

Original Research Article

Role of MRI and ultrasonography in evaluation of multifidus muscle in chronic low back pain patients

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ABSTRACT

Background: Low back pain (LBP) is a condition that will affect 60-80% of the population at some stage in their life. Epidemiological studies have shown that simple backache has point prevalence and a 1-month prevalence of 15-30% and 30-40% respectively. Studies that have been performed state that LBP is a self-limiting condition, but many people who have suffered from LBP will experience recurring episodes, which could lead to the development of chronic LBP. The objective of the study was to assess the role of MRI and USG in evaluating degenerative changes in multifidus muscle in chronic low back pain patients.

Methods: A Cross-sectional Observational study was done in 30 patients. Adult patients of either sex who presented with low back pain for 6 weeks or more and Grade 1 and grade 2 degenerative intervertebral disc changes as seen on plain skiagrams of L-S spine, A-P and lateral views were subjected to MRI and Ultrasound.

Results: Multifidus and paraspinal muscle atrophy and fatty degeneration should be considered in association with the clinical presentation and other abnormalities seen in MRI examination.

Conclusions: Whether LBP duration, severity and associated functional disability affect the degree of paraspinal muscle degenerative changes remains unclear. Possible reasons underlying the discrepant findings include variations among the age and symptoms of duration of the studied populations and small sample size.

Keywords: Low back pain, MRI, Multifidus, Ultrasonography

INTRODUCTION

Low back pain (LBP) is a condition that will affect 60-80% of the population at some stage in their life. Epidemiological studies have shown that simple backache has point prevalence and a 1-month prevalence of 15-30% and 30-40% respectively.¹⁻³

Studies that have been performed state that LBP is a self-limiting condition, but many people who have suffered from LBP will experience recurring episodes, which could lead to the development of chronic LBP. Back pain carries a worse prognosis if it was disabling or associated

with sciatica.⁴ Less is known about the epidemiology of chronic low-back pain with no associated work disability or compensation.⁵ For most episodes of low back pain, a specific underlying cause is never identified or even looked for, and the pain is believed to be due to mechanical problems such as muscle strain or joint sprain.⁶

Causes of chronic low back pain⁷

Nonspecific or idiopathic - attributed to spinal muscle strain or sprain. These patients are, in general, younger and have no clinical red flags.

Disc degeneration- It includes: Herniation - localized displacement of nucleus, cartilage, fragmented apophyseal bone, or fragmented annular tissue beyond the intervertebral disc space. Herniation is sub divided into:

- Protrusion - protrusion is present if the greatest distance in any plane between the edges of the disc material beyond the disc space is less than the distance between the edges of the base in the same plane.
- Extrusion - If in any plane the greatest distance between the edges of the disk goes beyond the distance between the edges of the base.
- Bulging - the presence of disk tissue diffusely (>50% of the circumference) extending beyond the edges of the ring apophyses. This bulging can be symmetric or asymmetric.

Central canal stenosis- Spinal stenosis can occur for various reasons, such as congenital spine abnormalities and disk herniation, but classically consists of the triad of disk bulge with facet hypertrophy and hypertrophy of the ligamentum flavum.

Infection

Ankylosing Spondylitis

Metastases

METHODS

This Cross-sectional Observational study was conducted in the department of Radiodiagnosis, Post Graduate Institute of Medical Education and Research, Dr. Ram Manohar Lohia Hospital, New Delhi, from November 2013 to March 2015. Approval from hospital and Institutional Ethical Committee was obtained prior to initiation of the study.

Patients of either sex who presented with low back pain for six weeks or more and who had Grade 1 and Grade 2 degenerative intervertebral disc changes on Plain Skiagrams of L-S Spine-AP and Lateral View, were included in our study. Patients diagnosed with neoplasm, tuberculosis, trauma, inflammatory arthritis and those showing severe degenerative intervertebral disc changes, advanced osteophytosis, spina bifida and ankylosing spondylitis etc. on preliminary X ray L-S spine were excluded from our study.

Post-operative patients and patients who had contraindications to MR evaluation-patients with pacemakers, claustrophobia, metallic implants were also not included in the study. A written informed consent was taken from all the patients. A detailed history was taken with emphasis on duration, severity, site of pain and aggravating and relieving factors. Associated symptoms like stiffness, fever or chills, weight loss, chronic cough, pain in other joints etc. were also noted. A continuous scale (VAS Scale) was used to grade the pain severity.

Oswestry disability index was used for functional disability. A complete general physical examination, local examination and neurological assessment of the patients were also done.

Ancillary radiological investigations

X-ray lumbar spine - A-P, lateral and oblique views were taken in all patients to exclude severe degenerative intervertebral disc changes, advanced osteophytosis, spina bifida and ankylosing spondylitis. Flexion and extension views were also taken where instability was suspected.

Grading for lumbar disc degeneration on X- ray⁸

- Grade 1: slight anterior wear and osteophyte formation
- Grade 2: definite anterior wear and osteophyte formation
- Grade 3: osteophyte formation and narrowing of disc
- Grade 4: large osteophyte formation; marked narrowing of disc ; sclerosis of vertebral plates and posterior subluxation

Ultrasonography

Ultrasound of spine was performed as an initial imaging modality in patients having chronic low back pain to measure the thickness and fatty infiltration of the multifidus muscle. Ultrasonography was done using High frequency (5-12 Mhz) linear transducer ultrasound machine. Acoustic gel was used for skin-transducer coupling.

Magnetic resonance imaging

MRI was performed using Siemens 1.5 tesla magnetom symphony. The thickness and the fatty infiltration of the multifidus muscle were measured. MR system using appropriate phased array coils according to protocol. Sedation (oral or intravenous) if required was given according to standardized guidelines. The MR sequences included: - T1_spin echo, T2_ spin echo, STIR, Fat suppressed and Gradient Images (GRE) for blood and calcification. Images were obtained in axial, coronal and sagittal planes.

Grading for fatty infiltration⁹:

- Mild: Replacement of less than 10% of the multifidus muscle bulk with fat and fibrous tissue.
- Moderate: Replacement of less than 50% of the multifidus muscle bulk with fat and fibrous tissue.
- Severe: Replacement of more than 50% of the multifidus muscle bulk with fat and fibrous tissue.

Percentage of cases showing pathological changes on ultrasound examination and MRI were determined.

Percentages of cases where ultrasonography missed the pathological changes but MRI was able to detect them were also determined.

RESULTS

A total of 31 adult patients with chronic low back pain were included in present study. All the patients were divided into five groups according to the age group- 20-30years, 31-40years, 41-50years, 51-60years and 61-70years. Maximum numbers of patients were in the age group 31-40 years (32.2%).

Out of the 31 patients included in this study, 20 (65%) were females and 11(35%) were males. The overall male to female ratio was 0.55:1. All the patients had chronic low back pain involving the lumbosacral region. The duration of the low back pain differed. All patients were included in the study that had low back pain for more than 6 weeks. The graph clearly shows that maximum patients had low back pain for 6 to 12 months. The patients were graded for pain severity on Visual Analog Scale and disability on Oswestry Low Back Pain disability scoring.

Visual analog scale

The patients were graded as having “no pain”, “minimum”, “moderate” and “severe” pain. 26 no. of patients (83.8%) had moderate pain according to the Visual Analog Scale. Four patients had severe pain and only one patient had minimum pain.

Oswestry low back pain disability scoring

According to the Oswestry Disability Scoring the patients were graded as “minimal”, “moderate”, “severe”, “crippled” and “bed bound”. X-ray: Before performing ultrasound and MRI, the patients were included on the basis of lumbosacral spine X-ray showing grade 1 and grade 2 degenerative changes. 18 patients (58%) showed grade 2 degenerative changes on lumbosacral spine x rays.

Ultrasound and MRI

Patients who were included in the study underwent ultrasound and MRI of the lumbosacral spine region for evaluating multifidus atrophy and fatty degeneration along L 1 to L 5. MRI findings were taken as the final diagnosis.

Multifidus atrophy

Atrophy was noted by measuring the thickness of multifidus muscle at L 1 to L 5 and then comparing the values to normal values (L1 - 27mm \pm 5 mm ; L2 - 29mm \pm 5.2mm ; L3 - 33mm \pm 5mm ; L4- 35.9mm \pm 5.3mm ; L5 -35.9mm \pm 4.8mm) (Figure 1a). The atrophied muscle showing lower values (Figure 1b). In all the patients

multifidus atrophy was localized only at the L 5 level in both ultrasound and MRI findings. Ultrasound showed 6 cases (19%) to have multifidus atrophy whereas MRI showed 9 (29%) cases to have the same, showing that ultrasound missed the atrophy in 3 (33%) cases.

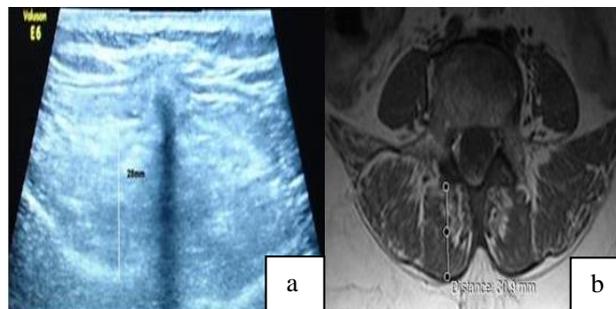


Figure 1: Multifidus atrophy; a) transverse section of USG at L 5 shows less than normal multifidus thickness; b) Axial T1 WMR image at L5 also shows less than normal multifidus thickness.

Multifidus atrophy V/S pain severity and disability

7 and 6 patients who showed atrophy of multifidus muscle had moderate pain severity on VAS and moderate disability on Oswestry Disability Score respectively. Only 2 patients who had atrophy had severe pain and disability.

Multifidus atrophy and duration

2 cases showing multifidus atrophy had low back pain for 6 weeks to 6 months. 3 cases showing multifidus atrophy had symptoms for 6 to 12 months. 4 cases showing atrophy had symptoms for more than a year.

Multifidus fatty degeneration

Multifidus fatty degeneration was noted by determining the amount of multifidus muscle replaced by fatty and fibrous tissue. The fatty degeneration was then visually graded accordingly as mild (replacing <10% of the muscle), moderate (replacing 10-50% of the muscle) (Figure 2) and severe (replacing >50% of the muscle) (Figure 3 and 4).

The grading of fatty degeneration was done separately at every lumbar level i.e. from L 1 to L 5. 29 patients had fatty degeneration at L 5 level followed by L 4 and L 3 (26 each). 21 numbers of cases with fatty changes was seen at L 1. Fatty degeneration of the multifidus in these cases was seen as the muscle showing increased muscle echo due to fat and fibrous tissue. Severe degeneration (Figure 4a) was not seen in any of the cases due to increased echoes from surrounding fat and fibrous tissue.

Moderate atrophy (muscle showing increased echogenicity >10% but less than 50% of its tissue) was seen mainly at L 5 and L 4 level.

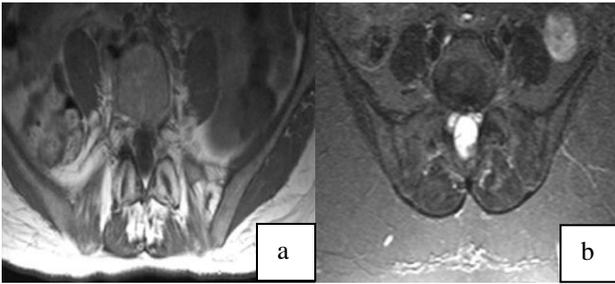


Figure 2: Moderate multifidus fatty degeneration; a) axial T1 WMR image at L5 also shows hyperintense fatty tissue replacing >10% but less than 50% of multifidus muscle; b) axial STIR image at L5 shows fat suppression of the fatty tissue seen on T1W image.

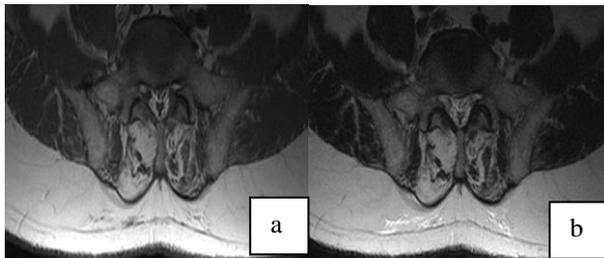


Figure 3: Severe multifidus fatty degeneration; a) axial T1 WMR image at L5 also shows hyperintense fatty tissue replacing 50% of multifidus muscle; b) axial T2W MR image at L5 also shows hyperintense fatty tissue replacing 50% of multifidus muscle.

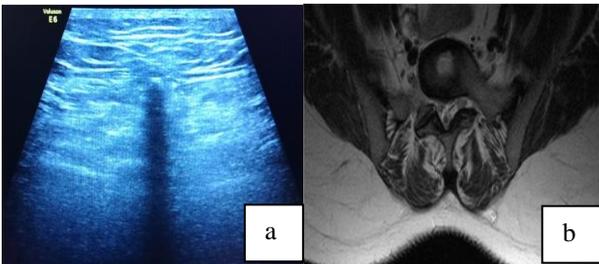


Figure 4: Severe multifidus fatty degeneration; a) transverse section of USG at L5 shows multifidus muscles showing increased echogenicity (>10% but less than 50% of its tissue). It was a case of misdiagnosis by USG; b) axial T₂ W MR image at L5 shows hyperintense fatty tissue replacing >50% of multifidus muscles.

Multifidus fatty degeneration (by MRI modality)

All the cases (31) showed fatty degeneration at L 5 level which was seen as hyperintense fatty tissue on axial T 1 and T 2 weighted images replacing normal multifidus muscle tissue with fat signal suppression seen on STIR axial images. 23 cases with fatty replacement was seen at L 1 level followed L 2 level however 11 and 8 patients showed moderate (Figure 2a and b) and severe (Figure 3a, b and Figure 4 b) degeneration at L 2 and L 1 respectively. In 5 cases each severe degeneration was

seen at L 5 and L 4 level followed by 3 cases each at L 3 and L 2 level.

Final diagnosis (by MRI) Vs USG diagnosis

Ultrasound missed the diagnosis in 26% of the cases i.e. 6 cases out of 23. More importantly severe degeneration was not picked up by ultrasound which was present in one of the patients. In 2 out of 7 cases (28.5%) moderate degeneration could not be detected. Ultrasound missed mild degeneration in 3 cases i.e. 20% of the cases.

L 1 Lumbar level

Ultrasound missed the diagnosis in 26% of the cases i.e. 6 cases out of 23. More importantly severe degeneration was not picked up by ultrasound which was present in one of the patients. In 2 out of 7 cases (28.5%) moderate degeneration could not be detected. Ultrasound missed mild degeneration in 3 cases i.e. 20% of the cases.

L 2 Lumbar level

Ultrasound missed the diagnosis in 8 cases out 22 i.e. in 36.3% of the cases. In all the 3 cases showing severe degeneration the diagnosis could not be made by ultrasound. In 4 out of 8 cases (50%) moderate degeneration was missed. Mild degeneration was missed in 1 case out of 11 i.e. in 9% of the cases.

L 3 Lumbar level

Ultrasound missed the diagnosis in 9 cases out of 23 i.e. 32% of the cases. The 3 cases showing severe degeneration were not picked. Moderate degeneration was missed in 3 out of 9 cases (33.3%). In 3 cases out of a total of 16 cases mild degeneration was missed.

L 4 Lumbar level

Ultrasound missed the diagnosis in 41% of the cases. 5 cases (100%) of severe degeneration were missed by ultrasound. Moderate degeneration was missed in 3 out of 12 cases (25%). Mild degeneration was missed by ultrasound in 33.3% of the cases.

L 5 Lumbar level

In 12 out of 31 cases (38.7%) of the cases ultrasound missed the diagnosis. The 5 cases showing severe fatty degeneration were not picked. In 31% of the cases moderate degeneration of multifidus was missed. 2 cases out of a total 10 cases showing mild degeneration were missed.

Fatty degeneration and LBP duration

Maximum grade of fatty degeneration was taken out of any of the lumbar levels (L 1 to L 5) in each case for corresponding with LBP duration. The patients who had

symptoms for 6-12 months showed 12 cases to have moderate degeneration and no case to have severe degeneration. Severe degeneration at any of the lumbar levels was seen in patients who had symptoms for more than a year and it was seen in 6 cases. No cases with mild degeneration were noted in patients with symptoms of more than a year.

Fatty degeneration and pain severity

Maximum grade of fatty degeneration was taken out of any of the lumbar levels (L 1 to L 5) in each case for corresponding with pain severity. Only one patient had minimum pain and showed a maximum grade of mild fatty degeneration at any of the lumbar levels. 26 patients had moderate pain and 15 of them had maximum grade of moderate fatty degeneration and one had severe at any of the lumbar levels. 4 patients had severe pain and had severe fatty degeneration at any of the lumbar levels.

Fatty degeneration and disability

Maximum grade of fatty degeneration was taken out of any of the lumbar levels (L 1 to L 5) in each case for corresponding with disability. 21 cases had moderate disability and showed a maximum of moderate fatty degeneration at any of the lumbar levels. The patients who showed minimal disability had mild degeneration in 5 cases and moderate degeneration in 2 cases. Patients with severe disability had mild, moderate and severe fatty degeneration in each of the patients.

DISCUSSION

Imaging plays a major role in the evaluation of the patients with low back pain. Despite the progress in diagnostic imaging techniques, the exact cause of LBP remains unknown in most of the cases. Moreover, the recurrence of LBP is extremely high; 60% to 84% of patients with an acute episode of LBP will have recurrent symptoms in the following year¹⁰. Over the past decades some attention has shifted towards paraspinal muscles, as variations in paraspinal muscle morphology (e.g. atrophy, fatty infiltration and asymmetry) have been observed in patients with LBP. However, their role in spinal pathology and symptoms remains ambiguous.

31 adult patients with chronic low back pain were evaluated using both USG and MRI. Lumbosacral spine x rays was done in all the cases and only patients with grade 1 and grade 2 degenerative changes were included. The multifidus muscle was evaluated for atrophy and fatty degeneration at L 1 to L 5 level in all the cases. MRI findings were taken as the final diagnosis. USG was not in agreement with the final diagnosis in 3 cases of multifidus atrophy and 12 (41.3%) cases at L 4 level followed by 12 (38.7%) cases of fatty degeneration at L 5 level. All adult patients i.e. above 18 years of age were included in the present study. The patients in the age group 31-40 year (10 cases, 32.2%) comprised the largest

group followed by patients in the 51-60 year group (8 cases, 25.8%). Out of the 31 patients included in the study, 20 (65%) were females and 11 (35%) were males. The overall male to female sex ratio was 0.55:1. In the study maximum number of patients had low back pain for 6-12 months (14 cases, 45.16%). The patients were graded for pain severity on Visual Analog Scale and disability on Oswestry Low Back Pain Disability Scoring. We found that maximum number (26, 83.8%) of patients had moderate pain severity on the Visual Analog Scale. On the Oswestry Disability Scoring maximum patients (21, 67.7%) had moderate disability. Kamaz et al in a study to evaluate cross sectional area changes in paraspinal muscles in chronic low back pain patients used VAS and ODI scales for clinical evaluation.¹¹ Beneck et al used the Oswestry Disability Scale in patients having back pain and found the patients to have minimal disability.¹² On x ray lumbosacral spine 18 patients (58%) showed grade 2 degenerative changes while 13 patients had grade 1 changes.

Multifidus atrophy

On USG multifidus atrophy (reduced thickness of multifidus muscle) was seen in 6 cases (19%) in our study. Demoulin et al also showed paraspinal muscle wasting with reductions in cross-sectional surface area in chronic low back pain patients.¹³ Chan et al found smaller multifidus cross-sectional area in chronic LBP patients than that in controls using B mode ultrasound.¹⁴

Fortin et al suggested that paraspinal muscles are smaller in patients with chronic LBP than in control patients and on the symptomatic side of patients with chronic unilateral LBP. Rostami et al compared cross sectional area of multifidus muscle in cyclists with and without low back pain. Data showed a significantly lower CSA of LM muscles in cyclists with LBP compared to controls in all positions. In our study only chronic low back pain patients were included. According to Hides et al patients with acute back pain also had reduced cross sectional area of multifidus muscle.¹⁵

The atrophy on ultrasound was localised to the L 5 level in all the patients. In a study Hides et al also showed that chronic LBP patients had significantly smaller multifidus CSAs than asymptomatic subjects at the lowest two vertebral levels. Similar findings were seen by Wall-work et al who showed a significantly smaller CSA of the multifidus muscle in CLBP patients compared to the healthy subjects at the L5 vertebral level. In present study MRI showed atrophy in 9 cases (29%). Hyun et al calculated multifidus pure muscle cross sectional ratio of involved to uninvolved sides in patients with low back pain and found abnormal ratio in 78.6% of the patients. Kim et al also found significantly smaller CSA of multifidus muscle in chronic low back pain patients.¹⁶

In present study MRI also found the atrophy to be localised only to the L 5 level. Lee et al found statistically

smaller CSA of erector spinae muscle at L 5 as compared to a healthy group. Beneck et al showed that average multifidus volume was diminished by 18.1% between healthy and chronic low back pain groups only at the L 5-S 1 levels. Kang et al in their study found that pure muscle cross sectional area was significantly smaller at the S 1 mid sacral crest level on the involved side as compared with the uninvolved side in the L 5 radiculopathy group.¹⁷

On the contrary Stokes et al found that irrespective of whether the symptoms were recent or chronic, multifidus dimensions were significantly greater on the side ipsilateral to the radicular pain symptoms. This could be due to an adaptive response by this muscle, such as to an increased role in stabilizing the lumbar spine in the face of overall paraspinal muscle atrophy.

In present study ultrasound showed 6 cases (19%) to have multifidus atrophy whereas MRI showed 9 (29%) cases to have the same, showing that ultrasound missed the atrophy in 3 (33%) cases. MRI showed a better delineation of the paraspinal muscle groups leading to accurate measurements and atrophy diagnosis.

Multifidus atrophy and pain severity/disability

In present study 7 and 6 patients who showed atrophy of multifidus muscle had moderate pain severity on VAS and moderate disability on Oswestry Disability Score respectively and only 2 cases with atrophy showed severe pain and disability. It showed that the degree of pain and disability was not related to multifidus atrophy which was also reflected in some studies.

Ploumis et al assessed the cross-sectional area (CSA) of paraspinal muscles in patients with unilateral back pain using MRI and correlated it with outcome measures (VAS and ODI). They found no statistically significant correlation between the duration of symptoms (average 15.5 months), patient's pain (average VAS 5.3) or disability (average ODI 25.2) and the relative muscle atrophy.¹⁸

Farshad et al reviewed MRI scans of 79 patients with symptomatic single level, unilateral, lumbar radiculopathy retrospectively to evaluate if the asymmetry of the multifidus muscle is related to the severity of compression of the nerve root. In 67 recessal and 12 foraminal symptomatic nerve root compressions the CSA ratio did not significantly correlate with the degree of nerve compression.¹⁹

The findings in present study was not in correlation with study conducted by Huang et al who evaluated chronic low back pain by determining the ratio of the cross-sectional areas of the lumbar multifidus of the unaffected and affected sides at the L 5 level using the ultrasound imaging. It showed a linear correlation between VAS scores and the ratio.

The finding could be due to the fact that the study only included cases with symptom duration of more than 6 months whereas our study included cases with more than 6 weeks of symptom duration.

Multifidus atrophy and duration

4 cases out of 9 cases (44.4%) showing atrophy had symptom duration for more than 12 months whereas 3 out of 14 cases (21.4%) and 2 out of 8 cases (25%) with atrophy had symptom duration for 6-12 months and 6 weeks to 6 months respectively. The results seem to show that atrophy and symptom duration are positively related.

This was also seen by Wu et al in a retrospective study carried out in the department of orthopedics of patients with low back pain. 31 cases were selected with duration more than a year with CT and MRI showing no obvious abnormalities. The changes of net cross-sectional area of multifidus and T2 signal ratio of the same patient were measured at different time by MRI. One of the results in the study indicated a positive correlation between the rate of decrease in cross sectional area of multifidus and duration of the symptom.²⁰

Multifidus fatty degeneration

Fatty degeneration was seen as seen as the muscle showing increased muscle echo due to fat and fibrous tissue on ultrasound. It was seen as hyperintense fatty replacement of the multifidus muscle on T1 and T2 axial scans. This was consistent with the findings of Hu Zhi Jun et al who estimated the intra- and inter measurement errors in the measurements of functional cross-sectional area (FCSA), density, and T2 signal intensity of paraspinal muscles using computed tomography scan and magnetic resonance imaging.²¹

In present study ultrasound showed, 29 patients (93.5%) had fatty degeneration at L 5 level followed by L 4 and L 3 (26 each). 21 number (67.7%) of cases with fatty changes was seen at L 1. On MRI, all the cases in our study showed fatty degeneration of multifidus muscle at the L 5 level. 22 cases (70.96%) showed fatty degeneration at L 2 followed by L 1 which had 23 cases with fatty replacement.

These findings were also seen by Mengiardi et al who showed the mean percentage fat content of the multifidus muscle to be 23.6% (95% confidence interval [CI]: 17.5%, 29.7%) in patients with chronic LBP and 14.5% (95% CI: 10.8%, 18.3%) in the volunteers (P = 0.014) by MR spectroscopy. Kjaer et al in a study showed fat infiltration in 81% of the adults with low back pain. Freeman et al concluded in their study that persisting lumbar multifidus dysfunction is identified by atrophic replacement of multifidus muscle with fat.²² Yanik et al used chemical shift MRI in 65 patients with back pain. The patients were grouped according to the fatty degeneration of multifidus muscles by a semi-quantitative

method (grade 0-4) on axial T2 weighted imaging. Chemical shift MRI was performed in the axial plane using a double-echo fast low-angle shot (FLASH) sequence. Fatty degeneration was calculated through signal intensity suppression rate (SISR) and signal intensity index (SII). SISR values in the multifidus muscle calculated for the patient groups were significantly lower than those calculated for the control group. SII values in patients groups were significantly higher than in the control group.²³

In a study by Min et al 100 patients with low back pain or radiating leg pain were examined. Their lumbar MRIs were visually analyzed semi-quantitatively for signs of lumbar MF muscle atrophy. Significantly more severe and extensive MF atrophy was observed in the radiculopathy group than in the non-radiculopathy group.²⁴

Present study showed maximum cases of fatty degeneration at the L 5 level. Fortin et al included 99 men in a longitudinal study. Baseline measurements of the lumbar multifidus and erector spinae muscles were obtained from T2-weighted axial images at L 3-L 4 and L 5-S 1, and interview data were obtained at baseline, 1- and 15-year follow-ups. The study concluded that, greater multifidus and erector spinae fatty infiltration at L5-S1 was associated with a higher risk of having continued, frequent, persistent LBP at 1-year follow-up.²⁵

Fatty degeneration and LBP duration

In present study the patients who had symptoms for 6 weeks to 6 months showed a maximum grade of mild degeneration at any of the lumbar levels. The patients with symptoms for 6-12 months showed 12 cases to have moderate degeneration and no case to have severe degeneration. Severe degeneration at any of the lumbar levels was seen in patients who had symptoms for more than a year and it was seen in 6 cases. The degree of fatty degeneration shows a positive relation with symptom duration. Similar finding was recorded by Wu et al in a study of 31 patients with back pain of more than a year and T 2 signal ratio was measured in two different scans some time apart. The result showed the T 2 signal intensity to increase as compared to the first scan.

Fatty degeneration and pain severity

In our study only one patient had minimum pain and showed a maximum grade of mild fatty degeneration at any of the lumbar levels while 26 patients had moderate pain and 15 of them had maximum grade of moderate fatty degeneration and one had severe at any of the lumbar levels. 4 patients had severe pain and had severe fatty degeneration at any of the lumbar levels. There was no relation between fatty degeneration and pain severity.

Similar findings were noted by Paalanne et al in a cross sectional imaging study in which muscle atrophy was

evaluated by assessing the fat content of the paraspinal muscles using Opposed-Phase MRI in patients with low back pain. The fat content of the multifidus muscles was significantly higher among women than men (14.0% vs. 5.3%, $P < 0.001$), but it was not significantly associated with symptom severity.

Fatty degeneration and disability

In our study 21 cases had moderate disability and showed a maximum of moderate fatty degeneration at any of the lumbar levels. The patients who showed minimal disability had mild degeneration in 5 cases and moderate degeneration in 2 cases. Patients with severe disability had mild, moderate and severe fatty degeneration in one of the patients each. There seem to be a positive relation between fatty degeneration and disability.

Choice of imaging modality

In our study MRI was able to accurately diagnose multifidus atrophy and fatty degeneration better than ultrasound. A study comparing multifidus muscle cross sectional area measurement between MRI and ultrasound suggested that both modalities could be used interchangeably. However, this study used a small sample of only ten healthy young females (21-31 years old), and such measures have not been validated in older individuals with LBP conditions. Atrophied muscles have more irregular boundaries and fatty infiltration, which greatly increase the level of difficulty when tracing the borders of the muscle of interest. Moreover, ultrasound does not allow the differentiation of muscle and fat tissues, thus accurate distinction of muscle tissues from fat borders is challenging.

CONCLUSION

In present study, we conclude that Multifidus and paraspinal muscle atrophy and fatty degeneration should be considered in association with the clinical presentation and other abnormalities seen in MRI examination. Multifidus muscle morphology and fatty infiltration can be evaluated using various imaging techniques, including MRI, Computed Tomography (CT) scan and ultrasound. MRI provides higher resolution images as compared to ultrasound and CT scan, and allows better detection of soft tissues, such as fat and muscle. MRI, as opposed to CT scan, has the benefit of being obtained without exposure to ionizing radiation. MRI also has greater precision of image repeatability than ultrasound, due to better visualization of identifiable spinal landmarks to position scan slices, which can be particularly important in longitudinal studies.

Whether LBP duration, severity and associated functional disability affect the degree of paraspinal muscle degenerative changes also remains unclear. More clinical research in larger number of patients in varied settings is needed.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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