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EVALUATION OF OFFICE BASED MANAGEMENT OF TYPE 1 DIABETES MELLITUS IN CHILDREN

KEYWORDS: Type 1 DM, Basal Bolus regimen, Growth, Nephropathy

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ABSTRACT Individuals with Type 1 DM confront serious lifestyle alterations. Impairment of growth and susceptibility to infections may also accompany chronic hyperglycemia. The present study aims at longitudinally analyzing the glycemic control, growth and complications in children with type 1 DM.
In an observational, cross sectional field study conducted over a period of 24 months, 50 children of Type 1 DM on treatment were analyzed.
The commonest symptoms were polyuria, polydipsia, weight loss and polyphagia with a significant number of patients presenting with Diabetic ketoacidosis. The basal bolus regimen helps to achieve better glycemic control. Poor glycemic control has a direct effect on development of complications including impaired growth velocity and early changes of diabetic nephropathy.

Introduction
Diabetes mellitus (DM) is the commonest endocrine disorder of childhood and adolescence characterized by hyperglycemia as a cardinal biochemical feature. Individuals with Type 1 DM confront serious lifestyle alterations that include an absolute daily requirement for exogenous insulin, the need to monitor their glucose level, and modify dietary intake.[1]

Children with DM have varied presentations including polyuria, polydipsia and weight loss. Many of the children present in frank ketoacidosis as the initial presentation of DM. Impairment of growth and susceptibility to infections may also accompany chronic hyperglycemia.

Efficient office based management of DM depends largely on the principles of insulin action and dosage adjustment, meal planning, growth assessment and the effects of exercise.[2]

The present study aims at longitudinally analyzing the glycemic control, growth and complications in children and adolescents with type 1 Diabetes Mellitus and the factors that determine these parameters.

Subjects and Methods –
In an observational, cross sectional field study conducted over a period of 24 months, 50 children (28 boys) less than 18 years of age who were diagnosed with Type 1 DM and on treatment for at least 6 months were included.

Details of the illness were recorded with reference to age of onset and symptoms at the time of presentation. Complete physical examination, measurement of growth parameters and systemic examination were carried out.

Biochemical analysis including blood glucose levels, microalbuminuria and glycosylated Hemoglobin estimation were recorded as per protocol of management. Changes in insulin regimen as compared to onset of illness and present status and requirement were also noted.

OBSERVATIONS AND RESULTS
The average age of onset was 8.04 years with almost equal gender distribution.

Polyuria was the most definite symptom of T1DM seen in 100% of the cases followed by polydipsia and weight loss. 42 (84%) children presented with ketoacidosis at the time of diagnosis.

Table 1- Symptoms at presentation

Symptom	Polyuria	Polydipsia	Polyphagia	Ketoacidosis	Weight loss	Infections at onset
N = 50	50	47	19	42	32	10
% present	100	94	38	84	64	20

The average duration of illness at the time of analysis was 1.7 years (6 months to 7 years) with an average blood sugar level of 458.8 mg/dl (220 to 640 mg/dl) and HbA1C of 12.4(7.5 to 16). Average C peptide levels were low (0.29).Basal bolus Regimen of Insulin therapy was used in 3 children and Split mix regimen in 47 children.

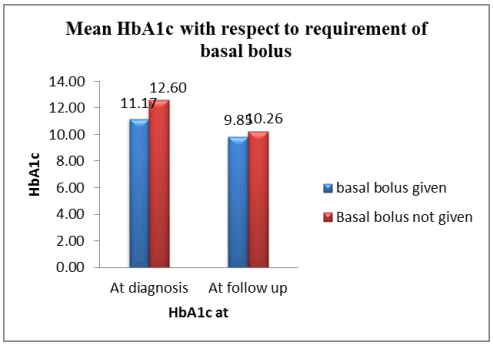

Chart 1 - Comparison of mean HbA1c with respect to insulin regimen.

By using 2 independent sample t-test p-value > 0.05. Though there is no statistically significant difference between mean HbA1C with respect to receiving basal bolus regimen at diagnosis and at follow up, the figures demonstrate better glycemic control (lesser HbA1C) for those who were on the basal bolus regimen

Growth was assessed on the basis of 'z' scores calculated for the height, weight and BMI. The values were grouped in 3 different ranges with <-0.2 suggesting growth faltering in either height or weight or BMI. 26% of the children enrolled were faltering in height while 24% were faltering in weight

Table 2: Comparisons of mean HbA1c with respect to z-score for height at follow up

	Z score for Height	Number of patients	HbA1c (Mean ± SD)	p-value
At Diagnosis	< -2	50	13.46 ± 1.48	0.011

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	-0.2 to 0.2	50	12.07 ± 1.76	
At follow up	< -2	50	10.85 ± 2.36	0.262
	-0.2 to 0.2	50	9.98 ± 2.32	

By using 2 independent sample t-test p-value > 0.05 therefore there is no significant difference between mean HbA1c with respect to z score for height at diagnosis and at follow up.

Only 8% monitored their sugars as per the advice given at enrollment .The data suggests that there is a mild negative correlation (-0.21) between the frequency of BSL monitoring and the HbA1c levels on follow up thus implying, better glycemic control in children who did frequent BSL monitoring.

A total of 19 children (38%) had a family history of DM, 6 of which were T1 and 13 were T2 DM. 5 children had developed microalbuminuria. The average duration of illness of the children who had microalbuminuria was 5 years while the mean HbA1c for these children was 9.96%.

Discussion

Presentation of type 1 diabetes peaks occur in 2 age groups: at 5-7 year of age and at the time of puberty with the 1st peak possibly corresponding to the time of increased exposure to infectious agents coincident with the beginning of school; the 2nd peak may correspond to the pubertal growth spurt induced by gonadal steroids and the increased pubertal growth hormone secretion (which antagonizes insulin).

The average age of presentation in our study was 8.04 years which corresponds to others studies where it ranges from 8.9 to 9.7 years.[3,4]

Incidence of type 1 diabetes is known to equally affect both genders with no preponderance towards either sex noted by others as well. [5]

The predominant symptoms of type 1 diabetes mentioned at the time of presentation include polydipsia, polyuria and polyphagia and weight loss [6]

Ketoacidosis is responsible for initial presentation of many diabetic children and is more likely to be present in children younger than 5 years of age because the diagnosis may not be expected at that age and the symptoms of polyuria, polydipsia and polyphagia may not be elicitable. Occasionally, the illness may be precipitated by an infection.

In our study the most common complaint was polyuria with all 50 participants (100%) complaining of polyuria, whereas 47 (94%) gave history of polydipsia and 19 (38%) gave history of polyphagia. 32 out of the 50 subjects had weight loss in the preceding weeks and 10 out of the 50 developed an infection which precipitated the illness. This is comparable with other studies where polyuria ranged from 80 – 83%, [7]polydipsia ranged from 77 – 85%. [8] .Ketoacidosis as initial presentation was seen from 5.8 – 48% by various authors. It was very high (84%) in our study. The possible reason for this observation could be due to the fact that ours was a tertiary care unit where in patients was refereed for management.

HbA1c value, apart from being one of the diagnostic tests of type 1 diabetes, is also the most important markers of long term glycemic control in these patients. In our study, the HbA1c values at diagnosis ranged from 7.5 to 16 with average HbA1c being 12.4. On follow up, most patients showed a decrease in HbA1c with values ranging from 4.4 to 15 and the average being 10.2. The comparison of HbA1c values at diagnosis and follow up shows significant reduction (p-value < 0.05) therefore there is a statistically significant difference between mean HbA1c at diagnosis and at follow up.

The dynamic relationship between carbohydrate intake, physical activity and insulin should be stressed from the very first moment. The insulin treatment modality should be as physiological as possible, but with consideration of the patient's and caregiver's preferences. Regular and NPH insulin may be mixed in the same syringe, given as pre-mixed insulin or given as separate injections.

A basal bolus regimen with Regular and NPH is preferred to pre-mixed insulin preparations. In our study, only 3 out of 50 children were on a basal bolus regimen at diagnosis while the rest were on a split-mix regimen. This was largely due to the cost of daily insulin being higher in basal bolus regime. A comparison of HbA1c between the children on basal bolus regimen and those on a split mix regimen showed that those on the basal bolus regimen, had a comparatively lower HbA1c than those on split mix regimen thus suggesting that the former was more effective. Similar findings were reported be Khadilkar et al, [9] Hathout EH et al [10] and Colino [11] et al in their studies.

In our study, we took anthropometric measures of all the included children on follow up and calculated 'z' scores for height, weight and BMI. Growth velocity was then assessed by dividing the children into 3 groups (<-2, -2 to 2, <2) based on their 'z' scores for height. 13 out of the 50 children had a 'z' score <-2 thus suggesting that they were faltering in height. The HbA1C values for these 12 children were assessed and it was found that the mean HbA1C was higher for all those who were faltering in height. This suggests that good glycemic control along with the genetic and environmental influence does have a role to play in the growth velocity also noted in other studies.[12, 13]

In our study, 5 children had presence of microalbuminuria on follow up. The mean duration of illness in all these children was 5 years while mean HbA1c levels were 9.96 suggesting poor glycemic controls. [14]

Conclusions –

- Type 1 Diabetes is the commonest endocrine disorder of childhood with peak age of onset being in the adolescent and pre-adolescent age groups with no sexual preponderance.
- The commonest symptoms of Type 1 Diabetes include polyuria, polydipsia, weight loss and polyphagia with a significant number of patients presenting with Diabetic ketoacidosis.
- Of the current insulin regimens being practiced, the basal bolus regimen has proven to help achieve better control and thus should be the regimen of choice wherever possible.
- Glycosylated Hemoglobin (HbA1c) is the best marker of prolonged glycemic control and is influenced by multiple factors including duration of illness, insulin regimen and compliance, diet and frequency of blood glucose monitoring.
- Poor glycemic control has a direct effect on development of complications including impaired growth velocity and early changes of diabetic nephropathy.

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