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Original article

Prevalence of diabetic retinopathy among self-reported adult diabetics in districts of Eastern Nepal in a community based study

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Abstract

Introduction: Diabetic retinopathy (DR) is the leading cause of blindness among working age adults around the world. Each year more and more people live with this condition, which can result in life-changing complications. Objective: To determine the prevalence and risk factors of diabetic retinopathy (DR) in a large community based screening programme, in order to estimate the future burden of the disease. **Materials and methods:** A cross sectional community based study was conducted between 1st January and 31st December 2014 in a purposive sample of adults with self-reported diabetes mellitus (DM) from Morang and Sunsari district of Nepal. A structured questionnaire was used to collect patient data. Ophthalmological evaluation was done and fundus was examined for grading DR using direct and indirect ophthalmoscope. Results: Among the 698 diabetic patients, mean age was 55.02±11.8 years (ranging from 24 to 91 years). 12.3% of diabetic were not under any treatment. Only 69.3% of patients had visited eye specialist for diabetic retinopathy screening. Prevalence of DR was found to be 15.3%; 13.9% had non-proliferative DR and 1.4% had proliferative DR. Prevalence of diabetic macular edema was 2.1%. In Morang district prevalence of DR was 14.2% and in Sunsari district it was 16.2%. In the binary-logistic regression analysis, duration of diabetes was associated with significantly increased risk of DR (OR: 1.13; 95% confidence interval (CI), 1.09 to 1.17; $p<0.001$). History of absence of arterial hypertension decreased the risk of DR (OR: 0.56; 95% CI, 0.36 to 0.87; $p=0.01$) **Conclusion:** One sixth of the patients with diabetes in the Eastern region of Nepal have retinopathy. Diabetic retinopathy risk increased with duration of diabetes and decreased with history of no co-existing arterial hypertension.

Keywords: Diabetic Retinopathy, Diabetes mellitus, Prevalence, Eastern Nepal, Risk factors

Introduction

Diabetes is one of the greatest global health burdens of the 21st century (International Diabetes Federation, 2015). Each year more and more people live with this condition, which can result in life-changing complications (International Diabetes Federation, 2015). Diabetic retinopathy (DR) is the leading cause of blindness among working aged adults around the world (Klein BE,2007). Uncorrected refractive errors (43%), cataracts (33%), glaucoma (2%), age related macular degeneration (1%) and diabetic retinopathy (1%) are the major causes of visual impairment globally (WHO, 2012). Although the major risk factors for DR (e.g., hyperglycemia,

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hypertension, dyslipidemia) have been examined in many epidemiologic studies and clinical trials, there is considerable variation in the consistency, pattern, and strength of these risk factors (Yau JW et al, 2012).

Prevalence of DR ranged from 17.6% in a study in India (Rema et al 2005) to 33.2% in a large study in United States (Wong TY, 2006). There is very few data available from Nepal, mainly outside Kathmandu valley.

The present study aims to evaluate the prevalence of diabetic retinopathy in a community-based purposive sample of adults with self-reported diabetes mellitus (DM) from Sunsari and Morang districts of Eastern Nepal.

Patients and Methods

A cross sectional community based study was conducted between 1st January and 31st December 2014. Five and 4 cities were selected randomly from Sunsari and Morang district respectively. Adults (20 years and above) with self-reported diabetes mellitus were included in the study by purposive sampling. Patients with media opacity (like corneal opacity and significant cataract) precluding fundus examination were not included in the study.

A structured questionnaire developed by Vitreoretina department of Biratnagar Eye Hospital was used for data collection. Informed consent was taken from all the participants. The study adheres to tenets of declaration of Helsinki. All participants were interviewed; socio-demographic details including age, gender, occupation, past history of ocular examination for diabetic retinopathy, duration of DM, treatment of DM and history of coexisting hypertension were collected. Age distribution was taken at 10 years interval as per International Diabetes Federation,2015. Distribution of duration of diabetes was done as per Centers for Disease Control and Prevention (CDC), 2011.

Detailed ophthalmological evaluation included dilated fundus examination to grade DR using direct and indirect ophthalmoscope. One of the 3 Ophthalmologists from the vitreoretina department was involved in examination of patients at different cities on a rotation basis. Best corrected Snellen's visual acuity was recorded and graded as per WHO categories for visual impairment 1977. Diabetic retinopathy was graded according to the Global Diabetic Retinopathy Project Group, 2003. The presence of retinopathy in one eye was considered as a positive diagnosis of DR and when asymmetrical disease was present, the stage of retinopathy was based on grade of DR in more severely affected eye.

Statistical analysis

Data was entered in an Excel spreadsheet (Microsoft Corp.) and analyzed using SPSS software (version 16.1, SPSS, Inc.). Continuous variables were expressed as the mean ± standard deviation and categorical variables were expressed as individual counts. Differences were considered statistically significant when the p value was less than 0.05. Subjects were divided into two groups based on the presence or absence of DR. Binary logistic regression analysis was performed between presence or absence of DR and duration of diabetes, age, male gender, no history of hypertension and whether visited eye specialist for DR.

Results

Six hundred and ninety eight diabetics were screened for diabetic retinopathy and were included in the study. Out of these, 303 (43.4%) patients were resident of Morang district and 395 (56.6%) of Sunsari district. Male: female ratio was 1.26:1. Mean age of the patients was 55.02±11.8 years (ranging from 24 to 91 years). More than half of patients (56.3%) belonged to the age group 50 to 69 years (Table 1). The major group of patients was housewives (37.7%), followed by business man (28.2%),

service man (14.8%), farmer (14.2%) and others (5.2%).

Majority of patients (85.1%) had diabetes for duration of 1 to 10 years (Table 2). More than half of diabetics (55%) were taking oral hypoglycemic agents, 29.5% of them were taking insulin, 12.3% were not under any treatment and 3.2% were under dietary control.

More than two third (69.3%) of patients had previously visited eye specialist for diabetic retinopathy screening. Of the study population, only 0.4% gave history of treatment in the form of retinal lasers and none of them had received any intraocular injections or had undergone retinal surgery. Around two fifth (42.4%) of patients gave history of coexisting hypertension.

Majority of the patient's best corrected Snellen's visual acuity (BCVA) was between 6/6 - 6/18 (Table 3).

Age adjusted prevalence of DR in the screened diabetic population was found to be 15.3%; 13.9% had non-proliferative DR and 1.4% had proliferative DR. Prevalence of diabetic macular edema was 2.1%. In Morang district prevalence of DR was 14.2% and in Sunsari district it was 16.2%. There was an insignificant difference (p=0.087) in the prevalence between male (15.2%) and female (15.5%) gender. There was no significant difference (p=0.832) in prevalence of DR between those who had visited ophthalmologist for DR screening (14.9%) and those who had not (16.4%). Highest prevalence of DR (60.7%) was seen among those having diabetes for duration of 16 to 20 years (Table 2). Prevalence of DR was highest (21.2%) in the age group 60 to 69 years and lowest (0.0%) in the age group 20 to 29 years (Table 1).

In the binary-logistic regression analysis in all adults, duration of diabetes was associated with significantly increased risk of DR (OR: 1.13; 95% confidence interval (CI), 1.09 to 1.17; p<0.001). History of absence of arterial hypertension decreased the risk of DR (OR: 0.56; 95% CI, 0.36 to 0.87; p=0.01). Age (OR: 1.005; 95% CI, 0.98 to 1.02; p=0.61), male gender (OR: 0.91; 95% CI, 0.58 to 1.42; p=0.68) and whether visited eye specialist for DR screening (OR: 0.77; 95% CI, 0.48 to 1.12; p=0.27) were not found to be associated with DR.

Table 1: Age distribution and gender distribution and adjusted prevalence of Diabetic retinopathy

Characteristic and Parameters		Total No. of patients in the subgroup (%)	Adjusted Prevalence of Retinopathy (%)
Age (in years)[a]	20-29	9 (1.3)	0
	30-39	47 (6.7)	4.3
	40-49	169 (24.2)	9.5
	50-59	190 (27.2)	18.4
	60-69	203 (29.1)	21.2
	70-79	67 (9.6)	14.9
	≥80	13 (1.9)	7.7
Gender	Male	389 (55.7)	15.2
	Female	309 (44.3)	15.5

[a] Age distribution as per International Diabetes Federation, 2015.

Table 2: Patient characteristics and Prevalence of retinopathy as per various parameters

Characteristic and Parameters		Total No. of patients in the subgroup (%)	Prevalence of Retinopathy (%)
Duration of diabetes (in years)[a]	0-2	243 (34.8)	9
	2-5	208 (29.8)	7.7
	6-10	143 (20.5)	20.3
	11-15	61 (8.7)	29.5
	16-20	28 (4)	60.7
	21-25	11 (1.6)	45.5
	26-30	4 (0.6)	0
H/O Hypertension	Yes	296 (42.4)	18.9
	No	402 (57.6)	12.7
H/O Visited Ophthalmologist for screening	Yes	484 (69.3)	14.9
	No	214 (30.7)	16.4

[a] Duration of diabetes as per Centers for Disease Control and Prevention, 2011.

Table 3: Visual acuity distribution and Grading of Diabetic Retinopathy (DR)

		Right eye (%)	Left eye (%)
Visual acuity[a]	6/6-6/18	501 (71.8)	496 (71.1)
	6/24-6/60	147 (21.1)	139 (19.9)
	5/60-3/60	25 (3.6)	28 (4)
	2/60-1/60	25 (3.6)	35 (5)
	<1/60-PL	0	0
	NPL	0	0
Grading of Diabetic Retinopathy[b]	No	596 (85.4)	601 (86.1)
	Mild NPDR	54 (7.7)	49 (7.0)
	Moderate NPDR	23 (3.3)	24 (3.4)
	Severe NPDR	15 (2.1)	16 (2.3)
	PDR	10 (1.4)	8 (1.1)
	DME	13 (1.9)	15 (2.1)

[a] Snellen's Visual Acuity graded as per WHO categories for visual impairement, 1977.

[b]Diabetic retinopathy graded according to the International Clinical DR Disease Severity Scale,2003.

PL- perception of light, NPL- no perception of light, NPDR- nonproliferative diabetic retinopathy, PDR- proliferative diabetic retinopathy, DME- diabetic macular edema

Discussion

Based on limited epidemiologic data, the 2015 International Diabetes Federation Diabetes Atlas estimated the diabetes national prevalence (20-79 years) of Nepal to be 3.3% i.e. around 526000 adults. Among the IDF regions, South East Asia ranked fifth with the age-adjusted (20-79 years) prevalence of diabetes as high as 8.8%. Also it is estimated that half of the diabetic in this population remain undetected (IDF,2015).

Prevalence of DR in our study was found to be 15.3% which was higher than 10.16%, reported by Thapa SS et al (2013) in the Bhaktapur Glaucoma Study. In other hospital based studies conducted in Kathmandu, DR prevalence ranged from 44% as reported by Shrestha MK et al (2008) to 78% as reported by Thapa R et al (2012).

In the present study, around 1/6th of the Nepalese patients with diabetes in this region were found to have DR, a prevalence that is similar to that reported in recent population-based prevalence studies from individual South Asian countries (Table 4). Prevalence of DR among urban Indians with diabetes was reported as 17.6% by Rema M et al (2005) in the Chennai Urban Rural Epidemiology Study (CURES). Raman R et al (2009) reported it as 18.0% in the Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study (SNDREAMS).

Table 4: Prevalence of Diabetic Retinopathy in South Asian countries

Country (Study by)	Year of publication	Study setting	Prevalence of DR (%)
Nepal (Thapa R et al)	2012	Hospital	78
Nepal (Shrestha S et al)	2007	Hospital	21
Nepal (Thapa SS et al)	2013	Population (regional)	10.2
India (Rema M et al)	2005	Population (regional)	17.6
India (Raman R et al)	2009	Population (regional)	18
Srilanka (Katulanda P et al)	2014	Population (national)	27.4
Pakistan (Mahar PS et al)	2010	Population (regional)	27.4
Pakistan (Hussain F et al)	2011	Population (regional)	12
Bangladesh (Akhter A et al)	2013	Population (regional)	21.6

In our study, prevalence of DR in Morang district was 14.2% and in Sunsari district it was 16.2%. In Dharan municipality of Sunsari district, Pokharel SM et al (2015) reported prevalence of DR to be 38.8%. Although higher prevalence values are reported in some hospital based studies, they are likely to be subjected to a significant selection bias. Differences in socioeconomic factors, including access to and the level of diabetes care are some of the possible explanations for the observed disparity in the prevalence rates (Yau JW et al, 2012).

United Kingdom Prospective Diabetes Study (1998) showed the prevalence of diabetic retinopathy to be 39% in male and 35% in female which was very high as compared to that in our study. More male than female were seen during our study period but there was no significant difference in prevalence of DR among them (p=0.087). This was similar to that reported by Shrestha et al (2008). On contrary, SNDREAMS (2009) reported that men were associated with increased risk of diabetic retinopathy (21.1%; versus 14.6% for women).

Highest prevalence of DR (60.7%) was seen among those having diabetes for duration of 16 to 20 years and duration of diabetes was found to be associated with significantly increased risk of DR (OR: 1.13; 95% CI, 1.09 to 1.17; p<0.001) in the present study population. Duration of diabetes has been suggested as major risk factor for DR by various authors in various studies (Shrestha MK, 2008; Raman R, 2009; Zheng Y,2012). This finding was recently confirmed in a metaanalysis by Yau et al (2012) and applies broadly across mild to vision-threatening stages of DR.

Hypertension is also considered as a risk factor for DR (UKPDS,1998; Yau JW, 2012). Similarly in our study, no history of hypertension was associated with decreased risk of DR (OR: 0.56; 95% CI, 0.36 to 0.87; p=0.01).

Although prevalence of DR was highest (21.2%) in the age group 60 to 69 years and lowest (0.0%) in the age group 20 to 29 years in this study population, age was not associated with an increased risk of DR (OR: 1.005; 95% CI, 0.98 to 1.02; p=0.61). In contrary to our finding, younger age was found to be an independent risk factor for any DR in Migrant Indians in an Urbanized Society in Asia: The Singapore Indian Eye Study (Zheng et al, 2012).

There is considerable variation in the consistency, pattern, and strength of risk factors for DR. Yau JW et al (2012) reported poor glycemic control and higher total cholesterol

levels to be associated with diabetic retinopathy. However, these parameters were not evaluated in this study.

The detection and treatment of sight threatening DR at an early stage is essential to ensure improved long term outcome. In our study only 1.4% patients had PDR, few patients gave history of laser treatment and none of them had a history of retinal surgery for DR. Patients with severe retinopathy may be attending tertiary eye care services and might not have attended screening camps.

There are some limitations to our study. The patients screened were not newly diagnosed cases referred for eye screening and only self reported cases were screened, thus selection bias could be there in estimating the prevalence of DR. Prevalence and risk factors for DR should be evaluated in a community-based nationally-representative sample and prospective follow up study should be conducted to establish causality for the identified risk factors.

Conclusion

One sixth of the patients with diabetes in the Eastern region of Nepal have retinopathy. Diabetic retinopathy risk increased with duration of diabetes and decreased with history of no co-existing arterial hypertension.

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