Diabetes & Metabolic Syndrome: Clinical Research & Reviews 10 (2016) 7–12

Contents lists available at ScienceDirect

Diabetes & Metabolic Syndrome: Clinical Research & Reviews

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

Original Article

THE metabolic syndrome and accurate cardiovascular risk prediction in persons with type 2 diabetes mellitus

A. Ipadeola [a,*], J.O. Adeleye [b]

[a] Department of Medicine, University College Hospital, Ibadan, Nigeria
[b] Department of Medicine, College of Medicine, University of Ibadan, Nigeria

ARTICLE INFO

Keywords:
Type 2 diabetes mellitus
Metabolic syndrome
Calculated absolute cardiovascular risk
UKPDS risk engine

ABSTRACT

Background: Persons with type 2 DM have a cardiovascular risk 2–4 times that of the normal population. Co-occurrence of metabolic syndrome (MS) with type 2 DM is associated with an increased risk of development of cardiovascular disease. The aim of this study was to determine the prevalence of the MS in patients with type 2 diabetes mellitus and to compare absolute cardiovascular risk in type 2 DM Patients with MS with those without MS.
Methods: Anthropometric measurements and Blood Pressure of 340 eligible patients with type 2 DM recruited into the study were taken. Participants' FPG, FLP and glycated haemoglobin were also estimated. Cardiovascular risk score was calculated using the United Kingdom Prospective Diabetes Study (UKPDS) risk engine. Diagnosis of the MS was the International Diabetes Federation Criteria (IDF).
Results: Over 66% participants had MS. The absolute cardiovascular risk score was found to be similar in persons with type 2 DM whether they fulfilled the criteria for diagnosis metabolic syndrome or not.
Conclusion: The absolute cardiovascular risk score was similar in type 2 DM patients with or without the metabolic syndrome.

1. Introduction

Type 2 diabetes mellitus (type 2 DM) accounts for 90–95% of all cases of diabetes mellitus (DM) and is characterized by insulin secretory defects and insulin resistance of varying degrees [1]. It is considered an independent risk factor for cardiovascular disease, and persons with type 2 DM are reported to have a cardiovascular risk two to four times greater than that of the normal population [2]. The metabolic syndrome (MS) refers to an aggregation of cardiovascular risk factors in a single individual with insulin resistance central in its pathogenic paradigm [3]. The metabolic syndrome is also associated with an increased risk for the development of cardiovascular disease [4]. People with this syndrome are twice as likely to die from a macrovascular event and three times as likely to have ischaemic heart disease and stroke compared with people without the syndrome [4]. The above, therefore, makes an assessment of its association with type 2 DM crucial. Accurate assessment of cardiovascular risk in persons with diabetes mellitus is a major first step for developing a plan for risk reduction in such persons with diabetes and has become necessary to inform the choice of therapeutic strategies for individual patients [5]. The use of cardiovascular risk calculation algorithms provide a method for accurate estimation of the cardiovascular risk in such patients. A number of risk calculation algorithms exist but have been found to underestimate the cardiovascular risk in persons with type 2 DM [5]. The UKPDS risk engine has been found to be quite accurate in persons with type 2 DM because it includes glycaemic control in its analysis [6,7]. The aim of this study was to determine the prevalence of the MS in patients with type 2 diabetes mellitus and to compare absolute cardiovascular risk in type 2 DM Patients with MS with those without MS.

2. Methods

This was a cross-sectional study of 340 consecutive persons with type 2 diabetes mellitus carried out at the University College

Abbreviations: ADA, American Diabetic Association; CHD, coronary heart disease; CVD, cardiovascular disease; DCCT, Diabetes Control and Complications Trial; DECODE, collaborative analysis of diagnostic criteria in Europe study group; DPP, Diabetes Prevention Program; DM, diabetes mellitus; EDTA, ethylenediamine tetra acetic acid; HDL-c, high density lipoprotein cholesterol; HbA1c, glycated haemoglobin; IDF, International Diabetes Federation; IR, insulin resistance; LDL-c, low density lipoprotein cholesterol; MS, metabolic syndrome; MOP, medical outpatient clinic; NCEP-ATP III, national cholesterol education project adult treatment panel; Type 1 DM, type 1 diabetes mellitus; Type 2 DM, type 2 diabetes mellitus; UKPDS, United Kingdom Prospective Diabetes Study; WHO, World Health Organization.

* Corresponding author. Tel.: +234 8037024916.
E-mail address: arinipade@yahoo.com (A. Ipadeola).

http://dx.doi.org/10.1016/j.dsx.2015.08.011
1871-4021/

Hospital, Ibadan over a four month period May 2008–September 2008. Ethical clearance was obtained from the Joint Institution Review Committee (IRC) of the University College Hospital and the College of Medicine, University of Ibadan.

2.1. Clinical evaluation

Demographic and clinical data were obtained from all subjects using a data collection form. Clinical data included the time of diagnosis of diabetes mellitus, duration of treatment, history of hypertension, previous or current history of ischaemic heart disease (angina, myocardial infarction or coronary revascularization procedure), cerebrovascular disease (e.g. TIA or stroke) or peripheral vascular disease, (e.g. intermittent claudication, gangrene of the lower extremities or revascularization procedure). History of cigarette smoking and alcohol use was also obtained. Family history of diabetes mellitus, hypertension, coronary heart disease, stroke and sudden unexpected death was also inquired about.

The radial pulse was examined in all subjects; persons found to have irregular pulse rhythm had an electrocardiogram to rule out atrial fibrillation. All clinical information was imputed into the UKPDS risk engine along with other parameters to obtain an absolute cardiovascular risk score for each patient.

2.2. Diagnosis of the metabolic syndrome

Patients were categorized as having the metabolic syndrome based on the International Diabetes Federation (IDF) definition [8]; as follows – Central obesity (defined as waist circumference $\geq$94 cm for men and $\geq$80 cm for women of African descent as European values are to be used in the absence of figures for Africans), plus any two of the following four factors:

1. Triglyceride level greater than 150 mg/dl, or on specific treatment for this lipid abnormality.
2. HDL cholesterol: less than 40 mg/dl in men and less than 50 mg/dl in female or on specific treatment for this abnormality.
3. Elevated blood pressure with systolic $\geq$130 or diastolic $\geq$85 mmHg or on treatment for previously diagnosed hypertension.
4. Fasting plasma glucose of $\geq$100 mg/dl or previously diagnosed type2 diabetes mellitus.

2.3. Waist circumference measurement

Waist circumference was measured using the protocol recommended by the World Health Organization [28]. A waist circumference of $\geq$80 cm in females and $\geq$ 94 cm in males was taken as indicative of truncal obesity [8].

2.4. Weight and height Measurement

Weight was measured (in kilograms) using a beam balance scale with subjects in light clothing and without shoes on. Height was measured (in metres) using a portable height/length measuring board without the subjects wearing footwear, caps or other head gear. Body mass index (BMI) was subsequently calculated using the formula:

$$\text{BMI} = \text{Weight}/\text{height}^2 (\text{kg}/\text{m}^2)$$

A BMI of 18.5–24.9 kg/m^2 was considered as normal. Values between 25 and 29.9 kg/m^2 implied overweight, while obesity was defined as a BMI $\geq$30 kg/m^2 [9].

2.5. Blood pressure

Blood pressure was measured with the patients seated after at least 5 min rest using a mercury sphygmomanometer with a standard adult cuff size of 12 cm was wrapped round the patient's arm and placed at the heart level. The cuff was applied closely to the upper arm with the lower end about 2.5 cm from the cubital fossa. The patient was seated with the back resting on the chair, the non-dominant arm used was resting on the table while both feet were resting on the floor. Korotkoff sounds phases I and V were taken as the systolic and diastolic blood pressures respectively and values were recorded to the nearest 2 mmHg. Two readings were taken 2 min apart and the average was recorded. Patients with systolic or diastolic blood pressure of $\geq$130 and $\geq$85 mmHg respectively were grouped as having hypertension according to the IDF criteria [8]. In addition, patients on treatment for previously diagnosed hypertension were also regarded as having hypertension.

2.6. Laboratory evaluation

Measurements were taken after an overnight fast of 8–14 h. Patients were seated and allowed to rest for 5 min, and then a venipuncture was performed after cleaning the skin with 70% methylated spirit, using a new sterile disposable needle and syringe. Ten millilitres (ml) of blood was collected out of which 2 ml was put into a fluoride oxalate bottle for fasting blood glucose estimation. The remaining 8 ml was transferred into separate potassium EDTA bottle for lipid profile and glycated haemoglobin analysis.

2.7. Plasma glucose measurement

Samples were spun after collection to obtain plasma and analysis was carried out in the Department of Medicine laboratory by a trained laboratory scientist and the investigator using the glucose oxidase enzymatic method.

2.8. Plasma lipid assay

Total cholesterol and Triglycerides were analysed in the same laboratory stated above using enzymatic methods and values were read off a colorimeter. High-density lipoprotein cholesterol (HDL-C) was determined using selective precipitation; followed by enzymatic method for measuring cholesterol. All reagents used were from "DIALAB Austria". Calculated values for low-density lipoprotein cholesterol (LDL-C) were obtained using the Fried-Wald's equation as follows (provided the plasma triglycerides are not greater than 400 mg/dl) [10].

2.9. Glycated haemoglobin estimation

Samples were stored at 2–8 °C. Analysis was done within one week of storage using the HbA1c ionic exchange chromatographic method (DIALAB, AUSTRIA). When this method was compared to the US National Glycohaemoglobin Standardization Program certified method (NGSP) which is DCCT referenced some correlation was obtained. The following formula was used by the manufacturer of the kit used (DIALAB, AUSTRIA) to obtain DCCT referenced values: HbA1c (NGSP) (%) = 0.86 HbA1c-Dialab (%) + 0.24. HbA1c of $\leq$6.5% was taken as good control according to the IDF, while >6.5% was taken as poor glycaemic control [8].

3. Calculated cardiovascular risk

A validated diabetes specific risk calculator known as the United Kingdom Prospective Diabetes Study (UKPDS) risk engine