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Morphological Changes in Degenerative Disc Disease on Magnetic Resonance Imaging: Comparison Between Young and Elderly

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ABSTRACT

Background: Morphological changes implicated in low back are complicated by additional age related degenerative changes in spine, which increases with aging. This study aims to compare the morphological MRI findings in young and elderly patients with low back pain and also correlate them with the clinical symptoms.

Methods: The study was a retrospective hospital record based comparative study carried out in a Teaching Hospital. MRI performed for patients with low back pain during May 2012 to October 2012 were reviewed. The MRI findings were compared between below 60 years and at and above 60 years and were also correlated with symptoms.

Results: A total of 301 MRI met the inclusion criteria out of which 228(75.74%) were young adults and 73(24.25%) were elderly adults. Degenerative changes and disc bulge was more common in elderly. Disc herniations including disc prolapse was more common in young adults. Disc protrusion involving L4-L5 was most common in the elderly while L5-S1 was most common in young adults. Nerve root compression was noted more commonly in the young adults. Radiculopathy was associated with grade III nerve root compression and paramedian disc protrusion in young adults while no such association was noted in elderly. No association of radiculopathy with presence of degenerative changes, spinal stenosis was noted in both groups.

Conclusions: Degenerative changes are more common in elderly while disc herniations are more common in young adults. Morphologic changes do correlate with symptoms in young adults to some extent while they do not correlate in elderly.

Keywords: Degenerative disc disease; elderly; low back pain; magnetic resonance imaging; young adults.

INTRODUCTION

Low back pain is a common problem in the young as well as the elderly population.[1,2] Degenerative disc disease, facet joint arthropathy, spinal canal stenosis and disc herniation are often implicated as the causes of back pain. However, features of degeneration in the spine are also identified in the asymptomatic individual, and are considered a part of normal aging.[3] The use of imaging modality is to provide accurate morphological information to aid in treatment planning. Magnetic Resonance Imaging (MRI) is the standard modality to evaluate for degenerative disc pathologies and its advent has helped us better understand the morphologic changes, biochemical changes and molecular changes associated with disc degeneration.[2] The pathologic changes implicated in back pain and radiculopathy are complicated by the age related degenerative changes in the spine.[2,3] These changes tend to increase with age. Thus the radiological picture of the patients with low back pain also differs according to age. The younger patients show truer picture of pathology than the elderly do in whom findings are more complicated by the age related degenerative changes. Thus this study aims to compare the morphological MRI findings in young and elderly patients with low back pain and also correlate them with the clinical symptoms.

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METHODS

The study was a retrospective hospital record based study performed at Department of Radiology and Imaging of Tribhuwan University Teaching Hospital (TUTH), a tertiary care referral center in Kathmandu, Nepal. The study population consisted of all patients who underwent MRI of lumbosacral spine from May 2012 to October 2012. MRI of all patients with low back pain was included in the study. MRI showing disc diseases and degenerative changes were included in the study and MRI study showing other pathologies like spondylodiscitis, dural or spinal cord pathology, metastasis, traumatic fractures, etc were excluded from the study. The division of elderly and young adults was considered at a cut off of 60 years, as this is the cut off used to define senior citizens by WHO and the senior citizen act 2063 of Nepal. MRI were divided into two groups: patient with age less than 60 years was considered as young adults and older than 60 years considered as elderly adults. MRI was performed with a Hitachi Aris Vento 0.3 Tesla permanent magnet MRI machine. T1W, T2W (FSE) images were obtained in axial and sagittal planes. MRI findings were assessed for presence of degenerative disc changes, disc herniation, spinal canal stenosis and neural foraminal stenosis; then findings were correlated with neurologic symptoms. The nomenclature for disc changes were adopted in accordance to the recommendation of the Combined Task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology of 2003.[4] Nerve root compression was graded according to Christian et.al (2004).[5] The findings were compared between two groups. Data was recorded in predesigned proforma and analysis was done with IBM SPSS 20.0 software. Chi square test was used to compare statistical significant difference between two groups for categorical variables.

RESULTS

A total of 301 MRI met the inclusion criteria for the study, out of which 228(75.74%) were young adults and 73(24.25%) were elderly adults. The mean age of young adults was 35.57±8.73 and elderly adults 66.90±4.86 years. In both groups, male showed slight predominance with 55.7% males in young adult group and 53.4% in elderly adult group.

One or more disc degeneration changes of the following were present in MRI of all the individuals. Disc desiccation change either focal or at multiple levels were more common in elderly (72; 98.6%) than in young adults (206; 90.35%) (p=0.02). Also the involvement of multiple levels was more frequent in elderly 55(75.3%) than in young adults 88(36.6%) (p<0.001). Annular tear was seen in 29(12.7%) young adults and in 10(13.7%) elderly; no significant statistical difference was found between the two groups. Disc bulge was seen more frequently in elderly (63; 86.3%) than in young adults (171; 75%).(p=0.04).

Table 1. Summary of disc herniation changes in young adults and elderly

	Young Adults N=228 N(%)	Elderly N=73 N(%)	p-value
Disc Protrusion	142(62.3)	35(47.9)	0.03
Single	122(53.5)	27(37.0)	0.20
Multiple	20(8.8)	8(11.0)	
Disc protrusion level			
L5-S1	61(26.8%)	11(15.1%)	
L4-L5	58(25.4%)	15(20.5%)	
L4-L5 and L5-S1 both	15(6.6)	5(6.8%)	
Others	8(3.50%)	4(5.47%)	
Disc protrusion location			
Central	52(22.8)	17(23.3)	
Centrolateral or paramedian	90 (39.5)	18(24.7)	0.135
Disc Extrusion	10(4.4)	2(2.7)	0.53
Disc Sequestration	1(0.4)	0	

Disc herniation was seen in 153(67.10%) young adults significantly more common than in elderly (37;50.68%) (p=0.01). Protrusion was the commonest herniation in both groups and protrusion was also more common in young adults (142; 62.3%) than in elderly (35; 47.9%) (p=0.03). Protrusion was most commonly seen at L5-S1 level (61; 26.8%) in young adults followed by L4-L5 level (58;25.4%). However in the elderly, protrusion was most commonly seen at L4-L5 level (15; 20.5%) followed by L5-S1 level (11;15.1%). Involvement of both L4-L5 level and L5-S1 level was fairly common in both the groups. (Table 1)

Spinal canal stenosis was seen in almost half of patients in both groups. Both groups did not show significant difference with regard to spinal canal stenosis and its severity. No difference between neural foraminal stenosis was seen between the two groups. Nerve root compression was, however, more common in young adults as compared to elderly (p=0.01). (Table 2) Other degenerative changes like facet joint arthropathy and ligamentum flavum hypertrophy was significantly higher in elderly population (p<0.001). (Table 3)

Table 2. Consequences of degenerative disc disease in young adults and elderly.

	Young Adults (N=228) N(%)	Elderly (N=73) N(%)	p-value
Spinal canal stenosis	120(52.6)	36(49.3)	0.62
Single	96(42.1)	25(34.2)	
Multiple	24(10.5)	11(15.1)	0.18
Foraminal Narrowing	149(65.35)	56(76.7)	0.07
Single	89(39.0)	22(30.1)	
Multiple	61(26.8)	34(46.6)	0.01
Nerve root compression	95(41.7)	19(26.0)	0.01
Nerve root compression			
Grade I	83(36.4)	17(23.3)	
Grade II	5(2.2)	1(1.4)	0.947
Grade III	7(3.1)	1(1.4)	

There was no significant difference in presence of radiculopathy between the two groups. The presence of radiculopathy was not seen to be associated with presence of disc herniation, nerve root compression, spinal canal narrowing or neural foraminal narrowing. There was a statistical significant association between presence of radiculopathy and paramedian disc protrusion in the young adults but no such association was seen in the elderly. Similarly, association was seen between grade III nerve root compression and radiculopathy in young patients. Grade III nerve root compression was defined as nerve root compressed between disc material and the wall of the spinal canal; the nerve root may appear flattened or be indistinguishable from disc material. [5] However, no such association was found in elderly. (Table 4; Table 5)

Table 3. Other Degenerative changes in LS spine.

	Young Adults (N=228) N (%)	Elderly (N=73) N(%)	p-value
Facet joint Arthropathy	54(23.7)	32(43.8)	<0.001
Facet joint Hypertrophy	0	1(1.4)	
Ligamentum Flava Hypertrophy	11(4.8)	13(17.8)	<0.001
Spondylolisthesis	6(2.6%)	3(4.11%)	

Table 4. Association of MRI findings with radiculopathy in young adults.

	Radiculopathy present (n=120) N(%)	No Radiculopathy (n=108) N(%)	p-value
Disc herniation	85 (70.83)	68 (62.96)	0.20
Disc protrusion	79 (65.83)	63 (58.33)	0.24
Paramedian disc protrusion	60 (50.0)	32 (29.62)	
Central disc protrusion	19 (15.83)	31 (28.70)	0.002
Nerve root compression	52 (43.33)	43 (39.81)	0.59
Severe Nerve root compression	10 (8.3%)	2 (1.85)	0.03
Central spinal canal stenosis	64 (53.33)	56 (51.85)	0.62
Neural foramina narrowing	81 (67.5)	68 (62.96)	0.47

Table 5. Association of MRI findings with radiculopathy in elderly.

	Radiculopathy present (n=36) N(%)	No Radiculopathy (n=37) N(%)	p-value
Disc herniation	20 (55.55)	17 (45.94)	0.41
Disc protrusion	19 (52.77)	16 (43.24)	0.41
Paramedian disc protrusion	11 (30.55)	12 (32.43)	
Central disc protrusion	8 (22.22)	4 (10.81)	0.28
Nerve root compression	10 (27.78)	9 (24.32)	0.73
Severe Nerve root compression	2 (5.56)	0	0.13
Spinal canal stenosis	16 (44.44)	20(54.05)	0.41
Neural foramina narrowing	28 (77.78)	28 (75.68)	0.83

DISCUSSION

Increasing age is associated with increasing musculoskeletal symptoms and also incidence of low back pain.[6] However in our study, number of MRI performed were almost two third in the younger age group as compared to elderly. The difference might be because of the greater severity and acuteness of disease in the young and evaluation for surgical intervention in the young patients. This might also indicate the difference of healthcare seeking practice in our setup where people more than 60 years are mostly dependent populations.

Degenerative disc changes is defined as presence of any or all of: desiccation, fibrosis, disc space narrowing, diffuse annular bulging beyond the disc space, extensive fissuring (i.e. numerous annular tears) and mucinous degeneration of the annulus, defects and sclerosis of the end-plates and vertebral apophyseal osteophytes.[4] The presence of degenerative changes and involvement of multiple levels was more common in elderly as compared to young adults in our study, which is consistent with previous studies demonstrating increased incidence of degenerative disc disease with aging.[6,7] Also bulging, defined as presence of disc tissue circumferentially 50-100% surrounding the disc,[4] which is not considered as disc herniation was also more common in elderly in our study, a result similar to other previous studies.[3] Bulging is a part of disc degeneration rather then herniation and is thus more common in elderly as compared to young.

Herniation was more common in young adults. Protrusion was the most common herniation and was also more common in young adults. The findings are however contrary to previous reports which reported an increase in prevalence of disc herniation with aging.[3] A study done to see the trend of disc herniation in elderly showed a decreasing trend in disc herniation with age especially after 80 years of age, however the study included patients above 65 years only, so comparison with young adults is not possible.[8] Single level involvement was more common for disc herniation then reported in other study, the most common level involved was L5-S1 for young adults and L4-L5 for elderly. The association between level of disc herniation and age has been previously established and has been attributed to reduced lumbar lordosis angle in elderly.[9, 10]

There was no significant difference in spinal canal stenosis in young and elderly in our study. This was in contrast to previously established fact that showed increase in spinal stenosis with aging.[2, 11] This difference in result could be because our study involved patients with low back complaints and radiculopathy rather than the general population. However, nerve root compression was seen more commonly in the young adults as compared to elderly. This may be attributed to increased incidence of disc herniation in young adults seen in our study. Also because MRI was performed in a 0.3T MRI, the assessment of nerve root compromise could be a source of bias and error.

Our study shows no correlation of spinal canal stenosis or nerve root compression as assessed on MRI with presence of radiculopathy. Experimental studies in animals, and clinical observations in the past suggested obstruction at two levels inducing ischemia to the cauda equina and nerve root in patients with spinal stenosis causes symptoms.[12] However studies done in the past to look for association between spinal stenosis and patients' symptoms did not show significant association between clinical symptoms and spinal stenosis. [2,13] Association between grade III nerve compression with radiculopathy was seen in young adults but not in elderly. Association between nerve root compression and clinical symptoms has been reported in some previous studies.[5,14] However some other studies report association only between severe nerve root compression and symptoms.[13] Our study however failed to demonstrate such association between nerve root compression and radiculopathy indicating more complicated interplay of patho-mechanism for radiculopathy in the elderly as compared to the young population. However the assessment of nerve root compression could be a source of bias and error in our study. Presence of centrolateral disc herniation was associated with radiculopathy in young patients, however no association was found between any type of or central disc herniation and radiculopathy. Also no association was also noted in elderly between disc herniation, or centrolateral disc herniation and symptomatology. The presence of radiculopathy in centrolateral disc protrusion is explained by the compression of lateral recess by the herniated disc in paramedian position where the traversing nerve root lies. Similar association was also seen in previous study.[15]

Our study had several limitations; firstly it was a hospital record based retrospective study among patients undergoing MRI scans for low back pain, which might not represent the true population with low back pain. Also MRI scans were done using a 0.3T MR machine, which has inherently low spatial resolution and difficulties with assessment of nerve root compression. We did not correlate the radiculopathy with the level of compromise. Degenerative disc diseases are more common in elderly population, however herniations tend to occur more commonly in the younger age group. The level of disc

herniation changes with age probably related to the change in lumbar lordosis. Radiculopathy in young can be explained by the underlying stenosis, compression and herniation. However in elderly the pathology does not correlate well with clinical findings. This might be because the pathology in elderly is complicated by the underlying age related changes and is actually interplay of various findings. The implications of this might be in planning treatment options for the elderly; as to mere relieving the compression or stenosis may not improve the patient symptoms.

CONCLUSIONS

The morphology and etiology of back pain differ significantly in young adults and in elderly, so does the pathogenesis of pain and radiculopathy. The study may lead to a new field to explore: the pathology of low back pain and radiculopathy in elderly in the background of degenerative disc disease.

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