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Synergistic effects of Vitamin D and magnesium in non-specific low back ache (nLBA) – A prospective comparative study

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ABSTRACT

Introduction: Low back ache constitute a group of symptoms with no clear etiopathogenesis and pose a major difficulty for a health care professional to diagnose and treat the disease per se. Low back ache has become permanent disability for certain individuals and interferes with normal functioning of day-to-day life activities.

Objective: This study was undertaken to establish the correlation and functional outcome between combination of Vitamin D & magnesium supplementation and Vitamin D supplementation for patients with non-specific low back ache.

Materials and Methods: An observational comparative study was performed with 117 patients of non-specific low back ache from June 2019 to May 2020. Out of 117 patients, a total of 60 patients (Group A) were treated with a combination of Vitamin D supplementation along with magnesium tablets for 3 consecutive months and remaining 57 patients (Group B) were treated with Vitamin D supplementation for 3 consecutive months. Both the groups were followed up for 6 months for pain relief assessed by VAS score and functional improvement in quality of life assessed by Oswestry Low Back Pain Disability Questionnaire.

Results: A significant difference was noted in the Group A compared to Group B which demonstrates an additive effect on the combination used in them. When analysing the change in parameters compared to the pre-interventions state both the groups showed significant improvements. However, upon analysis of the correlation between the parameters with regard to the change among the groups, we noted that Group A showed significant correlation with respect to the Calcium and Vit-D level improvement out of the intervention upon the observed results.

Conclusion: Treatment of non-specific low back ache with vitamin-D and magnesium shows synergistic effects with significant improvement in the functional outcomes and the pre-intervention metabolic parameters.

1. Introduction

In this modern and fast moving era, low back ache (LBA) has become the major cause of morbidity and disability which impairs the wellbeing, work place performance and functional quality of life of individuals.[1] Low back ache pose a major economic burden in curbing the disease agent. In a lifetime, at some point, 60 – 80% of adult population will experience low back ache.[2] In 2010, global burden of disease study estimated low back ache among top 10 diseases that account for highest number of disability-adjusted life year (DALY) worldwide.[3]

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Low back ache constitute a group of symptoms with no clear etiopathogenesis and pose a major difficulty for a health care professional to diagnose and treat the disease per se.[4] Low back ache has become permanent disability for certain individuals and interferes with normal functioning of day-to-day life activities. A total of 15% of LBA have a specific etiology that contribute to pain.[5] Hence, low back ache is divided into specific low back ache (sLBA) and non-specific low back ache (nLBA).

Non-specific low back ache is defined as patients experiencing low back pain with unknown etiology associated with loss of work productivity, poor quality of life, and high medical expenses, and is a substantial economic burden on society.[6,7] Low back pain may also be classified according to the duration of pain as acute (less than four weeks), subacute (between four weeks and three months), or chronic (three months or more).[8,9] Low back ache is an intermittent and recurring condition. Among people with a resolved episode of low back pain, it is estimated that between 24% and 74% will have a recurrent episode within one year.[10,11] The usual treatment for low back pain is self-care and non-prescription medication such as paracetamol or non-steroidal anti-inflammatory drugs.

Various researchers across the globe were working to find out the plausible etiology for nLBA. Indian gene pool is basically deficient in vitamin D due to lack of poor sunlight exposure and inappropriate food intake which is rich in vitamin D. Researchers have thrown light and worked intensively on vitamin D supplementation for nLBA. They postulated the anti-inflammatory, anti-microbial and immunomodulatory properties of Vitamin D and found an inter-link and cross-talks between vitamin D and LBA which gained the interest of orthopedicians to treat low back ache.[12–14] This study was undertaken to establish the correlation and functional outcome between combination of Vitamin D & magnesium supplementation and Vitamin D supplementation for patients with non-specific low back ache.

2. Materials and Methods

2.1. Patient's recruitment

A prospective comparative study was performed with 117 patients of non-specific low back ache from June 2019 to May 2020. Patients who were above 18 years and below 45 years, patients with normal spinal contour and patients who failed to respond for conservative treatment from past 3 months were included in the study. Patients who were below 18 years and above 45 years, patients with spinal deformities and degenerative changes, patients with specific causes of low back ache such as spinal infections, malignancies & seronegative arthropathies and patients with spinal trauma were excluded from the study.

2.2. Data collection

Once the patient revealed no spinal deformity or degenerations, their demographic details were recorded. The metabolic analysis for serum calcium and phosphorus were done by OCresolphthelein and ammonium phosphomolybdate method. Serum magnesium was detected by Chlorophosphonazo III method and Vitamin D by electrochemiluminiscence method. All the study group participants were subjected for plain radiograph of dorso-lumbo-sacral spine in AP and lateral views & MRI of lumbo-sacral spine with whole spine screening to exclude the possible causes of low back ache. All patients were subjected for battery of metabolic analysis such as serum vitamin D3, serum calcium, serum phosphorus and serum magnesium before giving treatment. They were analysed for pain and functional quality of life by VAS and Oswestry Low Back Pain Disability Questionnaire scoring.

Group A patients were given with muscle relaxants, calcium 500 mg daily, Vitamin D 60,000 IU tablet weekly and magnesium 200 mg twice daily for 3 consecutive months. Group B patients were given with muscle relaxants, calcium 500 mg daily, Vitamin D 60,000 IU tablet weekly for 3 consecutive months. Both the groups were analysed at the end of 6^{th} month with metabolic profile and for pain and functional quality of life by VAS and Oswestry Low Back Pain Disability Questionnaire scoring. The data were collected, tabulated and analysed statistically.

We used chi-square test and independent t-test to compare the nominal and ordinal variables in the analysis. We used Pearson's correlation to look into the correlation of the factors responsible for outcome and paired t-test to compare the outcome between the groups. A p-value less than 0.05 was considered significant.

3. Results

Out of 117 patients, a total of 60 patients (Group A) were treated with a combination of Vitamin D supplementation along with magnesium tablets for 3 consecutive months and remaining 57 patients (Group B) were treated with Vitamin D supplementation for 3 consecutive months and their general characteristics were as given in Table 1. Their metabolic analysis with serum vitamin D3, serum calcium, serum phosphorus and serum magnesium before and after treatment were as given in Table 2. Their functional score outcomes were also as presented in the Table 2 showing a significant difference in the Group A compared to Group B which demonstrates an additive effect on the combination used in them.

When analysing the change in parameters compared to the pre-interventions state both the groups showed significant improvements as shown in Table 3. However, upon analysis of the correlation between the parameters with regard to the change among the groups, we noted

Table 1: Characteristics of the population included for analysis

Parameters	Group A (n=57)	Group B (n=57)	p value
Gender			
Male	32 (56.1)	38 (66.7)	0.248
Female	25 (43.9)	19 (33.3)	
Total	57	57	
Age			
18 – 25	18 (31.6)	7 (12.3)	
26 – 32	20 (35.1)	14 (24.6)	0.009
32 – 38	8 (14)	19 (33.3)	
39 – 45	11 (19.3)	17 (29.8)	
BMI	24.45±0.55	24.54±0.59	0.43
Occupation			
Tailor	9 (15.8)	0	
Labourer	17 (19.8)	10 (17.5)	
Housewife	14 (24.6)	11 (19.3)	
Teacher	1 (1.8)	0	
Software	11 (19.3)	0	<0.001
Driver	5	0	
Engineer	0	1 (1.8)	
Doctor	0	4 (7.0)	
Police	0	7 (12.3)	
Farmer	0	14 (24.6)	
Businessman	0	10 (17.5)	
Duration of symptoms	7.47±3.97	7.89±3.26	0.538

that Group A showed significant correlation with respect to the Calcium and Vit-D level improvement out of the intervention upon the observed results.

4. Discussion

Non-specific low back pain (nLBA) is defined as low back pain not attributable to a recognizable, known specific pathology which leads to a significant loss of productivity and account for major socioeconomic burden. 90% of the patients with nLBA improve after 6 to 8 weeks of treatment with rest, pharmacological and physical therapy whereas 60% individuals show recurrence in two years to follow.[15]

Vitamin D and magnesium has the synergistic role in the musculoskeletal health. The disequilibrium in the homeostasis of vitamin D and magnesium results in major morbidity in muscular system. Vitamin D is required for magnesium absorption in the intestines. Profound magnesium deficiency causes hypovitaminosis of vitamin D.[16] Magnesium block central sensitization through NMDA receptors and blocks neuronal reflux of calcium and prevents potentiation of pain signaling.[17] Deficiency of vitamin D in individuals promote skeletal muscle hypersensitivity and sensory hyper innervation leads to rise in inflammatory markers in such individuals.[18] Magnesium acts as a catalyst in enzymatic activity of 25 hydroxylase and 1α-hydroxylase to form active form of vitamin D and forms an essential component in the intestinal absorption of Vitamin D.[19] Vitamin D and magnesium interact in a harmony to maintain normal physiological functions in humans. The causal relationship between vitamin D and magnesium deficiency leading to low back ache is poorly explained in the literature.[20]

Various studies have proved the vitamin D deficiency has direct causation for low back ache. Al Faraj et al attained 95% recovery of LBA when administered the cases with 3 months of oral 10,000 IUs of vitamin D/day.[21] Ghai B et al reported hypovitaminosis D in patients with chronic LBA. They concluded significant clinical and functional improvement in chronic LBA when administered with 60,000 IUs weekly dose of vitamin D for 8 weeks.[22,23] Bahinipati et al reported statistical significant correlation between vitamin D and magnesium in patients with low back ache.[19]

Our study has certain limitations despite being a prospective comparative study. The population included in the study had difference with regard to their age group clusters and their occupation which might alter the results of the study considering the impact of the age on the metabolic parameters analysed. Only limited number of participants were included in the study. Further, randomised controlled studies with appropriate study participants would be ideal to validate the results obtained from our study.

5. Conclusion

Treatment of non-specific low back ache with vitamin-D and magnesium shows synergistic effects with significant

Table 2: Metabolic profile of the study population

Parameters	Group A (n=57)	Group B (n=57)	p value
Pre Vit D	11.32±2.51	11.89±2.30	0.203
Post Vit D	2.32±0.30	2.02±0.268	<0.001
Pre Calcium	7.09±0.67	7.14±0.81	0.716
Post Calcium	10.35±1.23	7.50±0.43	<0.001
Pre phosphorus	1.48±0.40	1.58±0.38	0.17
Post phosphorus	3.92±0.64	2.59±0.48	<0.001
Pre magnesium	0.56±0.24	0.45±0.18	0.004
Post magnesium	2.24±0.29	0.89±0.15	<0.001
Pre VAS	8.26±0.89	8.44±0.84	0.285
Post VAS	3.68±1.18	5.07±0.72	<0.001
Pre OLBPDQ	75.56±9.29	79.09±8.80	0.040
Post OLBPDQ	29.56±10.21	50.95±5.21	<0.001

Table 3: Variation in the metabolic profile and outcome parameters among the study groups

S.No	Variable	Mean difference	Group A p value	Mean difference	Group B p value
1	Vitamin D	4.57±1.53	<0.001	3.36±1.06	<0.001
2	Magnesium	-19.35±2.46	<0.001	-8.43±3.17	<0.001
3	Calcium	-1.67±0.36	<0.001	-0.44±0.26	<0.001
4	PO4	-3.25±1.14	<0.001	-0.36±0.88	0.003
5	VAS	-2.44±0.77	<0.001	-1.00±0.68	<0.001
6	OLBPDQ	46.00±13.32	<0.001	28.14±9.70	<0.001

Table 4: Comparative correlation of metabolic factors among the study groups

S.No	Variable	Group A		Group B	
		Correlation (r)	p value	Correlation (r)	p value
1	Pre and post Vitamin D	0.486	**<0.001**	-0.073	0.590
2	Pre and post Mg	0.089	0.512	-0.136	0.312
3	Pre and post Ca	0.400	**0.002**	0.087	0.520
4	Pre and post PO4	-0.053	0.696	-0.244	0.068
5	Pre and post VAS	-0.072	0.596	0.094	0.486
6	Pre and post OLBPDQ	0.071	0.600	0.114	0.398

improvement in the functional outcomes and the pre-intervention metabolic parameters.

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7. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

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