

## Original Research Article

# Age and sex analysis of the modic changes in the vertebrae

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## ABSTRACT

**Background:** Modic changes are common bone marrow and end plate changes that appear on magnetic resonance imaging of the lumbar spine. These changes are clinically associated with back pain and are generally classified into three types. In this study, we aimed to determine the frequency of patients with end plate deformities according to age and sex in their vertebrae.

**Methods:** The study was performed on 100 patients (50 females, 50 males) who were admitted to Konya Education Research Hospital and thoracic region bone structures screened with MRI.

**Results:** Modic changes were observed most at L4-L5 levels.

**Conclusions:** We believe that the results obtained in our study will be beneficial in the surgeon, radiology and anatomy training.

**Keywords:** Modic, Vertebrae, Anatomy

## INTRODUCTION

Chronic low back pain is a pain in the lumbar sacral area of the spine that is longer than 12 weeks, sometimes spread to the lower extremity, and usually limits the range of motion due to pain. Chronic back pain is usually thought to be the result of mechanical causes and is not associated with an underlying condition such as infection, inflammation, neoplasm or fracture. It is thought that chronic back pain is often caused by disc or vertebra degeneration, musculoskeletal sprain or strain, or position or movement related disorders of the spinal column. Both chronic pain and impairment of functional status can reduce the quality of life of patients.<sup>1</sup>

Modic changes are common bone marrow and end plate changes that appear on magnetic resonance imaging of the lumbar spine. These changes are clinically associated with back pain and are generally classified into three types.<sup>2,3</sup>

The cortical end-plate and bone marrow show a three-step change defined by Modic. Type 1 changes appear to be bone marrow edema and vascular congestion. Type 2 changes bone marrow as fatty marrow. In Type 3, the vertebrae end-plates and adjacent corpuscles become dense sclerosis. The time between type 1 and type 3 changes is usually several years. Magnetic resonance imaging (MRI) is the best method for diagnosis.<sup>4,5</sup>

In this study, we aimed to determine the frequency of patients with end plate deformities according to age and sex in their vertebrae.

## METHODS

The study was performed on 100 patients (50 females-50 males) who were admitted to Konya Education Research Hospital and thoracic region bone structures screened with MRI. This study was carried out between January 2017 and June 2017. Patients ranging in age from 20 to

65 were included in the study. In the first step of working; patients who had previously applied to the hospital and who had obtained MRI and lumbar region images were identified. Modic changes in the lumbar vertebra were examined and typed. Distribution by gender was also determined.

The Ethics Committee Compliance Report of this study was taken from Necmettin Erbakan University.

## RESULTS

The modic change in both gender was maximum observed at L5 level (Table 1). The most common modic change is type 2 in both gender (Table 2). The typing of modic changes and their distribution by gender are presented in Table 1 and Table 2 in detail.

**Table 1: The frequency of modic changes compared to lumbar vertebrae.**

	L1	L2	L3	L4	L5	Toplam
<b>Kadın</b>	4	6	12	24	25	71
<b>Erkek</b>	5	8	9	21	32	75
<b>Toplam</b>	9	14	21	45	57	146

**Table 2: Classification of modic changes.**

	Tip1	Tip2	Tip3	Toplam
<b>Kadın</b>	8	40	2	50
<b>Erkek</b>	12	36	2	50
<b>Toplam</b>	20	76	4	100

## DISCUSSION

The end plates play a very important role in the biomechanical functions of the vertebrae. During disc degeneration, the last plaques exhibit change with age. These changes cause uneven distribution of loads across the entire disc, which in turn leads to cracks in the end plates. The erosion of the body and end plates of the vertebrae may be parallel to the modic changes, or may spread throughout the end plates, while always occurring in the intervertebral disc area infection.<sup>3</sup>

Changes in the signal intensity of the vertebral end plates and subchondral bone are frequently observed in MRI in individuals with spinal degenerative disease. In 1988, Modic and colleagues summarized these changes and classified them into three types, and modic change was used as a medical term in studies on spinal degenerative diseases. Modic changes are considered to be one of the parameters of morphological changes in spinal degenerative diseases in MRI.<sup>3</sup> Modic lesions are considered to be a part of degenerative disc disease and these lesions at L5-S1 level and especially type I lesions are strongly associated with back pain. Histological investigations have reported that type I is composed of fibrovascular granulation tissue, type II is composed of

yellow oil, and type III is composed of sclerotic bone. However, the underlying pathophysiological mechanisms for the development of these lesions are still controversial. These histopathological features of modic alterations suggest that type I modic alterations are early, and type 3 modic changes are late degenerative process periods.<sup>2</sup>

Peterson et al reported that modic changes at the L4-L5 level was particularly high at the end of the studies on the reliability of the identification and classification of modic changes in clinical practice.<sup>6</sup> Modic et al observed that modic changes distribution in L4-L5 or L5-S1 was the most common. Furthermore, the depth and grade of modic changes were highest in L4-L5 and L5-S1.<sup>3</sup> In our study, L5 was found 39.3% L4 30.8% L3 14.3% L2 9.5% L1 6.1%. It was observed that L4 and L5 had more modic changes than other studies.

Chung et al studied the frequency and distribution of modic changes in 59 asymptomatic patients and found 11 modic changes type I and 38 modic changes type II in 590 lumbar vertebral end groups.<sup>7</sup>

In our study, Type 1 20%, Type 2 76%, Type 3 4% were found. As in the case of study, Type 2 is the most visible modic change.

Several risk factors have been proposed for the development of facet joint osteoarthritis, for example, to contribute to advanced age, female gender, and lumbar spinal levels. The results of the study suggest that the presence of modic changes may be an independent risk factor for the formation of facet osteoarthritis. Nevertheless, it is a retrospective study and the lack of adequate knowledge of patient characteristics such as obesity, physical trauma, occupational factors, and smoking, which are known risk factors for facet osteoarthritis, is a major limitation of this study.<sup>8</sup>

Lomber disc degeneration occurs as a result of a variety of factors. Deterioration of the vertebral endplates results in impaired vascularization and consequent disc degeneration. Many causes such as aging, apoptosis, collagen disorders, new vascular formations, burdens on discs and abnormal proteoglycan contribute to the process of disk degeneration. Some types of disk degeneration cause changes in the hemi-flow and ultimately in the biomechanics of the segment.<sup>9</sup>

It has been suggested that there is a link between modal degenerative changes in vertebral bodies and symptomatic back pain.<sup>4,10,11</sup> However, this relation is not explained as much as it is and depends on conditions. In addition to modal changes, different specific infectious, degenerative and immunologic diseases, such as osseous infections, osteoarthritis, ankylosing spondylitis and spondylarthritis, can cause pain-related subchondral bone marrow signal changes.<sup>2</sup>

Most of the studies related to modic changes focus on the relationship between modic changes and back pain. Modic changes and facet joint osteoarthritis are thought to be potential sources of chronic low back pain, but it is not known whether a specific clinical finding is present in patients with modic alterations. Low back pain syndrome is a facet joint degeneration in patients with modic change.<sup>3</sup>

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