



Vitamin D level in cerebral palsy patients below 18 years

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Abstract

Background: *Low vitamin D level is associated with autoimmune disease, such as SLE, Multiple Sclerosis, Diabetes Mellitus, and Malignancies, skin, neurological and cognitive disorders. Low vitamin D level is associated with increased incidence of infections, such as tuberculosis. Adequate vitamin level is important in preventing falls and fractures.*

Cerebral palsy is the most common childhood disability and is considered as a static encephalopathy due to injury, ischemia or infection of immature brain during the prenatal, natal and post natal period up to the age of 2 years, resulting in abnormal tone, postures, involving movement resulting in unsteadiness of the gait.

Objectives: *To study the Vitamin D deficiency in cerebral palsy children below 18 years.*

Study Designs- *Hospital based cross section study*

Study Setting- *out patient department and cerebral palsy clinic in the department of physical medicine and rehabilitation, government medical college, thiruvananthapuram*

Study Subjects- *cerebral palsy children below 18 year attending the OPD and cerebral palsy clinic in the Department of Physical medicine and rehabilitation, Government medical college, Thiruvananthapuram:*

Results: *In our present study Vitamin D Deficiency was found in 33 out of 60 cases. The prevalence was found to be 55% which is high. Insufficiency was noted in 35% cases. Deficiency along with insufficiency constituted to 90%.*

Keywords: *vitamin D deficiency, cerebral palsy, early intervention.*

Background

Low vitamin D level is associated with autoimmune disease, such as SLE, Multiple Sclerosis, Diabetes Mellitus, Malignancies, skin, neurological and cognitive disorders. Low vitamin D level is associated with increased incidence of

infections, such as tuberculosis. Adequate vitamin level is important in preventing falls and fractures. Vitamin D deficiency is emerging as a public health problem throughout the world. The deficiency is under diagnosed and it is considered as the most common nutritional deficiencies.

Worldwide estimation of vitamin d deficiency is around one billion. Major source of vitamin D in adult and children are from exposure to sun light, diet and dietary supplements. Even though the majority of Indian population lives in areas where there is ample sunlight, vitamin D deficiency is common in all age groups and in both sexes across the country.

Vitamin D is a steroid and it acts as a steroid hormone in an endocrine manner. It is converted into its active form via 1α -hydroxylase enzyme. Kidney is the classical site for 1α -hydroxylase activity. It is also expressed in other tissues such as endothelial cells and vascular smooth muscles cells¹.

The fact that Vitamin D receptor (VDR) is present in more than 30 different tissues including pancreas, myocardium, and lymphocytes signifies its role in humans.²

Vitamin D and Bone

It acts independently on bone. Vitamin D increases the number and activity of osteoblasts, the bone forming cells. It also has a role in osteoclastogenesis. Calcitriol stimulates osteoblast to secrete alkaline phosphatase. Due to this enzyme, the local concentration of phosphate is increased. The ionic product of calcium and phosphorous increases leading to mineralisation and remodelling.³

US Endocrine Society classification ¹⁴	
Deficiency	<20 ng/mL (50 nmol/L)
Insufficiency	21-29 ng/mL (52.5-72.5) nmol/liter
Sufficiency	>30 ng/mL
Toxicity	> 150 ng/mL
<i>1mcg = 40IU; 0.025 mcg is 1IU</i>	

Measurement of Vitamin D Levels

The assays used to measure 25(OH) D levels should be capable of measuring both D2

(ergocalciferol) and D3 (cholecalciferol) derivatives. The total 25(OH) D [25(OH)D2 and 25(OH)D3] levels measured by high performance liquid chromatography (HPLC) or tandem mass spectrometry have been reported as the gold standard for Vitamin D metabolite assay. Other standard methods of measurement include radio-immune assays using monoclonal antibodies to 25(OH)D and chemiluminescent protein binding assay.

Cerebral palsy (CP) by definition comprises a group of permanent disorders of the development of movement and posture, that causes limitation of activity, due to non-progressive disturbances that occurred in the developing fetal or infant brain. In addition to motor disorders of cerebral palsy, there can be disturbances of sensation, perception, cognition, communication, and behavior, by epilepsy, and secondary musculoskeletal problems.⁵ Cerebral palsy stands as one of the leading causes of neuromuscular disability in children.⁶

Nutritional problems associated with Cerebral Palsy:

Feeding, growth and endocrine problems are defined in cerebral palsy. Feeding problems are common in cerebral palsy. Problems with saliva control are commonly present. Several of them have severe oral motor dysfunction. Those who have more severe functional disability require assistive feeding.⁷

Bone Mineral Density is reduced in adolescents with cerebral palsy.⁸ Multiple aspects of skeletal growth including skeletal maturation are altered in cerebral palsy.⁹

Vitamin D deficiency in Cerebral Palsy:

Due to inadequate intake as occurs in feeding problems, lack of sun exposure, drugs like anticonvulsants that interfere with Vitamin D metabolism, strict vegetarian diet, associated obesity and in institutionalized children.

Deficiency can cause rickets in children with cerebral palsy and it can aggravate knee deformities and interferes with ambulation. Deficiency can cause decrease in bone mineral

density leading to pathological fractures particularly in those taking antiepileptics, and also in non ambulant ones.¹⁰

Cerebral palsy is the most common childhood disability and is considered as a static encephalopathy due to injury, ischemia or infection of immature brain during the prenatal, natal and post natal period up to the age of 2 years, resulting in abnormal tone, postures, involving movement resulting in unsteadiness of the gait. The effects of cerebral palsy on functional ability vary greatly. The child may be ambulant or non ambulant with normal or abnormal intellectual function and tone disorders. Growth and nutrition disorders are commonly seen secondary health conditions in cerebral palsy. Regardless of the degree of motor impairments cerebral palsy children are at risk for malnutrition. Ambulation problems due to spasticity and contractures, swallowing difficulties, poor nutrition and poor exposure to sunlight aggravate nutritional bone difficulties due to vitamin d deficiency. The deformities caused by the vitamin D deficiency is preventable by early diagnosis, intervention and treatment.

This study is an effort to detect vitamin d deficiency in cerebral palsy children attending in the Physical Medicine department of government medical college Thiruvananthapuram which is tertiary care center for rehabilitation.

Objectives

To study the Vitamin D deficiency in cerebral palsy children below 18 years.

Materials and Methods

Study designs- Hospital based cross section study

Study setting- out patient department and cerebral palsy clinic in the department of physical medicine and rehabilitation, government medical college, thiruvananthapuram

Study subjects- cerebral palsy children below 18 year attending the OPD and cerebral palsy clinic in the Department of Physical medicine and

rehabilitation, Government medical college, Thiruvananthapuram

Inclusion Criteria

1. Children with confirmed diagnosis of cerebral palsy below 18 years of age
2. Informed consent of the patient, parents, or close relatives

Exclusion Criteria

1. Children with renal, hepatic or metabolic disease
2. Children with established rickets
3. Children not willing for blood tests

Sample size

Sample, $n = Z_{\alpha}^2 * P * q / d^2$

$n = 60$ (reference number-9)

Number of sample=60

Period of ethical consideration

Study started after ethical clearance, ethical committee recommended and approved a study period of six months. Sample were obtained from the stipulated time recommended by the committee

Methodology

Clinical examinations, recording of demographic details, drawing of blood samples and biochemical analysis of included patients in the studies

Procedures

3 ml of blood is drawn from the arm using aseptic precautions. Sample is centrifuged and serum separated. Vitamin D analysis is done using chemiluminescent protein binding assay. Estimation of vitamin D level in the serum along with the estimation of parathormone level, serum calcium, phosphorous and alkaline phosphatase was done.

Statistical analysis

Data is collected using proforma, and details were entered into Microsoft excel 2007 and analysed with statistical package for social science software programme. Qualitative variables were expressed using frequency distributions and percentage calculated. Association between qualitative

variables assessed using chi-square test. A p-value of 0.5 is taken as the level of significance.

OBSERVATIONS AND RESULTS

Table : Distribution of cerebral palsy children in various age groups.

Age	Frequency	Percent
0-5	25	41.7
6-10	24	40.0
11-17	11	18.3
Total	60	100.0

Distribution of gender in the study group

Sex	Frequency	Percent
Male	36	60.0
Female	24	40.0
Total	60	100.0

The present study had 60% males and 40% females.

Educational status of father

Education of Father	Frequency	Percent
No education	1	1.7
Below 10 th	9	15.0
10 th standard	28	46.7
Pre degree	16	26.7
Degree and above	5	8.3
Professional	1	1.7
Total	60	100.0

Fathers education : Maximum member occurred in the group of having finished 10th standard.

Annual Income of the Family

Income	Frequency	Percent
<10000	37	61.7
10001-20000	12	20.0
20001-50000	4	6.7
>50000	7	11.7
Total	60	100.0

Majority came under low income group.(61.7%).

Order of Birth

Order of Birth	Frequency	Percent
1 st	41	68.3
2 nd	15	25.0
3 rd	4	6.7
Total	60	100.0

Majority of study samples came under 1st born category (68.3%). Frequency was found to be 41 and percentage 68.3%.

Consanguinity

Consanguinity	Frequency	Percent
Not Consanguineous	56	93.3
2 nd degree	4	6.7
Total	60	100.0

1 st level of GMFCS	1	1.7
2 nd level of GMFCS	1	1.7
5 th level of GMFCS	1	1.7
Not applicable	57	95.0
Total	60	100.0

Among three patients with severe deficiency, their GMFCS levels are equally distributed under level 1,2 and 5.

Deficiency GMFCS	Frequency	Percent
1 st level of GMFCS	5	8.3
2 nd level of GMFCS	6	10.0
3 rd level of GMFCS	11	18.3
4 th level of GMFCS	2	3.3
5 th level of GMFCS	9	15.0
Non deficient	27	45.0
Total	60	100.0

Discussion

This is a hospital based prevalence study. Prevalence of Vitamin Deficiency in cerebral palsy children attending hospital outpatient department and so cerebral palsy clinic is studied.

In this study regarding Vitamin D deficiency in cerebral palsy patients, 60 patients were evaluated. Among the age group maximum number was obtained in the 0-5 age which has a frequency of 25 out of 60.

Regarding gender, males are more than females. Male to female ratio is 5:1. Erkin et al found the male to female ratio 1.45:1.¹¹ Studies have reported higher incidence of several developmental brain disabilities and cerebral palsy as well as structural differences in brain of male children born prematurely¹²

In our study majority of cases were from low socioeconomic group. Several studies have found that the lower socioeconomic group had significantly lower mean Vitamin D concentrations than the upper socio economic group¹³.

In our present study Vitamin D Deficiency was found in 33 out of 60 cases. The prevalence was found to be 55% which is high. Insufficiency was noted in 35% cases. Deficiency along with insufficiency constituted to 90%.

In a similar study conducted in a group of non ambulatory cerebral palsy children attending an outpatient clinic, 33.3% had Vitamin D deficiency.

Study was conducted in a group of non institutionalized cerebralpalsy children, which showed that 19% suffered from Vitamin D deficiency.

Other studies also showed different prevalence rates. In another study prevalence rate for vitamin D deficiency in cerebralpalsy was found to be 42%, in case of severely handicapped with history of fractures

In a hospital based study conducted in Indian children, by the department of paediatrics and community medicine , the hospital prevalence of Vitamin D deficiency was found to be 37.4%.¹⁴ Considering all these, the present study has shown a high prevalence rate for Vitamin D deficiency in cerebral palsy children. Vitamin D deficiency prevalence in the present study group is 55%, while studies in normal Indian children is only 37.4%. so there is a definite increase in prevalence of Vitamin D deficiency in cerebral palsy groups studied.

Serum levels of parat hormone was found to be elevated in deficient cases indicating a secondary hyperparathyroidism. Similar finding is seen in other studies which shows an inverse correlation between Vitamin D and parat hormone levels.¹⁵

Considering the other variables, it was found that individuals classified in the highest severity category (GMFCS 3-5) had a similar serum Vitamin D status as individuals in the least impaired category(GMFCS land2).This implies that other than the severity of motor impairment, there is an independent factor producing a risk for deficiency.

Similar pattern is seen with anticonvulsant taking group also. Deficiency is found in both medication taking and not taking group.

Medication taking group was small. Children on anticonvulsant Medications are at a higher risk for Vitamin D deficiency.¹⁵

Though Sun Exposure is an important factor in the production of vitamin D, deficiency is seen in both exposed and non exposed group as per the study. No statistically significant difference could be obtained favouring sun exposure.

Certain studies have shown similar finding showing vitamin D deficiency with adequate sun exposure.¹⁶

In Our study, the children with Vitamin D Deficiency were given supplementation from the Department of PM&R, Medical College, Thiruvananthapuram.

Conclusion

- 1) Male patients predominated the study group.
- 2) Majority of patients comes in GMFCS 3 to 5 group
- 3) Vitamin D deficiency is seen in high prevalence in cerebral palsy children below 18 years of age.
- 4) The hospital prevalence of Vit D was found to be 59 percent.

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