findings.

Annular tear documented in operative Findings.	Frequency	Percent
Present	33	70.2
Absent	14	29.8
Total	47	100

An annular tear was seen in 70.2% of the surgical findings in the patients of the research.

Figure 19: Allotment of enrolled samples with respect to the presence of annular tear as documented in operative Findings.

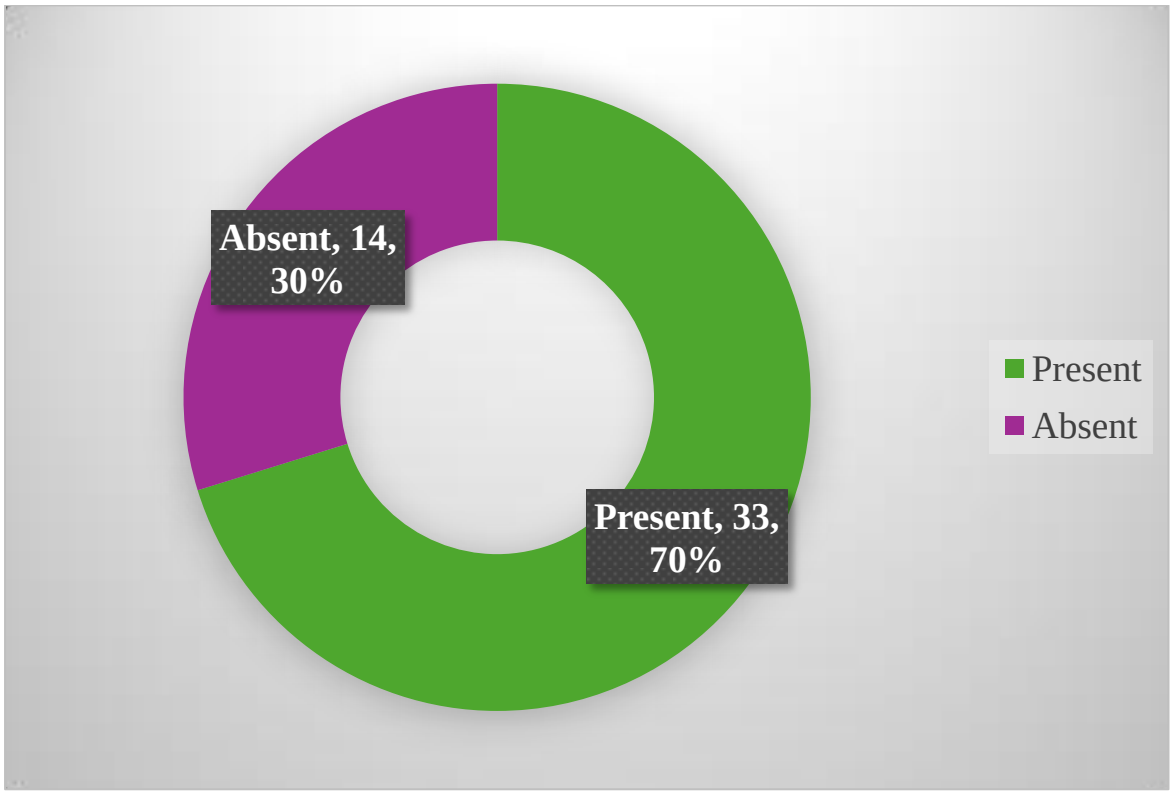


Table 13: Allotment of enrolled samples with respect to the lateral recess as documented in operative Findings.

Lateral recess	Frequency	Percent
Left Side	16	34
Right Side	10	21.3
Obliterated Bilaterally	15	31.9
No	6	12.8
Total	47	100

The operative findings revealed that 34% of the research samples had a lateral recess on the left side, whereas 21.3% of the study participants had it documented on the right side. The research samples exhibited bilateral presence in approximately 31.9% of cases.

Figure 20: Allotment of enrolled samples with respect to the lateral recess as documented in operative Findings.

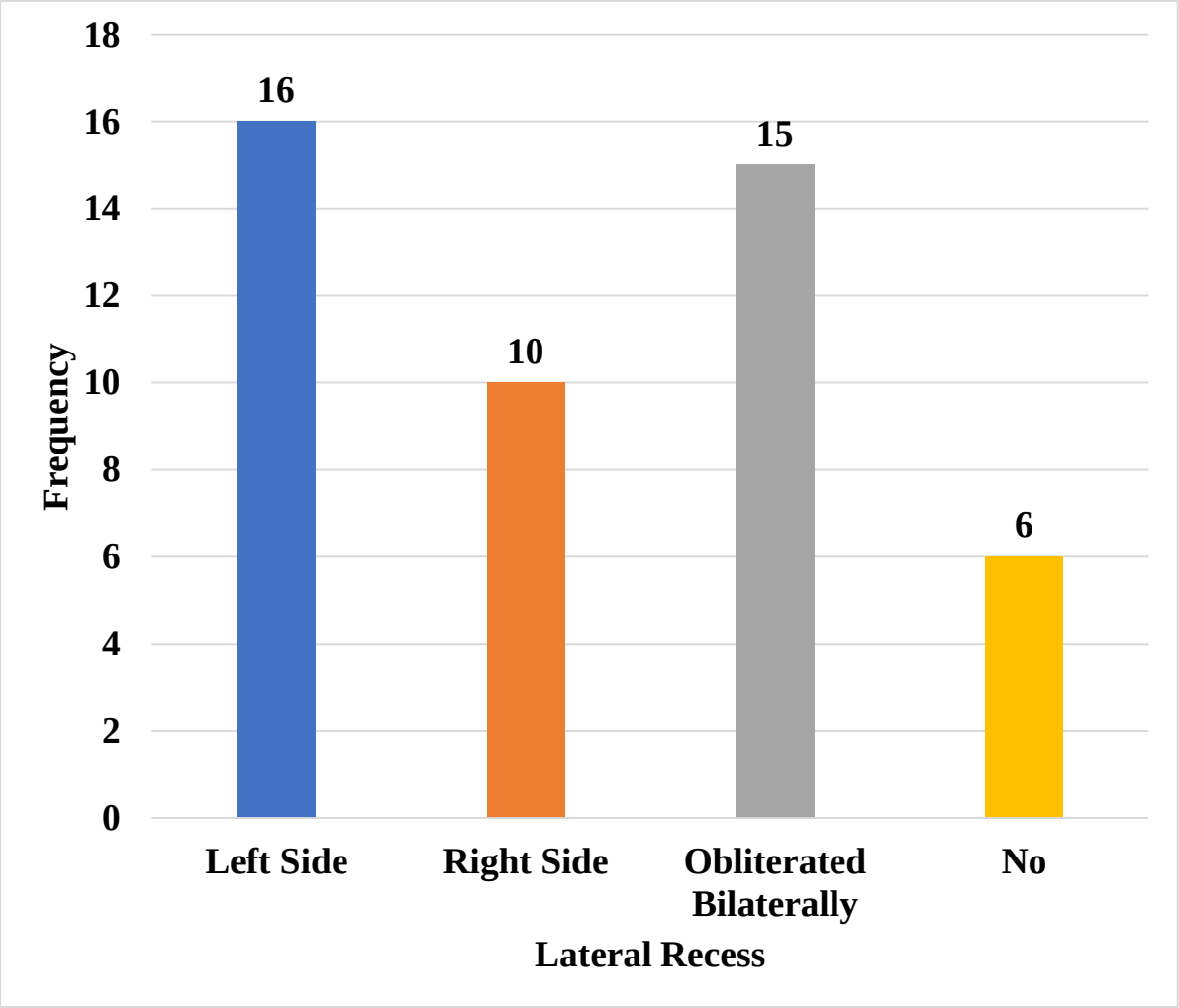


Table 14: Allotment of enrolled samples with respect to the foraminal stenosis as documented in operative Findings.

Foraminal stenosis	Frequency	Percent
Present Bilaterally	23	48.9
Left Side	12	25.5
Right Side	6	12.8
No	6	12.8
Total	47	100

Operative findings revealed that 25.5% of the research samples had foraminal stenosis on the left side, whereas 12.8% of the study participants had it on the right side. Approximately 48.9% of the studied samples exhibited bilateral presence.

Figure 21: Allotment of enrolled samples with respect to the foraminal stenosis as documented in operative Findings.

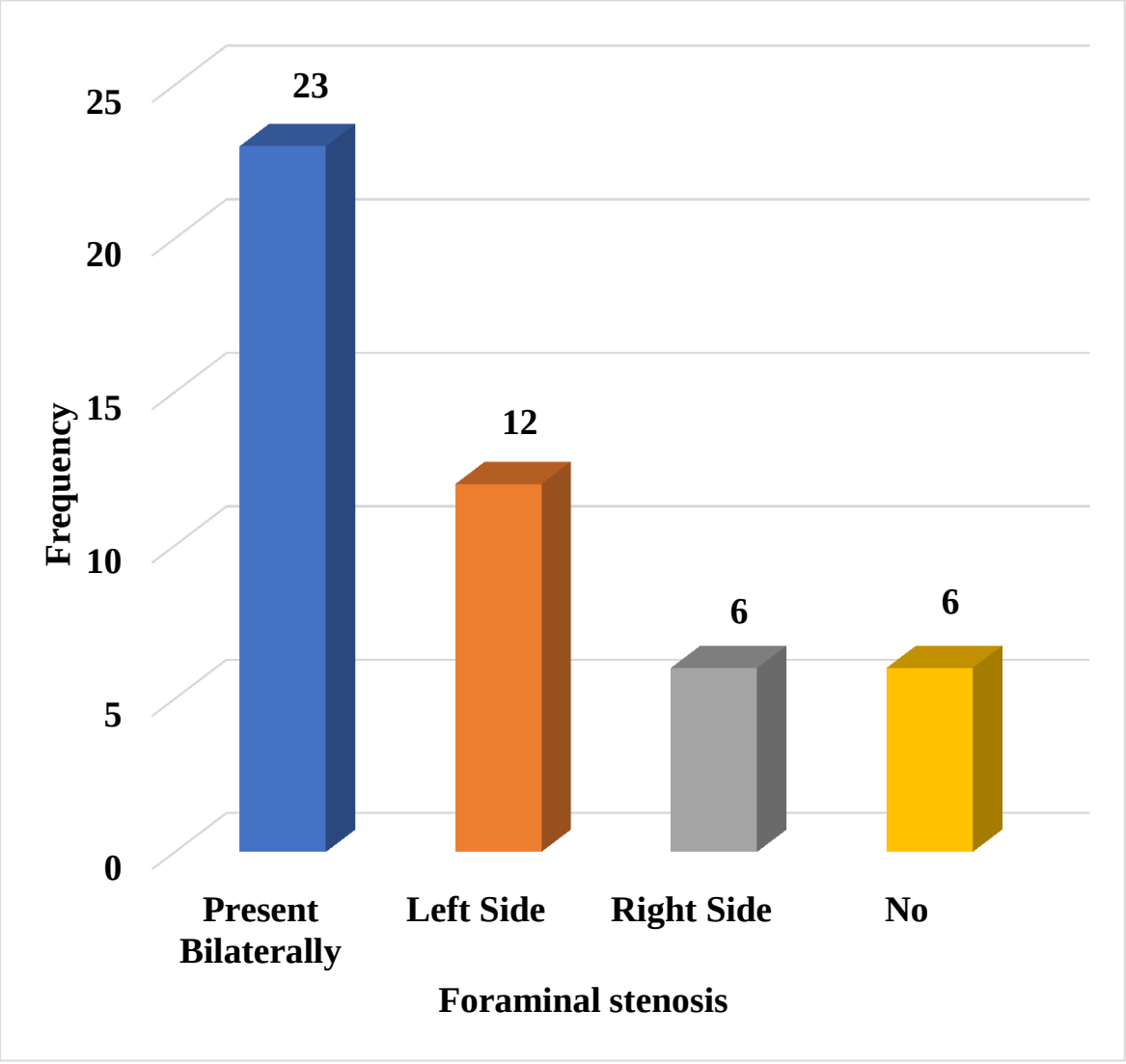


Table 15: Allotment of enrolled samples with respect to the presence of correlation between clinical, MRI and operative findings.

Correlation	Frequency	Percent
Present	41	87.2
No	6	12.8
Total	47	100

An 87.2% correlation was reported between the clinical, MRI, and surgical data among the research participants in this investigation.

Figure 22: Allotment of enrolled samples with respect to the presence of correlation between clinical, MRI and operative findings.

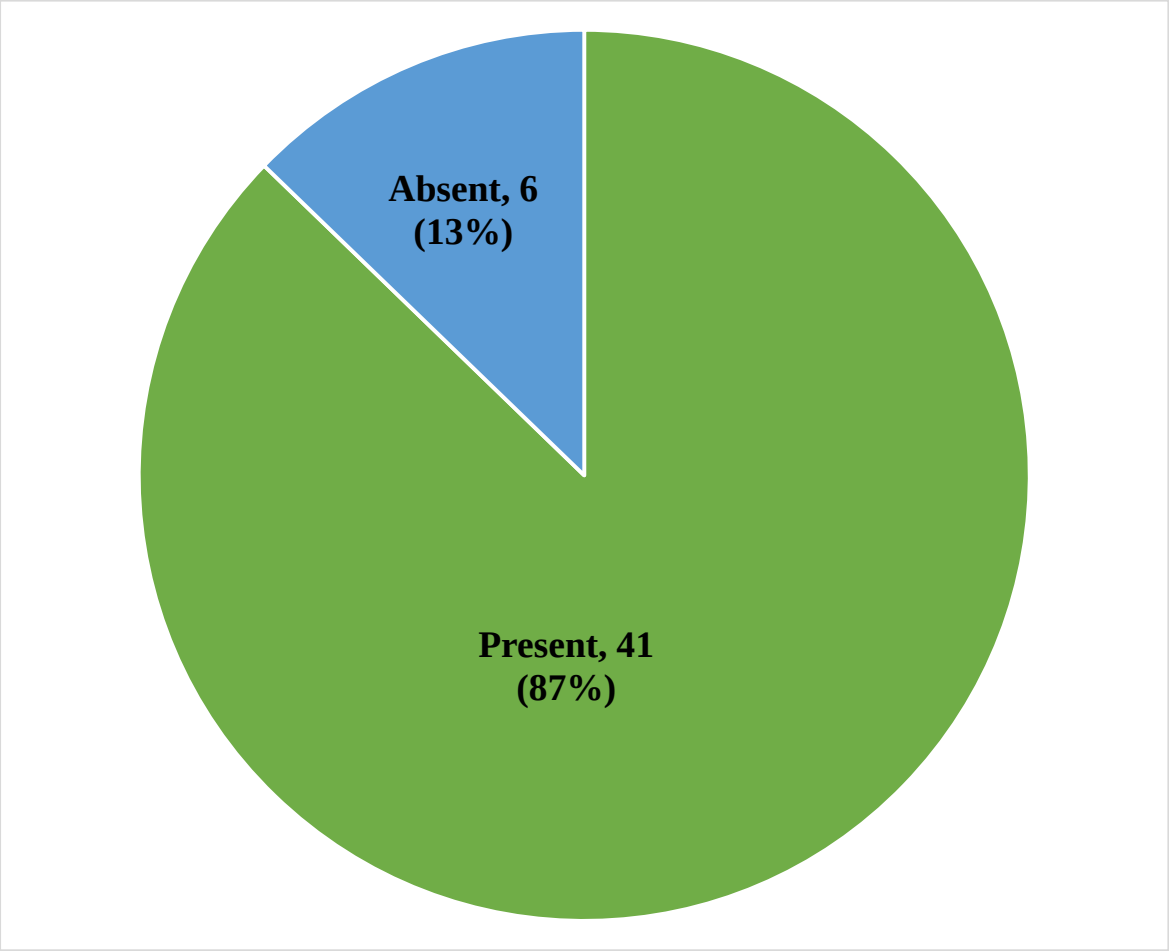
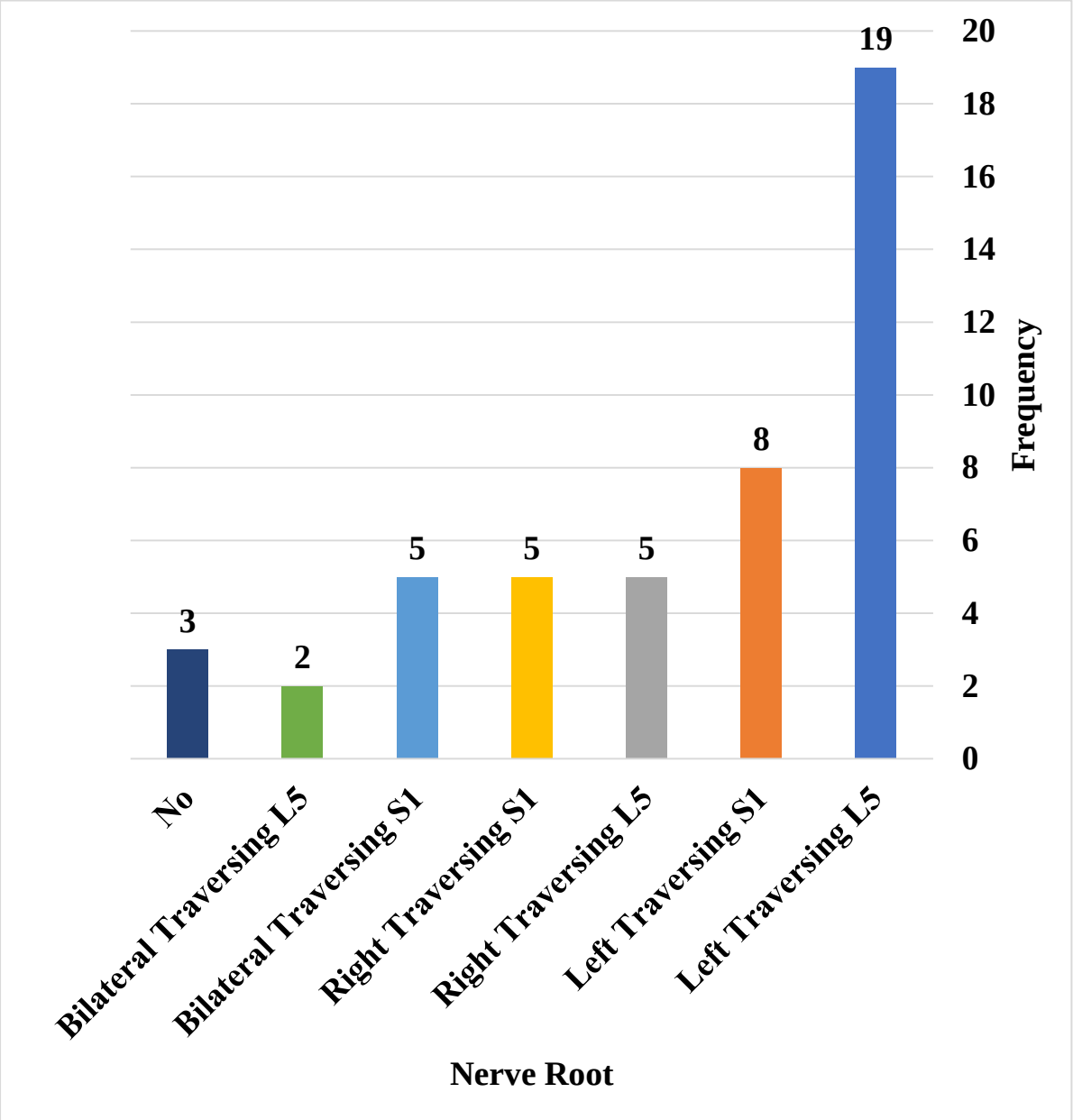


Table 16: Allotment of enrolled samples with respect to nerve root compression.

Nerve root	Frequency	Percent
Bilateral Traversing L5	2	4.3
Bilateral Traversing S1	5	10.6
Left Traversing L5	19	40.4
Left Traversing S1	8	17
Right Traversing L5	5	10.6
Right Traversing S1	5	10.6
No	3	6.3
Total	47	100

The study found that the most frequent occurrence of nerve root compression among the patients was identified at the left Traversing L5 level, while the second most common occurrence was noticed at the left Traversing S1 level.

Figure 23: Allotment of enrolled samples with respect to nerve root compression.



DISCUSSION

DISCUSSION

This prospective observational study included 47 patients diagnosed with Lumbar Intervertebral disc prolapse and having had unsuccessful conservative therapy for a minimum of eight weeks in the Orthopaedics department. This treatment regimen consists of a well-organized schedule of rest, accompanied by analgesic medication, and then followed by physiotherapy.

The clinical criteria utilized encompassed the presence of pain in the back that extends to the lower leg, as well as the existence of a neurological impairment. The documented MRI results encompassed the location, type, migration, amount of prolapse, high intensity zone, as well as the existence of lateral recess and foraminal stenosis. Surgical intervention was administered to patients who satisfied both the clinical and MRI criteria. Subsequently, the intraoperative data were compared and analysed in relation to the clinical along with MRI Findings of the patients.

Comparison of basic characteristics of the study patients with similar studies

The average age of the enrolled samples diagnosed with LIDP was 43.66 ± 9.38 years. Our study found that 78.7% of the subjects were male, while the remaining 21.3% were female.

The connection between MRIF and patients' reports of DP was investigated in a 2012 study by Bajpai et al. in India. [1] With an average age of 44.5 years, the gender distribution was as expected: 43 males as well as 32 women.

In 2012, Saleem and colleagues carried out a research study in Pakistan that was a cross-sectional study. The participants in this study were 163 people who had LDH.[44] The average age of the patients was 43.92 years, with a standard deviation of 11.76 years. Females made up 41.7% of the entire population, while males made up 58.3% of the overall population, with 95 people being males.

Table 17: Comparison of basic characteristics of the study patients with similar studies

Study	**Mean age of participants in years**	**Percentage of men**
Present study	43.66 ± 9.38	78.7
Bajpai et al[1]	44.5	57.3
Saleem et al[44]	43.92 ± 11.76	58.3
Dutta et al[41]	49	58
Wittenberg et al[40]	41	60

In 2019, Lakshmeesha et al did research in India including 58 individuals who presented with symptoms of LDH at the orthopaedic OP. These individuals were diagnosed with LIDP and the diagnosis was subsequently confirmed using MRI.[43] The age range of 45 patients, out of 58 total patients, was between 30 and 50 years old. There were 55% male patients and 45% female patients among those who were admitted.

Dutta et al conducted prospective research in India in 2016. The study comprised 50 samples with LDH during a 2-year period. [41] For the purpose of this investigation, the average age of the patients was 49 years old, with 58% being male and 42% being female.

In the year 1997, Wittenberg et al. conducted a follow-up study of fifty-four patients utilizing MRI prior to performing a microdiscectomy in Germany. [40] Their ages ranged between 19 and 72 years old, with the average being 41 years old at the time of the treatment. This group consisted of sixty percent males.

Comparison of clinical features of the study patients with similar studies

Among the study participants with LIDP, bilateral radiculopathy was found in 14.9% of them. Left radiculopathy was seen in 53.2% of the samples, while right radiculopathy was observed in 31.9% of the patients.

In a study by Bajpai in 2012, there were a total of 48 patients, which is 64 percent of the total, who suffered LDH. Six patients, which is 8 percent, had symptoms on both sides of their body, and the remaining 22 patients were on the left side and 20 patients were on the right side. [1]

Comparison of MRI findings of the study patients with similar studies

In our study MRI results indicate that 59.6% of the subjects exhibited intervertebral disc prolapse at the L4-L5 region. The remaining 40.4% was detected specifically at the L5-S1 level.

Similar finding was observed in the study by Nasir et al in which they carried out a correlational study among 32 diagnosed patients with lumbar disc prolapse in Pakistan by 2022. [3] A significant prevalence of disc prolapse was seen at the L4-L5 region. In 2012, Saleem et al conducted a cross-sectional study in Pakistan with 163 patients diagnosed with lumbar disc degeneration.[44] The incidence of disc degeneration was most pronounced at the L4-L5 level, as reported in 105 (64.4%) patients.

Table 18: Comparison of most common level of lumbar disc prolapse with similar studies.

Study	Commonest level of LDP	Percentage
Present study	L4-L5	59.6
Nasir et al[3]	L4-L5	31.3
Saleem et al [44]	L4-L5	64.4
Lakshmeesha et al[43]	L4-L5	60.3
Sahil Singla[47]	L5-S1	55

In 2019, Lakshmeesha did research in India.[43] The MRI showed that the level that was impacted the most frequently was the L4 and L5 level, which was detected in 35 different people. There were seven individuals who had L5 and S1 observed, while there were two patients who had L3 and L4 viewed. A total of 14 individuals experienced prolapse of discs at two levels, with the most prevalent levels being L4-L5 and L5-S1. Annular tear was seen in the MRI results of 59.6% of the individuals included in this research.

In 2016, Dutta conducted a prospective study in India. The research included 50 consecutive individuals with lumbar disc herniation who had discectomy over a span of 2 years. [41] A total of 16 individuals, accounting for 32% of the sample, exhibited annular tear on the MRI scan.

Among the research samples, the caudal side was the most frequent location for migration of herniation fragments, as evidenced in MRI results (6.4%). Among the research patients, the migration of herniated fragments to the cranial side was the second most prevalent, accounting for 4.2%.

Bajpai conducted a study in India. [1] Among the 75 patients examined in this investigation, 21 individuals exhibited the presence of herniated tissue causing foraminal invasion at one or more levels. However, a total of 48 individuals had radiculopathy.

Our study found that the most frequent occurrence of nerve root compression among the patients was identified at the left Traversing L5 level, while the second most common occurrence was noticed at the left Traversing S1 level.

Janardhana et al conducted a study in India in 2010 with 119 persons who had received a clinical diagnosis of lumbar disc prolapse.[16] According to the results, neural foramen compromise was observed in 157 among the 290 levels of DH in 119 different people. Nerve root compression was seen at 66 different levels.

In 2019, Lakshmeesha conducted a study. The diagnosis was later verified by MRI.[43] A total of 72.4% patients were found to have neurological involvement, whereas the remaining 27.6% patients did not exhibit any signs of having this involvement.

In our study, about 38.3% of the research participants had lumbar disc herniation in the central position, which was the most frequently seen in the MRI findings. The central and left paracentral location were the second most frequently seen (21.3%), followed by the right paracentral location (12.8%). Extrusion was the type of LDH that was shown to be the most prevalent in the MRI findings of the people who participated in the research. It accounted for 48.9% of the total. Protrusion was the subsequent most seen form among the patients who participated in the study, accounting for 40.4% of all instances investigated.

Saini et al conducted a prospective observational research in 2022 in India, focusing on 201 patients with LDH. [10] As indicated on MRI scans, the study found that among the group of people who had been diagnosed with LDH, 36.8% of them presented a bulge, 50.2% of them had a protrusion, 10.4% of them had extrusion, and 2.5% of them displayed sequestration. The study revealed that 38.3% of patients with LDH had a central location on MRI, whereas 31.8% had a foraminal impression, 28.8% had a paracentral picture, and 1% had an extraforaminal impression.

Janardhana conducted a research.[16] A total of 208 disc bulges were observed among 119 individuals. A total of 56 levels (including 43 individuals) exhibited disc protrusion. In a total of twenty-six cases, disc extrusion was seen, and twenty of those cases displayed fragment migration. With regard to the 56-

disc protrusions, 31 were situated in the central region, 23 were situated in the centro-lateral region, and two were situated in the far lateral region. Out of the total of 26-disc extrusions, 10 were located centrally, while the remaining 16 were situated in the centro-lateral region.

Dutta conducted follow up research. [41] Using MRI, the research zeroed in on the exact location of the 51 surgically corrected levels of DP. Out of the total, 33 were identified as paracentral, 14 as central, and four as foraminal.

Bajpai conducted a study [1]. Protrusion was seen in 44 patients, extrusion was present in 14 patients, sequestration was present in two patients, and 15 patients did not have any disc herniation.

Table 19: Comparison of most common type of LDH with similar studies.

Study	Most common type of LDH
Present study	Extrusion (48.9%)
Saini et al[10]	Protrusion (50.2%)
Bajpai et al[1]	Protrusion (58.6%)
Sahil Singla et al[47]	Bulge (53.3%)
Banjade et al[46]	Bulge (45.2%)

Sahil Singla and his colleagues conducted a descriptive cross-sectional research including 60 individuals diagnosed with lumbar disc prolapse. [47] The L5 and S1 level has the highest prevalence of disc herniation, which is 55%. The L4 and L5 level has the second highest prevalence, which is 38.3%, followed by the L3 and L4 level, which has 6.7%. The prevalent form of disc herniation is disc bulging, accounting for 53.3% of cases, followed by protrusion at 36.7%, and extrusion at 10%. Furthermore, the MRI revealed disc bulging in 48 cases (45.28%), protrusion in 46 cases (43.39%), and extrusion in 10 cases (11.32%) at various levels.

Banjade et al. observed that the L5 and S1 level had the highest prevalence of LIDP, accounting for 66.11% of cases. [46]

Comparison of this study correlation with other correlation studies

In our study 87.2% correlation was reported between the clinical, MRI, and surgical data among the research participants with Lumbar Intervertebral disc prolapse.

In 2016, Dutta conducted a prospective study in India. [41]. The researchers established a strong link between the results obtained from MRI scans and the features noticed during surgery.

Table 20: Comparison of Percentage of Correlation between the clinical, MRI, and surgical findings with similar studies.

Study	Percentage of Correlation between the clinical, MRI, and surgical findings
Present study	87.2%
Lakshmeesha et al[43]	94.8%

In 2019, Lakshmeesha conducted a study in India.[43] It was found that there was a substantial correlation between the patients complaints, the MRIF, and the understandings acquired during the surgical operation in 55 out of 58 patients.

Wittenberg et al. conducted prospective research in Germany in 1997. The study comprised a cohort of 54 individuals who had been enduring sciatic pain for an average duration of 12 months. Prior to microdiscectomy, the patients underwent MR imaging. The objective of the researchers was to establish a relationship between the imaging findings and the patients' clinical symptoms, both preoperatively and postoperatively. [40] The neurological impairment, assessment of straight leg raising, and examination of reflexes were conducted throughout the follow-up period in a group of 49 patients. These findings were then compared to the results of the MRI scans acquired before to the surgical procedure. There was no substantial association observed between the clinical complaints and the MRI results.

In 2022, Nasir et al conducted a correlational research [3]. Their conclusion was that there was no link between the MRIF and patients data of individuals with LIDP at L2 and L3.

CONCLUSION

CONCLUSION

In our study, 87.2% correlation was reported between the clinical, MRI, and surgical data among the research participants admitted with Lumbar Intervertebral disc prolapse. MRI is a valuable preoperative diagnostic tool that reveals structural alterations in the disc, as well as the dimensions and location of the extrusion or protrusion. The criteria for performing surgery in cases with prolapsed intervertebral disc is well-established.

Nevertheless, the choice to do surgery should only be taken when precise clinical observations, together with MRI results, enable the precise identification of the responsible fragment and sources of discomfort.

LIMITATION

- Given the limited number of people who participated and the restriction of the research to a specific site, it is plausible that the findings may not be applicable to the entire community.
- Functional outcome was not included in our study.

SUMMARY

SUMMARY

This prospective observational study included 47 patients hospitalized to RL Jalappa hospital from September 2022 to December 2023, diagnosed with Lumbar Intervertebral disc prolapse, and having had unsuccessful conservative therapy for a minimum of eight weeks in the Orthopaedics department. This treatment regimen consists of a well-organized schedule of rest, accompanied by analgesic medication, and then followed by physiotherapy.

The clinical criteria utilized encompassed the presence of pain in the back that extends to the lower leg, as well as the existence of a neurological impairment. The documented MRI results encompassed the location, type, migration, amount of prolapse, high intensity zone, as well as the existence of lateral recess and foraminal stenosis. Surgical intervention was administered to patients who satisfied both the clinical and MRI criteria. Subsequently, the intraoperative data were compared and analysed in relation to the clinical along with MRI Findings of the patients.

The average age of patients diagnosed as LIDP was 43.66 ± 9.38 yrs. The study found that 78.7% of the subjects were male, while the remaining 21.3% were female. Among the study participants with LIDP, bilateral radiculopathy was found in 14.9% of them. Left radiculopathy was seen in 53.2% of the samples, while right radiculopathy was observed in 31.9% of the patients.

The MRI results indicate that 59.6% of the subjects exhibited intervertebral disc prolapse at the L4-L5 region. About 38.3% of the research participants had lumbar disc herniation in the central position, the central and left paracentral location were the second most frequently seen (21.3%), followed by the right paracentral location (12.8%). A high intensity zone was seen in the MRI results of 59.6% of the individuals included in the research. The MRI results indicate that among the study samples, 36.2% exhibited LRFS on the left side, whereas 21.3% showed these conditions on the right side.

Among the study's samples, the most prevalent kind of lumbar disc herniation observed after surgery was extrusion, accounting for 57.4% of cases. The operative findings revealed that 34% of the research samples had a lateral recess on the left side, whereas 21.3% of the study participants had it documented on the right side. The research samples exhibited bilateral presence in approximately 31.9% of cases. Operative findings revealed that 25.5% of the research samples had foraminal stenosis on the left side, whereas 48.9% of the studied samples exhibited bilateral presence.

An 87.2% correlation was reported between the clinical, MRI, and surgical data among the research participants in this investigation. The study found that the most frequent occurrence of nerve root compression among the patients was identified at the left Traversing L5 level.

The accurate representation of morphometric features in MRI scans makes them a useful tool for preparing for surgery, and there is a robust positive correlation between IOF and MRI results. Nevertheless, the choice to have surgery should only be taken when a thorough examination of clinical evidence, together with MRI results, enables a precise identification of the specific fragment causing the problem and the sources of discomfort.

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ANNEXURE

ANNEXURE

ANNEXURE - 1

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

PATIENT INFORMATION SHEET

STUDY TITLE: "CORRELATION BETWEEN CLINICAL AND MRI FINDINGS WITH INTRA OPERATIVE FINDINGS IN LUMBAR INTERVERTEBRAL DISC PROLAPSE"

Study location: R L Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College, Tamaka, Kolar.

Details- Patients with suspected Lumbar Intervertebral disc prolapse presenting to Department of Orthopaedics of R.L.JALAPPA HOSPITAL AND RESEARCH CENTRE, attached to SRI DEVARAJ URS MEDICAL COLLEGE, TAMAKA, KOLAR

Patients in this study will have to undergo routine blood investigations (CBC, RFT, serum electrolytes, blood grouping, HIV&HBsAG), chest x ray, ECG and MRI of Lumbar spine.

Please read the following information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study we will collect information (as per proforma) from you or a person responsible for you or both. Relevant history will be taken. This information collected will be used only for dissertation and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by the Institutional Ethics Committee and you are free to contact the member of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

CONFIDENTIALITY

Your medical information will be kept confidential by the study doctor and staff and will not be made publicly available. Your original records may be reviewed by your doctor or ethics review board. For further information/ clarification please contact

Dr.NAVINBALAJI R(Post Graduate),
Department of ORTHOPAEDICS,
SDUMC, Kolar
CONTACT NO: 9003599992

ANNEXURE - II

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

INFORMED CONSENT FORM

Case no: **UHID no:**

TITLE: CORRELATION BETWEEN CLINICAL, MRI AND INTRA OPERATIVE FINDINGS IN LUMBAR INTERVERTEBRAL DISC PROLAPSE

I,_____ aged _____ ,after being explained in my own vernacular language about the purpose of the study and the risks and complications of the procedure, hereby give my valid written informed consent without any force or prejudice for Clinical examinations, MRI Scanning and Surgical procedure which is to be performed on me or _____ under any anaesthesia deemed fit. The nature and risks involved in the procedure (surgical and anaesthetical) have been explained to me to my satisfaction.

I have been explained in detail about the Clinical Research on

‘’CORRELATION BETWEEN CLINICAL, MRI AND INTRA OPERATIVE FINDINGS IN LUMBAR INTERVERTEBRAL DISC PROLAPSE**”** being conducted. *I have read the patient information sheet and I have had the opportunity to ask any question. Any question that I have asked, have been answered to my satisfaction.*

I consent voluntarily to participate as a participant in this research. I hereby give consent to provide my history, undergo physical examination, undergo the operative procedure, undergo investigations and provide its results and documents etc to the doctor / institute etc.

For academic and scientific purpose the operation / procedure, etc may be video graphed or photographed. All the data may be published or used for any academic purpose. I will not hold the doctors / institute etc responsible for any untoward consequences during the procedure / study. All the expenses estimated for the patients for above procedure will be beared by the primary investigator.

A copy of this Informed Consent Form and Patient Information Sheet has been provided to the participant.

(Signature & Name of Pt. Attendant) (Signature/Thumb impression & Name of patient)

(Relation with patient)---------

Witness: ----------

ANNEXURE-III

ಮಾಹಿತಿ ಒಪ್ಪಿಗೆ ನಮೂನೆ

ಪ್ರಕರಣ ಸಂಖ್ಯೆ:

IP ಸಂಖ್ಯೆ:

ಶೀರ್ಷಿಕೆ: ಲುಂಬಾರ್ ಇಂಟರ್ವರ್ಟೆಬ್ರಲ್ ಡಿಸ್ಕ್ ಪ್ರೋಲ್ಯಾಪ್ಸ್‌ನಲ್ಲಿ ಇಂಟ್ರಾ ಆಪರೇಟಿವ್ ಅವಿಷ್ಕಾರಗಳೊಂದಿಗೆ ಕ್ಲಿನಿಕಲ್ ಮತ್ತು ಎಂಆರ್ಐ ಸಂಶೋಧನೆಗಳ ನಡುವಿನ ಪರಸ್ಪರ ಸಂಬಂಧ

□ನಾನು, _____ , ನನ್ನ ಸ್ವಂತ ಸ್ಥಳೀಯ ಭಾಷೆಯಲ್ಲಿ ಅಧ್ಯಯನದ ಉದ್ದೇಶ ಮತ್ತು ಕಾರ್ಯವಿಧಾನದ ಅಪಾಯಗಳು ಮತ್ತು ತೊಡಕುಗಳ ಬಗ್ಗೆ ವಿವರಿಸಿದ ನಂತರ, ಕ್ಲಿನಿಕಲ್ ಪರೀಕ್ಷೆಗಳು, MRI ಸ್ಕ್ಯಾನಿಂಗ್ ಮತ್ತು ಸರ್ಜಿಕಲ್ ಪರೀಕ್ಷೆಗಳಿಗೆ ಯಾವುದೇ ಬಲ ಅಥವಾ ಪೂರ್ವಾಗ್ರಹವಿಲ್ಲದೆ ಈ ಮೂಲಕ ನನ್ನ ಮಾನ್ಯ ಲಿಖಿತ ತಿಳುವಳಿಕೆಯನ್ನು ನೀಡುತ್ತೇನೆ. ನನ್ನ ಮೇಲೆ ಅಥವಾ _____ ಯಾವುದೇ ಅರಿವಳಿಕೆ ಅಡಿಯಲ್ಲಿ ಸೂಕ್ತವೆಂದು ಪರಿಗಣಿಸುವ ವಿಧಾನ. ಕಾರ್ಯವಿಧಾನದಲ್ಲಿ ಒಳಗೊಂಡಿರುವ ಸ್ವಭಾವ ಮತ್ತು ಅಪಾಯಗಳು (ಶಸ್ತ್ರಚಿಕಿತ್ಸೆ ಮತ್ತು ಅರಿವಳಿಕೆ) ನನ್ನ ತೃಪ್ತಿಗೆ ನನಗೆ ವಿವರಿಸಲಾಗಿದೆ.

ಲುಂಬಾರ್ ಇಂಟರ್‌ವರ್ಟೆಬ್ರಲ್ ಡಿಸ್ಕ್ ಪ್ರೋಲ್ಯಾಪ್ಸ್‌ನಲ್ಲಿನ ಇಂಟ್ರಾ ಆಪರೇಟಿವ್ ಫೈಂಡಿಂಗ್‌ಗಳೊಂದಿಗೆ ಕ್ಲಿನಿಕಲ್ ಮತ್ತು ಎಂಆರ್‌ಐ ಫೈಂಡಿಂಗ್‌ಗಳ ನಡುವಿನ ಪರಸ್ಪರ ಸಂಬಂಧದ ಕುರಿತು ಕ್ಲಿನಿಕಲ್ ಸಂಶೋಧನೆ ನಡೆಸುತ್ತಿರುವ ಕುರಿತು ನನಗೆ ವಿವರವಾಗಿ ವಿವರಿಸಲಾಗಿದೆ. ನಾನು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಓದಿದ್ದೇನೆ ಮತ್ತು ಯಾವುದೇ ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳಲು ನನಗೆ ಅವಕಾಶವಿದೆ. ನಾನು ಕೇಳಿದ ಯಾವುದೇ ಪ್ರಶ್ನೆಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ಉತ್ತರಿಸಲಾಗಿದೆ. ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವವನಾಗಿ ಭಾಗವಹಿಸಲು ನಾನು ಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದ ಸಮ್ಮತಿಸುತ್ತೇನೆ. ನನ್ನ ಇತಿಹಾಸವನ್ನು ಒದಗಿಸಲು, ದೈಹಿಕ ಪರೀಕ್ಷೆಗೆ ಒಳಗಾಗಲು, ಆಪರೇಟಿವ್ ಪ್ರಕ್ರಿಯೆಗೆ ಒಳಗಾಗಲು, ತನಿಖೆಗೆ ಒಳಗಾಗಲು ಮತ್ತು ಅದರ ಫಲಿತಾಂಶಗಳು ಮತ್ತು ದಾಖಲೆಗಳನ್ನು ಇತ್ಯಾದಿಗಳನ್ನು ವೈದ್ಯರು / ಸಂಸ್ಥೆ ಇತ್ಯಾದಿಗಳಿಗೆ ಒದಗಿಸಲು ನಾನು ಈ ಮೂಲಕ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ.

ಶೈಕ್ಷಣಿಕ ಮತ್ತು ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಕಾರ್ಯಾಚರಣೆ / ಕಾರ್ಯವಿಧಾನ, ಇತ್ಯಾದಿಗಳನ್ನು ವೀಡಿಯೊ ಗ್ರಾಫ್ ಅಥವಾ ಛಾಯಾಚಿತ್ರ ಮಾಡಬಹುದು. ಎಲ್ಲಾ ಡೇಟಾವನ್ನು ಪ್ರಕಟಿಸಬಹುದು ಅಥವಾ ಯಾವುದೇ ಶೈಕ್ಷಣಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಬಳಸಬಹುದು. ಕಾರ್ಯವಿಧಾನ / ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಯಾವುದೇ ಅಹಿತಕರ ಪರಿಣಾಮಗಳಿಗೆ ನಾನು ವೈದ್ಯರು / ಸಂಸ್ಥೆ ಇತ್ಯಾದಿಗಳನ್ನು ಜವಾಬ್ದಾರರನ್ನಾಗಿ ಮಾಡುವುದಿಲ್ಲ.

ಮೇಲಿನ ಕಾರ್ಯವಿಧಾನಕ್ಕಾಗಿ ರೋಗಿಗಳಿಗೆ ಅಂದಾಜು ಮಾಡಲಾದ ಎಲ್ಲಾ ವೆಚ್ಚಗಳನ್ನು ಪ್ರಾಥಮಿಕ ತನಿಖಾಧಿಕಾರಿಯು ಭರಿಸುತ್ತಾನೆ.

ಈ ತಿಳುವಳಿಕೆಯುಳ್ಳ ಸಮ್ಮತಿ ನಮೂನೆಯ ಪ್ರತಿಯನ್ನು ಮತ್ತು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಭಾಗವಹಿಸುವವರಿಗೆ ಒದಗಿಸಲಾಗಿದೆ.

(ರೋಗಿಯ ಸಹಿ ಮತ್ತು ಹೆಸರು.ಸಹಿ ಮತ್ತು ಹೆಸರು) (ಸಹಿ/ಹೆಬ್ಬೆರಳಿನ ಗುರುತು ಮತ್ತು)

ರೋಗಿಯ ಹೆಸರು)

(ರೋಗಿಯೊಂದಿಗಿನ ಸಂಬಂಧ)---------

ಸಾಕ್ಷಿ:----------

(ಸಹಿ ಮತ್ತು ಸಂಶೋಧನಾ ವ್ಯಕ್ತಿ/ವೈದ್ಯರ ಹೆಸರು)----------

ANNEXURE - IV

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

UHID No: **CASE NO:**

TITLE: "CORRELATION BETWEEN CLINICAL, MRI AND INTRA OPERATIVE FINDINGS IN LUMBAR INTERVERTEBRAL DISC PROLAPSE "

1. BASIC DATA

- Name:
- Age/Sex:
- Address:
- Mobile No:
- Date of Procedure:
- Date of Admission/OP:
- Date of Discharge:

History:

General physical examination:

Vitals: Pulse- BP-

RR- Temp-

Systemic examination:

CVS-

RS-

PA-

CNS-

Preexisting systemic illness:

Local examination:

- Swelling :
- Tenderness :
- Right Left

- SLRT :
- Power:

L2 (Hip Flexion)		
L3 (Knee Extension)		
L4 (Ankle Dorsiflexion)		
L5 (EHL)		
S1 (Ankle Plantarflexion)		

- Deep tendon reflexes :
- Distal sensations :
- Peripheral pulsations :

RADIOLOGICAL INVESTIGATIONS:

MRI LS SPINE:

2. DIAGNOSIS:

3. INVESTIGATIONS:

- CBC -
- BT -
- CT -
- Blood grouping -
- Blood urea -
- Serum creatinine -
- Sodium –
- Potassium –
- RBS -

- HIV, HBsAg, HCV –

4. MRI FINDINGS:

- Prolapse level -
- Location -
- Type -
- Migration (superior and inferior) -
- Annular tear -
- Nerve Root Involvement -
- Lateral recess -
- Foraminal stenosis -

5. OPERATIVE TREATMENT:

- Operation date:
- Type of anaesthesia:
- Approach used:

6. INTRAOPERATIVE FINDINGS:

- Type
- Position of the fragment
- Migration
- Annular tear
- Lateral recess and foraminal stenosis -

7. DATE OF DISCHARGE:

ANNEXURE- V

MRI AND INTRAOPERATIVRE IMAGES

CASE 1:

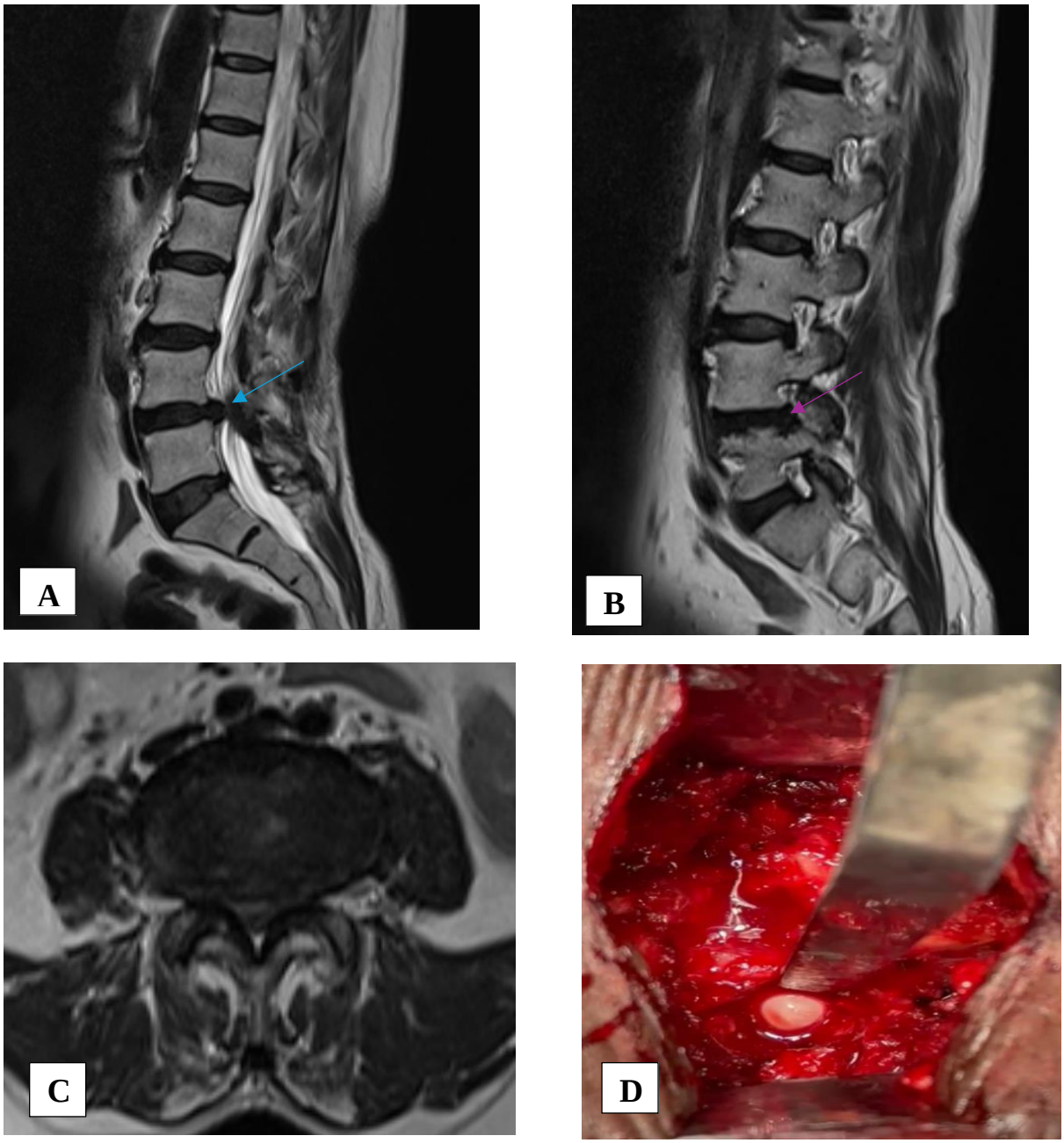

Figure 24 (A, B, C & D): A,B & C shows MRI T2 Sagittal & right parasagittal section of lumbar spine and axial section at L4-5 level with disc protrusion compressing thecal sac and cauda equine causing severe spinal canal stenosis (yellow arrow), narrowing of bilateral lateral recesses & neural foramina and abutting right traversing nerve root (green arrow)**. D** shows intra-operative disc protrusion at L4-5 level.

CASE 2:

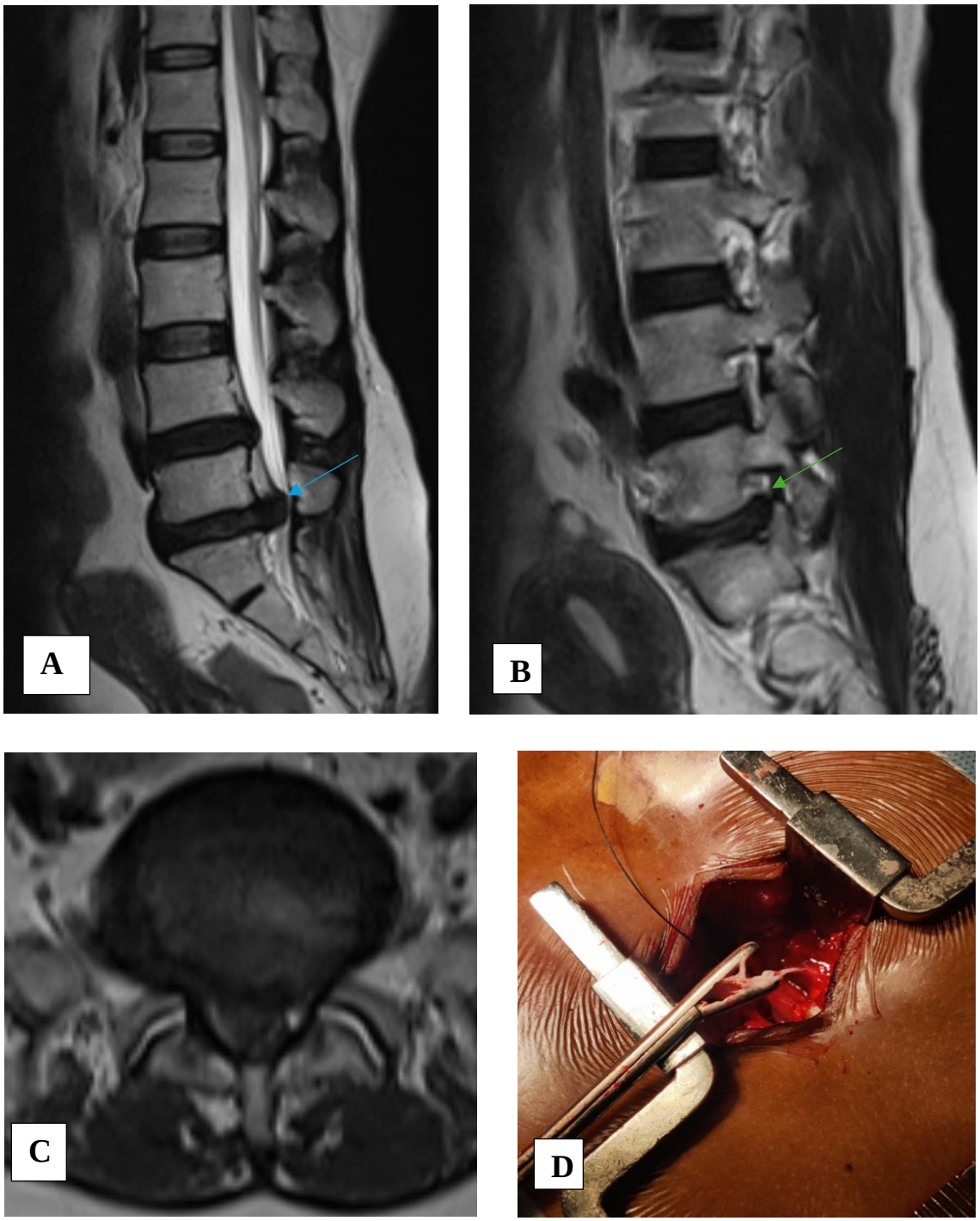

Figure 25 (A, B & C) shows MRI T2 Sagittal & right parasagittal section of lumbar spine and axial section at L5-S1 level with shows central disc protrusion causing severe spinal canal stenosis (yellow arrow), narrowing of bilateral lateral recesses & neural foramina and compressing right traversing nerve root (green arrow)**. D** shows Extracted disc from L5-S1 level.

CASE 3:

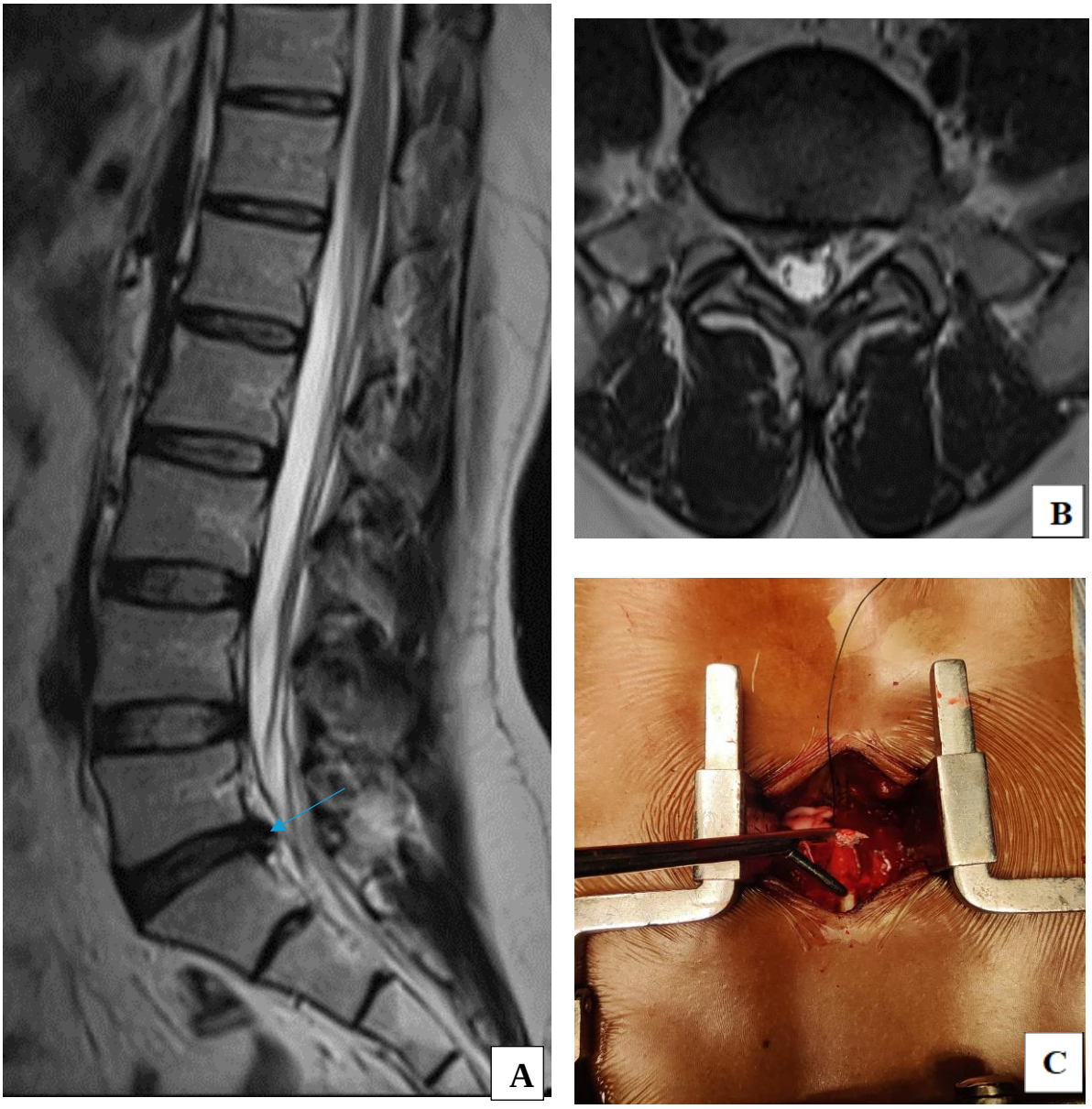

FIGURE 26: A,B shows MRI saggital section of lumbar spine and axial section at L5-S1 level showing asymmetrical disc protrusion predominenetly in right para-central location causing moderate spinal canal stenosis, narroeing of right lateral recess and compressing right traversing nerve root. **C** shows Intraoperative image of disc extraction from L5-S1 level.

CASE 4:

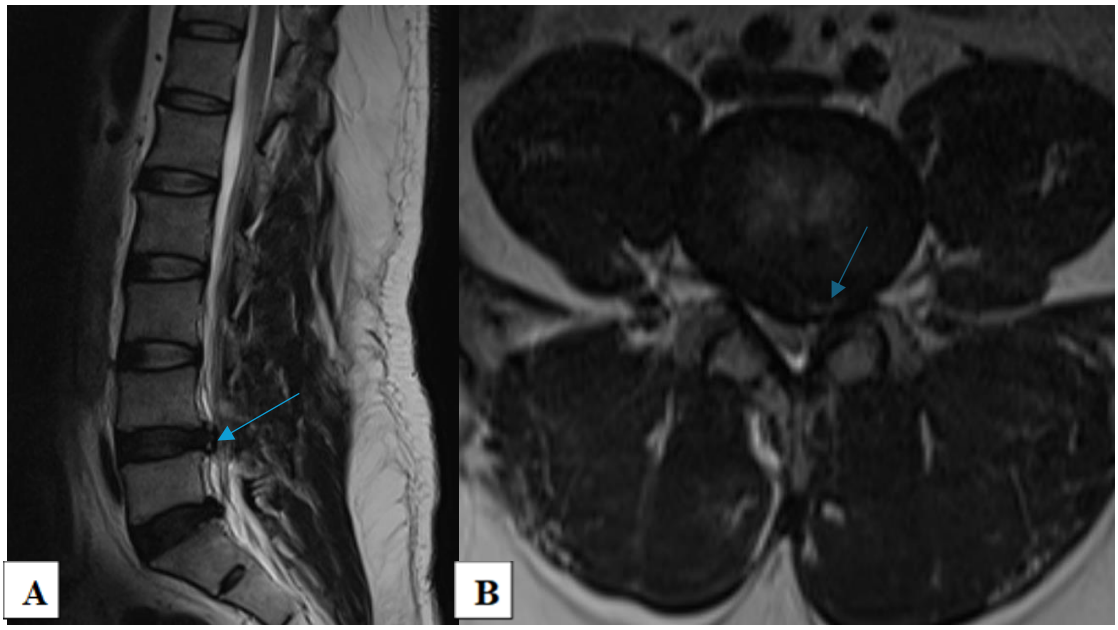

Figure 27 (A & B): MRI T2 Sagittal section of lumbar spine and axial section at L4-S5 level with shows asymmetrical disc protrusion (yellow arrow) with left para-central annular tear (blue arrow) causing severe spinal canal stenosis, narrowing of bilateral lateral recesses (left > right) & neural foramina and abutting left exiting nerve root.

CASE 5:

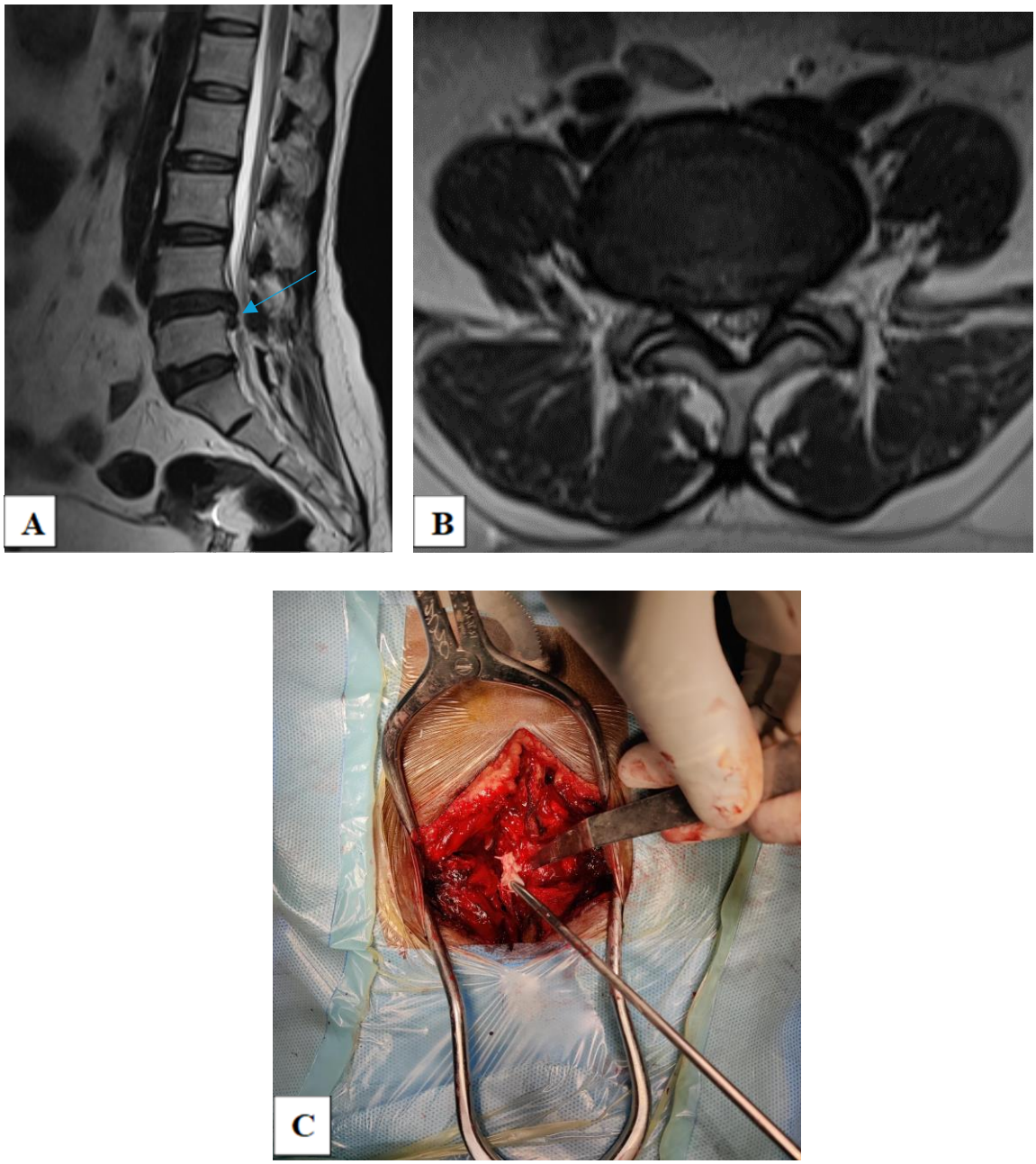

Figure 28 (A & B): MRI T2 Sagittal section of lumbar spine and axial section at L4-S5 level showing diffuse asymmetrical disc bulge with disc extrusion at right para-central location with caudal migration compressing thecal sac and causing severe spinal canal stenosis. There is obliteration of bilateral lateral recess, moderate bilateral foraminal narrowing, compression of bilateral traversing nerve roots and abutment of right exiting nerve root. **C Shows** Extraction of extruded disc from L4-L5 level.

ANNEXURE VI

KEY TO MASTER CHART

M- MALE

F- FEMALE

RT- RIGHT

LT- LEFT

B/L- BILATERAL

LR & FS -LATERAL RECESS AND FORAMINAL STENOSIS

AT- ANNULAR TEAR

MASTER CHART

S.NO		Age	Gender	RADICULOPATHY			MRI FINDINGS							INTRA-OPERATIVE FINDINGS					CORRELATION
	UHID			RT	LT	B/L	LEVEL	LOCATION	TYPE	MIGRATION	AT	NERVE ROOT	LR & FS	TYPE	MIGRATION	AT	LR	FS	
1	357153	27	Male	NO	YES		L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
2	333342	41	Male	YES	NO		L4-L5	CENTRAL AND RT PARACENTRAL	PROTRUSION	NO	ABSENT	RT TRAVERSING L5	RT SIDE	PROTRUSION	NO	ABSENT	RIGHT SIDE	RIGHT SIDE	PRESENT
3	339504	55	Male	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
4	306982	40	Male	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING S1	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
5	350946	55	Male	YES	NO		L4-L5	CENTRAL AND B/L PARACENTRAL	EXTRUSION	NO	PRESENT	RT TRAVERSING L5	RT SIDE	EXTRUSION	NO	PRESENT	RIGHT SIDE	RIGHT SIDE	PRESENT
6	344448	44	Female	YES	YES	YES	L4-L5	CENTRAL	SEQUESTRATION	CAUDAL	PRESENT	B/L TRAVERSING L5	NO	SEQUESTRATION	CAUDAL	PRESENT	NO	NO	PRESENT
7	282256	51	Male	YES	NO		L5-S1	RT PARACENTRAL	EXTRUSION	NO	PRESENT	RT TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
8	197369	32	Male	YES	NO		L5-S1	RT PARACENTRAL	PROTRUSION	NO	ABSENT	RT TRAVERSING S1	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
9	155405	40	Female	NO	YES		L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
10	192972	55	Female	YES	YES	YES	L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	B/L TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
11	184273	36	Male	YES	YES	YES	L4-L5	CENTRAL	EXTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	SEQUESTRATION	CAUDAL	PRESENT	OBLITERATED B/L	PRESENT B/L	NO
12	181718	42	Male	YES	NO		L4-L5	CENTRAL AND B/L PARACENTRAL	EXTRUSION	NO	PRESENT	RT TRAVERSING L5	RT SIDE	EXTRUSION	NO	PRESENT	RIGHT SIDE	PRESENT B/L	PRESENT
13	187091	40	Female	NO	YES		L4-L5	LT PARACENTRAL	SEQUESTRATION	CRANIAL	PRESENT	LT TRAVERSING L5	LT SIDE	SEQUESTRATION	CRANIAL	PRESENT	LEFT SIDE	LEFT SIDE	PRESENT
14	276115	58	Male	YES	NO		L5-S1	RT PARACENTRAL	PROTRUSION	NO	ABSENT	RT TRAVERSING S1	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
15	281255	53	Male	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING L5	LT SIDE	EXTRUSION	NO	PRESENT	LEFT SIDE	LEFT SIDE	PRESENT
16	279358	43	Male	YES	NO		L5-S1	RT PARACENTRAL	EXTRUSION	NO	PRESENT	RT TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
17	278227	58	Male	NO	YES		L4-L5	LT PARACENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
18	146645	32	Male	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING L5	LT SIDE	EXTRUSION	NO	PRESENT	LEFT SIDE	LEFT SIDE	PRESENT
19	250541	53	Female	YES	NO		L4-L5	CENTRAL AND B/L PARACENTRAL	EXTRUSION	NO	PRESENT	RT TRAVERSING L5	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
20	153659	27	Male	NO	YES		L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
21	249444	48	Female	YES	NO		L4-L5	CENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	EXTRUSION	NO	PRESENT	OBLITERATED B/L	PRESENT B/L	NO
22	251189	48	Female	YES	YES	YES	L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	B/L TRAVERSING S1	B/L	EXTRUSION	NO	PRESENT	OBLITERATED B/L	PRESENT B/L	PRESENT
23	255664	42	Male	NO	NO		L4-L5	CENTRAL	PROTRUSION	NO	ABSENT	NO	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
24	265599	45	Female	NO	YES		L4-L5	LT PARACENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
25	294630	43	Male	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	SEQUESTRATION	CAUDAL	PRESENT	LT TRAVERSING L5	LT SIDE	SEQUESTRATION	CAUDAL	PRESENT	LEFT SIDE	LEFT SIDE	PRESENT
26	248874	58	Female	NO	YES		L4-L5	LT PARACENTRAL	PROTRUSION	NO	ABSENT	NO	NO	EXTRUSION	NO	PRESENT	LEFT SIDE	LEFT SIDE	NO
27	257920	44	Female	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
28	286073	41	Male	NO	YES		L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
29	293954	23	Male	YES	YES	YES	L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	B/L TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
30	340727	42	Female	YES	NO		L5-S1	CENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING S1	NO	EXTRUSION	NO	ABSENT	RIGHT SIDE	RIGHT SIDE	NO
31	294094	40	Male	NO	YES		L4-L5	LT PARACENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
32	285365	37	Female	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
33	200434	23	Female	YES	YES	YES	L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	B/L TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
34	222528	27	Female	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	SEQUESTRATION	CRANIAL	PRESENT	LT TRAVERSING L5	LT SIDE	SEQUESTRATION	CRANIAL	PRESENT	LEFT SIDE	PRESENT B/L	PRESENT
35	230081	27	Male	YES	YES	YES	L5-S1	RT PARACENTRAL	PROTRUSION	NO	ABSENT	NO	NO	EXTRUSION	NO	PRESENT	LEFT SIDE	LEFT SIDE	NO
36	131043	45	Male	YES	NO		L4-L5	CENTRAL AND B/L PARACENTRAL	EXTRUSION	NO	PRESENT	RT TRAVERSING L5	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
37	138577	49	Male	NO	YES		L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING S1	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
38	215198	45	Male	YES	YES	YES	L4-L5	CENTRAL	EXTRUSION	NO	PRESENT	B/L TRAVERSING L5	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
39	280450	50	Male	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING L5	LT SIDE	EXTRUSION	NO	PRESENT	LEFT SIDE	PRESENT B/L	PRESENT
40	339737	36	Female	YES	NO		L5-S1	RT PARACENTRAL	PROTRUSION	NO	ABSENT	RT TRAVERSING S1	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
41	346964	32	Male	NO	YES		L4-L5	LT PARACENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT
42	333114	35	Male	YES	NO		L4-L5	CENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	EXTRUSION	NO	PRESENT	OBLITERATED B/L	PRESENT B/L	NO
43	155983	41	Male	NO	YES		L4-L5	LT PARACENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	LT SIDE	PROTRUSION	NO	ABSENT	LEFT SIDE	LEFT SIDE	PRESENT
44	156084	45	Male	YES	YES		L5-S1	CENTRAL	SEQUESTRATION	CAUDAL	PRESENT	B/L TRAVERSING S1	NO	SEQUESTRATION	CAUDAL	PRESENT	NO	NO	PRESENT
45	156110	46	Male	NO	YES		L4-L5	CENTRAL AND LT PARACENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING L5	LT SIDE	EXTRUSION	NO	PRESENT	LEFT SIDE	LEFT SIDE	PRESENT
46	156002	45	Male	NO	YES		L5-S1	CENTRAL	EXTRUSION	NO	PRESENT	LT TRAVERSING L5	NO	EXTRUSION	NO	PRESENT	NO	NO	PRESENT
47	187093	52	Male	NO	YES		L4-L5	LT PARACENTRAL	PROTRUSION	NO	ABSENT	LT TRAVERSING L5	NO	PROTRUSION	NO	ABSENT	NO	NO	PRESENT