

# Magnetic Resonance Imaging Evaluation for Chronic Back

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## Abstract-

### Background

Low back pain is defined as pain below the costal margin & above the inferior gluteal fold, with or without radiculopathy. It is called chronic if it persists for three months or more. It is one of the common indications for MRI in our clinical practice. The causes of low back pain include degenerative changes, spinal stenosis, neoplasm, infection, trauma, and inflammatory or arthritic processes. Among these, lumbar disc degeneration is the most commonly diagnosed abnormality associated with chronic low back pain.

### Aims and objectives

- To evaluate MRI findings of chronic lower back pain in the adult population in Birgunj.
- To determine the causes of chronic lower back pain by MRI imaging.

### Methodology

This is a descriptive cross-sectional study conducted into the Department of Radio-diagnosis and orthopaedics and trauma surgery, National medical college teaching hospital, Birgunj, Parsa, Nepal for the 1 year duration. Patients included in this study were 20 years and above with low back pain. With ethical clearance from the Institutional Review Committee of National Medical College and after obtaining the informed consent of the patient. MRI imaging of patients with low back pain done by using MRI Machine

### Result

In this total 92 patients were included with chronic low back pain presented in orthopedics out patient department advised for MRI of lumbosacral spine.

### Conclusion

This study includes symptomatic patients who came for MRI in the imaging center and may not represent the general population. Direct correlation of clinical symptoms i.e., radiculopathy with MRI findings was not performed in this study.

**Key World-** Chronic low back pain, MRI, Degenerative change, Disc, Neural foramina, Disc height.

## INTRODUCTION

Low back pain is defined as pain below the costal margin & above the inferior gluteal fold, with or without radiculopathy. It is called chronic if it persists for three months or more (1). It is one of the common indications for MRI in our clinical practice. The causes of low back pain include degenerative changes, spinal stenosis, neoplasm, infection, trauma, and inflammatory or arthritic processes. Among these, lumbar disc degeneration is the most commonly diagnosed abnormality associated with chronic low back pain (2). There are varieties of factors that contribute to this condition. Aging, axial loading of the disc, vascular growth, and abnormalities in collagen and proteoglycan all contribute to disc degeneration. Disc herniation with radiculopathy and chronic discogenic low back pain is the result of this degenerative process (3).

Although numerous modalities are available, magnetic resonance imaging (MRI) has emerged as the procedure of choice for the diagnostic imaging of painful conditions involving the lumbar region. MRI is non-invasive and does not require the use of ionizing radiation, it is safer than conventional plain film radiography or other commonly used procedures such as computerized tomography, myelography, discography, or radio nuclear bone scanning. The high degree of soft-tissue contrast and excellent spatial resolution characteristics of MRI has allowed examiners to observe lumbar anatomy in precise detail and to detect morphologic and biochemical abnormalities that were not observable previously. This dramatic increase in detection sensitivity has provided invaluable data for diagnosing degenerative, infectious, inflammatory, neoplastic, and metabolic disorders. Additionally, it has assisted in the generation of hypotheses relating to the role of many musculoskeletal abnormalities in the production of lower back pain or radiculopathy. It has also emerged as an investigation of choice over the other investigations for a herniated disc and has become a gold standard to diagnose the herniated disc (4). Globally, lower back pain ranks the highest in terms of disability and sixth in terms of overall burden with a point prevalence of 9.4% (5). In Nepal, the overall prevalence of lower back pain is 57.1% and that of chronic lower back pain is 16.4% (1). It has been estimated that one in every five adults suffers from chronic or recurring pain and another one in every 10 adults is newly diagnosed with chronic pain each year around the world (6).

Although back pain usually resolves spontaneously within 1 to 4 weeks, approximately 33% of individuals with low back pain continue to have persistent moderate-to-severe pain 1 year later, and approximately 20% of patients with back pain have pain that

is severe enough to cause substantial limitations of normal activities (7).

### **Aims and objectives**

To evaluate MRI findings of chronic lower back pain in the adult population in Birgunj.

To determine the causes of chronic lower back pain by MRI imaging.

### **Review of literature**

The occurrence of low back pain is associated with age, physical fitness, smoking, excess body weight, and strength of the back and abdominal muscles. Psychological factors associated with the occurrence of back pain are anxiety, depression, emotional instability, and pain behavior (e.g., exaggerated outward display of pain, guarding). Occupational factors, such as heavy work, lifting, bending, twisting, pulling, and pushing, clearly play a role, as do psychological workplace variables, such as job dissatisfaction. Psychosocial aspects of health and work in combination with economic aspects seem to have more impact on work loss than physical aspects of disability and physical requirements of the job.

Iyidobi et al. (2018) conducted study retrospective study of 60 adult patients in which 58.3% were males while 41.7% were females with the majority aged between 40 - 59 years. Their study revealed 90% of the images had disc prolapse while 73% had disc height reduction(8).

The retrospective study conducted by Adekanmi et al. (2018) to determine the prevalence and distribution of lumbosacral spine discs, osseous, ligamentum flavum, and facet joint changes in which there was a total of one hundred and eight low back pain patients in this study with a mean age of 49.9 years and a range of 8 to 77 years. And revealed multiple disc affectation seen in 75.3%; disc bulge (79.8%) was the commonest disc findings followed by dehydration in 74.0% (9).

Thapa et al (2015) conducted a retrospective hospital-based study was done by reviewing MRI report of 202 patients out of which 116 patients (57.4%) were male and 86 patients (42.6%) were female with the mean age of the study population was  $44.26 \pm 15.61$  (13-83) years. The most common involvement was observed at the L4- L5 level (76.7%) and L5-S1 levels (55.9%) followed by L3- L4 (30.6%) of the total cases(10).

### **Methodology**

This a descriptive cross-sectional study conducted into the department of Radiology and Orthopedics and trauma surgery, National Medical College, Birgunj, Parsa, Nepal for the 1 year duration. Patients included in this study were 20 years and above with chronic low back pain. With ethical clearance from the Institutional Review Committee Of National Medical College and after obtaining informed consent of patient. MRI imaging of patients with low back pain done by using MRI Machine ( AIRIS Vento O5 03T Hitachi MRI Scanner)

### **MR Imaging**

Imaging was performed by a trained MR radiographer. Lumbar spine MRI was done using a 0.3 T scanner. The scans consisted of sagittal and axial T1- weighted [repetition time/echo time (TR/TE) of 400/20.3] and T2-weighted (TR/TE of 3018/110 ms) turbo spin-echo and STIR images. The slice thickness of 5 mm was used for both sagittal and axial images. The interslice gap of 5 mm used with 384 x 196 / 512 matrix and a field of view of 300 x 300 were used for sagittal images, and 320 x 324 /512 matrix and a field of view of 300 x 300 mm for axial images. Only the disc spaces and areas adjacent to it were included in the axial scan. Vertebral bodies are not scanned throughout their extent in the axial section.

The variables assessed on MR imaging were: Disk signal changes, disk bulge, foraminal narrowing, loss of lumbar lordosis, spinal canal narrowing, protrusion, Extrusion, sequestration, decreased disc size, annular tear, thickened ligamentum flavum, and endplate change.

### **MR image evaluation**

Interpretation of the MR images was performed by two evaluators (principal investigator and one Radiologist). Initially, all images were screened for evidence of neoplastic, inflammatory infectious disorders or surgical scars and if any, the patient was excluded from the study. Images were examined for any presence of the aforementioned variables. Then each spinal level was examined separately. Almost all patients had more than one (multiple) findings hence at each spine level. In all cases of disagreement between the two observers, a third opinion was sought from another radiologist. The clinical condition of the subjects was compared with the imaging findings.

All the data collected was entered and analyzed by statistical program Statistical Package for Social Sciences (SPSS) version 25. Microsoft Word and Excel have been used to generate graphs, tables, and diagrams. The descriptive results were presented in terms of mean, standard deviation, frequency, and percentage. Chi-square and Fischer's exact test were employed for the analysis of categorical data. Karl Pearson's correlation is used to correlate the different variables.

### **Result**

In this total 92 patients were included with chronic low back pain presented in orthopedics out patient department advised for MRI of lumbosacral spine.

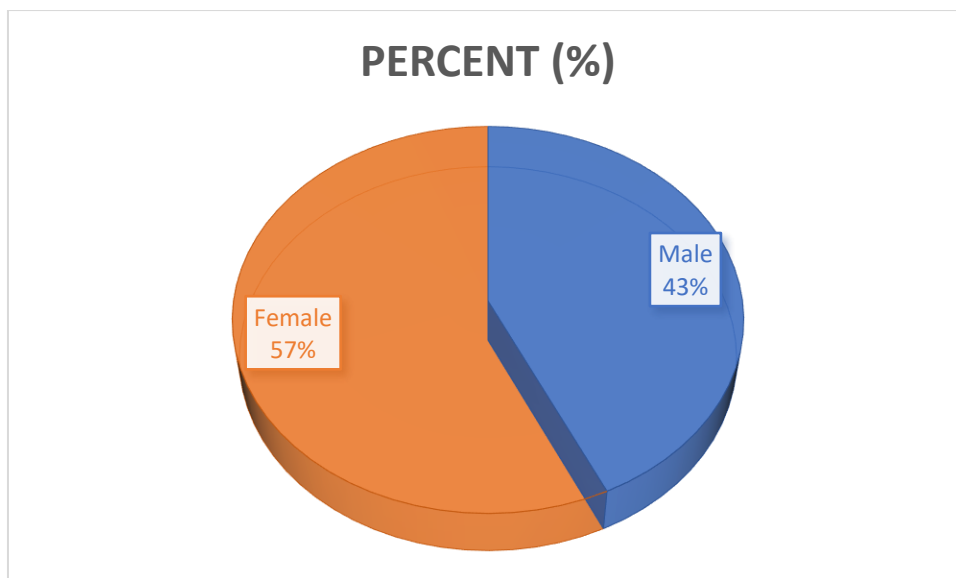


Fig 1: Chart showing the percentage of the number of cases by Gender

Of all the patients, forty (43 %) of the patients were females and fifty-two (57 %) were male, with a male to female ratio of 1.2:1.

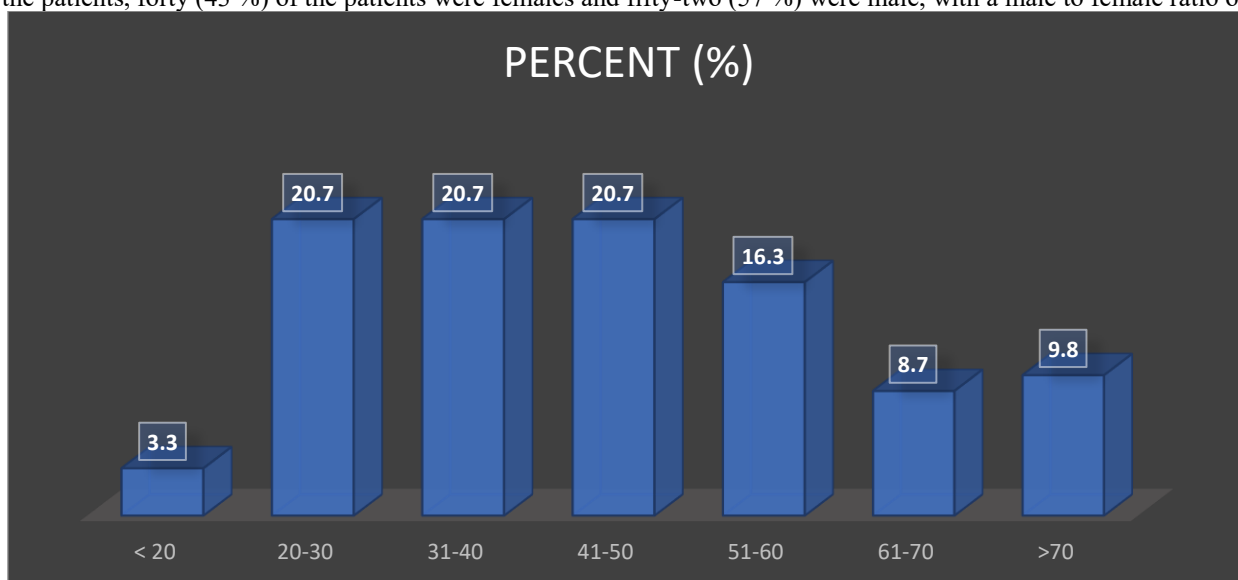


Figure 2: Age distribution of low back pain

The age distribution of the patient as represented in table 1 showed that about 55.5% were aged 40 years and above, while 34.8% were aged 50 years and above having chronic LBP symptoms. The most common age group affected shown by the above bar chart are from 20 to 50 years of age.

Table 1: MRI findings of LS spine in the study population

MRI Findings	No. Of Cases	Percentage
Disc Signal Change	64	69.6
Disc Bulge	86	93.5
Foraminal Narrowing	81	88
Loss of Lumbar Lordosis	24	26.1
Spinal canal narrowing	45	48.9
Protrusion	24	26.1
Extrusion	0	0
Sequestration	0	0
Decreased Dsc Height	10	10.9
Annular Tear	5	5.4
Thickened ligamentum flavum	8	8.7
Endplate change	27	29.3

The above table shows that in this study a total of 92 cases were studied, where there was disc bulge (86%) followed by foraminal narrowing (81%) and Disc signal change (64%). In this study, disc protrusion was the most common type of disc herniation. The annular tear was most frequently noted involving the L4-L5 intervertebral disc. No cases of sequestration and extrusion were found.

in this study. A significant number of patients having osseous changes related to endplate changes was noted involving multiple levels in this study.

**Table 2: Gender distribution of Low back Pain with MRI findings**

Lesion	Male	Female	Total
Disc Signal Change	40	24	64
Disc Bulge	51	35	86
Foraminal Narrowing	47	34	81
Loss of lumbar Lordosis	13	11	24
Spinal canal Narrowing	29	16	45
Protrusion	14	10	24
Extrusion	0	0	0
Sequestration	0	0	0
Decreased Disc Height	8	2	10
Annular Tear	3	2	5
Thickened Ligamentum Flavum	5	3	8
Endplate Change	16	11	27

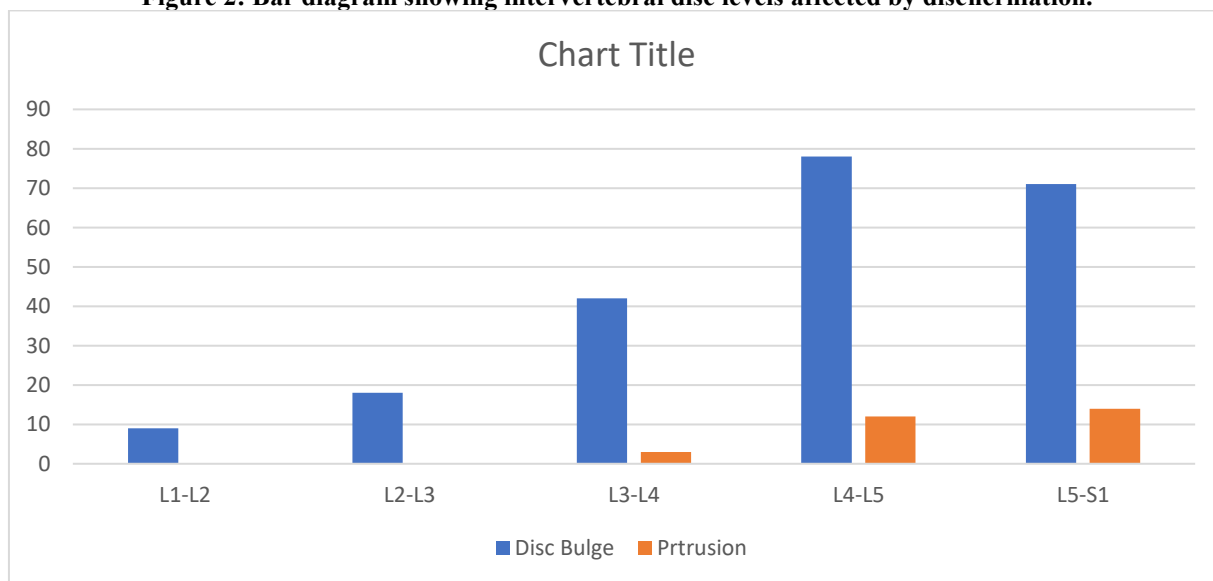
In the distribution of lesions among gender as shown by above Table, Disc bulge was shown to be significantly higher in males. Other findings are also higher in the male patients however they had been no association among these variables with gender except disc bulge. This shows that disc bulges are relatively common findings to be determined in male patients. The protrusion was common findings in the category of disc herniation however there are no patients who showed the findings of extrusion and sequestration. Disc herniation had no significant correlation with the gender of patients.

**Table 3 : The age distribution of lesions**

Lesion/Age	<20	21-30	31-40	41-50	51-60	61-70	>70	Total
Disc Signal Change	2	11	13	11	11	8	8	64
Disc bulge	2	17	17	18	15	8	9	86
Foraminal narrowing	2	17	14	17	15	7	9	81
Loss of Lumbar lordosis	0	5	6	6	4	1	2	24
Spinal canal narrowing	1	6	9	7	10	5	7	45
Protrusion	1	1	4	7	5	2	4	24
Extrusion	0	0	0	0	0	0	0	0
Sequestration	0	0	0	0	0	0	0	0
Decreased Disc Height	0	1	1	3	0	1	4	10
Annular Tear	0	0	0	3	0	1	1	5
Thickened Lig. Flavum	1	0	0	2	0	2	3	8
Endplate Change	0	2	7	3	7	4	4	27

Disc signal change, disc bulge, spinal canal narrowing, protrusion, decreased disc height, thickened ligamentum flavum, endplate changes as represented in Table 3 which had a significant association with the increasing age.

**Figure 2: Bar diagram showing intervertebral disc levels affected by disc herniation.**



The frequency of disc bulge and disc protrusion at different levels was demonstrated in the above bar diagram. The most common disc bulge involvement was observed at the L4-L5 level (84.7 %) and L5-S1 level (77.1%) followed by L3-L4 (45.6%). Disc protrusion was observed most commonly in L5-S1 (15.2%) followed by L4-L5 (13.0%) disc. The most common category was disc

bulge which was common in L4-L5.

## DISCUSSION

The main aim of diagnostic imaging is to form accurate anatomic data which ultimately affects the final therapeutic decision. This tertiary level hospital- based prospective cross-sectional study used 0.3 T MRI for diagnosis causes and its findings in cases of lower back pain. With an overall increase in life expectancy and more patients attending tertiary care hospitals in recent days for LBP, MRI has become an important diagnostic tool for the evaluation of the LS spine. Advantages of MRI include multiplanar capability, no radiation exposure, and is non-invasive with early detection of the lesions as compared to other modalities such as CT scans (11). The most common age group involved in this study was 20 to 50 years which had shown that there is early onset of chronic back pain and had different MRI findings related to different pathology. This study also had shown that 55.5% were aged 40 years and above, while 34.8% were aged 50 years and above. This is comparable to the findings of previous studies showing high prevalence in patients above 40 years of age which increases progressively to over 90% by 50 to 55 years of age (12). The results of this study indicate that around 99% of the patients with chronic LBP have some form of abnormal MRI findings. Almost all cases with MRI findings are related to degenerative changes (96%) and the study was done by Chou et al. had also showed that there is a statistically significant association between the degenerative changes on MRI with patients having symptoms of LBP (13). The most common MRI findings were disc bulges followed by disc desiccation and foraminal narrowing in the lumbar spine among adults whereas annular tear was a relatively rare finding. These observations are similar to studies conducted by Thapa et al. and Karki et al. in a study based on the Nepalese population (10, 14). In another study done by Saleem et al. more common findings were disc herniation and lumbar spinal stenosis (15). This difference maybe because of the population studied in different geographical regions. Disc degeneration was more commonly encountered among males 52 (57%) when compared with females 40 (43%).

On investigation of the patients between the 20 to 70-year-old patients with chronic back pain, it was found that disc degeneration with diffuse disc changes in the lower lumbar spine was commonly found at L4-L5 and L5-S1 IVD levels. The degenerative changes start at an early age in life, that is in the second and third decade observed in this study, and are directly considered to be a part of the normal aging process as explained by Shankar et al., still the primary cause is not known. In the study by Sharma et al., there had been a significant association between spinal canal narrowing, foraminal narrowing, and also with the decreased disc height (16).

In the study conducted by Sharma et al. most common neoplasia was vertebral hemangioma seen in five cases (4.6%). Overall, the findings are similar to another large-scale study done in Nepal (16). There was also one case of chronic back pain (1.08%) which shows no MRI findings whereas in other studies done by Iyidobi et al. (10%) and Verma et al. (11.2%) had slightly increased number of normal cases (8, 17).

## CONCLUSION

This study includes symptomatic patients who came for MRI in the imaging center and may not represent the general population. Direct correlation of clinical symptoms i.e., radiculopathy with MRI findings was not performed in this study.

This study however concluded a baseline of morphological changes in patients with low back pain in various age groups. In this study, MRI findings of degenerative changes which included disc signal changes, disc bulge, spinal canal narrowing, protrusion, decreased disc height, thickened ligamentum flavum and end plate changes were seen to be increasing with age.

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