

Lipid Profile in Relation to Glycemic Control in Type 1 Diabetes Children and Adolescents in Bangladesh

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Abstract

Introduction: Dyslipidemia and hyperglycemia are metabolic abnormalities commonly found in young patients with Type 1 diabetes mellitus (T1DM) and both increase the risk of cardiovascular disease. **Methods:** This cross-sectional study was aimed to evaluate the pattern of dyslipidemia and its relationship with other risk factors in children and adolescents with T1DM. A total of 576 T1DM patients aged 10–18 years who attended Changing Diabetes in Children, a pediatric diabetes clinic in Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine and Metabolic Disorders over 1 year period from July 2015 to June 2016 were included in this study. **Results:** The overall frequency of dyslipidemia was 65%. The high triglyceride, high cholesterol, high low-density lipoprotein (LDL) and low high-density lipoprotein were found in 50%, 66%, 75%, and 48%, respectively. Compared to patients without dyslipidemia, patients with dyslipidemia had significantly lower mean body mass index (kg/m²) (18.4 [interquartile range; 16.2–21.4] vs. 19.5 [17.3–21.5] ($P = 0.005$)); significantly higher median fasting blood sugar (12.7 [9.9–15.2] vs. 10.6 [7.9–12.6] ($P < 0.0001$)) and higher median glycosylated hemoglobin (9.8 [8.4–11.8] vs. 7.9 [9.3–10.5] ($P < 0.0001$)). Hypertension was significantly higher in dyslipidemic patients (9.4% vs. 2.5% $P < 0.002$). **Conclusion:** More than half (65%) of our children and adolescents with T1DM had dyslipidemia, among them high LDL was the most common. These findings emphasize the screening of lipid profile in T1DM children and adolescents.

Keywords: Children and adolescents, dyslipidemia, glycemic control, type 1 diabetes

INTRODUCTION

Hyperglycemia and dyslipidemia are metabolic abnormalities commonly found in young patients with type 1 diabetes mellitus (T1DM) and both increase the risk of cardiovascular disease (CVD).^[1] In patients with T1DM, atherosclerosis can occur earlier in life, leading to increased morbidity and mortality compared with the general population.^[2] Several studies have demonstrated serum lipid abnormalities in children with T1DM as well as an association between elevated glycosylated hemoglobin (HbA1c) and serum lipid levels.^[3–7] Dyslipidemia is a preventable risk factor for CVD. Screening for dyslipidemia should be performed soon after diagnosis when diabetes has stabilized in all children with T1DM aged >10 year (International Society for Pediatric and Adolescent Diabetes) and if normal results are obtained, this should be repeated every 5 year. If there is a family history of hypercholesterolemia, early CVD or if the family history is unknown, screening should commence as early as 2 year of age.^[8]

There is no research on dyslipidemia in T1DM children in Bangladesh so far. Through this study, we hope to compute the prevalence of dyslipidemia and its relation to glycemic control in the study cohort.

METHODS

Study design

A total 422 T1DM patients were randomly selected who visited Changing Diabetes in Children outpatient service from January 2015 to January 2016. The patients who had other illnesses, hypothyroidism, or taking any other medication were excluded. Diabetes mellitus was diagnosed according to the WHO, International Society for Pediatric and Adolescent

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Diabetes (ISPAD) criteria.^[8,9] Pancreatic autoantibodies were not available in our clinic, so patients were classified clinically as T1D with abrupt onset of typical symptoms of diabetes, usually who were nonobese, absence of signs of insulin resistance, severe diabetes with markedly elevated HbA1c, presenting with diabetic ketoacidosis, and requiring insulin from time of onset.

Detailed history was taken from the patients during the visit, and an examination was performed to measure systolic and diastolic blood pressures, height, weight, body mass index (BMI), and waist circumference.

This study was reviewed and approved by the local ethical committee, and all participants provided informed consent and/or assent.

BMI scores were calculated as weight (kg)/height (m²) and expressed in Z scores, according to the standards assessed by the CDC Growth Charts.^[10] For waist circumference, measuring tape (± 0.5 cm) was placed at the midpoint between the lowest rib and iliac crest, parallel to the ground, after exhalation. Samples (blood glucose, HbA1c, total cholesterol (TC), low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, and triglyceride [TG]) were obtained under conditions of metabolic stability after at least 8 h of fasting. The mean value of two HbA1c levels measured within 3 months was used as a surrogate marker for recent glycemic control. HbA1c $\geq 9\%$ was termed as poor glycemic control according to the ISPAD guideline.^[8]

Cut-off points for abnormal lipid levels (TC ≥ 200 mg/dL, LDL cholesterol ≥ 130 mg/dL, HDL cholesterol ≤ 35 mg/dL, and TG ≥ 150 mg/dL) were taken from the Third Report of the National Cholesterol Education Program^[11] and the American Diabetes Association.^[12] Dyslipidemia was defined by the presence of one or more abnormal serum lipid concentrations.

All statistical analyses were conducted with the use of PASW Statistics version 22 (SPSS Inc., Chicago, IL, USA). Comparisons across >2 groups were analyzed using ANOVA for normally distributed variables and the Kruskal–Wallis test for skewed data. Chi-squared tests were used to compare categorical data.

RESULT

Among 422 patients, 198 were male and 224 were female. The age range of the patients was 10 to 18 (median = 15.0 [interquartile range: 13.0–17.0]) years. The frequency of dyslipidemia was 64% and was more in pubertal age group (84%). The median duration of diabetes was 3.0 (2.0–6.0) years. Majority of our patients (74%) had < 5 years duration of diabetes.

The most frequent dyslipidemia found was high TG (50%) [Figure 1]. Comparison between the dyslipidemic and normolipidemic groups, weight standard deviation score was significantly lower ($P = 0.005$) and waist circumference was also lower in dyslipidemic group ($P = 0.057$) [Table 1]

There was no significant difference between the two groups regarding the family history of diabetes or duration of diabetes.

Glycemic control between two groups compared and HbA1c was significantly ($P = 0.001$) higher in dyslipidemic group. The mean fasting blood glucose was also significantly higher in dyslipidemic group ($P < 0.0001$). The different types of dyslipidemia were statistically significant while compared between good and poor glycemic control [Table 2].

DISCUSSION

In this cohort of 422 youth with diabetes, the prevalence of dyslipidemia was 64%, similar finding was found in a study done in Egypt (65%).^[13] The prevalence of dyslipidemia in children with T1DM varies between 29% and 66% in studies from different countries.^[5,13-18] The wide range of prevalence in various studies may be due to multiple genetic factors in different ethnic groups. The main disorder was hypertriglyceridemia in our study. This finding is in concord with the various studies^[19,20] though the most frequent dyslipidemia was high LDL in various studies.^[13,16,21]

There was a trend toward higher prevalence of dyslipidemia in female than in males; this finding is similar to other studies.^[14,22,23] There were no significant differences of diabetes duration between the dyslipidemic group and the normolipidemic group. A total of 63 patients with dyslipidemia had < 2 year's diabetes duration. Kanagalakshmi and Sultana and Guy *et al.* found that dyslipidemia in children and adolescents with T1D was present with short duration of diabetes. This is in not in agreement to the other findings that lipid concentrations correlate positively with the duration of diabetes.^[19]

The mean waist circumference was lower in dyslipidemic group than in normolipidemic (65 vs. 69) ($P = 0.057$) which was nearly significant. The finding is in contrast to other findings.^[13,24,25]

The majority (65%) in dyslipidemic group had significantly poor glycemic control (HbA1c $> 9\%$) in contrast to normolipidemic ($P = 0.029$). There was positive association between high TG, TC, and low HDL and poor glycemic control.

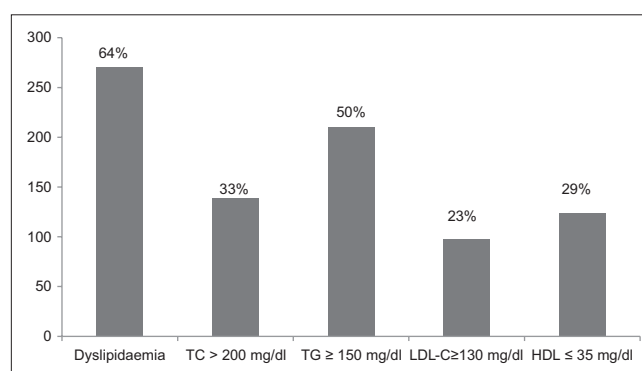


Figure 1: Different types of dyslipidemia

Table 1: Characteristics of patients with and without dyslipidemia

Parameter	Normolipidemia	Dyslipidemia	P
Age at assessment (years)	15.0 (13.0-18.0)	16.0 (13.0-17.0)	0.932
Age at diagnosis (years)	12.0 (8.2-14.0)	12.0 (8.0-14.0)	0.876
Gender (female percentage)	74 (49)	150 (56)	0.187
Duration of diabetes (years)	3.0 (2.0-6.0)	3.0 (2.0-5.0)	0.935
Family history of diabetes	148 (67)	74 (33)	0.264
Systolic blood pressure	100 (90-110)	100 (100-110)	0.065
Diastolic blood pressure	70 (60-70)	70 (60-80)	0.404
Height SDS	-1.8 (-2.4--0.98)	-1.7 (-2.6--1.06)	0.498
Weight SDS	-1.2 (-2.1--0.24)	-1.6 (-2.7--0.4.9)	0.005
Waist circumference	69.0 (60.0-76.0)	65 (58.0-75.0)	0.057
FBS	10.9 (7.9-12.9)	12.8 (9.9-15.3)	0.0001
HbA1c	9.3 (8.0-10.5)	9.8 (8.3-11.7)	0.001

SDS: Standard deviation score, FBS: Fasting blood sugar, HbA1c: Glycosylated hemoglobin

Table 2: Comparison of different types of dyslipidemia with good and poor glycemic control

	HbA1c		P
	<9%	>9%	
Age	16.0 (13.0-18.0)	15.0 (12.7-17.0)	0.115
Female	90 (40)	134 (60)	0.312
Diabetes duration (years)	4 (2-6)	3 (2-5)	0.009
TC \geq 200	40 (29)	99 (71)	0.003
LDL \geq 130	30 (30)	69 (70)	0.059
HDL \leq 35	102 (45)	124 (55)	0.005
TG \geq 150	70 (30)	140 (67)	0.022
Dyslipidemia	94 (35)	176 (65)	0.029

HbA1c: Glycosylated hemoglobin, TC: Total cholesterol, LDL: Low-density lipoprotein, HDL: High-density lipoprotein, TG: Triglyceride

Although high LDL was higher in dyslipidemic group, but it did not reach the statistical significance ($P = 0.059$). A positive association was found between HbA1c and serum lipid in different studies providing the evidence of positive effect of good glycemic control on serum lipid levels in children and adolescents.^[6,26,27] Our current findings provide evidence of poor glycemic control as a potential modifiable risk factor for dyslipidemia.

The strengths of this study include the large sample size. Nevertheless, possible confounding variables that could account for the association between poor glycemic control and dyslipidemia were not taken into account. Patients with poor glycemic control and worse treatment compliance may be the ones that also do not undertake preventive measures such as exercise and healthy diet.

CONCLUSION

Our study was first report of lipid data in Bangladeshi children and adolescents with T1DM. We have shown that there is the high prevalence of dyslipidemia which was associated with poor glycemic control. Longitudinal studies will provide early diagnosis and effective treatment of dyslipidemia which is a potential modifiable risk factor of CVD in children and adolescents with T1DM.

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Conflicts of interest

There are no conflicts of interest.

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