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To Assess Glycemic Control among Vitamin D Deficient Type 1 Diabetes Mellitus Children At Medical College Hospital, Bikaner Rajasthan

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Abstract

Background: Studies have identified that the deficiency of vitamin D is strongly connected with diabetes mellitus type 1. Vitamin D has the capability to control increased blood glucose level.

Aims: The study appraises the association among vitamin D deficiency, type 1 diabetes mellitus and glycated hemoglobin among children.

Methods: This study was conducted in the Department of Pediatrics and Diabetic Care & Research Centre, P.B.M Hospital, Bikaner, a tertiary care hospital in Northern Rajasthan. Patients presenting to study place, within study period, who fulfilled the inclusion criteria were enrolled for study. Children up to 18 years of age with T1DM were included in this study.

Results: In our study, mean HbA1c in very severe vitamin D deficiency group was 14.52±4.02 gm %, in severe vitamin D deficiency group was 10.95±2.66 gm %, and in suboptimal group was 14.06±2.08 gm %. When we compared severity of vitamin D deficiency with mean HbA1c values, the difference was found statistically highly significant (p=0.001).

Conclusion: Vitamin D deficiency among the patients of diabetes mellitus type 1 was high and was closely related with glycemic control.

Keywords: Vitamin D deficiency; Glycemic control; Type 1 diabetes mellitus.

Introduction

T1DM is a common endocrine, metabolic disorder of childhood and adolescence, with important consequences for physical and emotional development. T1DM affect more than 15 million people in the world. T1DM accounts for approximately 10% of all cases of diabetes mellitus[1]. Using population based estimates of diabetes incidence and prevalence, a recent study indicates that approximately 15,000 youths are diagnosed with T1DM each year[1]. While it accounts for most cases of diabetes in childhood, it is not limited to this age group; new cases continue to occur in adult life and approximately 50% of individuals with T1DM presents as adults.

Vitamin D refers to a group of fat soluble secosteroids, responsible for increasing absorption of calcium, magnesium and phosphate and multiple other biological effects. Vitamin D deficiency has a bearing not only on skeletal but also on extra skeletal diseases.

Vitamin D deficiency is prevalent in children and adolescents with diabetes mellitus[2-5]. The aetiology of this vitamin D deficiency is often attributed to the lack of sun exposure, poor intake of vitamin D containing foods such as salmon, or due to either volumetric dilution[6], or sequestration of vitamin D in fat depots[7].

Some studies shows promising role of vitamin D in prevention or delaying the progression of T1DM, while other shows no such relationship. Thus the current study is aimed to assess vitamin D deficiency in patients of T1DM and to find out the beneficial effects of vitamin D supplementation along with routine insulin therapy on glycemic control.

Material & Methods

Study design- Prospective hospital based interventional study.

Study place- Pediatric Hospital and Diabetic Care & Research Center, Sardar Patel Medical College & Associated Group of Hospitals, Bikaner, Rajasthan.

Study duration- 1 year (1st October, 2017 to 30th September, 2018).

Study population- Children up to 18 years of age, diagnosed with T1DM with vitamin D deficiency.

Sample Size- T1DM diagnosed children with vitamin D deficiency up to 18 years of age, reporting to study place, within study duration were included in study.

Sampling technique- purposive sampling

Study tool- A pre tested structured pro forma used.

Inclusion Criteria

Children with T1DM with vitamin D deficiency (25-OH vitamin D level less than 30 ng/ml), up to 18 years of age, who reports to study place, within study duration, without any exclusion criteria were included in the study.

These children were divided into two groups randomly, comprising equal number of children in each group.

Group A (Intervention group)

Group B (Non intervention group)

Exclusion Criteria

Patients of T1DM with normal vitamin D level (25-OH vitamin D level more than 30 ng/ml), who have history of past or current liver diseases, abnormal renal function, current use of vitamin D or calcium, during pregnancy.

METHOD

This study was conducted in the Department of Pediatrics and Diabetic Care & Research Centre, P.B.M Hospital, Bikaner, a tertiary care hospital in Northern Rajasthan. Patients presenting to study place, within study period, who fulfilled the inclusion criteria were enrolled for study. Children excluded according to exclusion criteria mentioned above. Children up to 18 years of age with T1DM were included in this study. Patient's parents were explained about the study and a written informed consent was obtained. At initiation of study, 25-OH vitamin D levels and HbA1c levels. 25-OH vitamin D levels were assessed by chemiluminescent immunoassay (CLIA) method. Patients with 25-OH vitamin D levels less than 30 ng/ml, were divided into two groups comprising equal number of children in each group.

Data Analysis

After collecting data, they were entered into excel sheet and were analyzed with the help of percentages, frequencies, mean, SD, and appropriate test of significance, wherever applicable.

Results

Table 1: Distribution of Cases according to Initial 25-OH vitamin D level in both groups

25-OH vitamin D (ng/ml)	Group A		Group B		Total	
	No.	%	No.	%	No.	%
<10 (Very Severe)	3	12.0	2	8.0	5	10.0

10-20 (Severe)	16	64.0	16	64.0	32	64.0
20-30 (Suboptimal)	6	24.0	7	28.0	13	26.0
Total	25		25		50	
Mean	14.80		16.34			
SD	5.09		5.14			
T	1.059					
P	0.295					

Table no. 5 shows out of total 50 cases, very severe vitamin D deficiency was found in 10 % (n-5) cases, severe vitamin D deficiency in 64 % (n-32) cases and optimum level in 26 % (n-13) cases. They were divided into Group A and Group B. Mean 25-OH vitamin D level in Group A was 14.80 ng/ml and 16.34 ng/ml in Group B. Both groups were statistically comparable (p>0.05).

Table 2: Correlation of initial 25-OH vitamin D levels with initial HbA1c (overall cases)

25-OH vitamin D (ng/ml)	HbA1c (gm %)		f	p
	Mean	SD		
<10 (Very Severe)	14.52	4.02	8.520	0.001
10-20 (Severe)	10.95	2.66		
20-30(suboptimal)	14.06	2.08		

In our study, mean HbA1c in very severe vitamin D deficiency group was 14.52±4.02 gm %, in severe vitamin D deficiency group was 10.95±2.66 gm %, and in suboptimal group was 14.06±2.08 gm %. When we compared severity of vitamin D deficiency with mean HbA1c values, the difference was found statistically highly significant (p=0.001).

Table 3: Relationship of 25-OH vitamin D levels with duration of insulin therapy (overall cases)

Duration of Insulin use (years)	25-OH vitamin D (ng/ml)		f	p
	Mean	SD		
<1	12.61	3.08	1.727	0.189
1-3	15.50	5.14		
>3	18.08	5.57		

According to above table, mean 25-OH vitamin D level in duration of insulin use <1 year group was 12.61±3.08 ng/ml, in duration of insulin use 1-3 years group was 15.50±5.14 ng/ml, and in >3 years duration of insulin use group was 18.08±5.57 ng/ml. This difference was found statistically insignificant (p>0.05).

Table 4: Distribution of Cases according to gender in relation to 25-OH vitamin D levels in both groups

25-OH vitamin D level (ng/ml)	Gender	Group A		Group B		Total		χ^2	p
		No.	%	No.	%	No.	%		
<10 (Very Severe)	Female	1	33.3	0	-	1	20.0	0.833	0.361
	Male	2	66.7	2	100	4	80.0		
10-20 (Severe)	Female	8	50.0	7	43.8	15	46.9	0.125	0.723
	Male	8	50.0	9	56.3	17	53.1		
20-30 (Suboptimal)	Female	4	66.7	7	100.0	11	84.6	2.758	0.097
	Male	2	33.3	0	-	2	15.4		

Out of total 5 patients in very severe deficient group, 1 was female and 4 were male, out of which 1 female was in Group A and equal number of male (2 in each) in both Group A and Group B. Out of total 32 severely deficient patients, 15 were female and 17 were male. Out of 15 female 8 were in Group A and 7 were in Group B. Out of 17 males, 8 were in Group A and 9 were in Group B. Out of total 13 suboptimal level patients, 11 were females and 2 were males. Out of 11 females, 4 were in Group A and 7 were in Group B. Both 2 males were in Group A and no males were in Group B.

There were total 27 females and 23 males, they were assessed on the basis of number of cases, gender wise in each vitamin D deficiency subgroup, There were comparable number of cases in both Group A and Group B subgroups. On applying chi square test, all groups had insignificant difference (p>0.05) and statistically comparable.

Table 5: Distribution of Cases according to residential area in relation to 25-OH vitamin D levels in both groups.

25-OH vitamin D level (ng/ml)	Residential Area	Group A		Group B		Total		χ^2	p
		No.	%	No.	%	No.	%		
<10 (Very Severe)	Rural	2	66.7	1	50.0	3	60.0	0.139	0.709
	Urban	1	33.3	1	50.0	2	40.0		
10-20 (Severe)	Rural	9	56.3	12	75.0	21	65.6	1.247	0.264
	Urban	7	43.8	4	25.0	11	34.4		
20-30 (Suboptimal)	Rural	6	100	4	57.1	10	76.9	3.343	0.067
	Urban	0	-	3	42.9	3	23.1		

Out of total 5 very severe deficient cases, 3 belonged to rural area and 2 belonged to urban area, out of 3 rural patients, 2 were in Group A and 1 was in Group B. Out of 2 urban patients, one was in Group A and one was in Group B. In total 32 severely deficient cases, 21 were from rural areas and 11 were from urban areas. Out of 21 rural patients, 9 were in Group A and 12 were in Group B. Out of 11 urban patients, 7 were in Group A and 4 were Group B. In total 13 suboptimal level patients, 10 were from rural area and 3 were from urban area. Out of total 10 rural area patients, 6 were in Group A and 4 were in Group B. All 3 urban patients were in Group B, no patients in Group A.

All cases were randomly allotted in all groups. There was equal distribution of cases in both Group A and Group B subgroups, locality wise. On applying chi square test, all groups had insignificant difference and statistically comparable ($p>0.05$).

Table 6 Distribution of Cases according to duration of insulin therapy (years) in both groups.

25-OH vitamin D level(ng/ml)	Duration of Insulin (years)	Group A		Group B		Total		χ^2	p
		No.	%	No.	%	No.	%		
<10 (Very Severe)	<1	1	33.3	0	-	1	20.0	2.222	0.329
	1-3	2	66.7	1	50.0	3	60.0		
	>3	0	-	1	50.0	1	20.0		
10-20 (Severe)	<1	3	18.8	1	6.3	4	12.5	1.693	0.429
	1-3	11	68.8	14	87.5	25	78.1		
	>3	2	12.5	1	6.3	3	9.4		
20-30 (Suboptimal)	<1	0	-	0	-	0	-	0.660	0.416
	1-3	4	66.7	6	85.7	10	76.9		
	>3	2	33.3	1	14.3	3	23.1		

In present study, out of total 25 Group A cases, 3 cases had very severe vitamin D deficiency and out of them 1 and 2 had their duration of insulin use, <1 years and 1-3 years respectively, while in Group B only 2 cases had very severe vitamin D deficiency and 1 each case had their duration of insulin use 1-3 years and >3 years.

In severe vitamin D deficiency group, out of total 16 cases, 3, 11 and 2 cases of Group A had their duration of insulin use <1, 1-3 and >3 years respectively and in Group B, out of total 16 severe vitamin D deficiency cases, 1, 14 and 1 cases had their duration of insulin use <1, 1-3 and >3 years respectively.

In suboptimal vitamin D deficiency group, out of total 6 Group A cases 4 and 2 cases had their duration of insulin use 1-3 and >3 years respectively and in Group B, out of total 7 cases, 6 and 1 cases had their duration of insulin 1-3 and >3 years respectively.

All cases were randomly allotted in all groups. On applying chi square test, both Group A and Group B cases had insignificant difference on the basis of duration of insulin therapy and statistically comparable.

Discussion

The present study was conducted at Department of Pediatrics & Diabetes Care & Research Centre, Sardar Patel Medical College, Bikaner (Rajasthan) from 1st October 2017 to 30th September 2018. In this study total 60 type 1 diabetes mellitus children, up to 18 years of age were screened. Ten cases were excluded according to exclusion criteria, 7 were with normal vitamin D levels, 2 were lost in follow up and 1 was with abnormal renal function test.

Various workers found different observations regarding vitamin D levels in type 1 diabetes mellitus patients. In our study, out of total 60 cases, 53 (88%) cases were 25-OH vitamin D deficient, 7(12%) cases were with normal 25-OH vitamin D levels.

Our results are in line with observation reported by Abbas et al[8]. They observed that 84% of T1DM children were vitamin D deficient.

Similarly Bener et al[9], observed that 90.6 % of T1DM children were with vitamin D deficient levels.

Whereas Mutlu et al[10] found that vitamin D deficiency was present in 37.5% (n=45) patients only, from total 120 children of T1DM.

In our study, maximum cases (64%) were in severely deficint group followed by in suboptimal level group (26%) and very severely deficient group (10%). All cases divided randomly into Group A and Group B. Mean 25-OH vitamin D level in group A was 14.80 ng/ml and 16.34 ng/ml in Group B. Both groups had insignificant difference and statistically comparable (p>0.05).

Our results are comparable to Bener et al[9]. They observed that in 25-OH vitamin D deficient, type 1 diabetes mellitus children, 68% cases were below 20ng/ml level and 32% cases were between 20-30 ng/ml level.

Our results differ in observation reported by Svoren et al[11]. They observed 80% cases were with suboptimal level and 20 % were with below 20 ng/ml level.

Similar observation reported by Abbass et al[8]. They observed that 64 % cases were from suboptimal level group.

In our study mean HbA1c in very severe vitamin D deficiency group was 14.52±4.02 gm%, in severe vitamin D deficiency group was 10.95±2.66 gm%, and in suboptimal group was 14.06±2.08 gm%. When we compared severity of vitamin D deficiency with HbA1c values, the difference was statistically highly significant (p=0.001). We have not observed any particular correlation between severity of 25-OH vitamin D deficiency and HbA1c values.

Our results are similar to observation by Simmons et al[95]. They did not observed any association between degree of glycemic control (HbA1c levels) and 25-OH vitamin D levels.

Although Buhary et al[96] found an inverse correlation between serum 25-OH vitamin D levels and HbA1c values (r= -0.16, P <0.000001).

Svoren et al[94] also observed inverse correlation between 25-OH vitamin D levels and HbA1c values (p=0.05) in their cross sectional study.

In our study, mean 25-OH vitamin D level in duration of insulin use <1 year group was 12.61±3.08 ng/ml, in duration of insulin use 1-3 years group, was 15.50±5.14 ng/ml, and in >3 years duration of insulin use group, was 18.08±5.57 ng/ml. The difference was statistically insignificant (p>0.05). In our study, we did not find any correlation between duration of insulin use and 25-OH vitamin D levels.

Conclusion

Vitamin D deficiency among the patients of diabetes mellitus type 1 was high and was closely related with glycemic control.

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