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Prevalence of Diabetes and Diabetic Retinopathy in Far-western Province of Nepal

Subash Bhatta, [1] Nayana Pant,[1] Suresh Raj Pant[1]

[1]Geta Eye Hospital, Kailali, Nepal

ABSTRACT

Background: Although diabetes is emerging as growing public health problem, there is limited population based data about the prevalence of the disease in Nepal.

Methods: This cross-sectional population-based survey, conducted in the Far-western province of Nepal from April 2020 to April 2021, used standardized RAAB + DR methodology. Diabetes was diagnosed on the basis of treatment history and random blood sugar test results of greater than 200 mg/dl. Diabetic retinopathy screening was done by ophthalmologists. All relevant data were imported into the RAAB software package (RAAB V.6) for analysis.

Results: Among 4615 study population, 2.8 % (n=129) had diabetes, and 35.7% (n=46) of the diabetics were newly identified cases. Of the known diabetics, 61.4% (n=51) never had an eye examination, and only 27.7% (n=23) of cases had their eye checked for DR in the last year. Fundus examination showed 13.2 % (n=17) of the diabetic patients to have some form of diabetic retinopathy and 6.2% (n=8) had diabetic maculopathy. Only 0.8% (n=1) of the cases were categorized as sight-threatening DR but a greater number of diabetes patients had severe visual impairment or blindness (3.9%) as compared to non-diabetic patients (1.8%).

Conclusions: Prevalence of diabetes and DR were relatively lower in Far-western Nepal. However poor coverage of screening examinations have left many of these cases undetected in the communities. Effective community-based diabetes and DR screening and referral programs can help to detect and treat diabetes and DR early on to prevent vision loss and other diabetic complications.

Keywords: Diabetes; diabetic retinopathy; maculopathy; rural Nepal, vision Impairment

INTRODUCTION

There is an increasing prevalence of diabetes in low and middle-income countries (LMIC) and the future estimates point to a grim reality. The number of people with DM in seven countries of the South East Asia (SEA) region is likely to increase from 87.6 million in 2019 to 115.1 million in 2030.[1, 2] Diabetic retinopathy (DR) is one of the major microvascular complications of diabetes mellitus (DM) and is also a leading cause of vision impairment and blindness, globally.[2,3]

There are no large population-based reports on the prevalence of diabetes and diabetic retinopathy from Nepal and most of the available literature are either city or hospital-based reports.[4-9] This is the first population based diabetes and DR survey in Far-western province of Nepal, which is one of the most underserved areas in the country.[10] The objective of the study was to understand the prevalence and correlates of diabetes and DR in the region. We believe that this study will provide important reference data for formulating DM and DR management strategies in the province.

METHODS

This cross-sectional population-based survey based on standardized Rapid Assessment of Avoidable Blindness (RAAB) [11] with Diabetic retinopathy (+DR) methodology was conducted in the Far western Province of Nepal from April 2020 to April 2021. The research was approved by Nepal Health Research Council (NHRC) and followed the tenets of the Declaration of Helsinki. Informed written consent was obtained from all participants. Exclusion criteria included people who had not been resident in the province for the past six months, and those who were unable or refused, for any reason, to provide meaningful consent to the study.

The sample size was calculated using the RAAB+DR V.6 software. The indicators used were the current population of 50 years and above (250,982 inhabitants), [10] the assumed prevalence of blindness among this group (2.8%) [12] with 20% tolerable error, 1.4 cluster design effect for a cluster of 35 people, 95% confidence intervals and

Correspondence: Subash Bhatta, Geta Eye Hospital, Godavari-5 Geta, Kailali, Nepal.
Email: subashbhatta@gmail.com, Phone: +977091575206.

10% non-response rate.[10, 12] The estimated sample size of 4615 was then divided into 132 clusters each consisting 35 people above 50 years of age.

A four days training was provided to the team members by International Centre for Eye Health (ICEH)/ London School of Hygiene and Tropical Medicine (LSHTM) certified RAAB trainer. One non-study cluster was piloted after the training to get the team members conversant with all survey procedures, including grading of diabetic retinopathy. A total of three teams led by ophthalmologists went to predefined clusters and examined the sample populations. All households in the randomly selected segment were visited door-to-door until person number 35 had been enrolled. A second segment was chosen at random in an adjacent cluster if there were fewer than 35 people of age 50+ in that segment. Visual acuity was recorded using tumbling-E optotypes (Precision Vision, Villa Park, Illinois) chart at six meters distance. People wearing glasses were tested with them and their visual acuity was considered as presenting visual acuity. Blindness (WHO criteria) was defined as presenting visual acuity (PVA) of less than 3/60 in the better eye, severe visual impairment (SVI) as PVA of less than 6/60 to 3/60, moderate visual impairment (MVI) as PVA of less than 6/18 to 6/60, and early visual impairment (EVI) as PVA less than 6/12 to 6/18.

Participants who were previously diagnosed with diabetes were classified as “known diabetes”. Participants with no previous history of diabetes were classified as “newly diagnosed diabetes” if they had a random blood glucose (RBG) level of ≥200 mg/dl when tested using a digital glucometer during the survey. Information regarding the previous history of diabetes, use of hypoglycemic medication, and diabetes eye check-up were elicited through a structured questionnaire. Anterior segment examination was done with diffuse torch light and portable slit lamp. Dilated fundus examination was carried out for diabetic patients using a Heine Beta 200 direct ophthalmoscope and Keeler Vantage binocular indirect ophthalmoscope with 20 diopter Volk lens. The Scottish DR grading system was used for grading diabetic retinopathy and maculopathy.[13] People requiring specialized examination and care were referred to appropriate health centers. Data were entered into the mobile RAAB app and then synced and imported into the RAAB software package (RAAB V.6) for analysis. We used descriptive statistics to present the percentages and 95% CI of each outcome variable studied in the survey.

RESULTS

Out of 4,615 sample population, 99.1% (n=4573) people responded to the study, and 2.8 % (n=129) were found to have diabetes. The prevalence of diabetes was 3.0 % (n=61) for males and 2.6% (n=68) for females (Table 1). About one third (35.7 %, n= 46) of the diabetics were newly identified cases. Out of the 129 total diabetic cases, 85.3% (n=110) allowed dilated fundus examination for grading of existing retinopathy or maculopathy.

Table 1. Acceptance of the random blood sugar test and DR examination among the study population.

		Males(n)	%	Females(n)	%	Total(n)	%
Full Sample	Examined	1995	99.4%	2548	98.8%	4573	99.1%
	Non responder	12	0.6%	30	1.2%	42	0.9%
	Total	2007	100%	2608	100%	4615	100%
Examined	RBG taken	1893	94.9%	2475	96.0%	4368	95.5%
	RBG refused	102	5.1%	103	4.0%	205	4.5 %
	Total	1995	100%	2578	100	4573	100
All diabetics	Known diabetics	41	67.2%	42	61.8%	83	64.3%
	Newly diagnosed diabetics	20	32.8%	26	38.2%	46	35.7%
	Total	61	100%	68	100%	129	100%
Known diabetics	Blood sugar <200	21	51.2%	22	52.4%	43	51.8%
	Blood sugar >= 200	20	48.8%	20	47.6%	40	48.2%
	Total	41	100%	42	100%	83	100%
All diabetics	DR examination done	55	90.2%	55	80.9%	110	85.3%
	DR examination refused	6	9.8%	13	19.1%	19	14.7%
	Total	61	100%	68	100%	129	100%
DR examination and maculopathy grading done	Retinopathy- graded	54	98.2%	51	92.7%	105	95.5%
	Retinopathy ungraded	1	1.8%	4	7.3%	5	4.5%
	Total	55	100%	55	100%	110	100%

Of the people with known diabetes, 16.9% (14) cases were not receiving any diabetes treatment. More males (n=5, 12.2%) were receiving insulin treatment compared to females (n=1, 2.4%). Coverage of DR screening was low among the known diabetics in the study group. We found that 61.4% (n=51) of the known diabetics never had an eye examination and only 27.7% (n=23) cases had their eye checked for DR in the last year (Table 2).

Table 2. Diabetes treatment and diabetic retinopathy screening history in people with known diabetes.

	Males		Females		Total	
	n	%	n	%	n	%
No treatment	7	17.1	7	16.6	14	16.9
Oral medication	29	70.7	34	81.0	63	75.9
Insulin (and/or oral medication)	5	12.2	1	2.4	6	7.2
Never had DR examination	28	68.3	23	54.8	51	61.4
Had DR examination within a year	10	24.4	13	31.0	23	27.7
DR examination 13-24 months ago	2	4.9	4	9.5	6	7.2
DR examination >24 months ago	1	2.4	2	4.8	3	3.6

Out of 129 diabetic cases, 13.2 % (n=17) had some form of diabetic retinopathy (Table 3). Most of the cases (n=12, 9.3%) had mild background retinopathy and none of the study population had proliferative diabetic retinopathy. 6.2% (n=8) of the examined diabetic patients had some form of diabetic maculopathy. Fundus examination and subsequent grading of retinopathy or maculopathy were not possible in 3.9% (n=5) of the cases. Only 0.8% (n=1) of the cases were categorized as sight-threatening DR (proliferative retinopathy and/ or referable maculopathy) in our study.

The majority of the cases with retinopathy/ maculopathy (n=9, 23.7%) were in the 70-79 years age group followed by 60-69 years age group (Table 4). More males (n=11, 18.0%) had some form of retinopathy or maculopathy as compared to females (n=6, 8.8%).

A greater number of diabetes patients had severe visual impairment or blindness (n=5, 3.9%) as compared to non-diabetic patients (n=77, 1.8%) (Table 5). A separate analysis showed that 66% (n=2) of diabetic patients with blindness had posterior segment causes (undetermined pathology) of decreased visual acuity compared to 26% (n=8) of non-diabetic patients.

Table 3. Prevalence of DR in diabetics and in entire sample.

Retinopathy and maculopathy grading	n	Among diabetics percentage (95% CI)	Full sample percentage (95% CI)
Retinopathy grade			
No retinopathy (R0)	88	68.2%(59.0-77.4)	1.9%(1.4-2.4)
Background DR-mild (R1)	12	9.3%(4.0-14.6)	0.3%(0.1-0.4)
Background DR-observable (R2)	4	3.1%(0.0-7.7)	0.1%(0.0-0.2)
Background DR- referable (R3)	1	0.8%(0.0-2.3)	0.0%(0.0-0.1)
Proliferative DR (R4)	0	0.0%(0.0-0.0)	0.0%(0.0-0.0)
Ungradable DR (R6)	5	3.9%(0.6-7.1)	0.1%(0.0-0.2)
Any retinopathy	17	13.2%(6.3-20.0)	0.4%(0.2-0.6)
Maculopathy grade			
No maculopathy (M0)	96	74.4%(65.5-83.3)	2.1%(1.6-2.6)
Maculopathy- observable (M1)	7	5.4%(0.3-10.5)	0.2%(0.0-2.3)
Maculopathy- referable (M2)	1	0.8%(0.0-2.3)	0.0%(0.0-0.1)
Ungradable maculopathy (M6)	5	3.9%(0.6-7.1)	0.1%(0.0-0.2)
Any maculopathy	8	6.2%(0.5-11.9)	0.2%(0.0-0.3)

Table 4. Prevalence of any retinopathy or maculopathy by age and gender in DM patients.

Age group	Males		Females		Total	
	n	Percentage (95% CI)	n	Percentage (95% CI)	n	Percentage (95% CI)
50-59	1	5.3% (0.0-15.4%)	1	3.8% (0.0-11.3)	2	4.4%(0.0-10.5)
60-69	3	14.3% (0.1-28.5%)	2	11.8%(0.0-27.3)	5	13.2%(2.6-23.7)

70-79	7	38.9% (14.1-63.6)	2	10.0%(0.0-22.6)	9	23.7% (8.2-39.2)
80+	0	0.0% (0.0-0.0)	1	20.0% (0.0-55.3)	1	12.5%(0.0-36.0)
All ages	11	18.0% (6.7-29.4%)	6	8.8% (2.4-15.2)	17	13.2% (6.3-20.0%)

Table 5. Prevalence of visual impairment and blindness among people with and without diabetes.

	Persons with diabetes		Persons without diabetes	
	n	Percentage (95% CI)	n	Percentage (95% CI)
Normal vision	106	82.2% (75.2-89.2)	3763	84.7% (83.0-86.3)
Early VI	9	7.0% (2.3-11.7)	327	7.4% (6.3-8.4)
Moderate VI	5	3.9% (0.6-7.1)	267	6.0% (5.1-6.9)
Severe VI	2	1.6% (0.0-3.6%)	47	1.1% (0.7-1.4)
Blindness	3	2.3% (0.0-4.9%)	30	0.7% (0.4-0.9)

DISCUSSION

This is the first population-based survey of diabetic retinopathy conducted in the Far western province of Nepal and also the first province level report on diabetic retinopathy based on RAAB+DR methodology from the whole country. The overall prevalence of diabetes (2.8%) in the population group of 50 years and above in our study was lower than the prevalence of diabetes (9%) among the elderly population (over 60 years) in another community-based study from Nepal.[7] This was probably due to the difference in cut-off age and the presence of a greater rural population in our sample compared to the study. This difference was also noted in a meta-analysis where the pooled prevalence rate of type 2 diabetes among Nepalese population was 8.4% (95% CI: 6.2-10.5%) and it was considerably lower for rural population (1.0%, 95% CI: 0.7-1.3%) compared to urban population (8.1%, 95% CI: 7.3-8.9%).[4] The rural population is physically more active compared to the people in cities as most of them are involved in farming and livestock.[10]

In addition to one third being newly diagnosed diabetics in our study, 16.9% of the known diabetics were also not using any treatment for the disease. A study from a referral center in Nepal also highlighted the poor status of diabetes control among diabetics as more than half of the diabetes patients included were not sure whether their diabetes was well-controlled. [14] Similarly, our study showed that 61.4% (n=51) of the known diabetics never had an eye examination and only 27.7% (n=23) cases had their eye checked for DR in the preceding year. Poor follow-up for DR screening is a well-known barrier in the effective management of diabetic retinopathy. Diabetes Association and the American Academy of Ophthalmology recommend dilated fundus examinations for all diabetic people at least once a year and more frequently as DR progresses.[15,16] However it is reported that only around 40% to 60% of Americans with diabetes receive annual dilated fundus examinations[17,18] and the rates are even lower in underserved and racial/ethnic minority populations.[19] This problem may be more profound in rural areas of developing countries as there is a big gap in knowledge about the disease and the required eye services are not easily accessible to the community as shown by a study from Nepal reporting on knowledge and practice of rural population about diabetic retinopathy. [20]

Of the total diabetic cases, 13.2 % (n=17) had some form of diabetic retinopathy and 6.2% (n=8) had diabetic maculopathy. Community-based studies done over the last fifteen years in the country have reported the prevalence of diabetic retinopathy to range from 10.6 to 23.8 %. [7, 20- 22] The rates of diabetic retinopathy and maculopathy seen in our study are comparable to a study from hilly areas of Nepal where 12.6% of cases had some evidence of diabetic retinopathy and clinically significant macular edema was found in 1.1% of cases.[20] However higher prevalence of DR (23.8%) is reported among urban population in Nepal.[7] Prevalence of diabetic retinopathy noted in our study is also comparable to some other studies from developing countries[23,24] but RAAB based surveys done in Papua New Guinea and Costa Rica reported much higher rates (46.4% and 23.5% respectively) of DR and/or maculopathy among the diabetic population of 50 years and above.[25,26] The likely causes of differences in prevalence rates of DR between different studies may be due to differences in study methodologies and sample populations including genetic, lifestyle and environmental factors. In our study, more males (18.0%) had some form of retinopathy or maculopathy as compared to females (8.8%) as also seen in a few other studies. [7, 23, 27] This could be linked to lifestyle differences such as alcohol intake and cigarette smoking, more prevalent among the male population.

The prevalence of sight-threatening DR in our study (0.8%) was significantly lower as compared to that reported among the urban population in Nepal (9.5%) and pooled global prevalence (10.2%) [7,28] A study from rural India however reported a lower prevalence of proliferative retinopathy (1.3%) as observed in our study.[29] Even though there were not a significant number of sight-threatening cases among the graded diabetic patients, a greater number of diabetes patients had severe visual impairment or blindness (3.9%) as compared to non-diabetic patients (1.8%). Diabetic retinopathy could not be graded in five cases and two cases were blind and were attributed to posterior segment diseases. Some of the ungraded cases in our study where vitreoretinal status couldn't be evaluated could also be cases of advanced diabetic retinopathy.

The strength of our study is in its robust methodology and implementation of the home-to-home screening program. Hence the prevalence rates of diabetes and DR reported in our study are more likely to represent the true prevalence of the disease in the population of the far western province of Nepal. The limitation of the study lies in the lack of slit-lamp examination and other investigative modalities that could have helped in better detection of some early PDR cases and maculopathy. As this study was part of the RAAB survey among patients above 50 years of age, we couldn't report the status of diabetes and DR in the younger population. Of note, the survey was interrupted for about 6 months due to the Covid pandemic and was completed with precautions, later on.

CONCLUSIONS

Our findings from the first diabetes and DR survey in far western province of Nepal indicate towards a lower prevalence of diabetes and DR in rural Nepal compared to urban settings. However, poor coverage of diabetes and DR screening examinations point to the increased risks of diabetes-related systemic and ophthalmic complications in future. DR screening programs with effective referral systems can play an important role in prevention and management of vision threatening DR complications in such underserved communities.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

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