

Comparative Study of Plain Radiograph and Magnetic Resonance Imaging in Diagnosing Non-Traumatic Causes for Lower Backache

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A B S T R A C T

Introduction: Low back ache or lumbago is one of the commonest patient complaints encountered in clinical practice. The causes of lumbago are many and include abnormalities of the lumbosacral spine or those related to the soft tissues surrounding the lumbosacral spine. Magnetic resonance imaging (MRI) provides a more complete information as compared to Computed tomography (CT) and plain radiograph. The aim of the study was to evaluate the accuracy of plain radiograph in detecting non traumatic causes for lower back pain and to analyse the effectiveness of conventional radiography in diagnosing non traumatic pathologies causing low back ache in comparison with Magnetic Resonance Imaging(MRI).

Material and methods: Study was a prospective cross sectional study over a period of 18 months, during which a total of 60 patients underwent MR and X ray imaging for non-traumatic low back ache in the Department of Radio diagnosis of a Tertiary Care Hospital. Informed consent was taken from all patients. Statistical analysis done by SPSS 23 software and chi square test for association between MRI and plain radiograph was done.

Results: The commonest age group affected by low back ache in the study was 20-50 years. The male to female ratio was 1.71:1. The commonest level of disc involvement by degenerative disease was L5-S1 and L4-L5. The commonest disc herniation characteristic was diffuse disc bulge. The clinical presentation of sciatica showed statistically significant correlation with neural foraminal narrowing on MRI. X ray findings correlated with MRI findings at all levels.

Conclusion: The commonest age group affected is 20-50 years. Degenerative disc changes were more common in L4-L5 and L5-S1 levels. Diffuse disc bulge is the commonest type of disc herniation seen. Sciatica is common in patients with neural foraminal narrowing(statistically significant) . X-ray showed statistically significant correlation with MRI at all levels.

Keywords: Plain radiograph, Magnetic Resonance Imaging, Lower Backache, Lumbar Spine

INTRODUCTION

Lumbago or lower backache is one among the commonest patient complaints seen in everyday clinical practice. The disease is particularly common in labourers, clerks, industrial workers and software professionals. The evolution of mammals from quadrupeds to bipeds resulted in a shift in the centre of gravity and subsequent mechanical stress on the lumbar spine. The occurrence of low back ache can be probably attributed to this evolution in the basic posture of human beings.

The causes of lumbago are multiple including abnormalities of lumbar spine or soft tissues surrounding the lumbosacral spine.¹

Lumbar spine degenerative diseases refer to a group of disorders, which include the inter-vertebral disc with or

without adjacent para-spinal structures compromise.² Persons with degenerative disease of lumbar spine can be asymptomatic or present with lower back pain with/without sciatica, but most patients are asymptomatic.^{3,4} The symptomatic individuals along with back pain and/or radiating radicular pain syndrome (sciatica).⁵ The potential causes could be the mechanical pressure of the neural components by Inter vertebral disc herniation or because of direct inflammatory and biochemical causes.^{5,6} Thirty five percentage(35%) of non-symptomatic persons may come with degenerative spine findings, including: disc dessication, any among the three Modic changes, facet joint arthropathy, Inter vertebral disc bulges and spinal canal stenosis.⁷ Spinal tumors can present with a wide range of symptoms including low back ache depending on the location.⁸ Magnetic Resonance Imaging (MRI) routinely demonstrate

the dorso-lumbar spine in multiple planes and extradural soft tissues (including intervertebral discs), paravertebral musculature, the exiting nerve roots and intra dural structures (including the spinal cord, conus medullaris and intrathecal roots). MRI provides more complete information about all these as compared to Computed Tomography (CT) with or without intrathecal contrast agents or myelography.⁹

The aim of the study was to evaluate the accuracy of plain radiograph in detecting non traumatic causes for lower back pain and to analyse the effectiveness of conventional radiography in diagnosing non traumatic pathologies causing low back ache in comparison with Magnetic Resonance Imaging(MRI).

MATERIAL AND METHODS

The present study was conducted in the department of Radiodiagnosis. It comprised of 60 cases of lower backache of both genders. All patients were informed regarding the study and written consent was taken. Ethical clearance was obtained before starting the study from institutional ethical committee. Selection of patient will be based on non-traumatic low back pain on clinical presentation and referral to MRI to detect pathology. If the inclusion criteria was fulfilled, the patients were thoroughly evaluated to find out any contraindications for MR imaging. Informed consent was taken after the patient was briefed about the procedure. The imaging was done using a 1.5 Tesla PHILIPS ACHIEVA MR scanner and routine imaging sequences was done. The patient's plain radiograph of LS spine AP & lateral views were taken. The images were procured and the radiology reports were stored in the department computer database. The parameters which were assessed included lumbar spondylosis, facet joint hypertrophy, spondylolisthesis, canal stenosis, disc lesions at each level and any other additional spine/soft tissue details. The data collected was tabulated in Microsoft Excel and analysis was carried out using Statistical Package for Social Sciences (SPSS). Representative cases and images were discussed in detail.

Inclusion criteria

- All non traumatic cases(20-69yrs)of low back ache

Exclusion criteria

- Postsurgical LS spine cases.
- Pregnant women.
- All Patients having cardiac pacemakers, prosthetic heart valves, cochlear implants or any metallic implants.
- Patients having history of claustrophobia .

STATISTICAL ANALYSIS

Data entered in excel sheet. Statistical analysis done by SPSS 23 software, using descriptive statistics, sensitivity, specificity and chi square test for association between MRI and plain radiograph with 5% level of significance and 95% confidence interval was done.

RESULTS

Sixty patients with complaints of lower backache were evaluated using plain Radiograph and MRI. The age group included in the study ranged from 20 years to 69 years. The

mean age of the patients included in the study was 39.2 years and around 44 patients were 50 years of age or younger (Table-1). The male to female ratio was 1.71:1. (Males=38, Females=22)

The most common indication for MRI lumbosacral spine was low back ache (n=52). All the patients had low back ache as the presenting complaint. Nine percent of the patients had low back ache with sciatica (n=8). Multiple disc abnormalities were present in 66.5% (n=40) when compared to single disc abnormalities (33.5%, n=20). The commonest multi-levels showing degenerative disc changes were L4-L5 (n=37) and L5-S1 (n=36). In cases with single disc degenerative changes, around 51.9% of the patients had degenerative disc changes at L5-S1 levels and 32.7% had changes at L4-L5 levels.

Distribution of single disc degenerative disease in the study group was 51.9% of the patients had degenerative disc changes at L5-S1 levels and 32.7% had changes at L4-L5 levels. (Figure-1)

Distribution of multiple disc abnormalities in the study population were as follows, the commonest levels involved in multiple disc abnormalities were L3-L4 / L4-L5 (30.3%) followed by L3-L4/L5-S1 (25.8%). (Figure-2)

The commonest disc herniation characteristic was Diffuse Disc Bulge (DDB) (78.1%,n=47). 34.2% of the patients had protrusion on MRI. Other MRI findings like spondylolysis,

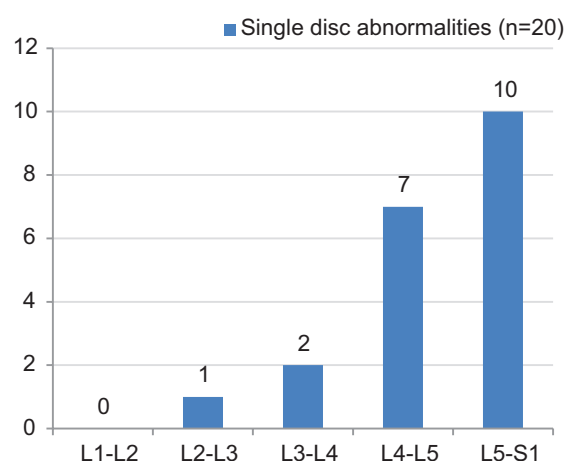


Figure-1: Distribution of single disc degenerative disease

Age group (years)	No. of patients	Percentage
20 – 29	20	32.9
30 – 39	12	19.3
40 – 49	12	19.3
50 – 59	15	26.5
60 – 69	1	1.9

Table-1: Age distribution of study population

Disc level	No. of patients	Percentage
L1-L2	3	5.8
L2-L3	7	11
L3-L4	24	40
L4-L5	33	55.5
L5-S1	29	48.4

Table-2: Radiograph findings in degenerative disc disease

end plate changes, disc protrusion, extrusion, neural foramina narrowing and their respective distribution in the study population is given by the (Figure 3). Neural foraminal narrowing correlated significantly with sciatica. ($p < 0.01$, Kendall Tau b two tailed non parametric correlation). Spondylolisthesis of L4 over L5 was seen in one case. Paraspinal soft tissue change was seen in one case of ancient Schwannoma

On X ray, the findings were IVD space height reduction and sacralisation of lumbar vertebrae. Around 4 patients (6.4%) had complete sacralisation while some of other patients showed partial sacralisation. Around 8 patients (14.2%) showed end plate changes. Sacralisation of L5 vertebra was noted in 16.1% of cases ($n=10$). Most of the IVD height reduction was at the L4/L5 and L5/S1 level. (Table-2) In our study we found that X-ray correlated well with MRI at all levels (L1-L2-100%, L2-L3-93.9%, L3-L4-80.9%, L4-L5-80.7%), and this was found to be statistically significant (p value < 0.01 , Kendall Tau two tailed non parametric

correlation). MRI detected disc changes in 18 cases in which X-ray showed no abnormality.

DISCUSSION

A total of sixty (60) patients participated with written consent in this study. The mean age group of the study population was 39.2 years. 71.6% of patients belong to the above 20years and below 50 years group. This is a significant and worrisome finding as this category of patients belong to the economically productive age group. Existing prevalence of IVDisk degeneration in younger subjects (20 to 39 years) could be probably explained secondary to genetic predisposition, repeated micro-traumas injuries and mechanical physical loading. As per available literature degenerative changes are frequent in individuals aged more than forty (40) years.^{10,11} Their prevalence appears to rise progressively over 90% by the age of 50 - 55 yrs.¹²

Males appeared to have slightly more incidence of degenerative disease of the IVD than females.¹³ This could be attributed to the skewed distribution of cases with respect to gender. A male predominance in degenerative disc diseases is reported in literature.¹⁴ All recruited subjects for the study were imaged using MRI lumbar spinal protocol to localise the involved sites with degenerative changes. Degradative changes were seen in almost all the study subjects. Mostly these were confined to the lower vertebrae levels (L4/L5 and/or L5-S1) (61.2%). Lumbar spine is the area most subjected to mechanical stress and thus this is the commonest area to be affected and as such is observed in this study.¹⁵

Commonest finding in lumbar degenerative changes is the disc displacement which can be in the form of either simple bulge or disc herniation.¹⁶ The herniated disks can be any among the following: IVD protrusion, IVD extrusion or IVD sequestration. In the study disc bulging was the commonest finding (around 78%); and similar observation was given by Dr.Sivas et al.¹⁷ In cases with herniated discs, majority (around 82%) of those herniation were mostly disc protrusion and only around 20% were disc extrusions.

In the study no disc sequestration was seen. Younger individuals between the ages of 20 & 39 years (40%) were found to have disc bulges whereas the subjects of middle age and above appeared to have disc herniation as a salient finding. In this study as almost around 63 percentages of herniated discs were at L4/L5 level and/or L5/S1 level. This can be attributed to the larger pressure load leading eventually to stress of the lower lumbar spinal levels. About half the patients in this study had central canal narrowing, which was comparatively higher than that which was reported by a study done under Modic et al¹⁸ and Shobeir et al.¹⁹ This difference can be attributed to the senior study subjects. Common age group for spinal narrowing is between 30years and 50 years of age¹⁰

Canal stenosis/narrowing was frequently seen at L4/L5 level and L5/S1 level, while there was no canal narrowing seen at the L1/L2 level which was similar to the findings in past studies.¹⁹ Subjects with sciatica showed spinal narrowing more often than those with lower backache.¹⁸ In the present study, the prevalence for canal narrowing/stenosis in patients with radiculopathy was around 42.8% and no such finding in

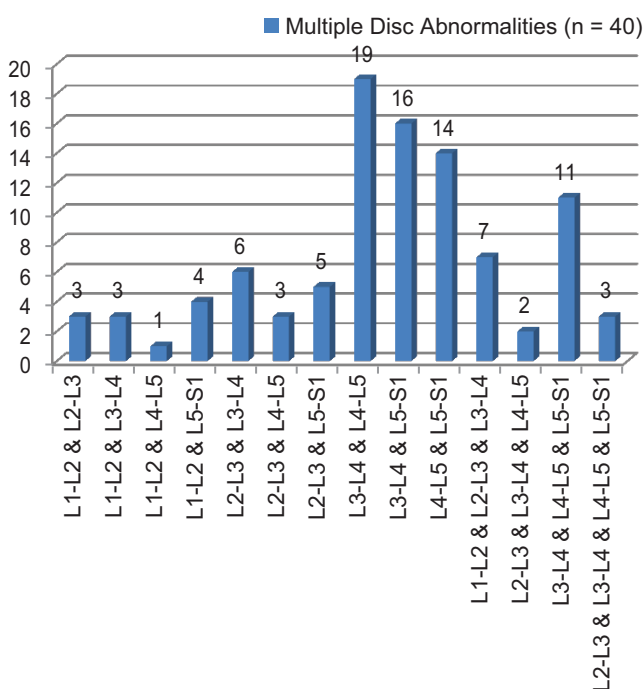


Figure-2: Distribution of multiple disc degenerative disease

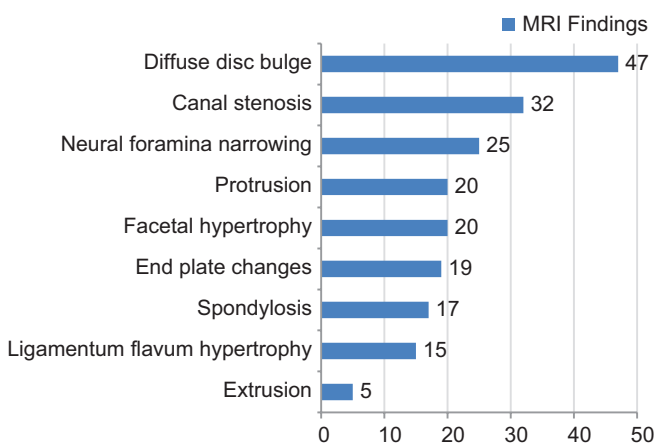


Figure-3: MRI findings in degenerative disc disease

patients presenting with only LBP. On a statistical point of view, this correlation has been statistically significant. Similar findings were noted in a study by Shobeir et al.¹⁹

X-ray is a fast and low cost imaging modality which is particularly good for detecting bony abnormalities. Although its sensitivity is lower than MRI in diagnosing the various degenerative disc diseases, it allows detection of abnormalities which can be further better characterised on MRI. In our study we found that X-ray correlated well with MRI at all levels (L1-L2-100%, L2-L3-93.9%, L3-L4-80.9% L4-L5-80.7%), and this was statistically significant. This is a significant finding in a developing country, as MRI is expensive and limited to certain institutions. So X-ray can be of help in situations where MRI is not widely available and also when there are financial limitations. This is almost the same as those observed by Benneker et al in their study.²⁰

CONCLUSION

In the present study, 60 MRI and X-ray films from patients with low back ache were analyzed. The following conclusions were drawn from this study:

The commonest age group affected by low back ache is 20-50 year age group.

Degenerative disc changes are more common in L4-L5 and L5-S1 levels.

Diffuse disc bulge is the commonest type of disc herniation seen on MRI.

Sciatica is common in patients with neural foraminal narrowing. This correlation was statistically significant.

REFERENCES

- Jarvik JG, Hollingworth W, Martin B, Emerson SS, Gray DT, Overman S et al. Rapid magnetic resonance imaging vs radiographs for patients with low back pain: a randomized controlled trial. *JAMA*. 2003;289(21):2810-8.
- Luoma K, Riihimäki H, Luukkonen R, Raininko R, Viikari-Juntura E, Lamminen A. Low back pain in relation to lumbar disc degeneration. *Spine (Phila Pa 1976)*. 2000;25(4):487-92.
- Urban PG, Jill, Sally Roberts. Degeneration of the intervertebral disc. *Arthritis Res Ther*. 2003; 5(3): 120-130.
- Lateef Humaira, Deepak Patel. What is the role of imaging in acute low back pain. *Curr Rev Musculoskelet Med*. 2009; 2(2): 69-73
- Jensen MC, Kelly AP, Brant Zawadzki MN. MRI of degenerative disease of the lumbar spine. *Magn Reson Q*. 1994;10(3):173-90.
- Modic T. Michael, Jeffrey S. Ross. Lumbar Degenerative Disk Disease. *Radiology* 2007;245,43-61.
- Smith AB, Soderlund KA, Rushing EJ, Smirniotopolous JG. Radiologic-Pathologic Correlation of Pediatric and Adolescent Spinal Neoplasms: Part 1, Intramedullary Spinal Neoplasms. *AJR* 2012;198:34-43.
- Kim SH, Bak KH, Kim DW, Kang TH. Primary intramedullary spinal sarcoma: a case report and review of the current literatures. *J Korean Neurosurg Soc*. Nov 2010;48(5):448-51.
- Haaga JR, Dogra VS, Forsting M, Gilkeson RC, Ha HK, Sundaram M. CT and MRI of the whole body, 5th edition, St. Louis: Mosby, 2003.
- Dahnet Wolfgang. *Radiology Review Manual 2007*. 6th Edition, 2007 Lippincott Williams & Wilkins. Philadelphia, Pennsylvania. Central Nervous System. Disk degenerative disease; pg 202/3/24.
- Cheung KM, Karppinen J, Chan D. Prevalence and pattern of lumbar magnetic resonance imaging changes in a population study of one thousand forty-three individuals. *Spine* 2009; 20;34(9):934-40.
- Kasdan RB, Howard JL. Neuroimaging of spinal diseases: a pictorial review. *Seminars in neurology*. 2008;28(4):570-89.
- Takatalo J, Karppinen J, Niinimäki J, Taimela S, Nayha S, Jarvelin MR, Kyllonen E, Tervonen O, 2009. Prevalence of degenerative imaging findings in lumbar magnetic resonance imaging among young adults. *Spine* 2009;34(16):1716-21.
- Ducati LG, Silva MV, Brandão MM, Romero FR, Zanini MA. Intradural lumbar disc herniation: report of five cases with literature review. *Eur Spine J*. 2013;22 Suppl 3:S404-8.
- Waris Eero, Eskelin Marja, Hermunen Heikki, Kiviluoto Olli, Paajenen Hannu, Disk degeneration in low back pain: a 17-year follow-up study using magnetic resonance imaging. *Spine* 2007 March Vol 32(6).
- Ong, J Anderson, J Roche A pilot study of the prevalence of lumbar disc degeneration in elite athletes with lower back pain at the Sydney 2000 Olympic Games. *Br J Sports Med* 2003;37:263-266.
- Sivas Acar Filiz, Deniz Ciliz, Uğur Erel, Esra Erkol Dnal, Kürsat Özorcan, Bülent Sakman. Abnormal Lumbar Magnetic Resonance Imaging in Asymptomatic Individuals, 2009 *Turk J Phys Med Rehab*; 2009;55(1):73-7.
- Modic T. Michael, Nancy A. Obuchowski, Jeffery S. Ross, Michael N. Brant-Zawadzki, Paul N. Grooff, Daniel J. Mazanec, Edward C. Benzel. Acute Low Back Pain and Radiculopathy: MR Imaging Findings and Their Prognostic Role and Effect on Outcome. *Radiology*, 2005;237(5):597-604.
- Shobeiri E, Khalatbari MR, Taheri MS, Tofghirad N, Moharamzad Y. Magnetic resonance imaging characteristics of patients with low back pain and those with sciatica. *Singapore medical journal*. 2009; 50(1):87-93.
- Benneker LM, Heini PF, Anderson SE, Alini M, Ito K. Correlation of radiographic and MRI parameters to morphological and biochemical assessment of intervertebral disc degeneration. *Eur Spine J*. 2005;14(1):27-35.

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