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Prevalence of Modic Change Observed on Magnetic Resonance Imaging in Patients With Low Back Ache and its Correlation With Plain Radiography in Indian Population

KEYWORDS: AP- Anterioposterior,CT- Computed Tomography,FLAIR- Fluid Attenuation Inversion Recovery, IVD-InterVertebral Disc,MRI-Magnetic Resonance Imaging,SE- Spin Echo,USG - Ultrasonogram

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ABSTRACT *Wide spectrum of disc abnormalities, including disc degeneration, disc bulging, disc protrusion, disc extrusions, nerve root compression and annular tears have been well recognized causes of back ache1 . In recent times Bone marrow and vertebral endplate signal changes (MODIC) seen on Magnetic Resonance imaging have also been considered to play a major role in low back ache and are dynamic markers of degenerative process affecting the vertebral bodies.*

INRODUCTION:
Various life style diseases have accelerated the physiological aging process of the intervertebral disks and increased degenerative changes in the spine causing back pain. Diagnosing patients with low back ache is a challenge for clinicians. Several studies have shown the occurrence of a wide spectrum of disc abnormalities, including disc degeneration, disc bulging, disc protrusion, disc extrusions, nerve root compression and annular tears as the cause of back ache.

Only since the advent of Magnetic Resonance Imaging due to its excellent soft tissue resolution, imaging of the bone marrow and vertebral endplate signal changes (MODIC) have been possible which were hitherto not well appreciated on plain radiography and have also been considered to play a major role in low backache2.

MODIC changes are metabolic and morphological dynamic markers of degenerative process affecting the vertebral bodies. These lesions can convert from one type to another with time, with mixed-type changes probably representing the intermediate stages in this conversion.

MODIC changes are most commonly seen in the lower lumbar vertebral bodies and this probably accounts to the relatively greater compression and shear forces imposed at these vertebral levels compared with cranial levels .These changes progress over time, have a greater inflammatory response to injury, and since there is alteration in the morphology at the vertebral end plates they have poor regenerative abilities and are additionally susceptible to minor injuries, and/or have one or more of the lifestyle factors associated(i.e. type of occupation and high body mass index).

Plain radiography is the first step in the evaluation of the spine. It is universally available, quick and inexpensive and can yield many diagnostic clues. It can readily reveal fractures, mal-alignment bony lesions, disc space narrowing and paraspinal collections.

While radiography may not always identify the cause for back ache, it may help direct further management. However plain radiography has got its own limitations. This is overcome by the other methods of imaging, the best being Magnetic Resonance Imaging which is the gold standard2,3.

MATERIALS AND METHODS
Source of data: Data for the study was collected from all patients of with low back ache, referred to the Department of Radiology,ASRAM MEDICAL COLLEGE,Eluru.

Inclusion criteria:
1. Both sexes.

2. All patients with complains of low back ache.

Exclusion criteria:

1. Pregnant women

2. Patients with Fracture vertebrae, infective pathology and spinal tumours

3. Previously operated patients for spinal surgery.

DISCUSSION:
RELEVANT ANATOMY
MODIC CHANGES: These changes occur adjacent to the cartilaginous endplates of the degenerative intervertebral discs. The classification of changes was MODIC type I changes (low SI in T1W and high SIin T2W images) indicated an ongoing active degenerative process and demonstrated vascularized fibrous tissue within the bone marrow.

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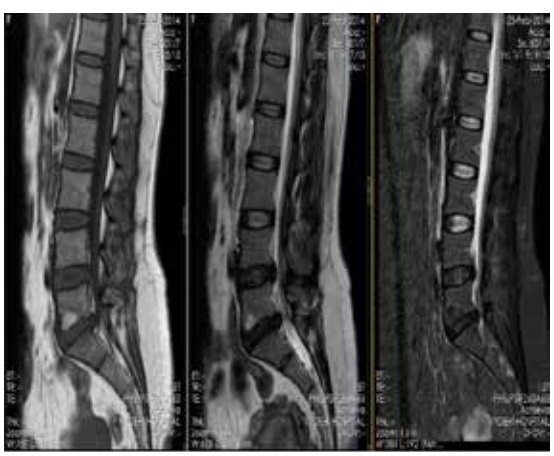
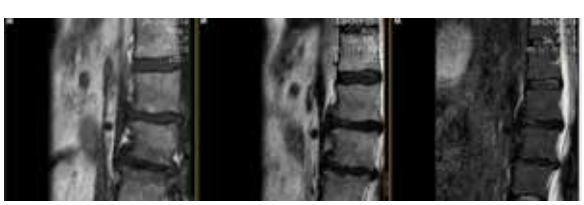
MODIC type II changes (high SI in T1W and T2W images) were more stable during a three-year follow-up and reflected fatty replacement of the bone marrow. Type III lesions were found later (low SI in T1W and T2W images), and they are thought to associate with endplate sclerosis in plain film radiography .The histological nature of type III changes remains undetermined. Mixed MODIC lesions (type I/II and type II/III) have also been identified1,2.

MODIC changes can convert from one type to another and that they all present different stages of the same path ological process.

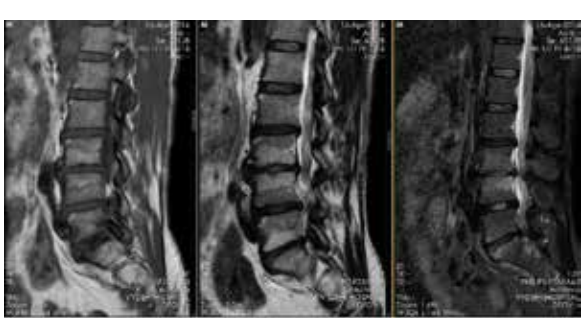
TYPE I MODIC CHANGES

TYPE II MODIC CHANGES





TYPE II/III MODIC CHANGES



TYPE III MODIC CHANGES

Pathogenesis

The etiology of MODIC changes is unknown Prevalence and distribution The prevalence of MODIC changes in patients with degenerative disc disease of the lumbar spine varies between 19 and 59% .Conversely, MODIC changes are uncommon in asymptomatic individuals without disc degeneration.

The most common type of MODIC change in the lumbar spine is type II and it may account for up to 80% of MODIC changes. MODIC changes most likely occur at L4–5 and L5–S1and associate with degenerative disc disease. In addition to disc degeneration, MODIC changes are also observed to occur in a lumbar segment with a disc herniation or segmental instability .Most studies describe MODIC changes occurring in the lumbar spine. However, these changes have also been reported in cervical and thoracic spine4 .

Determinants

It has been shown that the risk of disc degeneration is determined by a multitude of factors including age, genetic inheritance and loading history However, there is only limited information about the determinants of MODIC changes. MODIC changes are positively associated with age, supporting their degenerative etiology.

Obesity has been suggested as a risk factor for disc degeneration, but the results have remained controversial. In a patient study, MODIC changes were associated with increasing weight, but not with BMI.[49] Recently, overweight in combination with hard physical work was significantly associated with the prevalence of MODIC changes. In another population-based cohort, exposure to high-level physical activity at leisure time did not differ between subjects with Smoking has been suspected to carry deleterious effects on the intervertebral discs.

According to a systematic review, smoking is associated with LBP. Smoking is a risk factor for atherosclerosis, which is assumed to cause disc degeneration through diminished nutrition. In the Danish study, self-reported hard physical work in combination with heavy smoking was strongly associated with MODIC changes.

Differential diagnosis

There are many conditions that need to be considered in the differential diagnosis.

Spondylodiscitis, spinal neoplasms and inflammatory spondyloarthropathias may lead to signal intensity alterations that may mimic MODIC type I changes. In addition, the possibility of a signal change around Schmorl's node must always be kept in mind.

X RAYS:It is the first modality of choice, is easily and readily available to the general population. The standard radiographic examination for evaluating the lumbar spine includes the anteroposterior, lateral, and oblique projections.

The anteroposterior (AP) view is done to visualize vertebral bodies, posterior elements, sacrum ,alignment, SI joints, vertebral anomalies and psoas muscles. On the lateral projection of the lumbar spine, the vertebral bodies are seen in profile and the superior and inferior end plates are well demonstrated. Fractures of spinous processes are adequately evaluated on this projection, as are abnormalities involving the intervertebral disc spaces.

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Oblique views are particularly effective in demonstrating the facet joints (articular facets

RESULTS:

Out of 200 cases the incidence of low back ache was seen in 66% of the males and 34 % of females.

The incidence of low back ache was highest in the age group of 31-40(27.5%) followed by 41-50 yrs(25.5 %) and 51-60 yrs(23.5%). The youngest patient was 25 yrs and the eldest was 65 yrs. In all age groups there was male predominance seen.

Out of 60 patients with MODIC changes the incidence of sub type II/III (35%) was highest followed by type II(31%). Out of the 60 cases studied the highest incidence for type I was seen in the age group of 21-50 yrs,for type II 41-50 yrs, type III 51-60 yrs,type I/II 41-50 yrs and type II/III was 51-60

CONCLUSION:

We studied 200 cases prospectively, who presented with complaints of back pain and were subjected to both plain radiogram and MRI. Our study evaluated those patients with low back ache where the above mentioned causes of back ache have been ruled out and have bone marrow and vertebral endplate signal changes (MODIC). These MODIC changes were further correlated with plain radiography for identifying signs that indicate these changes otherwise established on MRI.

The results of this thesis indicate that bone marrow and vertebral endplate signal (MODIC) changes are a specific phenotype of degenerative intervertebral disc disease prevalent in 30 % of the our study population seen predominantly in the middle age and are almost always associated with intervertebral disc pathology. Though MRI today is the gold standard modality to image the lumbosacral region, plain radiogram a readily and universally available investigation at all levels of health care systems certainly does reveal certain signs that indicate MODIC changes and help us narrow down differentials on plain radiogram.

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