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ORIGINAL ARTICLE

Vitamin D Level and its Association with Mortality in Children Admitted in Pediatric ICU

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ABSTRACT

Objective: To study the relationship between the levels of vitamin D of pediatric ICU patients in Pakistan and its effect on the rate of mortality among them which will pave ways to improve the clinical outcomes among Pediatric ICU patients of Pakistan.
Study Design: Prospective observational study.
Place and Duration of Study: Pediatric Emergency Ward, Ghulam Muhammad Mahar Medical College, Sukkur Sindh Pakistan from 1st June 2018 to 31st December 2019.
Methodology: Seven hundred and eighty two children of both genders and aged range 1 to 15 years were enrolled. There Vitamin D levels were taken at the time of admission.
Results: The overall mortality rate was 13%. Mortality rate in sufficient group was ~9%. Mortality rate in insufficient group was up to 15% and in deficient group, it was 20.2%. The mortality rate was significantly higher in deficient and in insufficient group.
Conclusions: Vitamin D levels are a significant predictor in the outcome of mortality in pediatric ICU. It is essential to monitor Vitamin D levels regularly, and efforts should be made to increase Vitamin D levels if they are deficient.
Keywords: Vitamin D, Mortality, Pediatric ICU

INTRODUCTION

Vitamin D is a fat-soluble vitamin that plays a vital role in a balanced diet. Vitamin D is required for the mental and physical growth of children.[1] Vitamin D is crucial for calcium absorption from the intestine and kidneys. Moreover, it is essential to regulate the body's immune system as antigen-presenting cells (APCs), T and B cells, and macrophages all have vitamin D receptors.[2]

Vitamin-D deficiency is common in developing countries of South Asia, with 58.17% Pakistani population being Vitamin D deficient.[3]The prevalence rate is high in Karachi in children below five years of age up to 75%.[1] According to Bhatty et al[4], serum Vitamin D levels (serum 25 OHD) of 20.1-20.9 ng/ml were defined as vitamin D insufficiency and serum Vitamin D levels (serum 25 OHD) of <20 ng/ml was considered as Vitamin D deficiency.

Serum Vitamin D levels can also be used to predict patient's health outcome.[5] Various studies have shown that low levels of serum Vitamin D result in high mortality and worse prognosis in patients admitted in an intensive care unit (ICU).[6] As Vitamin D plays a role in the absorption of calcium from kidneys and intestine, its deficiency can cause hypocalcemia, which also contributes to high mortality in critically ill children. Deficiency of vitamin D in the pediatric population is directly linked with longer hospital stay in pediatric ICU and more significant morbidity of disease in pediatric patients via Pediatric Risk of Mortality Score.[7] Despite being highly prevalent in the pediatric population in Pakistan, there is little data available related to Vitamin D levels, and its associated complications and mortality risk especially in pediatric patients.

This purpose is to study the relationship between the levels of vitamin D of pediatric ICU patients in Pakistan and its effect on the rate of mortality among them, which will pave ways to improve the clinical outcomes among Pediatric ICU patients of Pakistan.

MATERIALS AND METHODS

This hospital based study was conducted in the Emergency Unit, Pediatric Ward in Pakistan from 1st-06-2018 to 31st-12-2019. A total of 782 children, both male and female of age group 1 to 15 were enrolled. Along with other relevant lab tests, Vitamin D levels were also done at the time of admission. Demographic information, lab values, and outcomes were noted in a self-structured questionnaire. Three groups were made according to serum vitamin D levels: sufficient group (serum vitamin D level ≥30 ng/mL), in-sufficient group (serum vitamin D level<30 ng/mL) and deficient group (serum vitamin D level < 20 ng/mL).[8] Ethical approval was taken from institution review board and informed consent was taken from each participants.

Data were analyzed using SPSS-22. Chi-square was applied to compare the outcome in various groups. A p-value of less than 0.05 indicates that the difference in outcome between groups with normal vitamin D levels and hypovitaminosis D is significant enough to discard the null hypothesis.

RESULTS

There were 395 (50.5%) male children and 387 (49.5%) female children in our study. Overall, 403 (51.5%) children had sufficient vitamin D, 191 (24.4%) had insufficient, and 188 (24.0%) had deficient levels of Vitamin D. There was no gender difference in Vitamin D level (Table 1).

The overall mortality rate was 13%. The sufficient group mortality rate was 8.9%; in the insufficient group, it was 14.6%, and in the deficient group, it was 20.2%. The mortality rate was significantly higher in the deficient and insufficient group compared to sufficient group (Table 2)

Table 1: Comparison of genders according to groups (n=782)

Gender	Sufficient (n=403)	Insufficient (n=191)	Deficient (n=188)	P values
Male	212 (52.6%)	92 (48.1%)	91 (48.4%)	.361
Female	191 (47.4%)	99 (51.9%)	97 (51.6%)	

Table 2: Frequency of mortality according to groups (n=782)

Mortality	Sufficient (n=403)	Insufficient (n=191)	Deficient (n=188)	P values
Discharge	367 (91.1%)	163 (85.4%)	150 (79.8%)	.0005
Death	36 (8.9%)	28 (14.6%)	38 (20.2%)	

DISCUSSION

In the present study, prevalence of vitamin D deficiency in pediatric intensive care unit was 24.0%. These results were comparable to a study conducted in India, which reports a 30.0% population with Vitamin D deficiency.[9] Other studies[10-12] conducted in various other parts of the world show a range of Vitamin D deficiency prevalence from 40% to 95%.

This study showed that there was an increase in mortality as the Vitamin D levels decreased. In the sufficient group mortality rate was 8.9%, in the insufficient group it was 14.6%, and in the deficient group, it was 20.2%. This finding is comparable to the results of Kumar and colleagues.[13] They reported a mortality rate of 13.1% insufficient group, 17.0% in insufficient group, and 21.6%

in the deficient group. A study conducted in the USA's adult intensive care unit also had a similar finding where mortality rate was observed to be higher in deficient group.[9]

Vitamin D levels are also related to the length of stay in the hospital. Shankar et al[11] reported that the duration of hospital stay was considerably longer in deficient group than those with normal vitamin D levels (7 vs 3 days).

The study's strength includes that patients were enrolled in a consecutive manner after informed consent, and hence patients belonging to every subspecialty participated in the study. Serum vitamin D levels were noted immediately after admission to minimize the influence of factors that may contribute to a decline in vitamin D levels following admissions. The study had its limitation as well. It was a single-center study. Sequential samples of Vitamin D levels were not collected instead vitamin D levels at the time of admissions were used, which may be influenced by pre-admission factors. The deficiency of vitamin D lead to higher infections chances, longer hospital stays and increased mortality risks. Vitamin D levels should be regularly monitored, and supplements may be taken to bring levels to be normal.[10-14]

CONCLUSION

The mortality rate was significantly higher in vitamin D insufficient and vitamin D deficient group. Further large-scale multi-center studies are needed to study the association of Vitamin D levels and mortality in the pediatric population. Vitamin D's role in the immune system should be further explored to understand its association with severe illness.

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