The Common Complications and Comorbidities among Saudi Diabetic Patients in Northern Saudi Arabia

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Abstract

Background: Diabetes mellitus (DM), is a group of metabolic disorders in which there are high blood sugar levels over a prolonged period with great harmful consequences, including cardiovascular and neurological complications, diabetic retinopathy, and diabetic nephropathy. Therefore, the objective of this study was to find out the common complications and comorbidities among diabetic Saudi patients in Northern Saudi Arabia. **Methodology:** Records of 50 diabetic patients were retrieved from King Khalid Hospital, Hail, Saudi Arabia. Different complications and comorbidities were documented and investigated. **Results:** Peripheral neuropath, retinopathy, diabetic septic foot, and amputation were identified among 40%, 38%, 14%, and 4%, correspondingly. Out of the 50 patients, 12 (24%), 18 (36%) and 8 (16%) were detected with thyroid diseases, dyslipidemia and renal complications, respectively. **Conclusion:** Hypertension, peripheral neuropathy, dyslipidemia, retinopathy, kidney complications and diabetic septic food represent the major complications and/or comorbidities among diabetic Saudi patients in northern Saudi Arabia. These complications and/or comorbidities must be well thought-out in epidemiological studies, so as to display disease burden and quality of diabetes care.

Keywords

Diabetes Mellitus, Comorbidity, Peripheral Neuropath, Retinopathy, Diabetic Septic, Saudi Arabia

1. Introduction

Diabetes mellitus (DM) is an emerging epidemic chronic diseases today, both in

developed and in developing countries [1] [2]. As it was estimated by World Health Organization (WHO), in 2014, there were 422 million persons had diabetes, and the prevalence is expected to double the year 2030 [3] [4]. The disease is characterized by impaired glucose tolerance (IGT) [5], which is associated with well-known factors including obesity, older age, a family history of diabetes, selected race and ethnicity groups, a history of IGT or of gestational diabetes mellitus, lipid abnormalities and reversible factors such as diet, physical activity and smoking [6] [7]. Detecting persons with undiagnosed type 2 DM (T2DM) is a public health priority, as the development to complicated T2DM can be delayed or stopped with lifestyle amendments [8] or pharmacological interventions [9].

The Middle East is expected to host the highest prevalence of DM due to dramatically increasing in the prevalence of obesity and metabolic syndrome in the world [10] [11] [12]. The prevalence of type 2 diabetes in Saudi Arabia is 32.8%. However, the predicted prevalence will be 35.37% in 2020; 40.37% in 2025 and 45.36% in the year 2030. The coefficient on time factor indicated that prevalence rate has increased during 1982-2015 [13].

In Saudi Arabia, food choices, size of portions and inactive lifestyle have extremely increased, which resulted in high risk of obesity. Moreover, numerous Saudis are becoming more obese because of the accessibility of fast foods, and this enhances the terrifying diabetes statistics [14].

Comorbidity, defined as the occurrence of one or more chronic conditions in the same person with an index-disease, occurs frequently among patients with diabetes [15]. Comorbidity has been shown to intensify health care utilization and to increase medical care costs for patients with diabetes [16]. Several comorbidities like cardiovascular diseases, retinopathy, nephropathy and diabetic foot have been reported [17]. A better understanding of DM and its related comorbidities can enhance the type and capacity of medical health care utilization as well as, enables to gain vision into future health care burdens of patients with DM. The objective of the present study was to assess complications and comorbidity of DM among Saudi in northern Saudi Arabia.

2. Materials and Methods

This is a retrospective study carried out in Diabetic Unit at King Khalid Hospital, Hail, Kingdom of Saudi Arabia (KSA). About 344 patients with previously diagnosed DM have visited the unit for complain other than DM within one year time (the period from 1st of January to 30 of December 2016). Out of 344 DM patients, 50 were diagnosed as having one or more comorbidity (s). All records regarding patients with DM and comorbidity were retrieved from Diabetic Unit. Data regarding the underlying comorbidities such as a positive family history, hypertension, thyroid disease, dyslipidemia, asthma, myocardial infarction, stroke, retinopathy, peripheral neuropathy, loss of vision, kidney complications, diabetic septic foot, amputation and demographical characteristics were recoded.

2.1. Statistical Analysis

Data management was done using Statistical Package for Social Sciences (SPSS version 16). SPSS was used for analysis and to perform Pearson Chi-square test for statistical significant (P value $P < 0.5$). The 95% confidence level and confidence intervals were used.

2.2. Ethical Consent

The study was approved by Ethical Committee, College of Medicine, University of Hail, KSA.

3. Results

The present study investigated 50 diabetic patients (25 males and 25 females), their ages ranging from 14 to 70 with a mean age of 53 years. The great majority of the patients were at age group 46 - 65 years followed by age ranges 26 - 45, 65+ and <25 years representing 24/50 (48%), 12/50 (24%), 11/50 (22%) and 3/50 (6%) respectively. The distribution of males and females is relatively similar among all age groups, as indicated in **Table 1**.

With regard to duration of having Diabetes mellitus disease, most of patients acquired the disease for a duration of 11 - 20 years representing 16/50 (32%) of whom 7/16 (43.8%) were males and 9/16 (56.2%) were females followed by durations, 6 - 10, new, <5 years and 21+ constituting 12 (6 males and 6 females),

Table 1. Distribution of the study population by age and sex.

Variable	Category	Males	Females	Total
Age	<25 years	1	2	3
	26 - 45	5	7	12
	45 - 65	12	12	24
	65+	7	4	11
	Total	25	25	50
Occupation	Working	17	6	23
	Non-working	8	19	27
	New	5	5	10
Duration of DM	<5 years	3	4	7
	6 - 10	6	6	12
	11 - 20	7	9	16
	21+	4	1	5
Types of diabetes	Type I	5	4	9
	Type II	20	17	37
	Gestational	0	4	4
Family history of Diabetes	Yes	14	14	28
	No	11	11	22

Figure 1. Description of the study population by age, occupation, type of Diabetes, Duration of disease and Family history.

10 (5 males and 5 females), 7 (3 males and 4 females), and 5 (4 males and 1 female), respectively, as indicated in **Table 1**, **Figure 1**.

Out of the 50 patients, 23/50 (46%) were working and the remaining 27/50 (54%) were non-working. Out of the 27 non-working individuals, 8/27 (29.6%) were males and 19/27 (70.4%) were females.

With regard to the type of Diabetes, 9/50 (18%) were found with type I, of whom 5/9 (55.6%) males and 4/9 (44.4%) were females. About 37/50 (74%) were found with Type II, of whom 20/37 (54%) were males and the remaining 17/37 (46%) were females. About 4/50 (8%) females were identified with gestational diabetes. About 27/50 (54%) were found with a family history of diabetes of whom 14/27 (51.9%) were males and 13/27 (48%) were females, as indicated in **Table 1**, **Figure 1**.

The distribution of the study population by comorbidities was summarized in **Table 2**. Out of the 50 patients, 28/50 (56%) were found with hypertension of whom 15/28 (53.6%) were males and 13/28 (46.4%) were females. Thyroid disease was identified in 12/50 (24%) patients of whom 4/12 (33.3%) were males and 8/12 (66.7%) were females. Dyslipidemia was identified in 18/50 (36%) patients of whom 7/18 (39%) were males and 11/18 (61%) were females. Asthma was identified in 8/50 (16%) patients of whom 2/8 (25%) were males and 6/8 (75%) were females. Myocardial infarction was identified in 6/50 (12%) patients of whom 4/6 (66.7%) were males and 2/6 (33.3%) were females. Stroke was identified in 2/50 (4%) male patients and couldn't be identified in females. Retinopathy was identified in 19/50 (38%) patients of whom 6/19 (31.6%) were males and 13/19 (68.4%) were females. Loss of vision was identified in 7/50 (14%) patients of whom 6/7 (85.7%) were males and 1/7 (14.3%) were females. Kidney complications were identified in 8/50 (16%) patients of whom 5/8 (62.5%) were males and 3/8 (37.5%) were females. Peripheral neuropathy was identified in 20/50 (40%) patients of whom 10/20 (40%) were males and 10/20 (40%) were

Table 2. Distribution of the study population by comorbidities.

Variable	Category	Males	Females	Total
Hypertension	Yes	15	13	28
	No	10	12	22
	Total	25	25	50
Thyroid disease	Yes	4	8	12
	No	21	17	38
Dyslipidemia	Yes	7	11	18
	No	18	14	32
Asthma	Yes	2	6	8
	No	23	19	42
Myocardial infarction	Yes	4	2	6
	No	21	23	44
Stroke	Yes	2	0	2
	No	23	25	48
Retinopathy	Yes	6	13	19
	No	19	12	31
Loss of vision	Yes	6	1	7
	No	19	24	43
Kidney complications	Yes	5	3	8
	No	20	22	42
Peripheral neuropathy	Yes	10	10	20
	No	15	15	30
Diabetic septic foot	Yes	3	4	7
	No	22	21	43
Amputation	Yes	2	0	2
	No	23	25	48

females. Diabetic septic foot was identified in 7/50 (14%) patients of whom 3/7 (42.9%) were males and 4/7 (57.1%) were females. Amputation was identified in 2/50 (4%) male patients and couldn't be performed in females, as indicated in **Table 2, Figure 2.**

Table 3 summarizes the distribution of the study population by comorbidities and age. In general, most of the cases of comorbidities were observed amongst elder people. The majority of the cases of hypertension were found among age group 46 - 65 years followed by 65+ representing 15/28 (53.6%) and 10/28 (35.7%) respectively. The majority of the cases of thyroid disease were found among age group 46 - 65 years followed by 65+ representing 7/12 (58.3%) and 3/12 (25%) respectively. The majority of the cases of dyslipidemia were found among age group 46 - 65 years followed by 65+ representing 10/18 (55.6%) and

Figure 2. Description of the study population by comorbidities.

Table 3. Distribution of the study population by comorbidities and age.

Variable	Category	<25 years	26 - 45	46 - 65	65+	Total
Hypertension	Yes	1	2	15	10	28
	No	2	10	9	1	22
	Total	3	12	24	11	50
Thyroid disease	Yes	1	1	7	3	12
	No	2	11	17	8	38
Dyslipidemia	Yes	1	3	10	4	18
	No	2	9	14	7	32
Asthma	Yes	0	1	5	2	8
	No	3	11	19	9	42
Myocardial Infarction	Yes	1	0	4	1	6
	No	2	12	20	10	44
Stroke	Yes	1	0	0	1	2
	No	2	12	24	10	48
Retinopathy	Yes	1	4	10	4	19
	No	2	8	14	7	31
Loss of vision	Yes	0	1	3	3	7
	No	3	11	21	8	43
Kidney complications	Yes	0	1	5	2	8
	No	3	11	19	9	42
Peripheral neuropathy	Yes	1	3	11	5	20
	No	2	9	13	6	30
Diabetic septic foot	Yes	1	1	4	1	7
	No	2	11	20	10	43
Amputation	Yes	1	0	1	0	2
	No	2	12	23	11	48

4/18 (22.2%) respectively. The majority of the cases of Asthma were found among age group 46 - 65 years followed by 65+ representing 5/8 (62.5%) and 2/8 (25%) respectively. The majority of the cases of myocardial infarction were found among age group 46 - 65 years followed by 65+ representing 4/6 (66.7%) and 1/6 (16.7%) respectively. The majority of the cases of Retinopathy were found among age group 46 - 65 years followed by 65+ & 26 - 45 representing 10/19 (52.6%) and 4/19 (21%) respectively. The majority of the cases of loss of vision were found among age group 46 - 65 years and 65+ representing 3/7 (42.9%) for each. The majority of the cases of kidney complications were found among age group 46 - 65 years followed by 65+ representing 5/8 (62.5%) and 2/8 (25%) respectively. The majority of the cases of peripheral neuropathy were found among age group 46 - 65 years followed by 65+ representing 11/20 (55%) and 5/20 (25%) respectively. The majority of the cases of Diabetic septic foot were found among age group 46 - 65 years representing 4/7 (57%), as indicated in **Table 3, Figure 3.**

4. Discussion

Patients with DM may experience many serious, long-term complications. Some of these complications may develop in to persistent comorbid disease. Most of the complications gradually worsen without suitable control. The control of these complications depends on a variety of factors including patient's awareness and health system measures. A better control of DM and its associated comorbidities can be achieved by better capacity of medical health care utilization and patient's education. Thus aim of this study was to assess complications and

Figure 3. Description of the study population by comorbidities and age.

comorbidity of DM among diabetic patients in northern Saudi Arabia.

In the present study, we only included the diabetic patients with well-defined complications or comorbid disease. About 18%, 74% and 8% of the study population were identified with type 1, type 2 and gestational DM. These percentages only represent the prevalence rates of diabetic patients with comorbidities other than the prevalence of specific type in Saudi Arabia. However, the prevalence rates differ in the Arab countries. Arabian countries with the highest prevalence of type2 DM include: Saudi Arabia 31.6%, Oman 29%, Kuwait 25.4%, Bahrain 25% and United Arab Emirates 25%. The lowest prevalence rate was revealed in Mauritania 4.7% and Somalia 3.9%. The highest prevalence was found in Gulf Cooperation Council (GCC) 25.45% whereas non-GCC countries had the lowest prevalence (12.69%). The combined mean prevalence of T2DM in both GCC and Non-GCC Arab countries was 16.17%. The prevalence of T2DM was found to be significantly associated with higher Gross Domestic Product (GDP) ($p = 0.020$) and energy consumption ($p = 0.017$) [17].

From the most frequent encountered comorbidities in the present study was hypertension. About 56% were found with hypertension of whom 53.6% were males and 46.4% were females. Approximately 75% of adults with DM also have hypertension. Hypertension and DM are common, interwaved disorders that share a substantial overlap in underlying risk factors (including: ethnicity, familial, dyslipidemia, and lifestyle determinants) and complications [18] [19].

Myocardial infarction, stroke and dyslipidemia were identified in 12%, 4% and 36% respectively in the present study. However, many macro-vascular complications are well known in patients with longstanding DM or hypertension; include coronary artery disease, myocardial infarction, stroke, congestive heart failure, and peripheral vascular disease [18]. Although progresses have been made in the management of DM complications, cardiovascular complications are still the leading cause of mortality in patients with DM [20] [21].

Other complications in this study were retinopathy found in 18% of the patients, loss of vision in 14%, peripheral neuropathy in 40%, kidney complications in 16% and diabetic septic foot in 14% patients. Although micro-vascular complications (retinopathy, nephropathy, and neuropathy) are usually related to hyperglycemia, studies have reported that hypertension establishes a significant risk factor, particularly for nephropathy [18]. The leading cause of non-congenital blindness is DM-related retinopathy, and that of end stage renal disease is diabetic nephropathy [20]. Hyperglycemia-induced abnormalities in the polyol, hexosamine, and protein kinase C pathways have been revealed to facilitate tissue impairment in DM [22]. Moreover, hyperglycemia promotes the formation of toxic advanced glycated end products and induces glomerular hyper-filtration, aberrant growth factor expression, and free radical damage from reactive oxygen species [23]. The pathogenesis of macro-vascular disease is multi-factorial, with substantial influences from dyslipidemia, hypertension, hyperglycemia, insulin resistance, dysfibrinolysis, obesity and lifestyle factors, such as sedentary habits

[24]. The superimposition of hypertension on diabetes further aggravates micro-vascular and macro-vascular complications through additive process that include arteriolar and capillary damage in retinal, renal, coronary, cerebral and peripheral vascular territories [25].

In a study of diabetic retinopathy, within five years of diagnosis of DM 14% of patients with type 1 and 33% with type 2 had developed diabetic retinopathy [26]. Diabetic nephropathy occurs in as many as 40% of patients with diabetes, and hypertension magnifies the risk of this micro-vascular complication [27]. Diabetic peripheral neuropathy affects about 70% of diabetic patients and is a leading cause of foot amputation [20].

However, there is a paucity of literature from Saudi Arabia regarding the prevalence rates of these complications from Saudi Arabia. However, in a study conducted a retrospective review of medical records of adult Saudi patients with type 2 diabetes, out of 1952 patients, 943 (48.3%) were males. Nephropathy was the most prevalent complication, found in 32.1% of patients. Acute coronary syndrome was found in 23.1%, cataract in 22.9%, retinopathy in 16.7% and myocardial infarction was found in 14.3%. Doubling of serum creatinine was found in 12.8% and 4% sent for dialysis. Hypertension was detected in 78.1% and dyslipidemia in 39.1%. Overall mortality was 8.2%. Multiple complications were frequent [28].

5. Conclusion

Hypertension, peripheral neuropathy, dyslipidemia, retinopathy, kidney complications and diabetic septic food represent the major diabetic associated complication in northern Saudi Arabia. These complications need to be considered in epidemiological studies, so as to monitor disease burden and quality of diabetes care.

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