Original Research Article

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The prevalence of retinopathy in diabetes mellitus and associated risk factors: a community-based cross sectional study in peri urban area

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ABSTRACT

Background: Visual impairment i.e. diabetic retinopathy is the one of most common manifestation of diabetes mellitus. Globally it is becoming an increasing public health problem especially in the developing countries because of increase in number of diabetic patients.

Methods: A cross sectional study was conducted in the vicinity of Urban Heath and Training Centre (UHTC), Peoples University, Bhopal over a period of 6 months through screening in camps held, which included a total of 840 participants (aged ≥25 years) by following simple random procedure and in those who had newly diagnosed or long standing diabetes were referred to ophthalmologist for further evaluation. Retinopathy was determined by ophthalmoscopy and fundus photography. Anthropometric measurements (BMI), glycosylated haemoglobin were also evaluated among the confirmed diabetic patients in the study.

Results: An increased prevalence of diabetes (5.95%) and retinopathy (28%) (95% CI 11.2-32.0) was found. In all age groups prevalence of bilateral blindness, bilateral low vision, unilateral blindness and unilateral low vision were respectively 2%, 28%, 0%, 70%. Independent risk indicators for the occurrence of diabetes such as age, BMI, HbA1c, were found significant for the occurrence of retinopathy in the study population.

Conclusions: Visual impairment due to diabetic retinopathy remains an important public health problem in people with diabetes so timely interventions are required to resolve this major issue.

Keywords: Prevalence, Diabetes mellitus, Diabetes retinopathy, Visual impairment, Community, Factors

INTRODUCTION

Longstanding diabetes can cause various serious consequences like diabetic retinopathy (DR), diabetic neuropathy & diabetic nephropathy (DN). Out of these DR is the most important ophthalmic complication of diabetes mellitus (DM) and in many adults, causes blindness. DR is the second leading cause of legal blindness in developed countries in addition to it being the primary cause of blindness in people between 25 and 64 years old. Diabetes mellitus is often associated with progressive loss of vision and is one of the fastest-

growing health problems in the world.^{6,7} The loss of vision is more likely to occur in people with type 2 diabetes than in older adults without type 2 diabetes.^{3,4} Moreover, a higher incidence of cataracts, glaucoma, or corneal diseases has also been observed in this population along with diabetic retinopathy.⁸⁻¹¹ Visual impairment not only worsens and reduces quality of life of diabetic patients but also increases economic burden on the society. The amplified prevalence of visual impairment in association with diabetes has become a major public health problem that entails significant attention.

The rapid evolution in urbanization in conjunction with increase in the prevalence of diabetes mellitus inescapably affects the pattern of visual impairment in Indian populations, especially in diabetic patients. Currently, little is known about how low vision and blindness are associated with type 2 diabetes in India. Thus, we conducted this study to determine the prevalence and factors associated with low vision in a population with previously diagnosed diabetes mellitus.

METHODS

Sample size calculation

As this study was only a part of continuing large epidemiological study worldwide, to determine the required sample size for this study, the formula: n=PQ/l2 was used, where P is prevalence (of DM + Pre DM) from the previous study, i.e. 0.14 (14%); Q=1 – P, i.e. 0.86 and l=allowable error of known prevalence i.e. 0.085×0.14 . Thus the calculated sample size, n=850. In the current study a total of 840 subjects participated. This subset of population was investigated to estimate the prevalence of retinopathy among diabetics and explore the associated risk factors for developing retinopathy. Following a simple random procedure 1000 individuals aged \geq 25 years were identified to participate in this study, among which 840 individuals agreed to participate and were investigated in the present study.

Study period

The present study was completed in 6 months period. Three camps were organized in three different places in the vicinity of UHTC for the period of two days each. The first camp was held in April 2015, second camp in May 2015 and the last camp in October 2015.

Inclusion criteria

Both men and women ≥ 25 years of age who were inhabitants of the camp area and were willing to participate voluntarily and comply with the instruction, were included in the study

Exclusion criteria

People who were not qualified by inclusion criteria were excluded from the study. Pregnant women and physically or mentally disabled persons unable to follow simple questions / instructions were excluded.

Methodology

This epidemiological survey was conducted through screening in camp settings within the catchment area of Urban Health and Training Centre (UHTC), People's University Bhopal, to detect diabetic retinopathy.

A total of 50 (36 male, 14 female) known diabetics were identified during the camps. 8 of 50 patients were early

age onset diabetics (diagnosed before the age of 30) and the remaining 42 patients were older onset diabetics. The participants were provided with the necessary information about this study and their consent taken. They were called to the Ophthalmology Unit for ophthalmic examination and treatment. At the same time, we reconfirmed the diabetic status of these 50 known diabetic patients by investigating their fasting and post prandial serum blood sugar levels. Moreover, the body mass index (BMI) and glycosylated hemoglobin (HbA1c) was furthermore tested for confirmed diabetic patients. Though recommended, we were unable to conduct further investigations (urine routine and microscopy, lipid profile, renal and liver function test and hip waist ratio) due to lack of personnel and time. Patient's ophthalmic examination was conducted in UHTC by trained ophthalmologist.

A detailed questionnaire, including socio-demographic status, DM and history of other illness, weight, height, and results of eye examination was given to all 50 patients.

Routine ophthalmologic examination was performed. When the best-corrected visual acuity (BCVA) in the better eye was ≤ 0.1 , it was accepted as legal blindness. If the BCVA was 0.2 to 0.4, it was accepted as low vision. When the BCVA in the better eye was ≥ 0.5 and the fellow eye was ≤ 0.1 , it was grouped as unilateral blindness, and if the BCVA was 0.2 to 0.4 in the fellow eye, it was grouped as unilateral low vision.

Data analysis

The data was entered in the pre-designed Microsoft office excel format which was later imported into the statistical software SPSS 20. The prevalence rates of diabetes and retinopathy were determined by simple percentages. Statistical comparisons between categorical variables were made by using $\chi 2$ test and comparisons between continuous variables were made by using independent sample t test. All presented p values are two-tailed. The statistical tests were considered significant at a level $\leq 5\%$ (≤ 0.05).

RESULTS

In the study a total of 840 participants were registered to attend all the activities of the camp. The mean $(\pm SD)$ age (in years) of the participants was 46 (± 12) years. All participants were divided into 4 age groups with 10 years age interval.

Among the participants 328 (39%) participants were between 25 to 35 years, nearly 300 (36%) were between 36 to 45 years, 159 (19%) were 46 to 55 years of age and 52 (06%) were above 56 years of age. Among the 840 participants 56% (n=470) were male and 44% (n=370) were female. Females participants being younger (mean ±SD, 45.0±11) compared to male (mean±SD, 46.0±12) participants.

Table 1: Demographic and socio-economic characteristics of the study subjects (n=840).

Variables		Frequency	Mean±SD/ Percentage	
	Male participants	470	46.0 (±12)	
Mean Age	Female participants	370	45.0 (±11)	
	Total participants	840	46.0 (±12)	
	25-35	328	39.04	
Age (in	36-45	301	35.83	
years)	46-55	159	18.92	
	>56	52	6.190	
Gender	Male	470	55.95	
Gender	Female	370	44.04	
	Illiterate	288	34.28	
	Primary	280	33.33	
Education	Middle	180	21.42	
	High school	61	07.26	
	Graduate	20	02.38	
	Post Graduate	11	1.30	
Occupation	Farmer and labor	260	30.95	
	Either Govt. or pvt. service	88	10.47	
	Businessmen	128	15.23	
	Housewives	290	34.52	
	Retired	74	08.80	
	Upper class	234	27.85	
Socio- Economic status	Upper middle class	277	32.97	
	Middle class	235	27.97	
	Lower middle class	58	06.90	
	Lower class	36	04.28	

A major portion of the 840 participants were illiterate (34%) and below primary level (33%), middle, high school, graduate, and masters' level participants were nearly 22%, 7%, 2% and 1% respectively. Major number of female participants was housewives (34%). Among the male participants, farmers and labors were 31%, service holders 10%, small businessmen 15% and retired personnel 8%. Among the total participants all but 28% were from upper class and 33% from upper middle class.; rest were from middle, lower middle or lower class according to their socioeconomic status.

Among the study sample of 840, only 50 people were found to be either newly diagnosed Diabetics or previously known diabetic cases hence prevalence of Diabetes was 5.95% in this peri urban community. Sociodemographic profile and characteristics of identified 50 diabetic patients, (42 are older and 8 are younger onset) is given in Table 1A. The female: male ratio was 2.5:1 for all diabetic patients and 76% of the diabetic patients (38)

patients) used oral anti diabetic drugs while rest 24% used insulin for treatment. The average age for the diabetic group was 43.6±12.5 years, nevertheless it was significantly lower for the insulin group (40.2±8.8 years) than oral anti diabetic users (50.4±7.4 years) (p <0.05). The average time since diagnosis was 6.2±5.3 years for all diabetic patients. Following ophthalmic examination of diabetic patients; 2% had bilateral blindness, 28% bilateral low vision and 70% unilateral low vision.

Table 1A: Distribution of known diabetic population with their variables (n=50).

	Number	Percentage (%)	
Age group			
Less than 30 years	8	16.00	
30 to 39 years	16	32.00	
40 to 49 years	7	14.00	
50 to 59 years	13	26.00	
More than 60 years	6	12.00	
Total	50	100.00	
Gender			
Female	14	28.00	
Male	36	72.00	
Total	50	100.00	
Education			
Illiterate	11	22.00	
Primary	14	28.00	
Middle	10	20.00	
High school	15	30.00	
Total	50	100.00	
Onset of diabetes			
Younger	8	16	
Older	32	84	
Type of anti-diabetic trea	atment		
Oral anti-diabetic drugs	38	76	
Insulin	12	24	
Vision			
Bilateral blindness	1	2.00	
Bilateral low vision	14	28.00	
Unilateral blindness	0	0.00	
Unilateral low vision	35	70.00	
Total	50	100.00	

As per Table 2, based on descriptive statistics of age, BMI and HBA1C among diabetic group, it was evaluated that BMI was in range of 20 to 31 with mean value of 28 and SD of ± 2.16 and HbA1c was in range of 7 to 9.2 with mean value of 7.93 and SD of ± 0.73 .

Distribution of low vision in relation to various parameters among the known diabetic subjects is given in Table 3. All of the diabetic females had unilateral low vision, while males had commonly unilateral low vision followed by bilateral low vision. Only 1 male had blindness Gender, age group and education among diabetic group had significant association with blindness

and low vision. The prevalence of legal blindness in the diabetic group was 2% (1 patient). This value was 2.9%

for males and 0% for females and the difference was statistically significant (p<0.05).

Table 2: Descriptive statistics as per their age, BMI and HbA1c.

Descriptive statistics	Minimum	Maximum	Mean	Std. deviation
Age	25	65	43.64	12.52
BMI (kg/square meter)	20	31	28.002	2.16
HbA1c	7	9.2	7.93	0.73

Table 3: Association of vision with various parameters (n=35).

	Vision					
Age group	Bilateral blindness	Bilateral low vision	Unilateral blindness	Unilateral low vision	Chi-square	P value
Less than 30 years	0	0	0	8		0
30 to 39 years	0	0	0	15	57.797	
40 to 49 years	0	7	0	0		
50 to 59 years	0	6	0	10		
More than 60 years	1	1	0	2		
Total	1	14	0	35		
Gender						
Female	0	0	0	14	10.937	0.012
Male	1	14	0	23		
Total	1	14	0	35	_	
Education						
Illiterate	1	5	0	4	17.884	0.037
Primary	0	7	0	6		
Middle	0	2	0	13		
High school	0	0	0	14		
Total	1	14	0	35		

DISCUSSION

The present study dealt with the prevalence of diabetes and its associated risk factors for diabetic retinopathy in a peri urban population in Bhopal. The prevalence of diabetes was found to be 5.95% which is comparable to the recent studies, but significantly higher than the studies conducted in early 2000s. 12-17 Data on the rising trend of diabetes in present study were based on the comparison of data accumulated from different parts of the country at different times applying not one single technique/system but different methods. 16 The prevalence of diabetes documented in this study was moderately a little higher than the prevalence found in rural China (5.6%), but was more aligned to prevalence in rural part of our country (6.3%) except that prevalence was lower to the occurrence of diabetes in rural population in Turkey (7.2%) and Pakistan (11.1%). The direct comparisons of prevalence rates are challenging owing to different methodologies applied and varied characteristics of the population. Therefore, it is difficult to make a scientific conclusion of the rising trend of diabetes. To compare secular trends, it would be more accurate to document prevalence of diabetes within the same region applying identical methodology.

Several studies showed that urbanization, economic development and affluent lifestyle are causing high prevalence of DM even in the developing countries.² The peri urban population is undergoing lifestyle transition due to socio-economic growth, which in turn is associated with this increased rate in the prevalence of diabetes in present study. The BMI in this population remains low; therefore, it would be difficult to ascribe the increased prevalence only due to higher caloric intake as a consequence of improved socio-economic condition. Rather higher pre diabetes in a lean population may also indicate genetical susceptibility in the population, making them prone to convert to diabetes with much lower change in obesity, although the BMI may remain low. Thus indicating chances of rapid progression from the normal state through pre diabetes to diabetes; this could imply a rapid increase in the diabetes epidemic or a worsening diabetogenic environment. Prospective studies are required to assess the exact changes occurring with regard to the diabetes epidemic. Obesity is an established risk factor for diabetes, and it was observed to have an important association with both general obesity and central obesity. It is of interest to note that general obesity was found to have more than 2-fold higher risk for developing diabetes in subjects with BMI >23.0 kg/m² in the previous study. It is noted that the risk of diabetes occurred at a lower BMI threshold (<23 kg/m²) in Asian Indians.²⁵ Conversely, in other studies higher BMI (>25.0 kg/m²) was found as an important predictor for occurrence of type 2 diabetes.^{16,13,14} A study in India found the prevalence of diabetes among urban and rural population was high even though the rates of obesity were low.²⁶ It was noticed that the risk of diabetes was augmented by central adiposity along with lower BMI threshold in Asian Indians.²⁵

In the present study, central obesity was observed even among people with normal BMI in the population. Therefore, the transition in lifestyle occurring in the periurban population seemed to produce rapid adverse changes like obesity favoring risk of developing diabetes. Our study also revealed strong evidence to suggest, that the development and progression of retinopathy is influenced and associated with glycosylated hemoglobin (HbA1c) level as well with BMI. In line with our study, in other studies too, a positive association had been publicized between BMI, HbA1C and retinopathy that included diabetic patients.

In the present study prevalence of retinopathy was 28% (95% CI 11.2-32.0) among the diabetic patients wherein unilateral low vision was 16% in the age group less than 30 years; however it was 30% in the age group 30 to 39 years. Bilateral low vision had 14% prevalence in age group 40 to 49 years and 12% in 50 to 59 years. In all age groups prevalence of bilateral blindness, bilateral low vision, unilateral blindness and unilateral low vision were respectively 2%, 28%, 0%, 70%. Prevalence of unilateral low vision and bilateral low vision amongst male were 46% and 28% respectively. Having found higher prevalence of diabetes in our population, it was indicative that the prevalence of retinopathy was increased in patients with increasing deciles of glycemic level.

Limitations

- We were unable to screen the remaining 790
 participants for diabetes, nor were able to enquire
 about history of diabetes in their family members
 especially parents.
- We were unable to conduct other recommended investigations i.e. Urine routine and microscopy, Lipid profile, Renal and Liver Function Test and Hip Waist Ratio which would have given us better and precise finding and results in association with diabetic retinopathy.

CONCLUSION

The present study confirms that prevalence of diabetes in peri-urban area is correlated with presence of Diabetic retinopathy which essentially requires more effective screening and treatment. In our study we have also highlighted variations and association susceptibility of known diabetic patients to branded risk factors of diabetes complications. Like other studies, done in other

regions in India and in other countries, the prevalence of diabetes points out affiliation with obesity, urbanization, BMI, changes in dietary habits and sedentary lifestyle as well as HbA1C levels, therefore leading to increased burden of diabetic retinopathy.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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