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A STUDY OF CORRELATION BETWEEN SERUM VITAMIN D LEVELS WITH LEVEL OF CONTROL OF CHILDHOOD ASTHMA AT PEDIATRICS DEPARTMENT OF NMCH, PATNA, BIHAR

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ABSTRACT

Objective: To study the association between serum vitamin D levels and levels of asthma control in children aged 5-15 years. Methods: Children with physician-diagnosed asthma who were under follow-up for at least 6 months were enrolled. Participants were categorized into three asthma control groups as per standard guidelines, and their serum 25-hydroxy vitamin D levels and pulmonary function tests were compared. Results: Out of 105 children with asthma enrolled in the study, 50 (47.6%) were controlled, 32 (30.5%) were partly controlled and 23 (21.9%) were uncontrolled. Median (IQR) serum vitamin D levels in these three groups were 9.0 (6.75, 15) ng/mL, 10 (6.25, 14.75) ng/mL and 8 (5, 10) ng/mL (P=0.24), respectively. Conclusion: We did not observe any association of serum 25-hydroxy vitamin D levels with the level of control of childhood asthma.

Introduction

`Vitamin D may have a role in asthma due to itswide-ranging effects on airway epithelium,bronchial smooth muscle, and immune cellscentral to the pathogenesis of asthma.

Information on association between vitamin D and levelof control of asthma in children is scarce. We, therefore,studied the association between vitamin D levels and level of control of asthma in children.

Material and Methods

A cross-sectional study was performed in the Department of Pediatrics at NalandaMedical College & Hospital, Patna, Bihar. Childrenwith physician-diagnosed asthma, aged 5-15 years, whohad been in regular follow-up in the clinic for at leastprevious six months were enrolled into the study afterruling out chronic illness, clinical rickets or evidence ofvitamin D supplementation in last six months, and aftergetting informed written consent. We planned to enroll aconvenience sample of 100 children. The study protocolwas approved by the Ethics Committee of the institute.

Detailed clinical history was obtained; this includeddietary habits of the child and numbers of hours spent inoutdoor during daytime to evaluate the sunlight exposureto the child. Respiratory system examination wasperformed. Nutritional status of the child was assessedbased on WHO growth charts.

Spirometry was performed using Master Screen IOS CareFusion, San Diego, California, USA). Wecategorized participants into different asthma controlgroups based on the Global (GINA) guidelines afterassessing the symptoms status in the previous four weeks.

Blood samples (2.5 mL) were collected in the studypopulation in two plain vials. Serum was separated bycentrifuging the sample at -4°C and was analyzed on thesame day for levels of 25-hydroxy vitamin D [25(OH)D]and parathyroid hormone (PTH). Serum calcium,inorganic phosphate and alkaline phosphatase wereanalyzed on the same day using spectrophotometricanalysis. Serum level of 25(OH)D was measured usingchemiluminiscence by using LIAISON (DiaSorin, Italy).

Serum 25(OH)D level of more than 20 ng/mL wasconsidered sufficient, level between 12 and 20 ng/mL asinsufficient, and value less than 12 ng/mL was consideredas deficient.

Data were collected on structured performa andmanaged using MS Excel software. Statistical analysiswas performed using Stata 11.0 (Stata Corp, College Station, TX). We used descriptive statistics for thecharacteristics of the subjects. Fisher's exact test/ chisquaredtest were used for proportions. For continuousvariables, ANOVA or Kruskal-Wallis test were used toassess statistical significance based on the distribution ofvariable (normal and non-normal, respectively). Vitamin D levels in children with different levels of control werecompared by Kruskal-Wallis equality of population ranktest.

RESULTS

A total of 108 children were enrolled into the study; 3children were excluded from analysis because bloodsample was not collected. The characteristics of the 105 enrolled children are shown in Table I.

Asthma status of 50 (47.6%) children werecategorized as controlled, 32 (30.5%) as partlycontrolled, and 23 (21.9%) as uncontrolled. Table IIcompares the pulmonary function tests (PFT) valuesbetween these groups.

The median (IQR) serum 25(OH)D level in the studyparticipants was 9 (6,14) ng/mL. The median serum25(OH)D levels were comparable in the three groupsbased on control of asthma. The prevalence of vitamin Ddeficiency in uncontrolled asthma group was higher

with78.2% children being vitamin D deficient (P=0.52)(Table III).

None of the major spirometric parameters showedstatistically significant correlation with serum vitamin Dlevel except FEF25 (% predicted) (r= 0.22; P=0.02) and PEFR (r=0.19; P=0.049).

The asthma control subgroups did not show anysignificant seasonal differences with the time ofsampling. Median (IQR) cumulative inhaled steroid use were 423 (214.5, 684) mg, 456 (241.5, 576) mg, and 363(330, 600) mg in deficient, insufficient and sufficientvitamin D status groups (P=0.98). Daily sunlightexposure was comparable in vitamin D sufficientparticipants and others (P=0.97).

Table I Comparison Of Characteristics Of Study Subjects Classified By The Asthma Control Status

	Asthma Control Status				
	Whole Group (n=105)	Controlled (n=50)	Partly controlled n=32	Un controlled n=23	P value
Age, in years; mean (SD)	10.6 (2.4)	10.8 (2.5)	10.0 (2.5)	11 (2.2)	0.92
Onset of symptoms in years; mean (SD)	3.2 (2.6)	3.0 (2.7)	3.1 (2.3)	3.6 (2.7)	0.59
Family History of asthma (%)	57(54.3%)	29 (58%)	16 (50%)	12 (52.2%)	0.76
Allergic Rhinitis; n (%)	61 (58.1%)	24 (48%)	18 (56.3%)	19 (82.6%)	0.017
Cough; n (%)	27 (25.7%)	8 (16%)	8(25%)	11 (47.8%)	0.018
Wheeze; n (%)	12 (11.4%)	1(2%)	5(15.6%)	6(26.1%)	0.004
Breathlessness; n (%)	12 (11.4%)	1 (2%)	5(15.6%)	6(26.1%)	0.004
Nasal Symptoms; n (%)	9 (8.5%)	2(4%)	3(9.4%)	4(17.4%)	0.14
Chest pain; n (%)	8 (7.6%)	0 (0%)	5(15.6%)	3(13.0%)	0.006
BMI, kg/m2; mean (SD)	16.6 (3.2)	16.6 (3.1)	16.5 (3.9)	16.7 (2.6)	0.95
Severity of Asthma					
Mild; n (%)	26 (24.8%)	11 (22%)	8(25%)	7(30.4%)	0.76
Moderate; n (%)	62 (59.0%)	31 (62%)	20 (62.5%)	11 (47.8%)	
Severe; n (%)	17 (16.2%)	8(16%)	4(12.5%)	5(21.7%)	
Number of Hospital Admissions in past 1 yr; n	10	4	1	5	0.14
Number of emergency visits in past 1 yr; n	19	8	2	9	0.52
Exacerbations in 1 yr; Median (IQR)	1 (0, 2)	1(0, 2)	1 (0, 2)	2(1, 4)	0.03
Steroid bursts in 1 yr; Median (IQR)	0 (0, 1)	0(0, 1)	0(0, 1)	0(0, 1)	0.86
Steroid (Budesonide) Current Use (mcg/d);	400 (100, 800)	400 (100, 800)	400 (100, 700)	400 (200, 800)	0.30
Median (IQR)					
Duration of use of Inhaled steroids in months;	28 (19, 36)	26 (18, 36)	26.5 (21, 36)	33 (24, 45)	0.127
Median (IQR)					
Symptoms used to assess control					
Day time Symptoms >2/wk; n (%)	11 (10.4%)	0	0	11 (47.8%)	<0.0001
Nocturnal Symptoms (Any); n (%)	36 (34.3%)	0	14 (43.8%)	22 (95.7%)	<0.0001
Limitation of Activities (Any); n (%)	29 (27.6%)	0	11 (34.4%)	18 (78.3%)	<0.0001
Need for Rescue >2/wk; n (%)	20 (19.1%)	0	4(12.5%)	16 (69.6%)	<0.0001
PFT Abnormality; n (%)	27 (25.7%)	0	12 (37.5%)	15 (65.2%)	<0.0001

Abbreviations: PFT: Pulmonary function test; SD: standard deviation; IQR: Interquartile range.

Table II Pulmonary Function Tests In Children With Different Levels Of Control Of Asthma

	Asthma Control Status					
	Whole group (n=105)	Controlled (n=50)		Partly controlled (n=32)	Uncontrolled (n=23)	P value
PFT Abnormality; n (%)	27 (25.7%)	0 (0%)		12 (37.5%)	15 (65.2%)	<0.0001
Percentage Predicted FEV1; Mean (SD)	87.7 (17.4)	94.1	(15.7)	83.3 (16.3)	80.1 (17.9)	0.0009
Percentage Predicted PEFR; Mean (SD)	84.7 (26.8)	93.8	(27.9)	74.5 (16.7)	78.9 (29.8)	0.0025
Percentage Predicted FEV1/FVC; Mean (SD)	95.9 (11.8)	99.9	(8.3)	94.4 (11.6)	89.4 (15.2)	0.001
Percentage Predicted FVC; Mean (SD)	91.3 (16.4)	94.1	(14.6)	87.8 (20.1)	89.8 (13.5)	0.22
Percentage Predicted FEF 25; Mean (SD)	57.9 (25.7)	64.7	(21.6)	52.0 (24.2)	51.2 (32.7)	0.033
Percentage Predicted FEF 75; Mean (SD)	81.6 (25.5)	91.2	(21.3)	73.8 (22.0)	71.4 (31.1)	0.0007

FEV : Forced Expiratory Volume-1 second; FVC: Forced Vital Capacity; PEFR: Peak Expiratory Flow Rate; FEF : Forced Expiratory Flow 75; FEF_{25}: Forced Expiratory Flow 25.

Table III Vitamin D In Different Asthma Control Groups

Characteristic	Asthma Control Status			
	Controlled (n=50)	Partly Controlled (n=32)	Uncontrolled (n=23)	P value
Serum 25(OH)D (ng/mL); Median (IQR)	9.0 (6.75, 15)	10 (6.25, 14.75)	8 (5, 10)	0.24
Serum PTH (pg/mL); Median (IQR)	46.3 (33.0, 64.4)	39.7 (29.9, 55.2)	40.9 (28.9, 62.1)	0.65
Vitamin D status, n (%)				
Sufficient - (25(OH)D >20 ng/mL)	5 (10%)	1 (3.1%)	1 (4.3%)	
Insufficient - (25(OH)D 12-19 ng/mL)	13 (26%)	11 (34.8%)	4 (17.4%)	
Deficient - (25(OH)D <12 ng/mL)	32 (64%)	20 (62.5%)	18 (78.26%)	0.52

DISCUSSION

We did not observe any significant association betweenserum vitamin D levels and the level of asthma control inchildren. We also did not observe any correlation between the 25(OH)D levels and various spirometricparameters (percent predicted) except for a statisticallysignificant positive correlation of vitamin D levels withFEF25 and PEFR values (% predicted).

Limitation of our study was a small sample size. Wedid not collect detailed information about dietary intakes,particularly vitamin D, and did not measure serum IgElevels. We did not have healthy children as controls as we levels of control of asthma.

In a case-control study, Awasthi, et al. reportedsignificant association between asthma control andvitamin D deficiency. In another study, vitamin D levels were lower in children with severe treatment resistantasthma as compared to moderate asthma group andcontrol subjects. In a cross-sectional study among 100 children, Searing, et al. reported positive correlationbetween vitamin D levels and FEV1 (percent predicted)and FEV1/FVC. On the other hand, a study done inThailand by Krobtrakulchai, et al. in 125 asthmaticchildren, vitamin D levels were similar between threeasthma control groups, and there was no associationbetween vitamin D levels and PFT values. Recent trials inchildren and adults with asthma have also failed todemonstrate the effect of vitamin D supplementation onsymptom control.

CONCLUSION

We conclude that there is unlikely to be anyassociation between vitamin D levels and the control ofasthma in children.

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