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Original Research Article

Prevalence of Hypertension in Patients with Type 2 Diabetes Mellitus

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Abstract

***Background*:** Hypertension frequently coexists with Type 2 diabetes mellitus (T2DM), significantly increasing the risk of cardiovascular and kidney complications. This dual burden escalates morbidity and mortality, emphasizing the need for early detection and effective management. However, there is limited research on hypertension prevalence among T2DM patients in Bangladesh. ***Objective*:** This study aimed to assess the prevalence of hypertension among patients with Type 2 diabetes mellitus and to identify associated risk factors in a tertiary care hospital in Dhaka, Bangladesh. ***Methodology*:** A prospective observational study was conducted at the Department of Medicine, Community Based Medical College, Bangladesh, from June 2022 to December 2022. A total of 83 T2DM patients were selected through purposive sampling. Data were analyzed using SPSS version 23.0, focusing on demographic characteristics, diabetes duration, body mass index (BMI), glycemic control, and blood pressure readings. ***Results*:** The overall prevalence of hypertension in T2DM patients was found to be 70.1%. Among the hypertensive patients, 42.2% had Stage 1 hypertension, while 27.9% had Stage 2 hypertension. Hypertension was significantly associated with the duration of diabetes, poor glycemic control (HbA1c > 7%), and a BMI greater than 25 kg/m². ***Conclusion*:** Hypertension is highly prevalent among patients with Type 2 diabetes mellitus, with poor glycemic control and obesity being significant risk factors. Regular monitoring and effective management of hypertension in T2DM patients are essential to reduce the risk of cardiovascular complications.

Keywords: Hypertension, Type-2 diabetes mellitus, Glycemic control, Body mass index, Prevalence, Risk factors.

INTRODUCTION

Hypertension is a prevalent comorbidity in Type 2 diabetes mellitus (T2DM), significantly increasing the risk of cardiovascular diseases (CVD), stroke, kidney dysfunction, and other complications. The co-existence of T2DM and hypertension, often referred to as the 'cardiovascular risk duo,' presents a considerable public health burden. This dual burden impacts healthcare systems globally, particularly in developing countries like Bangladesh, where both T2DM and hypertension rates are rising due to rapid urbanization, unhealthy diets, and sedentary lifestyles[1,2]. Studies indicate that patients with T2DM have a higher prevalence of hypertension compared to the general population, with figures ranging between 40-70% depending on the population and diagnostic methods used[3,4]. The underlying mechanisms behind this increased prevalence are multifactorial, involving insulin resistance, inflammation, endothelial dysfunction, and kidney damage. Insulin resistance, a hallmark of T2DM, contributes to sodium retention, increases sympathetic nervous system activity, and promotes vascular changes that lead to elevated blood pressure[5]. Moreover, chronic hyperglycemia can directly impair endothelial function and promote arteriosclerosis, thus enhancing the risk of hypertension and related complications[6]. Obesity, another common condition in T2DM patients, further exacerbates the risk of hypertension. Increased adiposity triggers inflammation, activates the renin-angiotensin-aldosterone system, and contributes to vascular dysfunction, all of which elevate blood pressure[7,8]. Poor glycemic control has also been strongly linked to the development of hypertension in T2DM patients. Elevated blood glucose levels contribute to endothelial injury, increase arterial stiffness, and elevate systemic

inflammation, all of which can drive blood pressure elevation[9,10]. In Bangladesh, while the prevalence of both hypertension and T2DM is rising, local data on the coexistence of these two conditions are limited. Given the escalating burden of both diseases, local studies are essential to understand the specific demographic and clinical factors influencing the development of hypertension in T2DM patients. This study aims to assess the prevalence of hypertension in patients with T2DM, and explore the associations with factors such as age, duration of diabetes, body mass index (BMI), and glycemic control. Understanding the epidemiology of hypertension in T2DM patients will inform more effective strategies for early diagnosis, management, and prevention, reducing the overall cardiovascular risk and improving health outcomes in the population.

METHODOLOGY

This prospective observational study was conducted at Community Based Medical College Bangladesh, from June 2022 to December 2022. The study included 83 patients with Type 2 diabetes mellitus (T2DM) selected through purposive sampling. Inclusion criteria were adult patients aged 30-70 years diagnosed with T2DM for at least one year. Exclusion criteria included patients with secondary hypertension, pregnant women, and those with other severe comorbidities such as chronic kidney disease or heart failure. Blood pressure measurements were taken using a standard mercury sphygmomanometer, with hypertension defined as systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg, or the use of antihypertensive medication. Demographic data, including age, gender, duration of diabetes, body mass index (BMI), and glycemic control (HbA1c levels), were collected. Medical history regarding cardiovascular disease and dyslipidemia was also recorded. Data were analyzed using SPSS version 23.0. Descriptive statistics, including frequencies and percentages, were used to present the prevalence of hypertension. Associations between hypertension and various clinical factors were determined using chi-square tests, with statistical significance set at $p<0.05$.

RESULT

A total of 83 patients with Type 2 diabetes mellitus (T2DM) were included in the study. The demographic and clinical characteristics of the study population are summarized. The mean age of the participants was 55.4 years (±9.2), with 58% males and 42% females. The mean duration of diabetes was 8.7 years (±4.5). Regarding body mass index (BMI), 62.6% of the participants were classified as overweight or obese, with a mean BMI of 28.4 kg/m² (±4.3). The overall prevalence of hypertension in the study population was 70.1%. Of the hypertensive patients, 42.2% had Stage 1 hypertension, while 27.9% had Stage 2 hypertension. The remaining 29.9% of the participants had normal blood pressure levels. The association between hypertension and clinical factors such as duration of diabetes, BMI, and glycemic control (HbA1c) was explored. A significant positive correlation was found between the duration of diabetes and the prevalence of hypertension ($p < 0.05$). Longer duration of diabetes was associated with a higher incidence of hypertension. In addition, participants with a BMI greater than 25 kg/m² were more likely to have hypertension compared to those with a BMI under 25 kg/m² ($p < 0.05$). Glycemic control, as measured by HbA1c levels, also showed a significant association with hypertension ($p < 0.05$). Specifically, participants with HbA1c levels above 7% had a higher likelihood of developing hypertension compared to those with better glycemic control. When analyzing the prevalence of hypertension by glycemic control, those with HbA1c > 7% exhibited a notably higher prevalence of hypertension. Among participants with HbA1c levels greater than 7%, 82.4% had hypertension, with 48.5% having Stage 2 hypertension. Conversely, among participants with HbA1c ≤ 7%, 45.1% had hypertension, with 30.5% in Stage 1 and 14.6% in Stage 2. The clinical features and hypertension stages are further detailed in the following tables, summarizing the distribution of hypertension based on clinical and demographic factors.

Table 1: Demographic and clinical characteristics

Characteristic	(Mean ±SD)/%
Age (years)	55.4 ± 9.2
Male	58%
Female	42%
Duration of diabetes (years)	8.7 ± 4.5
BMI (kg/m²)	28.4 ± 4.3
Overweight/Obese (BMI ≥25)	63%
Normal weight (BMI < 25)	37%

Table 2: Prevalence of hypertension and glycemic control (HbA1c)

HbA1c Levels	Hypertension (%)		
	%	Stage-1	Stage-2
≤ 7%	45.1%	30.5%	14.6%
> 7%	82.4%	33.9%	48.5%

Table 3: Distribution of hypertension stages by duration of diabetes

Duration	Normal BP	Hypertension (%)	
		Stage-1	Stage-2
≤ 5 years	33.3%	40.7%	26.0%
> 5 years	15.8%	43.4%	40.8%

Table 4: Prevalence of hypertension by BMI classification

BMI status	Normal BP	Hypertension (%)	
		Stage-1	Stage-2
BMI <25 Normal	59.2%	28.7%	12.1%
BMI ≥25 Obese	22.7%	45.3%	32.%

DISCUSSION

Hypertension is a well-known comorbidity in patients with Type 2 diabetes mellitus (T2DM), and its prevalence continues to rise due to factors such as obesity, insulin resistance, and prolonged hyperglycemia. The present study found that 70.1% of the participants with T2DM were hypertensive, with the majority classified under Stage 1 and Stage 2 hypertension. This high prevalence aligns with previous studies that report a significant burden of hypertension among diabetic patients. According to the American Diabetes Association (ADA), hypertension is common in T2DM, with estimates ranging from 50% to 80% of patients being affected by elevated blood pressure[11]. The association between diabetes duration and hypertension is well-established, as prolonged exposure to hyperglycemia is linked to endothelial dysfunction and increased vascular stiffness. In this study, a significant correlation was observed between a longer duration of diabetes and the prevalence of hypertension, which is consistent with other research that demonstrates how chronic hyperglycemia accelerates the development of cardiovascular diseases[12,13]. Studies by Wang *et al.*, and Kalghatgi *et al.*, have similarly highlighted that individuals with T2DM for more than five years have an increased risk of developing hypertension[14,15.] Another important factor contributing to hypertension in T2DM patients is obesity, particularly abdominal obesity, which leads to increased insulin resistance and altered renal sodium handling. Our findings show that individuals with a BMI ≥25 kg/m² had a significantly higher prevalence of hypertension compared to those with a BMI < 25 kg/m², supporting findings from other studies that underscore the role of obesity as a modifiable risk factor for hypertension in diabetic patients[16,17]. According to Singh *et al.*, overweight and obese patients with T2DM are at an increased risk of developing both hypertension and cardiovascular complications[15]. Glycemic control also plays a crucial role in the development of hypertension. In this study, patients with HbA1c levels above 7% had a notably higher prevalence of hypertension, corroborating research by Taha *et al.*, that found poor glycemic control to be a significant predictor of hypertension in diabetic individuals[18]. Elevated blood glucose levels lead to increased production of advanced glycation end-products (AGEs), which in turn cause vascular damage and promote the development of hypertension[19]. Our findings suggest that improving glycemic control can significantly reduce the risk of hypertension in T2DM patients. The impact of poor glycemic control on hypertension can also be attributed to the pathophysiological changes that occur with elevated glucose levels. Chronic hyperglycemia leads to endothelial dysfunction, increased sympathetic nervous activity, and altered renal function, all of which contribute to hypertension. Furthermore, poor glycemic control is often associated with other risk factors such as dyslipidemia and inflammation, which exacerbate the development of hypertension[20, 21]. A limitation of this study is that it is cross-sectional in nature, meaning causal relationships between diabetes, hypertension, and other factors cannot be established. Additionally, the study was conducted at a single center with a relatively small sample size, limiting the generalizability of the findings. Future longitudinal studies with larger, more diverse populations are needed to better understand the long-term effects of hypertension management in T2DM patients. This study highlights the high prevalence of hypertension in T2DM and the significant associations with diabetes duration, obesity, and poor glycemic control. Regular monitoring and early intervention in T2DM patients, particularly those with longer diabetes duration and poor glycemic control, are essential for preventing cardiovascular complications and improving overall health outcomes.

Limitations:

The study has several limitations, including its cross-sectional design, which prevents establishing causality. The sample size was relatively small and limited to a single center, which may affect generalizability. Additionally, factors like medication adherence and lifestyle interventions were not considered, potentially influencing hypertension prevalence and outcomes.

CONCLUSION

Hypertension is common in patients with Type 2 diabetes mellitus, with a prevalence of 70.1%. The study identifies significant associations between hypertension and factors such as longer diabetes duration, increased BMI, and poor glycemic control (HbA1c > 7%). These findings emphasize the need for regular blood pressure monitoring and better

management of diabetes and associated risk factors. Early intervention targeting hypertension and glycemic control may help reduce the cardiovascular burden in Type 2 diabetes patients, improving overall health outcomes.

Recommendations:

It is recommended to regularly monitor blood pressure in patients with Type 2 diabetes mellitus, particularly those with prolonged diabetes duration, elevated BMI, and poor glycemic control. Early identification and management of hypertension, along with optimizing glycemic control, can help reduce complications and improve overall patient health outcomes.

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