ORIGINAL ARTICLE

The Frequency of Modic Changes in Lumbosacral Spine in Patients with Low Back Pain

HUMAIRA SALEEM, SALEEM RAZA, ATIQ-UR-REHMAN SLEHRIA

ABSTRACT

Objective: To find the frequency of Modic changes in lumbosacral spine in patients with low back pain.
Study design: Cross sectional study.
Place and duration of study: Deptt. of Radiology CMH Lahore, from 26th Oct 2011 to 26th April 2012.
Methodology: All patients of low back pain fulfilling the inclusion and exclusion criteria were enrolled in the study**.** Magnetic resonance imaging (MRI) was performed after taking informed written consent in Department of Radiology, CMH Lahore. Lumbar MRI was performed with standard protocol on a 1.5T MRI-system (Philips closed MRI). All individuals were placed supine with straight legs in a psoas-tight position in order to imitate the upright lumbar lordosis. The imaging protocol consisted of one scanogram and four imaging sequences which were Sagittal T1-weighted, Sagittal T2-weighted, Axial T1-weighted and Axial T2-weighted images. Presence or absence of Modic changes was evaluated. If present, type I, type II or type III was determined. SPSS version 16 was applied to analyze the data. Mean and standard deviation was presented for age. Frequency and percentage were presented for gender, positive MRI scans and type of Modic changes in positive scans.
Results: A total of 200 patients were included in our study out of which 148(74%) were males and 52(26%) were females. Age of the patients ranged from 18 to 65 years. Out of total of 200 MRI scans, results of 162(81%) were positive for radiological findings. Modic Type II changes were seen in 94(47%), Modic Type I in 18(9%) and Modic Type III in 6(3%) patients. Many patients showed mixed type of Modic changes constituting Type I & II or II & III. Two patients showed all three types of changes in lumbosacral spine.
Conclusion: Modic changes are dynamic markers of the normal age-related degenerative process affecting the lumbar spine. The most common Modic change is type II and the most frequently involved level is the L5 / S1 in our population.
Keywords: Low back pain, Magnetic resonance imaging, Modic changes.

INTRODUCTION

Low back pain (LBP) is one of the most common health complaints. Almost everyone will have back pain at some time in their life. Most of the times, the exact cause of the pain cannot be found[1]. Low back pain is the number one cause of disability in the world, and one of the top three reasons people seek medical attention[2]. Despite several studies demonstrating that advanced radiologic testing does not improve outcomes in patients with low back pain, with or without radicular symptoms [nerve irritation, characterized, for example, by pain radiating down the back of the leg], the use of MRI in this context continues to soar[3].

MRI is considered by many to be the best imaging technique for the investigation of LBP[4]. Yet MRI also has limitations and drawbacks. MRI is expensive with a very high prevalence of abnormal findings among individuals without LB[5]. This high prevalence makes it difficult to attribute a patient's symptoms to certain imaging findings. Moreover, irrelevant findings can result in emotional stress, unnecessary utilization of resources and even unnecessary interventions, such as surgery.

Modic changes (MC) are bone marrow and endplate lesions visible on MRI. Modic changes constitute the crucial element in the degenerative disc disease (DDD) process around the disk in relation to LBP and clinical findings. DDD on its own is a fairly quiet disorder, whereas DDD with Modic changes is much more frequently associated with clinical symptoms. The present study was conducted to assess the frequency of Modic changes in lumbosacral spine in patients with LBP in our population.

METHODOLOGY

This study comprised of patients between the ages of 18 to 65 years having low back pain. It was conducted from 26th Oct 2011 to 26th April 2012. Those patients of either gender were included whose

Department of Radiology, CMH Lahore
Correspondence to Dr Humaira Saleem, Postgraduate Trainee, E-mail: shumaira31@yahoo.com Cell: 0320-4087618

pain radiated to one or both legs and duration of pain was between 2 weeks and 1 year. Patients with cauda equina syndrome, previous back surgery, spinal tumors and pregnancy were excluded from the study. After taking approval of the hospital ethical committee, all the patients fulfilling the inclusion and exclusion criteria were enrolled in the study**.** MRI was performed after taking informed written consent in Department of Radiology, CMH Lahore. To take informed written consent, patients were told that MRI is being done for study purpose and results will be published but there is no risk involved as far as the treatment is concerned. Lumbar MRI was performed with standard protocol on a 1.5T MRI-system (Philips closed MRI). All individuals were placed supine with straight legs in a psoas-tight position in order to imitate the upright lumbar lordosis. The imaging protocol consisted of one scanogram and four imaging sequences which were Sagittal T1-weighted, Sagittal T2-weighted, Axial T1-weighted and Axial T2-weighted images. Presence or absence of Modic changes was evaluated. If present, type I, type II or type III was determined. SPSS version 16 was applied to analyze the data. Mean and standard deviation was presented for age. Frequency and percentage were presented for gender, positive MRI scans and type of Modic changes in positive scans.

RESULTS

Out of total of 200 MRI scans, results of 162(81%) were positive for radiological findings. No findings were seen in 38(19%) scans. Among patients having positive MRI findings Modic Type II changes were found in 94(47%), Modic Type I in 18(9%) and Modic Type III in 6(3%) patients. Many patients showed mixed type of Modic changes constituting Type I & II or II & III. Two patients showed all three types of changes in lumbosacral spine.

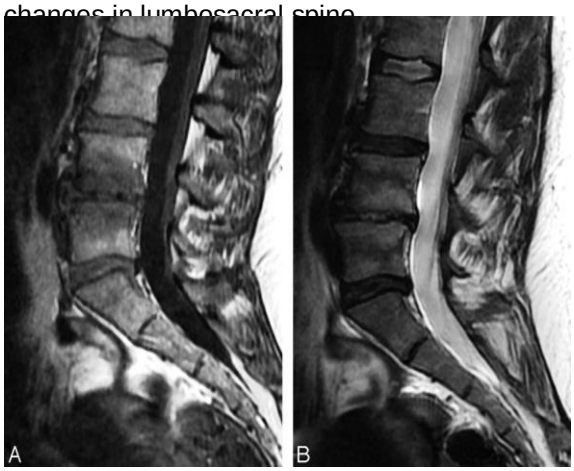

Fig 1: Modic type 1 changes are hypointense on T1WI (A) and hyperintense on T2WI (B).

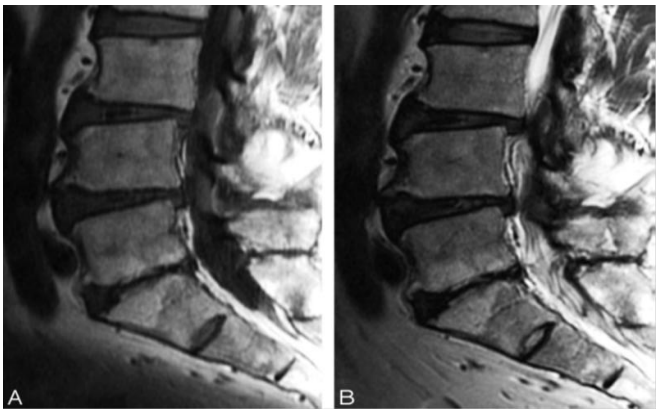

Fig 2: Modic type 2 changes are hyperintense on T1WI (A) and isointense or hyperintense on T2WI (B).

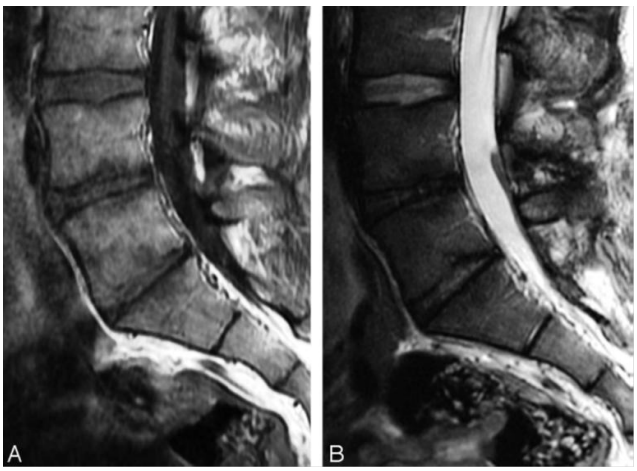

Fig 3: Modic type 3 changes are hypointense on both T1WI (A) and T2WI (B).

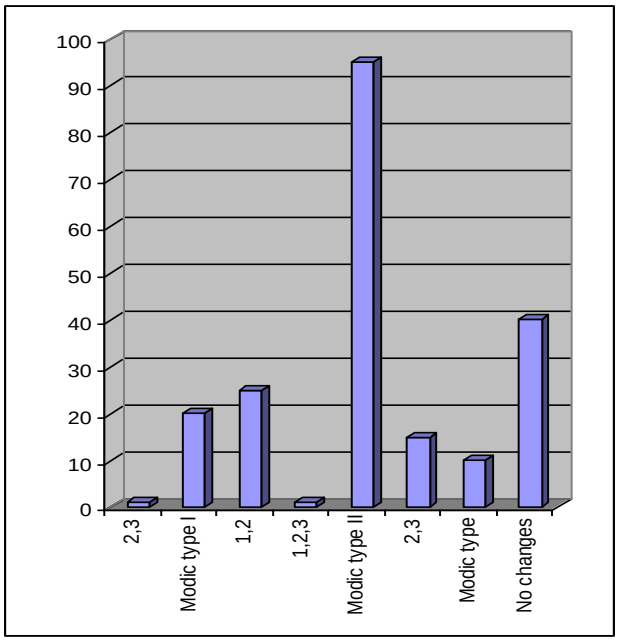

Fig 4: Frequency of Modic changes in positive scans.

DISCUSSION

Low back pain being the number one cause of disability needs imaging for the diagnosis of its cause and management. Most of the patients have advanced imaging testing despite several studies demonstrating that it does not improve treatment outcomes. The use of MRI is increasing also due to patient demand despite the fact that the exact cause of the pain cannot be found. The use of MRI may be justified in patients having radicular symptoms

With its high contrast and spatial resolution and lack of ionizing radiation, MRI is considered by many to be the best imaging technique for the investigation of LBP[4]. Yet MRI also has limitations and drawbacks. MRI is expensive with a very high prevalence of abnormal findings among individuals without LBP[6]. This high prevalence makes it difficult, or possibly even perilous, to attribute a patient's symptoms to certain imaging findings. Moreover, irrelevant findings can result in emotional stress, unnecessary utilization of resources and even unnecessary interventions, such as surgery.

Modic changes are bone marrow and endplate lesions visible on MRI. Bone marrow signal changes in the vertebral bodies were first reported by de Roos et al[7]. Modic et al[8] were credited with the classification of these signal intensity changes. In order to correspond to the Modic classification system, Modic changes were divided into four grades by Miller[9] in 1990, namely Grade 0: normal, no degeneration, Grade one: equivalent to MC type I, Grade two: equivalent to MC type II and Grade three: equivalent to MC type III. Then, Weishaupt et al[10] according to the vertebral height involved by endplate abnormalities on the midsagittal image, divided MC into four degrees: normal: no anomaly in T1 & T2WI, mild: the scope of signal intensity changes equal to or less than 25% of vertebral height, moderate: the scope of signal intensity changes between 25 and 50% of vertebral height and severe: the scope of signal intensity changes equal to or more than 50% of vertebral height.

Although spinal infection and tumor may manifest like Modic changes on MRI[11], the correct diagnosis is achieved usually by distinguishing their unique characteristics. With surrounding paravertebral soft-tissue edema or epidural mass effect, spondylodiscitis present as lesions with typically hyperintense signal on T2WI, compared to normal or hypointense signal on T2WI in degenerated disc, and with confluent hypointense signal on T1WI from the vertebral bodies and intervertebral disc space[12]. In addition, the erosion of vertebral body and endplates are always observed in intervertebral disk space infection, whereas Modic changes may be focal or diffuse along the endplates but tend to be linear and always parallel to the endplates. In addition, the possibility of Schmorl's node must always be kept in mind. Schmorl's nodes are characterized by a localized defect (hypointense on T1WI and hyperintense on T2WI) in endplates with a well-defined herniation pit and a surrounding wall of hypointense signal (on T1WI and T2WI) in the vertebral body[13]**.** Although bone marrow edema and sclerosis on MRI may also be identified in patients with spondyloarthropathy, systematic symptoms and plain radiographs may help differentiate them from Modic changes. In fact, metastasis is the most common type of neoplastic lesion found in the spinal column. Rare instances of metastatic involvement of the disc have been noted[14]. Therefore, metastatic disease is readily distinguished from Modic changes by the absence of disc space involvement.

Out of a total of 200 patients in our study 148(74%) were males and 52(26%) were females. These patients were evaluated after taking written consent from them. All patients had undergone MRI of lumbosacral spine. Positive MRI findings were found in 162(81%) patients while 38(19%) patients had negative MRI findings. Among patients having positive MRI findings Modic Type II changes were found in 94(47%), Modic Type I in 18 (9%) and Modic Type III in 6(3%) patients. Mixed changes were also noted in many patients showing conversion of changes from one type to another. Among mixed changes Type I & II were seen in 23 patients, Type II & III in 15 patients while only two patients showed all three Type I,II & III Modic changes. The most common Modic change was type II and the most frequently involved level was L5 / S1.

Modic changes constitute the crucial element in the degenerative process around the disk in relation to LBP and clinical findings. DDD on its own is a fairly quiet disorder, whereas DDD with Modic changes is much more frequently associated with clinical symptoms. Most authors agree that, among Modic changes, type 1 changes are the ones most strongly associated with LBP. In a study of 74 patients with DDD, Toyone et al[15] observed that 73% of patients with type 1 changes had LBP as opposed to only 11% of those with type 2 changes. Mitra et al[16] found a positive trend between the evolution of type 1 Modic changes into type 2 changes and the improvement of symptoms. In addition, they observed that patients in whom type 1 changes increased were clinically worsened. Albert and Manniche[17] reported a strong association between Modic changes and LBP as 60% of patients with Modic changes but only 20% of those without such changes had LBP. These authors also showed that type 1 changes were more strongly associated with LBP than type 2 changes.

But in our study we have more prevelance of Modic type II changes with a frequency of 47% in patients of low back pain. Many patients showed mixed type of Modic changes constituting Type I & II or II & III. Two patients showed all three types of changes in lumbosacral spine.

An updated algorithm for the diagnostic evaluation of LBP by the American College of Physicians and the management guidelines for LBP by American Pain Society were based on the most recent publications[4]. In spite of substantial advancements in technology during the past two decades, the main conclusions of all these guidelines are practically the same. All of the guidelines emphasize the importance of a focused history and thorough physical examination before any imaging is ordered. In addition, all agree that for patients with acute LBP and without any risk factor for serious spine abnormalities, imaging within the initial 4–8 weeks should not be performed. MRI and other MRI-based imaging techniques provide valuable information regarding the underlying causes of LBP. However, because of several factors, utilization should be limited to those patients who are most likely to benefit from these tests. In addition, to be able to evaluate the effectiveness and efficiency of new imaging technologies, clinicians and researchers should be encouraged to follow standardized practices that are in accordance with evidence-based medicine guidelines[18].

CONCLUSION

Patients with MC are a specific subgroup within LBP patients perhaps is premature, although MC has been strongly associated with LBP according to current evidence. Areas of future research should mainly include the mechanisms, natural history and relationship to symptoms.

The mechanisms of Modic changes are very important for the patients with LBP because they possibly lead to a correct diagnosis. Identification of a precise mechanism for the factors involved in the progression of Modic changes may be helpful for clinical treatment. Mechanisms of spontaneous conversion are of great importance for efforts to repair or step down the development of Modic changes through clinical intervention.

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