

Vitamin D Deficiency in Critically Ill Children in Karachi

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ABSTRACT

Objective: To evaluate vitamin D levels in critically ill children.

Subject and methods: There were 114 critical ill patients, who were admitted in pediatric ICU with severe respiratory depression (sat < 90%), infection (WBC > 10X 10³), myocarditis (EF < 40%). Blood sample was drawn for evaluation of vitamin D levels.

Results:- The average age of the children was 4.95±2.7 years. There were 63(55.26%) male and 51(44.74%) female. Frequency of vitamin D deficiency in critically ill patients was observed in 55.26% (63/114) children.

Conclusion: - In our study, critically ill children had higher frequency of vitamin D deficiency.

Keywords: Vitamin D, Critically ill patients, Infection, 25(OH) D levels

INTRODUCTION

The role of vitamin D is important for immune system, bone health, and calcium homeostasis.¹⁻³ It has pleiotropic effect in mucosal and endothelial functions. Vitamin D has several skeletal and extra skeletal functions that have immunomodulation and cardio-protection as well as improvement of antimicrobial action.⁴ In adults it has been seen that vitamin D have antimicrobial effect, in this way it protects from infections.¹

The Commonest source of vitamin D in skin is through UVB radiation which converts 7- dehydro cholesterol into 25(OH) vitamin D in liver having half-life of 2-3 weeks as it is inactive form which becomes active into 1,25 (OH) vitamin D in kidneys with half-life 4-24 Hrs.²

Vitamin D has an important role in critical illness and acute stress, however, its effects are still undetermined.^{2,6} Several recent studies established that vitamin D deficiency is correlated with longer stay in hospital with increase morbidity and mortality in children.^{2,4,6}

During critical illness, hemodilution, renal wasting of 25(OH) vitamin D and decreased synthesis of binding proteins has a potential role for vitamin D regulation.⁷

Previously few studies evaluated Vitamin D deficiency in children critically ill and admitted in PICU. Madden and others documented 40% critically ill children in PICU had lower vitamin D levels.⁵ Cases with pneumonia/bronchiolitis in PICU had a significant lower vitamin D levels when compared to those with normal respiration.

Identification of vitamin D deficiency in critically ill patients is very important so that vitamin D supplementation can be done. However, on the basis of result of this study, we may be able to create guidelines for time management of vitamin D deficiency.

METHODOLOGY

In this cross sectional survey, at intensive care unit of pediatrics department of Liaquat National Hospital Karachi during the period 2016-17 with non-probability consecutive sampling technique. The patients' age range was 2 months to 12 years age of either gender and they were Critical ill patient (severe respiratory depression (sat < 90%), infection (WBC > 10X 10³), myocarditis (EF < 40%). Whereas those cases taking vitamin D supplements doctor's prescription as proof, neonates with Sepsis (WBC > 14 X10³), hemolysis diagnosed as serum bilirubin > 2mg/dl, low birth weight < 2.5Kg and congenital malformations on clinical examination were excluded from the study. These cases were enrolled after taking informed consent from the parent/guardian. Patient demographics were recorded by the principle investigators. Blood sample was drawn to evaluate vitamin D levels and those with <20ng/ml were

documented as vitamin D deficiency. We used statistical package (20th version) for analysis of data.

RESULTS

The average age of the children was 4.95±2.7 years, duration of admission was 3.28±2.6 days, weight at birth 3.09±0.44kg, current weight 15.29±5.9 kgs, height was 100.45±12.7cm, and BMI of the children was 14.651±3.03 kg/m². (Table 1)

There were 63(55.26%) male and 51(44.74%) females, 55.26% (63/114) children had vit D deficiency. (Table 2)

Table 1: Demographic Information(N=114)

Variables	Mean ± SD	95% Confidence Interval for Mean		Median(IQR)
		Lower Bound	Upper Bound	
Age (Years)	4.95±2.7	4.456	5.46	4(3)
Duration of admission (days)	3.28±2.6	2.80	3.76	3(1)
Weight at the time of birth (kg)	3.09±0.44	3.008	3.175	3(0.4)
Current Weight (kg)	15.29±5.9	14.19	16.38	14(7)
Height (cm)	100.45±12.7	98.09	102.81	101.5(15)
BMI (kg/m ²)	14.651±3.03	14.087	15.214	14.38(3.1)

Table 2: Vitamin D Deficiency In Children With Critical Illness

Variable	Vitamin D Deficiency		Total	P-Value
	Yes	No		
Age	≤ 4 Years	34(57.6%)	25(42.4%)	0.524
	5 to 8 Years	20(48.8%)	21(51.2%)	
	9 to 12 Years	9(64.3%)	5(35.7%)	
Gender	Male	35(55.6%)	28(44.4%)	0.94
	Female	28(54.9%)	23(45.1%)	
Respiratory depression	Yes	21(72.4%)	8(27.6%)	0.031
	No	42(49.4%)	43(50.6%)	
Myocarditis	Yes	23(50%)	23(50%)	0.353
	No	40(58.8%)	28(41.2%)	
Infection	Yes	24(52.2%)	22(47.8%)	0.585
	No	39(57.4%)	29(42.6%)	
BMI	Normal	53(56.4%)	41(43.6%)	0.87
	Overweight	6(50%)	6(50%)	
	Obese	4(50%)	4(50%)	
Financial status	Poor	25(58.1%)	18(41.9%)	0.538
	Middle	30(50.8%)	29(49.2%)	
	Upper	8(66.7%)	4(33.3%)	

DISCUSSION

Generally, vitamin D deficiency in adult and pediatric population,⁷ which leads to osseous illness like rickets. Further, it may be associated with hormonal disorder, innate immunity,⁹ type 1 and 2 diabetes,¹¹ hypertriglyceridemia, neoplasms, hypertension,¹⁰ and¹² autoimmune disorders.¹³

Various studies updated the data regarding association between vit D deficiency and critical illness in pediatric ICUs. McNally and co workers¹⁴ also confirmed this hypothesis. However, another study by Rippel et al¹⁵ did not find the association of length of stay at hospital or survival with vitamin D deficiency.

In our study, total 114 critically ill patients were recruited. Most of the children were below and equal to 4 years of age and the average age of the children was 4.95±2.7 years and average, our observation was supported by a study done by Hanaa et al.¹⁶

Various studies reveal a graded inverse association of socioeconomic status with this morbidity and mortality.^{17,18} In our study population of 114 pts, Most of them were belonged to middle and poor class as 37.7% to poor and 51.7% to middle class respectively.

Authors are of the view that the role vit D is pivotal for innate immune and cardiovascular¹⁹⁻²⁰ function in addition to bone health.²¹⁻²² Hanaa Ibrahim Rady while analyzed patients admitted in PICU that of 63 critically-ill children, myocarditis was present in 25.3%.²³ In our study out of 114 patients 40.35 were admitted in PICU due to myocarditis. Previous data is evident regarding positive relationship vitamin D levels with illness severity in infected children. Lower respiratory tract infection cases had more risk of hospital admission having lower 25(OH)D levels.²⁴ McNally JD and others documented that patient with bronchiolitis/pneumonia requiring PICU admission were more prone to low vitamin D levels compared to those without LRTI.²⁵⁻²⁶ In our study severe respiratory depression was the cause of 25.44% admission in PICU. Severe blood stream infections alone account for significant morbidity and mortality. Out of 114 children in our study 40.35% were admitted to PICU due to severe infection.

This study demonstrated that, in a sample of critically ill children Frequency of vitamin D deficiency was observed in 55.26% (63/114) children. Our results are supported by recent investigations^{5,15,16} showing that hypovitaminosis D is common in critically ill children. It was observed that 55.26% of the present PICU patients had 25(OH)vitD<20 ng/mL, which is higher than the rate 34.5% reported by Rip-pel et al¹⁵ in a cohort of critically ill Australian children, 40.1% reported by Madden et al¹⁵ in north American children while our results are lower than 69% reported by McNally et al¹⁴ in Canadian children, respectively. In this study, respiratory depression was significantly associated with vitamin D deficiency while myocarditis and infection was not observed statistically associated with vitamin D deficiency. LRTI was more common in admitted cases with vitamin D deficiency, whereas few studies reported in upper respiratory tract infection also.

CONCLUSIONS

A higher prevalence of vitamin D insufficiency/deficiency was identified in children critically ill and admitted in PICU. A higher higher 25(OH) D levels may reduce the severity of critically illness. However, early screening and management may reduce the risk of mortality.

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