Diabetes & Metabolic Syndrome: Clinical Research & Reviews xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Diabetes & Metabolic Syndrome: Clinical Research & Reviews

journal homepage: www.elsevier.com/locate/dsx

Original Article

Prevalence of double diabetes in youth onset diabetes patients from east Delhi and neighboring NCR region

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ARTICLE INFO

Article history:
Available online xxx

Keywords:
Anti GAD antibody
Anti IA2 antibody
C-peptide
Double diabetes

ABSTRACT

Background: It is being increasingly reported that some of the youth onset diabetes patients cannot be classified clearly as type 1 diabetes mellitus (T1DM) or type 2 diabetes mellitus (T2DM) based on usual criteria and the term double diabetes (DD) coined for these cases.
Aim: The objective of the study was to find out the prevalence of DD in youth onset diabetes patients from east Delhi and neighboring NCR region.
Methods: A total of 200 patients with youth onset diabetes below 25 years of age were recruited from a tertiary care hospital in East Delhi. Clinical history, family history of diabetes and anthropometry of patients were recorded. Fasting serum C-peptide, Anti-IA2-antibody and Anti-GAD-antibody were measured in all patients. Patients positive for Anti-GAD-antibody (>1.05 U/ml) and C-peptide level >0.3 nmol/l were characterized as DD patients. Patients negative for Anti-GAD-antibody and C-peptide >0.3 nmol/l were kept under the category of T2DM. Patients with low C-peptide level along with one of the following, positive Anti-GAD-antibody, positive Anti-IA2-antibody and diabetic ketoacidosis (DKA) were considered as T1DM. Remaining patients were kept under the unknown category.
Results: Mean age of study subjects was 18.2 ± 7.1 years. Seven percent (7%) of the subjects were classified as DD, 51% as T1DM, 13% as T2DM and 29% were kept under the unknown category. Mean age of subjects with 22.2 ± 9.7, 16.9 ± 6.7, 20.6 ± 7.7 and 19.4 ± 7.4 years in DD, T1DM, T2DM and unknown category respectively. Mean BMI of subjects with DD, T1DM, T2DM and unknown category was 19.8 ± 5.7, 16.6 ± 3.7, 19.3 ± 4.1 and 18.0 ± 4.6 kg/m^2 respectively.
Conclusion: Double diabetes is an important occurrence among youth onset diabetes subjects. Only half of the subjects with youth onset of diabetes had T1DM.

1. Introduction

Double diabetes, is a condition in which subjects have characteristics of both type 1 and type 2 diabetes. It can develop in individuals who are already having type 1 or type 2 diabetes mellitus [1–4]. If an individual has type 1 diabetes and during a certain period of time he starts gaining excess weight and becomes obese then insulin resistance can develop as obesity is a major risk factor for development of insulin resistance and T2DM [5–8]. Similarly if an individual already has T2DM then it is believed that due to the long standing glucotoxicity and lipotoxicity metabolic immuno-suppression occurs which further changes the T cell immunity and can lead to autoimmunity. If a patient with type 2 diabetes stops producing insulin due to islet cell destruction, insulin dependence supervenes resulting in the entity that charecterizes double diabetes [9–13]. Double diabetes subjects have symptoms of both types of diabetes and while treating these subjects one needs to take care of insulin requirements as well as measures to treat obesity [1–4].

There are very few studies reporting the prevalence of double diabetes in youth onset diabetes subjects [1,10]. Therefore present study was planned to study the antibody profile, glycemic profiles and C-peptide in young diabetes subjects with young age at onset i.e. below 25 years belonging to East Delhi and neighboring NCR region to assess the prevalence rate of double diabetes among them.

Abbreviations: DD, double diabetes; DOY, diabetes of young; DKA, diabetic ketoacidosis; NCR, national capital region.

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http://dx.doi.org/10.1016/j.dsx.2017.08.016
1871-4021/

Table 1
Demographic and glycemic profile of study subjects.

Variables	T1DM (n = 102)	T2DM (n = 26)	Unknown (n = 58)	Double diabetes (n = 14)	P-value
Age (years)	16.9 ± 6.7	20.6 ± 7.7	19.4 ± 7.4	22.2 ± 9.7	a,b,d,e,f = > 0.05, c = 0.05
Male/female (%)	62.5/37.4	43.5/56.5	62.1/37.9	42.8/57.2	–
Duration of diabetes (years)	3.0 ± 3.9 (0–16)	2.65 ± 3.7 (0–15)	5.4 ± 4.5 (0–19)	1.8 ± 2.1 (0–7)	a,c,e = > 0.05, b = < 0.001, d, f = < 0.05
BMI (kg/m^2)	16.6 ± 3.7	19.3 ± 4.1	18.0 ± 4.6	19.8 ± 5.7	a,b,d,e,f = > 0.05, c = 0.05
Positive family history of diabetes (%)	15.0	19.3	24.1	28.7	–
Fasting plasma glucose (mg/dl)	249.8 ± 106.6	231.5 ± 95.6	262.1 ± 130.4	217.1 ± 127.7	a,b,c,d,e,f = > 0.05
Postprandial plasma glucose (mg/dl)	292.2 ± 104.6	273.7 ± 122.6	299.8 ± 125.3	253.6 ± 83.2	a,b,c,d,e,f = > 0.05
Fasting serum insulin (μ IU/ml)	12.2 ± 10.1 (1.63–52.0)	16.2 ± 28.2 (1.84–123.0)	12.7 ± 12.2 (1.58–61.4)	5.0 ± 5.1 (1.99–18.1)	a,b,c,d,e,f = > 0.05
HbA1c (%)	10.4 ± 2.7	9.3 ± 3.4	10.3 ± 2.4	10.9 ± 4.1	a,b,c,d,e,f = > 0.05

a = T1DM vs T2DM, b = T1DM vs Unknown, c = T1DM vs DD, d = T2DM vs Unknown, e = T2DM vs DD, f = Unknown vs DD.

2. Methods

Study was approved by Institutional ethics committee-Human research, University college of medical sciences, Delhi. Written consent was obtained from all study participants.

200 diabetes subjects with young age at onset i.e. below 25 years of age from east Delhi and neighboring NCR region were recruited from those enrolled under the project "Registry of people with diabetes with young age at onset" of Indian Council of Medical Research, New Delhi India. A structured questionnaire was filled to obtain data on socio-economic parameters and behavioural aspects. Anthropometric measurements were carried out. Family history was obtained to assess the role of genetic factors. Glycaemic measures i.e., fasting plasma glucose, postprandial plasma glucose (glucose oxidase peroxidase method) and HbA1c (HPLC method, BioRad Kit) were also done in all the study subjects. Serum C-peptide, insulin, Anti-IA2-antibody and Anti-GAD-antibody were measured in fasting samples. Serum C-peptide, insulin, Anti-IA2-antibody were measured using radioimmunoassay kits (Beckman Coulter, USA) and Anti-GAD-antibody were measured using ELISA kit (DRG, USA). Specificity, sensitivity, inter assay and intra assay precision of C-peptide kit was 97%, 0.011 ng/ml, <5.2% and <3.1%, insulin kit was 100%, 0.5 μ IU/ml, <3.4% and <4.3%, Anti-IA2-antibody kit was 100%, 0.16 U/ml, <5.3% and <2.8% and Anti-GAD-antibody kit was 87.1%, 85.0%, <5.4% and <4.6% respectively.

Youth onset diabetes subjects recruited in the study were initially classified on the basis of pre defined WHO criteria [14]. The study subjects were re-categorized as T1DM, T2DM and double diabetes based on their antibodies and C peptide concentrations (Anti-GAD-antibody, Anti-IA2-antibody, DKA and C-peptide levels). Subjects positive for Anti-GAD(>1.05 U/ml) and C-peptide levels more than 0.3 nmol/l were characterized as double diabetes subjects; subjects negative for Anti-GAD and C-peptide >0.3 nmol/l were kept under the category of T2DM and subjects with C-peptide <0.3 nmol/l and have any one of the following i.e. positive Anti-GAD-antibody, positive Anti-IA2-antibody or DKA were kept under the category of T1DM. Subjects who had low level of C-peptide but were negative for Anti-GAD-antibody, Anti-IA2-antibody or DKA were kept under the unknown category.

Statistical analysis: One way ANOVA followed by Tukey's test was used to compare age, duration of diabetes, BMI, fasting insulin, fasting and postprandial plasma glucose and HbA1c between the groups using SPSS 20.0. Data was considered significantly different if P-value was <0.05.

3. Results

The demographic details and glycemic profile of study subjects under various categories has been presented in Table 1. Mean age of study subjects was 18.2 ± 7.1 years. Seven percent (7%, n = 14) of the subjects were classified as DD, 51% (n = 102) as T1DM, 13% (n = 26) as T2DM and 29% (n = 58) were kept under the unknown category as per our study criteria defined on the basis of Anti-GAD, Anti IA2, DKA and C-peptide (Fig. 1). Three out of 14 subjects with DD were characterized as T2DM clinically and 11 were characterized as type 1 diabetes mellitus clinically. Twenty nine percent (29%, n = 58) of the subjects with low C-peptide level were found negative for all antibodies and were also negative for DKA. These cases were kept under the unknown category.

Anti GAD was the most prominent (29.5%) type of antibody followed by Anti IA2 (13%) found in the present study. C-peptide was found to be high in 20% of the subjects. Data of family history shows that 28.7% of subjects with DD had a positive family history of diabetes (first degree relative).

Antibody positivity rates in DOY (diabetes of young) subjects with increasing duration of diabetes has been shown in Table 2. There was a progressive decline in Anti-GAD and Anti-IA2 antibodies concentrations with increase in duration of diabetes.

Fifty percent (50%, n = 7) of the subjects with DD, 30.3% subjects with T2DM, 29.8% subjects of unknown category and 17.52% subjects with T1DM had diabetes related complications. Ten (10) out of 14 subjects were on insulin, 3 on oral antidiabetic agents (OADs) and 1 on insulin plus OADs in the DD group. Ninty three (93) out of 102 subjects with T1DM were on insulin and 9 on OADs.

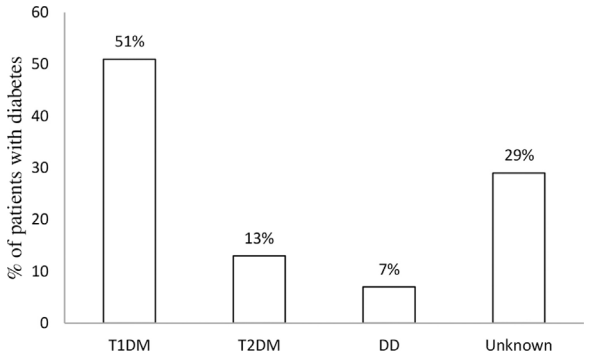

Fig. 1. Various categories of youth onset diabetes subjects. n = 200. T1DM; type 1 diabetes mellitus, T2DM; type 2 diabetes mellitus, DD; double diabetes.

Please cite this article in press as: B.K. Mishra, et al., Prevalence of double diabetes in youth onset diabetes patients from east Delhi and neighboring NCR region, Diab Met Syndr: Clin Res Rev (2017), http://dx.doi.org/10.1016/j.dsx.2017.08.016