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RESEARCH ARTICLE

ROLE OF MRI IN THE MANAGEMENT OF LOW BACK ACHE: A PROSPECTIVE STUDY

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ABSTRACT

Background: MRI load of low back ache patients is quite high. Nearly 75% of populations suffer from low backache (LBA) with or without sciatica at some or the other time during adulthood. Majority of these patients, after a clinical diagnosis of Prolapsed intervertebral disc, are referred for an MRI, primarly not only for the confirmation of the diagnosis but also for the patient satisfaction (demand) and medico legal reasons. The study was conducted to understand the significance of MRI findings in the production of LBA with Sciatica and its role in its management. ***Material and Methods:*** 130 patients of LBA, with sciatica unilateral 78 (60%), bilateral 40 (37.6%) and without sciatica 12 (9.23 %) diagnosed clinically as prolapsed intervertebral Disc, underwent MRI and were evaluated on a uniform pattern by double blind method. The clinical findings of pain distribution dermatomes, sensory loss, motor loss, deep tendon reflexes, local tenderness and straight leg raising tests (SLR) were recorded. MRI evaluation noted the Grades of Disc Degeneration, Level & Type of prolapse, Neural foramina compromise, root impingement and other miscellaneous findings. All the variables of clinical presentation and MRI findings were compared to find out their significance. Inter and intra observer variations were calculated for significance by Kappa coefficient. ***Results:*** MRI levels of disc prolapse, impingement, foramina compromise and disc extrusions correlated well with clinical picture in 109 (83.8%) patients. Disc bulges single or multiple were mostly (88%) asymptomatic. Small impingements with effacement did not correlate with neurological/ dermatome level clinically. There was insignificant inter or intraobserver variation in interpretation of most of the MRI observations (Kappa score 0.56), however a minor intraobserver variation of (Kappa 0.34) was observed in labeling various types of disc prolapses. ***Conclusions:*** Not all cases of LBA with or without sciatica are prolapse disc and vice versa. Paracentral protrusion or extrusion with moderate to severe foramina impingement correlate well with clinical presentation whereas, central bulges and small disc protrusions show poor relation to clinical findings. The management of LBA & sciatica should depend upon the severity of pain, its distribution, response to conservative treatment and importance of neurological deficit and MRI help should be sought only in cases not responding to conservative treatment, doubtful diagnosis, important neurological deficit (Bowl Bladder involvement) and in cases where surgery has been planned.

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INTRODUCTION

Low back ache is the cost, mankind is paying to the upright posture of evolution. The incidence of LBA is high globally, and in USA prevalence rate of 1.39 per 1,000 persons – years, accounting for3.15% of all emergency visits (Waterman, 2012). 70 to 80 percent of adults suffer from LBA some or the other time in life time (Olmarker *et al*., 1991). Commonest cause of LBA is lumbar disc prolapse (Postacchini, 1999; Vroomen *et al*.,2009). Diagnosis based on clinical history of lifting heavy weight, LBA with radiation with typical dermatome distribution, h/o similar episode in the past, Positive cough reflex and Positive SLR, localized tenderness, sciatic scoliosis, para/hypoesthesia, root specific motor weakness and absent deep reflexes are usually enough to make an accurate diagnosis of PIVD (Level L4-L5 OR L5-S1) in majority of cases. MRI is a non- invasive, safe investigation that helps clinician to visualize lumbar patho-anatomical changes in detail and also is of great value in localizing the disc, picking up discs at more than one level, diagnosing other associated lesions, infective or neoplastic and helps the surgeon to be certain of level, and location of the prolapsed or extruded or migrated disc to be explored. However the clinical significance of MRI findings is still controversial (Milette *et al*., 1976; Beattie, 2000), one is never sure that which particular MRI finding is responsible for

which clinical finding, hence it loses some of its diagnostic and prognostic value. The present study was undertaken to enhance our understanding of clinical value of MRI and make a judicial use of the same for better patient care.

MATERIALS AND METHODS

The study included 130 patients presenting with LBA with or without sciatica from February 2015 to February 2016, in orthopaedic department of GMC Jammu. There were 78 (60%) males and 52 (40%) females, otherwise healthy individuals in the age group of 18 to 65 years of age. The chief complaint was low back ache with predominantly root pain.

The inclusion criteria were

a) Low back ache with or without radiation to the lower limb.
b) Radicular pain along a specific dermatome.
c) Presence of sensory or motor deficit in a particular nerve root supply area.
d) Straight leg or well leg raising test positive.
e) Patients who gave written consent to be a part of study and publication.

The exclusion criteria were

a) Pain non specific , vague, upto knee or gluteal region.
b) Patients with first attack of Acute LBA.
c) Patients with h /o old spinal fracture, infection, tumor, spondylolisthesis, old spinal surgery.
d) Patients with known contraindications to MRI, like pace maker, prosthesis or metal implant.
e) Patients who did not give consent for the study for personnel reasons.

*Three or more criteria (Brant *et al*., 1995) of inclusion would make a diagnosis of lumbar disc prolapse Definitive. Patients who had at least two criteria with positive MRI findings were also included in the study. A thorough clinical examination was done by a senior consultant of orthopaedics and detail history and examinations were recorded in a standard proforma for the sake of uniformity. The patient was then referred to two senior radiologist with a request for MRI lumbar spine without giving clinical details.

MRI was done in all the patients with a 0.5 tesla machine and MRI findings were recorded on a proforma in a uniform manner, making note of the following in all the cases:

a) Disc degeneration (Grades 1 to 5 as per Pffirmann *et al.* (2001).
b) Extent and Type of Disc Prolapse (Disc bulge, Disc protrusion, Prolapse, Extrusion and sequestration) (Fig 1a,1b,1c).
c) Neural foramina/canal compromise.
d) Nerve root impingement/compression.
e) Other findings like ligamentum Flavum thickening/infolding, facet joint arthrosis and canal stenosis.

To assess the inter/intra observer variations Kappa coefficient was used and a value of more than 0.5 and more was taken as good agreement. MRI findings were matched with clinical findings to understand their association and find out the diagnostic and prognostic value of this correlation to help the overall management of LBA.

Fig. 1a. Normal disc

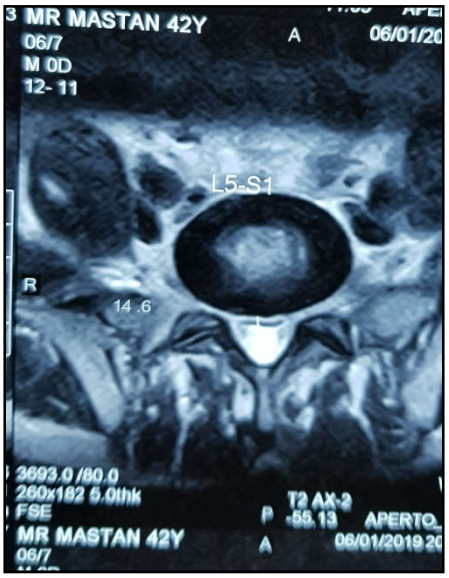

Fig.1b. Disc bulge

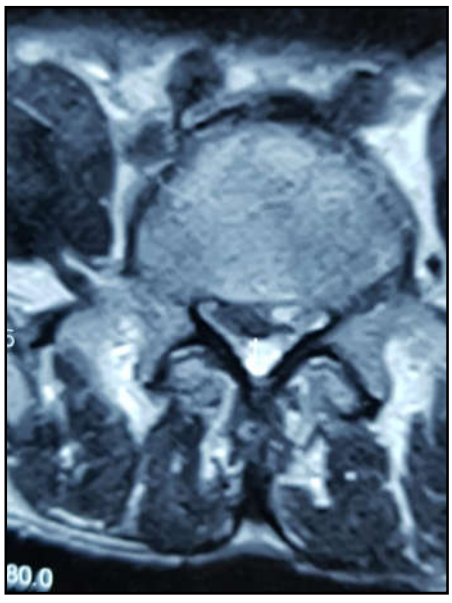

Fig.1c. Disc protrusion, extrusion & sequestration

RESULTS

The study included 130 healthy adult patients, 78 (60%) males, 52 (40%) females with a mean age of 43.5 years (18 – 65 years). The maximum number of patients 75 (57.69%) were in 30 to 50 years age group and only 3 (2.3%) below the age of 20 years.

Clinical observations: The referral of pain was identified as per the dermatome distribution. L3 dermatome was anterior distal thigh and knee, L4= anteromedial leg, ankle and distal front of knee, L5 = anterolatral leg, dorsum foot, and S1= outer sole of the foot and back of leg. There were 305 disc herniations in 130 patients. Commonest, dermatome involved were of L5 distribution in 60 (46.1%) patients, followed by S1 in 42 (32.3%) patients, another 10 (7.2%) had L4 and 8 (6.1%) had L3. Non specific distribution was seen in 10 (7.2%) cases. In addition 32 (24.6%) patients had involvement of more than one level (22 = L5-S1 & 10 = L4-L5) dermatomal pain distribution. Therefore, in total 92 patients (70.7%) had L5 dermatome involvement and next common was S1 dermatome in 64 (49.2%) of patients. Neurological symptoms like tingling, paresthesia, pins , pricks were present in 78 (60%) cases, out of these 38 were in L5 dermatome, 25 in S1, 3 in L4 another 12 patients had more than one level (L4-L5= 5, L5-SI= 7). In addition 40 patients had neurological deficit (25 = motor & sensory and 15 only sensory). 15 patients had deficit of more than one level (L4-L5 =6, L5 – S1=9), L4=4, L5=9 and S1 =12.

MRI findings: Disc degeneration of Grade 4 and above was seen in 110 (84.6%) patients at more than two levels. 64 (49.2%) patients had disc degeneration of three or more levels. 325 levels of 3 or 4 grade disc degeneration was seen in 130 patients (Average = 2.5). Disc herniation of 305 levels was found in 130 patients. Disc bulges were noted in 245 (86.8%), Disc protrusion was seen in 68 levels in 52 patients. Disc extrusion was detected in 36 patients and sequestration in 24 of extrusions. Kappa score for inter/intra observer was 0.64 on an average. Neural foramina compromise and nerve impingement: NFC (Neural Foramina Compromise) was found in 236 levels out of 305 disc herniations in 130 patients. Nerve root impingement was reported in 86 levels. Kappa value of 0.7 was calculated for inter/intra observer variations. Disc herniation and neural canal compromise values are shown in Table 1.

Non specific findings

- Ligamentum Flavum Thickening = 23 cases.
- Canal stenosis = 27 cases.
- Facet joint hypertrophy = 22 case.
- Spondylolisthesis = 6 cases.

A) Correlation between MRI level and clinical level: In case of more than one clinical dermatome involvement, one coinciding with neural compression on MRI was taken as MRI level. When neural foramina impingement was reported, L4-L5 involves L5 dermatome and L5 – S1 disc produced S1 radiculopathy were considered to be coinciding with clinical levels. There were 167 MRI levels producing 186 clinical symptom levels. ALL levels of MRI disc herniation matched with clinical dermatome levels except in 10 cases with non specific pain distribution (Table 2). Kappa score for clinical and MRI level was 0.76. Disc protrusion and extrusion in root canal with nerve root compression was symptomatic in 89% of cases, while only 56% of patients with disc bulge and nerve root compression were associated with radiculopathy or neurological symptoms. Disc extrusion with foramina compromise was symptomatic in 87% cases (Table 3).

B) Correlation of Neuro-deficit and root compression: There were 40 (30.7%) cases with neurological deficit. Out of these, 25 (62.5%) had disc bulge, 9 (22.2%) disc protrusion and 6 (15%) disc extrusion. Nerve root compression was seen in 27 (67.5%) cases. 15 cases had disc herniation at two or more levels with foraminal compromise and effacement. There were 78 non specific findings of ligamentum hypertrophy, stenosis, and facet joint enlargement at more than one or one level. Neurological symptoms were present in 78(60%) cases, L5=38, LS1=28, L4=3, More than one level L4 – L5=5, L5–S1=7.

C) Relation of disc protrusion/extrusion site to symptoms: Only 7 (20.6%) of central discs out of 34 were symptomatic, 23 (79.1%) of posterolateral discs out of 30 were symptomatic, another 4 out of 4 lateral discs were symptomatic and had neurological deficit. out of 36 extrusions, there were 16 sequestrations,6 central extrusions out of 10 were asymptomatic and 18 posterolateral and foraminal migratory discs were symptomatic and associated with neuro deficit in 10 cases.

D) MRI findings related to neurological deficit: Disc extrusion, multilevel disc bulges, foraminal compromise and findings of ligamentum flavum/facet joint hypertrophy and stenosis were often associated with chronic symptoms and frequent recurrences and neurological deficit. The association was found to be statistically significant (p value=0.75).

Table 1. Disc herniation and neural canal compromise

Sr.No.	Neural Canal Compromise	Disc Bulge	Disc Protrusion	Disc Extrusion
1	NONE	48	26	6
2	Foramen/lat. Recss com pro	133	14	9
3	Nerve root Impingement	41	28	21

Table 2. MRI- Disc level verses dermatomal level

Sr. No.	Disc Level On MRI	Dermatomal. Level	No. of Patients
1	L3	L4 LEVEL L3 RADICULOPATHY	3
2	L3	L4 LEVEL L4 RADICULOPATHY	6
3	L3	L4 LEVEL L4 AND L5 RADICULOPATHY	2
4	L4	L5 LEVEL L5 RADILOCULOPATHY	52
5	L4	L5 LEVEL L4,L5 RADICULOPATHY	7
6	L4	L5 LEVEL S1 RADICULOPATHY	6
7	L4	L5 LEVEL L5, S1 RADICCULOPATHY	4
8	L5	S1 LEVEL L5 RADICULOPATHY	12

Table 3. Type of disc -nerve canal compromise –symptomatic (%) – asymptomatic – total

Type of Disc	Nerve Canal Compromise	Symptomatic (%)	Asymptomatic	Total
Disc Bulge	ABSENT	8(10.9)	54	62
	Neural Foramina compro +	68(40)	98	166
	N. Root compression +	11(64.7)	6	17
Disc Protrusion	ABSENT	05(20)	20	25
	N. Foramina compro +	07(43.7)	9	16
	N. Root compression +	25(92.5)	2	27
Disc Extrusion	ABSENT	00(0)	6	6
	N. Foramina compro +	06(75)	2	8
	N. Root compression +	22(100)	0	22

DISCUSSION

The main objective of the present study was to understand the contribution of MRI in the management of low back ache patients. All the clinical as well as MRI findings of low backache patients were evaluated in detail and an attempt was

made to correlate them, so as to know that which of pathoanatomical finding on MRI was responsible for clinical presentation and how it can be of diagnostic and prognostic utility. Studies correlating clinical and MRI findings are few in number (Postacchini, 1999; Milette *et al*., 1999; Elfering, 2002; Rankie, 1976) and their reports are inconclusive or contradictory. In view of this, the present double blind prospective study was undertaken from February 1915 to Feb, 1916. The study included 130 patients, 78 (60%) males and 52 (40%) females, in the age group of 18 – 65 years (Mean age = 43.5). Male dominance in our study coincides with the other studies (Jeetendra, 2013) and is perhaps because of their involvement in vigorous, heavy jobs especially in hazourdos hilly terrain of our region. Mean age of 43.5 is similar to many a studies (Horal, 1969; Suk, 1976; Jeetendra, 2013; Janardhana, 2010). Clinical diagnosis of prolapse disc was made on h/o recurrent episodes associated with bending forward, lifting weights in 66% of cases in our series and it was statistically significant (P value = 0.001) Similar observations were made by Vroomen and Krom (Vroomen *et al*., 2000), Rainville *et al*. and Jeetendra *et al*. (2013).

Radiculopathy was present in 87% of our patients which is higher than other studies (Vroomen *et al.,* 2000) 54% and Jeetendra *et al.* (2013) 67%). SLR in our study was positive in 88% of patients, similar to that of Vroomen *et al*. (2000) but slightly higher than Jeetendera *et al.* (2013) 73%. In our study, clinical and MRI findings correlated very well in (90.15%) cases. Kappa coefficient 0.7 indicated good agreement, however in 11 (9.85%) cases clinical levels did not match with MRI levels.

Neural foramina compromise and nerve root compression were found to be more symptomatic than those without neural foramen compromise. Neural foramina compromise varies with the position of disc, as central protrusions and extrusions are less likely to cause neural deficit/symptoms as compared to posterolateral or far lateral discs, as was reported by Janardhana *et al.* (2010) in their study. This indicated that a patient of disc bulge with foramina compromise is more likely to be symptomatic than a patient with disc extrusion in centric position, however study by Dora and Schmid *et al.* (2005) have reported poor prognosis in all disc extrusions which is disagreed in our study. This has its importance when surgery is planned for a case with more than one MRI level involved, the level causing neural canal compromise/compression is the one most likely to be the cause of symptoms/deficit and need to be explored. Neurological deficit correlated well with nerve root compression seen on MRI, in our series root compression was associated with neurological deficit in 27 (67.5%) out of 40 patients, however 89% of our patients were symptomatic (pain, paraesthesia or sensory/motor deficit), if they had neural foramina rootcompression/compromise. Out of 40 cases of neurological deficit in our series, 14 (35%) had ligamentum flavum hypertrophy and 8 (20%) had facet joint hypertrophy. Our findings matched well with Janardhana *et al.* (2010). Ankle reflex was absent in 40 % of our patients with neurological deficit (P value </=0.05), similar figures of Jeetendra *et al.* (2010) (39%) and Weise 36%. In our study 31.2% of patients had L4–L5 level involved as compared to 36% of Jeetendra *et al.* (2010) and 43% of Modic *et al.* (1998) and Garrdio *et al.* (1993). Nearly 100% of patients with MRI reported disc protrusion/extrusion with nerve root compression had symptoms. The clinical findings of multi dermatomal involvement or atypical distribution was difficult to correlate with MRI findings of multidisc involvement or other miscellaneous findings. We believe, MRI is a Gold standard in the diagnosis of disc prolapse , its importance lies in its ability to accurately pin pointing a displaced disc material, but also giving information about multilevel involvement, migrated disc, associated canal stenosis, pathoanatomical changes of hypertrophy of ligamentum- flavum and facet joints apart from ruling out infective, neoplastic, metabolic and intra/extra medullary benign tumors. Hence, MRI forms an essential tool for the surgeon before contemplating any surgical venture in present day scinerio.

Conclusions

- MRI findings fairly explain the clinical presentation in low bachache with radiculopathy.
- MRI is a Gold standard in the diagnosis of PIVD.
- All MRI findings do not have clinical significance in all cases of PIVD.
- The MRI finding of posterolateral disc prolapse/ extrusion with foramina compromise is mostly associated with radiculopathy.
- Central protrusions/extrusions/effacement/disc bulges without foramina compromise are usually not significant.
- The type of disc herniation: Bulge, Protrusion or Extrusion correlate poorly with clinical signs and symptoms.
- The neural foramina compromise correlates well with clinical picture.

In view of the above statements, it becomes amply clear that a detailed history, a thorough clinical examination is reasonably reliable in diagnosing most cases of prolapse intervertebral disc in lumbar spine. Although MRI is a GOLD STANDARD in diagnosis of PIVD, it is a costly investigation, not easily available in primary or secondary care hospitals and moreover realizing heavy workload on MRI machines in tertiary care hospitals, resulting in long waiting lists, its mandatory to ask for an MRI very judicially. MRI should be reserved for patients planned for surgery to accurately know the level of intervention, how many levels and what else is required to be done.

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Conflict of Interest: None

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