

Magnetic Resonance Imaging Lumbo Sacral Spine in Assessment of Low Back Pain in Young Adults

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Abstract

Introduction: Low back pain (LBP) is a common health problem in population worldwide leading to concomitant disability which has assumed a public health importance in our setting. While it is relatively common in elderly, the incidence of LBP in young adults was alarmingly increasing.

Purpose: To find etiology of LBP in symptomatic young adults (10-35 years). Identification of associated modifiable risk factors of LBP in young adults and accordingly enable successful implementation of prevention strategies.

Materials and Methods: This was a prospective study of 100 respondents. A questionnaire was used to obtain information on clinical symptoms, socio-demography, lifestyle, occupation, and other risk factors associated with LBP amongst clinically symptomatic young cases below 35 years attending magnetic resonance imaging (MRI) department in Government Medical College, Aurangabad.

Results: Of 100 cases, 54 were females and 46 males, 30 (65.21%) males and 35 (64.81%) females had abnormal MRI findings. Most common etiology of LBP found was degenerative disc disease (76.92%) followed by trauma (7.69%), tumors (4.61%) and infective (4.61%), inflammatory (3.07%) and least common etiologies being metabolic (1.53%) and developmental - Scheuermann's disease (1.53%). Among 50 cases showing positive disc degeneration findings, 27 (54%) were involved in heavy physical activity, 21 (42%) in prolonged hours of sitting (>8 h), and rest 2 were involved in prolonged standing. Hence, we found that LBP incidence was associated with increased hours of heavy physical activity and prolonged hours of sitting.

Conclusion: The prevalence of LBP among young adult cases in our setting is high, with preventable and treatable predisposing factors. Cases should improve their physical fitness, practice frequent breaks, and stretching during sitting. Public health efforts should be directed at educating people on occupational and lifestyle habits.

Key words: Astrocytoma, Discogenic, Hemangioma, Sacroiliitis, Scheuermann

INTRODUCTION

Low back pain (LBP) or lumbago is one of the most common patient complaints encountered in clinical practice, having significant economic consequences to the affected patient, especially young employed individuals thereby leading to loss of national economy by loss of

labor working days. About 40% of sick absences from work is because of LBP - making it the second most common cause of workplace absenteeism after the common cold.¹

Occupation related factors are the most important risks associated with LBP.² Modifiable factors are poor posturing, prolonged sitting, twisting, bending, stooping, and lifting of heavy loads.³

Need for the Study

The association of lumbar disc disease with advancing age is well known and documented.^{4,5} However, an increasing incidence of lumbar disc disease in young adults and adolescents has also been reported by studies done in various populations world over.⁶⁻⁸

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We noticed an alarming increase in number of young population between 15 and 35 years complaining of LBP, who were referred to The Department of Radiodiagnosis, Government Medical College Aurangabad for MRI Lumbosacral spine. Associated modifiable risk factors were faulty posturing, general health status, hours of physical activity, prolonged hours of sitting, computer usage.

Lumbar disc disease is an important cause of low back ache and describes L4-L5 as the most common site for degenerative disc disease.⁹

Variety of factors contributing to this degeneration are aging, axial loading of disc, abnormal posturing, vascular in growth, and abnormalities in collagen and proteoglycan all contribute to disc degeneration. Disc herniation with radiculopathy and chronic discogenic LBP are the result of this degenerative process.¹⁰

MRI has become the initial imaging technique of choice in evaluation of cases having lower back pain or radicular pain for demonstration of objective evidence of pathology in a location consistent with clinical findings.¹¹

MRI demonstrates the lumbar spine in multiple planes and extradural soft tissues (including intervertebral discs), paravertebral musculature, the exiting nerve roots and intradural structures (spinal cord, conus medullaris, and intrathecal roots).

The causes of LBP include:

1. Degenerative: Intervertebral disc abnormalities, lumbar canal stenosis associated nerve compression, spondylolisthesis, facet arthropathy, Schmorl's nodes
2. Infections: Tuberculosis (TB)
3. Inflammation: Sacroiliitis (young females)
4. Developmental and congenital abnormalities: Transition vertebra, scoliosis, Scheuermann's disease¹²
5. Neoplastic: Primary/metastatic bone disease
6. Lumbosacral muscle and soft tissue related disorders: Muscle sprain and strains
7. Miscellaneous: Osteopenia/Osteomalacia/Osteoporosis and non-spinal causes such as renal calculi, pancreatitis, abdominal aortic aneurysm, and gynecological disorders like endometriosis.

MATERIALS AND METHODS

MRI machine PHILIPS 1.5 Tesla, in Department of Radiodiagnosis, Government Medical College and hospital, Aurangabad was used for MRI scanning of lumbosacral spine.

MRI lumbosacral spine was done in all patients as described below:

The details of the procedure were explained to the patient and relatives. A written, informed, valid consent was taken from patient and relatives. Prior to scan detailed history of operations, pacemaker surgery, aneurysmal clip, otology implants, etc., was taken. Contrast study was done in very rare cases under anesthesia standby with all emergency drugs ready to manage the sensitivity reactions of contrast media.

Inclusion Criteria

All cases (15-35 years) of low back ache referred to Government Medical College Aurangabad, Radiology department for MRI imaging, during the study period.

Exclusion Criteria

Pregnant women, age > 35 years, <15 years, patients with metallic implants (cardiac pacemakers, cochlear implants, ocular prostheses, dental implants, and implantable cardiac defibrillators).

OBSERVATION AND RESULTS

MRI of the lumbosacral spine was performed on 100 cases in the age group of 10-35 years. There were 46 males and 54 females.

Among 46 males presenting with back pain 30 cases (65.21%) had abnormal MRI findings and among 54 females presenting with back pain 35 (64.81%) had abnormal MRI findings (Table 1).

35 of the 100 cases in the study group had no abnormal MRI findings (Table 1).

Most common etiology of LBP found in young adults was degenerative disc disease (76.92%) (Table 2).

Maximum number of cases affected by degenerative disc disease was noted in age group of 31-35 years (52%) (Table 3).

Out of total 50 cases showing disc degeneration, 84% patients showed the involvement of L4-L5 intervertebral disc level, followed by L5-S1 (44%) and L1-L2 (10%) was least commonly affected (Table 4).

27 (54%) were involved in heavy physical activity, and out of these, 12 were homemakers (Table 5).

21 (42%) cases were involved in prolonged hours of sitting, and out of these, 12 were involved in clerical jobs like bank employees, typist, young call center employees (Table 5).

Table 1: Gender wise incidence of normal and abnormal MRI

MRI Findings	Males	Females	Total
Abnormal MRI	30	35	65
Normal MRI	16	19	35
Total	46	54	100

MRI: Magnetic resonance imaging

Table 2: Sex wise distribution of etiologies of low back pain

Etiologies	Males	Females	Total
Degenerative	21	29	50
Trauma	4	1	5
Tumor	1	2	3
Infection	2	1	3
Inflammation	0	2	2
Metabolic	1	0	1
Developmental disorder-Scheuermann's disease	1	0	1
Total	30	35	65

Total MRI positive cases 65, MRI: Magnetic resonance imaging

Table 3: Age and sex wise distribution of degenerative disc disease

Age	Males	Females	Total
10-15	0	0	0
16-20	1	0	1
21-25	2	2	4
26-30	7	12	19
31-35	11	15	26
Total	21	29	50

Total cases showing disc degeneration - 50

Thus, excluding the positive cases of trauma (5), tumor (3), infection (3), inflammatory (2), metabolic (1), and Scheuermann's disease (1), out of the rest 85 symptomatic cases, 44 (51%) were involved in heavy physical activity of which 17 (38.6%) had normal MRI findings, second 36 (42.35%) were involved in prolonged sitting, of which 15 (41.67%) patients were normal (Table 6).

On follow-up, we noticed that most of these cases were subjected to back exercises and stretching which helped them become symptom-free.

- After degenerative disc disease being the most common cause of LBP, we had 5 patients of traumatic backache
- We saw 3 cases of Infective etiology; all three were below 30 years of age
- 3 patients had findings of spinal tumors one each of spinal astrocytoma, osteoblastoma and spinal dermoid
- Inflammation was seen in 2 cases, both of them were females below 30 years and known cases of ankylosingspondylosis with raised HLA B27 levels
- Rare causes included one patient of thalassemia and another of Scheuermann's disease.

Table 4: Level wise distribution of disc involvement

Level of affected disc	Males	Females	Total
L1-L2	1	4	5
L2-L3	3	4	7
L3-L4	4	12	16
L4-L5	18	24	42
L5-S1	11	11	22

Table 5: Occupation wise distribution of degenerative disc disease

Age in years	Heavy physical activity		Prolonged sitting		Prolonged standing	
	Males	Females	Males	Females	Males	Females
10-15	0	0	1	0	0	0
16-20	0	0	1	0	0	0
21-25	2	1	0	1	0	0
26-30	1	7	6	4	0	1
31-35	5	11	7	2	0	1
Total M/F	8	19	14	7	0	2
Total M+F	27		21		2	

Total degenerative cases - 50, M: Males, F: Female

Table 6: Occupational factors responsible for signs and symptoms

Occupational factors	Abnormal MRI	Normal MRI	Total
Heavy physical activity	27	17	44
Prolonged sitting	21	15	36
Prolonged standing	2	3	5

DISCUSSION

Lumbar disc degeneration was the most common cause of LBP around world and the majority is due to disc herniation. Due to development of MRI, non-invasive and excellent imaging of spine is possible.

In our study, there were more females (54%) as compared to male cases (46%).

Among 46 males presenting with back pain 30 cases (65.21%) had abnormal MRI findings. Among 54 females presenting with back pain 35 (64.81%) had abnormal MRI findings. Hence, in our study, males showed a slightly higher affection than females.

Men are more commonly affected to disc degeneration than women. It is most likely due to increased mechanical stress and injury.¹³ In a review by Punnett, the attributable factor for LBP was also higher among men (41%) than women (32%).¹⁴ The reason proffered was that men usually engage in occupations associated with heavy physical workload and whole-body-vibration compared with women.¹⁴

Females had a higher prevalence of LBP as compared to males (Schneider *et al.* 2006 total sample of 5315 persons, Wijnhoven *et al.* 2006).^{15,16} It has been associated with hormonal changes, irregular or prolonged menstrual cycle, different pain perception and recall of symptoms.^{16,17} In another study, female rice farmers in Thailand were more likely to develop LBP than males.¹⁸ Another study among staff in a rural hospital also found that female workers had a greater prevalence of LBP.¹⁹

Degenerative Disc Disease

The most common abnormality noted in our study was degenerative disc disease (76.92%). Most cases of disc degeneration were observed in age group of 31-35 years in our study.

Disc desiccation is a common degenerative change of intervertebral discs. It results from replacement of the glycosaminoglycans within the nucleus pulposus with fibrocartilage which leads to reduced disc height due to reduction in nucleus pulposus volume.²⁰

In study by Takatalo *et al.* (2011). Intervertebral disc degeneration was associated with low back symptom severity among young adults suggesting that the symptoms may have a discogenic origin at this age.²¹

In our study, we have found the majority of the disc lesions were at L4-5 (84%) followed by at the level L5-S1 (44%), least being at the level of L1-L2 (10%) which were consistent with findings of other studies. Similar findings were seen in a study conducted by Saleem *et al.* (2013) out of 163 cases; disc degeneration was most commonly present at the level of L4-L5 105 (64.4%).²²

In our study, among 50 cases showing positive disc degeneration MRI findings, 27 cases (54%) were involved in heavy physical activity. In the world, 37% of LBP are attributed to occupation.²³ Professionals who are exposed to vibrations or long-standing positions such as health-care workers, occupational drivers and construction workers are more prone to LBP. LBP is associated with working postures which included vigorous bending, bending and twisting simultaneously, a bent and twisted posture for long periods, and making repetitive movements with the trunk. This finding was consistent with other studies.^{14,24-27}

In our study, 21 cases (42%) were involved in prolonged hours of sitting (> 8 h), of which 10 cases were involved in clerical jobs such as bank employees, typist, young call center employees and 2 cases (4%) were involved in jobs requiring prolonged standing hours such as teacher and salon worker.

Our findings were comparable to many other previous studies, In 2007, Lis *et al.* concluded, that in working adults, prolonged sitting has been identified as a risk factor for LBP.²⁸ According to a study done by Callaghan and McGill in 2001, the reported consequences of prolonged sitting are increased spinal compression load²⁹ and increased activity of paraspinal muscles.³⁰ As a result, LBP can occur due to tissue microdamage and paraspinal muscle dysfunction.³¹

A total of 50 cases had degenerative disc degeneration findings in lumbosacral spine of which 18 cases had affection at multiple contiguous sites, and 5 cases showed the involvement of multiple non-contiguous sites (Figure 1a and b) and rest 27 had affection of single intervertebral disc level (Figure 2a and b).

Other associated findings were Schmorl's nodes in 5 (10%) patients and endplate changes in 7 (14%) patients.

Sacroiliitis

Two (3.07%) cases in our study showed evidence of sacroiliitis, and both were females. These were known cases of ankylosing spondylosis with raised HLA B27 levels, one

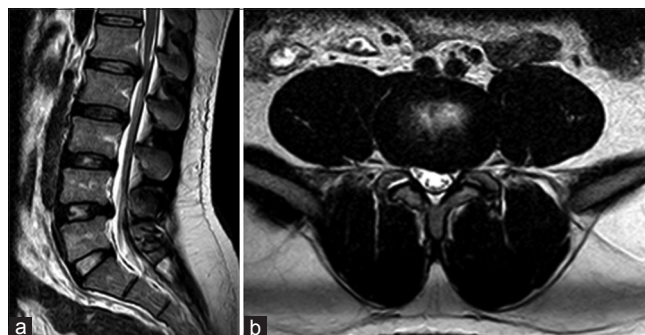


Figure 1: (a) Typical imaging findings in degenerative disc disease - T2W sagittal image showing affection at multiple contiguous intervertebral disc levels L1-2, L2-3, L4-5, (b) T2W axial image at the level of L4-5 intervertebral disc showing postero and bilateral paracentral disc protrusion compressing traversing and bilateral exiting nerve roots

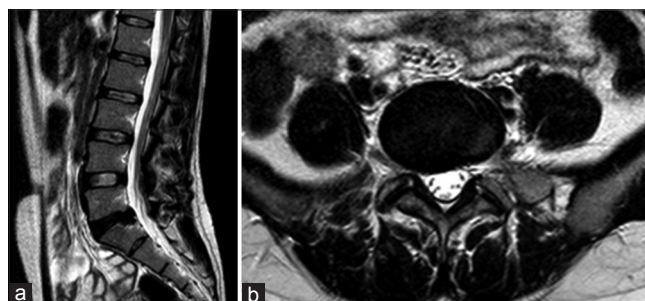


Figure 2: (a) Typical imaging findings in degenerative disc disease. T2W sagittal image showing affection at single L5-S1 disc level, (b) T2W axial image at the level of L5-S1 intervertebral disc showing right paracentral disc protrusion compressing right exiting nerve root

of them revealed short tau inversion recovery hyperintense signal intensity in articular surface of sacrum on the left side (Figure 3). Another patient showed altered signal intensity in bilateral iliac blades.

Sacroiliitis is a noninfectious inflammatory process involving the sacroiliac joint and is a diagnostic criterion for seronegative spondyloarthropathies. Imaging methods are of great value for confirming the diagnosis of this condition.³² Cases typically have an insidious onset pain, which is relieved with physical activity and worsens during late night time. Sciatica may be the result of referred pain or the inflammatory changes in the immediate vicinity of the sacroiliac joint directly affecting the nerve.³³ MRI can provide information about the activity of the disease and for making an early diagnosis of sacroiliitis.³⁴

Shankar *et al.* (2009) showed that MRI abnormality was present in 29 cases (50 joints, bilateral in 21 and unilateral in 8) and in none of the controls. This accounts for a sensitivity of 87.9% and a specificity of 100%.³⁵

Tubercular Spondylitis

3 (4.61%) cases in our study were diagnosed as tubercular spondylodiscitis, 2 of these cases had hyperintense signal on T2W images involving L3-L4 intervertebral disc and adjoining superior and inferior end plates of vertebral bodies. Another patient revealed infective etiology at D12 vertebra, with anterior epidural extension of the associated soft tissue compressing spinal cord.

TB spondylitis can occur at any age. Middle-aged adults are the most frequently affected by TB spinal infection.

In a study of 42 cases by Khalequzzaman and Hoque (2012). The peak incidence was found to be in a 3rd decade

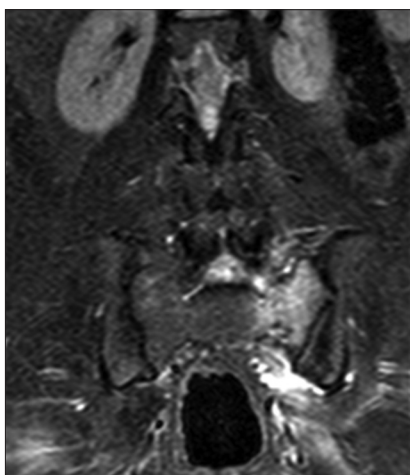


Figure 3: Ankylosing spondylosis, showing short tau inversion recovery hyperintensity in articular surface of sacrum on left side

(48.43%) with male predominance, 2.5 times more than females. Destruction and collapse of vertebrae (88.1%) with posterior element involvement (54.76%). Paraspinal soft tissue involvement was seen in most of the cases (80.95%). MRI was found sensitive and accurate modality for diagnosis of TB spondylitis.³⁶

Trauma

5 (6.15%) cases in our study had traumatic LBP, two of the cases showed compression fracture of L1 vertebral body, two cases had anterior wedge compression fracture of L2 vertebral body one of them with accompanying diffuse marrow edema, and last one revealed a fracture of L3 vertebral body.

Tumor

3 (4.61%) cases of our study group had spinal tumors. One patient revealed Grade I osteblastoma involving posterior part of L2 vertebral body on the right side, right pedicle, and right transverse process extending into the spinal canal and causing nerve compression. Other patient had heterogeneously enhancing elongated intradural intramedullary lobulated lesion, extending from vertebral levels L1-L2 vertebrae causing spinal canal expansion at this level (Figure 4a and b) Findings of spinal astrocytoma were confirmed postoperatively. The third patient was a case of recurrent spinal dermoid.

Bone Hemangiomas

In our study, hemangiomas were noted incidentally in 11 cases mostly in L3 and L4 vertebral bodies along with associated other degenerative disc disease findings. This appeared to be incidental finding with no correlation with symptomatology.

Metabolic

We had one patient who was a known case of thalassemia major suffering from LBP; his spine revealed diffusely

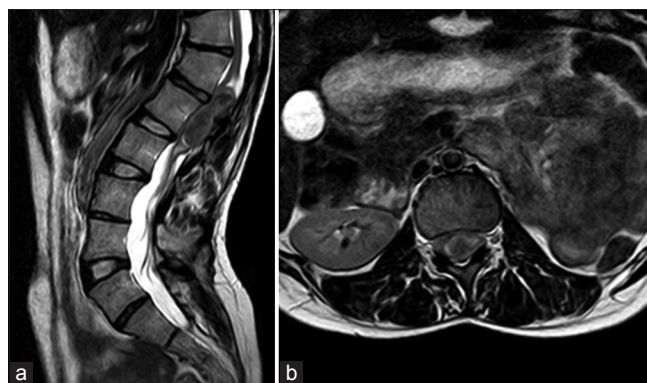


Figure 4: T2W sagittal (a) and axial (b) image shows elongated intradural intramedullary lobulated lesion, extending from vertebral levels L1-L2 vertebrae causing spinal canal expansion at this level, findings of spinal astrocytoma were confirmed



Figure 5: Scheuermann's disease revealed multiple Schmorl's nodes at superior endplate of D7, L2, L3, L4 and inferior endplates of D5 vertebral body with narrowed L4-5 disc space. Partial fusion of D1, D2, D3, D4-D5 and D7-D8 vertebral bodies

decreased signal intensity (hypointense on all sequences) involving all vertebrae and their posterior elements, visualized calvaria and base of skull, s/o Hematopoietic marrow-marrow reconversion.

Scheuermann's Disease

We had one patient of Scheuermann's disease which revealed Schmorl's nodes at superior end plate of D7, L2, L3, L4 vertebral bodies and inferior endplate of D5 vertebrae, with relatively narrowed L4-L5 intervertebral disc. Partial anterior fusion of D1, D2, D3, and D4-D5 and D7-D8 vertebral bodies was also seen (Figure 5).

Scheuermann Disease is a spinal disorder named after Dr. Holger Werfel Sheuermann who in 1921, first described a structural thoracic kyphosis mainly affecting adolescents.³⁷ Its classic diagnostic criterion was "3 or more consecutive wedged thoracic vertebrae," proposed by Sorenson in 1964.³⁸ However, this disease included pathological changes also like disc and endplate lesions, primarily Schmorl's node, and irregular vertebral endplate.^{37,38} Therefore, the diagnosis of "atypical" Scheuermann disease was proposed for cases with only one or 2 wedged vertebrae and no notable kyphosis, but characteristic disc/endplate lesions including Schmorl's node and endplate irregularity.³⁹⁻⁴²

CONCLUSION

MRI is the most comprehensive, non-invasive and safe imaging modality for diagnosis of LBP. The incidence of LBP is considerably high in young adults and more frequent in age group of 31-35 years. Most common etiology of LBP found in young adults is degenerative disc disease (76.92%) and the most commonly affected intervertebral

disc level is L4-L5 (84%), followed by L5-S1 (44%). Heavy physical activity (61.36%) is the most common occupational factor responsible for degenerative disc disease, followed by prolonged sitting (42%). Among symptomatic patients involved in prolonged sitting, 41.67% revealed no signs on MRI indicating the modifiable nature of degenerative disc disease in that group.

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