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Original Article

Radiology Section

Categorization of Pathology Causing Low Back Pain using Magnetic Resonance Imaging (MRI)

NIRMALKUMAR GOPALAKRISHNAN[1], KULASEKARAN NADHAMUNI[2], T. KARTHIKEYAN[3]

ABSTRACT

Background: Low backache is the most common ailment flooding the orthopaedic clinic. Most of the population at least once seek medical attention for low back ache. Magnetic Resonance Imaging (MRI) is a non invasive, commonly used diagnosing modality and accurate in diagnosing pathology causing low back ache.

Aim: To classify and quantify the causes of low back pain referred to radiology department by MRI.

Materials and Methods: Patients with back pain referred to radiology department were subjected to single MRI scan after ruling out any contraindications using the following sequences: T1W Turbo Spin Echo, T2W Turbo Spin Echo, Gradient-echo, Myelogram and short TI inversion recovery (STIR), in all imaging planes. Gadolinium enhanced T1W turbo spin echo sequence was used wherever necessary.

Results: Data were analysed using Excel 2007, SPSS 14, Students t-test. Degenerative disc diseases were the commonest pathology followed by congenital and traumatic lesions. Neoplastic lesions were the least common. Commonest herniation type being the disc bulge (79%) followed by disc protrusion (15%), disc extrusion (6%) and disc sequestration (<1%). The posterolateral disc herniation as the commonest and foraminal the least. Sacralisation was the most common congenital spinal anomaly, followed by lumbar scoliosis and perineural cyst. There is no sex difference in disc protrusion but male preponderance in disc extrusion with subligmentous extrusion.

Conclusion: MRI is useful in classifying the spinal lesions which again influences the treatment modality and clinical outcome. Degenerative disc disease is the single most common category which accounts for most the Low Back Ache for which a preventing strategy should be drafted.

Keywords: Degenerative disc disease, Low backache, Magnetic resonance imaging

INTRODUCTION

Low backache is one of the most common reasons for outpatient visits and 80% to 90% of the population will experience this problem at some time [1]. It results from a wide spectrum of causes ranging from orthopaedic, surgical, gynaecological and neurological diseases to pregnancy, menstrual period, genitourinary tract diseases and acute gastroenteritis.

Low backache can be acute or chronic. Acute low back pain is defined as lumbosacral pain of less than six weeks duration with or without progressive or disabling symptoms. Most acute back pain is mechanical in nature, as a result of either trauma to the lower back or a disorder such as arthritis.

About 70% of acute low backache is attributed to spinal muscle strain or ligament injury (sprain) [2,3]. Acute low backache can be uncomplicated or complicated. A complicated acute low backache is one when symptoms persist longer than six weeks. The indications of a complicated status include recent significant trauma; unexplained weight loss or fever; immune suppression; history of malignancy; intravenous (IV) drug use; prolonged corticosteroid use, osteoporosis; age>70; focal neurologic deficit with progressive or disabling symptoms [4] and these preclude radiological evaluation. Low backache that persists for more than three months is considered as chronic. Chronic low backache may be related to poor ergonomics like prolonged awkward posture, repetitive bending, prolonged sitting etc., in occupation, other physical or psychological stress and pathological conditions.

Most of the low backache resolves at least for a period of time with conservative treatment. But some proportion of patients has persistent pain not resolving with conservative conventional treatment. Managing this proportion is a laborious task to establish a diagnosis and select a suitable treatment modality. Radiological imaging plays a key role in aiding to establish or rule out pathological conditions and most importantly to influence the therapeutic decision-making process. Radiological evaluation of the lumbosacral spine has seen major advances over the past two decades. Plain radiography, computed tomography (CT) and MRI are the mainstay. With its high contrast and spatial resolution and lack of ionizing radiation, MRI is the best imaging technique for imaging of the spine [5,6]. MR imaging provides multiplanar reconstruction and high contrast resolution for lesion characterisation. Unenhanced and contrast-enhanced MR imaging has the ability to demonstrate inflammatory, neoplastic, and most traumatic lesions as well as show anatomic detail not available on isotope studies. MR Imaging shows high sensitivity and specificity in evaluating spinal infections [7,8]. With MRI evolving as the modality of choice for evaluating spinal lesions, this study aims to evaluate and categorize the spinal causes for low backache using MRI, an observational cross sectional study.

MATERIALS AND METHODS

This study involves 200 patients with low backache with or without radiculopathy, referred to the Radiology Department in Sri Venkateshwaraa Medical College Hospital and Research Centre, Puducherry, India for MRI evaluation over a period of one year between august 2013 and august 2014.

Prior institutional ethical committee clearance was obtained and informed consent from the patients was also obtained.

Patient selection

Inclusion criteria: All patients referred from Orthopaedic, Neurosurgery and other departments for radiological evaluation of low backache with or without radiculopathy.

- Patients of all age groups and both sexes.

Pathology	No. of Cases	Percentage
Degenerative disc disease	159	79.5%
Traumatic lesions	11	5.5%
Infective lesions	7	3.5%
Neoplastic lesions	4	2%
Congenital lesions	19	9.5%
Total	200	100%

[Table/Fig-1]: Shows the quantum of various spinal lesions

Herniation Types	L1/L2	L2/L3	L3/L4	L4/L5	L5/S1	Total
Disc bulge	12	38	106	178	120	454
Disc Protrusion (focal and broad based)	9	7	11	35	21	83
Disc Extrusion with subligamentous extension	0	1	6	15	11	33
Disc sequestration	0	0	0	2	1	03
Total	21	46	123	230	153	573

[Table/Fig-2]: Shows the disc herniation types at various lumbar levels

Position of Herniated Disc	Postero Lateral	Central	Foraminal
Total no.	372(65%)	169(30%)	32(5%)

[Table/Fig-3]: Shows the prevalence of different position of herniated disc

Disc Bulge	Age <30	Age 30-50	Age >50	Total
Male	19	51	25	95
Female	6	50	56	112
Disc protrusion				
Male	10	17	9	36
Female	3	18	14	35
Disc extrusion with subligamentous extension				
Male	2	14	5	21
Female	1	7	1	9
Disc sequestration				
Male	0	2	0	2
Female	0	1	0	1
Total	41(13%)	160(51.5%)	110(35.5%)	311

[Table/Fig-4]: Shows Age distribution of degenerative disc disease among male & female

Exclusion criteria

Patients with contraindications to MRI (e.g., prosthetic heart valves, cardiac pacemakers, ferromagnetic vascular clips, cochlear implants, intraocular metallic foreign bodies, claustrophobia, etc.). Detailed history of the patient were recorded and MRI of spine was done using the following sequences: T1W Turbo Spin Echo, T2W Turbo Spin Echo, Gradient-echo , Myelogram and STIR, in all imaging planes (axial, coronal and sagittal planes).Gadolinium enhanced T1W turbo spin echo sequence was used wherever necessary. Scan was done extending from lower thoracic (T10) to lumbosacral region.

Equipment Siemens magnetom - 1.5 Tesla MRI Scanner

STATISTICAL ANALYSIS

using Excel 2007, SPSS 14. Students t-test.

RESULTS

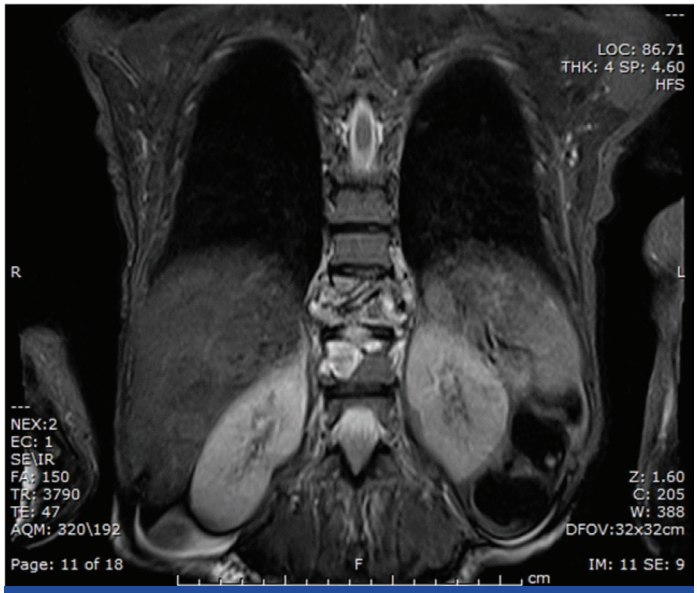
The [Table/Fig-1] shows degenerative disc disease as the commonest pathology followed by congenital and traumatic lesions in this study. Neoplastic lesions were the least common type of spinal lesions in this study. [Table/Fig-2] shows the commonest herniation type being the disc bulge (79%) followed by disc protrusion (15%), disc extrusion (6%) and disc sequestration (<1%). [Table/Fig-3] depicts the posterolateral disc herniation as the commonest and foraminal the least. [Table/Fig-4] shows male preponderance for severe lesions like disc extrusion and disc sequestration. There is no difference between male and female in disc protrusion and tide towards female with disc bulge. [Table/Fig-5] shows that in this study, a case of schwannoma (intradural extramedullary location) and three cases of metastases (extradural) were seen. [Table/Fig-6] shows that sacralisation was the most common congenital spinal anomaly in this study, followed by lumbar scoliosis and perineural cyst. [Table/Fig-7] shows a case of tuberculous spondylodiscitis with vertebral body defects and abnormal heterogeneous T1, T2 and STIR signal in T12, L1 vertebral bodies and intervening disc and bilateral subligamentous paraspinal collection. In [Table/Fig-8], left parasagittal section of T2W sequence demonstrates an extradural lesion in left lateral epidural space causing impingement of the traversing nerve root which was found to be Schwannoma. Well demarcated extradural T1 hypo and T2 hyperintense Tarlov cyst (Type II extradural spinal meningeal cyst) is seen at S2-3 intervertebral level in [Table/Fig-9]. [Table/Fig-10] shows a case of L4 vertebral body metastasis with complete destruction, collapse and retropulsion of the vertebral body causing secondary canal stenosis.

Location	No. of cases (n=4)	Percentage
Extradural	3	75%
Intraduralextramedullary	1	25%
Intramedullary	0	0%
Total	4	100%

[Table/Fig-5]: Shows the different locations of tumours in spinal cord

Congenital Lesion	No. of Cases (n=19)	Percentage
Sacralization/ Lumbarization	14	74%
Scoliosis	3	16%
Perineural cyst	2	10%

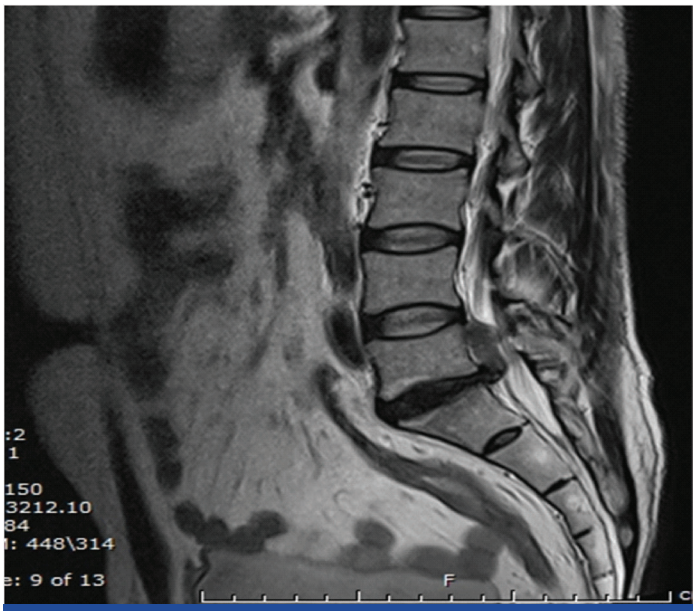
[Table/Fig-6]: Shows the various types of congenital lesions in lumbar region



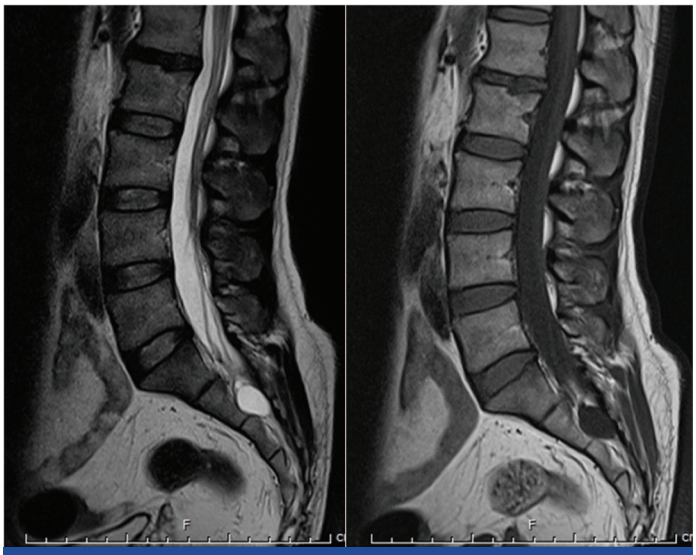
[Table/Fig-7]: Coronal T2W images showing heterogeneous increased signal involving the T12, L1 vertebral bodies and the intervening disc with vertebral body/ endplate destruction and bilateral paraspinal extension which turned out to be a case of tuberculous spondylodiscitis

DISCUSSION

The most common source of lumbar pain is related to some form of spinal degeneration [9]. Disc degeneration involves structural disruption and cell mediated changes in composition. Mechanical, traumatic, nutritional and genetic factors all may play a role in the cascade of disc degeneration.

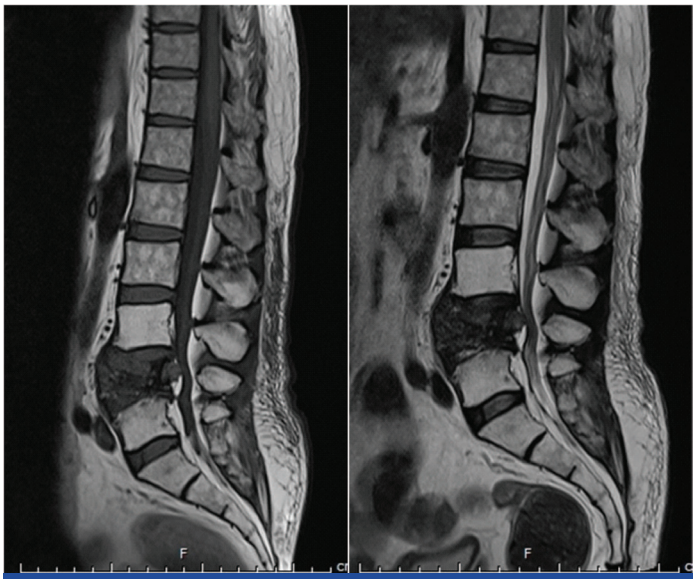


[Table/Fig-8]: Sagittal T2W image showing slightly lobular intermediate signal intense extradural Schwannoma measuring about 2.4 cm in craniocaudal dimension located inantero left lateral epidural space at L5 vertebral level causing lateral recess obliteration and traversing nerve root compression



[Table/Fig-9]: Sagittal T1 & T2W images of lumbosacral spine demonstratingawell defined T1 hypo and T2 hyper intense (CSF isointense) perineural cystic lesion (Tarlov Cyst)at S2-3 intervertebral level

Irrespective of the etiology, by the age of 50 year, 85%-95% of adults show evidence of degenerative disc disease at autopsy [10]. Abnormal discs can be classified as bulge or herniated disc. Herniated disc is sub classified as protrusion, extrusion and sequestration. The diagnosis of herniation is usually made when displacement of disc material is beyond the edges of the ring apophyses. A herniated disc is more specifically characterised as bulge, protrusion, extrusion or sequestration. These distinctions are based on the shape of the displaced material. Bulge may be symmetrical or asymmetrical. Protrusion is present if the greatest distance, in any plane, between the edges of the disc material beyond the disc space is less than the distance between the edges of the base in the same plane. Extrusion is present when, in at least one plane, any one distance between the edges of the disc material beyond the disc space is greater than the distance between the edges of the base in the same plane or when no continuity exists between the disc material beyond the disc space and that within the disc space. Extrusion may be further specified as sequestration if the displaced disc material has lost completely any continuity with the parent disc. Bozzao et al., in their study on lumbar disc herniation in patients managed non-operatively has revealed spontaneous resolution of



[Table/Fig-10]: Sagittal T1 & T2W images showingpathological collapse, loss of definition and destruction of the L4 vertebral body demonstrating diffuse low T1 and T2W signal intensity with posterior convex bulging of the vertebral body cortex indenting the thecal sac

disc herniation in which MRI was the optimal, noninvasive imaging study to document these changes [11]. Cheung et al., [12] showed that majority of lumbar disc herniations occur at L5/S1 and L4/L5 levels. In this study the cumulative disc herniation in the lower three lumbar discs being 506 as against upper two lumbar discs level which is 67.

In their study, Knop-Jergas et al., [13] concluded that more than 60% of disc herniations occur along the posterolateral (paracentral) margin of the disc, whereas 30% occur directly posterior (central) and 10% laterally (foraminal) and the type influences the clinical outcome. In this study posterolateral disc herniation accounts for 65% followed by central at 30% and foraminal 5%. Andrew and Jeffrey [14] stated that acquired spinal stenosis due to degenerative joint and disc disease accounts for vast majority of cases presenting with low backache. In this study degenerative disc disease stands at 79.5% of all cases present with low back pain. Modic and Ross [15] described annular fibrosus fissuring on T2W images as areas of increased signal within the normal low signal intensity annulus. Similar signal intensity as mentioned above for posterior annular tear was noted in this study as well. In patients with spinal stenosis, Park et al., [16] found the mean thickness of ligamentum flavum was 4.44 mm, compared to 2.44 mm thickness in the control group. Other studies have shown normal thickness of the ligamentum flavum as ranging from 1.8 to 5 mm [17]. The thickened ligamentum flavum along with bulging annulus aggravates the stenosis. In our study, the mean thickness of ligamentum flavum is 3.17 mm. Lower thoracic spines were the commonest site for ligamentum flavum hypertrophy and in lumbar spine L4/L5 level was the commonest site (six cases), followed by L1/L2 level (4 cases). Kalichman et al., [18] measured antero-posterior diameter of dural sac at midvertebral body level and concluded 10-12 mm (relative) and <10 mm (absolute) as the cut-off values for lumbar spinal canal stenosis. Most of spinal stenosis typically affects men between the ages of 35 and 65. In this study mid-sagittal antero-posterior diameter of < 11 mm at midvertebral body level and mid-sagittal duralsac antero-posterior diameter of <8 mm at intervertebral disc level was considered as the criteria for lumbar canal stenosis. Thirty-eight cases (19%) were noted to have secondary lumbar spinal canal stenosis in this study. All of them were above 30 yr age group. Degenerative disc disease found to be more in the 30 -50 yr age group (51.5%) followed by 35.5% in above 50 yr age group and least (13%) in below 30 yr age group. Bazan C [19] stated that nerve sheath tumours are mostly intradural (72%) and 14% are purely extradural and 14% dumbbell shaped with both intra and extradural components. In

this study MRI showed altered signal intensities involving multiple vertebral bodies, appearing hypo-intense to normal bone marrow on T1W images and heterogeneous signal intensity on T2W images (hypointense - tumour, hyperintense - oedema). STIR sequences were used to differentiate oedema and tumour, in which oedema appeared hyperintense. Postcontrast T1W images also delineated tumour from oedema. In this study, out of six extradural lesions, five cases were metastases and one case was schwannoma (17%). The intradural extramedullary lesion was a case of meningioma. The most common extradural neoplastic lesion noted in this study was vertebral metastates (five cases - 83%). Of these, three cases (60%) were diagnosed cases of carcinoma breast, indicating breast carcinoma as the most common cause of vertebral metastases in this study. In this study no cases of intramedullary neoplastic lesions were encountered.

In a recent longitudinal cohort study by Pradeep et al., [20] examining associations between incident MRI findings and incident spine-related symptom outcomes, they concluded that only three MRI findings to have large magnitude associations with symptoms. Annular fissures were associated with chronic low back pain, disc extrusions and nerve root impingement had radicular symptoms and no other findings were shown to have large scale association with symptoms. Though our study was not a longitudinal study nor numerical pain rating scale was used to assess the outcome or quantify the disability, it shows a definite association of the degenerative imaging changes with patient symptomatology either with isolated low back ache or with associated radiculopathy.

CONCLUSION

MRI is useful in classifying the spinal lesions which again influences the treatment modality and clinical outcome. Degenerative disc disease is the single most common category which accounts for most the Low Back Ache for which a preventing strategy should be drafted.

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PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Radiology, Sri Venkateshwaraa Medical College Hospital and Research Centre, Ariyur, Puducherry, India.
2. Professor & Head of Department, Department of Radiology, Sri Venkateshwaraa Medical College Hospital and Research Centre, Ariyur, Puducherry, India.
3. Assistant Professor, Department of Anatomy, Sree Balaji Medical College & Hospital (Bharath University), Chrompet, Chennai, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Nirmalkumar Gopalakrishnan,
Assistant Professor, Department of Radiology, Sri Venkateshwaraa Medical College Hospital and Research Centre,
Ariyur, Puducherry, India.
E-mail : drgnirmal@yahoo.co.in

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