



Original Research Article

Study of risk factors and prevalence of hypertension among type 2 diabetes patients

S Arunkumar^{1,*}, V Sakthivel¹, R Praveen Babu¹, Naveen Sathish.V¹¹Dept. of Medicine, Vinayaga Mission Medical College, Puducherry, India

ARTICLE INFO

Article history:

Received 01-06-2021

Accepted 24-08-2021

Available online 17-08-2022

Keywords:

Hypertension

Type 2 diabetes mellitus

Prevalence

ABSTRACT

Introduction: According to the World Health Organization, hypertension is responsible for 13% of all deaths worldwide, making it a critical public health problem in developing and developed countries. Economic development, affluence, urbanization, and dietary westernization have contributed to a rise in the prevalence of type 2 diabetes mellitus (DM) and hypertension in South Asian countries.

Aim: To study the prevalence of hypertension among adult type 2 diabetic patients and identify risk factors that may affect the development of hypertension in those patients.

Materials and Methods: A cross-sectional study was conducted from May 2009 to May 2010 at the Department of Diabetology and Medicine Vinayaka Mission's Medical College & Hospital, Karaikal. 100 patients with Type 2 Diabetes of age 35 and above were screened and included in the study.

Results: Out of 100 patients with Diabetes Mellitus, 54 patients were hypertensive, and 46 were non-hypertensive. Hypertension was found to be more common in people aged 45 to 64. Our study reported that hypertension was present in 29% of males and 25% of females. Complications like neuropathy (9.3%) non-proliferative diabetic retinopathy (46.51%); proliferative diabetic retinopathy (4.65%); hypertensive retinopathy (2.33%); nephropathy (2.33%); ulcer foot (4.65%); coronary artery disease (27.9%) and stroke (2.33%) were observed in Diabetic patients and were identified as an independent risk factor for hypertension. It was also found that 31.94% of study populations were in the pre-hypertensive stage and 22.22% were in the second stage of hypertension.

Conclusion: The prevalence of hypertension in patients with DM is high. Duration of diabetes was also one of the contributing factors for hypertension in Type 2 diabetes mellitus. It also concluded that the prevalence of hypertension increases with age advancement in DM.

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Diabetes mellitus and hypertension are both significant risk factors for coronary artery disease, heart failure, and cerebrovascular disease, and are considered major medical and public health problems worldwide. Since most diabetic patients develop hypertension (HTN) and stroke, up to 80% of people with diabetes will die of cardiovascular disease, especially hypertension (HTN) and stroke.¹

Patients with diabetes who develops hypertension are observed with a large number of complications and end-organ damage. The morbidity and mortality of such cases contribute to a major public health problem, economic impact on family and healthcare.

When compared to the general population, the coexistence of hypertension and type 2 diabetes is a considerable risk factor for the development and progression of macrovascular and microvascular problems in patients with diabetes. At least 45 percent of deaths from heart disease and 51 percent of deaths from stroke are

* Corresponding author.

E-mail address: avsarun.kkl@gmail.com (S. Arunkumar).

caused by hypertension. The prevalence of diabetes for all age groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030.² Cardiovascular disease, which accounts for 75 percent of hospitalizations and 70-80 percent of diabetic patients, is the leading cause of morbidity and mortality.^{3,4} Since hypertension and diabetes often coexist, diabetic patients have about twice the rate of hypertension as non-diabetic patients.⁵ When hypertension and diabetes coexist, the risk of cardiovascular disease (CVD) rises by 75%, adding to an already high-risk population's overall morbidity and mortality.^{6,7} In 2025, the number of adults with HTN is expected to rise by around 60%, to a total of 1.56 billion.⁷ When HTN is present in diabetic patients, mortality increases by 7.2 times.

2. Aim

To study the prevalence of hypertension among adult type 2 diabetic patients and identify risk factors that may affect the development of hypertension in those patients.

3. Materials and Methods

A cross sectional study was conducted from May 2009 to May 2010 in the medical clinic at the Department of Diabetology and Medicine Vinayaka Mission's Medical College & Hospital, Karaikal. A total of 100 patients was examined and analyzed in this study. An ethical clearance approval was taken for the conduct of the study. The participants in the study were given the opportunity to give their informed consent.

All the consecutive Type 2 Diabetes of age 35 years and above attending the diabetic clinic of Vinayaka Mission's Medical College & Hospital, Karaikal, who did not have any features mentioned in exclusion criteria, were included in the study.

3.1. Exclusion criteria

Patients with shock state or septicemia or patients with injuries or accidents, pregnant and breastfeeding women and patients who were unwilling to participate in the study were excluded.

Diagnosis of Diabetes: As per American Diabetes Association (ADA 2000), the patient is diagnosed as diabetic if random Blood Sugar ≥ 200 Mg/dl and fasting Blood Sugar > 126 Mg/dl.

Diagnosis of Hypertension: JNC 7 recommendation was taken as criteria for diagnosing hypertension in diabetic patients during data collection. All subjects taken for the study were declared hypertensive patients if they had a Systolic Blood Pressure ≥ 130 mmHg and Diastolic Blood Pressure ≥ 80 mmHg. The subject, who was already known to be hypertensive and already in medication, was also included.

When people went to the hospital's outpatient department, they were automatically enrolled in the research. After thoroughly explaining the study procedures, the participants gave their informed consent. Relevant history and measurements were taken, a questionnaire was filled out according to the study proforma, and relevant investigations were requested during their medical evaluation at our hospital. To diagnose diabetes and related abnormalities, relevant investigations were carried out. The information was gathered and the findings were analyzed. Blood was collected from peripheral veins and analyzed for Blood sugar (fasting and 2 hr Post-Prandial Blood Sugar, Urea, Creatinine). ECG, BMI, and Blood pressure were also recorded for further evaluation and analysis.

Data were entered in a Microsoft Excel spreadsheet in computer analyzed using FPI into 2000. Significance was considered if the 'P' value was less than 0.05.

4. Results

A total of 100 people with Type 2 diabetes mellitus were the subject population of this study, out of which 54 patients were hypertensive and 46 patients were non-hypertensive, as shown in Figure 1.

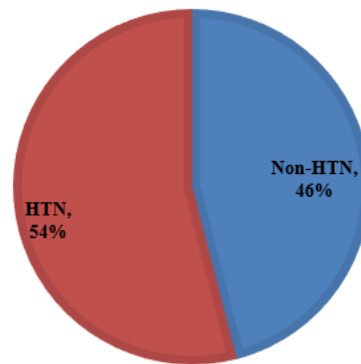


Fig. 1: Prevalence of hypertension in DM patients.

The 45–64 age group was shown to have a higher prevalence of hypertension. It was noted that the percentage of hypertension was higher in when compared to Non-hypertensive diabetes. (p-value < 0.021)

Our study showed that hypertension was present in 29% of males and 25% of females. (Table 2)

Patients were classified BMI < 25 and BMI ≥ 25 . The sub-analysis of the data with references to sex indicated that BMI was more among females. (p < 0.0001) (Table 3)

The duration was classified as less than 1 year and more than 1 year. Hypertension was seen more in diabetes of more than 1 year. (p < 0.0001) (Table 4)

Complications like neuropathy (9.3%), non-proliferative diabetic retinopathy (46.51%); proliferative diabetic retinopathy (4.65%); hypertensive retinopathy (2.33%); nephropathy (2.33%); ulcer foot (4.65%); coronary artery

Table 1:

Age	Hypertensive				Non-Hypertensive			
	Male	Female	Total	%	Male	Female	Total	%
35 – 44	3	3	6	11.11.%	10	6	16	34.78%
45 – 54	12	7	19	35.19%	12	6	18	39.13%
54 – 64	9	11	20	37.04%	5	3	8	17.39%
65 – 74	4	4	8	14.81%	3	1	4	8.70%
>75	1	0	1	1.85%	0	0	0	0%
Total	29	25	54	100%	30	16	46	100%

Table 2: Gender Vs Hypertension

Gender	Hypertension	Non hypertension
Male	29	30
Female	25	16

Table 3: BMI Vs Hypertension

BMI	Hypertension				Non-Hypertension			
	Male	Female	Total	%	Male	Female	Total	%
<25	8	1	9	16.67%	18	4	22	47.83%
>25	21	24	45	83.33%	12	12	24	52.17%
Total	29	25	54	100%	30	16	46	100%

Table 4: Duration of diabetes period

Years	HTN	%	Non-HTN	%
<1 Year	9	16.67%	25	54.35%
>1 Year	45	83.33%	21	42.65%
Total	54	100%	44	1000%

Table 5: Complications and hypertension in type 2 diabetes mellitus

Complications	Hypertension	%	Non- Hypertension	%
Neuropathy	4	9.3%	5	11.11%
Non Proliferative Diabetic Retinopathy	20	46.41%	21	46.66%
Proliferative Diabetic Retinopathy	2	4.65%	1	2.22%
Hypertensive retinopathy	1	2.33%	1	2.22%
Nephropathy	1	2.33%	1	2.22%
Ulcer Foot	2	4.65%	3	6.67%
Coronary Artery Disease	12	27.9%	12	26.68%
Stroke	1	2.33%	1	2.22%
	43	100%	45	100%

Table 6: Staging of hypertension in type 2 diabetes mellitus

Stage	Male	%	Female	%	Total	%
PRE-HTN 120- <139/80-90	17	73.9%	6	26.8%	23	31.94%
Stage-I 140- 159/ 90-99	15	45.45%	18	54.34%	33	45.83%
Stage-II >160/>100	10	62.5%	6	37.5%	16	22.22%

disease (27.9%) and stroke (2.33%) were witnessed in our study group as depicted in table 5 and figure 5. The study revealed that the blood pressure status did not influence complications in the study. Hence both hypertension and diabetes were independent risk factors in producing complications.

Type 2 diabetes mellitus were staged according to JNC 7 classification. It was found that 31.94% of study populations were in the pre-hypertensive stage and 22.22% were in the second stage of hypertension. (p-value =0.39) (Table 6)

5. Discussion

Diabetes Mellitus is a progressive disorder. Whenever diabetic patients develop elevated blood pressure, the end organ complication increases multifold. In one of his studies, Epstein concluded that hypertension is twice as prevalent in people with diabetes as in non-diabetic individuals.⁸ Another group of studies conducted in Jordan, Saudi Arabia and in ethnic regions also revealed that hypertension is more common in type 2 diabetics than in age and sex-matched patients without diabetes, with prevalence rates ranging from 32 percent to 82 percent.^{9–11}

In our study, 54 patients developed hypertension and 46 patients were non-hypertension. 32.94% of the study population occupied the prehypertension stage and 22.22% in stage 2 of JNC 7 classification hypertension was almost equally distributed in both sexes. Patients in the age group 45 – 64 years showed a high prevalence of hypertension and it was found that the prevalence of hypertension increased with age. Hypertension state is independent of gender.

Furthermore, according to our study, patients with a higher BMI (25 kg/m²) have a higher risk of developing hypertension than those with a higher BMI. This finding agreed with the results of previous studies conducted by various researchers in various countries.^{12–14} The possible explanation for this is excess weight gain leads to enhanced cardiovascular risk, endothelial dysfunction, inflammation, hemodynamic changes, and atherosclerosis. Furthermore, when a person becomes overweight, he or she develops insulin resistance, excess bad cholesterol in blood vessels, narrows blood vessels, and eventually develops HTN. Patients with a longer duration of diabetes mellitus showed a higher incidence of hypertension, possibly due to atherosclerosis of vessels. Obesity magnifies the prevalence of hypertension among various study groups. Moreover, in a patient with diabetes mellitus who developed hypertension, complication increases. So morbidity and mortality of such cases contribute to the public health problem, economic impact on family and health care, increasing cost of treatment.

6. Conclusion

In this study, patients with DM had a high prevalence of hypertension. Both microvascular and macrovascular

complications of diabetes are common in people who have both hypertension and diabetes. One of the most important ways to avoid negative outcomes is to prevent and treat hypertension in diabetic patients. As a result, intervention steps should be taken, with earlier and more effective blood pressure management showing the most promise in reducing the occurrence of complications and related mortality.

7. Conflict of Interest

The authors declare that they have no conflict of interest.

8. Source of Funding

None.

References

- Haldar R. Global Brief on Hypertension: Silent Killer, Global Public Health Crisis. *Indian J Physical Med Rehabil.* 2013;24(1):2.
- Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes care.* 2004;27(5):1047–53. doi:10.2337/diacare.27.5.1047.
- American Diabetes Association. Type 2 diabetes in children and adolescents. *Pediatrics.* 2000;105(3):671–80. doi:10.1542/peds.105.3.671.
- Goldberg RB, Capuzzi D. Lipid disorders in type 1 and type 2 diabetes. *Clin Lab Med.* 2001;21(1):147–72.
- Paul B, Sapra B, Maheshwari S, Goyal RK. Role of losartan therapy in the management of diabetic hypertension. *J Assoc Physicians India.* 2000;48(5):514–8.
- Sowers JR, Epstein M, Frohlich ED. Diabetes, hypertension, and cardiovascular disease: an update. *Hypertension.* 2001;37(4):1053–9.
- Adler AI, Stratton IM, Neil HA, Yudkin JS, Matthews DR, Cull CA, et al. Association of systolic blood pressure with macrovascular and microvascular complications of type 2 diabetes (UKPDS 36): prospective observational study. *BMJ.* 2000;321(7258):412–9.
- Epstein M, Sowers JR. Diabetes mellitus and hypertension. *Hypertension.* 1992;19(5):403–18.
- Mubarak FM, Froelicher ES, Jaddou HY, Ajlouni KM. Hypertension among 1000 patients with type 2 diabetes attending a national diabetes center in Jordan. *Ann Saudi Med.* 2008;28(5):346–51.
- Akbar DH, Ahmed MM, Algambi AA. Cardiovascular risk factors in Saudi and non-Saudi diabetics. *Saudi Med J.* 2003;24(6):684–92.
- Baskar V, Kamalakannan D, Holland MR, Singh BM. Does ethnic origin have an independent impact on hypertension and diabetic complications? *Diabetes, Obesity Metab.* 2006;8(2):214–9. doi:10.1111/j.1463-1326.2005.00485.x.
- Mengesha AY. Hypertension and related risk factors in type 2 diabetes mellitus (DM) patients in Gaborone City Council (GCC) clinics, Gaborone, Botswana. *Afr Health Sci.* 2007;7(4):244–5.
- Berraho M, Achhab YE, Benslimane A, Rhazi KE, Chikri M, Nejari C, et al. Hypertension and type 2 diabetes: a cross-sectional study in Morocco (EPIDIAM Study). *Pan Afr Med J.* 2012;11(1):52.
- Mansour AA. Prevalence and control of hypertension in Iraqi diabetic patients: a prospective cohort study. *Open Cardiovasc Med J.* 2012;6:68–71. doi:10.2174/1874192401206010068.

Author biography

S Arunkumar, Associate Professor

V Sakthivel, Professor

R Praveen Babu, Assistant Professor

Naveen Sathish.V, Senior Resident

Cite this article: Arunkumar S, Sakthivel V, Babu RP, Naveen Sathish.V. Study of risk factors and prevalence of hypertension among type 2 diabetes patients. *Panacea J Med Sci* 2022;12(2):300-304.