ORIGINAL ARTICLE

Glycaemic Control, Dyslipidaemia and Metabolic Syndrome among Recently Diagnosed Diabetes Mellitus Patients in Tamale Teaching Hospital, Ghana

Le Contrôle de Glycaemic, Dyslipidaemia et le Syndrome du Métabolisme parmi le Diabète Récemment Diagnostiqué les Patients de Mellitus dans Tamale l'Enseignement de l'Hôpital, le Ghana

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ABSTRACT
BACKGROUND: **Poor glycaemic control, dyslipidaemia and metabolic syndrome are all risk factors for cardiovascular disease.**
OBJECTIVE: **To determine the association between glycaemic control, dyslipidaemia and metabolic syndrome and their relative incidence among recently diagnosed diabetic patients in Tamale Teaching Hospital, Ghana.**
METHODS: **This prospective study, which involved a sample size of 240 diabetics, was conducted at the Tamale Teaching/ Regional Hospital in the Northern Region of Ghana from September 2006 to August 2007. Data obtained about each patient included blood pressure, anthropometric measurements, fasting glucose, lipid, lipoprotein cholesterol, and HbA1C levels. The metabolic syndrome was diagnosed according to the National Cholesterol Education Programme Adult Treatment Panel III criteria.**
RESULTS: **The frequency of good glycaemic control, poor glycaemic control, dyslipidaemia and metabolic syndrome among the patients were 96 (40.0%), 144 (60.0%), 164 (68.3%) and 104 (43.3%) respectively. Dyslipidaemia occurred in 56 (58.3%) of the patients with good glycaemic control and 108 (75.0%) of those with poor glycaemic control. Metabolic syndrome occurred in 32 (33.3%) of the patients with good glycaemic control and 72 (50.0%) of the patients with poor glycaemic control.**
CONCLUSION: **Among recently diagnosed diabetic patients in Tamale Teaching Hospital in Ghana, dyslipidaemia and metabolic syndrome were each associated with poor glycaemic control. Dyslipidaemia was the most sensitive predictor of cardiovascular disease, followed by poor glycaemic control and thirdly metabolic syndrome. WAJM 2010; 29(1): 8–11.**

Keywords: **Diabetes mellitus, metabolic syndrome, cardiovascular disease.**

RÉSUMÉ
CONTEXTE: *le pauvre contrôle de glycaemic, dyslipidaemia et le syndrome du métabolisme est tous les facteurs de risque pour la maladie cardiovasculaire.*
OBJECTIF: *déterminer l'association entre le contrôle de glycaemic, dyslipidaemia et le syndrome du métabolisme et leur incidence relative parmi les patients diabétiques récemment diagnostiqués dans Tamale l'Enseignement de l'Hôpital, le Ghana.*
MÉTHODES: *Cette étude potentielle, qui a impliqué une grandeur de promotion de 240 diabétiques, a été accomplie à l'Hôpital d'Enseignement Tamale / l'Hôpital Régional dans la Région du Nord du Ghana du septembre de 2006 à l'août de 2007. Les données obtenues de chaque patient ont inclus la tension, anthropometric les mesures, le glucose de jeûne, lipid, lipoprotein le cholestérol et les niveaux HbA1C. Le syndrome du métabolisme a été diagnostiqué selon le Comité de Traitement d'Adulte de Programme d'Éducation de Cholestérol national III critères.*
RÉSULTATS: *la fréquence de bon contrôle de glycaemic, pauvre contrôle de glycaemic, dyslipidaemia et syndrome du métabolisme parmi les patients était 96 (40.0 %), 144 (60.0 %), 164 (68.3 %) et 104 (43.3 %) respectivement. Dyslipidaemia s'est produit dans 56 (58.3 %) des patients avec le bon contrôle de glycaemic et 108 (75.0 %) d'entre ceux avec le pauvre contrôle de glycaemic. Le syndrome du métabolisme s'est produit dans 32 (33.3 %) des patients avec le bon contrôle de glycaemic et 72 (50.0 %) des patients avec le pauvre contrôle de glycaemic.*
CONCLUSION: *Parmi les patients diabétiques récemment diagnostiqués dans Tamale l'Enseignement de l'Hôpital au Ghana, dyslipidaemia et du syndrome du métabolisme a été chacun associé au pauvre contrôle de glycaemic. Dyslipidaemia était le prophète le plus sensible de maladie cardiovasculaire, suivie par le pauvre contrôle de glycaemic et le syndrome troisièmement du métabolisme. WAJM 2010; 29 (1): 8–11.*

Mots clé : *le Diabète mellitus, le syndrome du métabolisme, la maladie cardiovasculaire.*

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INTRODUCTION

Concentration of glycated haemoglobin (HbA_{1C}) is an indicator of average blood glucose concentration over the preceeding two–three months. HbA_{1C} is currently considered the best index of glycaemic control for diabetic patients in clinical settings.[1,2]. HbA_{1C} is used both as an index of mean glycaemia and as a measure of risk for the development of micro- and macrovascular diabetic complications.[3,4] Studies suggest that poor glycaemic control is significantly associated with the development of macrovascular complications of diabetes mellitus.[3] Other studies also indicate that dyslipidaemia, that is, abnormal levels of lipids, is an important risk factor for cardiovascular disease.[5] Similarly, the metabolic syndrome is a "clustering" of several risk factors for cardiovascular disease and early mortality in patients with type 2 diabetes[6] and nondiabetic subjects.[7] Thus, poor glycaemic control (HbA_{1C}), dyslipidaemia and metabolic syndrome are all risk factors for cardiovascular disease.

An association between HbA_{1C}, dyslipidaemia and metabolic syndrome, the commonly measured indicators of cardiovascular disease has not been determined among diabetes mellitus patients in the Northern Region of Ghana. Thus the objective of this study was to investigate the relative prevalence of poor glycaemic control, dyslipidaemia and metabolic syndrome and a possible association between poor glycaemic control, dyslipidaemia and metabolic syndrome among recently diagnosed diabetes mellitus patients in the Northern Region of Ghana.

SUBJECTS, MATERIALS, AND METHODS

Study Population

This prospective study was conducted at the Tamale Teaching/Regional Hospital in the Northern Region of Ghana from September 2006 to August 2007. All participants consented to participate in the research. Study protocols were approved by the ethics committee of the hospital. Recently diagnosed (<1 year) diabetes mellitus patients were consecutively selected until a sample size of 240 was obtained. Diabetes was defined according to the WHO.[8]

Patient's file values of the same day of data collection were used as an aid to cross check, and where necessary interviews and measurements were repeated.

Data Collection

A standardized questionnaire was used to collect information on demographic and clinical characteristics such as age, sex, ethnicity (tribe) duration of diabetes, family history of diabetes, hypertension, other physician-diagnosed diseases and stress, and diabetes and hypertension medication profile.

Physical Measurements

Heights and weights were measured in subjects wearing lightweight clothing and without shoes and BMI calculated (kg/m^2). Waist circumference was measured on bare skin during midrespiration at the narrowest indentation midway between the lowest rib and the iliac crest.[6,9,10] Blood pressure was measured twice per patient with five minutes intervals in the sitting position after 30 minutes of rest and the mean recorded.

Biochemical Measurements

Blood specimens were obtained after eight to fourteen hours of overnight fast. Serum fasting glucose, total cholesterol, triglycerides, and high density lipoprotein (HDL) cholesterol were measured by enzymatic methods using an ATAC 8,000 Random Access Chemistry autoanalyzer (élan diagnostics, A4-001-1198) and its reagent kits. LDL cholesterol was calculated using Friedewald's formula.[11] HbA_{1C} levels were measured by an inhibition of latex agglutination principle simultaneously with total haemoglobin by haemiglobin thiocyanate method, using DCA 2000+ analyzer (Bayer model 5031, USA) and its reagent kits. Glycaemic control was assessed based on HbA_{1C} measurement and classified as good (HbA_{1C} <7.5%), that is, controlled diabetes or poor (HbA_{1C} e+7.5%), that is, poorly controlled diabetes. Dyslipidaemia was diagnosed as the presence of one or more of the following factors: total cholesterol >5.2 mmol/L; triglycerides >1.69 mmol/L; HDL cholesterol in males <1.00 mmol/L and in females <1.30 mmol/L; and LDL cholesterol >3.36 mmol/L. Metabolic syndrome was diagnosed using the NCEP ATPIII criteria,[12] that is, the presence of three or more of the following factors: waist circumference in males >102 cm and in females >88 cm; triglycerides $\geq$1.70 mmol/L; HDL cholesterol in males <1.00 mmol/L and in females <1.30 mmol/L; blood pressure $\geq$130/85mmHg or on antihypertensive medication; and fasting glucose >6.1 mmol/L.

Statitical Analyses

Statistical analyses were performed using the statistical package for social sciences (SPSS) for windows programme version 11.0. The χ^2 test was used to determine the statistical significance of differences in proportions. A p value of less than 0.05 was considered significant.

RESULTS

A total of 240 recently diagnosed (<1 year) diabetes mellitus patients were recruited into this study, with 59 (24.6) males and 181 (75.4) females. The mean age of the patients was 47.2±12.3 years, with a range of 13.0 to 80.0 years. The mean value of Body Mass Index (BMI) of the patients was 26.0±4.5 kg/m^2 and it varied from 15.7 to 45.0 kg/m^2. The mean preprandial glucose value of the patients was 8.4±5.2 mmol/L, and it ranged from 3.3 to 29.1mmol/L. Fifty-two (21.6%) patients had low preprandial glucose levels of <5.0 mmol/L, 94 (39.2%) good (normal) preprandial glucose levels of 5.0 – 7.2 mmol/L and another 94 (39.2%) high (abnormal) preprandial glucose levels of >7.2 mmol/L (Table 1).

The mean HbA_{1C} value was 8.0±2.6%, with a range of 4.2 to 14.0%. Exactly 96 (40.0%) of the patients had good glycaemic control (HbA_{1C} <7.5%) and 144 (60.0%) poor glycaemic control (HbA_{1C} $\geq$7.5) (Table 1). One hundred and sixty-four (68.3%) of the patients had dyslipidaemia (Table 1). It was realized that 56 (58.3%) of the patients with good glycaemic control had dyslipidaemia and 108 (75.0%) of those with poor glycaemic control were with dyslipidaemia. One

Table 1: Frequency of Metabolic Derangements and Metabolic Syndrome

Variable	Number (%)		
	All Patients	Good Control	Poor Control
Preprandial hyperglycaemia	94(39.2)	–	–
Poor Glycaemic Control			
(HbA$_{1C}\geq$7.5)	144(60)	–	–
Dyslipidaemia	164(68.3)	56(58.30	108(75)
Metabolic Syndrome	104(43.3)	32(33.3)	72(50)

*Values in poorly controlled patients significantly different from those in good control, P <0.01.

Table 2: Frequency of Metabolic Factors in Recently Diagnosed Diabetic Patients With Good and Poor Glycaemic Control

Metabolic factors	Patients with good glycaemic control (HbA$_{1C}$<7.5%) N = 96		Patients with poor glycaemic control (HbA$_{1C}\geq$7.5%) N = 144		P value
	No.	%	No.	%	
Dyslipidaemia (total)	56	58.3	108	75.0	0.01
Metabolic syndrome	32	33.3	72	50.0	0.001

hundred and four (43.3%) of the recently diagnosed diabetic patients had metabolic syndrome. It was observed that 32 (33.3%) of the patients with good glycaemic control had metabolic syndrome (Table 2) and 72 (50.0%) of the patients with poor glycaemic control had metabolic syndrome.

DISCUSSION

Cardiovascular disease is the leading cause of death in type 2 diabetes.[13] Poor glycaemic control, dyslipidaemia and metabolic syndrome are all risk factors for cardiovascular disease.[3,5,6] The distribution of glycaemic control among recently diagnosed diabetes patients in Tamale Teaching Hospital in Ghana was 40.0% with good glycaemic control (HbA$_{1C}$<7.5%), that is, controlled diabetes 60.0% with poor glycaemic control (HbA$_{1C}\geq$7.5%), that is, poorly controlled diabetes, showing that, 60.0% of the patients may be associated with cardiovascular disease by HbA$_{1C}$ values. The prevalence of dyslipidaemia among the recently diagnosed diabetes patients was 68.3%. This value is slightly less than a value of

78.0% found among type 2 diabetes patients, mainly American non-Hispanic whites.[14] This value also indicates that 68.3% of the patients carry cardiovascular risk by total dyslipidaemic prevalence values.

The prevalence of dyslipidaemia in patients with poor glycaemic control (75.0%) was significantly higher than that in patients with good glycaemic control (58.3%). Thus dyslipidaemia was associated with worsening glycaemic control. This agrees with earlier findings that indicated that dyslipidaemia was positively associated with HbA$_{1C}$ in individuals with diabetes.[15] The prevalence of the metabolic syndrome among the recently diagnosed diabetes patients was 43.3%. This value is lower than the value of 68.5% found among diabetes patients in the Republic of Cyprus using the NCEP ATP III criteria (used in this study). This also implies that 43.3% of the patients had risk for cardiovascular disease by metabolic syndrome prevalence value. The prevalence of the metabolic syndrome in patients with poor glycaemic control (50.0%) was significantly higher than

that in patients with good glycaemic control (33.3%). Thus, the metabolic syndrome was associated with worsening glycaemic control. Dyslipidaemia (68.3%) was the most sensitive predictor of cardiovascular disease, followed by poor glycaemic control (60.0%), and thirdly metabolic syndrome (43.3%) in this study. However, whether dyslipidaemia was the most specific predictor of cardiovascular disease remains to be determined.

Conclusion

Dyslipidaemia and metabolic syndrome are each associated with poor glycaemic control (HbA$_{1C}\geq$7.5%) in Northern Ghanaian diabetics. Poor glycaemic control, dyslipidaemia and metabolic syndrome may be independent risk factors for cardiovascular disease. Hence, poor glycaemic control can neither replace dyslipidaemia nor metabolic syndrome as an indicator of cardiovascular disease. Dyslipidaemia was the most sensitive predictor of cardiovascular disease, followed by poor glycaemic control and thirdly metabolic syndrome.

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