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Prevalence of Hypertension and Obesity among Emirati Patients with Type 2 Diabetes

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Abstract

Introduction: Hypertension and obesity are key risk factors for long-term complications associated with type 2 diabetes mellitus (type 2 DM). Previous studies have shown that the prevalence of hypertension and obesity is high in the United Arab of Emirates (UAE). However, none of these studies has focused on the investigation of hypertension and obesity in Emirati patients with type 2 DM.

Methodology: The present study is a retrospective observational study which was conducted in Rashid Centre for Diabetes and Research (Ajman, UAE). Medical records for 510 diabetic Emirati patients were examined and 51 medical records were excluded due to incomplete or missing medical data. 459 medical records of Emirati patients with type 2 DM were filtered, examined and analyzed and the following variables were included in the investigation: anthropometric variables, diabetes type and duration, BMI, HbA1c, blood pressure and lipid profile.

Results and conclusions: Findings of the present study have demonstrated that the prevalence of hypertension and obesity in Emirati patients with type 2 DM were 63% and 57%, respectively. Compared to non-hypertensive patients, hypertensive patients with type 2 DM were older and had higher levels of HbA1C and about 60% of the hypertensive patients were obese. A strong positive relationship between the systolic blood pressure, and age and diabetes duration was observed whereas the diastolic blood pressure was negatively correlated with age and diabetes duration. The prevalence of hypertension and obesity among Emirati patients with type 2 DM was significantly high. Age and diabetes duration have opposite effects on systolic and diastolic blood pressure.

Keywords: Emirati patients; Type 2 diabetes mellitus; Obesity; Hypertension

Abbreviations: BMI: Body Mass Index; BP: Blood Pressure; Dbp: Diastolic Blood Pressure; DM: Diabetes Mellitus; Hba1c: Hemoglobin A1c; HDL: High Density Lipoprotein; LDL: Low Density Lipoprotein; RCDR: Rashid Centre for Diabetes and Research; Sbp: Systolic Blood Pressure

Introduction

Diabetes mellitus (DM) is one of the most challenging health problems in the Gulf countries including the United Arab Emirates (UAE) [1,2]. The latter has experienced a pronounced economic growth during the last decade and this directly and indirectly influenced the lifestyle of Emirati population and led to a considerable increase in the prevalence of several risk factors for chronic disorders such as DM [3]. In 2009, Diabetes International Foundation revealed that five of the gulf countries are among the top ten countries for prevalence of DM with an estimated increase of 93.9% between 2010 and 2030 [1]. It is noteworthy that the increase in the prevalence of DM is strongly associated with multiple prevalent risk factors including hypertension and obesity [2].

It is well established that hypertension and obesity are major risk factors for cardiovascular disease which is considered as a leading cause of morbidity and mortality in type 2 DM. The relative risk of long-term cardiovascular complications among patients with DM is significantly higher compared to the general population [4-8]. It has been demonstrated that 40% and 60% of the patients with DM at age of 45 and 75, respectively, are hypertensive and about 80% of type 2 DM patients are overweight or obese [9-11].

Several assumptions were made to explain the pathogenic relationship between hypertension and DM and these include: (i) insulin resistance produces stimulatory effects on the sympathetic nervous system and the renin-angiotensin system and (ii) abnormalities in catecholamines and sodium metabolism [12-14]. On the other hand, lipotoxicity is regarded as the main pathogenic link between obesity and insulin resistance in DM [15].

Previous studies have shown that tight blood pressure (BP) control leads to a considerable reduction in the incidence and progression of long-term vascular complications associated with type 2 DM including stroke, heart failure and death [9,16,17]. In addition, it is evident that weight loss contributes greatly in improving insulin resistance and dyslipidemia that associated with type 2 DM [17].

The National Epidemiological Study of Hypertension in the UAE (NESH-UAE) has revealed that hypertension is significantly high among Emirati aged between 30 and 50 years and it seems to be more prevalent among females (54%) compared to males (47%). Additionally, a more recent study has reported a high prevalence of hypertension among UAE children and adolescents and emphasized

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the positive relationship between hypertension and obesity [18]. The prevalence of the latter among this population was 34.8% (females) and 34.0% (males) [19]. Furthermore, a study by Al-Maskari et al. was conducted in Al Ain district in 2004, has demonstrated that the prevalence of macrovascular diseases among persons with DM in the UAE is 29.5%, respectively [20].

These previous findings are important and informative however it also highlights the necessity of conducting further studies to examine and verify the prevalence of hypertension and obesity among Emirati patients with type 2 DM. Accordingly, the present study was designed to (i) determine the prevalence of hypertension and obesity among Emirati patients with type 2 DM and (ii) to investigate the relationship between two disorders, if any, in Emirati patients with type 2 DM who attending Rashid Centre for Diabetes and Research (RCDR). The latter is a specialized diabetes center which offers various clinical services to patients with DM in the UAE and it is located in Ajman (one of the seven Emirati states constituting the UAE).

Methodology

Subjects and setting

The present study is a retrospective cross-sectional study which was conducted in RCDR between June 2014 and September 2014. All the subjects of the study were Emirati with type 2 DM (>18 years old) who attending RCDR diabetes clinic in a quarterly basis (initial visit and three follow up visits per annum).

Medical records of 510 Emirati patients with DM were randomly selected from Diamond, an electronic medical records database, which includes 3214 medical records of patients with DM (June 2010-June 2014). All these medical records were created, monitored and updated by RCDR consultant diabologists.

51 medical records were excluded for the following reasons: (i) incomplete or missing data, (ii) medical records of type 1 DM patients and (iii) medical records of patients aged less than 18 years old. 459 medical records of Emirati patients with type 2 DM were examined and analyzed and the following variables were included in the investigation: age (years), gender (male/female), age at diagnosis (years), DM duration (years), body mass index (BMI, kg/m^2), systolic blood pressure (sBP, mmHg), diastolic blood pressure (dBP, mmHg), hemoglobin A1c (HbA1C, %), total cholesterol (mmol/l), triglycerides (mmol/l), high densitylipoprotein (HDL, mmol/l) and low density lipoprotein (LDL, mmol/l).

The presence of hypertension was determined based on diagnosis by RCDR consultant diabologists (BP ≥ 130/80 mmHg) at the initial visit and or use of antihypertensive medications and obesity was defined as BMI ≥ 30 Kg/m^2. After hypertension and obesity were identified in this sample, the study subjects were divided into six groups: (i) hypertensive, (ii) normotensive, (iii) obese, (v) non-obese, (vi) hypertensive and obese, and (vii) normotensive and non-obese. Several comparisons and assessments of the above-mentioned variables were performed within these six groups.

Statistical analysis

All data are expressed as the means (± SD) and counts (percentage) for continuous and discrete variables, respectively. Independent two sided *t* test was used to compare discrete variables of different groups and the association between sBP and dBP and the above-mentioned variables was determined using Pearson's correlation coefficient. Two-tailed *p* value less than 0.05 was considered statistically significant.

Results

A total number of 459 Emirati patients with type 2 DM were included in the study. As shown in Table 1, the mean age of the studied population was 55.6 years with 59% female patients. The average age at diagnosis and DM duration were 43.9 years-old and 11.31 years, respectively. In addition, BMI, HbA1C and the mean blood pressure of these patients were 32.1 kg/m^2, 8.9 % and 136/73 mmHg, respectively.

The findings of the present study have shown that 63% of the Emirati patients with type 2 DM are hypertensive (sBP, 143.1 ± 22.7 mmHg and dBP, 74.3 ± 11.2 mmHg). Compared to normotensive patients, hypertensive patients were older (59.6 ± 11.4 years), had longer duration of DM (12.8 ± 7.6 years) and the mean of age at DM diagnosis was significantly higher (P<0.0001) in patients with hypertension (Table 2). In addition, HbA1c level (9.0 ± 2.0 %) was significantly higher (P<0.05) among hypertensive patients compared to normotensive patients. BMI (32.3 ± 7.0 kg/m^2) was slightly higher among hypertensive patients and about 60% of the hypertensive patients with type 2 DM were obese. There was no significant difference in the lipid profile (total cholesterol, triglycerides, HDL and LDL) between the two groups (Table 2).

The prevalence of obesity among the studied population was 57%. Obese Emirati patients with type 2 DM were significantly younger (52.7 ± 12.6 years, P<0.0001) compared to non-obese patients (Table 3). In addition, obese patients had significantly shorter duration of DM (P<0.05) compared to non-obese patients. On the other hand, HbA1c

Variables	
Subjects (*n*)	459
Age (years)	55.6 ± 12.9
Gender Male, *n* (%) Female, *n* (%)	 188 (41) 271 (59)
BMI (kg/m^2)	32.1 ± 12.2
Age at diagnosis (years)	43.9 ± 12.5
Diabetes duration (years)	11.3 ± 7.6
HbA1c (%)	8.9 ± 2.0
sBP	136. 8 ± 21.7
dBP	73.3 ± 10.6

Data are expressed as means ± SD for continuous variables and as counts (percentage) for categorical variables

Table 1: Demographic and clinical profile of the studied population.

Variables	Hypertensive	Normotensive	*p*Value
n (%)	287 (63)	172 (37%)	-
Age (years)	59.6 ± 11.4	48.9 ± 12.5	<0.0001
Gender, Female, *n* (%)	176 (61)	95 (55)	-
BMI (kg/m^2) ≥ 30 (kg/m^2), *n* (%)	32.3 ± 7.0 174 (60)	31.6 ± 6.1 97 (45)	>0.05 -
Age at diagnosis (years)	46.4 ± 12.3	39.7 ± 11.9	<0.0001
Diabetes Duration (years)	12.8 ± 7.6	8.9 ± 6.9	<0.0001
Systolic BP (mmHg)	143.1 ± 22.7	126.0 ± 14.5	<0.001
Diastolic BP (mmHg)	74.3 ± 11.2	71.6 ± 9.2	<0.05
HbA1C (%)	9.0 ± 2.0	8.5 ± 1.8	<0.05
Total Cholesterol (mmol/l)	4.6 ± 1.2	4.7 ± 1.1	>0.05
Triglycerides (mmol/l)	1.9 ± 1.8	1.7 ± 1.4	>0.05
HDL (mmol/l)	1.2 ± 0.3	1.3 ± 2.1	>0.05
LDL (mmol/l)	2.8 ± 1.0	3.0 ± 0.9	>0.05

Data are expressed as means ± SD for continuous variables and as counts (percentage) for categorical variables

Table 2: Demographic and clinical data of hypertensive vs normotensive patients with type 2 diabetes mellitus.

Variables	Obese	Non-obese	*p* Value
n (%)	261 (57)	199 (43)	-
Age (years)	52.7 ± 12.6	59.5 ± 12.1	<0.0001
Gender, Female, *n* (%)	170 (65)	102 (51)	-
BMI (kg/m^2)	36.4 ± 5.5	26.3 ± 2.5	<0.0001
Age at diagnosis (years)	41.6 ± 12.1	35.1 ± 21.1	<0.0001
Diabetes Duration (years)	10.6 ± 7.5	12.3 ± 7.7	<0.05
Systolic BP (mmHg)	135.7 ± 21.2	138.3 ± 22.1	>0.05
Diastolic BP (mmHg)	73.2 ± 10.4	73.4 ± 10.8	>0.05
HbA1C (%)	9.0 ± 2.1	8.7 ± 1.9	>0.05
Total Cholesterol (mmol/l)	4.6 ± 2.1	4.6 ± 1.2	>0.05
Triglycerides (mmol/l)	1.8 ± 1.8	1.8 ± 1.6	>0.05
HDL (mmol/l)	1.2 ± 1.7	1.2 ± 0.3	>0.05
LDL (mmol/l)	2.9 ± 0.9	2.9 ± 1.1	>0.05

Data are expressed as means ± SD for continuous variables and as counts (percentage) for categorical variables

Table 3: Demographic and clinical data of obese vs non-obese patients with type 2 diabetes mellitus.

was slightly higher among obese patients however no significant differences were observed in the BP and lipid profile (total cholesterol, triglycerides, HDL and LDL) between the obese and non-obese patients (Table 3).

As shown in Table 4, hypertensive and obese patients were significantly older (57.0 ± 11.3 years, $P<0.05$) with longer duration (12.6 ± 7.7 years) of DM and the mean age at diagnosis (43.9 ± 11.7 years) was higher compared to normotensive and non-obese patients.

A strong positive relationship between the sBP and age ($r=0.307$, $P<0.0001$) and DM duration ($r=0.095$, $P<0.05$) was observed. On the other hand, dBP was negatively correlated with age ($r=-0.120$, $P<0.05$) and DM duration ($r=-0.200$, $P<0.0001$) (Table 5).

Discussion

There is unequivocal evidence that determination of the prevalence of DM risk factors such as hypertension and obesity in Emirati population is a very essential measure for creating and designing DM specialized care and management plans. For the first time, the present study investigated and determined the prevalence of hypertension and obesity among Emirati patients with type 2 DM in the Northern Emirates of the UAE. The present study has reported a high prevalence (63%) of hypertension among Emirati patients with type 2 DM attending RCDR. Age is considered as a key factor for development of hypertension in these patients.

In agreement with these findings, a study by Arifulla et al. has demonstrated that about 80% of the patients attending a tertiary care hospital in Ajman have hypertension which is strongly correlated with age and DM duration [21]. On the other hand, an investigation of macrovascular complications among patients with DM in Al-Ain district has shown that 35 % of the population had hypertension. This variation in the prevalence of hypertension in the UAE could be due to several differences between the present study and the previous studies including: (i) the sample size (ii) the study design and (iii) the nationality of the study participants. The UAE is well known as one of the most ethnically diverse countries where 80% of the population is of non-Emirati origin [22,23]. Previous studies have included all the nationalities in the UAE whereas the present study only included Emirati citizen with type 2 DM. Several observations (unpublished data) have suggested that there are differences between Emirati population and other populations in the UAE and this includes the lifestyle and the genetic background. Additionally, in the present study the diagnosis of DM was confirmed by consultant diabologists.

A substantial amount of the literature has demonstrated that prevalence of hypertension in type 2 DM patients varies across different ethnic and racial groups. In Asia, the highest prevalence of hypertension in patients with type 2 DM was 85.8% and 60.2% at BP thresholds of 130/80 mmHg and 140/90 mmHg, respectively and the lowest prevalence of hypertension in persons with DM was 40.4% at BP threshold of 140/90 mmHg [24,25]. Similarly, the highest and the lowest prevalence of hypertension in type 2 DM among Africans were 80% and 38.5 %, respectively [26].

On the other hand, several reports have shown that hypertension is very prevalent among Europeans with DM and the highest and the lowest rates were 95% and 29.3%, respectively [27-29]. In USA, 70.9% was the highest prevalence of hypertension among type 2 DM patients and the lowest prevalence reported was 66.9% [30]. Taking into account the previous and the present findings, it seems that hypertension affects more than 60% of the patients with type 2 DM, globally.

Emirati hypertensive patients with type 2 DM have higher HbA1c levels compared to normotensive patients however no significant differences were observed in the lipid profile of these two groups. It is noteworthy that normotensive Emirati patients are obese suggesting

Variables	Hypertensive and Obese	Normotensive and Non-obese	p Value
n (%)	163 (36)	76 (17)	-
Age (years)	57.0 ± 11.3	53.6 ± 12.3	<0.05
Gender, Female, *n* (%)	107 (65)	33 (43)	-
BMI (kg/m^2)	36.8 ± 5.8	26.2 ± 2.3	<0.0001
Age at diagnosis (years)	43.9 ± 11.7	42.2 ± 11.2	<0.05
Diabetes Duration (years)	12.6 ± 7.7	10.7 ± 7.9	>0.05
Systolic BP (mmHg)	141.9 ± 22.4	126.9 ± 14.9	<0.0001
Diastolic BP (mmHg)	74.0 ± 10.9	71.1 ± 8.9	<0.05
HbA1C (%)	9.3 ± 2.1	8.7 ± 1.8	<0.05
Total Cholesterol (mmol/l)	4.6 ± 1.2	4.7 ± 1.3	>0.05
Triglycerides (mmol/l)	1.8 ± 1.9	1.7 ± 1.4	>0.05
HDL (mmol/l)	1.1 ± 0.3	1.7 ± 0.3	>0.05
LDL (mmol/l)	2.8 ± 1.0	3.0 ± 1.1	>0.05

Data are expressed as means ± SD for continuous variables and as counts (percentage) for categorical variables

Table 4: Demographic and clinical data of hypertensive and obese vs normotensive and non-obese patients with type 2 diabetes mellitus.

	sBP		dBP	
Variables	*R*	*P* value	*r*	*P* value
Age	0.307	<0.0001	- 0.120	<0.001
BMI (kg/m^2)	0.006	>0.05	-0.057	>0.05
Age at diagnosis (years)	0.285	>0.0001	0.008	>0.05
Diabetes duration (years)	0.095	<0.05	-0.200	<0.0001
HbA1c (%)	0.067	>0.05	0.059	>0.05
Total Cholesterol (mmol/l)	0.006	>0.05	0.087	>0.05
Triglycerides (mmol/l)	0.009	>0.05	0.066	>0.05
HDL (mg/dL) (mmol/l)	0.063	>0.05	0.066	>0.05
LDL (mg/dL) (mmol/l)	-0.005	>0.05	-0.081	>0.05

DBP: Diastolic Blood Pressure; R: *Pearson's* Correlation Coefficient; SBP: Systolic Blood Pressure

Table 5: Association between demographic and clinical variables and systolic and diastolic blood pressure.

that obesity is not directly related to hypertension in these group of patients.

The present study has also revealed that the 60% of the hypertensive Emirati patients with type 2 DM were obese whereas the prevalence of obesity among normotensive patients was 45%. In contrast, a national multicentre study in Brazil has reported that 40.5% of the hypertensive type 1 DM patients with mean age of 30.5 years were obese or overweight whereas a lower incidence (29.2%) of obesity was observed among normotensive patients [31]. The mean age of the study population and the type of DM clearly explain the differences in the prevalence rate of obesity among hypertensive DM patients in the latter and the present study. Comparatively, results from Swedish National Diabetes Register have demonstrated that the prevalence of hypertension among type 2 DM varies based on the values of BMI. The prevalence of hypertension among normal weight (BMI<25 kg/m^2), overweight (BMI 25-29.9 kg/m^2) and obese (BMI ≥ 30 kg/m^2) patients with DM was 76.6%, 83.4% and 87.5%, respectively [11].

Several lines of evidence suggested that obesity has a dramatic influence on the development of type 2 DM vascular complications [32]. International studies have shown that the prevalence of obesity among DM patients is more than 30% supporting the findings of the present study which revealed that the prevalence of obesity among Emirati patients with type 2 DM is 57%. Similar prevalence rates of obesity among patients with type 2DM were reported in Qatar and Jordan, 53.5% and 58.6%, respectively [33,34]. However, it seems that the highest prevalence of obesity in the world was reported in the Middle East particularly in Iran and Sauid Arabia, 85.5% and 83.45%, respectively [35,36].

One of the interesting findings of the present study is that Emirati obese patients with type 2 DM were significantly younger than the non-obese patients. In addition, there were no significant differences in BP and lipid profile between the obese and non-obese patients. Given that the BMI value of the latter is 26.3 kg/m^2 (considered overweight) and the mean age of the two groups is above 50 years may provide an appropriate interpretation for these outcomes.

A comparison between the hypertensive obese and normotensive non-obese patients has shown that age is the most important determining factor of hypertension in this group of patients however, DM duration was not significantly different between these two groups of patients. Taking into account this finding along with the previous findings, we can propose that factors other than obesity and DM duration contribute to development of hypertension in Emirati patients with type 2 DM and this may include diverse genetic profiles and lifestyle components. Further studies are required to elaborate on how these factors can act as risk factors for development of hypertension in Emirati patients with type 2 DM.

As expected, sBP was significantly higher among hypertensive patients with type 2 DM compared to normotensive patients. There is strong evidence for the positive effect of lowering blood pressure on the microvascular complications associated with DM and it has been shown that the rate of stroke and death was considerably reduced in patients with BP 144/82 mmHg compared to patients with higher BP, 154/87 mmHg [9,37,38]. Classically, sBP has been viewed as being a stronger predicator of cardiovascular disease and coronary heart disease compared to the dBP, however several reports have also demonstrated that diastolic hypotension as consequential event of antihypertensive therapy is associated with an increased risk of myocardial infarction [39]. Additionally, it has been found that the relative risk of the latter is doubled at dBP threshold of 60 mmHg compared to dBP threshold of 100 mmHg [40]. Moreover, ageing seems to have opposed effects on sBP and dBP and this hypothesis is supported by the findings of the present study which indicated that sBP was positively correlated with the age and DM duration whereas a negative association was found between dBP, and age and DM duration. Other reports have emphasized the effects of aging on dBP by showing that the latter increases until the age of 60 years old and then it starts to decline continuously [41,42]. A study by Ronnback et al. has further supported these findings by indicating that sBP of type 1 DM subjects in all age-groups was significantly higher than in subjects without DM, whereas the changes of dBP were age-dependent, younger subjects (<40 years old) and older subjects (>45 years old) had higher and lower dBP, respectively [43]. Similarly, in type 2 DM a consistent increase in sBP with age was reported however dBP failed to gradually increase with age [24]. In the light of the above-mentioned findings, it is reasonable to suggest that guidelines for BP control in patients with DM should include minimal dBP rate target and elderly patients with long duration of DM should maintain dBP>70 mmHg to avoid the cardiovascular morbidity and mortality associated with diastolic hypotension. Whether the beneficial effects of avoiding the latter are more important than maintaining sBP <130 mmHg in DM remains to be a debatable question [44].

Although all RCDR hypertensive patients with type 2 DM are taking multiple antihypertensive medications, the mean of the sBP among this population was 143 mmHg. This may indicate the presence of resistant hypertension in RCDR type 2 DM patients, therefore further studies need to be conducted to investigate the nature of resistant hypertension and the effects of antihypertensive therapy in this group of patients.

Conclusions

The prevalence of hypertension among Emirati patients with type 2 DM is considerably high (63%) and age is the key factor for the development of hypertension in DM. Prevalence of obesity among the studied population is 57% and obese patients were significantly younger than non-obese patients. Interestingly, the present study has demonstrated that in Emirati patients with type 2 DM, sBP was increased in age- and DM duration-dependent fashion whereas dBP was negatively correlated with age and DM duration.

Competing Interests

The authors declare that they have no competing interest.

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