DOI: https://doi.org/10.53350/pjmhs020231711613

ORIGINAL ARTICLE

Frequency of Diabetic Retinopathy and its Association with Hypertension in Patients of Type-II Diabetes Mellitus

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ABSTRACT

Background: Poorly controlled diabetes is associated with numerous complications, primarily resulting from vascular damage. The coexistence of hypertension has been shown to further exacerbate diabetic complications. In Pakistan, an estimated 20–60% of individuals suffer from both diabetes and hypertension concurrently, significantly increasing the risk of adverse outcomes. Therefore, the present study aimed to find out the association between hypertension and the development of diabetic retinopathy in our population.

Methods: A case–control study was carried out in the Department of Internal Medicine at Bahawal Victoria Hospital, Bahawalpur. Laboratory investigations included fasting blood glucose, random blood glucose, and glycosylated hemoglobin (HbA1c) levels. Blood pressure measurements were done. Screening for diabetic retinopathy was performed by fundoscopic examination. SPSS version 20 was used to analyse the data. A p-value of less than 0.05 was considered statistically significant.

Results: The mean age of participants in Group A was 51.7 ± 9.4 years, whereas in Group B it was 49.5 ± 8.7 years. A longer duration of diabetes was observed in Group A compared with Group B. Higher blood glucose levels were more commonly associated with the development of diabetic retinopathy in Group A, with mean fasting blood sugar of 159.11 ± 9.42 mg/dL and random blood sugar of 182.39 ± 10.12 mg/dL. Overall, approximately 40% of the diabetic patients were also hypertensive. Systolic hypertension showed a strong and statistically significant association with diabetic retinopathy, with a p-value of 0.001.

Conclusion: The present study demonstrated a strong positive association between diabetic retinopathy and hypertension. In addition to other established risk factors, hypertension should be recognized as an important modifiable determinant in the development and progression of diabetic retinopathy.

Keywords: Diabetes mellitus, Diabetic retinopathy. Hypertension

INTRODUCTION

Diabetes mellitus is a metabolic disorder characterized by either insufficient insulin secretion or impaired insulin action, leading to classical symptoms such as polyuria, polydipsia, and polyphagia[1]. The global burden of diabetes is substantial and continues to rise, contributing significantly to increased morbidity and mortality. In developing countries such as Pakistan, the prevalence of diabetes is alarmingly high; among an estimated population of 160 million, approximately 7 million individuals are affected. According to World Health Organization rankings, Pakistan currently occupies the eighth position globally for diabetes prevalence[2,3], with projections indicating a rise to fourth place by the year 2025[4]. National-level surveys have reported an overall diabetes prevalence of approximately 19.25% in the country[5].

Poorly controlled diabetes is associated with numerous complications, primarily resulting from vascular damage. These include microvascular complications such as diabetic neuropathy, nephropathy, and retinopathy, as well as macrovascular complications including cardiomyopathy and cerebrovascular accidents[6]. Among these, diabetic retinopathy is one of the most common and extensively studied complications.

Evidence from previous studies indicates that the duration of diabetes is a major risk factor, with a reported prevalence of approximately 33.3% in individuals with a disease duration of 10–12 years[7]. The coexistence of hypertension has been shown to further exacerbate diabetic complications. In Pakistan, an estimated 20–60% of individuals suffer from both diabetes and hypertension concurrently, significantly increasing the risk of adverse outcomes[8]. Experimental studies have demonstrated that effective blood pressure control in hypertensive diabetic patients can delay the progression of diabetic retinopathy[9,10,11], and blood pressure regulation has been shown to play a crucial role in the development of microvascular complications[12].

Received on 11-07-2023
Accepted on 06-11-2023

Despite the high burden of these comorbid conditions, limited studies have been conducted in the local population to evaluate the relationship between diabetes and hypertension. Therefore, the present study aimed to find out the association between hypertension and the development of diabetic retinopathy in our population.

MATERIAL AND METHODS

A case–control study was carried out in the Department of Internal Medicine at Bahawal Victoria Hospital, Bahawalpur from September 2022 to February 2023. The sample size was determined using the OpenEpi sample size calculator and comprised a total of 170 participants, including 70 cases (Group A: patients with diabetic retinopathy) and 100 controls (Group B: patients without diabetic retinopathy). Patients diagnosed with type 2 diabetes mellitus aged between 35 and 70 years were enrolled in the study. Individuals with type 1 diabetes mellitus, those with other established causes of retinopathy, or those who declined to provide informed consent were excluded.

Demographic and clinical information was documented using a predesigned proforma. Laboratory investigations included fasting blood glucose, random blood glucose, and glycosylated hemoglobin (HbA1c) levels. Blood pressure measurements, including systolic and diastolic values, were obtained using a standard sphygmomanometer. Screening for diabetic retinopathy was performed after pharmacological pupil dilation with homatropine eye drops, followed by fundoscopic examination using an ophthalmoscope.

Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS), version 20. Categorical variables were expressed as frequencies and percentages, whereas continuous variables were presented as means with standard deviations. To assess associations between variables odds ratios were calculated. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 170 known cases of diabetes mellitus were included in the study, of whom 70 were diagnosed with diabetic retinopathy. The mean age of participants in Group A was 51.7 ± 9.4 years, whereas in Group B it was 49.5 ± 8.7 years. A longer duration of diabetes was observed in Group A compared with Group B. Higher blood glucose levels were more commonly associated with the development of diabetic retinopathy in Group A, with mean fasting blood sugar of 159.11 ± 9.42 mg/dL and random blood sugar of 182.39 ± 10.12 mg/dL. Both systolic and diastolic blood pressure values were higher among patients with diabetic retinopathy, measuring 165.6 ± 15.5 mmHg and 87.5 ± 7.8 mmHg, respectively, as shown in Table 1. Overall, approximately 40% of the diabetic patients were also hypertensive.

For further evaluation, participants were stratified based on systolic blood pressure (SBP) and HbA1c levels. Systolic hypertension showed a strong and statistically significant association with diabetic retinopathy, with a p-value of 0.001 and an odds ratio of 1.42. Additionally, the combined effect of elevated systolic blood pressure and increased HbA1c levels was associated with a higher likelihood of developing diabetic retinopathy, with statistically significant p-values and odds ratios as presented in Table 2.

Table 1. Characteristics of study participants

	Group A (with DR) (n=70)	Group B (without DR) (n=100)
Age (years)	51.7 ± 9.4	49.5 ± 8.7
Duration of Diabetes (years)	9.9 ± 2.3	8.7 ± 5.1
Fasting blood sugar (mg/dl)	159.11 ± 9.42	154.63 ± 13.27
Random blood sugar (mg/dl)	182.39 ± 10.12	174.47 ± 12.38
Hemoglobin A1c	7.51 ± 0.42	7.65 ± 0.37
Systolic blood pressure (mmHg)	165.6 ± 15.5	158.9 ± 11.7
Diastolic blood pressure (mmHg)	87.5 ± 7.8	81.3 + 4.9

Table 2 Association between diabetic retinopathy, blood pressure and HbA1c

	Group A (n=70)	Group B (n=100)	OR (95% CI)	p-value
Systolic BP			1.39	0.04
≥ 140 mmHg	42	59		
< 140 mmHg	28	41		
HbA1C			1.09	0.248
≥7.0	39	61		
< 7.0	31	39		
SBP ≥140 mmHg and HbA1C ≥7%	24	47	1.42	0.001
SBP < 140 mmHg and HbA1C <7%	30	33	1.12	0.09
SBP < 140 mmHg and HbA1C ≥7%	16	20	0.78	0.032

DISCUSSION

Previous evidence from the United Kingdom has demonstrated that effective blood pressure control can reduce the risk of developing microvascular complications by approximately 37% in patients with type 2 diabetes mellitus[13]. Current recommendations emphasize maintaining systolic blood pressure below 130 mmHg and diastolic blood pressure below 80 mmHg to minimize the risk of such complications[14].

Data from Pakistan on this topic remain limited. A study conducted in Lahore reported that 33% of hypertensive diabetic patients had non-proliferative diabetic retinopathy, whereas 21.5% exhibited the proliferative form of the disease[15]. Similarly, Shera et al. observed a 64.6% prevalence of hypertension among patients with diabetic retinopathy and identified a significant association between microvascular complications and hypertension, longer duration of diabetes, and HbA1c levels exceeding 8%[16].

In contrast, Hashim et al. reported that 42.8% of diabetic patients in Rawalpindi were hypertensive, with a significant correlation between hypertension, age, and duration of diabetes[17]. However, Saqib et al. documented a lower prevalence of hypertension (31%) in Faisalabad and found no significant association with age or duration of diabetes[18]. The findings of the present study are consistent with the latter, as no significant association was observed between diabetic retinopathy and either age or duration of diabetes, although 40% of diabetic patients were found to be hypertensive. The absence of a statistically significant association may be attributed to the relatively small sample size, despite age and duration of diabetes being well-established risk factors for the progression of diabetic retinopathy.

Leiden et al. evaluated multiple risk factors for diabetic retinopathy and reported significant associations with age, HbA1c levels, and both systolic and diastolic hypertension, while no association was found with fasting blood glucose levels[19]. Conversely, the current study did not demonstrate a significant relationship between diabetic retinopathy and fasting blood glucose, random blood glucose, or HbA1c levels; however, a strong positive association was identified with both systolic and diastolic hypertension. These findings are in agreement with those reported by Saqib et al.[20]. Additionally, it has been reported that for every 5 mmHg increase in systolic or diastolic blood pressure, the risk of developing diabetic retinopathy rises by nearly 40%, even among normotensive individuals with type 2 diabetes21.

CONCLUSION

The present study demonstrated a strong positive association between diabetic retinopathy and hypertension. In addition to other established risk factors, hypertension should be recognized as an important modifiable determinant in the development and progression of diabetic retinopathy.

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This article may be cited as: Ahmed A, Abro AH, Bijarani AN, Rehman AU, Khan K, Nayyer N; Frequency of Diabetic Retinopathy and its Association with Hypertension in Patients of Type-II Diabetes Mellitus. Pak J Med Health Sci, 2023;18(11):613-615.