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RESEARCH PAPER

GLYCAEMIC CONTROL AMONGST DIABETIC MELLITUS PATIENTS IN UMUAHIA METROPPOLIS, ABIA STATE, NIGERIA

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ABSTRACT

This study was designed to determine the level of glycaemic control among diabetic patients and to assess the relative associations with some diabetic complications. Subjects for this study were diabetic volunteers (diagnosed using the 1999 who criteria), who willingly granted their informed consent. They reported at the diabetic clinic of the Federal Medical Centre (FMC) Umuahia where their weights (in kg), heights (in metres), age of subject, sex, type and duration of diabetes mellitus and body mass index (BMI) were measured/calculated and recorded. The data obtained were analysed using the statistical package for social sciences (SPSS). The student t-test was used and $P \leq 0.05$ was considered as statistically significant. The results show that only 38% of the subjects had good diabetic control while poor glycaemic control was seen in 62% of the subjects. Poor control was more prevalent among females than males and also associated with more diabetic complications than in subjects with good control. Thus, regular and prompt diabetic care is strongly encouraged to reduce the increasing prevalence of poor glycaemic control and the associated cardiovascular health burden.

Key words*: Glycaemic control, Diabetes mellitus, Umuahia, Nigeria.*

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder primarily characterized by elevated blood sugar levels, macrovascular and microvascular complications that substantially increase the morbidity and mortality associated with the disease and reduce the quality of life of the affected individual (Klein, 1995). It is associated with absolute or relative deficiencies in insulin action and/or insulin secretion (WHO, 1985).

The World Health Organization (WHO) classification defines the underlying etiology of type 2 diabetes as defects in insulin secretion, with a major contribution from insulin resistance (Scheen, 2006). It is the commonest endocrine disease whose prevalence is said to be on the increase globally (Amos et al., 1997). Whilst type 1 DM appears to be uncommon in the developing countries, type 2 DM on the other hand, is at its highest prevalence in non-Caucasoid communities (King and Zinnet, 1988). However, regardless of the contributions of defects in insulin sensitivity versus insulin secretion, defective function of the pancreatic B-cells is now accepted as the hallmark of type 2 diabetes (Scheen, 2006; Kahn, 2003).

It is now well accepted that the best biochemical indicator of long-term glycaemic control in DM is the estimation of glycated haemoglobin (HBA) (Malik et al., 1996 ; Bachusr, 1996 ; Uchefuna and Mba, 2003). Glycated haemoglobin is derived from haemoglobin a, which is the major component of adult haemoglobin. Formation of HBA begins during erythropoiesis and continues through the 120-day life span of the red blood cells. Formation of

HBA is irreversible and the level in the red blood cells depends on the concentration of blood glucose, so that a single HBA value reflects the average blood glucose concentration for the preceding 8-12 weeks (Compagnucci et al., 1981).

The oxidative stress – over production of superoxide, induced by hyperglycaemia is the pivotal pathogenic factor mediating the emergence of diabetic complications in type 2 diabetes, while also producing increased cardiovascular risk by enhancing macrovascular complications (Ceriello, 2006). The over production of superoxide at the mitochondrial level may also be involved in damaging B-cells, leading to their failure and overt diabetes.

It is known that loss of glycaemic control is predominantly due to progressive B-cell dysfunction, with the contribution of different factors mainly glucose toxicity and oxidative stress. The oxidative stress can lead to an increase in apoptosis in B cells and therefore contributes to the progressive deterioration of B-cell function in type 2 diabetes (Kaneto et al., 1996; De guema et al., 2005). The pathophysiology of type 2 diabetes, as well as the therapeutic goal of achieving strict glycaemic control as soon as possible, and to maintain this in the long-term, provides the rationale for the use of appropriate drugs early in the disease (Schemethaner, 2004).

Poor glycaemic control causes the accumulation of sorbitol and advanced glycaemic end products which are responsible for causing the chronic complications of DM (Brownlec, 1994). Diabetes mellitus is a lifelong disease and so there is a tendency that the morbidity associated with it will also increase with time (Ihekwaba and Ojule, 2001). Studies have shown that DM and its related complications were responsible for nearly 10% of medical deaths (Chukwak et al., 1999).

Studies done in types 1 and 2 DM subjects have shown unequivocally that strict control of the blood glucose prevents or delays the progression of diabetic complications (DCCTRG, 1993; UKPDSG, 1998). Strict glycaemic control is now the corner stone of management of person with DM (Unadike et al., 2010).

This study therefore, investigates the degree of glycaemic control amongst persons attending the diabetes clinic of the Federal Medical Centre (FMC) Umuahia, in South Eastern Nigeria.

MATERIALS AND METHODS

Study duration and protocol: The study lasted between June and December 2010 and the national protocols for utilizing human subjects were closely adhered to. However, the study was conducted in compliance with the declaration on the right of the patient (WMA, 2000).

Participants: One hundred and twenty (120) confirmed diabetic mellitus subjects 55 males (46 %) and 65 females (54%) were involved in this study. They were made up of diabetic volunteers, diagnosed using the 1999 who criteria (WHO, 1999), who willingly granted their informed consent and who also attended the diabetic clinic of the hospital.

Study procedure, sample collection and analysis: All the subjects who gave consent were weighed on light clothing using the DAN5 weighing scale (Seca, Uk) which was regularly standardized with a 10kg steel weight. Height was measured using a standard meter rule mounted on a stand. From both measurements, the body mass indices (BMI) was calculated using the formula BMI = weight (in kg)/ height (in meters)^2 (Garrow and Webster, 1999). Glycaemic control was assessed using glycated haemoglobin (HBAic) which was assayed using the chromatography method (Jayness et al., 1985). Poor glycaemic control was defined as a HBA_{ic} level of >7% and good glycaemic control defined as a HBAic <7%.

Statistical analysis: data analysis was done using the SPSS version 10. Comparsion of means was done using the student t-test. The level of statistical significance was taken as $p<0.05$.

RESULTS

The demographic profile of the study population is shown in table 1.there were fifty-five males and sixty-five females, aged between ten seventy-nine years. The clinical characteristics of the study subjects are shown in tables 2-4. The mean age of the study subjects was 54.7 ± 8.7years, while the mean body mass index was 28.6 ± 3.4kg/m^2 with mean glycated heamoglobin of 8.4 ± 1.7%.

Forty-six (38%) of the subjects had good glycaemic control, while seventy four (62%) had poor control. Twenty six males (22%) had good glycaemic control while twenty nine (24%) had poor glycaemic control. Twenty females (17%) had good glycaemic control while forty-five females (38%) had poor glycaemic control. One hundred and fourteen subjects had type 2DM while six were type 1 DM persons. Forty-two of the one hundred and fourteen DM subjects (37%) who had type 2DM had good glycaemic control, while four (67%) type 1DM had good glycaemic control and this was not statistically significant ($p>0.05$).

Table 1: Demographic profile of the study population

Age range	Males number	Females number	Total number
10 – 19	4	2	6
20 – 29	3	2	5
30 – 39	5	7	12
40 – 49	10	14	24
50 – 59	18	20	38
60 – 69	11	14	25
70 – 79	4	6	10
Total	55	65	120

Table2: Clinical characteristics of study subjects (n = 120)

Parameter	Mean ±Sd
Age	54.7 ± 8.7 years
BMI	28.6 ± 3.4 kg/m^2
Duration of DM	6.3± 4.7 years
HB A_{ic}	8.4 ± 1.7%

Key: BMI = Body Mass Index, DM = Diabetes Mellitus. HBA_{IC} = Glycated Haemoglobin.

Table3:Glycaemic control according to gender

Good control (HBA_{ic}<7%)	Poor control HBA_{ic}>7%)	Total
Males 26	29	55
Females 20	45	65
Total 46	74	120

Table 4: Glycaemic control according to type of DM

Good control (HBA_{ic}<7%)	Poor control (HBA_{ic}<7%)	Total
Type 1 DM 4	2	6
Type 2 DM 42	72	114
Total 46	74	120

DISCUSSION

The importance of tight blood glucose control in preventing and/or delaying the progression of complications in diabetic patients has been identified by many studies (DCCTRG, 1993; UKPDSG, 1998a). In the widely acknowledged Diabetes Control and Complications Trial (DCCT) and the Stockholm Diabetes Intervention study

done in type 1 diabetic patients, it was shown unequivocally, that lowering blood glucose delayed the onset and slowed the progression of complications (DCCTRG, 1993). In the DCCT study, it was shown that the incidence or progression of retinopathy reduced by 54% - 76% and the need for photocoagulation was therefore reduced by 56%. Also the incidence of clinical albuminuria was reduced by 54% and clinical neuropathy by 69%. There was also a general reduction in diabetic complications as glycaemic levels approached the normal range.

In the United Kingdom Prospective Diabetes Study (UKPDS) done in type 2 diabetic patients, it was clearly shown that retinopathy, nephropathy and neuropathy were reduced by the lowering of the blood glucose levels with intensive therapy in which a mean HBA_{1c} of 7.0% was achieved (UKPDSG, 1998a). It was also shown that for every percentage point decrease in HBA_{ic}, there was a 25% reduction in diabetes related deaths; a 7% reduction in all cause of mortality and an 18% reduction in combined fatal and non fatal myocardial infarction (UKPDSG, 1998a,b,c; KCSG, 1998). The guidelines for management of DM recommend intensive control of blood glucose reaching glycated haemoglobin level of less than 7%, since this was associated with reduced morbidity and mortality (ADA, 2004). However, despite all the wealth of evidence available as to the benefit of good glycaemic control in preventing diabetic complications, studies have shown that good glycaemic control is not achieved in many diabetic patients (Qari, 2005; Azab, 2001; Khattah et al, 2000; Akbar, 2001). This may be associated with a low level of health education about drug compliance and treatment in majority of the diabetic patients.

In this study, good glycaemic control was seen in only 38% of the subjects while poor glycaemic control was seen in as many as 62% of the subjects. The possible reasons for this poor control include low level of literacy/health education amongst our people, poverty, poor health seeking behaviour of our people, poor compliance and adherence with follow up visits and medication, over-dependence on quack medical practitioners and prayer houses. Many diabetic patients in our society also make use of alternative medicines including leaves, roots and herbs in treating their ailments. All these constitute a great delay before the patients present at the appropriate health facility.

A study by Qari (2005), done among Saudi persons with diabetes mellitus, poor glycaemic control was seen in 42% of the subjects. In other studies done in other countries, poor glycaemic control was also seen in most of the subjects (Azab, 2001; Khattah et al., 2000; Akbar, 2001). The study by Otieno et al. (2003) in Nairobi, Kenya, showed that the majority of the persons with diabetes mellitus had poor glycaemic control and this was presumed to be due to suboptimal medication (fake drugs) and deteriorating diabetes (late presentation at diabetic clinics).

In a similar study in Calabar, Nigeria, 63% of the subjects had poor glycaemic control (John et al., 2005). Factors identified for the poor glycaemic control in that study included poverty, illiteracy and poor compliance and adherence with medications. The study by Coker and Fasanmade (2006), in Lagos, Nigeria, documented poor glycaemic control as well. In their study, the mean glycated haemoglobin (HBA_{ic}) level was 10.5%. They concluded also that both physicians and patients' dependent factors were responsible for the poor outcome. The study by Adebisi et al (2007), in Ilorin, Nigeria, also documented this poor glycaemic control in 500 persons with diabetes mellitus and the mean HBA_{ic} level was 8.0%. It is therefore evident from these studies that poor glycaemic control is common in Nigerian persons with diabetes mellitus. The problem may even be getting worse from the results of this present study on account of the rising inflation.

The low rates of good glycaemic control in this study calls for more urgent attention. With the overwhelming evidence that good glycaemic control prevents or delays diabetic complications, efforts must be intensified by medical personnel looking after persons with DM to educate them on the benefits of adhering strictly to medical nutrition therapy, and medications to prevent these complications. A recent study has shown that the occurrence of severe hypoglycaemia is associated with increased mortality amongst patients with type 2 diabetes and other cardiovascular risk factors (Bonds et al., 2010). Consequently, good glycaemic control must be achieved without causing hypoglycaemia.

About 20% of patients with type 2 DM have hypertriglyceridaemia or low high density lipo-proteins (HDL) cholesterol levels (Laakso, 1997). These abnormalities are powerful risk factors for coronary artery disease in these patients and are common in those with poor glycaemic control. Diabetic patients with dyslipidaemia frequently develop atherosclerosis and consequently hypertension. Superoxide, which is present in diabetic patients with dyslipidaemia is suspected to play an important role in the initiation of this atherosderosis (Hiramatsu and Arimori, 1998). Also poor glycaemic control may contribute to diabetic dyslipidaemic and erectile dysfunction (ED) (Unadike et al., 2008). Diabetes mellitus is an important organic cause of erectile dysfunction with a prevalence rate of 75% after 30 years of duration of the disease, and the incidence of ED is three times higher in diabetes than in

non-diabetes (Romeo et al., 2000). It is therefore extremely important to aggressively manage all the major cardiovascular risk factors especially hypertension and dyslipidaemia.

Hyperglycaemia increases the risk of ED. High glucose levels affect the vasculature and result in the accumulation of advanced glycation end products which promote vascular disease and neuropathy, thus contributing to ED (Thomas and Chook, 2004). Penile erections rely on neural stimulation of the penile vasculature endothelium and corpus cavernosum lacunae to trigger lacunae and smooth muscle relaxation and vasodilation which spurs filling and erection (De vriese et al., 2000). Poor glycaemic control induces cardiovascular risk factors like hyperlipidaemia which cause vascular damage and thus diminish the response at a number of steps, thereby promoting ED (Lu, 2000).

Evidence shows that strict glycaemic control substantially reduces the risk of developing complications such as blindness, kidney failure and heart disease and slows their progression, thus improving quality of life (Diabetes facts and figures, 2006). It must be pointed out here that the average cost of a test for glycated haemoglobin in our society is high at about N3000 ($ 22). Consequently, most patients continue to use blood glucose for glycaemic control since they cannot afford the much better but costlier glycated haemoglobin test, hence the low number of patients used in this study. With the increasing prevalence of diabetes in our society (Ngwogu et al., 2012), we recommend that diabetes care and cost of glycated haemoglobin tests be subsidized by the government to help ensure a wider usage of this method, as well as good glycaemic control. Also health education on diabetic care should be made compulsory in all health centres and diabetic clinics to ensure compliance with treatment.

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AUTHOR(S) CONTRIBUTION

Ngwogu K. O, Mba I.E.K. and Ngwogu A.C. contributed to the successful completion of this study. Their carrier background played important roles.