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Prevalence of Diabetic Retinopathy in Diabetes Mellitus Patients Attending a Tertiary Care Hospital in Central Indian Population

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Abstract

Background: Diabetic retinopathy is a micro vascular complication affecting the eyes of both Type 1 and Type 2 diabetes mellitus due to long-term hyperglycaemia. Diabetic retinopathy is the leading cause of blindness among working aged adults around the world.

Objectives: To estimate the prevalence of Diabetic Retinopathy and to find its association with age, gender and disease severity among diabetes mellitus.

Methods: This is a hospital based cross-sectional study which aimed to study the prevalence of diabetic retinopathy in diabetes mellitus patients attending in a tertiary care hospital in Central India. 320 already diagnosed diabetic subjects were included in the study, which were evaluated for diabetic retinopathy by funds examination after dilating the eyes. Findings were noted and prevalence was evaluated by age, gender and duration of diabetes mellitus.

Results: In present study, out of 320 subjects, 84 subjects (26.25%) were affected with diabetic retinopathy. Age, gender and duration of DM variables emerged as important risk factors for DR with P = 0.001, 0.03 and 0.001 respectively. Significant association was found between diabetic retinopathy and age range, gender and duration of diabetes.

Conclusions: there is increased risk of diabetic retinopathy by advanced age and longer duration of the disease. Therefore, periodic screening of diabetic patients should be carried out for early detection and prevention of loss of vision.

Keywords: Diabetes mellitus, Diabetic retinopathy, Duration of diabetes, Non proliferative Diabetic Retinopathy (NPDR).

Introduction

Diabetes Mellitus (DM) is one of the commonest diseases in the world, especially the industrialized world. But recently, the "Silent epidemic" of diabetes has been spreading like a wild fire through the developing world. India has earned the dubious distinction of being termed the "Diabetes capital of the world" with number of patients expected to cross 79.4 million by year 2030.[1] Diabetic mellitus (DM) is also a group of metabolic disorder of carbohydrate metabolism in which glucose is underused, producing hyperglycemia. Different statistics have led to diabetes being described as one of the main threat to human health in the 21st century.1 DM is the major cause of renal morbidity and mortality, and diabetic nephropathy is one of chronic kidney failure.[2]There are various factors leading to the development of diabetic retinopathy namely duration of diabetes, glyceamic

control, age at onset of diabetes, uncontrolled hypertension. Again, type 2 diabetes is the commonest form of diabetes constituting 90% of the diabetic population of any country.[3] that's why, the prevalence of retinopathy in type 2 diabetes is fast gaining importance in the field of research. All people with diabetes are at risk – those with Type I diabetes and those with Type II diabetes. The longer a person has had diabetes, the higher their risk of developing some ocular problem. Between 40 and 45 percent of Americans diagnosed with diabetes have some stage of diabetic retinopathy.[4] After 20 years of diabetes, nearly all patients with Type I diabetes and >60% of patients with Type II diabetes have some degree of retinopathy; however, these statistics were published in 2002 using data from four years earlier, limiting the usefulness of the research. The subjects would have been diagnosed with diabetes in the late 1970s, before modern fast-acting insulin and home glucose testing.

Classification and prevalence of diabetic retinopathy

Diabetic retinopathy is primarily classified into non proliferative Diabetic Retinopathy (NPDR), formerly termed simple, or background retinopathy, and proliferative DR (PDR). Progression from mild characterized by increased vascular permeability, to moderate, and then to severe NPDR characterized by vascular closure and an increased risk for the development of PDR2 distinguished by the growth of new blood vessels on the retina and posterior surface of the vitreous. Visual impairment in diabetic retinopathy occurs due to diabetic macular edema (DME) and PDR. DME is defined as retinal thickening/hard exudates within 500 m of the centre of the macula which is due to increased permeability of retinal vessels leading to macular edema and retinal thickening. The other cause of visual impairment in DR is PDR where there may be a sudden vitreous haemorrhage from the unstable new vessels resulting in total or partial visual loss or from pre-retinal haemorrhage/fibrosis or traction at the macula. Prior studies had also assumed a clear glyceamic threshold between people at high and low risk of diabetic. It is believed that optimal screening strategies for DR in DM is necessary to public health due to its disastrous outcomes. Therefore, it is crucial to explore the prevalence of DR as well as PDR and NPDR in DM patients to provide further evidence for screening strategies.[5-7]

This prospective observational study was conducted to evaluate the sign and symptoms as well as prevalence of diabetic retinopathy among previously diagnosed diabetic mellitus patients visiting to our routine OPD in the Department of Ophthalmology in a tertiary care hospital resided in Central India.

Material and Methods

The retrospective study was conducted in the Department of Opthalmology, Sri Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh, over a period of 6 months from October 2018 to April 2019. An ethical clearance was obtained from the institutional committee prior the study. The study included 320 patients of diabetes mellitus age range between 20-70 years age group of either sex.

A full medical history was taken including age of patient, duration of diabetes, treatment details, history of hypertension, and hyperlipidemia. Fasting blood glucose of each patient was estimated after an overnight fast. Diabetic control was graded as Normal (<100 mg/dl), Moderate control (100-126 mg/dl), and High (>126 mg/dl). Glycosylated hemoglobin assay was not done in all cases and hence not included in this study. Hypertension was deemed to be present when the systolic blood pressure was >140 mm Hg or when diastolic blood pressure was >90 mm Hg or when patient gave history of hypertension controlled with medications. graded as present when total cholesterol was >200 mg/dl or when

patient was on medication for hyperlipidemia. The pupil of each eye was dilated using Tropicamide 1% and phenylephrine 10% eye drops followed by detailed fundus examination with direct and indirect ophthalmoscopy. DR patients were classified according to the grading in the worse eye.

Diagnosis

Visual acuity test: Uses an eye chart to measure how well a person sees at various distances (i.e., visual acuity).

Pupil dilation: The eye care professional places drops into the eye to dilate the pupil. This allows him or her to see more of the retina and look for signs of diabetic retinopathy. After the examination, close-up vision may remain blurred for several hours.

Ophthalmoscopy or fundus photography: Ophthalmoscopy is an examination of the retina in which the eye care professional: (1) looks through a slit lamp biomicroscope with a special magnifying lens that provides a narrow view of the retina, or (2) wearing a headset (indirect ophthalmoscope) with a bright light, looks through a special magnifying glass and gains a wide view of the retina. Hand-held ophthalmoscopy is insouciant to rule out significant and treatable diabetic retinopathy. FundUs photography generally captures considerably larger areas of the fundus, and has the advantage of photo documentation for future reference, as well as availing the image to be examined by a specialist at another location and/or time.

Fundus Fluorescein angiography (FFA): This is an imaging technique which relies on the circulation of fluorescein dye to show staining, leakage, or nonperfusion of the retinal and choroidal vasculature.

Optical coherence tomography (OCT): This is an optical imaging modality based upon interference, and analogous to ultrasound. It produces crosssectional images of the retina (B-scans) which can be used to measure the thickness of the retina and to resolve its major layers, allowing the observation of swelling. The eye care professional will look at the retina for early signs of the disease, such as:

- Leaking blood vessels,
- Retinal swelling, such as macular edema,
- Pale, fatty deposits on the retina (exudates) – signs of leaking blood vessels,
- Damaged nerve tissue (neuropathy), and
- Any changes in the blood vessels.

Diabetic retinopathy also affects microcirculation thorough the body. A recent study[17] showed assessment of conjunctival microvascular hemodynamicssuch as vessel diameter, red blood cell velocity and wall shear stress can be useful for diagnosis and screening of diabetic retinopathy. Furthermore, the pattern of conjunctival micro vessel was shown to be useful for rapid monitoring and diagnosis of different stages of diabetic retinopathy.[8]

Subjects were explained about the study and once the consent was received, data regarding age, gender, age at onset of diabetes, duration of diabetes, history of smoking, alcohol intake, and socio-economic status was documented. Height and weight was measured. Blood pressure was recorded with mercury sphygmomanometer. Then the subjects were evaluated for diabetic retinopathy by fundus examination after dilating the eyes. Findings were noted and subjects were categorized as no retinopathy, nonproliferative and proliferative diabetic retinopathy using the ETDRS classification. The factors contributing to the development of retinopathy was also studied according toKlein R et al[18] in 1986.

Three age groups were made to evaluate age distribution i.e. 18-30 years, 31-50 years and 51-70 years. Duration of diabetes was distributed as 0-5 years, 6-10 years and more than 10 years.

All the data were analyzed using descriptive statistics. The statistical software used was SPSS 20.0. The results were considered significant at a two-tailed level of 0.05.

Results

The retrospective study was conducted in the Department of Opthalmology, Sri Shankaracharya Institute of Medical Sciences, Bhilai, Chhattisgarh, over a period of 6 months from October 2018 to April 2019. An ethical clearance was obtained from the institutional committee prior the study. The study included 320 patients of diabetes mellitus age range between 20-70 years age group of either sex.

Schematic representation of the study design is shown in table 1. The total number of subjects studied was 320. Mean age was 44.88 ± 10.07 years. The diabetic subjects were predominantly adults with more than 70% aged above 30 years. There was a female preponderance with females constituting (57.5%) of the population studied. Majority of them (nearly 37.5%) were labors, unemployed (30%) and less professionals were 32.5%. 40% patients were having more than 10 year of disease. 26% patients were having 0-5 year of disease and 22 patients were having 6-10 year of disease.

Age-wise distribution of the diabetic patients screened and the prevalence of diabetic retinopathy is shown in the Table 2. The prevalence of diabetic retinopathy in this study was 26.25%. Out of 320pre diabetic patients, in the first age group (20-35 years), only 4 patients were having DR. In the second age group (35-50 years), 16 patients were having DR and in the last age group (51-70 years), 64 patients were having DR. Thelast age group showed highest prevalence in DR. This denotes the positive correlation of age and duration of disease with Diabetic Retinopathy.

Out of 84 DR patients, 45 were males and 39 were females which showed male prevalence of the disease.

A multiple logistic regression analysis was performed to see which among these variables would predict higher chances of developing DR. Age, gender andduration of DM variables emerged as important risk factors for DR with P = 0.001, 0.03 and 0.001 respectively. [Table 2 and 3]

Table 1: Demographic variables

Characteristics	Group	Number	Percentage (%)
Age group (years)	**20-35**	**18**	**22.5**
	36-50	**24**	**30**
	51-70	**38**	**47.5**
Duration (years) of Diabetes Mellitus	**0-5**	**26**	**32.5**
	6-10	**22**	**27.5**
	more than 10	**32**	**40**
Gender	**Male**	**136**	**42.5**
	Female	**164**	**57.5**
Occupation	**Labour**	**120**	**37.5**
	Professional	**104**	**32.5**
	Nonworking	**96**	**30.0**

Table2: Age-wise distribution of the diabetic patients screened and the prevalence of diabetic retinopathy

Age in years	Diabetic Retinopathy			Prevalence (%)	p-value
	Present	Absent	Total		
20-35	4	20	24	7.5	0.001
36-50	16	57	72	22.5	
51-70	64	180	224	70.0	
Gender					0.03
Male	44	92	136	42.5	
Female	39	145	184	57.5	

DR also correlated with the duration of DM. We found that only 12 patients 0-5 year duration of disease showed DR, they also have advance age predominance. Duration of DM upto 6-10 year of DM showed 26 patients with DR.

highest prevalence of 45 patients was found in third group i.e. more than 10 year duration of DM disease.

Table 3: Duration-wise distribution of the diabetic retinopathy in diabetic mellitus patients

Duration of diabetes (years)	Diabetic Retinopathy		p- Value
	Present n	**Absent n**	
0-5	12	48	0.001
6-10	26	82	
10<	45	107	
Total	83	237	

This finding was statistically significant (p=0.001).

Discussion

Diabetic retinopathy is one of the most severe microvascular complications in patients with diabetes and is a leading cause of irreversible vision loss in working-aged adults (20–74 years). The high prevalence of DR in type 2 diabetic patients imposes a large economic burden. Severity of hyperglycemia, presence of hypertension and duration of diabetes are widely recognized as major risk factors for the development of DR.[8, 9]This retrospective study was conducted on 320 previously diagnosed DM patients, age range between 20-70 years age group of either sex.

Mean age was 44.88 ± 10.07 years in this study. The diabetic subjects were predominantly adults with more than 70% aged above 30 years. There was a female preponderance with females constituting (57.5%) of the population studied. Majority of them (nearly 37.5%) were labors, unemployed (30%) and less professionals were 32.5%. 40% patients were having more than 10 year of disease. 26% patients were having 0-5 year of disease and 22 patients were having 6-10 year of disease. These findings were similar to the results found in previous studies[13] like Gadkari SS et al[1] in 2014 in his eye screening study and Kertes PJ et al[3] in 2007 in their study on Evidence Based Eye Care. Varma R et al[7] in 2004 on DR in Latinos showed opposite results.

In our study, the prevalence of DRwas26.25% and similar to that observed by Remaet al[6](17.6%) and Raman etal[7](18.1%)in studies performed in the southern states of India.

Even NPDR was more prevalent as compared to PDR just like other studies done in South India. This may further suggest that the possibility of differences in the prevalence of DR maybe not exist ent among diabetic patients of different geographical origins and ethnic groups.

However the possibility may be explored by doing larger population based studies across the country. Males were more affected (55.17%) than females as the issues of gender bias and social barriers to treatment modifying access to screening and treatment are known to exist. We observed the duration of diabetes to be related with the development of DR and the percentage of patients affected with DR increases with the increasing duration of Type 2 Diabetes Mellitus.

Age-wise distribution of the diabetic patients screened and the prevalence of diabetic retinopathy is shown in the Table 2. The prevalence of diabetic retinopathy in this study was 26.25%. Out of 320 pre diabetic patients, in the first age group (20-35 years), only 4 patients were having DR. In the second age group (35-50 years), 16 patients were having DR and in the last age group (51-70 years), 64 patients were having DR. The last age group showed highest prevalence in DR. This denotes the positive correlation of age and duration of disease with Diabetic Retinopathy. Tapp RJ et al[4] in 2003 in his similar study on Australian population found similar results, Rema M et al[6] in 2005 in his study on DR in urban India also showed similar results.

Out of 84 DR patients, 45 were males and 39 were females which showed male prevalence of the disease. A multiple logistic regression analysis was performed to see which among these variables would predict higher chances of developing DR. Age, gender and duration of DM variables emerged as important risk factors for DR with P = 0.001, 0.03 and 0.001 respectively [Table 2 and 3].Some previous studies showed similar results like Mitchell P et al[10] in 1998, Chen MS et al[11] in 1992 in their study on Prevalence and risk factors of diabetic retinopathy among noninsulin- dependent diabetic subjects.

As did other studies, this study showed a significantly higher prevalence with increase in age (26.25%) and duration of diabetes. The prevalence of any DR was more in participants with known DM than in those who were newly diagnosed (13.1% vs 2.8%). When data of the rural population were compared with those of the urban population, which were reported earlier, a higher prevalence of any DR in the newly diagnosed was found in urban compared with rural populations (6% vs 2.8%). In the Wisconsin epidemiological study,[13] prevalence of DR varied from 28.8% in persons who had diabetes for <5 years to 77.8% in persons who had diabetes for 15 or more years.[12-16]According to Bhutia KL et al[20] in his study on Type 2 Diabetic Patients Attending Tertiary Care Hospital In Sikkim, DR appeared as early as <5 years of DM in 1.5% of the population and 31% patients developed DR after 20 years of DM. Tapp RJ et al4 in 2003 found similar resultsin his study on Australian population, Rema M et al[6] in 2005 in his study on DR in urban India, Varma R et al[7] in 2004 on DR in Latinos.

Rema M et al[6] in 2005 in his study on DR in urban India, studied 1715 participants with DM, he found prevalence of DR 17.6% patients in the rural Chennai population. Varma R et al[7] in 2004 on DR in his study on 1217 DM patients in Los Angeles Latinos population showed highest prevalence (46.9%) in DR. Broadbent DM et al[8] in their study on Liverpool, UK population in 1998 found 33.6% prevalence of DR patients and Leske MC et al[9] in 1999 in their study on Barbados, West Indian population.

In the present study DR was present in 84 patients out of the 320 known DM patients referred for evaluation which is lower compared to most studies. It may be due to racial and demographic factors. However, the methods of detecting retinopathy used in different studies may be the most important reason found 26.25% prevalence of DR patients.

The prevalence of diabetes and DR is continuously increasing. According to studies done in South Indian urban population, the prevalence of DR ranges from 12% to 22.4%.[1,6] The prevalence of DR among other countries such as Singapore and Japan is less than India.

Conclusion

This was the first study of its kind which estimated the prevalence of DR in Central Indian hospital-based diabetic populations (26.25%). The study also observed that the presence of DR, despite vision being near normal, strengthens a case for regular ocular examinations in diabetic patients. Our study also created awareness among the patients about DR who were evaluated during the course of the study. More effort should be given to determine more risk factors for the occurrence of DR in patients with diabetes. Although the present study was able to define many of these factors, much still needs to be done. Awareness about retinopathy, good control of blood sugar, cholesterol and high blood pressure will decrease the incidence of DR. this study can contribute in early evaluation of disease.

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