The Prevalence of Diabetic Retinopathy Among Known Diabetic Population in Nepal

Mishra SK, Pant BP, Subedi P

Nepal Netra Jyoti Sangh

Tripureshwor, Kathmandu, Nepal.

Corresponding Author

Pooja Subedi

Nepal Netra Jyoti Sangh

Tripureshwor, Kathmandu, Nepal.

E-mail: subedipooja108@gmail.com

Citation

Mishra SK, Pant BP, Subedi P. The Prevalence of Diabetic Retinopathy among Known Diabetic Population in Nepal. *Kathmandu Univ Med J* 2016;54(2):134-9.

ABSTRACT

Background

The worldwide prevalence of diabetic retinopathy (DR) was found to be 34.6%. WHO estimates that DR is responsible for 4.8% of the 37 million cases of blindness throughout the world. In a study undertaken in urban population in Nepal, M.D. Bhattarai found the prevalence of diabetes among people aged 20 years and above to be 14.6% and the prevalence among people aged 40 years and above to be 19%. Studies on DR, to our knowledge, have mostly been hospital based in Nepal. Little information is available about prevalence of DR at the community level in Nepal.

Objective

To investigate the prevalence of diabetic retinopathy and associated risk factors among known diabetic population of Nepal.

Method

A descriptive cross sectional study was conducted among individuals aged 30 and more using cluster sampling method. The study sites were Kathmandu metropolitan city and Birgunj sub-metropolitan city. A sample size of 5400 was calculated assuming 5% prevalence rate with 95% confidence level, 5% worst acceptable level and 1.5 cluster sampling design effect. Study participants were interviewed, anthropometric measurements and fundus photograph was taken from participants with diabetes. Fundus photographs were used to grade retinopathy.

Result

Around 12% of the respondents were diabetic, mean age 55.43±11.86 years, of which slightly more than half were females (50.2%). Among these diabetic respondents 9.9% had some forms of diabetic retinopathy, mean age 54.08±10.34 years, 56.7% were male. When severe grade of retinopathy in any eye was considered as overall grade of retinopathy for the individual, prevalence of Non-proliferative Diabetic Retinopathy, Proliferative Diabetic Retinopathy and complete vision loss was found to be 9.1%, 0.5% and 0.3%. Prevalence of Diabetic Macular Edema was 5.5%. Duration of diabetes, family history of diabetes and blood pressure at the day of survey was found to be associated with having any retinopathy.

Conclusion

Diabetic retinopathy is emerging as a public health threat in Nepal. With increasing diabetes, DR can be expected to increase more. Existing eye care services may require upgrading to provide quality and affordable retinopathy services to address this emerging problem.

KEY WORDS

Diabetes, prevalence, retinopathy, risk

INTRODUCTION

Globally, 347 million people have diabetes and more than 80% of diabetes deaths occur in low and middle income countries.[1] Around 366 million people are estimated to have diabetes mellitus (DM) by 2030 and the increase in adult diabetes is estimated to be far more (69%) in developing countries than in developed countries (20%).[1,2] Increase in prevalence of diabetes leads to increased prevalence of diabetic retinopathy (DR).[3] The worldwide prevalence of DR was found to be 34.6%.[3] WHO estimates that DR is responsible for 4.8% of the 37 million cases of blindness throughout the world.[1] Increasing trend in diabetes coupled with improved diabetic management leading to reduced diabetic deaths from macrovascular complication, has led to increasing number of people presenting and living with DR making it the leading cause of blindness globally.[3,4]

In a study undertaken in urban population in Nepal, M.D. Bhattarai found the prevalence of diabetes among people aged 20 years and above to be 14.6% and the prevalence among people aged 40 years and above to be 19%.[5] Studies on DR, to our knowledge, have mostly been hospital based in Nepal. These studies have estimated the prevalence of diabetic retinopathy from as minimum of 19% to as high as 78% in their study population.[6-11] Little information is available about prevalence of DR at the community level in Nepal. Thus, this study was undertaken to assess the status of diabetic retinopathy in the community level in Nepal. The objective of this study was to estimate the prevalence of DR and assess associated risk factors of DR in Nepal.

METHODS

A cross sectional descriptive study was conducted. The study was undertaken among individuals aged 30 or more at the time of research. A proportionate cluster sampling design was used. Kathmandu metropolitan city and Birgunj sub-metropolitan city were selected as the study site as the prevalence of diabetes has been found highest in urban areas of Nepal. Household visits were made in the randomly selected clusters to identify the study population and collect necessary data from July to December 2014. Diabetic respondents were further interviewed on their health beliefs and practices related to diabetes and DR. Anthropometric measurements and retinal image were also obtained from these participants.

Assuming the prevalence of diabetes among population aged 30 or more to be 5%, a sample size of 2750 (2724 rounded up to 2750) was calculated for Kathmandu city and 2650 was calculated for Birgunj (a total of 5400 in two cities). A confidence level of 95%, worst acceptable error of 5%, and cluster sampling design effect of 1.5 was used for sample calculation.

The ethical review committee of Nepal Netra Jyoti Sangh (NNJS) approved the research. An informed written consent was administered to each participant; only those who agreed to participate were included in the study.

The participants, with whom the communication could be established, were informed about the status of retinopathy in their eyes. Those participants who were diagnosed with vision threatening eye problem like cataract or who were diagnosed to have a grade of retinopathy that required treatment were informed about their eye health problem and available treatment options. Those who agreed to be treated were referred to a contracted eye hospital and treated for free.

'WHO STEPS Protocol' and 'Anthropometric measurement guide by USAID' were used as reference tool to guide anthropometric measurements. For weight, three subsequent measurements were taken in a digital weighing machine and the repeating measurement was noted as the weight of the respondent. Wall mountable stadiometer, measuring tape, and mercury sphygmomanometer were used to measure height, waist/hip circumference, and blood pressure respectively. Recommendations, of BMI cut-off points in Asian population, by WHO was used to define obesity.[12] Individuals with BMI below 18.5 were classified as underweight, from 18.5 to 22.9 were classified as healthy, from 23 to 26.9 were classified as overweight, and above 27 were classified as obese. For analysis, men with >0.90 waist to hip ratio and women with >0.85 waist to hip ratio were classified as being in increased risk. The waist circumference of 90 cm in men and 80 cm in women was used as the cut-off point.

Fundus photos were taken with a smartscope developed by the company OPTOMED. It was a hand held non-mydriatic fundus camera with a 40º field of view.

The statistical software Epi Info 7 was used for data analysis. The diabetic participants who refused for fundus photography (n=15) and whose fundus photos were of poor quality such that grading could not be done (n=37), were excluded from analysis other than descriptive analysis.

RESULTS

A total of 5400 individuals, aged 30 or more, participated in the study. Fifty two percentage of the participants were male. The eldest respondent was 98 years. The mean age of the respondents was 47.1±13.3 years. Majority of the respondents were form the age group 30 to 40 years (34%) followed by 40 to 50 years (26.8%). Around 19% of the individuals were 50 to 60 years of age, around 12% were aged 60 to 70 years, around 6% were aged 70 to 80 years and only 2% were of more than 80 years of age. Around 25% of the respondents were illiterate. Twenty-four percentage of the respondents had primary schooling. Around 26% and 11% of the respondents had secondary and higher secondary level of education respectively. Only 12% of the respondents had formal education above higher secondary

level. Majority of the respondents were in some kind of business (34.4%) closely followed by homemakers (32.8%). Rests of them were involved in service (20.3%), agriculture (4.2%), labor (6.2%), and other occupation (2.1%).

Around 12% of the respondents were diabetic, mean age 55.43±11.86 years, of which slightly more than half were females (50.2%). Majority of the diabetic respondents were aged 50-60 years. Most of them were illiterate (30.94%) (Table 1).

Table 1. Background characteristics and diabetic status

Background characteristics		Diabetes	
		Yes	No
Age of the respondent (n=5394)	30-40	56	1778
	40-50	132	1316
	50-60	227	819
	60-70	150	474
	70-80	76	256
	>80	17	93
Sex (n=5400)	Female	330	2255
	Male	328	2487
Occupation (n=4541)	Agriculture	27	165
	Business	152	1409
	Homemaker	180	1310
	Labor	16	264
	Others	16	79
	Service	88	834
Educational status (n=5375)	Illiterate	203	1185
	Primary	184	1109
	Secondary	154	1262
	Higher Secondary	54	575
	Above	61	587

The average age at which the respondents were diagnosed as diabetic was 48±11.4 years ranging from 16 to 86 years. The mean duration of diabetes was 7.34±6.51 years. Majority (68%) of these respondents had been diabetic for less than 10 years. Around 47% of the respondents with diabetes reported to be hypertensive. Forty three percentage of the diabetic respondents had a family history of diabetes (Table 2).

Around 21% of the diabetic respondents had never had their eye examined. Ninety-three percent of diabetic respondents believed that they had an easy access to blood sugar test services and 14% owned a glucometer. However, only 26.1% of the respondents had their blood sugar tested within a month and other 26% had their blood sugar tested in 3 months. Around 1% of the diabetic respondents had never met a physician after being diagnosed as diabetic. Among those who had met a physician at least once, only 63% had been informed about risk of diabetic retinopathy by their physician (Table 2).

Table 2. Distribution of risk factors among diabetic respondents

Background characteristics		Diabetic respondents (%)
Age at diagnosis of diabetes	<30	3.0
	30-40	20.2
	40-50	33.6
	50-60	27.1
	60-70	12.5
	70-80	2.9
	>80	0.8
Duration of diabetes	0-5 years	43
	5-10 years	25
	>10 years	32
Hypertension	Yes	46.5
	No	53.5
Family history of diabetes	Yes	57
	No	43
Birth weight of children born from a diabetic women above 4 k.g.	Yes	16.4
	No	42.27
	Don't know	41.32
Eye examination	Before past 12 months	36.6
	Within past 12 months	42.3
	Never	21.1
Routine for blood sugar test	Within a month	26.1
	In 3 months	26.1
	Irregular	47.9
Easy access to blood test services	Yes	93
	No	7
Last appointment with a physician	Within 6 months	80.7
	Within 6 to 12 months	12.3
	Within 1 to 2 years	2.9
	Before 2 years	4.1
Informed about ones physician about diabetic retinopathy	Yes	63.3
	No	36.7
Physical exercise	Yes	78
	No	22
Diet control	Yes	89
	No	11
Tobacco consumption	Yes	32
	No	68
Alcohol consumption	Yes	21
	No	79

While 82% of diabetic respondents were aware that eyes of diabetic individual could be affected as a complication of diabetes, only around 75% knew that these complications could lead to blindness (Table 3).

This survey found that 9.9% of the diabetic respondents had some forms of retinopathy, mean age 54.08±10.34 years, 56.7% were male. Most of them were from the age group 50-60 years. Majority (38.3%) of those with some

grade of retinopathy had primary schooling. Around 18% of them were illiterate. Majority of those with some grades of retinopathy were businessperson (40%) followed by homemakers (30%). (Table 4)

When severe grade of retinopathy in any eye was considered as the overall grade of retinopathy, the prevalence of non-

Table 3. Knowledge and attitude of the respondents

Attitude	Responses		
	Agree (%)	Don't Know (%)	Disagree (%)
Diabetes may affect the eyes of the diabetic person	81.61	16.41	1.98
Complications due to diabetes may lead to blindness	74.62	22.34	3.04
Control of blood sugar helps reduce risk of complications resulting from diabetes	93	6.39	0.61
Complications of diabetes may manifest at any age	81.40	15.70	2.90
People with diabetes should have their eye checked regularly	81.28	17.20	1.52
Appropriate diet control reduces the risk of complications resulting from diabetes	96.05	2.89	1.06
Regular physical exercise reduces the risk of complications resulting from diabetes	94.98	3.80	1.22
Diabetes can be controlled by use of medicines only	1.67	3.95	94.38

Table 4. Background characteristics and diagnosis of retinopathy

Background characteristics		Diagnosis of retinopathy		P-value
		Yes	No	
Age (n=606)	30-40	6	50	0.46
	40-50	13	113	
	50-60	27	186	
	60-70	8	124	
	70-80	5	63	
	>80	1	10	
Sex (n=606)	Female	26	278	0.26
	Male	34	268	
Educational Status (n=604)	Illiterate	11	169	0.17
	Primary	23	150	
	Secondary	16	127	
	Higher Secondary	3	46	
	Above	7	52	
Occupation (n= 451)	Agriculture	3	23	0.18
	Business	20	122	
	Service	8	73	
	Homemaker	15	155	
	Labor	0	16	
	Others	4	12	

Table 5. Diagnosis of retinopathy by risk factors

Background characteristics		Diagnosis of retinopathy		P-value	Odds ratio (CI of 95%)
		Yes	No		
Duration of diabetes	Less than a year	2	36	0.1522	
	1-5 years	17	210		
	5-10 years	14	141		
	10-15 years	13	86		
	15-20 years	6	39		
	20-25 years	5	16		
	>25 years	3	17		
Hypertension	Yes	26	252	0.677	0.8922(0.5211-1.5273)
	No	34	294		
Duration of hypertension	Less than a year	0	4	0.4858	
	1-5 years	14	77		
	5-10 years	5	60		
	10-15 years	5	54		
	15-20 years	2	21		
	20-25 years	0	14		
	>25 years	1	10		
Family history of diabetes	Yes	33	226	0.043	1.7306(1.0122-2.9589)
	No	27	320		
Sleep apnea	Yes	25	273	0.22	0.7143(0.4163-1.2257)
	No	35	273		
Diet control	Yes	53	483	0.976	0.9876(0.43.3-2.2666)
	No	7	63		
Physical exercise	Yes	45	427	0.57	0.8361(0.4504-1.5521)
	No	15	119		
Weight loss after diagnosis of diabetes	Yes	36	367	0.161	0.646(0.3496-1.1946)
	No	17	112		
Tobacco consumption	Yes	20	172	0.779	1.084(0.6154-1.9104)
	No	40	373		
Cigarette consumption	Yes	6	49	0.79	1.127(0.4614-2.7527)
	No	54	497		
Alcohol consumption	Yes	18	109	0.0698	1.7182(0.9518-3.1018)
	No	42	437		
Birth weight	Yes	5	43	0.3617	1.7151(0.532-5.5297)
	No	8	118		
Blood pressure	Desired-SBP from 90 to 119 and DBP from 60 to 79	6	111	0.0023	
	Hypertensive emergency-SBP 180 and above and DBP 110 and above	0	1		
	Prehypertension- SBP from 120 to 139 and DBP from 80 to 89	21	271		

Blood pressure	Stage 1 hypertension- SBP from 140 to 159 and DBP from 90-99	25	126		
	Stage 2 hypertension- SBP from 160 to 179 and DBP from 100-109	8	35		
BMI	Underweight	1	14	0.762	
	Normal	24	182		
	Overweight	24	245		
	Obese	11	101		
Waist to hip ratio	Increased risk	59	520	0.311	
	Low risk	1	24		
Waist Circumference	Increased risk	43	397	0.828	
	Low risk	17	147		

proliferative diabetic retinopathy (NPDR), proliferative diabetic retinopathy (PDR), and complete vision loss was found to be 9.1%, 0.5% and 0.3% respectively. The prevalence of diabetic macular edema (DME) was found to be 5.5%.

Duration of diabetes was found to be significantly associated with having any retinopathy (p-value 0.03). Family history of diabetes was also found to be associated with having DR (OR 1.73, 95% CI 1.01-2.96). Additionally, people with higher blood pressure level were more likely to have any forms of retinopathy (p-value 0.002). No significant difference was found between the respondents with and without retinopathy with respect to age, sex, educational status, occupation, reported hypertension, diet control, physical exercise, weight loss after diagnosis of diabetes, tobacco consumption, and alcohol consumption. Not any anthropometric indicators used in the survey like body mass index (BMI) (p-value 0.76), waist to hip ratio (p-value 0.31) and waist circumference (p-value 0.82) were found to be associated with having any DR (Table 5).

DISCUSSION

This study found the overall prevalence of DR to be 10% and of NPDR, PDR and DME to be 9.1%, 0.5% and 5.5% respectively. Other studies conducted in Nepal, mainly hospital based, have found the prevalence of DR to be 19% to as high as 78%.[6-11] In a study undertaken by Thapa et al. the prevalence of diabetic retinopathy was found to be around 78% among patients attending vitreo-retinal services of a tertiary hospital; the prevalence must have been high because it is more probable that people experiencing some kind of problem in the eye visited the vitreo-retinal services.[11]

On a study titled "Global Prevalence and major risk factors of Diabetic Retinopathy", by Yau et al. the worldwide prevalence of DR was found to be 34.6% and the prevalence of PDR and DME was found to be 6.96% and 6.81% respectively.[13] The prevalence of DR and DME in adults is estimated to be 29% and 3% respectively in the USA.[4] Studies show much higher prevalence of DR in China. The prevalence of DR was found to be 43% and 37% in rural and urban China respectively.[4] These statistics indicate that DR is increasing in Asian world in an alarming rate.

Duration of diagnosis of diabetes was significantly associated with diagnosis of any retinopathy. A number of other studies have also linked duration of diabetes with retinopathy.[10,14-16] However, none of the other risk factors like age of the participant, smoking and alcohol consumption was found to be associated with DR. Similar to the results of this study, another study by Thapa et al. found no significant association between DR and age of the respondents or smoking behaviour.[10]

Du et al. in their study undertaken in Shandong Peninsula, China, found that the majority of their study population with DR were females ($p < 0.0001$).[14] In our study, however, the prevalence of DR was found to be higher in males than in females but the difference was statistically insignificant. The factors like diet control and physical exercise were not found to be associated with diabetic retinopathy in this study. It might have been because people were found to report mere withdrawal of potato or rice from the meal or some meters of walk as diet control and physical exercise practice. Studies using standard dietary and physical activity reporting tool should be undertaken to enhance the understanding of diet and physical exercise in development of DR.

A number of studies have shown that associated hypertension in diabetic patients increases the risk of micro and macro vascular complications.[15,16] This study also found a significant association between blood pressure at the day of the survey and any retinopathy in the eye (p-value 0.0023). Concurrent with this result, a study on 'Prevalence, risk factors and awareness of diabetic retinopathy among admitted diabetics patients at a tertiary level hospital in Kathmandu' by Thapa et al. also found significant association between being hypertensive and presence of DR.[10] However, in our study, the participant reported hypertensive status was not found to be associated with diabetic retinopathy. This may suggest that people are less aware about their hypertensive status.

In this study, none of the anthropometric indicators (BMI, waist to hip ratio, waist circumference) were found to be associated with any DR. However, anthropometry and obesity have been linked strongly with diabetic retinopathy in other studies. A study on "Are obesity and anthropometry risk factors for Diabetic Retinopathy?: The Diabetes Management Project" by Dirani et al. found strong association of BMI and waist circumference with DR. The study showed that obese participants were more than 3 times likely to have any retinopathy.[17]

The limitation of this study is that the fundus photos were taken with a non-mydriatic fundus camera and the retinal images may not have been as precise and clear as that could have been obtained from a mydriatic fundus camera. A non mydriatic camera was used because of its portability.

CONCLUSION

Findings of this research signify that DR is growing as a threat to public health in Nepal. Around 10% of the diabetic people were found to have any retinopathy. Diabetes itself is in an increasing trend in the world and with increasing diabetes, the DR is also expected to increase. The current level of eye care services directed towards addressing DR may fall short to address this emerging problem. All the stakeholders need to orient their action towards enhancing eye care services to be able to provide quality services that are accessible and affordable to diabetic people.

People were found to be less aware about the micro vascular complication of diabetes, were less regular to meet a physician for diabetes control, were less likely to be informed about need of regular eye checkup, and were found less likely to consult an eye specialist regularly. This leads to poor diabetes and diabetic retinopathy management. Awareness needs to be created among the people about the possible complications of diabetes. A behavior changing communication is required to urge people to maintain a stable acceptable blood sugar level and to monitor the micro or macro vascular changes regularly. The goal should be of early identification and treatment. It would be fruitful to establish coordination between general medical service providers and the eye care service providers to develop a coordinated service system for diabetes and diabetic retinopathy care.

ACKNOWLEDGEMENT

Ministry of Health and Population, Nepal Government for financial support, Mr. Y.D. Sapkota for realizing the need of the research, Research Steering Committee of NNJS, Dr. Raghunandan Byanju; Retina Specialist for grading the fundus photographs, Mr. Basanta Dhakal; Statistical Consultant, Enumerators: Mr. Aavash Khanal, Mr. Nabin Bhatta, Ms. Stuti Pokhrel, Mrs. Samjhana Dahal, Mrs. Neeta Dahal and Mr. Saroj Raut and Fundus Photographer Sudeep Koirala Chettri, R.M. Kedia Eye Hospital, Bharatpur Eye Hospital and Nepal Eye Hospital and all NNJS board members and staffs.

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