

Characteristics of children and adolescents at onset of type 2 diabetes in a Tertiary Hospital in Bangladesh

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ABSTRACT

Introduction: Recent data show that the prevalence of diabetes among children and adolescents is increasing in some ethnic groups. The worldwide epidemic of childhood obesity has been accompanied by an increase in the incidence of type 2 diabetes (T2D) in youth. **Methods:** The aim of this study was to describe the baseline characteristics of children and adolescents diagnosed ≤ 18 years who had features of T2D and presented at Changing Diabetes in Children, Paediatric Diabetes Clinic at Bangladesh Institute of Research and Rehabilitation of Diabetes, Endocrine, and Metabolic Disorders. All patients who were newly diagnosed and came to the clinic from March 2011 to March 2015 were included. **Results:** Among 939 newly registered patients, 77 (8%) had a diagnosis of T2D. The age at diagnosis was 9–10 years in 11 patients (14%), 11–14 years in 46 (60%) and 15–17 years in other 20 patients (26%). Majority of the children had a positive family history of T2D (94%) and 58% were obese. Median fasting insulin (27.9 [17.3–99.3]) was high in 76% patients. Insulin was started initially along with metformin in 40 patients and could be stopped in six patients in 3 months. **Conclusion:** Our study reflects that T2D is emerging as a problem in children and adolescents in Bangladesh.

Key words: Bangladesh, children and adolescents, type 2 diabetes

INTRODUCTION

Type 1 diabetes (T1D) is one of the most common chronic diseases among children and adolescents. Type 2 diabetes (T2D) is not common in children and regarded as a disease of adults and occurs most often during the second

decade of life. However, recent data show that the prevalence among children and adolescents is increasing in some ethnic groups.^[1-4] The worldwide epidemic of childhood obesity has been accompanied by an increase in the incidence of T2D in youth, which now accounts for 8–45% of new pediatric cases in urban diabetes centers.^[5-8] It is of more concern that T2D was seen initially in older children and now prediabetes and diabetes have become encountered in even younger children. In a study done in school-going children in India, the prevalence of prediabetes was 3.7%.^[9] The prevalence of IFG (95% CI) was 3.4% (2.63 - 4.17) and T2DM was 1.8% (1.23 - 2.37) in a study done in different schools in Bangladesh.^[10] The global increase in incidence has become a major concern now and obesity, lack of physical activity,

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and sedentary life style might have a causative role. The development of T2D in early age is likely to be associated with earlier development of complications. As because comorbid characteristics of insulin resistance are commonly present at diagnosis or appear early in the course of T2D, they should be screened earlier than T1D where these disorders are generally seen as complications of long-standing diabetes rather than as comorbid condition.^[11-13]

To the best of our knowledge, there is hardly any specific study on clinical characteristics of T2D in children and adolescents in our country. We aimed to determine the baseline characteristics of T2D in children and adolescents who are coming for follow-up in Changing Diabetes in children (CDiC) Diabetes Clinic in Bangladesh Institute of Research and Rehabilitation of Diabetes, Endocrine, and Metabolic Disorders (BIRDEM), the largest Paediatric Diabetic Center in Bangladesh.

METHODS

This observational cross-sectional study was done with children and adolescents diagnosed at ≤ 18 years who had features of T2D ($n = 77$) presented at CDiC Paediatric Diabetes Clinic at BIRDEM, a Tertiary Care Hospital in Bangladesh. These patients were newly diagnosed who came to the clinic from March 2011 to March 2015. All patients had measurements of fasting and 2 h postprandial plasma glucose with 1.75 g/kg or 75 g of glucose; diabetes mellitus was diagnosed as fasting plasma glucose (FPG) ≥ 7 mmol/L or 2 h postglucose load ≥ 11.1 mmol/L.^[14]

In a resource-limited developing country like Bangladesh, C-peptide, antibody or insulin level are not routinely done to classify the type of diabetes rather classify on clinical basis.

The following criteria were considered in diagnosing T2D:

- Presence of obesity or overweight
- Positive family history
- Presence of acanthosis nigricans
- Other features of metabolic syndrome, for example, polycystic ovary syndrome and dyslipidemia
- Availability of fasting insulin level.

CDiC is a dedicated Paediatric Diabetes Clinic with multidisciplinary team managing diabetes in children and adolescents. This clinic gets referrals from all parts of Bangladesh, as services are provided at subsidized cost or with nominal fees. Informed consent was obtained from the parents to use the data of the children and adolescents and the family members for scientific purposes.

Details of demographic and clinical history were recorded. We looked for acanthosis nigricans in all patients. Blood

pressure was measured by auscultation after 5 min of rest, and hypertension was diagnosed when blood pressure was $\geq 95^{\text{th}}$ percentile for age and sex.^[15]

The body mass index (BMI) was calculated as weight in kilogram divided by square of the height in meter. BMI was calculated and classified using the cutoff points ($\geq 85^{\text{th}}$ percentile overweight and $\geq 95^{\text{th}}$ percentile as obese) using the Center for Disease Control and Prevention growth chart.^[16] Waist circumference was measured along with height and weight. A cutoff of 0.5 was used to differentiate low waist to height ratio (WHtR) from high WHtR.^[17,18] Investigations such as fasting blood glucose, glycated hemoglobin (HbA1c), and lipid profile were routinely done in all patients at diagnosis. Estimation of blood glucose and lipid profile was done by enzymatic colorimetric method using multichannel auto analyzer. Total cholesterol >200 mg/dl, triglyceride >150 mg/dl, low-density lipoprotein cholesterol >130 mg/dl, and high-density lipoprotein cholesterol <40 mg/dl were designated abnormal.^[19,20] Insulin resistance index was determined by homeostatic model and calculated as the product of the fasting plasma insulin level ($\mu\text{Unit/ml}$) and the FPG level (mmol/l), divided by 22.5.^[21] HbA1c was assessed by Clover A1c using photoelectric method.

Data were processed using the Statistical Package for the Social Sciences (SPSS) (SPSS Inc, Chicago, IL, USA). Summary statistics are reported as mean \pm standard deviation if normally distributed or median and interquartile range for skewed data.

RESULTS

Over 4-year period, 939 patients were registered at CDiC clinic. Among them, 77 (8%) had a diagnosis of T2D. Girls were predominating (female:male - 1.8:1). The age at diagnosis was 9–10 years in 11 patients (14%), 11–14 years in 46 (60%), and 15–17 years in other 20 patients (26%). Majority of the children had a positive family history of T2D (94%); parental history was present in 58 (74%) and 53 (70%) had second degree family history (grandparents with T2D) [Table 1].

At diagnosis, 49 patients (63%) had typical and 26 (34%) had atypical symptoms [Table 1]. Among the atypical symptoms, 8% patients had undue fatigability and enuresis and 4% girls had pruritus vulvae. Only two (3%) patients presented with diabetic ketoacidosis. Two patients were asymptomatic who were diagnosed incidentally while tested because of obesity and/or strong family history. Majority of the children had acanthosis nigricans (74%).

Only seven children (9%) had normal weight, 33% was overweight, and 58% were obese [Table 2]. The WHtR was high in all children and adolescents with a mean value of 0.59 ± 0.056 [Table 2].

Twenty-five (32%) patients had hypertension during diagnosis. They were advised to follow-up with weight-reducing dietary advice.

Fasting insulin could be done in only 21 patients (mean - 63.9 ± 72.0) and was high in 76% patients and in others, it was within upper normal range. Isolated hypertriglyceridemia was found in 13%, hypercholesterolemia in 35%, and combined hyperlipidemia in 6% patients.

Life style modification was advised to all, providing emphasis on diet and exercise. Mean HbA1c was 10.6 ± 2.7

Table 1: Demographic status among children and adolescents with T2D (n=77)

| Characteristics | n (%) |
|------------------|---------|
| Age at diagnosis | |
| 10 years | 11 (14) |
| 11-14 years | 46 (60) |
| 15-18 years | 20 (26) |
| Gender | |
| Male | 26 (34) |
| Female | 51 (66) |
| Area | |
| Urban | 66 (86) |
| Rural | 11 (14) |
| Family history | |
| Positive | 72 (94) |
| Negative | 4 (5) |
| Unknown | 1 (1) |

Table 2: Clinical characteristics of T2 D children and adolescents

| Characteristics | n (%) mean |
|-------------------------------|--------------------|
| Symptoms | |
| Typical symptoms | 49 (63%) |
| Atypical | 26 (34%) |
| Asymptomatic | 2 (3%) |
| BMI | |
| Normal weight | 7 (9%) |
| Overweight | 25 (33%) |
| Obese | 45 (58%) |
| Mean WHtR | 0.59 ± 0.05 |
| Blood pressure | |
| Mean systolic(mm of Hg) | 112 ± 11.5 |
| Mean diastolic(mm of Hg) | 71.6 ± 7.6 |
| HbA1c at diagnosis (mmol/l) | 10.6 ± 2.7 |
| HbA1c after 3 months (mmol/l) | 8.0 ± 2.0 |
| Fasting Insulin (μ U/ml) | $27.9 (17.3-99.3)$ |
| HOMA-IR | $14.8 (8.8-75.4)$ |
| TG (mg/dl) | 177.82 ± 76 |
| Cholesterol (mg/dl) | 176.1 ± 35.1 |
| LDL (mg/dl) | 86.0 ± 33.9 |
| HDL (mg/dl) | $30 (26-68.2)$ |

at diagnosis. Forty patients had their HbA1c >9 who were in high-risk group and insulin was started initially along with metformin. In other patients, monotherapy ($n = 37$) with metformin was prescribed. The insulin could be stopped in six patients within 3 months. All of them had symptoms of hypoglycemia. In monotherapy group, metformin was stopped in two patients in 3 months. The HbA1c could be done in 38 patients after 3 months (mean 8.0 ± 2.0) [Table 2].

DISCUSSION

The highest prevalence of T2D in children has been reported from Japan.^[22] The rising prevalence of the disease has now been reported from various parts of the world including Australia, New Zealand, Japan, Hong Kong, the United Kingdom, Libya, Bangladesh^[23] as well as the Arabian Gulf.^[24] The rising incidence has been attributed to the increasing rate of obesity in children.^[25]

In our study, we found that 8% was T2D in newly diagnosed children with diabetes. It shows the fact that T2D occurs even in the developing countries. In concurrence with the reports from the developed countries,^[3,8,22,25-30] obesity, female sex, parental history of T2D, and pubertal age appeared to be strongly associated with the disease in Asian children.

Rapid urbanization has become a risk factor for T2D. In our study, we found that 86% of cases were from urban area, which is similar to a recent report from Sudan.^[31] As expected, female preponderance was present in our group.^[32-34]

The American Academy of Diabetes recommends for screening overweight in children aged 10 years or more with a family history of diabetes and or signs of insulin resistance for diabetes.^[30] In our group, we found four (5%) patients were diagnosed at 9 years of age, which was similar to a recent report.^[31]

Obesity was present in more than half of our children, which was consistent in a study done in Asian-Indian children.^[4] The sign of insulin resistance such as acanthosis nigricans was common in our patients, a similar finding was reported by Drake *et al.* and Ehtisham *et al.* and others.^[3,26,30]

Hypertension was found to be high (32%), which is consistent with several studies done in T2D.^[31,35-37] Hyperlipidemia is a well-known comorbidity in children and adolescents with T2D. Hyperlipidemia is a well-known comorbidity in children and adolescents with T2D.

Isolated hypertriglyceridemia (13%), hypercholesterolemia (35%), and combined hyperlipidemia (6%) were found in our patients, hypercholesterolemia in one third and hypertriglyceridemia in more than half patients were found in a study done in Australian youth with T2 D.^[35]

CONCLUSION

Although the limitation of the study was small sample size and hospital-based study, it reflects T2D is emerging as a problem in children and adolescents, as the center is the largest diabetic hospital in Bangladesh. Despite the constraints of investigations and facilities to differentiate T1, T2, and MODY, we could diagnose the patients as T2 clinically while insulin was not prescribed in around 50% of the cases and also omitted within 3 months in some of the cases.

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Conflicts of interest

There are no conflicts of interest.

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