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ORIGINAL ARTICLE

Prevalence and Factors Associated with Modic Changes of Lumbosacral Spine in Nepalese Patients with Chronic Low Back Pain

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ABSTRACT

Aim: To determine prevalence and factors affecting modic changes (MC) of vertebral endplate in patients with chronic low back pain Nepalese patients coming to a neurosurgical–tertiary care center in Nepal.

Materials and methods

Study design: Prospective analytical study

Sample size: 194 cases

Sampling technique: Nonprobability consecutive sampling

Data collection and analysis: Patients clinical data like age, gender, occupation, body mass index, smoking habit, and history of diabetes mellitus (DM) were noted and status of Modic changes were noted from the MRI.

The analysis was done using SPSS-20. Mean and standard deviation (SD) were calculated for quantitative variables. Frequency and percentage were calculated for qualitative variables. Effect modifier has been controlled through stratification and post-stratification Chi-square test was applied with P≤0.05 was taken significantly.

Results: Overall prevalence of the Modic changes was 50.5% where MC II was the commonest of all the types. Prevalence of MC was significantly higher in patients who are elderly, obese, had severe pain on presentation, and had a habit of smoking .

Conclusion: Modic change occurring at the vertebral endplate is a common phenomenon with significant association with the age, severity of pain, smoking, and Body Mass Index (BMI).

Clinical significance: Modic changes (MC) are the pathological changes of the vertebral body and endplate of the vertebra. Its prevalence in the general population is about 6% and presented in about 35% of patients with low back pain. Various researches have been conducted to see its association with back pain; however, controversies still persist. So this research further highlights the factors that could be associated with its prevalence.

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INTRODUCTION

Modic change (MC) was first described in MRI by de Roos et al. in 1987 as pathological changes of the vertebral body and endplate of the vertebra.[1] In 1986 its classification was formulated by Modic et al., into three types secondary to marrow edema, fatty degeneration and bony sclerosis (Table 1).[2,3]

As MC is primarily diagnosed by MRI,[4] its actual prevalence in general population is difficult to calculate; however, is quoted around 6% and is present in about 35% of patients with low back pain (LBP).[5] Since Modic et al. firstdescribed these changes, there have been various researches conducted to see its association with back pain; however, controversies still persists. MC Type I (MC-I) has a poor outcome in the patient with persistent LBP [6] and has less improvement of back pain following microdiscectomy if they have Type I changes preoperatively.[7] These vertebral endplate changes are also the essential features of associated disease progression.[8]

Despite all these facts, controversies still persists. Hutton et al. claimed that these vertebral endplate changes are reversible.[4] Similarly, Keller et al. stated that they do not influence the clinical course of back pain,[9] and Jensen et al. showed their association with LBP are not constant.[10]

Table 1: Classification of Modic changes

Types	*Underlying Pathology*	*TI*	*T2*
MC- I	Marrow edema	Hypointense	Hyperintense
MC- II	Fatty degeneration	Hyperintense	iso-hyperintense
MC- III	Bony sclerosis	Hypointense	Hypointense

With the objective to determine prevalence and factors affecting Modic changes of lumbosacral vertebral endplate in patients with chronic low back pain, this study was conducted in a neurosurgical tertiary care center in Nepal.

MATERIALS AND METHODS

Study design: Prospective analytical study
Sample size: 194 cases
Sampling technique: Non-probability consecutive sampling
Duration: 3 months
Inclusion criteria: All male and female patients of 30–70 years of age, presented with moderate to severe pain, visual analogue scale (VAS) >3, for more than 3 months duration in this institute.

Exclusion Criteria

- Patients presented with recent trauma
- Obvious vertebral body injury or spinal injury
- Obvious vertebral body or disc lesions like metastasis or tuberculosis
- Obvious spinal deformity like scoliosis.

Data collection: All patients meeting the inclusion criteria were enrolled in the study. Patients clinical data like age, gender, occupation, body mass index, smoking habit, and history of diabetes mellitus (DM) were noted, and status of modic changes was noted from the MRI of the patient (Figs 1 to 3) based on its classification (Table 1).

Data Analysis

Analysis has been done through SPSS software; version 20. Mean, standard deviation has been calculated for age, duration of pain, BMI, and VAS. Frequency and percentage have been calculated for gender, smoking status, diabetes mellitus and MC in the vertebral endplate. Effect modifier has been controlled through the stratification of age, gender, duration of LBP, BMI, VAS, diabetes mellitus, and smoking status to see the effect of these factors on MC. Post-stratification chi-square test was used, and p-value of ≤0.05 was considered significant.

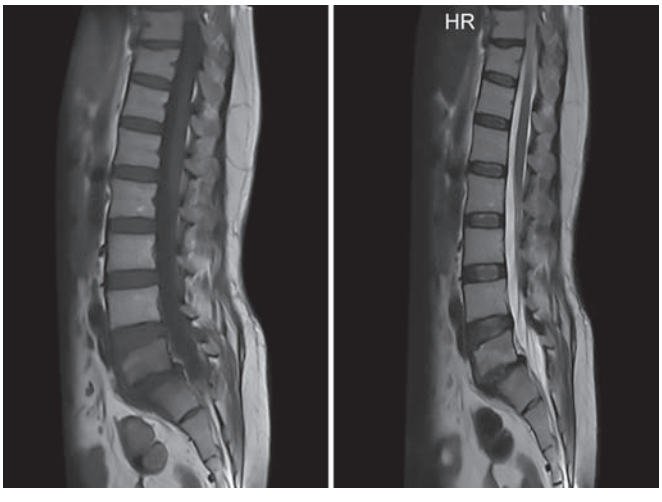


Fig. 1: Modic change at S1

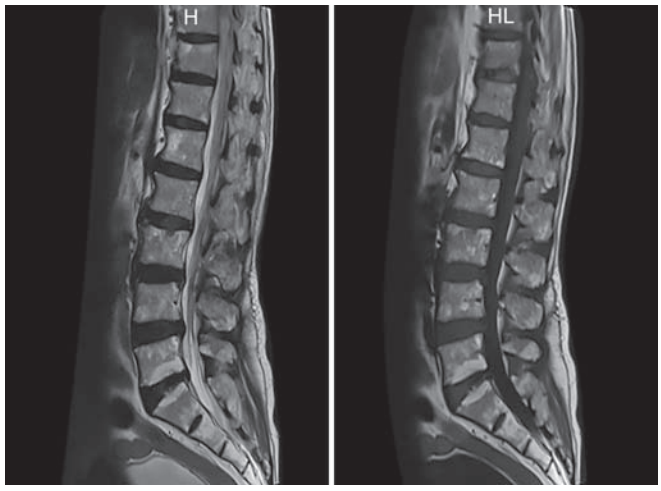


Fig. 2: Modic change at L3

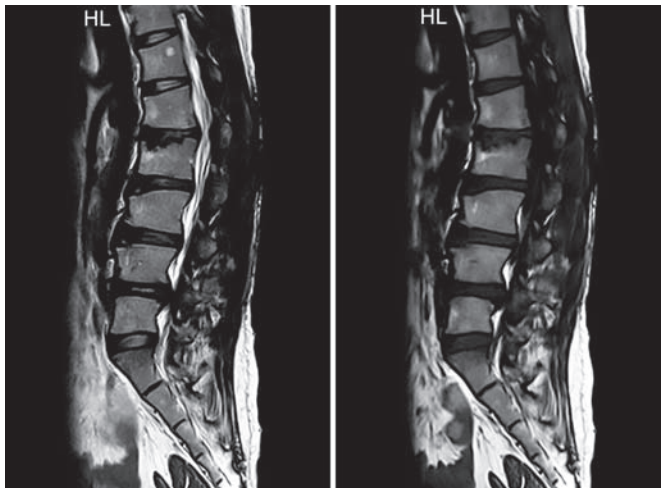


Fig. 3: Modic change at L2

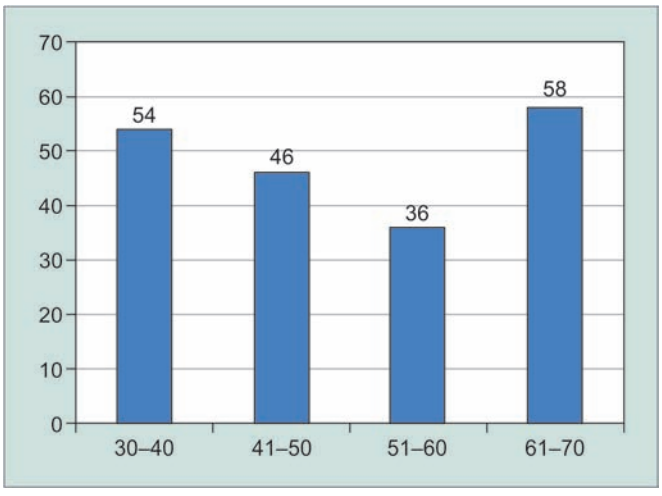
RESULTS

There were a total of 194 patients enrolled in the study, where 58.2% were females, and 41.8% were males. The age of the patients ranged from 30 to 70 years old. Age groups of 30–40 years and 60-70 years were more common, i.e., 2 7.8% and 29.9% respectively (Graph 1) with the mean age being 50.36 (SD: 13.22) years (Graph 2).

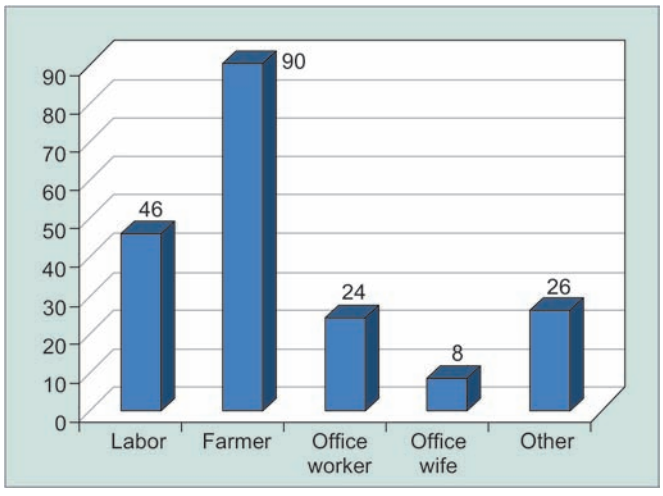
Among the enrolled patients, the highest frequency of the patients werefarmers (46.4%) followed by 23.7% labors (Graph 3). The criteria "other" invariably involved the elderly (60–70 years of age), and they were retired office worker, army personnel, or not involved in any activities besides daily chores (Graph 4).

In this study, 11.3% of the total sampled patients had a previous history of diabetes mellitus, and 42.8% had a habit of smoking (Table 2).

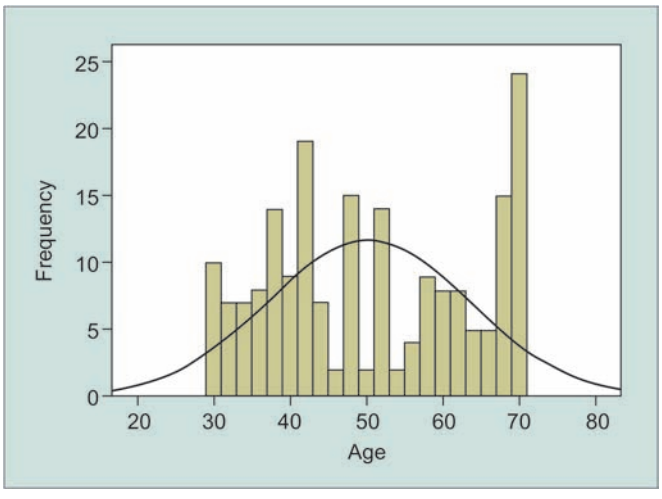
Only those patients with low back pain of more than three months durationwere considered in this study.



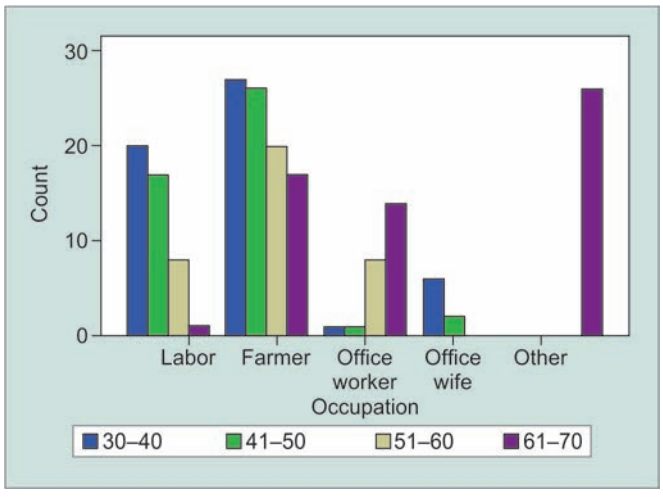
Graph 1



Graph 3



Graph 2



Graph 4

Table 2: Demographical data of diabetes and smoking

Categories		*Frequency*	*Percent*
Diabetes mellitus	No	172	88.7
	yes	22	11.3
Smoking	no	111	57.2
	yes	83	42.8

Among them, the most extended period of low back pain was 19 months, with mean duration being 9.64 (SD 2.76) months.

Mean BMI of the patients was 22.50 (SD 2.7) kg/m^2. Of all the patients, 70.6% of the patients had a healthy weight, and 20.6 % of them were overweighted (Table 3).

Table 3: Distribution of patients in different body mass index categories

BMI categories	*Frequency*	*Percent*
Underweight (<18.5)	17	8.8
Healthy weight (between 18.5 and 25)	137	70.6
Overweight (between 25 to 30)	40	20.6

VAS ranged from 4 to 9 with mean being 6.46 (SD 1.45). Among all the patients, the majority of patients (67.5%) had a moderate degree of pain (Table 4).

Table 4: Presentation of patients with different severity of pain

Visual analogue scale categories (VAS)	*Frequency*	*Percent*
Moderate pain (VAS 4-7)	131	67.5
Severe pain (VAS>7)	63	32.5
Total	194	100.0

Prevalence and Association of Factors Affecting Modic Changes

The overall prevalence of MC was 50.6% (Table 5) with MC I being 9.3%, MC II being 35.6 % and MC III being 5.7% (Table 6).

Modic change (MC) had no significant gender preponderance (Table 7); however, was significantly associated with age. With advancing age the prevalence of MC was increasing, until the highest prevalence (66.66%) at 61-70 years of age.

Table 5: Prevalance of modic changes

Modic changes	*Frequency*	*Percent*
No	96	49.5
Yes	98	50.5

Table 6: Prevalance of different categories of modic changes

		Frequency	*Percent*
Modic changes	No modic changes	96	49.5
	Modic I	18	9.3
	Modic II	69	35.6
	Modic III	11	5.7
	Total	194	100.0

Table 7: Association of different factors with modic changes

		Modic changes		
Categories		*no change*	*Modic change*	*p-value*
Gender	Female	60	53	0.248
	Male	36	45	
Age Categories	30-40	40	14	0.000*
	41-50	21	25	
	51-60	12	24	
	61-70	23	35	
Occupation	Labor	24	22	0.123
	Farmer	48	42	
	Office worker	7	17	
	Housewife	6	2	
	other	11	15	
VAS	Moderate Pain	72	59	0.032*
	Severe pain	24	39	
Duration of Pain	3 to 6	9	11	0.06
	7 to 10	56	52	
	11 to 14	29	23	
	15 to 18	2	11	
	More than 18	0	1	
DM	No	86	86	0.822
	Yes	10	12	
Smoking	No	80	31	0.000*
	Yes	16	67	
BMI categories	Underweight	12	5	0.001*
	Healthy Weight	74	63	
	Overweight	10	30	

*means p-value <0.05.

Prevalence of MC was highest in patients who have a sedentary lifes tyle like office worker (17/24, 70.83%), and retired personnel (15/26, 57.26%); compared to other active groups like farmer and labor. However, the relation was not statistically significant (Table 7).

Prevalence of MC was common if the patient presented with severe pain (39/63, 57.14%) and the value was statistically significant. However, there was no significant association with the duration of pain (Table 7).

DM does not have a significant association with MC. But, the patient having a habit of smoking possessed higher prevalence of MC (67/83 , 80.72%) with the high level of significance (Table 7).

The higher the BMI category, thehigher was the prevalence of MC. The overweighed patients had 75% prevalenceof MC which was statistically significant (Table 7).

DISCUSSION

Prevalence of Modic Changes

The overall prevalence of MC ranged from 16- 25% in a different study population.[2,11-15] However in patients with chronic LBP the prevalence was as high as 62%.[16,17] In this study, 98 out of 194 patients with chronic LBP, who had a history of back pain for more than 3 months, had MC which accounted for 50.5%.

Modic Changes and Gender

Females seem to have a higher prevalence of MC in most of the studies, which ranged between 52.5 to 70%, but statistic does not have a significant association in most of them.[17-22] Similarly, our study also showed a higher prevalence of MC in female though it was statistically not significant.

Modic Changes and Age

Various studies have included the age from, 18 to 80 years in the study population. And, some of those studies has shown significant association of MC with age.[2,15-17,19] In this study, there was a similar finding of increasing prevalence of MC with increasing age groups, and the values were statistically significant.

Modic Changes and Occupation

Nepal is an agricultural country, 80% of the population survives as a farmer.[23] This evidence was reflected in this study with the maximum number of patients being farmer (90, 46.39%), and was followed by labor (35, 19.4%). Kjaer et al. in their study also showed a relationship between heavy physical work and modic changes;[24] however, the prevalence of MC was more common in patients who lived a sedentary lifestyle like office worker (70.83%) and retired personnel (57.26%), but the association was not statistically significant.

Modic Changes and VAS, Duration of Pain

This study enrolled the patients with moderate (VAS 4–7) and severe (VAS >7) pain. The prevalence of MC seems

to be significantly associated with severity of pain at presentation, 61.9% of MC was noted in the patient who presented with severe pain; however, the prevalence of MC was not associated with the duration of pain.

Modic Changes and Diabetes, Smoking

Kjaer et al. in their study also showed the positive association of smoking with modic changes.[24] Similarly, in our study, there was a significant association of smoking with MC in vertebral endplates. The prevalence was 80.7% in patients who had the habit of smoking compared to 27.9% in the non-smoker.

Modic Changes and BMI

In previous studies, overweight in combination with laborious physical activity was significantly associated with the prevalence of modic changes.[25] Similar findings were also note in the study of Karchevsky et al. where it showed there was the significant association between prevalence of MC with increasing weight but not with BMI. In this study, the prevalence of MC seems to be increasing from 29.4% among underweighted patients to 75% among overweighed patients with a high level of statistical significance (Table 7).

CONCLUSION

Modic change occurring at the vertebral endplate is a common phenomenon with the prevalence of 50.5% in patients presented with chronic low back pain, with Type II MC having the highest prevalence of all the subtypes. These changes have a significant association with the age, habit of smoking, the severity of pain at presentation, and BMI.

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