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MAGNETIC RESONANCE EVALUATION OF DEGENERATIVE LOWER SPINE IN CHRONIC LOW BACK PAIN PATIENTS

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ABSTRACT:

Introduction:

Lower back pain is a common complaint of middle aged and elderly in our population usually secondary to degenerative spine disease. MRI is the imaging modality of choice due its excellent spinal soft-tissue contrast and demonstrates discs changes, multiplanar imaging capability and lack of radiation.

Aims and Objective:

To evaluate the MRI changes of spine with low back pain and to characterization, extent, and changes associated with the degenerative lumbar disc disease.

Study design: Cross-sectional and observational study.

Materials and Methods: A total 75 patients of low back, who clinically diagnosed of lumbar disc degeneration with age group between 35 to 75 y were studied on 1.5 Tesla Magnetic Resonance Imaging machine using sagital, axial and coronal T1,T2 myelogram and STIR sequences. The vertebra, intervertebral disc, posterior elements of spine, spinal canal and nueral foramens is looked for the changes of degeneration. The spinal cord and the nerve roots are observed for signs of compression and degeneration.

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Result: disc changes were more prominent in degenerative spine disease and males were more commonly involved. Changes of disc like decreased disc height, Disc bulge, Annular disc tear, disc herniation, disc extrusion, narrowing of spinal canal, narrowing of lateral recess, compression of neural foramen, ligamentum flavum thickening and facetal arthropathy was common at the L4 –L5 disc level followed by L5-S1 and L3-L4 in order. Most of the patients showed loss of lumbar lordosis. Posterior osteophytes are common at L3 - L4 & L5 –S1 disc level. L1- L2 disc involvement and spondylolisthesis are less common.

Conclusion: Lower Lumbar disc degeneration is the most common cause of low back pain. MRI is the standard imaging modality for detecting disc pathology due to its advantage of lack of radiation, multiplanar imaging capability, excellent spinal soft-tissue contrast and precise localization of intervertebral discs changes.

Key words: chronic low back, magnetic resonance imaging, mri, spine, disc

INTRODUCTION: The problem of LBP in the developed world nears epidemic proportions and is on the increase with a lifetime prevalence of LBP (at least one episode of LBP in a lifetime) reported to be up to 84%[1]. LBP is clearly an important health problem whose etiology can be indefinable or defined due to degeneration, infective or neoplastic lesions. Low back pain has been described as "An illness in search of a disease"[2]. Lumbar radiography may not identify all the abnormalities related to LBP symptoms and may be harmful because it exposes the gonads to ionizing radiation. MRI has several advantages including multi-player capabilities, superior soft tissue contrast and lack of ionizing radiation. It provides useful information that is likely to affect treatment. Several studies have detailed the sensitivity and specificity of MRI in detecting different spine disease conditions such as neoplasms, infiltrative marrow disease, infections, spondyloarthropathies and degenerative disc disease[3]. Likewise, the sensitivity of MRI for diagnosing complications resulting from degenerative disc disease like stenosis and nerve root compression is high[4]. Low back pain secondary to degenerative disc disease affects men more than women. The main symptom of disc degeneration after low back pain is sciatica. Sciatica pain occurs mostly on one side of the body. It is a sharp shooting type of pain. Mild tingling sensation, dull ache, or burning sensation can occur. Pain may radiate to the calf or sole of the foot. Sciatic pain aggravates on standing, walking, bending, straining and coughing. In severe case, patient becomes unable to move around [6,7]. There are many risk factors associated with the lumbar disc degenerative disease like advancing age, smoking, obesity, trauma, heavy weight lifting, height, genetic factors[8] and hereditary factors. Certain occupations like machine drivers, carpenters and office workers are also associated with it.

AIMS AND OBJECTIVE:

To evaluate the MRI changes of spine with low back pain and to characterization, extent, and changes associated with the degenerative lumbar disc disease.

MATERIALS AND METHODS: A total 75 patients of low back pain, who clinically diagnosed of lumbar disc degeneration with age group between 35 to 75 y were studied on 1.5 Tesla Magnetic Resonance Imaging machine using sagital, axial and coronal T1,T2, Myelogram and STIR sequences. The vertebra, intervertebral

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disc, posterior elements of spine, spinal canal and nueral foramens are looked for the changes of degeneration. The spinal cord and the nerve roots are observed for signs of compression and degeneration. All the observation was done by three Radiologists (Professor, Associate Professor and Resident). Patients between 35 to 75 y of the age with low back pain were included in the study after obtaining a verbal consent. Patients with age<35 y and > 75 y, the history of trauma, prior surgery, spinal infections were excluded from the study. In the study 75 patients were clinically examined and their findings were noted. The following MRI findings were noted: lumbar lordosis preserved or not, Schmorl's nodes present or not, decreased disc height (fig 7,8)as compared to the upper and lower vertebral levels and changes of disc as follows.

Disc desiccation: It is a common degenerative change of intervertebral discs. On MRI imaging, the disc loses its central high T2 signal [Fig-1,3]. Normally, central nucleus pulposus shows high signal intensity on T2WI and peripheral annulus, low signal intensity on T2WI [Fig-a].

Annular tear: It is also called annular fissure and is a separation between annular fibers, avulsion of fibers from vertebral body insertion or break through fibers involving one or more layer of the annular lamella. Tear in the disc is seen as hyperintese on T2 Weighted images. Annular tear is further classified according to axial location into: median, paramedian(fig 6), foraminal and extra-foraminal. Foraminal disc herniation often very troublesome for the patient because compression of a 'Dorsal Root Ganglion'. Extra-foraminal is very rare.

Disc bulge and protrusions (fig-1,3): The annulus fibrosus normally may bulge diffusely a little beyond the vertebral margins. However, bulging of more than 2–3 mm is usually associated with loosening of the concentric layers of the annulus fibrosus, or radial fissures and accelerated dehydration of the nucleus. Protrusions are focal bulges of the annulus fibrosus associated with radial tears. These can occur from any part of the disc circumference. The commonest are posterior and consist of the following types: (A) posterolateral, the commonest; (B) duffuse; (C) midline posterior (D) lateral, which is lateral to the spinal canal , and can involve the dorsal root ganglion in the intervertebral foramen and (E) far lateral, beyond the foramen and often affecting ventral rami.

Disc Herniations (fig-5): herniations are fibrocartilaginous masses attached to, but lying outside the annulus fibrosus. These usually extend cranial or caudal to the disc in the anterior epidural space as migratory fragments usually pass one or other side of the midline septum. In about 10 per cent, the herniation extends through the posterior longitudinal ligament or its lateral membrane sequestrated fragments detach and become freely mobile.

Migration: Whenever displacement of disc material is away from the site of extrusion it is called migration. Migration can occur either in cranial or caudal directions [Fig-15,16].

Sequestration: When the displaced disc material has completely lost any continuity with the parent disc it is called sequestration.

Ligamentum Flavum Thickening: Ligamentum flavum thickening was measured on the axial image, perpendicular to the spinal canal axis and parallel to the lamina, where ligamentum flavum were seen along

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their entire length & measurement were taken at the half length of ligament flavum. According to Park et al., we had labeled a >4 mm ligamentum flavum thickening as thickened[9] [Fig-10].

Facetal arthropathy: Facetal arthropathy was noted as reduction in synovial facetal joint space with loss of high signal intensity on T2WI [Fig-10].

Narrowing Of The Spinal Canal (fig 6)**:** In the mid sagittal T2 Weighted images spinal canal diameter was measured. Spinal canal diameter less than 12 mm, indicates narrowing of the canal.

Narrowing Of Lateral Recess (fig 6)**:** A lateral recess is the space which is bounded ventrally by the posterior surface of the vertebral body, dorsally by the superior articular facet, and laterally by the pedicle. Medially, it is open toward the spinal canal. It is measured at the level of the pedicle in axial section, If it is less than 4 mm it is considered abnormal. Compression of neural foramen was observed in T2W Sagittal image.

Reactive changes occur in the vertebral bodies, both in the peripheral disc margin (osteophytes) and in the cancellous bone adjacent to the vertebral end-plates. Osteophytes generally reduce the range of movement and may result in spontaneous fusion. Elsewhere in the spine, disc-related osteophytes (fig-8) usually do not involve the spinal canal, even when large.

Modic described three types of reactive changes in the cancellous bone adjacent to the vertebral end-plates: (type 1) in the acute stage of disc disease there is invasion of the cancellous spaces by fibrovascular reactive tissue; in time this leads to (type 2) fatty replacement of red marrow; eventually this leads to (type 3) bony sclerosis. These changes are exquisitely shown by MRI: (A) type 1 changes yield low signal on T1W and high on T2W; (B) type 2 changes yield high signal on T1W and T2W (fig-7,unless fat suppressed, when they will yield low signal); (C) type 3 changes yield low signal on all sequences(fig-8). The vertebral end-plates may fracture and displace into the vertebral body, but the dense compact bone is not destroyed. Occasionally the end-plates become very irregular and the degenerative process progresses to a destructive discovertebral lesion, which may simulate many features of infective spondylitis. The key differentiation is the signal intensity of the disc on T2W – in degenerative change it will be low, whereas in infection it should be high.

RESULTS

Total 75 patients were studied in the evaluation of MRI appearance of Degenerative Spinal Disease. Five patients were excluded from the study as they had history of prior surgery, spinal infections. From total 75 patients, 50 patients (i.e.66.66% of total patients) were male and 25 patients (i.e.33.33% of total patients) were female. Lumbar lordosis was preserved in 42 (i.e. 56% of total patients) patients and loss of the lumbar lordosis was seen in 33 (i.e. 44% of total patients) patients. Conus end at L1 and disc between L1-L2 vertebral level which was most common and seen in 56 patients (i.e. 74.66% of total patients). Decrease disc heights were commonly seen in L4-L5, L5-S1 and L3-L4 disc levels. L4 – L5 disc involvement was common & seen in 43 cases (i.e. 57.33% of the disc involvement). Twenty five patients (i.e. 33.33% of total patients) showed medial annular disc tear. In medial annular disc tear L4 –L5 disc were common seen. Fourteen patients (i.e. 18.6% of total patients) showed paramedian annular tear. 6 patients (i.e. 8% of total patients) showed foraminal annular tear. In foraminal annular disc tear L3 –L4 disc were common. Herniation in 27 patients (36%), extrusion in 12 cases (i.e.12%) and disc bulge in 56 cases (i.e. 74.66%). Herniation was common at L4 –L5 disc

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level; Extrusion was common at L4 – L5 disc level. Disc bulge was common at L3 – L4, L4-L5 and L5-S1. L3 – L4, L4-L5& L5 – S1 level shows maximum osteophytes . Spinal canal narrowing was seen in 36 cases (i.e. 48%). Spinal canal narrowing was common in L4 – L5 disc . Narrowing of lateral recess and compression of neural foramen were seen in 48 cases (i.e. 64%) Facetal arthropathy and ligamentum flavum thickening was seen in 54 cases (i.e.72%) & both were common at the L4 – L5 and L5-S1 disc level. Eight patients (i.e. 10.6% of total patients) showed listhesis in the spine in the form of anterolisthesis or retrolisthesis. Anterolisthesis is common as compare to retrolisthesis . L5 vertebral body listhesis over S1 vertebral body was common in both anterolisthesis & retrolisthesis.

DISCUSSION:

Men are more commonly affected to the disc degeneration than women. It is most likely due to the increased mechanical stress and injury[10] and Disc desiccation is a common degenerative change of intervertebral discs. It results from the replacement of the glycosaminoglycans within the nucleus pulposus with fibro cartilage which leads to reduced disc height due to reduction in nucleus pulposus volume[12]. The lower back pain and sciatica were due to nerve root compression, which was significantly associated with disc degeneration [14]. Lumbar disc degeneration is the most common cause of low back pain around the world and noninvasive excellent imaging of spine is possible due to development of MRI. The findings of our study were consistent with other studies[11]. Most common cause of disc degeneration was observed in 5th and 6th decades of life in our study, which was comparable with other studies [11]. Disc degeneration with diffuse disc changes are more commonly found at L4 - L5 and L5 – S1 level [11] and L1 – L2 is least common. Multiplicity in the disc level involvement is common as compare to the single disc involvement; which is also correlates with past studies[13].

CONCLUSION AND RECOMMENDATIONS: Lumbar disc degeneration (LDD) is the commonest MRI pattern in patients with low back pain . Disc desiccation is common in patients with low back pain. We hope that with the aid of diagnostic imaging modalities such as MRI the primary care physicians will be able to make a more directed referral to an appropriate specialist for timely intervention. This will improve the quality of health care services and management of the patient. MRI should be done in patients with LBP. This routinely done on patients with suspected complicated LBP in developed countries and the practice should also follow suit in our setup. MRI axial images should be obtained in a contiguous manner to avoid skip areas which may miss free disc fragments.

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FIGURES:

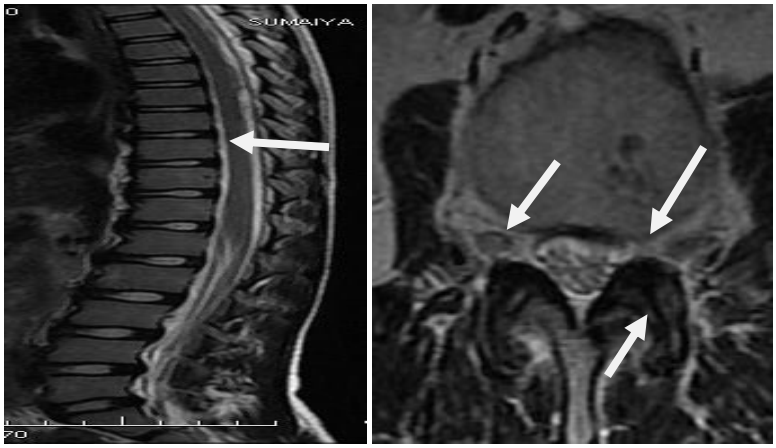

Fig:A,B-shows normal vertebral bodies and disc with hyperintense nucleus pulposus. Dorsal root ganglion and facet joint.

Fig:1,2-T2-SAG and Myelogram, shows disc bulge with compression of cauda equina.

Fig-3,4- T2-SAG and Myelogram, shows disc herniation with compression of cauda equina.

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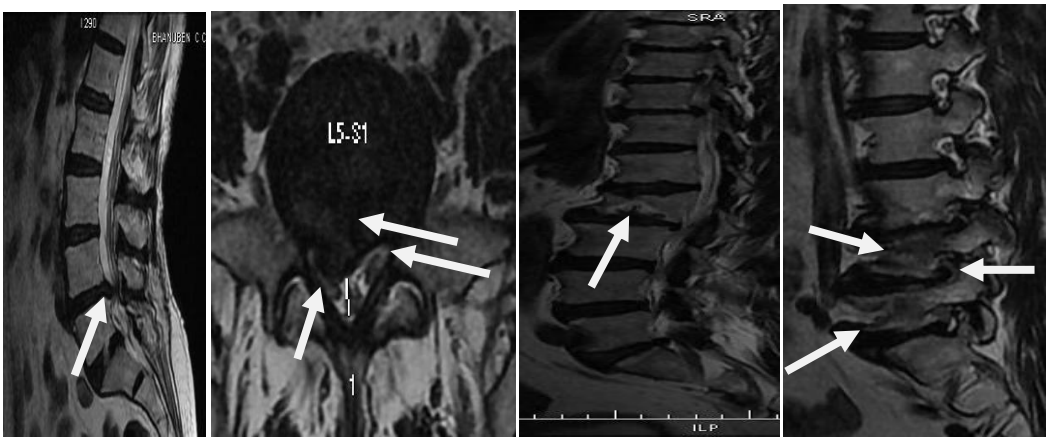

Fig:5-disc herniation with caudal migration, Fig-6-shows paramedian anular tear with spinal canal narrowing and right lateral recess obliteration. Fig:7-decreased disc height with yellow marrow conversion in body of vertebra (modic type-2 changes). Fig:8-shows decreased disc height with osteophyte with bony sclerosis of vertecral body (modic tye-3 changes) and spinal canal stenosis.

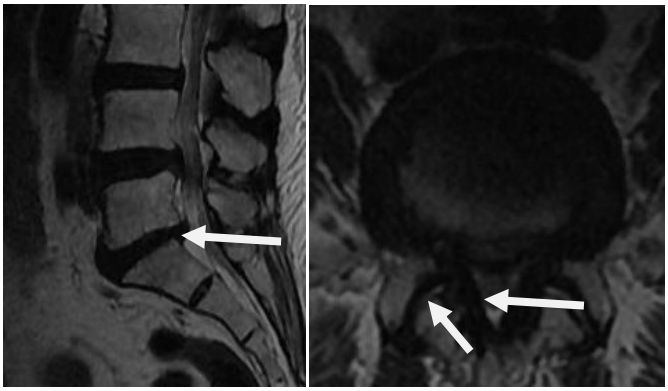

Fig:9-shows grade I anterolisthesis. Fig:10-shows thickened ligamentum flavum and facet joint arthropathy.

REFERENCES:

1. Walker B. The prevalence of low back pain: a systematic review of the literature from 1966 to 1998. Journal of Spinal Disorders. 2000; 13(3):205- 217.

2. Teasel W.R., White K. Clinical approaches to low back pain: Part 1-Epidemiology, diagnosis, and prevention. Can Fam Physician. 1994; 40:481-486.

3. Algra P.R., Bloem J.L., Tissing H., Falke T.H., Arndt J.W., Verboom L.J. Detection of vertebral metastases: comparison between MR Imaging and bone scintigraphy. Radiographics. 1991; 11: 219-32.

4. Kent D.L., Haynor D.R., Larson E.B., Deyo R.A. Diagnosis of lumbar spinal stenosis in adults: A meta-analysis of the accuracy of CT, MR, and myelography. AJR Am J Roentgenol. 1992; 158: 1135-44. 19.

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Impact Factor: 3.426

5. Beattie P.F., Meyers S.P., Stratford P., Millard R.W., Hollenberg G.M. Associations between patient report of symptoms and anatomic impairment visible on lumbar magnetic resonance imaging. Spine. 2000; 25: 819-28.

6. Neuropathy-sciatic nerve; sciatic nerve dysfunction; low back pain-sciatica [Internet]. Bethesda (MD): A.D.A.M. Inc.; c2013 [cited 2012 Aug 12]. Available from: http://www.ncbi.nlm.nih.gov/pubmedhealth/ PMH0001706/.

7. Bakhsh A. Long-term outcome of lumbar disc surgery: an experience from Pakistan. *J Neurosurg Spine.* 2010;12:666-70.

8. Battie MC, Videman T, Gibbons LE, Fisher LD, Manninen H, Gill K. 1995 Volvo Award in clinical sciences: determinants of lumbar disc degeneration—a study relating lifetime exposures and magnetic resonance imaging findings in identical twins. *Spine.* 1995;20: 2601–12.

9. Park JB, Chang H, Lee JK. Quantitative analysis of transforming growth factor-beta 1 in ligamentum flavum of lumbar spinal stenosis and disc herniation. *Spine* (Phila Pa 1976). 2001;26:E492–95.

10. Wang YX, Griffith JF. Effect of menopause on lumbar disc degeneration: potential etiology. *Radiology*. 2010;257:318-20.

11. Cheung KM, Karppinen J, Chan D, Ho DW, Song YQ, Sham P, et al. Prevalence and pattern of lumbar magnetic resonance imaging changes in a population study of one thousand forty-three individuals. *Spine* (Phila Pa 1976). 2009;34(9):934-40.

12. Lipson SJ, Muir H. Experimental intervertebral disc degeneration: morphologic and proteoglycan changes over time. *Arthritis Rheum.* 1981;24:12–21.

13. Takatalo J, Karppinen J, Niinimäki J, Taimela S, Näyhä S, Järvelin MR, et al.Prevalence of degenerative imaging findings in lumbar magnetic resonance imaging among young adults. *Spine* (Phila Pa 1976). 2009;34(16):1716-21.

14. Shambrook J, McNee P, Harris EC, et al. Clinical presentation of low back pain and association with risk factors according to findings on magnetic resonance imaging. *Pain*. 2011;152:1659–65.

