FREQUENCY OF VERTEBRAL END PLATE MODIC CHANGES IN PATIENTS WITH LUMBOSACRAL SPINE DEGENERATIVE DISC DISEASE USING MRI AS THE IMAGING MODALITY

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ABSTRACT

Objective: Lumbosacral spine degenerative disc disease is a common condition presenting usually with low back pain .It is frequently associated with vertebral end plate modic changes. In this article we evaluate frequency of vertebral end plate modic changes in patients with lumbosacral spine degenerative disc disease.

Materials and methods: The study is a retrospective study. It was conducted in Peshawar institute of medical sciences from 1st May 2015 to 1st May 2016 during which we evaluated the prevalence of modic changes and there type in 70 patients with lumbosacral spine degenerative disc disease.

Results: Out of the 770 discs of 70 patients (from upper end plate of L1 to upper end plate of S1) 38% end plates (296) showed end plate modic changes with type II modic changes being the commonest (37%) followed by mixed changes (32.4%).Type I change was noticed in 16.2% while type III in 14.1%.The conversion of type I to type II was observed in two patients who came for follow up MRI with symptom improvement. The end plates commonly involved were at L5-S1 (49%) and L4-L5 (44%) level with other levels being involved but less commonly.

Conclusion: Modic changes are part of the normal age-related degenerative process affecting the lumbar spine. These lesions can convert from one type to another with time, with mixed-type changes probably representing the intermediate stages in this conversion.

Key words: Lumbosacral spine, degenerative changes, magnetic resonance imaging, modic changes.

INTRODUCTION

Degenerative vertebral endplate and subchondral bone marrow changes were first noted on MR imaging by de Roos et al in 1987.[1] These changes are closely related to the normal degenerative process affecting the lumbar spine, and their prevalence increases with age. However, the exact pathogenesis underlying these changes and their relation to segmental instability of the lumbar spine and to low back pain remain unclear[2]. A formal classification was subsequently provided by Modic et al in 1988. Three different Modic types (I, II, and III) were initially described by Modic[3]. Since then, mixed Modic lesions have been identified, suggesting that all Modic changes can progress from one type to another and that they all present different stages of the same pathologic process[4]. Manifestations of degenerative disc disease by imaging include disc space narrowing, loss of T2 signal intensity from the disc space, fissures, fluid, vacuum changes, calcification, ligamentous changes, marrow changes, herniation, osteophyte formation, malalignment, and stenosis[8]. A prevalence of 22% to 50% of disc levels affected by Modic changes has been observed in patients with degenerative intervertebral disc disease[1,2]. Although several series, including the original study of Modic et al[2], have shown that type 2 changes are the most frequent and may account for up to 90% of Modic changes, other studies have suggested that type 1 changes may be more common and may constitute up to 68% of Modic changes in patients with lumbosacral spine degenerative disc disease[5].

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MATERIALS AND METHODS

The lumbar spines (L1-S1) of 70 patients with degenerative disc disease (manifestations of degenerative disc disease by imaging include disc space narrowing, loss of T2 signal intensity from the disc space, fissures, fluid, vacuum changes, calcification, ligamentous changes, marrow changes, herniation, osteophyte formation, malalignment, and stenosis) were analyzed for prescence of modic changes. Patients were scanned with 1.5-T MRI. Two radiologists assessed the MR images by T1weighted, T2 weighted and fat-saturation T2 weighted sequences and classified them according to the Modic changes. Pure oedematous end plate signal changes were classified as Modic Type I; pure fatty end plate changes were classified as

Modic Type II; and pure sclerotic end plate changes as Modic Type III. A mixed feature of both Types I and II with predominant oedematous signal change is classified as Modic I–II, and a mixture of Types I and II with predominant fatty change is classified as Modic II–I. Thus, the mixed types can further be subdivided into seven subtypes: Types I–II, Types II–I, Types I–III, Types III–I, Types II–III, Types III–II and Types I–III.

RESULTS

Seventy patients with lumbosacral spine degenerative disease were assessed for presence of modic changes out of which 39 patients were male and 31 females. Mean age of patients was from 45 to 65 years. Out of the 770 discs of 70 patients (from upper end plate of L1 to upper end plate of S1) 38% end plates (296) showed end plate modic changes. Type II changes were commonest and were found in 110 end plates(37%) followed by mixed changes which were present in 96 end plates(32.4%). Type I changes were present in 48(16.2%) while type III were least common present in 42 end plates (14.1%)(fig 1). The mixed types especially Types I–II and Types II–I made up the majority of mixed end plate changes (fig 3). It was noted that patients with type I end plate changes suffered more from back pain as compared to patients with type II changes which is a more stable type of the degenerative process. Seven patients returned for a follow up MRI in in this one year duration in which two patients showed transition from type I to type II with history of improvement in there back pain. The vertebral end plates commonly involved is at L5-S1 level (49%) followed by L4-L5 (44%) with other levels involved but less commonly.

DISCUSSION

End plates serve as the interface between rigid vertebral bodies and pliant intervertebral disks. Because the lumbar spine carries significant forces and disks don't have a dedicated blood supply, end plates must balance conflicting requirements of being strong to prevent vertebral fracture and porous to facilitate transport between disk cells and vertebral capillaries. Consequently, end plates are particularly susceptible to damage, which can increase communication between proinflammatory disk constituents and vascularized vertebral bone marrow. Damaged end plate regions can be sites of reactive bone marrow lesions that include proliferating nerves, which are susceptible to chemical sensitization and mechanical stimulation. Although several lines of evidence indicate that innervated end plate damage can be a source of chronic low back pain, its role in patients is likely underappreciated because innervated damage is poorly visualized with diagnostic imaging[6]. Degenerative processes may affect the disc or other support structures and may occur as acute, subacute, or chronic problems. Manifestations of degenerative disc disease by imaging include disc space narrowing, loss of T2 signal intensity from the disc

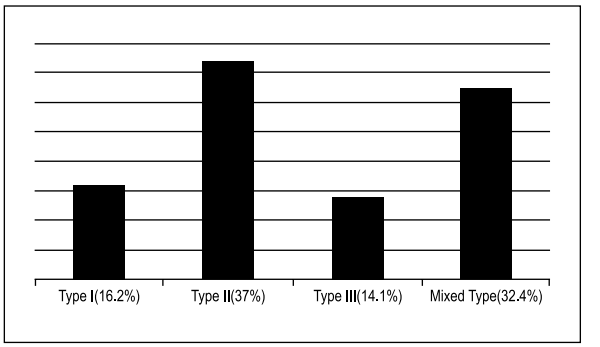

Figure 1: Bar chart showing frequency of different types of modic changes.

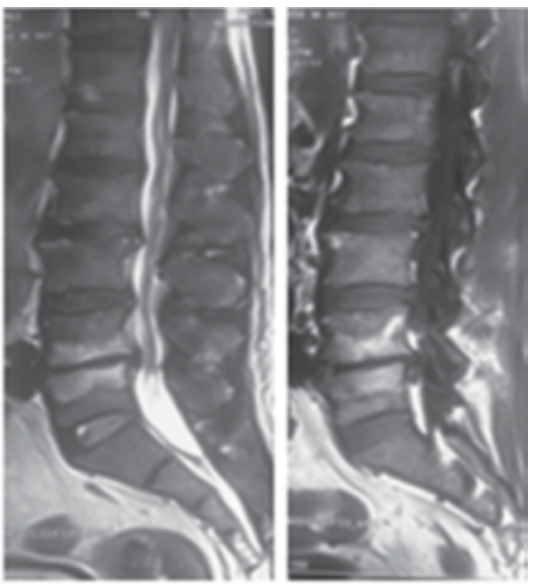

Fig:2 Saggital T2 and T1WIs of the lumbosacral spine showing type II end plate modic changes at L4-L5 level.

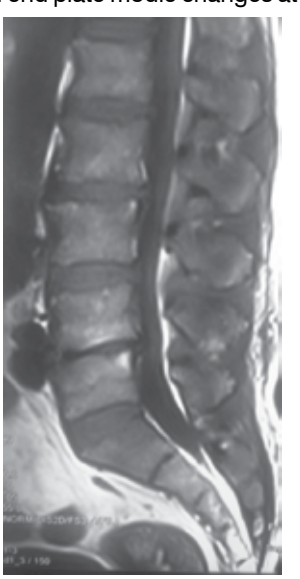

Fig:3 Saggital T1WI of lumbosacral spine showing mixed modic changes at L4-L5 level with predominant fat component type II-I.

space, fissures, fluid, vacuum changes, calcification, ligamentous changes, marrow changes, herniation, osteophyte formation, malalignment, and stenosis[7]. Ageing and degenerative disc disease may be similar, although degenerative changes occur more rapidly[8]. Three main types of MC have been described. M1 shows decreased signal intensity on T1-weighted images (T1w) and increased signal intensity on T2-weighted images (T2w). M1 is thought to represent acute inflammatory changes in degenerative disc disease, on the basis of fibrovascular replacement in histopathological specimens of subchondral bone marrow[1]. Type 2 MC (M2) shows increased signal intensity on both T1w and T2w, and it appears as yellow marrow replacement in histopathological specimens. M2 could represent a more stable phase of degenerative disc disease, but it does have the potential to convert to another type. Type 3 MC (M3) shows decreased signal intensity on both T1w and T2w and is associated with extensive subchondral bone sclerosis on plain radiographs. Mixed Modic types are thought to develop when one Modic type converts to another. A high prevalence of modic end plate changes (20 to 50%[1,2]) has been reported in patients with lumbar spine degenerative disc disease which is comparable to our study results(38%). In our study we found that type II changes are most frequent (37%)(fig 2)followed by mixed changes. These results are comparable to the results of the study conducted by D Roos[1] et al and R Rahme[2]. The association of Modic changes with clinical symptoms has also been evaluated in several studies. Toyone et al found an association between Modic Type I change and low back pain [9]. They stated that 73% of patients with a Type I change, but only 11% of patients with Type II, had significant low back pain. In our study two patients who came for a follow up MRI showed transition from type I to type II with improvement of back pain. The same fact was also noticed in a recent study ,by Mitra et al who found a positive trend between the evolution of Type I to Type II change and symptom improvement[10]. In our study we observed that the end plate changes are more common at L5-S1(49%) and L4-L5(44%) levels. The common involvement of these levels was also reported in a study conducted by Kuisma M et al[11]. The main differential diagnosis of modic changes is disc space infection. Although post contrast studies may reveal enhancement in both the cases but is more common with infections. In addition the prescence of pre or para vertebral soft tissue component will favour prescence of infection.

CONCLUSION

It is concluded that Modic changes are part of the normal age-related degenerative process affecting the lumbar spine. These lesions can convert from one type to another with time, with mixed-type changes probably representing the intermediate stages in this conversion. Type 1 changes are likely to be inflammatory in origin and seem to be strongly associated with low back pain. In contrast, type 2 changes are less clearly associated with low back pain and seem to indicate a more biomechanically stable state. Also the conversion of type I to type II is associated with symptom improvement. The exact nature and clinical significance of the less common type 3 changes remains unclear.

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