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Radio-Diagnosis

ROLE OF MAGNETIC RESONANCE IMAGING (MRI) AND COMPUTED TOMOGRAPHY (CT) IN DEGENERATIVE DISEASES OF THE SPINE

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ABSTRACT The prevalence of degenerative disc disease is linearly related to the age. Intervertebral disc degeneration begins early in life. Degeneration includes changes involving the endplates (sclerosis, defects, Modic changes and osteophytes), as well as disc changes (fibrosis, annular tears, desiccation, loss of height and mucinous degeneration of the annulus fibrosis). High prevalence of asymptomatic disc degeneration must be considered when MRI is used for assessment of spinal symptoms. **Aim -** The aim of this article is to assess role of MRI and CT in degenerative diseases of cervical, dorsal and lumbosacral spine and their advantages and disadvantages. **Methods -** Prospective and descriptive study of patients referred from various clinical departments (Orthopedics, General Medicine, General Surgery and Obstetrics & Gynecology) to the department of Radio-Diagnosis at our hospital for a period of 18 months. **Results -** In 70 patients studied, 54 % were males and 46 % were females. Loss of curvature is observed in 65 % patients on MRI scan. Osteophytes are observed on CT scan in 90 % of the patients. Disc bulges are observed on MRI scan in 96% of the patients. Modic changes are seen on MRI scan in 67 % of the patients. Nerve root compressions are observed in 27 % of patients on MRI scan. Thecal sac indentations are observed in 64 % of patients on MRI scan. Compression fractures are noted in 4 % patients on CT scan. Spondylolisthesis is noted in 11 % patients on CT scan. Disc protrusions are observed in 65 % of the patients on MRI scan. **Conclusion -** Marginal osteophytes and compression fracture are visualized on Computed Tomography. Disc bulges, disc herniations, Thecal sac indentations, nerve root compressions are visualized on Magnetic Resonance Imaging. Both MRI and CT scan complement each other.

KEYWORDS : Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Loss of curvature, Osteophytes, Compression fractures, Disc bulges, Disc protrusions, Thecal sac indentations, Nerve root compressions, Spondylolisthesis.

INTRODUCTION

Degenerative diseases of the lumbar spine refer to group of disorders, where intervertebral discs with adjacent spine structures are compromised. This can be due to normal aging or associated with pathologies.[2]

Two-thirds of adults will experience low back pain at some point in their lives, which makes it a frequent symptom.[1]

The most often utilized spine imaging tests in primary care settings to evaluate LBP are plain radiography, computed tomography, magnetic resonance imaging and bone scanning. The most popular type is plain radiography since it is inexpensive and widely accessible. However, there was no conclusive evidence to indicate the existence of a causal association between radiographic results and nonspecific LBP, according to a systematic evaluation of published observational studies.[3]

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MRI may be utilized instead of CT when organs or soft tissue are being evaluated, since it is superior at differentiating between normal and pathological soft tissue.[4]

MATERIALS AND METHODS

The prospective and descriptive study conducted at The Oxford Medical College, Hospital and Research Centre, Bangalore had included all patients who were referred to department of Radio-Diagnosis from various clinical departments with complaints of back pain or neck pain. Patients were imaged with MRI for evaluation of degenerative spine diseases using Axials (T1, T2, FLAIR, GRE, SWI, DWI, ADC), Sagittal (T1, T2), Coronal (T2), Oblique coronal (T1) sequences and CT scan with 3D reconstruction of the images.

Statistical Analysis

The data was expressed in number, percentage, age, mean and standard deviation. Statistical package for social sciences (SPSS 25.0) version was used for analysis.

RESULTS

Age: The study population is around 70 and in that 17 subjects were at the age of 59-69 years around 15 subjects were at the age of 39-49 and 49-59 age. >79 years only 2 subjects were participated.

9 subjects were enrolled with age group of 69-79 years

7 subjects were under the age 29-39 years and around 5 subjects were under the age 19-29 years.

Table 1: Age Distribution Of Patients

Age in years	Number of cases	Percentage (%)
19-29	5	7.1
29-39	7	10.0
39-49	15	21.4
49-59	15	21.4
59-69	17	24.3
69-79	9	12.9
>79	2	2.9
Total	**70**	**100.0**

Gender: Among 70 subjects, 38 subjects were male and 32 subjects were females.

Table 2: Sex Distribution

Sex	Number of cases	Percentage
Male	38	54.3
Female	32	45.7
Total	**70**	**100.0**

Loss of curvature: In 46 subjects, loss of curvature is present on MRI scan and in 24 subjects, loss of curvature is not present.

Table 3: Loss Of Curvature Of Spine On CT Scan

Loss of curvature	Number of cases	Percentage
Absent	24	34.3
Present	46	65.7
Total	70	100.0

Osteophytes: In 63 subjects, Osteophytes is observed on CT scan and in 7 subjects, Osteophytes are absent.

Table 4: Patients With Osteophytes On CT Scan

Osteophytes	Number of cases	Percentage
Absent	7	10.0
Present	63	90.0
Total	**70**	**100.0**

Disc bulge: In 67 subjects, Disc bulges are observed on MRI scan and in 3 subjects, Disc bulges are not present.

Table 5: Patients Having Disc Bulges On MRI Scan

Disc bulges	Number of cases	Percentage
Absent	3	4.3
Present	67	95.7
Total	70	100.0

Modic changes: In 47 subjects, Modic changes are observed on MRI scan and in 23 subjects, Modic changes are not present.

Table 6: Modic Changes In Patients Detected On MRI Scan

Modic changes	Number of cases	Percentage
Absent	23	32.9
Present	47	67.1
Total	**70**	**100.0**

Nerve root compression: In 19 subjects, nerve root compressions are observed on MRI scan and in 51 subjects, nerve root compressions are not seen.

Table 7: Patients Having Nerve Root Compressions On MRI Scan

Nerve root compressions	Number of cases	Percentage
Absent	51	72.9
Present	19	27.1
Total	**70**	**100.0**

Thecal sac indentation: In 45 subjects, thecal sac indentations are observed on MRI scan and in 25 subjects, thecal sac indentations are not present.

Table 8: Patients Having Thecal Sac Indentations On MRI Scan

Thecal sac indentation	Number of cases	Percentage
Absent	25	35.7
Present	45	64.3
Total	**70**	**100.0**

Compression fracture: In 3 subjects, compression fractures are observed on CT scan and in 67 subjects, compression fractures are not present.

Table 9: Patients Having Compression Fractures On CT Scan

Compression fractures	Number of cases	Percentage
Absent	67	95.7
Present	3	4.3
Total	**70**	**100.0**

Spondylolisthesis: In 8 subjects, Spondylolisthesis is observed on CT scan and in 62 subjects, Spondylolisthesis is not present.

Table 10: Patients Having Spondylolisthesis On CT Scan

Spondylolisthesis	Number of cases	Percentage
Absent	62	88.6
Present	8	11.4
Total	70	100.0

Disc protrusion: In 46 subjects Disc protrusion is observed on MRI scan and in 24 subjects Disc protrusion is not present.

Table 11: Patients Having Disc Protrusions On MRI Scan

Disc Protrusions	Number of cases	Percentage
Absent	24	34.3
Present	46	65.7
Total	**70**	**100.0**

DISCUSSION

According to various studies and reports it has been confirmed that 60% to 80% of common people suffers from low backache minimum once in lifetime. Mild degenerative changes of spine are physiological and should be considered pathological only if these abnormalities are causing symptoms and clinical signs. Many structural components of spine are responsible for low backache of degenerative etiology including the intervertebral disc, vertebral periosteum, facet joints and spinal ligaments.[5,6,7]

The most frequent and common location of these changes is lumbar spine due to heavy mechanical stress. In MRI of spine the term degeneration referred to any one or more among the following imaging findings including, diffuse bulging (Fig. 1) or herniation of the disc (protrusion, extrusion, sequestration and migration), annulus fissuring, annulus tears, Modic changes (type I, II, III) in end plates (Fig. 2), facetal arthropathy, ligamentum flavum hypertrophy, neural foramen stenosis (grade I, II, III) and, spinal canal stenosis (grade I,II,III) osteophytes at the vertebral apophyses.[8]

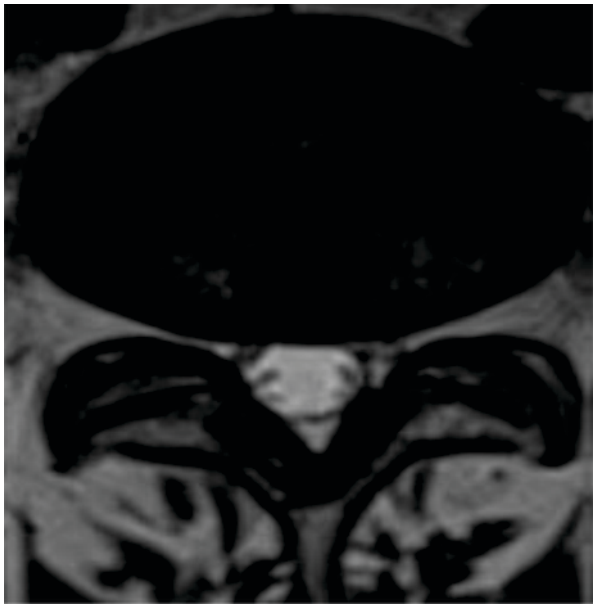

Figure 1: MRI T2 weighted axial image showing diffuse disc bulge of the L4-L5 intervertebral disc causing anterior thecal sac indentation in a 60 years old male patient.

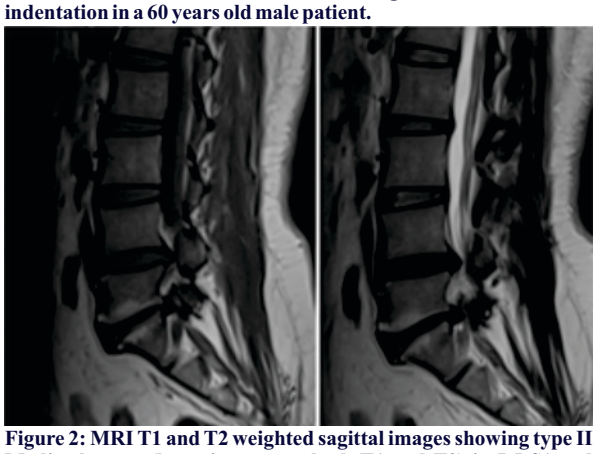

Figure 2: MRI T1 and T2 weighted sagittal images showing type II Modic changes (hyperintense on both T1 and T2) in L5-S1 end plates in 50 year old female patient.

In magnetic resonance imaging, these changes are manifested as T2 signal loss in intervertebral disc, narrowing of disc space, presence of fissures in annulus, air locules in disc space, calcification within the intervertebral disc, ligament flavum hypertrophy, altered marrow signals, marginal osteophytosis, disc herniation, vertebral mal-alignment and spinal canal stenosis. Plain radiography (x-ray) of lumbosacral spine is routinely advised in patients of low back pain to identify the gross morphological bony changes in vertebral body and its posterior elements but complete evaluation of the soft issues elements e.g. intervertebral disc, nerve roots, spinal cord, ligaments and various smaller structures of spine is not possible. With continuous advancement in imaging technology and hardware, MRI has improved the identification and diagnosis of the cause of low back pain and MRI has become the preferred modality for evaluation of degenerative spine diseases as it provides multi planar imaging capability, superior delineation of intervertebral disc, nerves, ligament, para spinal muscles, epidural fat, cerebrospinal fluid and bone marrow.[9]

Modic changes in this study increased with age, 19.6%, 44.6 % and 52.8 % in the age group of 29-39 years, 49 to 59 years and 59 to 69 years respectively and this finding was statistically significant (p-value 0.027) and this is similar to the findings by Kuisma et al (2009). This variation can be due to normal aging process in older individuals.[1]

CONCLUSION

This study concludes that in this study:

- Disc degenerative changes was common among 40 – 60 years age group.
- Males were more commonly affected than females.
- L4-L5 was the most common level to be affected by disc bulge.
- Nerve root compression was common in L4-L5 levels.
- Marginal osteophytes and compression fractures were well visualized on Computed Tomography.
- Disc bulges, disc herniations, thecal sac indentations and nerve root compressions were well visualized on Magnetic Resonance Imaging.
- Both Magnetic Resonance Imaging and Computed Tomography were useful in diagnosing degenerative spinal disease in this study. Both modalities complement each other.

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