



Cross-sectional Study

Prevalence of hypertension in Type-2 diabetes mellitus

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ABSTRACT

Background: Cardiovascular disease is the most prevalent cause of morbidity and mortality in diabetic patients. Hypertension (HTN) has been confirmed as a major risk factor for cardiovascular disease, which is frequently associated with diabetes mellitus (DM). Therefore, the detection and management of elevated blood pressure (BP) is a critical component of the comprehensive clinical management of diabetics. Since the rates of hypertension in diabetics are lacking in Afghanistan, this study aimed to evaluate the prevalence of elevated blood pressure in type-2 diabetic patients.

Materials and methods: This is a descriptive cross-sectional study, which included 321 type –2 diabetic patients (119 males, 202 females) with a mean age of 53.86 ± 11.54 years who were presented to the Noble OPD center from November 2019 to January 2020.

Results: The elevated blood pressure was detected in 70.5% of the patients. It was more prevalent in women than men (76.8% and 59.7% respectively). The mean systolic blood pressure was 146.94 ± 23.19 mmHg and mean diastolic blood pressure was 89.61 ± 11.59 mmHg. The mean pulse pressure was 57.32 ± 15.58 mmHg and the mean arterial pressure was 48.98 ± 7.73 mmHg. The mean body weight was 73.09 ± 13.75 Kg. The mean duration of diabetes mellitus was 7.08 ± 5.95 years with the average HbA1c of $9.27 \pm 2.41\%$. The mean body mass index (BMI) of the patients was noted 28.77 ± 5.58 kg/m².

Conclusion: This study showed 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.

1. Introduction

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 seventh-leading cause of death by 2030 [1].

Cardiovascular disease is the most prevalent cause of morbidity and mortality in diabetic patients. Hypertension has been confirmed as a major risk factor for cardiovascular disease, which is frequently associated with diabetes mellitus. Therefore, the detection and management of elevated blood pressure (BP) is a critical component of the comprehensive clinical management of diabetics. 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) [2].

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 [3].

Currently, about one million Afghans suffer from diabetes and the prevalence in the general population is estimated about 5–9%, which means that there could be one to two million undiagnosed cases of diabetes in Afghanistan. There are several predisposing factors for diabetes in Afghanistan, including aging, rapid urbanization, carbohydrate dependent diet, obesity, and physical inactivity [4]. Since the rates of hypertension in diabetics are lacking in Afghanistan, this study aimed to evaluate the prevalence of elevated blood pressure in type-2 diabetic patients.

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2. Method and materials

This descriptive, cross-sectional, and single-centered study was approved by the Institutional Review Board for Ethical Issues in Clinical Research, which is compatible with the Declaration of Helsinki. The diabetic patients aged 20–80 years, presented to our hospital for the treatment of Diabetes Mellitus from Nov 2019 to Jan 2020, had blood pressure 140/90 mmHg, or were on antihypertensive medication included in this study. The Blood pressure was recorded in a sitting position in the right arm, using a standard mercury sphygmomanometer with appropriate cuff size. For optimal blood pressure estimation, patients were allowed to be seated quietly for 5–10 min to alley anxiety and restlessness. The patients who were seriously ill, pregnant women, Type-1 diabetic patients, and patients who did not want to be included in the study were excluded.

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 the weight in kilograms divided by the square of the height in meters.

A questionnaire was designed in which all necessary/relevant/support questions were asked based on the title of the concept note. Similar studies and questionnaires were reviewed and a contextualized questionnaire for this study was produced.

Statistical analysis of the data was performed in SPSS, Version 24 program (IBM, Armonk, New York). Correlation between different continuous variables was tested using two tailed Pearson tests.

This work has been reported in line with the STROCSS criteria 2021 [5].

3. Results

In this study, a total of 321 type-2 diabetic patients (119 male, 202 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 [Fig. 1]. 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 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. 2]. 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 baseline demographic characteristics of the patients are illustrated in Table [1].

4. Discussion

Hypertension is an extremely common co-morbidity 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 [5].

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 [6].

The prevalence of diabetes is rapidly increasing from 4.7% in the 1980s to 8.5% in 2014, with a total of 422 million cases worldwide, and 1 in 10 adults having diabetes. Type 2 diabetes is a major cause of cardiovascular disease and mortality, with a mortality rate of 27% higher than that for the cohort without diabetes. 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 increased to 25.5% in 2014, whereas the rate of type 2 diabetes decreased to 10.2% [7].

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 [8].

Adults with type 2 diabetes and poor glycemic control are at increased risk for the development of microvascular complications involving the kidney that are exacerbated by comorbid hypertension. In the U.S. and Puerto Rico, over 116,000 adults began treatment for end-stage renal disease (ESRD) in 2009, and the two leading causes were diabetes and hypertension, with incident rates of ESRD increased among African American, Native American, and Hispanic populations. Data from the UK Prospective Diabetes Study (UKPDS) and other adult studies have addressed the impact of intensive treatment of hyperglycemia and hypertension on the development and progression of diabetic nephropathy [9].

The aims of the study conducted by Zhao, Zeng, et al., were to evaluate the prevalence, risk factors, and prognostic significance of masked hypertension in diabetic patients. They demonstrated that concurrent masked hypertension increases the odds of having cardiovascular disease [10].

Although progressively increased prevalence of dyslipidemia and hypertension was observed in patients with diabetes in Taiwan, there was a decrease in the prevalence of stroke and CVD in the past 10 years. Among those with macrovascular diseases, except PVD, there was a trend of decreased prevalence of hypertension and dyslipidemia during the study period. In patients with microvascular diseases, the prevalence of hypertension and dyslipidemia in patients with eye diseases increased in the past 10 years. More aggressive management of different risk factors is warranted in diabetic patients with various vascular diseases [11].

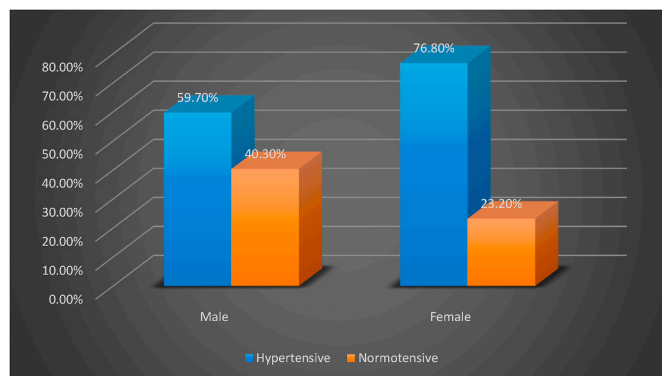


Fig. 1. Bar chart showing the frequency of hypertension in type- 2 diabetic patients between males and females.

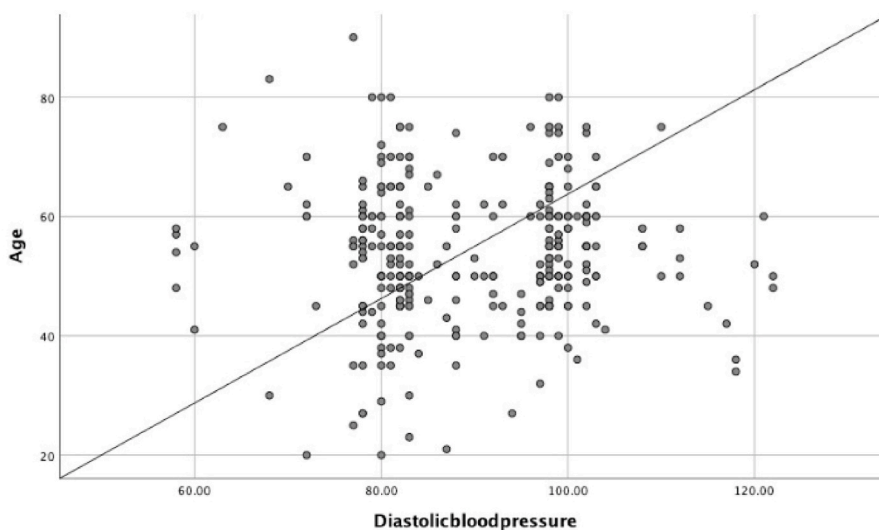


Fig. 2. Showing no significant correlation between diastolic pressure and age of the patients.

Table 1
Basic demographic characteristics of the participants.

Variables	Values
Age (y)	53.86 ± 11.547
Male, n (%)	37% (119)
Female, n (%)	63% (202)
Duration of diabetes (y)	7.08 ± 5.956
HbA1c (%)	9.27 ± 2.41
Prandial plasma glucose (mg/dl)	225.37 ± 89.16
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

In India, although the overall hypertension rate among patients with T2DM in the study by Tharkar et al. [58] was 39%, the urban prevalence was 63.2% and the rural prevalence was 36.8%. Hypertension prevalence among adults from the general population in urban India ranges from 20% to 40% and in rural areas from 12% to 17%. Therefore, the by-locality hypertension rates reported by Tharkar et al are consistent with the expectation of hypertension rates that are 1.5–3.0 times higher in persons with T2DM than in those without diabetes [12].

Cardiovascular complication is the leading cause of mortality in patients with diabetes. Dyslipidemia and hypertension are the major risk factors contributing to cardiovascular disease [11].

Hypertension is a major independent risk factor for coronary artery disease, stroke, heart failure, and renal failure. One of every 3 American adults or approximately 67 million adults (31%) has hypertension. A person over the age of 55 years has a 90% lifetime risk of developing hypertension. Hypertension accounts for 18% of cardiovascular disease deaths in Western countries [13].

In our study, the elevated blood pressure was detected in 70.5% of the patients, which is much higher than the prevalence of hypertension in diabetic patients reported by Unadike et al. [14]. The reason for this high prevalence might be the pattern of patients which are visiting or being treated in our center, which is a subspecialty clinic and most of the patients are either referred or complicated patients.

In a systematic review of literature conducted by Colosia et al. the prevalence of hypertension in type 2 diabetes in Sweden, Germany, and Brazil was reported 95, 92.6 and 90% respectively, which is much higher than the prevalence of hypertension in this study (Colosia et al.,

2013). [15]. However, this prevalence in Iran, India, and Japan are reported to be 49.9, 42, and 40.4% respectively which is much lower than in this study.

The mean age of the patients was 53.86 ± 11.54 mmHg year and mean duration of diabetes was 7.08 ± 5.95 year which are close to that reported by BC Unadike in Nigeria [16]. The short and long term glycemic indices were high in this study; mean HbA1c was 9.27 ± 2.41% and mean random plasma glucose was 225.37 ± 89.16 mg/dl which shows long and short term poor glycemic control in the study population. The reason for this poor blood glucose control might be again the site of the study which was a subspecialty care center and most of the patient were either diabetic patients with complications or were referred from other centers for proper treatment.

From gender view point, 63% of the participants of our study were females and the remaining 37% were males, which shows huge gender difference. As this is a small institution based cross sectional study, so the difference may not reflect the actual distribution of diabetes in the community.

The prevalence of hypertension was different between the two gender, 59.7% of the males and 76.8% of the females had hypertension and the remaining 40.3% of the males and 23.2% of the females were normotensive respectively. This is again a significant difference and may not represent the actual difference of hypertension distribution in diabetic patients in the community. One reason for this difference might be the cultural issues that most of the women if not all in this community are strictly limited to the home environment and going out only in the time of necessity. Other reasons for this high prevalence of diabetes and hypertension in the female gender might be lack of exercise and physical activity, as well as rapid urbanization due to internal displacement of the people from a vast agricultural environment to the outskirts of the Kabul city and finally lack of proper environment for exercise might be amongst other reasons.

The systolic blood pressure and age had a positive correlation and there was an increase in systolic blood pressure with increasing age, on the other hand the correlation between age and diastolic blood pressure was statistically insignificant. 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 hypertension among diabetics in the community and cause-effect relationship. Thus, for knowing the actual prevalence of hypertension in type-2 diabetics a large community-based study is required to be conducted by a multidisciplinary team with the support of the Ministry of health or other organization.

5. 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.

Provenance and peer review

Not commissioned, externally peer reviewed.

Declaration of conflict of interest

The authors declare no conflict of interest.

Ethical approval

The manuscript was approved by the institutional review board for ethical issues in clinical research and is compatible with the declaration of Helsinki.

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Author contribution

Concept – MWN; Design – HAE; Supervision - HAE; Resources and data Collection- MWN; Literature Search - MWN; Writing Manuscript – HAE; Critical Review -.MWN. All authors have read and approved the final manuscript.

Registration of research studies

ID: NCT05266885.
[ClinicalTrials.gov](https://clinicaltrials.gov).

Guarantor

The corresponding author is the guarantor for the work and he has the responsibility of access to the data, and controlling the decision to publish.

Consent

Written informed consent was obtained from the patients for

publication of this study. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Declaration of competing interest

- The authors have no potential conflicts of interest to disclose.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.103758>.

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