

A Retrospective Analysis Of Magnetic Resonance Imaging Findings In 20 -40 Year Old Patients With Low Back Pain. Experience At A Semi Urban Tertiary Healthcare Centre In Northern India.

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Citation

S Verma, P Gupta, A Munshi, P Goyal, S Verma, V Sardana. *A Retrospective Analysis Of Magnetic Resonance Imaging Findings In 20 -40 Year Old Patients With Low Back Pain. Experience At A Semi Urban Tertiary Healthcare Centre In Northern India.* The Internet Journal of Spine Surgery. 2010 Volume 6 Number 1.

Abstract

Objective– This study was done to assess the spectrum of pathology of lumbar degenerative disc disease via MRI, to correlate MRI findings with the symptomatology and assessment of relevance of MRI findings in young adult patients with low back pain. **Methods:** A retrospective hospital based study was done of 232 patients who underwent lumbar spine MRI for low back pain symptom complex with exclusion of acute spinal infection, recent trauma, tumors, spinal dysraphism and metabolic conditions from the study. The MRI findings were interpreted independently and subsequently correlated with clinical history and examination findings from patients' records. **Results-** 26 (11.2%) of the 232 patients in the study group had completely normal MRI findings. 2 patients had zygapophyseal joint arthropathy only with no evident diskal abnormality on MRI. Multiple contiguous level disc disease was noted in 138 (59.5%) patients, multiple level disc disease with skipped segments was noted in 14(6%) patients, and 52 (22.4%) patients had single level disc involvement. Disc degeneration on MRI was most frequent at L4-L5 level (79.3%) followed by L5-S1 level (68.9%), L3-L4 level (32.8%), L2-L3 level (16.3%) and L1-L2 level (9.5%). Disc herniations were most frequent at L4-L5, L5-S1 and L3-L4 levels in decreasing order of frequency. Nerve root compromise was noted most frequently at L4-L5 level (56.9%), followed by L5-S1(41.4%) and L3-L4 (19%) levels. Annular tear was most frequent in L4-L5 intervertebral disc (36.2 % cases), followed by L5-S1 (32.8%) , L3-L4 (8.6%) and L2-L3 (3.4%) respectively. Vertebral end plate changes were most common at L5-S1 and L4-L5 vertebral levels with Modic Type II changes (12.5%) and Type I changes (3.45%). Significant associated findings i.e. transitional vertebra, spondylolysis with anterolisthesis of L5 vertebra, Scheuermann disease, Chiari 1 type malformation, thoracic cord syrinx, block L4-L5 vertebra and old healed vertebral pathology not involving lumbar spine were noted in 59 (25.4%) patients. **Conclusion-** This study shows utility of MRI in depicting objective evidence of lumbar degenerative disc disease in symptomatic young adult patients with clinical suspicion of disease. Foraminal/subarticular disc protrusions/extrusions and significant nerve root compromise on MRI are more likely in clinical setting of radicular pain. Presence of transitional vertebra/ Scheuermann disease, lumbar vertebral neural arch defects, old infective/traumatic pathology in other segments of spine should be investigated in presence of young lumbar degenerative disc disease.

INTRODUCTION

Lumbar disc degeneration occurs commonly in humans. There are a variety of factors that contribute to this condition. Aging, axial loading of disc, vascular in growth, and abnormalities in collagen and proteoglycan all contribute to disc degeneration. Disc herniation with radiculopathy and chronic discogenic low back pain are the result of this degenerative process.¹

Although multiple imaging modalities for evaluating lumbar

disc disease are available including radiography, dynamic radiography, multidetector CT (MDCT), MDCT myelography and discography, the advent of MRI has made possible, the non invasive imaging of lumbar spine with excellent spatial and contrast resolution. It has become the initial imaging technique of choice in evaluation of patients having lower back pain or radicular pain for demonstration of objective evidence of pathology in a location consistent with clinical findings.² MR- neurography and Dynamic- MR imaging (Upright Spinal MRI) are newer MR imaging

techniques which have become available in clinical practice facilitating three dimensional imaging of nerves and imaging of spine in axial loading respectively.^{3,4}

The association of lumbar disc disease with advancing age is well known and documented.^{5,6,7} However an increasing incidence of lumbar disc disease in young adults and adolescents has also been reported by studies done in various populations world over.^{8,9,10} As most of the studies were cross sectional or cohort studies in general population, and not much studies having been done in Northern Indian geographical region, this hospital based study of the symptomatic patients in the young adult (20-40yrs) age group, irrespective of gender, religion, socio-economic group and occupation was done to assess the spectrum of pathology of lumbar degenerative disc disease on MRI, to correlate MRI findings with the symptomatology and assessment of relevance of MRI findings.

PATIENTS AND METHODS

This hospital based retrospective study was conducted in Department of Radiodiagnosis and Imaging and interventional Radiology, Subharti Medical College and affiliated CSS Hospital, Meerut. A total of 232 patients in the 20 to 40 years age group who underwent MRI of lumbar spine for complaints of chronic low backpain , radicular pain, neurogenic claudication or various other symptoms and signs suggestive of lumbar degenerative disc disease from December 2008 till April 2011 were included. The patients having MRI findings of acute spinal infection, recent trauma, tumors, spinal dysraphism and metabolic conditions were excluded from the study. The MRI examination was done on 1.5T GE HDe 8 channel scanner with acquisition of the T1W, T2W, STIR images in sagittal, axial and coronal planes. The following criteria were evaluated on MRI: lumbar disk degeneration (graded as per classification given by Pfirrmann et al¹¹, table 1), disc herniation (graded as normal, bulge, protrusion, extrusion and sequestration), presence of annular tear, nerve root compromise (graded as per Pfirrmann et al classification¹², table 2), degenerative vertebral endplates changes (graded as per Modic classification¹³, table 3), and presence of zygapophyseal joint degeneration. The MRI findings were interpreted independently and subsequently correlated with clinical history and examination findings from patients' records.

Figure 1

Table 1 : Classification system for lumbar disc degeneration based on routine MR imaging developed by Pfirrmann et al.

Grade	Appearance on FSE T2W sag images of spine
I	Structure of disc is homogeneous, with bright, hyperintense, white signal intensity and a normal disk height.
II	Structure of disc is inhomogeneous, with hyperintense, white signal intensity. The distinction between the annulus and nucleus is clear, & the disk height is normal, with or without horizontal gray bands.
III	Structure of the disc is inhomogeneous with intermediate, gray signal intensity. The distinction between the annulus and nucleus is unclear and the disk height is normal or slightly decreased.
IV	Structure of the disc is inhomogeneous with hypointense, dark gray signal intensity. The distinction between the annulus and nucleus is lost and the disk height is normal or moderately decreased.
V	Structure of the disc is inhomogeneous with hypointense, black signal intensity. The distinction between the annulus and nucleus is lost and the disc space is collapsed.

Figure 2

Table 2 : Grading system developed by Pfirrmann et al for compromise of intraspinal extradural lumbar nerve root.

Grade	Compromise of intraspinal ,extradural lumbar nerve root
0 (normal)	No compromise of the nerve root is seen. There is no evident contact of the disc material with the nerve root and the epidural fat layer between the nerve root and the disk material is preserved.
1 (contact)	There is visible contact of disc material with the nerve root and the normal epidural fat layer between the two is not evident. The nerve root has a normal position and there is no dorsal deviation.
2 (deviation)	The nerve root is displaced dorsally by disc material.
3 (compression)	The nerve root is compressed between the disk material and wall of the spinal canal ; it may appear flattened or be indistinguishable from disc material.

Figure 3

Table 3: Modic classification for signal intensity changes in vertebral body bone marrow adjacent to endplates of degenerated discs.

Type	Description of marrow adjacent to endplates
1	Decreased signal intensity on T1W images and increased signal intensity on T2W images
2	Increased signal intensity on T1W images and iso or slightly hyperintense signal intensity on T2W images.
3	Decreased signal intensity on both T1W and T2W images.

RESULTS

Out of the 232 patients included in the study, 124 patients (53.45%) were male and 108 patients (46.55%) were female. The mean age of male and female patients were 29.9 yrs and 32.2 yrs respectively with mean age of the study group being 31 yrs.

26 (11.2%) of the 232 patients in the study group had completely normal MRI findings. 2 patients had zygapophyseal joint arthropathy only with no evident diskal abnormality on MRI.

Multiple contiguous level disc disease was noted in 138 (59.5%) patients, multiple level disc disease with skipped segments was noted in 14(6%) patients, while 52 (22.4%) patients in the study group had single level disc

involvement.

The incidence of disc degeneration on MRI was most frequent at L4-L5 level (79.3% of cases) followed by L5-S1 level (68.9%), L3-L4 level (32.8%), L2-L3 level (16.3%) and L1-L2 level (9.5%) with advanced disc degeneration (Grade III and higher as per Pfirrmann et al¹¹) noted most frequently at L4-L5 and L5-S1 levels.

The incidence of various categories of disc herniation at various levels was calculated and presented in the table 4. The L4-L5 (84.5% of cases) and L5-S1(69.8%) levels were the most often affected followed by L3-L4(30.2%) in decreasing order of frequency.

Figure 4

Table 4: showing incidence of various categories of disc herniation at each disc level

Disc level	Bulge	Protrusion	Extrusion	Sequestration
L1-L2	4	1	0	0
L2-L3	18	10	2	0
L3-L4	40	26	4	0
L4-L5	92	74	28	2
L5-S1	70	56	34	2
S1-S2	2	2	0	0

Accordingly nerve root compromise was also noted most frequently at L4-L5 level (56.9% of cases) ,followed by L5-S1(41.4%) and L3-L4 (19%) levels in decreasing order of frequency as can be seen in the table showing incidence of various Grades of nerve root compromise at each lumbar disk level.

Figure 5

Table 5. showing incidence of various Grades (as per Pfirrmann et al) of nerve root compromise at each lumbar disk level.

Intervertebral Level	Grade 0	Grade 1	Grade 2	Grade 3
L1-L2	230	2	0	0
L2-L3	218	10	4	0
L3-L4	198	30	14	0
L4-L5	100	84	40	8
L5-S1	136	42	42	12

Annular tear was most frequently noted involving L4-L5 intervertebral disc (36.2 % cases), followed by L5-S1 (32.8%) , L3-L4 (8.6%) and L2-L3 (3.4%) respectively.

Vertebral end plate changes were seen infrequently in this study group most commonly at L5-S1 and L4-L5 vertebral levels with Modic Type II changes (12.5% of cases) being

most common followed by Type I changes (3.45%). Type III changes were not identified in any of the patients in the study group.

Facet or zygapophyseal joint degenerative arthropathy was noted in all the patients except the twenty six cases with normal MRI findings.

Thirty four (14.65%) patients in the study group had transitional vertebra (22 with sacralisation of L5, 12 with lumbarisation of S1). Spondylolysis with anterolisthesis of L5 vertebra was noted in 9 (3.9%) patients. Scheuermann disease was identified in 6 patients (2.6%) , old healed infective vertebral lesions not involving lumbar spine were noted in 4 patients (1.7%). Block L4-L5 vertebra (2 cases), Chiari 1 type malformation (2 cases) and thoracic cord syrinx (2 cases) were other noted incidental but significant findings.

Out of the study group 120 patients had complaints of lower back pain only while rest of the 112 patients had additional symptoms of radicular pain with positive clinical examination for nerve root compression/ stretching. There was good correlation between the MRI findings and clinical picture in both the groups as foraminal or subarticular disc protusions, extrusions, sequestrations and significant nerve root compromise (Grade II/III Pfirrmann et al) as depicted on MRI were more significantly seen in the group having both lower back pain and radicular pain while disc bulges, central protusions and Grade I nerve root compromise were seen more commonly in patients with lower back pain only without associated radicular pain (p <0.005).

No significant correlation was noted between annular tears or zygapophyseal degenerative arthropathy and radicular pain.

Figure 6

Figure 1. Sagittal T2W images shows grade IV L3-L4 and L4-L5 IV disc degenerations with bulge of L3-L4 and protrusion of L4-L5 IV discs.



Figure 7

Fig 2. T2W sagittal image shows multiple level lumbar disc degeneration with extrusion of L4-L5 IV disc.



Figure 8

Fig 3. T2W axial image shows diffuse L5-S1 intervertebral disc posterior protrusion with grade III right exiting nerve root and grade II left exiting nerve root compromise.

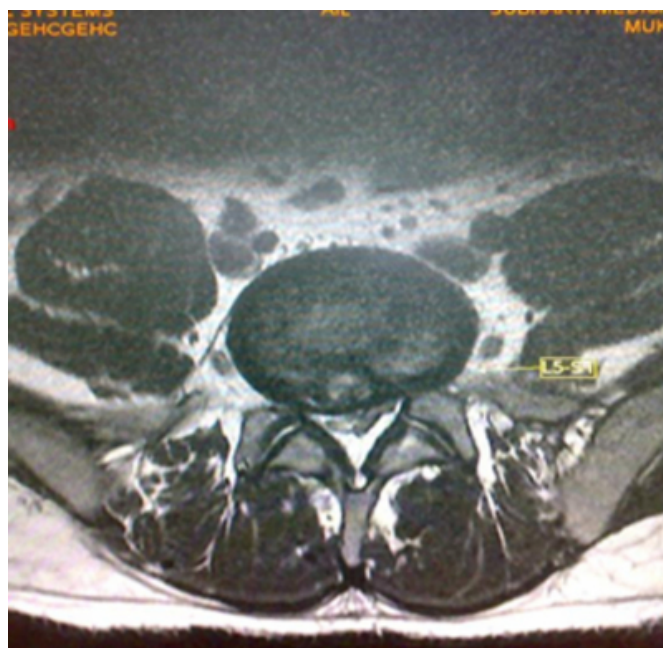


Figure 9

Fig 4. T2W axial image shows posterior annular tear of L4-L5 intervertebral disc with posterior protrusion. Bilateral zygapophyseal joint degenerative arthropathy noted.



Figure 10

Figure 5. Sagittal T2W and TIW images of same patient reveal Modic type II endplate changes involving S1 vertebra.

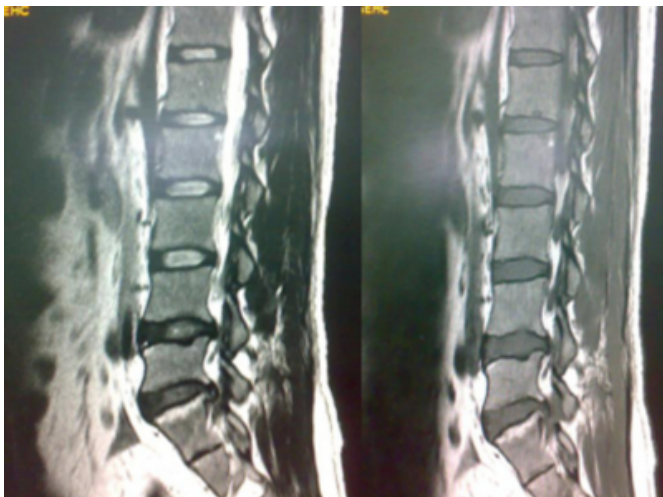


Figure 11

Figure 6. Sagittal T2W image shows grade II anterolisthesis of L5 vertebra with grade IV L5-S1 IV disc degeneration.



DISCUSSION

This retrospective study in a defined population revealed the spectrum of findings and utility of magnetic resonance imaging in patients between 20 to 40 yrs of age with clinical complaints of lower back pain in our setting.

206 (88.8%) patients in this study had objective evidence of pathology on MRI while in 26 (11.2%) patients the MRI examinations were normal. None of the patients having normal MRI findings had symptoms and signs of radicular pain or abnormal neurological findings suggestive of non discogenic/ structural origin of their back pain.

Most abnormal MRI findings were found at the lowest lumbar levels (L4-L5 & L5-S1).

Foraminal and subarticular disc protrusions and extrusions and Grade II/III nerve root compromise (Pfirmann et al¹³) were more consistently associated with radicular pain in comparison to disc bulges, central protrusions and Grade I nerve compromise. These findings are in agreement with studies done by other authors.^{5,12,14,15,16}

Significant associated findings i.e. transitional vertebra, spondylolysis with anterolisthesis of L5 vertebra, Scheuermann disease, Chiari 1 type malformation, thoracic cord syrinx, block L4-L5 vertebra and old healed vertebral

pathology not involving lumbar spine were noted in 59 (25.4%) patients in the study group. While transitional lumbosacral vertebra¹⁷, Scheuermann disease^{18,19}, lumbar spondylolysis with listhesis²⁰ are documented factors predisposing to disc degeneration, the importance of other mentioned conditions in lumbar disc disease needs further investigation.

CONCLUSION

This study shows utility of MRI in depicting objective evidence of lumbar degenerative disc disease in symptomatic young adult patients with clinical suspicion of disease. Foraminal/subarticular disc protrusions/extrusions and significant nerve root compromise on MRI are more likely in clinical setting of radicular pain. Presence of transitional vertebra/ Scheuermann disease, lumbar vertebral neural arch defects, old infective/traumatic pathology in other segments of spine should be investigated in presence of young lumbar degenerative disc disease.

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