

Prevalence of Hypertension in Patients with Type-2 Diabetes Mellitus

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Abstract: Background: Hypertension contributes enormously to the global disease burden and mortality. The prevalence of hypertension among type 2 diabetes mellitus (DM) patients is higher than that of age- and sex-matched patients without diabetes, ranging from 32% to 82%. Diabetes mellitus is a global health issue, about 9% of adults have diabetes, and an estimated 1.5 million people die due to diabetes worldwide each year. Increasing age, trend of obesity and worsening renal function increasing the prevalence of hypertension in people with type-2 diabetes mellitus. **Objective:** To assess the prevalence of hypertension in patients with type-2 diabetes mellitus. **Methods:** This was a cross-sectional study which was conducted in the Department of Medicine, 250 Beded Mohammad Ali Hospital, Bogura, Bangladesh during the period from January to December 2023. In total 100 patients with type-2 diabetes mellitus attended to the mentioned hospital with proper documents were finalized as the study people. Besides data regarding type 2 diabetes mellitus, data of blood pressure and macro-vascular as well as micro-vascular complications were collected. A predesigned questionnaire was applied to collect patient data. All data were processed, analyzed and disseminated by MS Office and SPSS version 20. **Results:** In this study, a total of 100 type-2 diabetic patients (56 male, 44 female) were observed. The mean age of the patients was 53.86 years with Standard deviation (SD) of ± 11.54 years. The mean duration of diabetes mellitus was 7.08 SD ± 5.95 years. In analyzing the duration of type 2 diabetes among participant we observed 46%, 25%, 18% and 11 % participants suffered from T2DM for 1-5, 6-10, 11-15 and >15 years respectively. Finally, among total participants in analyzing the prevalence of hypertension we observed out of 100 patients with T2DM only 32 were with hypertension which was 32%. On the other hand, in analyzing the stages of hypertension among total participants we found, 32% were with normal and pre-hypertension (in total 68%) respectively. On the other hand, among 32% hypertensive participants, 20% (n=20) were with stage I HTN whereas 12% (n=12) were with stage II HTN. **Conclusion:** In this study, the prevalence of hypertension among type 2 diabetes patients was found some higher than that in normal. But if we consider the number of pre-hypertensive patients as a potential concern, then it is alarming. The findings of this study may be helpful in the treatment arena of diabetes and in similar further studies.

Keywords: Prevalence, Hypertension, Type-2 diabetes mellitus, T2DM.

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INTRODUCTION

Hypertension contributes enormously to the global disease burden and mortality. The prevalence of hypertension among type 2 diabetes mellitus (DM) patients is higher than that of age- and sex-matched patients without diabetes, ranging from 32% to 82% [1]. It is a disorder in which the blood pressure (BP) is abnormally high and is described as systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg [2–4]. According to the Global Health Observatory Report, the overall prevalence of hypertension in adults ≥ 25 y of age was around 40% in 2008 [5]. Diabetes mellitus is a global

health issue, about 9% of adults have diabetes, and an estimated 1.5 million people die due to diabetes worldwide each year. WHO anticipates that Diabetes could be the seven- leading cause of death by 2030 [6]. Type 2 DM account about 90–95% of all cases of DM, and it increases the risk of both macrovascular diseases (CAD, cerebrovascular disease or “stroke,” and peripheral vascular disease) and microvascular diseases (retinopathy, nephropathy, and neuropathy) [7]. Cardiovascular disease is the major cause of morbidity and mortality among diabetic patients, accounting for 75% of hospitalizations and 70-80% of deaths [8]. In

fact, coronary heart disease (CHD) is the leading cause of death among diabetic patients, who have a two to fourfold higher risk of CHD mortality and incidence of nonfatal CHD events compared with patients without diabetes [9]. Diabetes mellitus and hypertension are inter-related diseases that strongly predispose an individual to atherosclerotic cardiovascular disease [10]. Despite significant advances in understanding of the pathogenesis and treatment of hypertension, there continues to be debate regarding the pharmacologic treatment of hypertension, especially in high-risk groups such as the diabetic patients having the chronic kidney disease (CKD) [7]. Hypertension is one of the risk factors for the complications of diabetes. Several studies have indicated that lowering BP has importance in diabetic patients. Additionally, treatment administration shall be based on the conditions of the patients and the availability of the resources [8]. The prevalence rate of hypertension among type 2 diabetics is higher than that of age and sex- matched patients without diabetes, ranging between 32% and 82% [11]. Since the rates of hypertension in diabetics are lacking in Bangladesh, this study aimed to evaluate the prevalence of elevated blood pressure in type-2 diabetic patients.

METHODOLOGY & MATERIALS

This was a cross-sectional study which was conducted in the Department of Medicine, 250 Beded Mohammad Ali Hospital, Bogura, Bangladesh during the period from January to December 2023. In total 100 patients with type-2 diabetes mellitus attended to the mentioned hospital with proper documents were finalized as the study people. A structured questionnaire was used to gather information on sociodemographic variables (gender, age and level of education), smoking status, history of hypertension, use of anti-hypertensive medications, and duration of diabetes. Anthropometric measurements including weight and height were measured by trained staff. Blood pressure was measured using standardized mercury sphygmomanometers. A trained nurse performed the procedures while the subject was in a sitting position with the arm at the level of the heart and after 5 minutes rest. Two blood pressure readings were taken from each patient and their average reading was used. The patient was labeled as having hypertension if systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 80 mmHg, or if the patient was on antihypertensive medications. The weight was recorded in kilograms to the nearest 0.1 kg using a weighing scale, and the height was recorded in meters to the nearest 0.05 m. The body mass index (BMI) was

calculated as weight in kilograms divided by squared height in meters (7,8). BMI was categorized as underweight (<18.5 kg/m²), normal (18.5-24.9 kg/m²), overweight (25-29.9 kg/m²), and obesity (≥ 30 kg/m²) (7,8). Classification of patients as type 2 DM was based on clinical grounds of non-dependence on insulin for survival (9). Data analysis was done using SPSS version 14. Comparison of means was done using the Student's t test and chi-square. The level of statistical significance was taken as $P < 0.05$.

RESULTS

In this study, a total of 100 type-2 diabetic patients (56 male, 44 female) were observed. The mean age of the patients was 53.86 years with Standard deviation (SD) of ± 11.54 years. The mean duration of diabetes mellitus was 7.08 SD ± 5.95 years. Mean HbA1c of the patients was 9.27 SD $\pm 2.41\%$ and mean random plasma glucose was 225.37 SD ± 89.16 mg/dl. The elevated blood pressure was detected in 70.5% of the patients. The minimum systolic blood pressure was 76 mmHg and the maximum was 241 mmHg with a mean systolic blood pressure of 146.94 SD ± 23.19 mmHg. Minimum diastolic blood pressure in these patients was 58 mmHg and the maximum was 122 mmHg with a mean of 89.61SD ± 11.59 mmHg. The mean pulse pressure was 57.32 SD ± 15.58 mmHg and the mean arterial pressure of the study population was 48.98 SD ± 7.73 mmHg. The mean bodyweight of the patients was 73.09 SD ± 13.75 Kg. Duration of diabetes had statistically significant negative correlation with both body weight and BMI of the patients, it means that there was significant decrease in both body weight and BMI with increasing duration of diabetes mellitus. The systolic blood pressure and age had a positive correlation and there was an increase in SBP with increasing age, on the other hand the correlation between age and diastolic blood pressure was statistically insignificant [fig-1]. In analyzing the duration of type 2 diabetes among participant we observed 46%, 25%, 18% and 11 % participants suffered from T2DM for 1-5, 6-10, 11-15 and >15 years respectively. Finally, among total participants in analyzing the prevalence of hypertension we observed out of 100patients with T2DM only 32 were with hypertension which was 32%. On the other hand, in analyzing the stages of hypertension among total participants we found, 32% were with normal and pre-hypertension (in total 68%) respectively. On the other hand, among 32% hypertensive participants, 20% (n=20) were with stage I HTN whereas 12% (n=12) were with stage II HTN.

Table-1: Demographic status of participants (n=100)

Variables	Values
Age (y)	53.86 \pm 11.547
Male, n (%)	56% (100)
Duration of diabetes (y)	7.08 \pm 5.956
HbA1c (%)	9.27 \pm 2.41
Prandial plasma glucose (mg/dl)	225.37 \pm 89.16

Variables	Values
Systolic blood pressure (mmHg)	146.94 ± 23.19
Diastolic blood pressure (mmHg)	89.61 ± 11.59
Pulse pressure (mmHg)	57.32 ± 15.58
Mean arterial pressure (mmHg)	48.98 ± 7.73
Body weight (kg)	73.09 ± 13.75
Height (m)	1.59 ± 0.09
BMI (kg/m ²)	28.77 ± 5.58

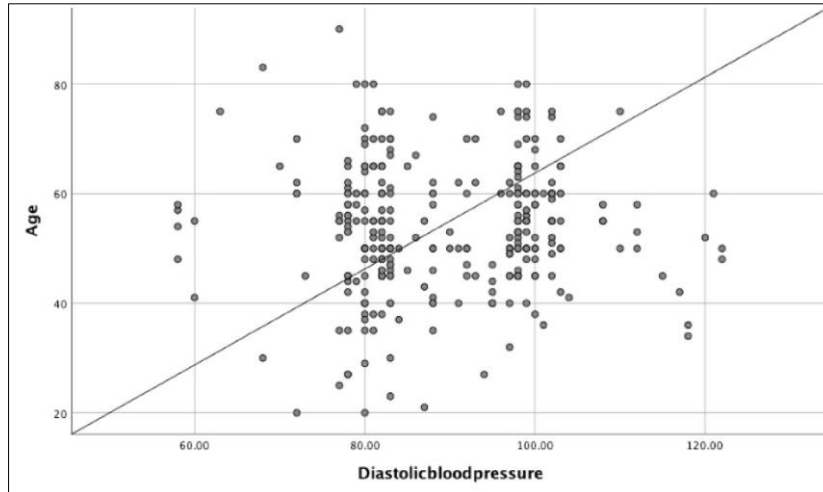


Fig-1: Showing no significant correlation between diastolic pressure and age of the patients

Table-2: Duration of T2DM Participants, prevalence of hypertension and status of hypertension among total participants (n=100)

Duration	N (%)	Prevalence of hypertension	N (%)	HTN Status	N (%)
1-5 Years	46 (46.0)	hypertention	32(32.0)	Normal	32(32.0)
6-10 Years	25 (25.0)	Non-Hypertention	68(68.0)	Pre HTN	36(36.0)
11-15 Years	18 (18.1)	-	-	Stage I HTN	20(20.0)
>15 Years	11 (11.0)	-	-	Stage II HTN	12(12.0)

DISCUSSION

Hypertension is an extremely common comorbidity amongst persons with diabetes mellitus, which is said to be twice more prevalent in diabetics than in non-diabetic individuals. It has also been shown that hypertension in diabetic persons is associated with accelerated progression of both microvascular (retinopathy, nephropathy, and neuropathy) and macrovascular (atherosclerotic) complications. The macrovascular disease accounts for the majority of deaths in patients with Type 2 DM [12]. Hypertension and type 2 diabetes are common lifestyle-related diseases throughout the world. In 2012, the World Health Organization (WHO) dealt with high blood pressure and hyperglycemia as serious problems and reported obesity as a major issue [13]. In this study, a total of 100 type-2 diabetic patients (56 male, 44 female) were observed. The mean age of the patients was 53.86 years with Standard deviation (SD) of ± 11.54 years. The mean duration of diabetes mellitus was 7.08 SD ± 5.95 years. Moreover, among elderly people over 80 years of age, those with type 2 diabetes have a 4.3 times higher mortality rate than those with other diseases like congestive

heart failure. In South Korea, the prevalence rates of HTN and type 2 diabetes were estimated to be 29.0% and 9.0% in 2012; the rate of HTN decreased to 25.5% in 2014, whereas the rate of type 2 diabetes increased to 10.2% [14]. In our study, prevalence of hypertension was noted in 32 (32%) patients. Priya *et al.*, [15] observed hypertension in 43% of the patients. In a study by Ramachandran *et al.*, [16] 38% study subjects were hypertensive. Essential hypertension accounts for the majority of hypertension in individuals with diabetes, particularly those with Type-2 diabetes, who constitute more than 90% of people with a dual diagnosis of diabetes and hypertension. Many previous studies have shown the main factors of hypertension and type 2 diabetes to include age, sex, smoking, exercise, family history, dietary habits, body mass index (BMI), and waist circumference. In particular, obesity in terms of BMI is the main cause of these diseases; thus, with an emphasis on continuous weight management, research is actively being conducted. However, some studies have suggested that type 2 diabetes may occur due to metabolic syndrome even with a normal BMI and waist circumference [17]. Hypertension is acknowledged to be a major risk factor in the progression of diabetic renal

disease. Recent observations suggest that, impaired cellular response to insulin predisposes to increased vascular smooth muscle tone. Recently reported studies from laboratory demonstrate that insulin in physiological doses attenuates the vascular contractile response to phenylephrine, serotonin, and potassium chloride. Thus, insulin appears to normally modulate (attenuate) VSM contractile responses to vasoactive factors, and insulin resistance should accordingly be associated with enhanced vascular reactivity [18]. The overabundance of oxidants is mechanistically connected with the multifactorial etiology of insulin resistance, primarily in skeletal muscle tissue and the subsequent development of Type-2 diabetes. Strategies to prevent and ameliorate oxidative stress remain important in the overall treatment of insulin resistance and Type-2 diabetes [19]. Hypertension often antedates and likely contributes to the development of nephropathy in many diabetic individuals [20]. Diabetic nephropathy, which occurs after 15 years of diabetes in one-third of people with insulin dependent diabetes mellitus (Type-1 diabetes) and 20% of those with NIDDM, is an important contributing factor to the development of hypertension in the diabetic individual [10]. The high BP associated with diabetic nephropathy is usually characterized by sodium and fluid retention and increased peripheral vascular resistance [21]. Isolated systolic hypertension is considerably more common in diabetics, and supine hypertension with orthostatic hypotension is not uncommon in diabetic individuals with autonomic neuropathy. In analyzing the duration of type 2 diabetes among participant we observed 46%, 25%, 18% and 11% participants suffered from T2DM for 1-5, 6-10, 11-15 and >15 years respectively. Finally, among total participants in analyzing the prevalence of hypertension we observed out of 100 patients with T2DM only 32 were with hypertension which was 32%. On the other hand, in analyzing the stages of hypertension among total participants we found, 32% were with normal and pre-hypertension (in total 68%) respectively. On the other hand, among 32% hypertensive participants, 20% (n=20) were with stage I HTN whereas 12% (n=12) were with stage II HTN. Among those with macrovascular diseases, except PVD, there was a trend of decreased prevalence of hypertension and dyslipidemia during the study period. Duration of diabetes had statistically significant negative correlation with both body weight and BMI of the patients. It means that there was significant decrease in both body weight and BMI with increasing duration of diabetes mellitus. This decrease in body weight might be either due to age related sarcopenia or may be explained by the catabolic state of most of the patients, which can be inferred from mean HbA1c and mean random plasma glucose of the study population. Loss of glycemic control in the long term may be either due to poor adherence of the patients to the treatment or it may be due to lack of support from the family for continuation of the treatment. This is a small clinic-based cross-sectional study in a subspecialty care center, so it may not represent the actual distribution of

hyper- tension among diabetics in the community and cause-effect relationship.

CONCLUSION

The findings of our study show high prevalence of hypertension in type-2 diabetes patients with a significant difference in the rate of elevated blood pressure between males and females (it was higher in females than males). The systolic blood pressure had a positive correlation with age. However, it was insignificant for diastolic blood pressure. Healthcare providers and other health sector should work in collaboration for designing appropriate preventive strategies targeting the modifiable risk factors associated with hypertension.

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