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Dyslipidaemia Among Bangladeshi Children and Adolescents with Type-1 Diabetes: An Observational Study

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Abstract:

Introduction: *Dyslipidemia increases the frequency and severity of micro and macrovascular complications of type 1 diabetes (T1D).*

Materials & Methods: *This cross-sectional study was aimed to evaluate the frequency of dyslipidaemia and its association with other risk factors in children and adolescents with type 1 diabetes. A total of 397 Type 1 diabetes (T1DM) patients aged 10-18 years who attended, Paediatric diabetes clinic in BIRDEM over one year period were included in this study.*

Results: *The overall frequency of dyslipidaemia was 63.5% and median duration of diabetes was 3.0[2.0- 5.0 years]. The High LDL was most cmmmon dyslipidaemia (81%) in our study population. FBS was significantly higher 12.8[10.0-15.5] vs 10.8[7.7-12.6] (p<0.0001)) and higher median HbA1c 9.9 [8.5-11.9] vs 9.0[7.9-10.5] (p<0.0001)) was found in dyslipidaemic patients. Median systolic blood pressure was higher (110 vs100) in dyslipidaemic patients (p =.042).*

Conclusion: *The frequency of dyslipidemia was high among the children and adolescents with T1DM which was associated with poor glycaemic control. Our results provide strong support for prior literature in emphasizing the importance of good glycemic control, to reduce the risk of dyslipidaemia.*

Key words: *Dyslipidaemia, Type 1 diabetes (T1D), Glycaemic control*

Introduction:

Dyslipidemia increases the frequency and severity of micro and macrovascular complications of type 1 diabetes (T1D).[1] Hyperglycemia and dyslipidaemia are metabolic abnormalities commonly found in young patients with type 1 diabetes mellitus (T1DM), and both increase the risk of cardiovascular disease.[2] Diabetes, Dyslipidaemia, and increased blood pressure cause damage to arterial vessels because of atherosclerosis. In patients with type 1 diabetes, atherosclerosis occurs earlier in life, leading to increased cardiovascular morbidity and mortality compared with those in the general population.[3] Studies of the natural history of atherosclerosis development in type 1 diabetes showed an origin of the lesions in childhood and adolescence.[4] Dyslipidemia is defined as abnormal plasma lipid levels and is characterized by decreased levels of high-density lipoprotein cholesterol(HDL-C) and increased low-density lipoprotein cholesterol(LDL-C) and triglycerides (TGs).[2,5] Dyslipidaemia is preventable risk factor for cardiovascular disease (CVD). Different studies in children with T1DM have shown association between elevated glycosylated hemoglobin (HbA1c) and serum lipid levels.[6-10] Screening for dyslipidemia should be performed after diagnosis (when diabetes stabilized) in all children with type 1 diabetes from age 11 years. If normal results are obtained, this should be repeated every 5 years.[11] If there is a family history of hypercholesterolemia, early cardiovascular disease (CVD) or if the family history is unknown, screening should commence as early as age 2 years.[11]

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There are few studies on dyslipidaemia in children with type 1-diabetes in Bangladesh so far. The aim of our study was to determine the frequency of dyslipidemia and its association with clinical and laboratory findings in children and adolescents with T1 DM followed up in the Changing Diabetes in Children (CDiC) Pediatric Diabetes Outpatient Clinic in BIRDEM hospital.

Materials and Methods:

We randomly selected 397 Type 1 diabetes (T1DM) patients aged 10-18 years who came for follow up in CDiC, a Paediatric diabetes clinic in BIRDEM Hospital over one year period(January 2016 to February 2017). T1DM was classified with clinical criteria of our center, -patients presented with abrupt onset of typical symptoms of diabetes, usually who were non obese, absence of signs of insulin resistance, severe diabetes with markedly elevated HbA1c, presenting with diabetic ketoacidosis (DKA), requiring insulin from time of onset.[12] Detailed history including age, gender, duration of diabetes and clinical examination of the patient was performed during the clinic visit. Blood pressure was measured by auscultation after 5 min of rest, and hypertension was diagnosed when blood pressure was ≥ 95th percentile for age and sex.[13] BMI scores were calculated as weight (kg)/height (M^2) and assessed by the CDC Growth Charts.[14] 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. After an overnight fast of 8 hours, 5 ml peripheral blood was collected by venipuncture. Estimation of blood glucose and lipid profile was done by enzymatic colorimetric method in BIRDEM lab using multichannel auto analyzer. Cut off points for abnormal lipid levels (TC-200 mg/dL, LDL cholesterole-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[15] and the American Diabetes Association.[16] Dyslipidemia was defined by the presence of one or more abnormal serum lipid concentrations. HbA1c ³9% was termed as poor glycaemic control according to ISPAD guideline.[17] The study was approved by the local ethical committee, and informed consent was taken from either parents or caregivers of all children.

Data were analyzed by Statistical Package for the Social Sciences program version 21. Descriptive statistics are presented as mean (SD)score for normally distributed data and median (interquartile range or range) for skewed data. Continuous data were compared using parametric test ANOVA and skewed data using the non parametric test Kruskal-Wallis test. Chi squared tests were used to compare categorical data.

Result:

Dyslipidaemia was found in 252 children and adolescents (63.5%) and 145 (36.5%) had normolipidaemia. Among them, 44.8% were male and 55.2% were female.The median age was 16.0[IQR: 13.0- 18.0] years and median duration of diabetes 3.0[IQR: 2.0 – 5.0] years. The High TG, High Cholesterol, High LDL and low HDL were found in 47%, 66.8%,81% and 37% respectively (Fig 1). High LDL was the most common dyslipidaemia. Patients with dyslipidemia had significantly lower median BMI (kg/m^2) (18.2 [IQR; 16.2-21.2] vs 19.2[17.2-21.6] (p = .015)) (Table 1). High systolic blood pressure and HbA_1c were associated with dyslipidaemia. FBS (mmol/L) was significantly higher (12.8[10.0 -15.5] vs 10.8[7.7-12.6] (p<0.0001)) and higher median HbA1c (%) (9.9 [8.5-11.9] vs 9.0[7.9- 10.5] (p<0.0001) in dyslipidaemic patients (Table1).Around 70% patients with dyslipidaemia were in high risk group(³9%) (Fig 2).

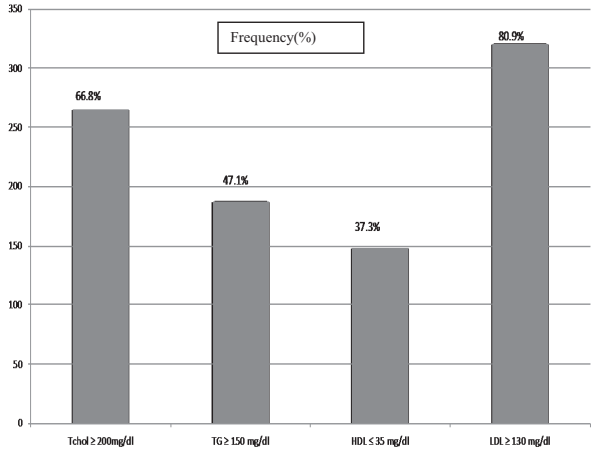

Fig.-1: *Different types of dyslipidaemia (n=397)*

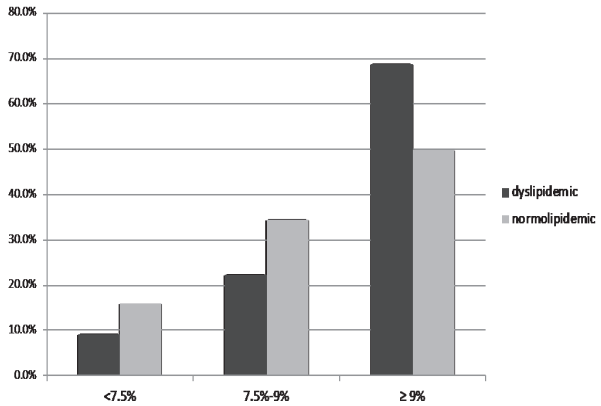

Fig.-2: *HbA1c in dyslipidaemic vs normolipidaemic patients (n=397)*

Table-I

Patients characteristics in Normolypidaemia vs Dyslipidaemia (n=397)

Parameter	Normolipidaemia	Dyslipidaemia	P value
Age at assessment (years)	16.0[IQR: 13.0- 18.0]	16.0[IQR:13.0- 17.0]	0.711
Sex (male%)	147(52)	22(44)	0.300
Duration of diabetes (years)	3.0 [IQR: 2.0- 5.0]	3.0[IQR: 2.0-6.0]	0.598
BMI (kg/m^2)	19.2[IQR: 17.1- 21.6]	18.2 [IQR:16.2- -21.2]	0.015
Waist circumference (cm)	70.0[IQR: 60.5-77.0]	66.0[IQR:58.0-75.0]	0.061
Systolic Blood Pressure (mm of Hg)	100[IQR: 90-110]	110 [IQR: 90.0-120]]	0.042
Diastolic Blood Pressure (mm of Hg)	70 [IQR: 60-75]	70 [IQR:60-80]	0.194
HbA1c (%)	9.0[IQR:7.9 -10.5]	9.9[IQR:8.5-11.9]	0.0001

Discussion:

We found that prevalence of lipid abnormalities was high (63.5%) with relatively short disease duration (median 3.0[2.0- 5.0 years]) in our study population. In SEARCH study done in 512 youth with type 1 diabetes abnormal lipid levels and atherogenic changes in lipoprotein composition, was found in relatively short disease duration.[18] In our previous study, we also found high prevalence (65%) of dyslipidaemia in children with type 1diabetes.[19] In a study done among 239 patients with T1 DM in Brazil, the ratio of dyslipidemia was 72.5% and it was shown that dyslipidemia developed most frequently due to hypercholesterolemia and less frequently due to hyperglyceridemia.[20] Though in different studies prevalence of dyslipidaemia in children with type 1diabetes varies between 3.8% and 72.5%.[18-24] Multiple genetic factors in different ethnic groups may be the cause of wide range of prevalence of dyslipidaemia in various studies. Moreover, local dietary habit, selection of age range may be other reasons of high number of dyslipidaemia in our study population. In our previous study we found that hyperglyceridemia was most common[19] but in this study population, High LDL(81%) was most common dyslipidaemia. In SEARCH study that the most frequent lipid abnormalities in youth with type 1 diabetes compared with non diabetic control subjects are elevated apoB levels and an increased proportion with small, dense LDL particles.[18] High LDL was more frequent dyslipidaemia found in various studies.[25-27] There was trend towards higher prevalence of dyslipidaemia in female than in males,which was consistent with our previous study and also other studies.[28-31] Although higher BMI was found in different studies, BMI and waist circumference were lower in patients with dyslipidemia compared to those without dyslipidemia in our study which reflects the genetic factors may influence with other modifiable factors with dyslipidaemia.

In our study, high HbA1C, systolic blood pressure and lower BMI were associated with patients with dyslipidaemia. A study done in 202 patients in Turkey mean age, mean HbA1C levels and BMI were found to be significantly higher in patients with dyslipidemia.[32]

The strengths of this study include the large sample size. Our current findings provide evidence of poor glycaemic control as a potential modifiable risk factor for dyslipidaemia.

Conclusion:

High TG was found more prevalent in T1 DM which was associated with poor glycaemic control and most common dyslipidemia was high LDL among children and adolescents with T1DM which was associated with poor glycaemic control and high systolic blood pressure. Our results provide strong support for prior literature in emphasizing the importance of good glycemic and BP control, to reduce the risk of dyslipidaemia.

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