ORIGINAL RESEARCH PAPER

Radio-Diagnosis

ROLE OF MAGNETIC RESONANCE IMAGING IN THE ASSESSMENT OF DEGENERATIVE CERVICAL DISC DISEASES

KEY WORDS:

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INTRODUCTION

Cervical intervertebral disc herniation is an important cause of neck and arm pain. Herniation of disc is defined as a localized displacement of disc material beyond the limits of the intervertebral disc space. This herniation results in neck and arm pain with paresthesias in a dermatomal distribution and muscle weakness.

Disc herniation of the same size may be asymptomatic in one patient and can lead to severe nerve root compromise in another patient. The use of Magnetic Resonance Imaging (MRI) in the search for biological causes of neck pain remains controversial as studies have shown that patho-anatomical changes in the cervical spine are also common in healthy volunteers [1–11], even though certain MRI findings appear more prevalent in people with pain compared to people without pain [2,3].

Herniation may be described as a protrusion, extrusion or sequestration. In protruded type of disc herniation displaced disc material remains in continuity with the disc of origin and contained by annulus fibrosus. In extruded type disc material migrate through the annulus fibrosus but contained by posterior longitudinal ligament. In sequestered type disc material is free in spinal canal. Disc herniation may be posterolateral or central. Symptoms may begin as localized neck pain. This pain may be followed by referred (radicular) pain going down in the arm or forearm, this suggest progression of disease and indicate nerve root irritation or compression. Other symptoms include sensory loss, parasthesias and hyporeflexias.

Magnetic Resonance Imaging is reliable at demonstrating, soft disc protrusion in the cervical spine, where there is less epidural fat [4]. Thus it has become the choice of investigation for patients suspected of cervical disc herniation. The anatomy of intervertebral disc is best appreciated on T2 weighted sagittal Magnetic Resonance Imaging. Due to intensity differences of cerebrospinal fluid, disc and neural tissue, excellent contrast is obtained. The axial slices demonstrate the disc bulges, protrusion, extrusion and their resultant nerve root and thecal sac compressions. Moreover with Magnetic Resonance Imaging an examination of the entire cervical region including the osseous structure, extradural cerebrospinal fluid interface and spinal cord can be obtained with a single modality in an outpatient setting and in a non-invasive fashion [5].

Main objective of this study is to study the effectiveness of Magnetic Resonance Imaging in the assessment of degenerative cervical disc diseases.

MATERIALS & METHODS:

This cross-sectional study was conducted in the Department of Radio diagnosis, Sri Aurobindo Medical College & Post Graduate institute, Indore from 1st april, 2021 to 30th September 2022, after approval from institutional research & ethical committee.

Patients with clinical suspicion of degenerative cervical disc diseases referred from various department of our institute were subjected to MRI after taking written informed consent. Study population comprised of 50 patients.

Informed written consent was taken from the patient or patients relatives before subjecting the patient to scanning by MRI. The findings were recorded on pre-structured proforma. The study was performed on a Siemens 1.5 T MAGNETOM®Symphony® with Tim technology MR Machine. Routine MR pulse sequences i.e SagittalT1WI, Sagittal & axial T2WI , Axial gradient echo MR & Coronal STIR were be obtained.

OBSERVATIONS & RESULTS:

Table 1: Distribution of patients based on age.

Age (years)	Number	Percentage (%)
20-40 yr	17	34
40-60 yr	27	54
>60 yr	6	12

Graph 1: Pie chart showing age distribution of the subjects

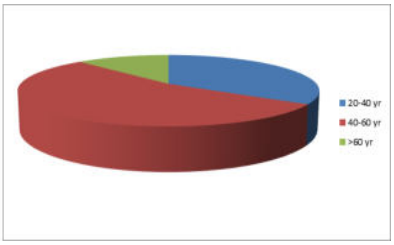


Table 2: Distribution of patients based on gender.

Gender	Number	Percentage (%)
Male	23	46
Female	32	54

Graph 2: Pie chart showing gender distribution of the subjects

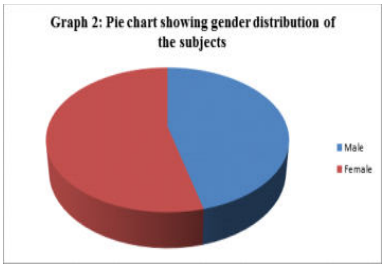


Table 3: Distribution pattern based on disc bulge.

Disc bulge	Number	Percentage (%)
Central	46	92
Para-central	13	26
Foraminal	2	4

Graph 3: Bar diagram showing disc Bulge patterns of the subjects

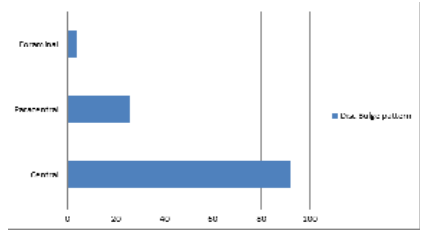


Table 4: Distribution pattern based on disc herniation.

Disc herniation	Number	Percentage (%)
Bulge	48	96
Protrusion	8	16
Extrusion	2	4
Sequestration	0	0

Graph 4: Bar diagragm showing disc Herniation patterns of the subjects

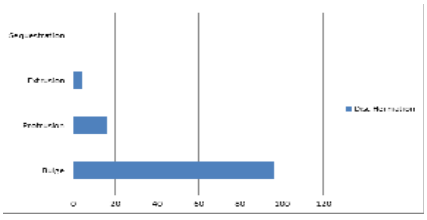
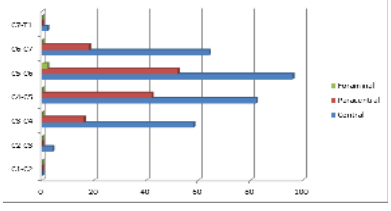


Table 5: Distribution pattern based on disc bulge at different levels.

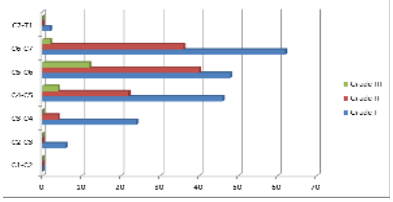
Disc bulge	Central		Para-central		Foraminal	
	Number	%	Number	%	Number	%
C1-C2	0	0	0	0	0	0
C2-C3	2	4	0	0	0	0
C3-C4	29	58	8	16	0	0
C4-C5	41	82	21	42	0	0
C5-C6	48	96	26	52	1	2
C6-C7	32	64	9	18	0	0
C7-T1	1	2	0	0	0	0



Graph 5: Bar diagram showing distribution pattern based on disc bulge at different levels.

Table 6: Distribution pattern based on spinal canal stenosis.

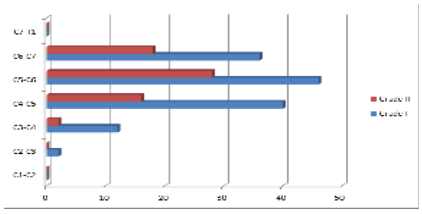
Spinal canal stenosis	Grade I		Grade II		Grade III	
	Number	%	Number	%	Number	%
C1-C2	0	0	0	0	0	0
C2-C3	3	6	0	0	0	0
C3-C4	12	24	2	4	0	0
C4-C5	23	46	11	22	2	4
C5-C6	24	48	20	40	6	12
C6-C7	29	58	14	28	1	2
C7-T1	1	2	0	0	0	0



Graph 6: Bar diagram showing distribution pattern based on spinal canal stenosis.

Table 7: Distribution pattern based on neural foramen stenosis.

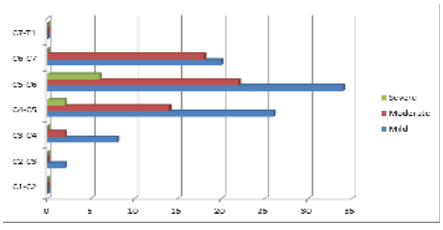
Neural foramen stenosis	Grade I		Grade II	
	Number	%	Number	%
C1-C2	0	0	0	0
C2-C3	1	2	0	0
C3-C4	6	12	1	2
C4-C5	20	40	8	16
C5-C6	23	46	14	28
C6-C7	18	36	9	18
C7-T1	0	0	0	0



Graph 7: Bar diagram showing distribution pattern based on neural foramen stenosis.

Table 8: Distribution pattern based on cord compression.

Cord compression	Mild		Moderate		Severe	
	Number	%	Number	%	Number	%
C1-C2	0	0	0	0	0	0
C2-C3	1	2	0	0	0	0
C3-C4	4	8	1	2	0	0
C4-C5	13	26	7	14	1	2
C5-C6	17	34	11	22	3	6
C6-C7	10	20	9	18	0	0
C7-T1	0	0	0	0	0	0



Graph 8: Bar diagram showing distribution pattern based on cord compression.

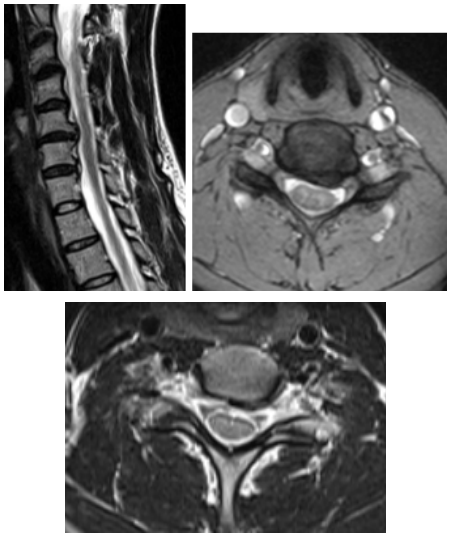


Fig 1: Sagittal T2 WI, axial T2WI & GRE sequences showing left para-central disc protrusion at C5-C6 level, casuing mild indentation on the thecal sac & left traversing nerve roots.

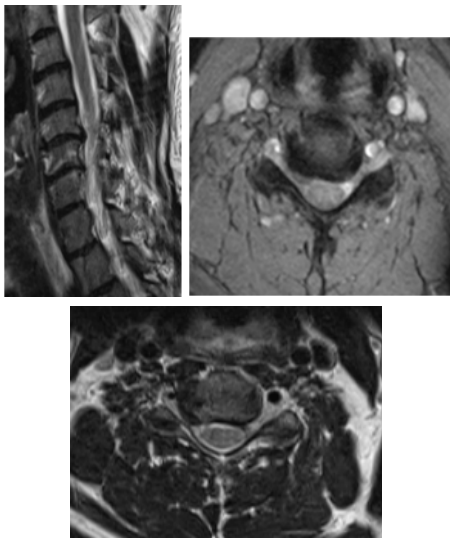


Fig 2: Sagittal T2WI, axial T2WI & GRE sequence showing right foraminal stenosis at C5-C6 level, causing compression over right exiting nerve roots

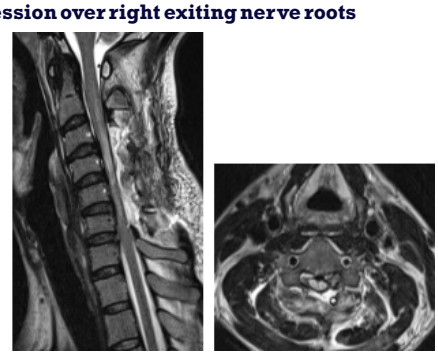


Fig 3: Sagittal & axial T2WI sequence of cervical spine showing posterior disc bulges at C3-C4 & C5-C6 levels, causing compression over cord with cord edema.

DISCUSSION

According to various studies and reports it has been confirmed that 50% to 70% of common people suffers from neck & shoulder pain minimum once in lifetime. The severity of pain may be severe and may cause debilitation. 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 neck pain of degenerative etiology including the intervertebral disc, vertebral periosteum, facet joints and spinal ligaments [6,7,8].

The present cross section observational study evaluated MRI imaging characteristics in patients with cervical degenerative disease. The outcome variables evaluated were disc bulge, disc herniation, spinal canal and neural foramen stenosis & cord compression. The impact of independent variables like age and gender on these indices were also evaluated.

The mean age of this study group is 50 ±12.5 years , as degenerative changes is common in individuals above 40 years of age and its prevalence increases progressively to over 90% by 50 to 55 years of age. Majority of patients (54%) in our study were in the age group of 40-60 yrs with majority being females (54%). This was consistent with the study done by Modic MT et al, 2007[9].

Most common pattern of disc herniation is disc bulge seen in 96% patients followed by protrusion (16%) & extrusion (4%). Sequestration was not seen in any of the study subjects. Most common pattern of distribution of disc bulge is central seen in 92% patients followed by para-central (26%) & foraminal (4%). Central disc bulge was most commonly found at C5-C6 levels (96%) followed by C4-C5 (82%) & C6-C7 (64%) levels. Para-central disc was common at C5-C6 level seen in 52% patients followed by C4-C5 (42%) & C6-C7 (18%) levels. Foraminal stenosis was seen only in 1 patient (2%) at C5-C6 level. This was consistent with the study done by Modic MT et al, 2007[9].

Spinal canal stenosis overall, was most commonly encountered at C5-C6 level. Grade I stenosis was most commonly seen at C6-C7 level with 29 patients (58%) followed by 24 patients (48%) at C5-C6 level, 23 patients (46%) at C4-C5 level, 12 patients at C3-C4 level (24%) & 3 patients at C2-C3 level (6%). Grade II stenosis was most commonly seen at C5-C6 level with 20 patients (40%), followed by 14 patients (28%) at C6-C7 level, 11 patients (22%) at C4-C5 level & 2 patients at C3-C4 level (4%). Grade III stenosis was most commonly seen at C5-C6 level with 6 patients (12%) followed by 2 patients (4%) at C4-C5 level & 1 patient (2%) at C6-C7 level. Similar findings were seen in the study done by Yusuhn Kang et al. [12]

Neural foramen stenosis was seen most commonly at C5-C6 level. Grade I stenosis was most commonly seen at C5-C6 level with 23 patients (46%), followed by 20 patients (40%) at C4-C5 level, 18 patients (36%) at C6-C7 level & 6 patients (12%) at C3-C4 level. Grade II stenosis was most commonly encountered at C5-C6 level with 14 patients (28%), followed by 9 patients at C6-C7 level & 8 patients at C4-C5 level (16%). This was consistent with the study done by Sujin K, MD et al [10] & Bryn Hilton et al [11]. Cord compression was found only in those patients presenting with severe cord compression i.e in total 5 patients. Out of these, 3 patients were seen at C5-C6 level (6%) followed by 1 patient at C4-C5 level (2%).

Overall, cord compression was most commonly encountered at C5-C6 level. Milder degree was seen at C5-C6 level with 17 patients (34%), followed by 13 patients at C4-C5 level (26%), 10 patients at C6-C7 level (20%) & 4 patients at C3-C4 level (8%). Moderate degree of compression was most commonly seen at C5-C6 level with 11 patients (22%), followed by 9 patients at C6-C7 level (18%) & 7 patients at C4-C5 level (14%). Severe degree was seen in 3 patients at C5-C6 level (6%) followed by 1 patient at C4-C5 level (2%). This was consistent with study done by Yuichiro Morishita et al [13] who explained the relationship between the cervical spinal canal diameter and the pathological changes in the cervical spine.

CONCLUSION:

In our study following conclusions were made –

- Degenerative disc changes is common among 40 – 60 years age group.
- Females are affected more commonly than males.
- Central type is the most type of disc bulge followed by para-central & foraminal.
- C5-C6 is the most common spinal level which is affected by the disc bulge & protrusions.
- Grade II and III Spinal canal stenosis is common at C5-C6 level whereas Grade I spinal canal stenosis is common at C6-C7 level.
- Grade I neural foramen stenosis is common in C4-C5 and C5-C6 levels. Grade II is common in C5-C6 & C6-C7 intervertebral disc levels.
- Cord compression along with cord edema is common in C5-C6 intervertebral disc level followed by C4-C5 & C6-C7 levels.

This study showed the role of MRI in cervical disc diseases.

MRI is safe, cost effective & may be used as a reliable tool with which we can assess the level, type and position of cervical disc herniation and can plan the subsequent appropriate management.

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