

## DIABETES COMPLICATIONS AND THEIR RELATION TO GLYCEMIC CONTROL AMONG PATIENTS ATTENDING DIABETIC CLINIC AT KING KHALID NATIONAL GUARD HOSPITAL IN JEDDAH, SAUDI ARABIA

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### ABSTRACT

This study addresses the prevalence of ischemic heart disease, hypertension and long term complications of *diabetes mellitus* among patients attending the diabetic clinic and their relation to glycemic control.

**Methods:** A study was conducted on a cross section on all consecutive patients attending the diabetic clinic at King Khalid National Guard Hospital in Jeddah, Saudi Arabia, from January 2007 to January 2008. The degree of glycemic control was gauged using blood level of glycosylated hemoglobin (HbA1C) and classified into good (less 7%), fair (7.1-8%), poor (8.1-9%) and very poor (greater than 9%). All patients were screened for hypertension, ischemic heart disease and micro vascular complications.

**Results:** Two hundreds and ten patients were recruited in the study. Glycemic control was good in 17 (8.1%), fair in 49 (23.2%), poor in 56 (26.6%) and very poor in 88 (41.9%). There was high prevalence of retinopathy (76; 36%), microalbuminuria (80; 37.9%), neuropathy (108; 51.2%) and ischemic heart disease (51; 24.2%), especially among patients with poor and very poor control. Although the presence of hypertension, frank nephropathy and peripheral vascular disease was also disturbingly high among diabetic patients, their frequency was the same among good, fair, poor and very poor glycemic control groups.

**Conclusion:** The prevalence of long-term complications of diabetes mellitus was alarmingly high among Saudi nationals. Microvascular complications and ischemic heart disease were also noticed to be more common in diabetics with poor and very poor glycemic control. This emphasizes the need of national awareness program about the gravity of the problem.

**Keywords:** *Diabetes mellitus*, Complications, Glycemic control

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## INTRODUCTION

*Diabetes mellitus* (DM) has become one of the most important chronic public health problems worldwide<sup>[1]</sup>. It is estimated that the global number of adults suffering from any form of diabetes will reach 285 million in 2010 and may increase to 439 million in 2030, most of them Type 2 DM cases<sup>[2,3]</sup>. The reported prevalence of DM among Saudi adults between the ages of 30 to 70 years was 23.7%<sup>[4]</sup>.

*Diabetes mellitus* is a growing cause of morbidity and mortality through macrovascular complications (stroke, myocardial infarction, and coronary artery disease) and microvascular diseases (retinopathy, nephropathy and neuropathy)<sup>[5]</sup>. Prevalence reports from studies worldwide on microvascular and macrovascular complications of Type 2 diabetes show varying rates. The prevalence of cardiovascular complications is varying between 10% to 22.5%<sup>[6-9]</sup>. The rate of recurrence of cataracts is 26% to 62%<sup>[10]</sup>, nephropathy 17% to 28%<sup>[11]</sup> and neuropathy 19% to 42%<sup>[12,13]</sup>. Recent studies have shown that intensive glycemic control decreases the risk of micro-vascular complications<sup>[9]</sup>.

A study from Saudi Arabia showed that diabetes is associated with significant high rate of long term complications. Famuyiwa and co-workers studied the prevalence of diabetic complications among Type 1 and Type 2 diabetes. This study found that ischemic heart disease was present in 41.3%, stroke in 9.4%, foot infections in 10.4%, amputations in 5.1%, cataract in 42.7%, neuropathy in 35.9%, retinopathy in 31.5%, hypertension in 25% and nephropathy in 17.8% of patients with Type 2 diabetes<sup>[14]</sup>.

However, this study did address the correlation between the rate of complications and glycemic control. The undertake of the present study is to determine the prevalence of macrovascular and microvascular diabetic complications in patients with Type 2 diabetes attending diabetic clinic at King Khalid National Guard Hospital (KKNHG) in Jeddah, Saudi Arabia, and examine their relation to glycemic control level.

## METHODS

The study was conducted on a cross-section of all consecutive patients with the diagnosis of Type 2 diabetes who was attending the diabetic clinic at KKNHG from January 2007 to January 2008. All patients with active follow-up visits were included in the analysis. Patients who were diagnosed to have Type 1 diabetes, gestational diabetes and pediatric patients (age less than 15 years) were excluded from the study.

Data included baseline characteristics of age, gender, blood pressure and laboratory results. Hypertension was based on a preexisting history of hypertension and measurement of blood pressure (BP), where systolic blood pressure (SBP) was greater than 130 mm Hg and/or a diastolic blood pressure (DBP) greater than 80 mm Hg. This was based on the seventh report of the Joint National Committee on the Prevention, Detection, Evaluation and Treatment of High

Blood Pressure (JNC 7). Blood pressure measurements from at least 3 readings per year were recorded as mean BP per year. The presence of ischemic heart disease (IHD) was based on clinical, electrocardiographic, biochemical and angiographic evidence of myocardial ischemia presenting as angina and/or myocardial infarction (MI).

All diabetics had lipid profile done as base line and at follow-up, especially upon treatment. Diagnosis of dyslipidemia was based on the 2004 American Diabetes Association (ADA) treatment guidelines, which recommend that the following lipid criteria should be met for patients with diabetes: low density lipoprotein-cholesterol (LDL-C) < 2.6 mmol/L (100 mg/dl), triglycerides < 1.7 mmol/L (150 mg/dl) for both gender and high density lipoprotein-cholesterol (HDL-C) > 1.0 mmol/L (40 mg/dl) in men and >1.3 mmol/L (50 mg/dl) in women.

Urine spot testing for microalbumin was done twice for each diabetic patient at least two weeks apart. Nephropathy was defined by the presence of three positive readings per year of persistent proteinuria by urinary dipstick.

Retinopathy was documented by the ophthalmologist by the presence of retinal hemorrhages, exudates and macular edema, or features of proliferative retinopathy. Neuropathy was considered if there was persistent numbness, paraesthesia, loss of a tuning fork tested the sense of vibration, or failure to elicit knee and/or ankle jerk after reinforcement.

The degree of glycemic control was gauged using blood level of glycosylated hemoglobin (HbA1C) and classified into good (less 7%), fair (7.1-8%), poor (8.1-9%) and very poor (greater than 9%).

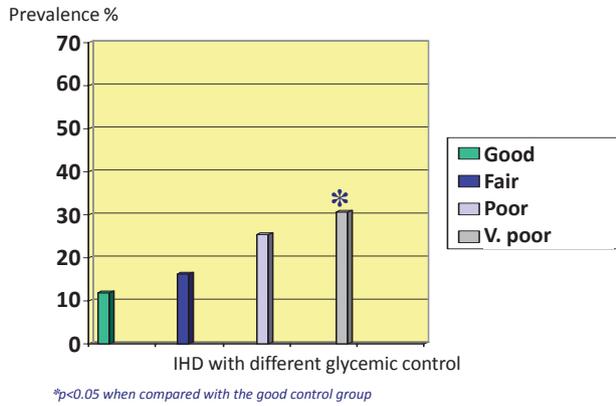
Data management and analysis were conducted using Statistical Package for Social Sciences (SPSS) program, version 16. Continuous variables are presented as mean  $\pm$  SD whereas categorical variables are presented as numbers and percentages. The t-test was used to compare means. The chi-square test was used to compare categorical variables. Results were regarded statistically significant when p-value is less than 0.05. Ethical approval was obtained from ethical committee. Patient information confidentiality was guaranteed and all data were used for research purposes only.

## RESULTS

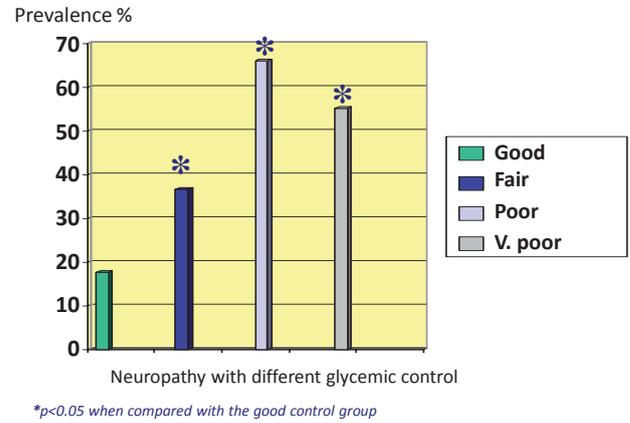
From study populations of 210 patients, hypertension was observed in 88 (41.9%) patients while significant IHD was noticed to be present in 51 (24.2%) subjects. Hyperlipidemia was observed in 131 (62.4%) patients. The prevalence of retinopathy was 76 (36%), microalbuminuria was 80 (37.9%), nephropathy was 16 (7.6%) and neuropathy was 108 (51.2%). Neuropathy, hyperlipidemia, hypertension and microalbuminuria were more prevalent followed by retinopathy and IHD. Nephropathy was the least prevalent complication. Glycemic control was generally unsatisfactory in most of the patients and noticed to be good in 17 (8.1%), fair in 49 (23.2%), poor in 56 (26.6%) and very poor in 88 (41.9%).

There was a trend of high frequency of IHD (Fig. 1), and micro-vascular complications such as microalbuminuria (Fig. 2), retinopathy (Fig. 3), and neuropathy (Fig. 4) among patients with poor and very poor control, compared to

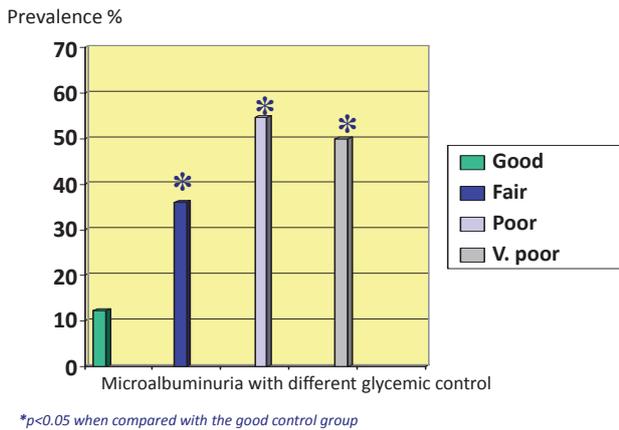
those with fair and good control. In contrast the frequency of hypertension (Fig. 5), frank nephropathy (Fig. 6) and peripheral vascular disease (Fig. 7) was more or less the same among good, fair, poor and very poor control groups.



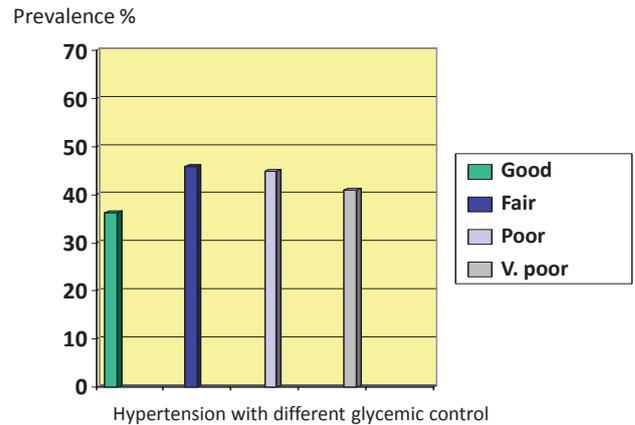
**Figure 1.** Prevalence of ischemic heart disease among diabetic patients at KKNKH.



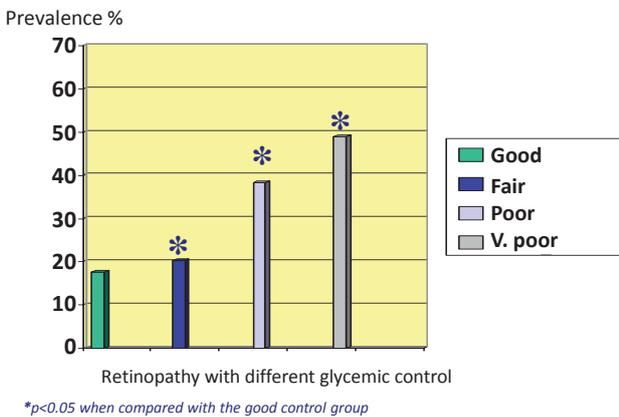
**Figure 4.** Prevalence of Neuropathy among diabetic patients at KKNKH.



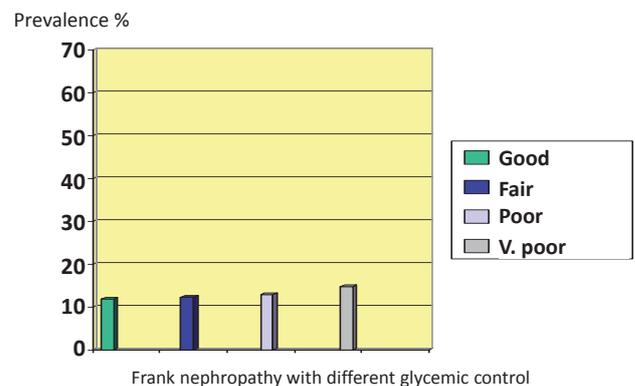
**Figure 2.** Prevalence of microalbuminuria among diabetic patients at KKNKH.



**Figure 5.** Prevalence of Hypertension among diabetic patients at KKNKH.



**Figure 3.** Prevalence of Retinopathy among diabetic patients at KKNKH.



**Figure 6.** Prevalence of frank Nephropathy among diabetic patients at KKNKH.

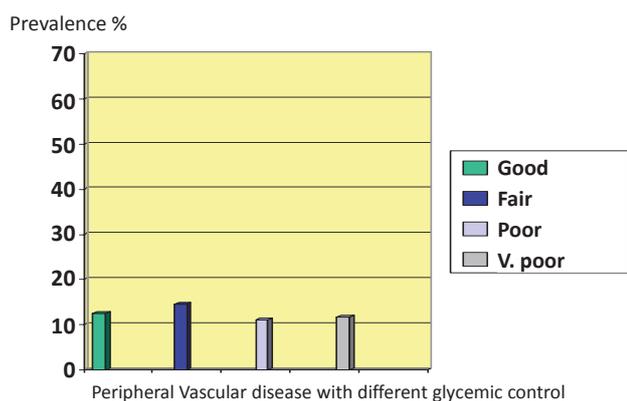


Figure 7. Prevalence of Peripheral Vascular Disease among diabetic patients at KKNHG.

## DISCUSSION

In this study, it addresses the rate of Type 2 diabetes complications in a hospital setting. This study, like other studies from Saudi Arabia, showed a high prevalence of hypertension (41.9%) among Type 2 diabetes. Although, studies by Al Nozha *et al.*<sup>[4]</sup> and Famuyiwa *et al.*<sup>[14]</sup> reported a relatively lower prevalence rate of hypertension among diabetes (34% and 25%, respectively) compared to our study, nevertheless, the rate reported by these studies are still alarmingly high. On the other hand, studies by Alwakeel *et al.* and Akber *et al.* found that hypertension to be present in 78% and 60%, respectively, among diabetic patients, which is much higher than the prevalence rate reported in our study<sup>[15,16]</sup>. The prevalence of IHD in this study was 24%, which is similar to that reported in Alwakeel *et al.* study of 23.1%<sup>[15]</sup>. However, less than 41% rate reported by Famuyiwa *et al.*<sup>[14]</sup>. Nevertheless, studies from Saudi Arabia, including our study as well as these studies, demonstrated a higher prevalence of IHD compared to reports from Western countries<sup>[6,9]</sup>. This may be attributed to the lack of awareness of the complications of hypertension and hyperglycemia, in addition to an increased prevalence of other cardiovascular risk factors among Saudis. In fact, our studies showed that dyslipidemia was disturbingly very high (62%) among diabetic patients, and may partly contribute to the increased prevalence of IHD among our patients.

On the other hand, the frequency of retinopathy among our patients was 36% which is comparable to other studies from Saudi Arabia<sup>[17]</sup> as well as United Kingdom<sup>[9]</sup>. Similarly microalbuminuria prevalence was 37.9% and nephropathy was 7.6%, which are in concordance with those reported by other local studies<sup>[15,18,19]</sup>. Also, the rate of progression of diabetic nephropathy in Saudi diabetes patients was noticed to be fast when compared with data reported from other part of the world<sup>[20]</sup>.

The reported neuropathy in this study was 51% and was higher than that reported by Famuyiwa *et al.*<sup>[14]</sup> and Alwakeel *et al.*<sup>[15]</sup> (35.9% and 13.7%, respectively). However, the high rate of this complication in our study was not surprising, as preliminary data from the western part of Saudi Arabia

suggested that, the overall prevalence of neuropathy in diabetic patient is 82%, which is one of the highest in the world<sup>[16]</sup>. This probably could be due the lack of early screening for this debilitating condition, which can lead to other serious complications. In fact, Qidawi *et al.* in 2001, reported that 29% of Saudi patients with diabetic peripheral neuropathy have some features suggestive of diabetic neuroarthropathy and that 18% of those patients underwent foot amputations<sup>[21]</sup>.

The incidence of chronic complications in Type 2 DM patients was significantly correlated to the degree of hyperglycemia and diabetic control, as measured by the plasma glucose or the HbA1c level. In the present study, IHD and micro-vascular complications of DM were noticed to be more common in diabetics with poor and very poor glycemic control, which is concordance with international studies. Stratton *et al.* in a cohort study found that 1% reduction in average HbA1c was associated with reductions of 14% for myocardial infarction and 37% for microvascular complications<sup>[9]</sup>. On the other hand, the prevalence of hypertension, frank nephropathy and peripheral vascular disease seems not to be related to the degree of glycemic control.

The present study has some limitations, including the number of patients enrolled in the study was not large enough and may not be very representative of the whole country. Additionally, our study was cross sectional and hospital based. Nevertheless, our study showed that the diabetic control among Saudi nationals was probably unsatisfactory in which most of the patients have poor and very poor control. It was also documented, that the macrovascular complications and microvascular complications of Type 2 diabetes in a single area from the Kingdom, and this may help as a reference for future larger scale studies. The prevalence of macrovascular and microvascular complications of diabetes is considerably high among our diabetic patients and many patients had multiple complications. These are very alarming findings and emphasizes the need for a national awareness program (for both patients and physicians) about the gravity of the problem. Earlier and frequent screenings in patients with Type 2 diabetes for the development of complications is crucial and that will lead to identify patients at high risk. In addition, our study has highlighted the importance of good glycemic control in preventing these long term complications.

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