

## ORIGINAL ARTICLE

## PREVALENCE OF HYPERTENSION IN TYPE 2 DIABETICS

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**Background:** Type 2 diabetes and hypertension are important and common chronic diseases that have a huge impact on the health of individuals as well as the health care systems. This study was conducted to estimate the prevalence of hypertension and its associated risk factors among type 2 diabetic patients. **Methods:** This cross-sectional study was carried out at the Diabetes Clinic, Medical Unit III, Jinnah Postgraduate Medical Centre Karachi from 1<sup>st</sup> July, 2015 to 31<sup>st</sup> December, 2015. Two hundred and sixty-two type 2 diabetic patients aged 18 to 80 years were selected using non purposive convenient sampling technique. Each consenting patient underwent a detailed medical history, physical examination and laboratory assessment for measurement of fasting blood glucose, HbA1c and lipid profile. Hypertension was defined according to AHA criteria. **Results:** Out of 262 patients 101 (37.8%) were males and 161 (62.2%) were females. Mean age of all patients was 53.03±9.9 years and mean duration of diabetes was 10.07±6.04 years. A total of 187 (72.5%) patients were found out to be hypertensive. Patients with a shorter duration (<10 years) of diabetes (75.7%), obesity (72.6%), and central obesity (77.42%) had higher rates of hypertension. Hypertension was found to be significantly associated with dyslipidemias and presence of central obesity ( $p<0.05$ ). **Conclusion:** The prevalence of hypertension was high in diabetics. Among diabetic patients hypertension was significantly associated with dyslipidemias and central obesity.

**Keywords:** Hypertension, diabetes, risk factors, mortality, obesity, Body Mass Index

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## INTRODUCTION

Type 2 diabetes and hypertension are two important and prevalent health concerns worldwide.<sup>1</sup> It is estimated that over 170 million people are affected with Diabetes worldwide.<sup>2</sup> Both the diseases are major risk factors for stroke and coronary heart disease.<sup>3</sup> In addition to coronary heart diseases and stroke, other complications of diabetes mellitus include heart failure, peripheral vascular disease, renal impairment, retinopathy and neuropathy.<sup>4</sup> The prevalence of both diseases is increasing rapidly due to lifestyle changes in the developed as well as in the developing countries.

The common well known risk factors for developing hypertension in general population include old age, male gender, smoking, sedentary life style, High Body Mass Index (BMI), and dyslipidemia.<sup>5</sup> The presence of type 2 diabetes as well as its duration and control also contribute in development of hypertension. It is fair to say that the coexistence of both diabetes and hypertension coexist more frequently than mere chance would suggest.<sup>6</sup>

Typically, hypertension in type I as well as type II diabetes is characterized by an increase in the peripheral vascular resistance. In addition, hypernatremia has also been found to play a role in the pathogenesis of increased blood pressure in diabetic population.<sup>6</sup> Over the years, evidence has accumulated to suggest a key etiological role for insulin resistance/hyperinsulinemia in the focalization of hypertension in

all sorts of diabetes.<sup>6</sup> Several studies have suggested that hyperinsulinemia which is frequently found in type II diabetes is independently associated with an increased risk for cardiovascular disease in these patients.<sup>7-11</sup>

The frequency of hypertension in diabetic population is almost twice as compared to non-diabetic general population, ranging between 32% and 82%.<sup>12</sup> The presence of hypertension in diabetic patients substantially increases the risks of micro vascular as well as macro vascular complications. Indeed, when hypertension coexists with diabetes, the risk of coronary heart disease is increased by 75%, which further prone a high risk population to increased risk in terms of morbidity and mortality.<sup>13</sup> Additionally, a study noted that hypertension was found to be present in almost half of deaths due to diabetes mellitus and diabetes was diagnosed in 1 out of 10 patients diagnosed with hypertension.<sup>6</sup> Therefore, it's essential to detect and treat hypertension in type 2 diabetic patients to reduce the complications and prevent the premature mortality.

There are limited data available in Pakistan on the prevalence of hypertension in type 2 diabetic patients as well as in general population. Furthermore, little is known about the associated risk factors for development of hypertension in patients with type 2 diabetes. This cross sectional study aimed to determine the prevalence and the associated risk factors of hypertension in type 2 diabetic patients in a large tertiary care based hospital.

## MATERIAL AND METHODS

This descriptive cross-sectional study was conducted at the Diabetes Clinic, Medical Unit III, Jinnah Postgraduate Medical Centre Karachi for a period of six months from 1<sup>st</sup> July, 2015 to 31<sup>st</sup> December, 2015. A total of 262 diabetic patients aged 35 years to 71 years, were enrolled into the study using non-purposive convenient sampling technique. There were 101 males and 161 females in the study population. A detailed, written informed consent was obtained from the patients before their enrolment into the study. A detailed medical history was obtained from the patients before they were subjected to a thorough physical examination and laboratory assessment. The relevant data obtained from the patients was recorded on a pre-designed proforma. The recorded information included age of the patients, their ethnicity, history of hypertension, the duration of diabetes mellitus, and their lifestyle: whether sedentary or not. Sedentary life style was defined if patient had less than 150 minutes of exercise per week which included brisk walk or other aerobic exercises. Physical activity was assessed by self-report only.

The physical examination of study participants included measurement of height, weight, BMI and the waist circumference (WC) by a trained examiner. The waist circumference was measured at a point midway between the last rib and the iliac crest and with the patient at minimal inspiration. The BMI was calculated as a ratio of the weight in Kg and the square of the height of patient in meters. The blood pressure (BP) was obtained with a mercury sphygmomanometer, in the right arm of patients in the supine position, after 5 min of quiet rest. For laboratory assessment the blood samples were taken from ante-cubital vein after a 12 hour overnight fast for measurement of Fasting Plasma Glucose (FPG), total cholesterol (TC), triglyceride (TG), Low Density Lipoprotein cholesterol (LDL-C) and High Density Lipoprotein cholesterol (HDL-C). The measurement of HbA1c was done by A1C Now (Bayer). The data recorded from patients were entered into SPSS version 19. Data was expressed either as the mean  $\pm$  standard deviation or median [inter-quartile range (25%–75%)] or as percentage. Differences between groups were tested using an independent two-sample *t*-test for continuous variables, and the Pearson chi-square test was used to test for differences in the distribution of categorical variables. All provided *p*-values represent the results of two-sided tests and *p*<0.05 were considered statistically significant. For the purpose of statistical analysis, the age of patients was further categorized into two groups and for this purpose the cut-off age was determined to be 55 years.

Smokers were defined as people currently smoking or have had smoked in past but have quit now. Diabetes duration of 10 years was set as a cut-off limit

and patients were re-categorised as having been diagnosed with diabetes mellitus for up to 10 years or more than 10 years. For the purpose of study, systolic blood pressure was defined as blood pressure up to 140 mmHg. Normal diastolic blood pressure was defined as blood pressure up to 90 mmHg.

The body mass index was calculated as weight in Kg divided by height squared in meters (Kg/m<sup>2</sup>). Asian cut-off was used for defining over weight and obesity. For males, central obesity was defined as a waist circumference more than 90 cm and for females central obesity was defined as a waist circumference more than 80 Cm.

An HbA<sub>1c</sub> level of less than 7 was taken as indicative of controlled diabetes mellitus. Similarly, dyslipidemia was defined on the basis of presence of any of the following: 1) a high triglyceride level (>150 mg/dL) or drug treatment for high triglycerides; 2) a high LDL-cholesterol level (>100 mg/dL) or drug treatment for high LDL; 3) a low HDL-cholesterol level (men, <40 mg/dL; women, <50 mg/dL) or on drug treatment.

## RESULTS

The sample data included 262 patients aged 24–80 years. Among them 101 (38.54%) were males and 161 (61.46%) were females. Mean age of all patients was 53.03 $\pm$ 9.9 years and mean duration of diabetes was 10.07 $\pm$ 6.04 years. Age of the youngest subject was 35 years, and the oldest study participant was 71 years old.

**Table-1: Risk factors for hypertension in T2DM [n(%)]**

Risk Factors	Total	Hypertension		<i>p</i>
		Yes	No	
<b>Gender</b>				
Male	101 (38.54)	77 (76.24)	24 (23.76)	0.17
Female	161 (61.46)	110 (68.32)	51 (31.68)	
<b>Age</b>				
Up to 55	121 (46.18)	89 (73.55)	32 (26.45)	0.47
>55	141 (53.82)	98 (69.50)	43 (30.50)	
<b>Duration of Diabetes</b>				
Up to 10 years	107 (40.84)	81 (75.70)	26 (24.30)	0.20
>10 years	155 (59.16)	106 (68.39)	49 (31.61)	
<b>Life style</b>				
Sedentary	203 (77.48)	145 (71.43)	58 (28.57)	0.98
Non sedentary	59 (22.52)	42 (71.19)	17 (28.81)	
<b>Smoking</b>				
Smokers	109 (41.60)	73 (66.97)	36 (33.03)	0.15
Non smokers	153 (58.40)	114 (74.51)	39 (25.49)	
<b>BMI</b>				
Non-Obese	83 (31.68)	57 (68.67)	26 (31.33)	0.51
Obese	179 (68.32)	130 (72.63)	49 (27.37)	
<b>Central Obesity</b>				
Present	155 (59.16)	120 (77.42)	35 (22.58)	0.01
Absent	107 (40.84)	67 (62.62)	40 (37.38)	
<b>Diabetes Control</b>				
Controlled	101 (38.55)	65 (64.36)	36 (35.64)	0.38
Uncontrolled	161 (61.45)	112 (69.57)	49 (30.43)	
<b>Dyslipidemia</b>				
Present	152 (58.02)	118 (77.63)	34 (22.37)	0.01
Absent	110 (41.98)	69 (62.73)	41 (37.27)	

A total of 187 (72.5%) patients were hypertensive. The mean systolic and diastolic blood pressures (BP) were  $160 \pm 14$  mmHg (95% CI, 136.6–136.9) and  $95 \pm 8$  mmHg (95% CI, 78.7–78.9) respectively.

Socio-demographic factors shown in Table-1 indicate that the prevalence rate of HTN is higher among males (76.23%) and the younger age groups with a higher rise in patients younger than 55 years (73.5%). Patients with a shorter duration (<10 years) of diabetes (75.7%), obesity (72.6%), and central obesity (77.42%) had higher rates of HTN. Hypertension was found to be significantly associated with dyslipidemias and presence of central obesity ( $p < 0.05$ ).

## DISCUSSION

Diabetes Mellitus (DM) is a major health problem in the developed world. It has also been increasingly recognized as a serious health problem in Pakistan. Currently there are about 7 million diabetic patients in Pakistan<sup>14</sup> and this number is increasing day by day. According to the World Health Organization estimates, by the year 2025 Pakistan will rank 4<sup>th</sup> from the current 8<sup>th</sup> position in the world according to the prevalence of DM.<sup>14</sup> The development of hypertension in diabetic population is influenced by diabetes itself and hypertension has been noted in from as low as one-thirds to more than three fourths of diabetic population.<sup>12</sup>

The prevalence of hypertension in this study was very high. Earlier, Pell and colleagues had reported that the prevalence of hypertension among diabetic population was 54% more than the general population.<sup>15</sup> They also noted that though there was no association between prevalence of hypertension among diabetic patients and their weight, atherosclerosis and its complications were twice as common in diabetics compared to the general population.

A systematic review published recently was conducted with a view to identify the prevalence of hypertension and/or obesity among type 2 diabetic patients across the globe.<sup>16</sup> The researchers noted that the prevalence of hypertension was generally high among type 2 diabetic patients throughout the world. Most of the studies which were included in this systematic review reported the prevalence of hypertension in excess of 50% and prevalence rates as high as 75% for hypertension in type 2 diabetics were also noted. The prevalence of obesity varied from 30%–50%.<sup>16</sup> The researchers also reported that the prevalence of hypertension among obese diabetics was 70% and more in studies from Asia.<sup>16</sup> However, a recently published study from India reported an overall prevalence of hypertension in 25.6% of type II diabetic population.<sup>17</sup> Interestingly, they reported that 52.7% study participants were pre-hypertensive. However, the

researchers did not define pre-hypertension in this study.<sup>17</sup>

Earlier, the Hypertension in Diabetes Study reported that the prevalence of hypertension in diabetes was 39% in their study cohort.<sup>18</sup> As compared to diabetic males (35%), more diabetic females (46%) had hypertension. Another study from Morocco reported comparable prevalence rates of hypertension (>70%) in type 2 diabetic population.<sup>12</sup> The researchers reported that the association between hypertension, and age, BMI and duration of diabetes was found to be statistically significant.<sup>12</sup> On the other hand, studies from Nigeria put the prevalence of hypertension in type 2 diabetic population at around 60%.<sup>19,20</sup>

## CONCLUSION

The prevalence of hypertension in type-2 diabetic patients is significantly higher as compared to general population. Whether this increased prevalence is due to diabetes itself as a result of microvascular and macrovascular complications or due to an independent association with diabetes is unclear.

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