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Original Research Article

A Study of Correlation between Vitamin D Levels and Paediatric Epilepsy in a Tertiary Care Hospital of North Eastern India

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Abstract

Background: Vitamin D deficiency is common among epileptic patients. Several studies have investigated the correlation between vitamin D levels and paediatric epilepsy, but it is still unclear and further research is needed. Therefore, present study was designed to investigate correlation between vitamin D levels and paediatric epilepsy.

Methods: The current study comprised a cross-sectional analysis of vitamin D levels in 60 children (37 male and 23 female) with epilepsy aged 1 to 12 years. A self-created case record form was used to record demographics, clinical symptoms, signs, and laboratory values, including vitamin D levels, which were classed as normal, insufficiency, or deficient.

Results: The study comprised 60 paediatric epilepsy children aged 1 to 12 years, who were receiving anti-epileptic therapy. The total prevalence of hypovitaminosis D in paediatric epilepsy was found to be 80%. The study included 37 (61.67%) male children and 23 (38.33%) female children. In terms of vitamin D prevalence, there were 20 (86.96%) females and 27 (72.97%) males with hypovitaminosis D. Females had a higher frequency of hypovitaminosis D. It was also discovered that older children were more prone to hypovitaminosis D. Furthermore, the longer the duration of epilepsy, the greater the likelihood of hypovitaminosis D. Moreover, present findings also suggest that children with multidrug therapy have higher probability of hypovitaminosis D.

Conclusion: The study found that hypovitaminosis D is prevalent in paediatric epilepsy patients. Females have a higher prevalence, and longer epilepsy duration increases the likelihood of hypovitaminosis D. Children with multidrug therapy also have a higher risk. Larger-scale research is needed to validate these findings.

Keywords: Vitamin D deficiency, paediatric epilepsy, hypovitaminosis D, monodrug therapy, multidrug therapy.

Introduction

Vitamin D is an essential component that helps the body maintain calcium and phosphorus balance. The relevance of vitamin D was recently highlighted when it was discovered to be involved in cell differentiation and proliferation, immunological function, and the prevention and treatment of certain malignancies [1, 2]. Adult epilepsy patients may be vitamin D deficient, according to research [3, 4]. Anti-epileptic medications that increase cytochrome P450 enzymes in the liver, such as phenytoin and carbamazepine, promote the catabolism of vitamin D and its derivatives. This reduces vitamin D levels, leading in hypocalcemia and secondary hyperparathyroidism, which eventually leads to a loss of bone mineral density (BMD) [5-7]. However, there is still debate about the effect of anticonvulsants on vitamin D levels and bone health in paediatric patients [8].

Epilepsy is one of the most prevalent neurological illnesses, affecting around 0.5-1% of the population [9]. It is linked to the occurrence of fractures. A seizure, a fall, or without previous seizures directly trigger some of them. Antiepileptics use has been recognized as a risk factor for bone density loss and poor calcium metabolism [10]. The risk of fracture occurring after a few years of taking AED is 2-6 times higher than in the general population [11].

Although there is evidence that vitamin D deficiency is associated with epilepsy, systematic screening for vitamin D deficiency and prophylactic vitamin D treatment in children with epilepsy are not evidence-based. Furthermore, it varies widely across clinical practice guidelines

[12-14]. Therefore, present study was aimed to investigate correlation between vitamin D levels and children with epilepsy.

Materials and Methods

This observational cross sectional study was conducted jointly by Department of Neurology and Department of Paediatrics of Agartala Government Medical College, Agartala for a period of 6 month (May 2023–October 2023).

Inclusion Criteria

Children in the age group of 1-12 year with epilepsy were included in the study.

Exclusion Criteria

1) Febrile convulsion

2) Children below 1 year.

3) Children with preexisting rickets.

Methodology

Demographics, clinical symptoms, signs, and laboratory parameters, including vitamin D levels, which were classified as normal (>30 ng/dL), insufficiency (20–30 ng/dL), or deficiency (<20 ng/dL), were recorded using a self-created case record form.

Statistical Analysis

MINITAB Version 17 was used for statistical analysis. The chi-square test was used to analyze the data. The significance level was chosen at 5%. p-value < 0.05 was considered significant.

Results

The study included 60 children with epilepsy between the ages of 1 and 12 who were receiving anti-epileptic medication. There were 37 male children (61.67%) and 23 female children (383.3%). Figure 1 shows the vitamin D levels of patients of various ages. 1 (1.67%) of children aged 1-3 years had vitamin D deficiency, 8 (13.33%) had vitamin D insufficiency, and 6 (10%) had normal vitamin D level. 13 (21.67%) children aged 4-6 years had vitamin D deficiency, 10 (16.67%) had vitamin D insufficiency, and 4 (6.67%) had sufficient vitamin D. There were 5 (8.33%) children with vitamin D deficiency, 1 (1.67%) with vitamin D insufficiency, and 1 (1.67%) with vitamin D sufficiency in the 7-9 year age group. Of the children in the age group >9 years, 7 (11,67%) had vitamin D deficiency, 2 (3.33%) had insufficient vitamin D, and 2 (3.33%) had sufficient vitamin D. Applying the chi-square test yielded a P value of 0.139. Thus, there isn't a statistically significant variation between the groups.

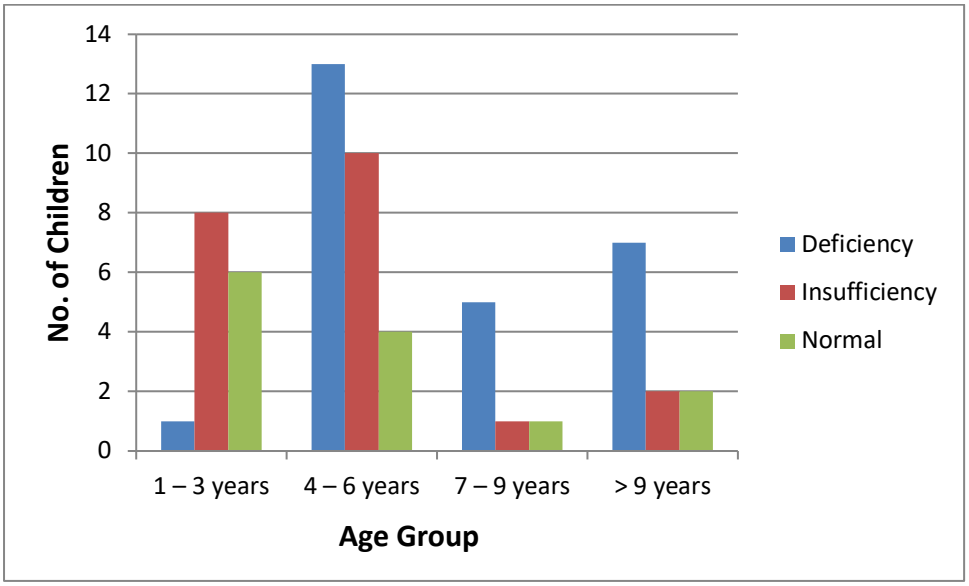

Figure 1: Age profile of the study group

In the present investigation, it was found that 10 (16.67%) of the male children had sufficient vitamin D, 13 (21.67%) had insufficient vitamin D, and 14 (23.33%) were vitamin D deficient. However, 3 (5%) of the females had sufficient vitamin D, 9 (15%) had insufficient vitamin D, and 11 (18.33%) were vitamin D deficient (Figure 2). The Chi square test yielded a P value of 0.195. Consequently, no statistically significant variation was seen between the groups.

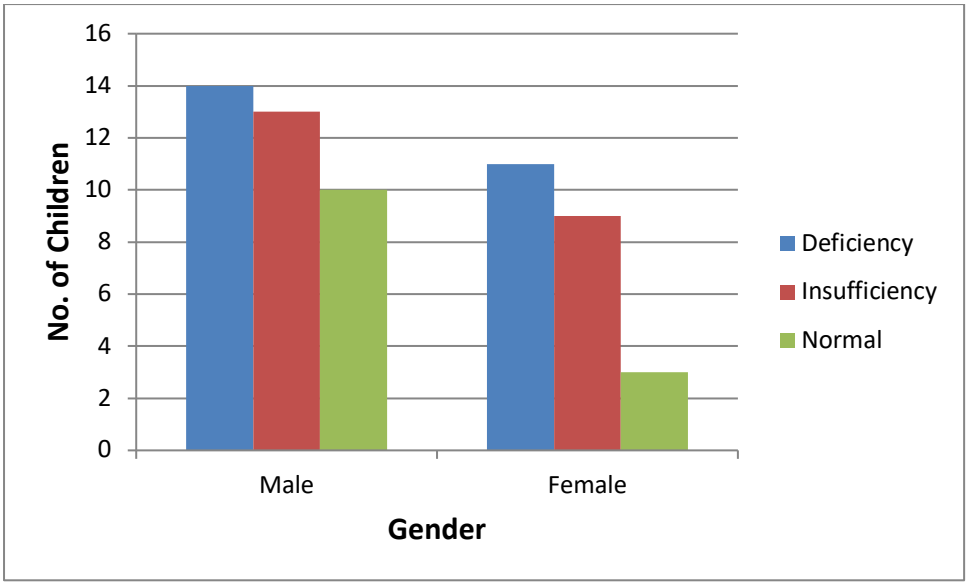

Figure 2: Gender profile of the study group.

Results of severity of vitamin D deficiency with respect to duration of treatment of epilepsy were indicated in Table 1. In children with 1-2 years of treatment, there were 15 (25%) children with vitamin D deficiency, 16 (26.67%) with vitamin D insufficiency and 8 (13.33%) with sufficient vitamin D . In children with 2-4 years of treatment, there were 7 (11.67%) children with vitamin D deficiency, 4 (6.67%) with vitamin D insufficiency and 3 (5%) with normal vitamin D level. In children with 4-6 years of treatment, there were 4 (6.67%) children with vitamin D deficiency, 2 (3.33%) with vitamin D insufficiency and 1 (1.67%) with vitamin D sufficiency. In children with 6-8 years of treatment, there was only 1 (1.67%) child with vitamin D deficiency. However, no children were found with vitamin D insufficiency and sufficiency. Chi square test was applied, and P value of 0.552 was obtained. Therefore, statistically no significant difference exists between the groups.

Table 1: Duration of treatment and severity of vitamin D deficiency.

Duration of Treatment (Yrs)	Deficiency	Insufficiency	Normal	Total	P Value
1-2 years	15 (25%)	16 (26.67%)	8 (13.33%)	39 (65%)	0.552
2-4 years	7 (11.67%)	4 (6.67%)	3 (5%)	14 (23.33%)	
4-6 years	4 (6.67%)	2 (3.33%)	1 (1.67%)	7 (11.67%)	
6-8 years	1 (1.67%)	0 (0%)	0 (0%)	1 (1.67%)	
Total	26 (43.33%)	22 (36.67%)	4 (6.67%)	60 (100%)	

The duration of epilepsy and severity of vitamin D deficiency are indicated in Table 2. In 1-3 years age group, there were 11 (18.33%) children with vitamin D deficiency, 17 (28.33%) with vitamin D insufficiency and 7 (11.67%) with vitamin D sufficiency. In 4-8 years age group, there were 12 (20%) children with vitamin D deficiency, 5 (8.33%) with vitamin D insufficiency and 5 (8.33%) with vitamin D sufficiency. In age group >8 years, 3 (5%) children had vitamin D deficiency. Chi square test was applied and P value of 0.057 was obtained. Therefore, statistically, no significant difference exists between the groups.

Table 2: Duration of Epilepsy and severity of Vitamin D Deficiency.

Duration of Epilepsy (Years)	Deficiency	Insufficiency	Normal	Total	P Value
1-3 years	11 (18.33%)	17 (28.33%)	7 (11.67%)	35 (58.33%)	0.57
4-8 years	12 (20%)	5 (8.33%)	5 (8.33%)	22 (36.67%)	
>8 years	3 (5%)	0 (0%)	0 (0%)	3 (5%)	
Total	26 (43.33%)	22 (36.67%)	12 (20%)	60 (100%)	

During multidrug therapy, there were 17 (28.33%) children with vitamin D deficiency, 10 (16.67%) with vitamin D insufficiency and 4 (6.67%) with vitamin D sufficiency. Whereas, in mono drug therapy, there were 12 (20%) children with vitamin D deficiency, 19 (15%) with vitamin D insufficiency and 8 (13.3%) with vitamin D sufficiency (Figure 3). Chi square test was applied and P value of 0.139 was obtained. Therefore, statistically no significant difference exists between the groups.

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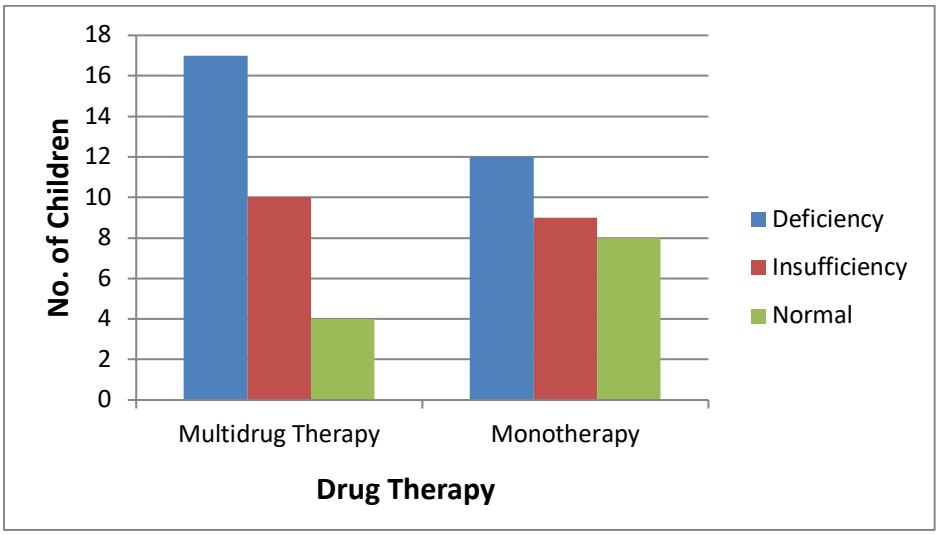

Figure 3: Type of therapy and severity of vitamin D deficiency.

Discussion

Vitamin D deficiency is prevalent among children with epilepsy who are treated with anti-epileptic drugs (AEDs) [15, 16]. Several studies have investigated the correlation between vitamin D levels and pediatric epilepsy. One study found a weak correlation between vitamin D levels and bone mineral density (BMD) in children with epilepsy who received oral AEDs [17]. Another study reported a high prevalence of vitamin D deficiency among children with epilepsy, with obesity and receiving enzyme-inducer AEDs identified as risk factors [18].

According to the present study, 80% of children with epilepsy had hypovitaminosis D overall. 78 individuals with a mean age of 11.64±4.37 years were included in a similar survey by Shellhaas *et al.* [19]. Of those, 75% had hypovitaminosis D testing positive. According to their research, children and girls with greater BMIs had a higher probability of having low 25-hydroxy vitamin D levels.

A second study by Harinarayan *et al.* [20] on the general population found that 40% of males and 70% of females in southern India were deficient in vitamin D, indicating a high prevalence of the condition in the area. However, our research revealed that vitamin D deficiency was more common in epileptic patients than in the general population.

The present study included 37 (61.67%) male and 23 (38.33%) female children. When the prevalence of vitamin D was compared by gender, 20 (86.96%) females and 27 (72.97%) males had hypovitaminosis D. As a result, females in our study had a higher prevalence of hypovitaminosis D. Shellhaas *et al.* [19] discovered that girls were at the highest risk of hypovitaminosis D. In addition, Vasudevan *et al.* [21] discovered that, as compared to male children, female children had a 1.9 (95% CI 1.3 to 4.0) times higher incidence of vitamin D deficiency.

In our study, children with epilepsy were divided according to the duration of epilepsy: 1-3 years, 3–8 years and >8 years. We found that there were 35 children with 1–3 years of epilepsy, of which 27 (80 %) had hypovitaminosis D. 22 children with 4–8 years of epilepsy and 17 (77.27 %) had hypovitaminosis D. Similarly, 3 children with >8 years of epilepsy and all (100 %) had hypovitaminosis D. In our study, we found that higher the duration of epilepsy, higher was the probability of hypovitaminosis D. In a study by Fong and Riney [22], vitamin D deficiency was present in 69.4 % of children with 1-3 years of epilepsy, 76.2 % of children with 4–7 years of epilepsy and 84 % of children with 1-3 years of epilepsy. Similarly, in a study by Hamid *et al.* [23], hypovitaminosis D was found in 67.6 % of children with <2 years duration, 72.1% of children with 2–4 years duration of epilepsy and 77.8 % of children with 4–6 years duration epilepsy. So, the greater the duration of epilepsy common is hypovitaminosis D.

Regarding the type of therapy, we found 31 children with multidrug therapy. Out of which, 27 (87.1 %) children had hypovitaminosis D. Similarly, there were 29 children with monodrug therapy and out of which 21 (72.41 %) had hypovitaminosis D. Therefore, our findings suggest that children with multidrug therapy have higher probability of hypovitaminosis D. In a similar study, Fong and Riney [22] also found higher incidence of hypovitaminosis D in children with multidrug therapy. In another study, Lee *et al.* [24] observed that polytherapy significantly negatively

affected the longitudinal change of 25-hydroxy vitamin D.

Limitations

The study had a small sample size, with only 60 paediatric epilepsy patients enrolled, which may restrict the generalizability of the findings. Furthermore, the study was conducted in a single tertiary care facility in North Eastern India, which may limit the generalizability of the results to other populations or areas.

Conclusion

This study concludes that hypovitaminosis D was common in paediatric epilepsy patients, with an overall frequency of 80%. Females were shown to have a higher prevalence of hypovitaminosis D as compared to males. It was also observed that the higher the duration of epilepsy, higher the probability of hypovitaminosis D. Furthermore, type of therapy suggests that children with multidrug therapy have higher probability of hypovitaminosis D. Larger-scale research with a more diverse population are needed to validate the findings. Furthermore, research into the long-term effects and outcomes of vitamin D deficiency in children with epilepsy, such as the impact on bone health, fracture risk, and the development of other comorbidities, is strongly advised.

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