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Original Research Article

Assessment of growth among children with type 1 diabetes mellitus

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ABSTRACT

Background: As insulin is important regulator of growth hormone related factors, especially insulin like growth factors (IGF-1) and insulin like growth factors binding proteins (IGFBP-3), disorders of insulin production can result in poor growth. Studies suggest that growth abnormalities are common in subjects with poor metabolic control and longer disease duration. Growth parameters are important indicators of a child overall health and they are influenced by factors like blood glucose control in diabetic children.
Methods: After obtaining institutional ethical committee clearance and informed consent from parents/subjects, a prospective observational study was conducted from January 2018 to June 2019. Anthropometry of each participant (height, weight, BMI) measured and 4 ml of venous blood was collected for HbA1C levels. Results were compared with age specific standards. Anthropometry and blood investigations performed once in 3 months for 1 year.
Results: Out of 30 cases, 53.3% (n=16) were males and 46.7% (n=14) were females with M:F ratio of was 1:1.04. Among those with poor HbA1C control 73.69% (n=14) had short stature at the entry of the study and the results was statistically significant (p=0.043). Among those with poor HbA1C control, 72.73% (n=08) had short stature at the one year follow up and the results was statistically significant (p=0.017). Which suggests that linear growth in children with type 1 diabetes is highly related to glycemic control.
Conclusions: Growth was compromised in diabetic children. Children diagnosed at younger age need monitoring of good glycemic control and drug compliance to optimize the growth.

Keywords: T1DM, HbA1C, Height

INTRODUCTION

Diabetes mellitus (DM) is chronic metabolic disorder affecting almost 6% of the world's population. Type 1 DM (T1DM) accounts for approximately 10% of all cases of diabetes. The diabetes atlas 2017 estimates that there are 128,500 children and adolescents with diabetes in India.[1] Genetic susceptibility for T1DM in a child with diabetic parents is estimated about 3%.[2]

DM characterized by hyperglycemia as a cardinal biochemical feature. Understanding of natural history of T1DM has changed dramatically over the last three decades with the combination of-genetic, autoantibody and metabolic markers of the disease. Genetically susceptible individuals with a fixed number of β cells when exposed to a putative environmental trigger, develop β-cell autoimmunity. This process, marked by the development of islet cell reactive auto antibodies, pretends the development of activated auto reactive T cells capable of destroying β cells, resulting in a progressive and predictable loss in insulin secretory function.[3]

T1DM adversely affects linear growth. Growth and pubertal spurt in diabetic children is affected due to abnormalities in physiological bone growth and perturbations in growth hormone-insulin like growth factor-Insulin (GH-IGF-I) axis.[4-8]

Aims and objectives

Aim and objectives of the study were to assess the relationship between growth and metabolic control in children with T1DM and to study the effect of duration of illness on growth.

METHODS

After obtaining institutional ethical committee clearance and informed consent from parents/subjects.

Study type

Prospective observational study was conducted.

Study place

Study conducted at Mysore medical college and research institute, Mysore from January 2018 to June 2019.

Inclusion criteria

All children with diagnosed T1DM aged between 4-16 years of age on treatment at Cheluvamba hospital were included in the study.

Exclusion criteria

Patients on medication other than insulin for blood glucose control or with known comorbidities (celiac disease, untreated hypothyroidism, Addison's disease, HIV/AIDS, renal failure and other chronic diseases) were excluded from the study.

Statistical analysis

Statistical analyses were carried out using SPSS (version 16). Microsoft Word was used to create text and generate tables and graphs. Differences in means were tested using Student's t test. CHI square test was used to look for association in two-by-two variables.

Anthropometry of each participant (height, weight, body mass index) was measured and 4ml of venous blood was collected for HbA1C levels. Anthropometry and blood investigations performed once in 3 months for one year.

The WHO growth charts were used for growth assessment. Stadiometer was used to measure standing height. Failure to attain optimal linear growth, defined as height below two standard deviation from mean height. Height for age between -2 and -3 standard deviation is classified as moderate stunting. Height for age below -3 standard deviation is classified as severe stunting.

RESULTS

Out of 30 diagnosed cases of T1DM included in this study population and were followed up for one year. The study results were analyzed with appropriate statistical methods.

The 43.3%, (n=13) were in the age group 5 to 10 years and 56.7%, (n=17) were in the age group >10 years. The 53% (n=16) were males and 47% (n=14) were females, 56.7% (n=13) of the study subjects had normal height and 43.3% (n=17) of the study subjects had short stature at beginning of the study and the result was not statistically significant (p=0.985) (Table 1, Figure 1 and 2).

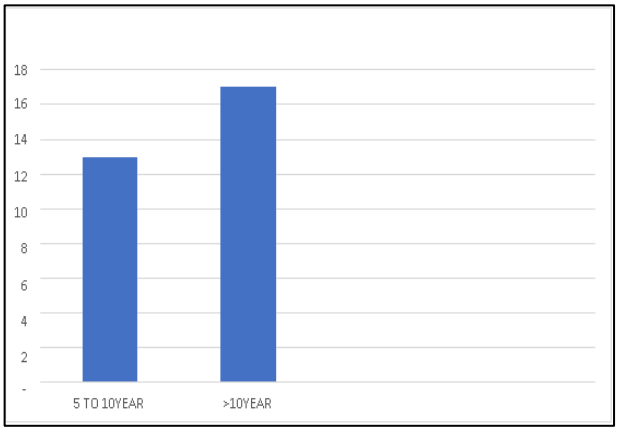

Figure 1: Age wise distribution.

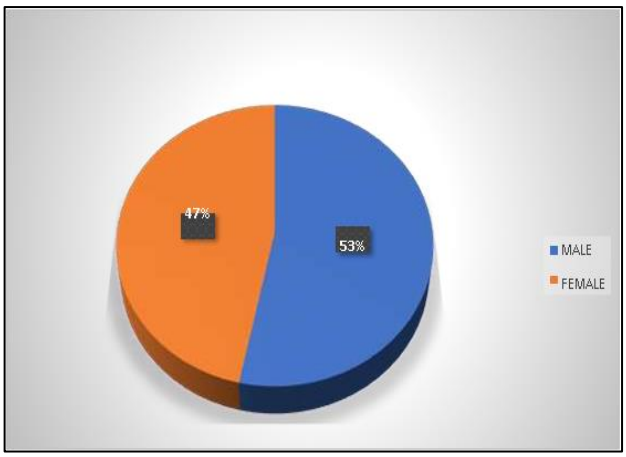

Figure 2: Sex wise distribution of study population.

Table 1: Height at the entry into study.

Height at entry of study	N	Percent (%)
Normal	13	56.7
Short	17	43.3
Total	30	100

Out of 30 cases, 4 (80%) out of 13 with normal height with 1 (20%) out of 17 with short at the beginning of the study had good HbA1C. Eight out of 15 cases with normal height and 1 out of 15 cases with short stature had good HbA1C at the end of the study.

Among those with poor HbA1C control, 73.69% (n=14) had short stature at the entry of the study and the results was statistically significant (p=0.043). Among those with poor HbA1C control, 72.73% (n=08) had short stature at the one year follow up and the results was statistically significant (p=0.017).

That is children with good glycemic control had less growth shortening. Mean growth velocity for height in children with T1DM is significantly affected compared to normal children and was statistically significant with p=0.010.

In this study we observed that children with poor glycemic control had more decline in their growth velocity and longitudinal growth of children with good glycemic control was less affected.

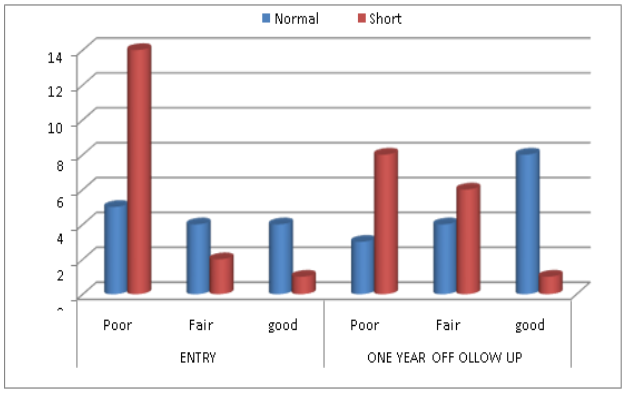

Figure 3: HbA1C at the entry and end of the study and at one year follow up.

Table 2: Relationship between height at the entry of study and HbA1C.

HbA1C	Normal at entry of study		Short at entry of study		Total	
	N	%	N	%	N	%
Poor	05	26.31	14	73.69	19	100
Fair	04	66.6	02	33.4	06	100
Good	04	80	01	20	05	100
Total	13	43.3	17	56.7	30	100

Table 3: Relationship between height at one year of follow up and HbA1C.

HbA1C	Normal at one year of follow up		Short at one year of follow up		Total	
	N	%	N	%	N	%
Poor	03	27.27	08	72.73	11	100
Fair	04	40	06	60	10	100
Good	08	88.8	01	11.2	09	100
Total	15	50	15	50	30	100

Table 4: Comparison of growth velocity (height) of diabetic children with normal children.

Age group (in years)	Mean growth velocity	
	Normal children	Diabetic children
4 to 16	4.6 cm	3.76 cm

DISCUSSION

T1DM is one of the most common chronic endocrine disorders among children and adolescents, and its complications, including impaired childhood growth, remain a major concern. In this study, we aimed to address the relationship between metabolic control and the growth status in children with T1DM.

In the study group,43.3%, (n=13) were in the age group 5 to 10 years and 56.7%, (n=17) were in the age group of more than 10 years. In a study by Salerno et al the mean age at onset was found to be 8.5±3.2 years.[7]

Out of the 30 cases, 53’3% (n=16) were males and 46.7% (n=14) were females. Among the children who were short at entry of study M:F ratio was 1:1.4. There was no sex predominance in our study. In a study by Gale et al it has been described that the overall sex ratio is almost equal in diabetic children under 15 years.[12] Although data from various regions suggest a slight high incidence in male population and a lower incidence in female population. On an average both genders carry almost equal risks.

Among those with poor HbA1C control 73.69% (n=14) had short stature at the entry of the study. The 72.73% (n=08) had short stature at the one year follow up and the results were statistically significant (p=0.043) In a study by Joyce et al HbA1c level<8% were associated with growth acceleration and the most severe growth retardation occurred when HbA1c levels were>16%.[13]

The results of that study demonstrated that the linear growth velocity in children with type 1 diabetes is highly related to glycaemic control. That is children with better glycemic control had less growth shortening.

Limitations

We did not evaluate IGF1 concentrations which could have further helped in understanding the reason for lower height velocity and reduced final height.

CONCLUSION

In our study 30 diagnosed cases of T1DM were included and were followed up for one year. In this study we observed that children with poor glycemic control had more decline in their growth velocity and longitudinal growth of children with good glycemic control was less affected. We conclude that children with T1DM are shorter and have lower growth velocity for height in comparison with healthy children. Better glycemic control was associated with better linear growth velocity.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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