

## Original article

# Radiological evaluation of spinal diseases in a tertiary care centre

Nimisha E.K <sup>\*1</sup>, Shivaprasad V.R<sup>2</sup>, Vijaykanth Reddy<sup>3</sup>

Department(s) and institution(s)

<sup>\*1</sup> Resident Department of Radiology, Sri Venkateshwaraa Medical College and hospital, Ariyur, Puducherry- 605102, India.

<sup>2</sup> Professor Department of Radiology, Sri Venkateshwaraa Medical College and hospital, Ariyur, Puducherry- 605102, India.

<sup>3</sup> Resident Department of Radiology, Sri Venkateshwaraa Medical College and hospital, Ariyur, Puducherry- 605102, India.

Corresponding author: Dr. NIMISHA.E.K

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### ABSTRACT:

**INTRODUCTION:** Low back pain(LBP) is the most common debilitating condition worldwide, and can result in compromised quality of life. In adults, disc degeneration has been claimed to be the main cause of back pain followed by facet joint pain and sacroiliac joint pain. The present study evaluated the pattern of imaging findings in patients referred with complaints of low back pain in the locality.

**MATERIALS AND METHODS:** This cross sectional study includes 100 patients who were referred to Radiology department for lumbosacral radiograph for low back pain. Approval from scientific and ethical committee was obtained. The subjects were examined using X-ray-600mA, 800mA, Magnetic resonance imaging - Siemens 1.5 Tesla Magnetom. The patients with a known history of trauma, spinal surgery and pediatric age group were excluded from the study. The patients with abnormal X-ray findings were subjected to MRI- LS spine for further evaluation.

**RESULTS:** This study population consists of 65% males and 35% females. The population for the study was a highly selected cohort of patients who could afford MRI. Some of the patients who were referred for MRI did not turn up probably due to socio-economic reasons. MRI and radiographs resulted in nearly identical outcomes for tertiary care patients with low back pain.

**CONCLUSION:** The study revealed the ability of MRI in evaluation of various spine changes and the strength of correlation between MRI and X-ray findings confirms the value of MRI in assessment of back pain.

**KEYWORDS:** low back pain, degenerative disease, X-ray, MRI, radiograph

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### INTRODUCTION

Low back pain is a common cause of morbidity in all individuals. Approximately 2% of the general population presents with complaints of low back pain with or without radiculopathy. It has been estimated that almost 70% of the population will experience back pain sometime in their life. Imaging of spine allows complete evaluation of static and dynamic factors that are related to degenerative disease of the spine. It is also useful in diagnosing different aspects of spine degeneration<sup>2</sup>.

The major role of imaging is to distinguish the 95% of patients with simple back pain from the 5% with serious underlying diseases or neurologic impairments. Night pain is an important differential symptom of certain skeletal neoplasms such as osteoid osteoma and osteoblastoma. The incidence of primary spinal tumors has been estimated at 2.5–8.5 per 100,000 people per year. The incidence of metastatic disease involving the vertebrae, epidural space and leptomeninges accounts for 97% of tumors involving the spine. Primary tumors of the spine,

spinal cord, spinal meninges, and cauda equina are relatively rare.

Patients with a spinal infection also presents with axial back pain that is insidious, non-mechanical and not relieved by rest. Confirmation and localization of a spinal infection usually depend on imaging findings. MRI is preferred because of its high sensitivity and specificity. The lumbar region is most often affected (50% of cases), followed by the thoracic spine (35% of cases) and the cervical spine.

Patients below 40 years who are in economically productive age group are most commonly affected. Lumbar disc prolapse occurs following the degeneration of intervertebral disc and is commonly seen at L4-5 and L5-S1 levels. Earlier, Swenson and Anderson noted that psychological variables associated with low back pain led to dissatisfaction at the working environment and is a major cause of worry and fatigue at the end of the workday affecting the patients both mentally and physically<sup>3</sup>.

The introduction of MRI to clinical practice has been one of the most important advances in patients with spine tumors. The characterization of spine tumors by MRI involves determining, in the context of patient's age and sex, the location of the lesion and whether or not it enhances after gadolinium injection.

The specificity of MRI to differentiate infectious spondylitis from other conditions depends on the signal characteristics and anatomic distribution of the infection and the patient's clinical history. Evidence of involvement of two consecutive

vertebrae and the intervening disk is virtually diagnostic of infectious spondylitis. Spinal infections commonly demonstrate typical signal intensity on T1- and T2-weighted images and enhancement within the affected bone marrow after the administration of gadolinium-based contrast material.

#### **OBJECTIVES**

- To describe and categorize the pattern of imaging findings in patients referred with complaints of non-traumatic low back pain in the locality.

#### **METHODOLOGY**

This cross sectional study includes 100 patients with complaints of non-traumatic low back pain who were referred to Radiology department for lumbosacral radiograph. Approval from scientific and ethical committee were obtained. Prior to the study, the protocol was explained to the subjects and the informed consent was obtained respectively. The subjects were examined using X-ray-600mA, X-ray-800mA, Magnetic resonance imaging - Siemens 1.5 Tesla Magnetom. There was no sex discrimination for selection of the cases and patients with a known history of trauma, spinal surgery and pediatric age group were excluded from the study. The patients with abnormal X-ray findings were subjected to MRI- LS spine for further evaluation. Patients who had complex spinal fracture on LS x-ray are subjected to Computed tomography. All vertebral and disc changes based on X-ray and MRI findings were documented which includes anterolisthesis, retrolisthesis, osteophytes, modic changes, disc bulge, disc herniation, disc dehydration, nerve root compression, neoplasms and infections.

**RESULTS**

Cross sectional study was done and a total of 100 patients were enrolled into this study.

**DATA ANALYSIS:**

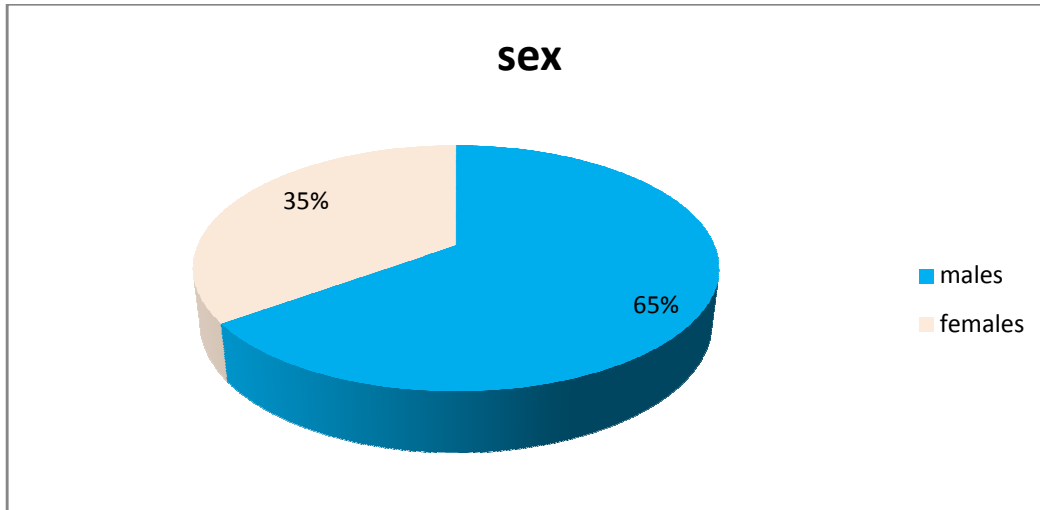
**Table: 1, Distribution of study subjects based on Age (n = 100):**

AGE	FREQUENCY	PERCENTAGE	MEAN + SD
30-39	37	37%	33.8yrs( + 2.9 yrs)
40-49	21	21%	43.8 yrs( + 2.9 yrs)
50-59	22	22%	55.5yrs ( + 2.7 yrs)
>60	20	20%	64.9yrs( + 4.4yrs)
<b>Total</b>	100		

This table shows the distribution of patients among various age groups

Major affected (37%) age group is between 30 – 39 years.

Distribution of study subjects based on gender (n = 100).



**Figure 1:** This pie chart shows the number of male and female patients referred to us for evaluation of low back pain. In this study, majority of them were male patients (65%)

**Table: 2, Distribution of study participants based on socioeconomic status classified under BG Prasad scale (n = 100):**

Socioeconomic status	Frequency
<b>I</b>	3 (3%)
<b>II</b>	7 (7%)
<b>III</b>	33 (33%)
<b>IV</b>	43 (43%)
<b>V</b>	14 (14%)

This table shows the distribution of socioeconomic status. According to BJ Prasad, majority of the patients (43%) were under Class IV of socioeconomic status.

Distribution of study population based on their occupation (n = 100):

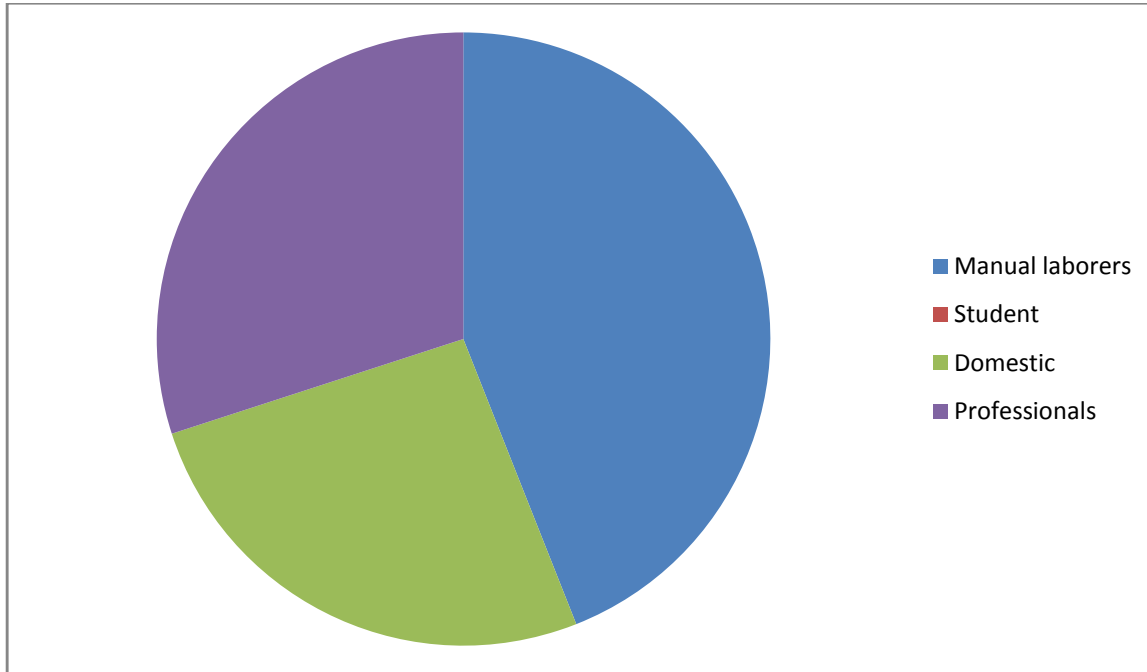
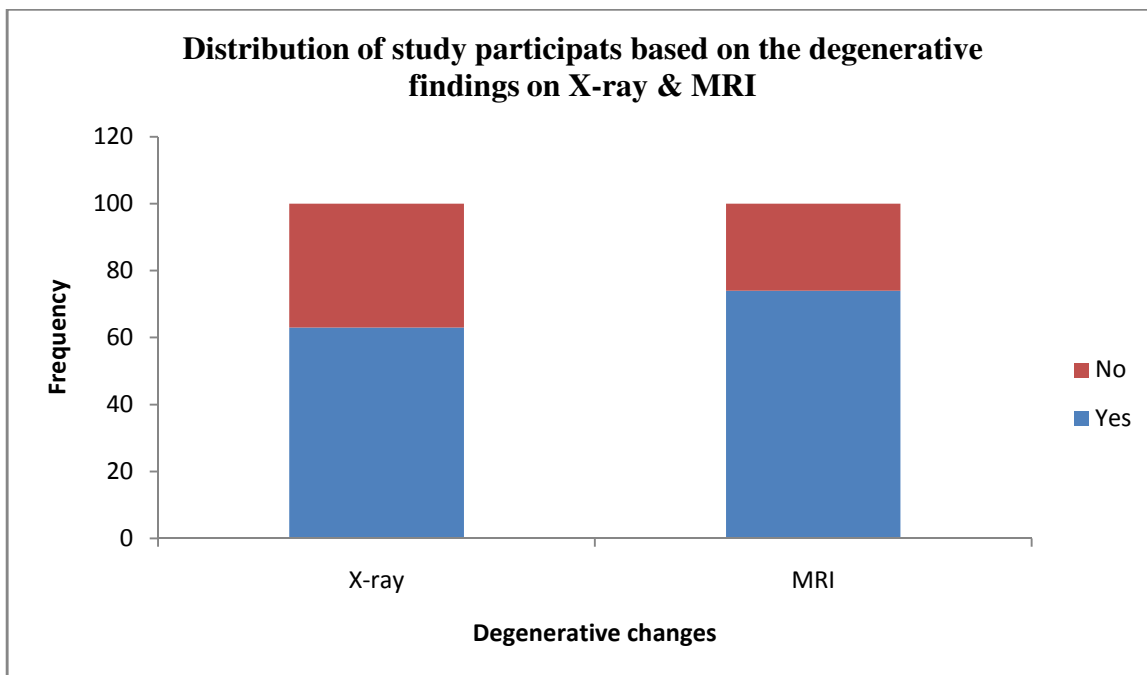


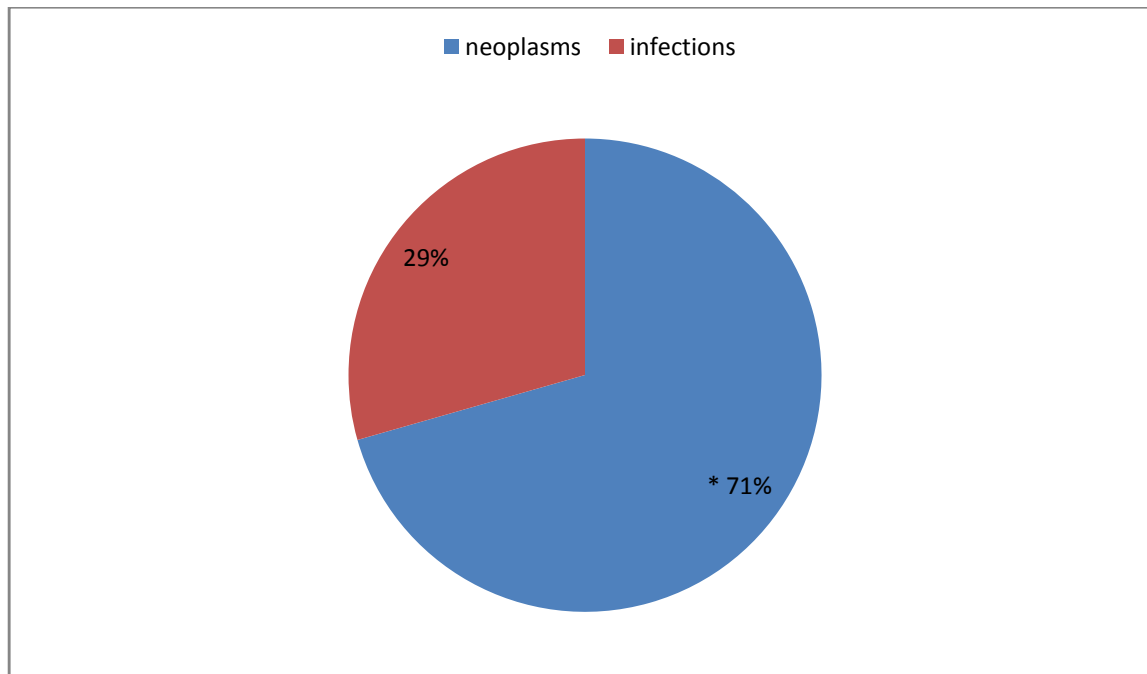
Figure 2: The pie chart shows the distribution of occupation in the study, Majority of the patients were found to be manual laborers (44%). No students were found in the study

Distribution of study participants based on degenerative findings on X –ray and MRI (n=100)



**Figure 3: this is a component bar chart showing the distribution based on degenerative findings on MRI and X-ray. X-ray findings concluded that among 100 patients with low back pain 63% had degenerative changes and 37% were normal. MRI reported that 74% had degenerative changes and 26% were normal.**

**Distribution of non-degenerative changes on MRI ( n= 17):**



**Figure 4, This pie chart shows the distribution of non-degenerative changes on MRI (n= 17). Majority (71%) were found to be neoplasm.**

**Neoplasm (71%): Majority (92%) of the patients were found to have hemangioma.**

**Table 3, Distribution of diagnostic validity of X-ray over MRI (n=100)**

Diagnostic Value	Percentage (%)	C.I
Sensitivity	69	(67.5 – 70.5)
Specificity	100	(77.8 – 100)
Positive predictive value	100	(99.9 – 100)
Negative predictive value	24	(22.74 – 25.26)

**Sensitivity:**

If MRI shows true positive result, then the chances of getting positive result in X- ray is 69%. Though we obtained an estimate of sensitivity as 69%, it could vary between 67.5% - 70.5%.

**Specificity:**

If MRI shows truly negative result, then the chances of getting negative result in X- ray is 100%. Though we o

### CASE 1



AB

**Osteophyte; A- Plain LS spine x-ray showing marginal osteophytes at the level of L1, L2, L3, L4 and L5. B- T2 weighted sagittal image showing the osteophytes. There is disc herniation noted at the level of L1-L2, L2-L3, L3-L4, L4-L5**

### CASE 2AB



**Metastasis; A-T2 &B-T1 weighted sagittal images showing heterogeneous lesions at L3 and L5 vertebral body with destruction, which is hyperintense on T2 and hypointense on T1**

### CASE 3



### AB

**TB spondylitis; A- T2 & B-STIR weighted sagittal image showing diffuse poorly delineated T2W/STIR marrow hyperintensity and corresponding low T1W signal in T12 & L1 vertebral body is noted.**

obtained an estimate of specificity as 100%, it could vary between 77.8% - 100%.

### DISCUSSION

Low back pain includes a spectrum of spine pathologies. The present study has been done in the Department of Radiodiagnosis, Sri Venkateshwaraa Medical College and Research center, Ariyur, Pondicherry. The study included a total of 100 patients presenting with complaints of low back pain who were referred to department of Radio diagnosis from the departments of Orthopedics. A total of 100 patients were enrolled into this study. These data highlights the spectrum of spinal diseases associated with low back pain in our hospital. The mean age was 47.3 Years (SD=14.5years). Sixty five percent were male and thirty five percent were female. Majority of patients worked in office settings or as worked in domestic setting (housewives /farmers/unemployed).

The population for the study was a highly selected cohort of patients who could afford MRI excluding many poor patients who may have had the other patterns. Some of the patients who were

referred for MRI but did not turn up due to socio-economic reasons like lack of funds for MRI scan. MRI and radiographs resulted in nearly identical outcomes for tertiary care patients with low back pain. It was found that the radiographs were sensitive though nonspecific, and that some specific findings were better seen on plain radiographs when compared to MRI, for example defects in the pars interarticularis.

The frequency of degenerative changes varies with age of the individuals. In this study, it was noted that young adults are bound to have more frequent complaints of low back pain compared to the geriatric age group. Low back pain was seen to be more common in males (65%) in this study. Similar results were seen in study by N.K Irurheet al<sup>4</sup> which showed LBP to be more common in males (65%) as opposed to females (34%). All the above studies indicate that males are more commonly affected than females and our study showed similar

finding. Young manual labourer who had to lift heavy weights for their daily wages are more at risk compared to females and also showed slight male predominance. In my study, majority of the patients (44) were manual laborers. There were 30 professional workers and 26 domestic. There were significant differences in frequencies of occurrence of positive imaging findings across different occupations. Manual workers showed highest frequencies of muscle spasms, osteophytes and disc disease. This is similar to a study by Massimo et al<sup>5</sup> which showed that heavy physical work load had severe detrimental effects to the back with worsening of degenerative changes if any. Heavy physical activity has been known to result in increase in osteophyte formation. Manual workers tend to be exposed to strenuous jobs hence the observations in this study.

#### **IMAGING FINDINGS:**

##### **Degenerative diseases of spine**

A major number of disease processes were diagnosed on MR often undetected on conventional radiography. Multiplanar MR provides remarkable diagnosis in the assessment of spinal structures. In our study degenerative spine pathology was the most common finding, affecting 74 patients and majority of the patients had L4-5 involvement. Majority of the cases on X-rays had osteophytes (42%) when compared to MRI (22%). This could be attributed to the limited ability of MRI to properly evaluate bony structures as opposed to plain radiography. While most studies rate highly the diagnostic imaging power of MRI, plain radiographs still play a major role in the provision of certain additional information which can be limited in MRI. Standing and dynamic radiographs can reveal misalignment and instability (iatrogenic and degenerative) as well as pseudo

arthroses, endplate sclerosis, erosions and additional calcific densities. These bony changes are difficult to see on MRI due to their inherent properties<sup>6</sup>.

Disc space narrowing has been found to have strong association with low back pain than other radiographic features. Both MRI and Plain radiographs showed equal proportions in detection of anterolisthesis and retrolisthesis. Frymoyer et al. in a study of 321 patients found that only when traction spurs or obvious disc space narrowing or both were present, the incidence of severe back and leg pain, leg weakness, and numbness increase. These positive findings had no relationship to heavy lifting, vehicular exposure, or exposure to vibrating equipment<sup>7</sup>.

Disc herniation (20% ) encountered on MRI and these patients are found to present with complaints of low back pain associated with radiculopathy. Takatalo et al reported this to be less than 1% among individuals aged between 20 and 22 years<sup>8</sup>. Disc bulge (77%) is one of the most common finding encountered on MRI and these patients are found to present with complaints of chronic low back pain. But few of them had associated radiculopathy. The prevalence is about 25% among young individuals who presents with complaints of low back pain<sup>9</sup>. The common spine level involved in disc bulges is at the L5/S1<sup>10</sup>.

Two cases of fractures were noted. Both X-ray and MRI did not add much information to our study, thus proving the fact that X-ray combined with MRI stands superior to all other routine studies done to evaluate the osseous and soft tissue findings of lumbar spine. A high proportion (66%) of patients also had dehydrated discs - reduction in disc signal intensity. Cheung et al (2009) reported a significant



association between lumbar disc degeneration on MRI and back pain<sup>10</sup>.

Type I Modic changes were seen 20%, 28.5% and 33.3% in the age group of 30 to 39 years, 40 to 59 years and 60 to 70 years respectively and Type II Modic changes (14%) were more common than type I (5%). Vertebral changes were seen associated with disc changes in most of the patients. It is similar to the findings quoted by by Kuisma et al (2009)<sup>11</sup>. Type II Modic changes (14%) were more common than type I (5%) and this is similar to what was found by Kuisma et al<sup>11</sup>. Out of total 100 patients, Modic changes and osteophytes in 22 patients, anterolisthesis (17) and retrolisthesis (2). The most common site for bulges and herniation was L4/L5 (73%) and (20%) respectively. Biluts (2009) reveals the significance of MR imaging and cites lumbar disc diseases as an important cause of low back ache. L4-L5 is the commonest site for degenerative disc disease in his study<sup>12</sup>. Anterior osteophyte is most commonly seen. Degenerative changes in disc occur commonly in L4-L5 and L5-S1 disc spaces<sup>13</sup>. Thecal sac pathology was seen in 34 patients with predominance of thecal sac compression followed by flavum thickening. The overall prevalence of nerve root or thecal sac compression is reported to be 73% and it is more frequent at level L5/S1<sup>14</sup>.

#### **Non degenerative diseases of spine:**

In our study, infectious cause of back pain was seen in 5 patients and neoplastic cause was found 12

patients. Out of the 12 neoplasms diagnosed, 11 were found to be benign and one case of malignancy - Metastasis was reported. Yochum TR (1993) reported that hemangiomas are most common benign neoplasms<sup>15</sup>. Fox MW (1993) found that asymptomatic hemangioma occurs in men and women. About 60% of VHs are discovered incidentally on imaging studies and are asymptomatic lesions<sup>16</sup>. Out of the 5 infections diagnosed, 3 were found to be tuberculous origin and two case of pyogenic abscess. Atlas SW et al (2002) found that in tuberculosis patients, skeletal involvement is due to hematologic dissemination<sup>17</sup>. Rigamonti D (1999) found that spinal epidural abscess (SEA) can occur at any site along the spinal axis<sup>18</sup>. The study revealed the ability of MRI in evaluation of various spine changes including detection, localization, characterization and assessment of the extent of disability. The strength of correlation between MRI and X- ray findings confirms the value of MRI in assessment of back pain.

#### **CONCLUSION**

This study was done in order to establish pattern of lumbar spine disease in our locality. From these observations, we find that MR imaging aids in the evaluation of non-traumatic cases of low back ache using MRI LS spine and plain radiography and helps in diagnosing osseous and extra osseous lesions and further in the appropriate management by the referring physician / surgeon.

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