

Magnetic Resonance Imaging Findings in Degenerative Disc Disease of Cervical Spine in Symptomatic Patients

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ABSTRACT

Background: The pathophysiological findings demonstrated in cervical spine in Magnetic Resonance Imaging (MRI) can explain only partly the occurrence of neck and shoulder pain. This study aims to evaluate the occurrence of cervical degenerative disc pathologies in symptomatic patient with neck pain and radiculopathy.

Methods: The study was a retrospective and institutional record based descriptive study carried out for the duration of 3yrs in a well-equipped imaging center. Only MRI performed for neck pain with or without radiculopathy with complete clinical form was included in the study. MRI findings were entered in SPSS spread sheet and analyzed using SPSS 19.0.

Results: A total of 750 MRI was reviewed among which 571(76.13%) had cervical degenerative disc pathology. Disc degeneration and disc bulge was the most common finding, followed by neural foraminal stenosis, disc herniation and myelopathic changes. Disc degeneration and disc bulge was seen more frequently in patients older than 40 years than those less than 40 years. Disc herniation was rare in extremes of age and noted predominantly in productive population between 3rd and 6th decade of life.

Conclusions: Disc degeneration and global disc bulge were predominant findings in symptomatic patients increasing with the age. Disc herniation and neural foraminal stenosis were common changes seen associated with neck pain with or without radiculopathy and were predominant in productive age group.

Keywords: Cervical degenerative disc disease; MRI; symptomatic patient.

INTRODUCTION

Cervical spine is particularly more prone for degenerative change due to the excessive mobility of the region to aid in neck movement. Many influential factors such as age, sex, occupation and weight also lead to the degenerative changes.¹ Degenerative disc disease can cause discogenic neck pain, which can be complicated by nerve root and spinal cord compression with neurological symptoms. However there is a great debate and controversy on the etiology of chronic neck pain and role of imaging in evaluation of chronic

neck pain. The first line imaging evaluation in chronic neck pain is radiograph but it has several limitations and also exposes patient to radiation. MRI is however the imaging evaluation of choice in patients with neurologic symptoms regardless of the radiographic findings.² In patient with chronic neck pain without neurologic symptom the relevance of MRI findings should be viewed in the background of normal age related degenerative changes. The pathophysiological findings demonstrated in cervical spine in MRI can explain only partly the occurrence

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of neck and shoulder pain.³

This study aimed to evaluate the MRI findings of degenerative disc disease in cervical spine in symptomatic patients with neck pain with or without radiculopathy.

METHODS

The study was a retrospective and descriptive study conducted in symptomatic patient who were referred for MRI of cervical spine at Kathmandu Imaging in Kathmandu, Nepal. All MRI of cervical spine from May 2010 to May 2013 were reviewed. Only those MRI performed for chronic neck pain and/or radiculopathy to upper limbs with complete clinical form and report were included in the study.

MR images were acquired by 0.35 Tesla Siemens MRI machine (Magnetom C- an open MRI system from Germany). MRI images were acquired using head and neck (medium /large sized) combination coil with read matrix of 256. Images were acquired in sagittal plane in T1 weighted spin echo (Repetition time (TR)/ Echo time (TE) - 610 /14) and T2 weighted spin echo (TR/ TE -3500 /117 ms) with slice thickness of 3.5 mm; gap of 20% of slice thickness and FOV of 260 mm. Images obtained in axial plane consists of T1 weighted spin echo (TR/TE - 610/ 14 ms) and T2 weighted gradient echo (TR/TE - 1100/26 ms) with slice thickness of 3.5 mm; slice gap of 10 % of slice thickness and FOV of 230 mm. Coronal images and Short Tau Inversion Recovery (STIR) sequences (TI - 110 ms) were acquired in some cases for further evaluation.

Three experienced radiologists, one senior with more than 10 years experience in Spine MRI, reported the MRI images with mutual consensus in disputed issues. Disc Bulge, disc herniation, degenerative disc changes were defined as per the recommendation of combined task force.⁴ Disc herniation includes disc protrusion, disc extrusion and sequestration. Neural foraminal stenosis was defined as obliteration of epidural fat by disc material or due to facet joint arthropathy. Spinal cord compression with myelopathic changes was diagnosed when the compressed cord shows abnormal high signal intensity in T2 weighted and fat suppressed inversion recovery images.

The data were plotted in SPSS sheet and statistical analysis was obtained from SPSS version 19.

RESULT

A total of 750 patients were included in this study. There were 457 (60.9 %) male and 293 (39.0 %) female patients. The age of the patients ranged from 11 to 95 years with mean age of 45.0 ± 14.86 years. The maximum number of patients (24.5 %) was in 5th decade i.e. 41 to 50 years age group. More than 80 % of patients were in productive age group of 21 to 60 years as represented in Figure 1.

Degenerative disc disease in the form of disc desiccation, disc bulge, disc herniation was the most common findings accounting 571(76.13%) patients. Some forms of non-degenerative pathologies were seen alone or in combination with disc degeneration in 121(16.13%) patients and 108(14.4%) patients had normal MRI of the cervical spine as shown in Table 1.

Table 1. Distribution of degenerative changes according to sex

Findings	Total (N=750)	Male (N=457)	Female N=293)	P-value
Degenerative changes	571(76.13)	359 (78.56)	212(72.35)	$\chi^2= 3.78$; $p=0.052$
Disc bulge	370 (49.3)	236(51.6)	134(45.7)	$\chi^2=2.5$; $p=0.11$
Single Level	107(14.3)	57(12.5)	50(17.1)	$\chi^2=7.2$; $p=0.007$ OR- 1.21 (CI-1.04-1.40)*
Multiple Level	263(35.1)	179(39.2)	84(28.7)	
Disc herniation	159 (21.2)	101 (22.10)	58(19.79)	$\chi^2=0.57$; $p=0.45$
Single Level	136(18.1)	84(18.4)	52(7.7)	
Multiple Level	23(3.1)	17(3.7)	6(2.0)	$\chi^2=1.25$; $p=0.26$
Neural foraminal stenosis	363 (48.4)	265 (57.99)	98(33.45)	
Cord compression with myelopathic changes	43 (5.7)	39(8.5)	4(1.4)	$\chi^2=0.204$; $p=0.65$

(*- OR- Odd's ratio-1.21. Males are likely to have multiple level of disc bulge with odds of 1.21 as females)

Table 2. Distribution of disc herniation according to level and age group

Level	Herniation	C2-C3	C3-C4	C4-C5	C5-C6	C6-C7	C7-D1
+/< 20	0(0)	0	0	0	0	0	0
21-30	12 (7.5)	0	1	2	5	5	0
31-40	45(28.3)	0	1	4	27	18	0
41-50	53(33.3)	1	3	6	29	22	0
51-60	31(19.5)	0	5	6	16	10	1
61-70	15(9.4)	0	1	5	6	6	0
71-80	3(1.9)	0	1	1	0	1	0
80+	0(0)	0	0	0	0	0	0
Total	159	1 (0.6)	12(7.5)	24 (15.1)	83(52.2)	62 (39.0)	1 (0.6)

Disc desiccation with disc bulge were the commonest degenerative change demonstrated in 370(49.3%) patients. Disc Bulge was noted most commonly at C5-C6 level (275; 36.7%) followed by C4-C5 level (223; 29.7%) as represented in Figure 2. Involvement of Multiple levels was more common than single level. Disc bulge was more frequently seen in males than females however the difference did not reach statistical significance. Involvement of multiple level was also more frequent in males than females which was statistically significant at $P < 0.05$ with odds ratio of 1.21 as shown in Table 1. Disc Bulge was seen more frequently in patients older than 40 years (263; 59.1%) than in patients less than 40 years of age (107; 35.1%) which was statistically significant ($\chi^2 = 41.78$; $p < 0.001$, OR- 1.58)

Disc herniation was seen only in 159(21.2%) patients. Disc herniation was most commonly seen in 5th decade of life i.e. in age group of 40-50 years. No disc herniations were seen in age group less than 20 and more than 80 years. More than 80% of disc herniation was seen in middle age group i.e. between 30 and 60 years, the working population as represented in Figure 3 and Table 2. The disc herniation in cervical spine occurred most commonly at C5-C6 level (52.2 %) which was followed by C6-C7 level (38.9%) and C4-C5 level (15.0 %). Disc herniation was most common at C5-C6 level accounting for 52.2% of all herniation followed by C6-C7 (38.9%) and C4-C5 (15.0%) levels as shown in Table 2. Disc herniation was more common in males than in females however the difference did not reach statistical significance. Involvement of multiple levels was uncommon and seen only in 23(3.1%) patients. There was no difference in involvement of multiple levels between genders as shown in Table 1.

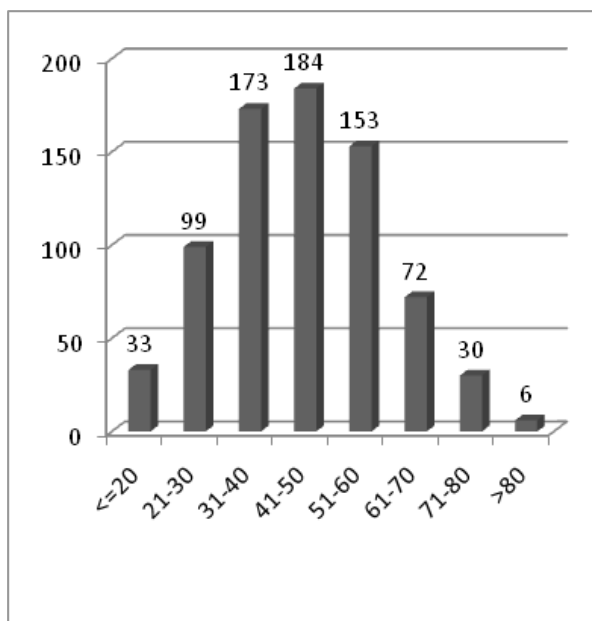


Figure 1. Age Distribution of Patients

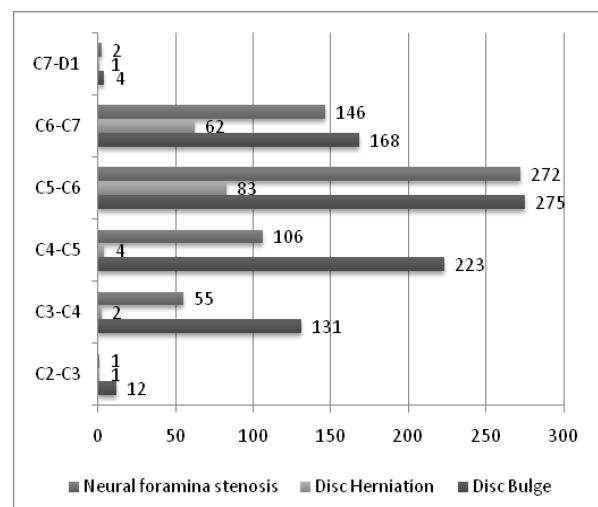


Figure 2. Distribution of degenerative changes according to level

Neural foraminal stenosis was seen in 363 (48.4%) patients. It occurred due to various reasons e.g. disc protrusion, posterior marginal osteophytes or hypertrophied facet joints. Similar to disc herniation, neural foraminal stenosis occurred most commonly at C5-C6 level accounting for 74.9 % of all neural foraminal stenosis followed by C6-C7 (40.2 %) and C4-C5 (29.2 %) levels as represented in Figure 2.

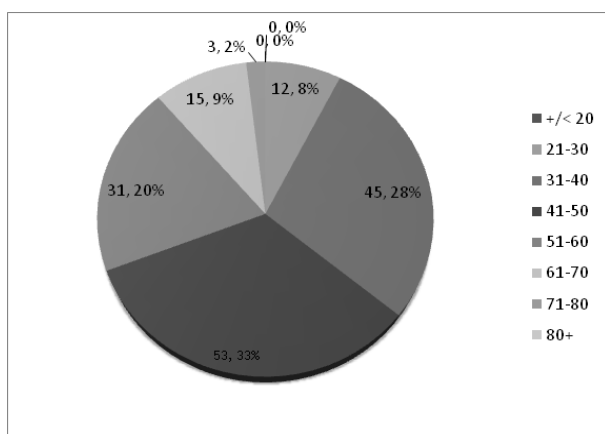


Figure 3. Distribution of disc herniation according to age groups

One of the most severe complications of cervical degenerative disc disease is spinal cord compression and myelopathic changes. In our study spinal cord compression and myelopathic changes was noted in 43(5.7%) patients. Most of the patients with myelopathic changes were males 39(8.5%) with only 4(1.4%) females however the difference was not statistically significant.

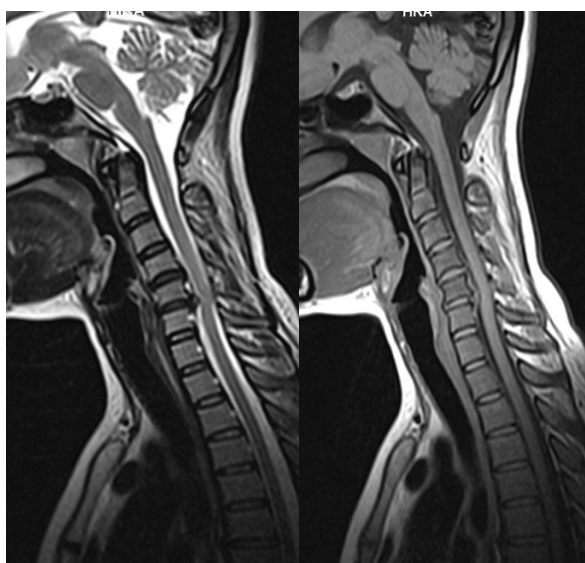


Figure 4. MRI Cervical Spine T1 and T2 Sagittal changes according to level

DISCUSSION

Degenerative disc disease and disc herniation can be complicated by myelopathy or radiculopathy. Neurological symptoms can occur in established cervical spondylosis or can be the presenting feature of the disease.² In this study MRI examination was performed for evaluation of chronic neck pain with or without radiculopathy, which revealed degenerative disc disease to be the most common cause while non-degenerative diseases accounting for only some cases. Spondylosis and /or disc herniation has been implicated in majority of cases of neck pain and radiculopathy in previous epidemiological studies.^{5,6} Almost 14 percent of the MRI performed was normal in this study. The normal MRI findings in our study may be due to the varied non structural etiology of neck and shoulder pain including several work-related, psychosocial and individual factors.³ Another factor for the normal findings in MRI may be due to low field strength MRI used in this study, which might not be able to detect all minute structural changes and identify the source of cervical discogenic pain.⁷

Diffuse annular bulging with other degenerative disc changes was the most common degenerative changes in cervical spine. These changes could be age related degenerative changes in cervical spine and can be an overlap confounding the structural factors implicated in neck pain. In a study of asymptomatic patients undergoing MRI of cervical spine majority were disc bulges and only few were disc protrusion.⁸ Similarly another study comparing symptomatic and asymptomatic patients found equal incidence of degenerative changes including disc bulge in both groups.³ In this study disc bulge was found with higher incidence in patients over 40 years of age; a finding favoring its age related etiology rather than a pathological entity. Matsumoto et al., showed increase in degenerative disc changes at their study in asymptomatic patients.⁸ We found increased incidence and multiplicity of global disc bulge in males as compared to females. Similar findings has been found in Matsumoto et al., study with higher incidence in males as compared to females.⁸ However the difference in our study may also be because of higher proportion of males in our study.

Disc herniation including protrusion, extrusion and sequestration was seen in approximately 20% of the patients which was less common as compared to disc bulge. No disc herniations were seen in extremes of ages and most of the disc herniations was seen in the productive age group of 30-60 years. Disc herniation was the only finding significantly associated with neck

pain and radiculopathy in a comparative study between symptomatic and asymptomatic subjects.³ Thus the most structural neck pain and radiculopathy due to disc herniation occurs in actively working population. A large number of Patients with neck pain and radiculopathy without disc herniation suggests psychological factor in the causation of neck pain. Psychological assessment is known to have a strong predictive value in chronic neck pain.⁹

Neural foraminal stenosis was common in our study. Neural foraminal stenosis can entrap exiting nerve root and cause radiculopathy.

Myelopathic changes associated with disc degeneration was uncommon and occurred only in approximately 5% of cases. Males showed higher prevalence of myelopathy however no statistically significant difference exists. We used signal changes in T2 weighted and fat suppressed inversion recovery images as the indicator of myelopathy which has been considered the strongest evidence of myelopathy. MRI can diagnose cervical myelopathy however has not shown to be associated with clinical symptoms significantly.¹⁰

CONCLUSIONS

Disc degeneration and global disc bulge were predominant findings in symptomatic patients increasing with age. Disc herniation and neural foraminal stenosis were common changes seen associated with neck pain with or without radiculopathy. These changes were predominant in productive age group. Myelopathic changes associated with disc degeneration was less common finding.

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