

DIAGNOSTIC UTILITY OF MRI FINDINGS COMPARED TO PER-OPERATIVE FINDINGS IN LUMBAR INTERVERTEBRAL DISC PROLAPSE PATIENTS

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Abstract:

Background: Diagnosis of syndromes related to lumbar spine has improved with use of magnetic resonance imaging (MRI). Neurological signs of herniated lumbar disc are important to make a decision whether to operate the patient or not. Hence, clinical examination is also important in patients with herniated lumbar disc.

Objective: To study diagnostic utility of MRI findings compared to per-operative findings in Lumbar intervertebral disc prolapse patients

Methods: Hospital based diagnostic evaluation study was carried out among 30 patients having signs and symptoms of herniated lumbar disc. All the consecutive patients presenting with low back ache (LBA) and sciatica admitted were thoroughly examined. Neurological examination, X-ray Lumbar Spine AP and lateral, MRI were done. MRI lumbar spine was graded as per Michigan scale. Surgery was done electively under general anesthesia in prone position. Patients were followed to assess the pain.

Results: Both MRI and per-operative findings agreed on the actual finding of zone of disc prolapse in 24 (80%) of the cases and differed in remaining six (20%) of the cases. The sensitivity of MRI compared to per-operative finding in diagnosing central zone of disc prolapse was 84.6% of cases and 76.5% in diagnosing lateral zone of disc prolapse. The outcome of surgery was excellent in 43.3% of cases followed by fair in 50% of the cases. It was poor in only two cases.

Conclusion: Subjects in the age groups 40-59 years were commonly affected MRI is a very sensitive in detecting symptomatic lumbar disc prolapse.

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Introduction

Herniated disc is most commonly seen in people in their third to fifth decade of life. Its incidence is about 5 to 20 cases per 1000 adults annually. ¹ A male to female ratio of 2:1 has been recorded. ² It has been estimated that prevalence of lumbar spine herniated disc which is symptomatic is 1-3%. ³ The most significant prevalence is seen among people in third to fifth decades of their life. There is an approximately 95 percent chance in people between 25-55 years old, of herniated discs which occur either at L4-L5 or L5-S1. The underlying etiology is Disc disease, in less than five percent of patients with back pain. ⁴

A focal displacement of nucleus annulus or end plate material beyond the normal boundaries of intervertebral disc space is called the Lumbar disc herniation. Its consequences include the displacement of epidural fat, nerve root and /or thecal sac which causes pain, weakness or numbness in a sclerotomal or dermatomal distribution. ⁵

A disc herniation can be diagnosed clinically based on the history, physical examination findings and the results of imaging test. The tests included in a conventional physical examination are: testing for threshold of pain, testing for deficits of sensory, motor and reflex actions, "straight leg raising test." However, diagnostic accuracy of these clinical examination is limited. ⁶

Diagnosis of syndromes related to lumbar spine has improved with the use of magnetic resonance imaging (MRI). But, it cannot replace the conventional clinical examination. Neurological signs of herniated lumbar disc are important to make a decision whether to operate the patient or not. Hence, clinical examination is also important in patients with herniated lumbar disc. MRI has been found to be superior over computed tomography (CT) and myelogram for the diagnosis of the herniated lumbar disc. ⁷

Hence, present study was carried out to study diagnostic utility of MRI findings compared to per-operative findings in Lumbar intervertebral disc prolapse patients

METHODS

Hospital based diagnostic evaluation study was carried out. The study was carried out at department of Orthopedics, Malla Reddy Institute of Medical Sciences, Hyderabad over a period from June 2019 to July 2021. We were able to include 30 patients having signs and symptoms of herniated lumbar disc as per the inclusion and exclusion criteria. Institutional Ethics committee approval was obtained and informed consent was taken from patients.

Inclusion criteria:

1. Patients aged between 20-70 years of either gender
2. Radiculopathy of at least 6 weeks not relieved by conservative methods
3. Disc herniation with neurological deficit.
4. Nerve root tension signs like straight leg raising test (SLRT)

Exclusion criteria:

1. Age below 20 years and above 70years.
2. Patients with previous history of Spinal trauma, Infection, Tumor, Lumbar canal stenosis, Spondylolisthesis.

3. Failed back syndrome.

All the consecutive patients presenting with low back ache (LBA) and sciatica admitted into the ward were thoroughly examined after proper clinical history. A detailed neurological examination was done. X-ray Lumbar Spine Antero-posterior and lateral views and dynamic standing flexion, extension lateral views were taken. MRI of lumbar spine findings were graded as per Michigan scale. Surgical profile and pre anesthetic checkup was done. Surgery was done electively under general anesthesia in prone position.

General anesthesia protocol: Inj. Midazolam - 1mg, Inj. Glycopyrrolate - 0.3mg, Inj. Fentanyl - 1 microgram/kg, Inj. Propofol 2mg/kg, Inj Vecuronium 0.08-0.1mg/kg (Neuromuscular blocker), and Isoflurane 0.6-1% (Inhalational agent) were used.

Per-operative findings of disc protrusion/extrusion, location, ligamentum flavum thickening, nerve tightness and spinal canal stenosis were noted. Disc removed was sent for histopathological examination to confirm the disc material. Post-operative recovery was noted and neurological improvement was noted. Patients were followed up periodically at regular intervals.

The physical signs were elicited by examination before surgery. Back signs, signs of tension and signs of neurological in legs were seen. Back related signs were “loss of normal lumbar lordosis”, “para-spinal spasm”, “sciatic scoliotic list” and movement limitation of spinal range. Straight leg raising test (SLR) was used to find out the tension signs. For SLR, patient was asked to be in supine position with full extension of knee. With extended knee, the leg was raised slowly till the patient told that he is having pain and that angle was noted. Weakness of motor, sensor and reflex changes were noted during neurological examination.

The patients were categorized on follow-up examination as free from pain, almost free from pain, residual pain with improvement, no improvement. First two categories were named as excellent, third as fair and last as poor

Statistical analysis:

The data collected was entered in Microsoft Excel. Sensitivity of MRI in detecting symptomatic lumbar disc prolapse was calculated. The result were considered significant at $P < 0.05$

Results:

Table 1: Distribution of study subjects as per baseline characteristics

Characteristics		Number	%
Age (years)	21-29	4	13.3
	30-39	2	6.7
	40-49	11	36.7
	50-59	9	30
	60-70	4	13.3
Sex	Male	16	53.3
	Female	14	46.7

Impact occupation of	Significant	14	46.7
	Not significant	16	53.3
Mode of injury	Lifting heavy weight	8	26.6
	Bending	12	40
	Unknown	10	33.3
Duration of backache (weeks)	6	2	5
	7-48	20	68.3
	48-60	8	26.7
Distribution of pain	More in lower limbs than back	7	23.3
	More in back than lower limbs	23	76.7
Side involved in sciatica	Right	12	40
	Left	11	36.6
	Bilateral	7	23.3

Age group of 40-49 was most commonly affected (36.7%). Males affected number was slightly more than females (53.3% vs. 46.7%). In 46.7% of cases, the impact of occupation was significant. Bending was the most common mode of injury. Majority (68.3%) had backache since 7-48 weeks before they presented to the hospital. Majority (76.7%) had pain more in back than lower limbs. Right and left side were equally affected among cases (Table 1)

Table 2: Distribution of study subjects as per signs

Signs		Number	%
Spinal signs	Loss of lordosis	18	60
Sciatic scoliotic list	Towards side of pain	9	30
	Opposite side of pain	6	20
Tenderness	Present	20	66.7
	Absent	2	6.7
	Localized	8	26.6
Nerve root tension signs	SLR positive <30°	8	26.7
	SLR positive <30-60°	12	40
	SLR positive >60°	10	33.3

60% of the cases had loss of lordosis. 30% had sciatic scoliotic list towards side of pain. Tenderness was seen in 66.7% of the cases. Among Nerve root tension signs, majority (40%) had SLR positive <30-60° (Table 2)

Table 3: Correlation between zone of disc prolapse as seen on MRI according to Michigan scale of disc prolapse and Per-operative finding of the zone of disc prolapse

Zone of disc prolapse on MRI according to Michigan scale disc prolapse	Per-operative finding of zone of disc prolapse.	No. of patients
Central	Central	11 (36.7%)
Lateral	Lateral	13 (43.3%)
Far lateral	Far lateral	0
Central	Lateral	2 (6.7%)
Central	Far lateral	0
Lateral	Central	0
Lateral	Far lateral	4 (13.3%)
Far lateral	Central	0
Far lateral	Lateral	0

Both MRI and per-operative findings agreed on the actual finding of zone of disc prolapse in 24 (80%) of the cases and differed in remaining six (20%) of the cases (Table 3)

Table 4: Sensitivity of MRI compared to per-operative findings

MRI findings	Per-operative findings		
	Central	Lateral	Far lateral
Central	11	2	0
Lateral	0	13	4

The sensitivity of MRI compared to per-operative finding in diagnosing central zone of disc prolapse was 84.6% of cases and 76.5% in diagnosing lateral zone of disc prolapse (Table 4)

Table 5: Outcome of surgery for pain during follow up

Outcome	No. of patients	Percentage
Excellent	13	43.3
Fair	15	50
Poor	2	6.6

The outcome of surgery was excellent in 43.3% of cases followed by fair in 50% of the cases. It was poor in only two cases (Table 5)

DISCUSSION

Age group of 40-49 was most commonly affected (36.7%). Males affected number was slightly more than females (53.3% vs. 46.7%). In 46.7% of cases, the impact of occupation was significant. Bending was the most common mode of injury. Majority (68.3%) had backache since 7-48 weeks before they presented to the hospital. Majority (76.7%) had pain more in back than lower limbs. Right and left side were equally affected among cases. 60% of the cases had loss of lordosis. 30% had sciatic scoliotic list towards side of pain. Tenderness was seen in 66.7% of the cases. Among Nerve root tension signs, majority (40%)

had SLR positive <30-60°. Both MRI and per-operative findings agreed on the actual finding of zone of disc prolapse in 24 (80%) of the cases and differed in remaining six (20%) of the cases. The sensitivity of MRI compared to per-operative finding in diagnosing central zone of disc prolapse was 84.6% of cases and 76.5% in diagnosing lateral zone of disc prolapse. The outcome of surgery was excellent in 43.3% of cases followed by fair in 50% of the cases. It was poor in only two cases.

We found that age group of 40-49 was most commonly affected and males were more affected compared to females. Rydevik B et al ⁸ reported that the males were more than females and average age was 40.8 years from their study. Kerr RSC et al ⁹ also found that the average age was 40 years in their study.

We found that bending was the most common mode of injury followed by trauma in the present study. Webre H et al ¹⁰ however reported that trauma to the back followed by heavy work was the most common reason of injury which subsequently developed in the disc herniation.

We noticed that Majority (68.3%) had backache since 7-48 weeks before they presented to the hospital. Spangfort EV et al ¹¹ also noticed that majority had back pain on an average since 5-6 years. Webre H et al ¹⁰ also found that the back pain duration was almost 10 years before the patients presented to them.

In the present study, Majority (76.7%) had pain more in back than lower limbs. Kerr RSC et al ⁹ also found that sciatica was seen in 99% of the cases. Leg pain was bilateral in 10% of the cases. 30% of the cases reported to have tingling and numbness. Rydevik B et al ⁸ reported that sciatica was seen in all cases. Leg pain was main symptom in 88% of the cases. 96% developed extruded fragment among those who presented with leg pain only.

In the present study, 60% of the cases had loss of lordosis. 30% had sciatic scoliotic list towards side of pain. Tenderness was seen in 66.7% of the cases. Among Nerve root tension signs, majority (40%) had SLR positive <30-60°. These findings are similar to those reported by Kosteljanetz M et al. ¹² Matsui H et al ¹³ concluded that sciatic scoliotic list is not predictive but suggestive of herniation of the disc. Jonsson B et al ¹⁴ found that 86% of the cases in their study had positive SLR test. 26.7% of the cases had positive SLR below 30°. 40% of the cases had positive SLR at 30-60°. 33% of the cases had positive SLR at more than 60°.

We found that 73.3% of the cases had reduced power of dorsiflexors in ankle and toes. 50% of the cases had reduced power in flexion of ankle plantar. In 60% of the cases, ankle reflex alterations were noted. In 40% of the cases, knee reflex alterations were seen. Kerr RSC et al ⁹ also found similar results. Kuslich SD et al ¹⁵ also reported similar results.

We noticed that the complication rate was high in those patients who presented to us after more than eight months of symptoms. Silverplat K et al ¹⁶ reported that the outcome depends upon the duration of symptoms before the patient presents to the hospital. If it is less than six months, then the outcome will be good or excellent. Hurme M et al ¹⁷ observed that the most significant risk factor for poor prognosis was having sciatica for >2 months before presenting to the hospital. Quigley MR et al ¹⁸ reported similar results. In the present study, Most Patients developed instability (15%) at the operated level at one year follow up. The delay in the follow up was because of COVID pandemic. A few Patients in this study had developed stiffness of the back. They had reduced flexion movements at the lumbar spine at 1 year follow up due to delay in the start of the physiotherapy and apprehension by the Patients that early start of physiotherapy may lead to recurrence of symptoms. Hence we recommend

physiotherapy to strengthen back muscles to be initiated by 3 months post-operative period. Patients with more than 8 months duration of sciatica had still persistence of pain, lesser degree than before surgery in the post-operative period. Hence the duration of the hospital stay is more in this Sub cohort.

Approximately 100% had the herniation at same level as predicted by MRI. MRI coincided with per-operative findings exactly in 80% of the cases. Kosteljanetz M et al ¹² reported similar findings.

There was positive correlation between MRI findings and per-operative findings in 24 (80%) out of 30 and negative correlation in 6 (20%) out of 30 patients. All the patients were clinically examined, patients were subjected to MRI and all patients underwent lumbar discectomy and intra op findings were noted. MRI is a helpful preoperative diagnostic investigation which shows structural changes in the disc the size and the site of the extrusion or protrusion and should be used as an indication for surgery when there is a strong correlation with the clinical findings. In this study the zone of disc prolapse which was found on MRI as per Michigan scale of disc prolapse correlated positively with per operative finding of disc prolapse in 24 patients (Central disc prolapse in 11 patients and lateral disc prolapse in 13 patients) while there was negative correlation in 6 patients.

CONCLUSION

Subjects in the age groups 40-59 years are commonly affected There was positive correlation between clinical, MRI findings with intra operative findings. Neurological findings on examination have significant localizing importance. MRI is a very sensitive in detecting symptomatic lumbar disc prolapse. MRI is a helpful preoperative diagnostic investigation which shows structural changes in the disc, the size and the site of the extrusion or protrusion. The study highlights the importance of a thorough clinical examination in coming to a diagnosis of the level of disc prolapse.

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