

Hypertension in Saudi Adults with Type 1 And 2 Diabetes Mellitus

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Abstract

Background: Diabetes and hypertension (HTN) are among the most common chronic non-communicable diseases.

Methods: A cross sectional study was conducted at the Primary Health Care Clinics at King Fahad Armed Forces Hospital, Jeddah, Saudi Arabia. A total of 1546 Saudi with type 1 diabetes (T1DM) and type 2 diabetes (T2DM) were randomly selected.

Results: A total of 1546 patients attending the Primary Health Care Clinics were reviewed. There were 313 (20.2 %) diagnosed with T1DM and 1233 (79.8%) with T2DM. Out of the total 1546 patients, HTN was present in 124 (8%) of T1DM patients and 777 (50.3%) of T2DM patients. Total of 901 (58.2%) patients with diabetes and HTN included in this study; 365 (40.5%) male and 536 (59.5%) female. HTN was diagnosed in 13.8% of T1DM and 86.2% of T2DM patients. A female predominance (sex ratio male: female) 1:2.8 for T1DM+HTN and 1:3 for T2DM + HTN. T2DM + HTN were significantly older and have higher HbA1c than patients with T1DM+HTN. Significant female predominance across the body mass index groups between T1DM + HTN compared to T2DM+HTN particularly female T2DM + HTN. Significant frequent cases of T2DM+HTN compared to T1DM + HTN across the HbA1c and 24 hours Urine micro albumin groups. No significant gender differences were found in the HbA1c and 24 hours Urine micro albumin groups.

Conclusion: The frequency of hypertension in patients with diabetes in this study is high. It is mandatory to have adequate diagnostic, therapeutic and educational resources in addition to competent physicians who can manage hypertension in diabetic patients by using a continuing, comprehensive and coordinated approach.

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Introduction

Diabetes mellitus and hypertension (HTN) are two of the most common diseases affecting both developed and developing countries and occur at a higher prevalence in the older age group and result from both genetic and environmental etiological factors [1-3]. HTN is an extremely common comorbidity in patients with diabetes, affecting approximately 20-60% of patients, depending on age, ethnicity, and body weight [4]. The prevalence of HTN in diabetic individuals appears to be approximately twofold that in the non-diabetic population. This is clearly the case for type I diabetes (T1DM) and is probably valid for type 2 diabetes (T2DM) as well, although the relation is somewhat more controversial with regard to the latter.

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Patients with T1DM currently make up about 6% to 8% of the total diabetes population. Among those with T1DM, the incidence of HTN rises from 5 percent at 10 years, to 33 percent at 20 years, and 70 percent at 40 years [5]. HTN is extremely common in patients with T2DM, affecting up to 60% [6]. In contrast to patients with T2DM, those with T1DM typically develop renal disease before developing hypertension [7-9]. The presence of HTN in patients with diabetes markedly enhances development of microvascular and microvascular disease in these individuals. Diabetic individuals with coexisting hypertension have a much greater prevalence of stroke and transient ischemic episodes than do normotensive diabetics. Both hypertension and diabetes mellitus are major independent risk factors for accelerated atherosclerosis and ischemic heart disease and peripheral vascular disease [10-14]. Therefore, the aim of the present study is to determine the frequency of HTN in cases with T1DM and T2DM among the patients who have attended the primary health care center in a Saudi community.

Methods

A cross sectional study was conducted at Primary Health Care Clinics at King Fahad Armed Forces Hospital. A total of 1546 Saudi diabetic patients were randomly selected. The demographic data and medical history were documented. Blood Pressure readings were within a gap of 15 minutes using a mercury sphygmomanometer by palpation and auscultation method in right arm in sitting position. Two readings were taken 15 min apart and the average of both the readings was taken for analysis. HTN was also diagnosed based on anti HTN medications or having a prescription of antihypertensive drugs and were classified as Hypertensive irrespective of their current blood pressure reading or if the blood pressure was greater than 140/90 mmHg i, e systolic BP more than 140 and diastolic BP more than 90 mm of Hg–Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. [15] The Body mass index (BMI) was considered normal if it was below 25 kg/m², 25-29.9 kg/m² overweight and 30 kg/m² or greater was obese. The HbA1c was divided into three groups; < 7.0, 7.0 - 8.9 and ≥ 9.0. 24 hours Urine micro albumin (mg/24 h) was divided into three groups; < 15.0, 15.0 - 45.0 and > 45.0. The study was approved by the ethical board of King Fahad Armed Forces Hospital.

Statistical Analysis

Univariate analysis of baseline and follow up demography and clinical laboratory endpoints were accomplished using unpaired t-test. Chi square(X²) test were used for categorical data comparison. All statistical analyses. Were performed using SPSS Version 22.0. All P values were based on two-sided tests. P < 0.05 was considered significant.

Results

A total of 1546 patients attending the Primary Health Care Clinics were reviewed. There were 313 (20.2%) diagnosed with T1DM and 1233 (79.8%) with T2DM. Out of the total 1546 patients, HTN was present in 124(8%) of T1DM patients and 777(50.3%) of T2DM patients. Total of 901 (58.2%) patients with diabetes and HTN included in this study; 365 (40.5%) male and 536 (59.5%) female, (Table 1). HTN was diagnosed in 13.8% of T1DM and 86.2% of T2DM patients. A female predominance (sex ratio male: female) 1:2.8 for T1DM + HTN and 1:3 for T2DM + HTN. T2DM + HTN were significantly older and have higher HbA1c than patients with T1DM + HTN. (Figure 1) shows significant female predominance across the body mass index groups between T1DM + HTN compared to T2DM + HTN particularly female T2DM + HTN. Significant frequent cases of T2DM + HTN compared to T1DM + HTN across the HbA1c and 24 hours Urine micro albumin groups, Figure 2 and 3. No significant gender differences were found in the HbA1c and 24 hours Urine micro albumin groups.

Parameters		T1DM + HTN 124 (13.8)	T2DM + HTN 777 (86.2)	P value
Gender	Male	33(9)	332 (91)	0.001
	Female	91 (17)	445 (83)	
Age(years)		26.5 ± 3.9	40.6 ± 6.5	< 0.0001
Body mass index		33.0 ± 7.4	31.4 ± 7.8	0.009
HbA1c		8.2 ± 2.2	8.7 ± 2.2	0.04
Serum creatinine		65.1 ± 15.5	75.0 ± 28.2	< 0.0001
24 hours Urine micro albumin (mg/24h)		66.0 ± 143.0	131.3 ± 312.0	0.04

Table 1: Demographic patient's parameters and Comparison of features between diabetics and hypertension.

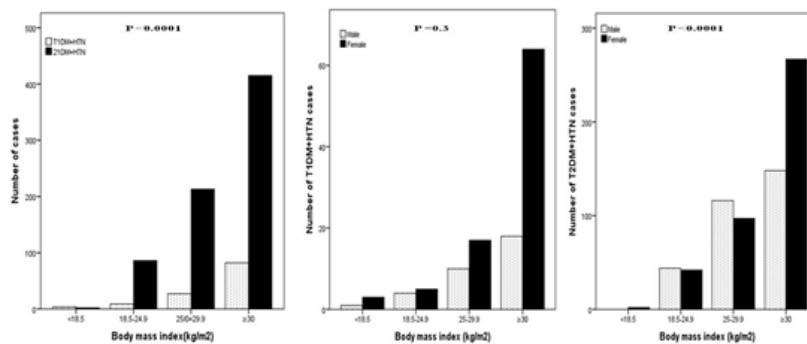


Figure 1: Frequency of T1DM and T2DM and HTN according to body mass index groups and gender.

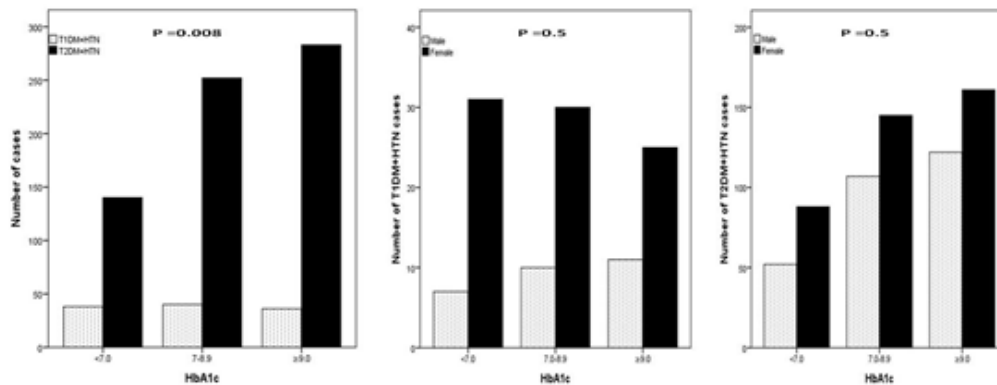


Figure 2: Frequency of T1DM and T2DM and HTN according to HbA1c groups and gender.

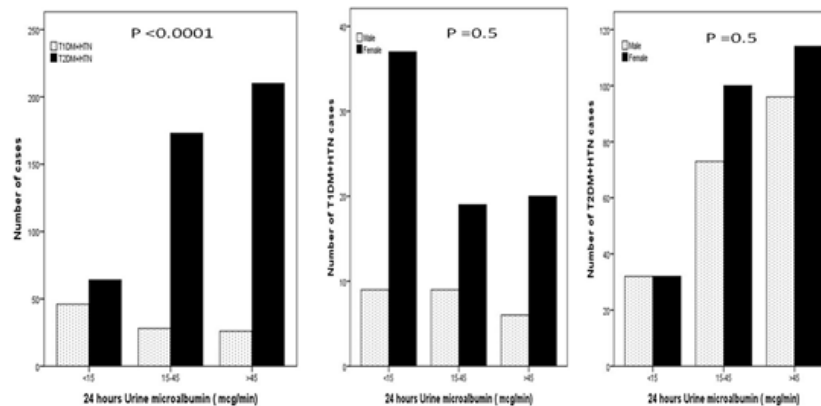


Figure 3: Frequency of T1DM and T2DM and HTN according to 24 hours Urine micro albumin groups and gender.

Discussion

There is many evidence for an increased prevalence of hypertension in diabetic persons [16]. The coexistence of HTN and T2DM is a major risk factors to the development and progression of microvascular and microvascular complications in people with diabetes compared to the general population [17-19]. Both HTN and T2DM increase the risks of cardiovascular disease, stroke, nephropathy and retinopathy [7,20,21]. Indeed when HTN coexists with diabetes, the risk of cardiovascular disease is increased by 75%, which further contributes to the overall morbidity and mortality of an already high risk population.

The prevalence rate of HTN among T2DM is ranging between 32% and 82% which translates up to 3 times greater than in age- and sex-matched patients with diabetes [7,9,21]. In discordance with our finding where female was more predominance, male sex has been associated with an increased incidence of hypertension in some studies but not in all [22,23]. Compared to Arab population, the prevalence rate of HTN reported in this study (50.3%) among patients with T2DM is lower to the 64.5% rate reported in Qatari diabetics and 72.4% rate reported in Jordanian diabetics. In other Arab populations, the prevalence rate of hypertension is moderate: 53% in Saudi diabetics, 44% in Omani diabetics and 38% in Bahraini diabetics. Compared to other populations, the rate of hypertension among diabetics in our study is lower to the 74%, 74.4% and 73% rates of hypertension reported in UK Caucasians, Italian and Spanish populations, respectively. This prevalence is lower than the 82% prevalence rate reported about Afro-Caribbean individuals living in UK and much higher than the 32% and 39% rates reported among diabetics in the Turkish and Taiwanese populations, respectively. The explanation for differences in frequency by each country could be due to different methods of surveillance, differences in definitions of hypertension, population characteristics and ethnic variations. Hyperglycemia and increase in total body exchangeable sodium leading to extracellular fluid accumulation and expansion of the plasma volume contributes to the pathogenesis of hypertension in DM [22, 24-33].

The close association of diabetes with HTN is commonly thought to be due to underlying obesity, insulin resistance, and/or hyperinsulinemia [20, 34-36]. Hyperinsulinemia induces HTN through increased renal tubular reabsorption of sodium and water, increased sympathetic nervous system activity, proliferation of vascular smooth muscle cells, and alterations of transmembrane cation transport. At physiological concentrations, insulin decreases urinary sodium excretion, an action mediated by binding to specific high-affinity receptors [34-38]. Recent data suggest that cellular insulin resistance, rather than hyperinsulinemia may lead to HTN [39]. In addition, impaired cellular response to insulin predisposes to increased vascular smooth muscle tone which is the hallmark of hypertension in the diabetic patients [39].

Few studies of HTN in T1DM patients have been conducted; the majority of these studies analyzed HTN in adult diabetic patients and reported a prevalence of 24 to 43% which is lower to those observed in the current study [40-47]. Most non-glycemic risk factors for incident HTN identified herein are consistent with those described elsewhere, including older age and greater BMI [22,23,48,49]. BMI merits specific note because their associations with HTN add to growing evidence that obesity is a clinically relevant health problem for people with T1DM [50]. HbA1c was significantly associated with more frequent HTN in T2DM than in T1DM. Extensive literature describes effects of hyperglycemia on the vascular wall. Through increased quantities of advanced glycation end products, reactive oxygen species, and sorbitol, hyperglycemia can lead to vasoconstriction (via alterations of endothelin and nitric oxide) and to extracellular matrix deposition. Activation of protein kinase C may play a central role in these pathways. Changes leading to vascular remodeling may progress over long periods on the development of HTN [51,52]. However, the long-term effect of hyperglycemia on blood pressure is not known.

Diabetic nephropathy will develop in as many as 40% of IDDM patients [16]. HTN often contributes to the development of nephropathy in many diabetic individuals [53,54]. Diabetic nephropathy, which occurs after 15 years of diabetes in one-third of people with T1DM and 20% of those with T2DM, is an important contributing factor to the development of HTN in the diabetic individual [55]. The HTN associated with diabetic nephropathy is usually characterized by sodium and fluid retention and increased peripheral vascular resistance [16].

The objective of HTN and diabetes care is to reduce its mortality and complications and to improve the quality of life for patients suffering from this chronic health problem [49]. To achieve these aims, it is mandatory to have adequate diagnostic, therapeutic and educational resources in addition to competent physicians who can manage HTN and diabetes by using a continuing, comprehensive and coordinated approach. Many essential resources for the care of patients with HTN and T2DM are not available at primary health care settings [56]. Urgent provision of these resources is essential to introduce good health care for hypertensive diabetic patients.

Several limitations of the current study must be addressed. We used a clinical definition of T1DM that was assigned by physicians and was applicable to all patients, which is similar to previous studies [57]. However, autoantibody and C-peptide levels were not measured. Therefore, some patients with other types of diabetes may have been included. Nevertheless, it is important to emphasize that 93.1% of our patients were diagnosed before the age of 30, which supports the high probability that these patients had T1DM. Additionally, the prevalence of hypertension may have been overestimated because diagnosis was based on the measurement of a blood pressure in one day rather than two separate measurements on two separate days. Due to the cross-sectional nature of this study, the observed population reflects a selected yet comprehensive group of patients. Our study could be limited by the question of clustering of cases within the study region and the effect that might have on our estimates, in addition, the current study population may appear limited in size and therefore may underestimate the true frequency of T1DM and T2DM and HTN in the general population. Despite this limitation, our study is one of the Saudi study done on a large sample, which was specifically interested in the problem of hypertension in diabetic patients and reported very important information on the epidemiology of hypertension in Saudi diabetics

In conclusion, the frequency of HTN in patients with T1DM and T2DM in this study is high. It is mandatory to have adequate diagnostic, therapeutic and educational resources in addition to competent physicians who can manage HTN in diabetic patients by using a continuing, comprehensive and coordinated approach.

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