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Evaluation of systemic risk factors in diabetic retinopathy among patients with type 2 Diabetes Mellitus in a tertiary care hospital: An analytical study

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Abstract

Background: Diabetes mellitus (DM) is a major health concern in Southeast Asia, and diabetic retinopathy (DR) is one of its most debilitating complications.

Aim: To investigate the association of systolic and diastolic hypertension, age, duration of diabetes, and glycemic control (HbA1c) with the occurrence of DR in patients with type 2 DM.

Methodology: This case–control study included 500 patients attending the Ophthalmology Department of NCMCH, Israna, Panipat, Haryana. Patients with proteinuria were excluded to eliminate the influence of nephropathy. Participants were aged between 40–80 years and divided into two groups: Group A (with DR) and Group B (without DR). Clinical parameters such as systolic and diastolic blood pressure, fasting blood sugar, random blood sugar, and HbA1c were evaluated.

Results: Patients with DR had significantly higher systolic blood pressure compared to those without DR (141.8 ± 11.01 vs. 124.5 ± 13.6 mmHg, P<0.001). No significant difference was observed in diastolic BP between groups. The mean age of patients with DR was significantly higher than those without DR (57.5 ± 7.9 vs. 55.1 ± 8.1 years, P<0.001). The mean duration of diabetes was also longer in the DR group (12.2 ± 5.1 vs. 7.9 ± 4.4 years, P<0.001). HbA1c levels were significantly higher in patients with DR than in those without DR (8.4 ± 0.8 vs. 7.5 ± 0.8, P<0.001), highlighting the role of poor long-term glycemic control in the development of DR.

Keywords: Diabetes mellitus, diabetic retinopathy, hypertension, HbA1c, duration of diabetes

Introduction

Diabetes mellitus (DM) is a major public health problem worldwide. According to recent estimates, more than 422 million people are affected globally, of which 69.2 million live in India. [1] With increasing prevalence, significant research has been directed toward reducing the morbidity and mortality associated with DM. Improved survival of diabetic patients has, however, led to a higher burden of chronic complications affecting multiple organ systems, including the eyes, kidneys, nerves, heart, and blood vessels. [2]

Among these complications, diabetic retinopathy (DR) is one of the most common microvascular disorders and a leading cause of preventable blindness in the working-age population. [3] In India, the prevalence of DR is rising steadily, making it a significant cause of visual disability. Although largely preventable and treatable, DR continues to pose a public health challenge. Epidemiological studies such as the Aravind Comprehensive Eye Study reported a DR prevalence of 10.5% in rural South India [4], while the Chennai Urban Rural Epidemiology Study (CURES) reported a prevalence of 17.6% in urban Chennai. [5]

Several risk factors have been implicated in the development and progression of DR. The duration of diabetes is considered the strongest predictor, with prevalence increasing steadily with disease duration. For instance, Dandona et al. reported DR in 87.5% of patients with type 2 diabetes for more than 15 years. Hypertension has also been identified as a key factor, possibly through hemodynamic changes, endothelial damage, and vascular endothelial growth factor (VEGF)-mediated mechanisms. [10–12] Clinical studies, including the UKPDS and WESDR, have demonstrated significant associations between blood pressure and DR progression.

Dyslipidemia is another important contributor. Elevated serum cholesterol, LDL cholesterol, and triglyceride levels are linked to retinal hard exudates and diabetic macular edema (DME), both of which are risk factors for vision loss. [13–14] The CURES Eye Study further highlighted a strong association of DR and DME with high LDL levels and total cholesterol, even after adjusting for age. [5] Additionally, obesity and higher body mass index (BMI) have been investigated as risk factors, with some studies showing positive associations, though results remain inconsistent across different ethnic groups. [15–17]

In India, the reported prevalence of DR ranges between 7.03% and 25%. The All India Ophthalmological Society (2014) documented a prevalence of 21.7%. [19–20] Blindness due to DR has profound effects on patients' quality of life and functional independence, and it may also worsen their ability to control diabetes, thereby increasing the risk of other complications. [21] Importantly, DR serves as an indicator of other systemic microvascular complications such as diabetic neuropathy and nephropathy. Given these factors, studying the risk profile of DR is essential. Identifying predictors such as age, duration of diabetes, hypertension, dyslipidemia, obesity, and poor glycemic control can aid in early detection, timely intervention, and reduction of the burden of visual disability in diabetic patients.

Methodology

This case–control study was conducted at a single tertiary care center in India — NC Medical College and Hospital, Israna, Panipat, Haryana. Ethical clearance was obtained prior to the commencement of the study. A total of 500 patients attending the Ophthalmology Department were enrolled. To avoid the confounding influence of nephropathy, patients with proteinuria were excluded. All participants were informed about the study objectives, procedures, privacy, and confidentiality, and written informed consent was obtained before inclusion (Table 1).

Procedure

All patients underwent a detailed ocular examination. Fundus evaluation was performed using direct fundoscopy, and the findings were confirmed with slit-lamp biomicroscopy using a 90D lens. Based on fundus examination, patients were divided into two groups:

Group A: Patients with diabetic retinopathy (n = 250)
Group B: Patients without diabetic retinopathy (n = 250)

Blood pressure was measured twice in the sitting position using a mercury sphygmomanometer, and the mean values of systolic and diastolic pressures were recorded. Fasting blood sugar (FBS), random blood sugar (RBS), and glycated hemoglobin (HbA1c) levels were assessed in both groups.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 23.0. Continuous and categorical variables were compared between groups using the Student's *t*-test. The association of risk factors with diabetic retinopathy was evaluated using odds ratios (ORs). A p-value < 0.05 was considered statistically significant.

Observation and Results

Table 1. Age for sample size ranges between 40 – 80 years

Group	Gender		Age (years)		Duration of diabetes (in years)	
	Male	Female	Mean	SD	Mean	SD
A	120	130	57.5	7.9	12.2	5.1
B	122	128	55.1	8.1	7.9	4.4

Table 2. Observed mean blood pressure, fasting blood sugar and glycated haemoglobin values in diabetic retinopathy and non diabetic retinopathy subjects

Group	**Systolic BP (in mm of Hg) (Mean±SD)**	**Diastolic BP (in mm of Hg) (Mean±SD)**	**Fasting Blood Sugar (in % of Hb) (Mean±SD)**	**HbA1c (in % of Hb) (Mean±SD)**
A	141.8±11.01	87.4±16.3	190.8±39.7	8.4±0.8

B	124.5±13.6	85.6±14.7	176.6±39.9	7.5±0.8

Systolic BP
Mean systolic BP of patients with diabetic retinopathy was 141.8 ± 11.01 mm of Hg while that of patients without diabetic retinopathy was significantly lower i.e. 124.5 ± 13.6 mm of Hg. This evidenced the fact that systolic BP is higher in patients of diabetic retinopathy.

Diastolic BP
Mean diastolic BP of patients with diabetic retinopathy was 87.4 ± 16.3 mm of Hg while that of patients without diabetic retinopathy was significantly lower i.e. 85.6 ± 14.7 mm of Hg. Thus, diastolic BP also followed the systolic BP of being higher in patients with diabetic retinopathy.

Fasting blood sugar
Mean blood sugar of patients with diabetic retinopathy was 190.8 ± 39.7 gm/dL while that of patients without diabetic retinopathy was lower i.e. 176.6 ± 39.9 gm/dL.

HbA1C levels
Mean HbA1C levels of patients with diabetic retinopathy was 8.4 ± 0.8 while that of patients without diabetic retinopathy was lower i.e. 7.5 ± 0.8 mm. This evidenced that patients with poor control on blood sugar over a long period of time has higher chances of developing diabetes related complications (TABLE 2).

Discussion

Several studies have investigated the association of systemic risk factors with diabetic retinopathy (DR). TM Arbab et al. reported a significant correlation of DR with both systolic (P<0.02) and diastolic hypertension (P<0.007), while no significant association was observed with age, duration of diabetes, fasting blood sugar, or HbA1c, possibly due to a small sample size. [22] In contrast, Ishihara et al. demonstrated significant associations of DR with systolic blood pressure (P<0.01), age (P<0.05), duration of diabetes (P<0.001), and HbA1c (P<0.001), but not with diastolic blood pressure. [23] Similarly, Van Leiden et al. found significant associations of DR with age (P<0.03), HbA1c (P<0.03), fasting blood sugar (P<0.08), and systolic hypertension (P<0.02), whereas diastolic hypertension was not a significant factor. [24]

In our study, we observed findings consistent with these reports. Patients with DR had significantly higher systolic blood pressure compared to those without DR (141.8 ± 11.01 vs. 124.5 ± 13.6 mmHg, P<0.001). However, diastolic blood pressure did not differ significantly between the two groups. The mean age of patients with DR was also significantly higher than those without DR (57.5 ± 7.9 vs. 55.1 ± 8.1 years, P<0.001), supporting the role of advancing age as a risk factor. Additionally, the mean duration of diabetes was markedly longer in patients with DR (12.2 ± 5.1 vs. 7.9 ± 4.4 years, P<0.001), reaffirming that longer disease duration increases the risk of retinal damage. Poor glycemic control was also evident, as HbA1c levels were significantly higher in patients with DR compared to non-DR patients (8.4 ± 0.8 vs. 7.5 ± 0.8, P<0.001), demonstrating the detrimental effects of sustained hyperglycemia on retinal vasculature.

Taken together, these findings highlight that systolic hypertension, increasing age, longer duration of diabetes, and poor glycemic control are major predictors for the development of DR, whereas diastolic blood pressure appears to have a less consistent association. Our results align with prior studies, adding evidence from an Indian tertiary care population.

Conclusion

Our study demonstrates that diabetic retinopathy is significantly associated with older age, longer duration of diabetes, poor glycemic control (HbA1c), and systolic hypertension. Early screening and strict control of these risk factors are crucial to reducing the prevalence and morbidity associated with DR. Timely investments in prevention, patient awareness, and risk-factor management can substantially improve the quality of life of individuals with long-standing diabetes and reduce the risk of vision-threatening complications, including blindness.

Reference

1. Vision 2020. International Agency for the Prevention of Blindness(IAPB): Vision Atlas 16th Jan 2017.
2. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes. Care*. 33(1),62–69 (2009).
3. 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.
4. Nirmalan PK. Prevalence of Vitreoretinal Disorders in a Rural Population of SouthernIndia. *Arch Ophthalmol*. 2004;122(4):581–6.
5. Rema M, Premkumar S, Anitha B, Deepa R, Pradeepa R, Mohan V. Prevalence of Diabetic Retinopathy in Urban India: The Chennai Urban Rural Epidemiology Study (CURES) Eye Study, I. *Invest Ophthalmol Vis Sci* . 2005;46(7):2328–33.
6. Rema M, Ponnaiya M, Mohan V. Prevalence of retinopathy in non insulin dependent diabetes mellitus at a diabetes centre in Southern India. *Diabetes Res Clin Pract*. 1996;34(1):29–36.
7. Kohner EM, Aldington SJ, Stratton IM, Manley SE, Holman RR, Matthews DR. Diabetic retinopathy at diagnosis of non insulin dependent diabetes mellitus and associated risk factors. United Kingdom Prospective Diabetes Study, 30. *Arch Ophthalmol*. 1998;116:297–303.
8. Dandona L, Dandona R, Naduvilath TJ, McCarty CA, Rao GN. Population based assessment of diabetic retinopathy in an urban population in southern India. *Br J Ophthal*. 1999;83(8):937–40.
9. Maurya RP. Diabetic retinopathy: My brief synopsis. *Ind J Clin Exp Ophth*. 2015;1(4):189–90.
10. Kohner EM. Diabetic retinopathy. *Br Med Bull*. 1989;45(1):148–73.
11. Fujisawa T, Ikegami H, Yamato E, Kawaguchi Y, Ueda H, Shintani M, et al. Association of plasma fibrinogen level and blood pressure with diabetic retinopathy, and renal complications associated with proliferative diabetic retinopathy, in Type 2 diabetes mellitus. *Diabetes Med*. 1999;16(6):522–6.
12. Kostraba JN, Klein R, Dorman JS, Becker DJ, Drash AL, Maser RE. The Epidemiology of Diabetes Complications Study. IV. Correlates ofdiabetic background and proliferative retinopathy. *Am J Epidemiol*. 1991;133:381–91.

13. Chew EY, Klein ML, Ferris FL, Remaley NA, Murphy RF, Chantry K, et al. Association of elevated serum lipid levels with retinal hard exudates in diabetic retinopathy. *Arch Ophthalmol* . 1996;22:1079–84.
14. Mohan R, Mohan V, Susheela L, Ramachandran A, Viswanathan M. Increased LDL cholesterol in noninsulin dependent diabetes with maculopathy. *Acta Diabetol Lat*. 1984;21:85–9.
15. Katusic D, Tomic M, Jukic T, Kordic R, Sikic J, Vukojevic N. Obesity - a risk factor for diabetic retinopathy in type 2 diabetes? *Coll Antropol*. 2005;29(1):47–50.
16. van Leiden HA, Dekker JM, Moll AC, Nijpels G, Heine RJ, Bouter LM, et al. Blood Pressure, Lipids, and Obesity Are Associated With
17. Retinopathy: The Hoorn Study. *Diabetes Care*. 2002;25(8):1320–5.
18. Zhang X, Saaddine J, Chou C *et al*. Prevalence ofdiabetic retinopathy in the United States, 2005- 2008. *JAMA*. 304(6), 649–656 (2010).
19. Gadkari S, Maskat Q, Nayak B. Prevalence of diabetic retinopathy in India: The All India Ophthalmological society diabetic retinopathy Eye Screening Study 2014. *Indian J. Ophthalmol.* 64(1), 8–4 2016.
20. Rameez Hussain, Bindu Rajesh, Anantharaman Giridhar, Mahesh Gopalakrishnan, Sanjai Sadasivan, Justin James, Hussain R, Rajesh B, Giridhar A *et al.* Knowledge and awareness about diabetes mellitus and diabetic retinopathy in suburban population of a South Indian state and its practice among the patients with diabetes mellitus: A population-based study. *Indian. J. Ophthalmol*. 64(4), 272–276 (2016).
21. Brown M, Brown G, Sharma S *et al.* Utility values and diabetic retinopathy. Am J Ophthalmol 128(3), 324–330 (1999).
22. Arbab T, Hanif S, Iqbal S *et al.* Hypertension as risk factor in diabetic retinopathy in type-2 diabetes. *Pak. J. Ophthalmol.* 24(4), 201–204 (2008).
23. Ishihara M, Yukimura Y, Aizawa T *et al.* High blood pressure as risk factor in diabetic retinopathy development in NIDDM patients. *Diabetes. Care.* 10(1), 20–25 (1987).
24. Van Leiden H, Dekker J, Moll A *et al.* Risk factors for incident retinopathy in a diabetic and nondiabetic population: The Hoorn Study. *Arch. Ophthalmol*. 121(2), 245–251(2003).