Prevalence of diabetic retinopathy following a community screening for diabetes

G Paudyal,[1] MK Shrestha,[1] JJ Meyer,[2] R Thapa,[1] R Gurung[1] and S Ruit[1]

[1]Tilganga Eye Centre, Kathmandu, Nepal and [2]University of Utah School of Medicine, Salt Lake City, UT, USA

Corresponding author: Mohan Krishna Shrestha, MPH, Post Box 561, Tilganga Eye Centre, Kathmandu, Nepal, e-mail-research@tilganga.com.np

ABSTRACT

Diabetic retinopathy is a public health challenge in developing countries including Nepal and is not like other preventable or treatable causes of blindness. The aim of study was to estimate the prevalence of diabetic retinopathy following a community screening for diabetes. A community-based, cross sectional study was designed to screen for diabetes in people age ≥ 40 years in a semi-urban community of Kathmandu, Nepal. In those individuals with detected diabetes, a comprehensive eye examination was performed by an ophthalmologist and diabetic retinopathy was graded using a standard protocol. 1,475 persons were screened for diabetes with a mean age of 54.7 ± 12 years with sex ratio of 0.69 male per female. Thirty-four subjects were found to have impaired fasting glucose and sixty subjects had diabetes. The prevalence of diabetes mellitus was 4.1% (60) but 6.4% (94) had an abnormal blood sugar level. Fifty-seven diabetic patients visited at-Tilganga Eye Centre for ocular examination. Among examined patients, the prevalence of diabetic retinopathy was 19.3% (11). Only one person had clinically significant macular edema requiring laser therapy. The prevalence of hypertension and cataracts were the same among patients with and without diabetic retinopathy. The prevalence of diabetic retinopathy was low but one of sixteen newly diagnosed diabetics did have evidence of diabetic retinopathy. Eighty-four percent of known diabetics had never had their eyes examined for ocular complications. Community awareness and physician coordination should be emphasized to increase the eye examination rate.

Keywords: diabetic retinopathy, prevalence, screening, Nepal.

INTRODUCTION

Diabetic retinopathy (DR) is a potentially blinding and visually disabling complication of diabetes that eventually develops in nearly all patients with type 1 diabetes and a high proportion of patients with type 2 diabetes.[1,2] The prevalence of DR is dependent on the prevalence of diabetes, which is expected to continue to rapidly increase in Asia in the coming decades.[3] In Nepal, an epidemic of diabetes in urban areas has been described[4] with nearly one third of people over 40 years of age showing impaired fasting glycaemia or diabetes.[5] Compounding this situation is the fact that many patients may not be aware or low awareness of their diabetic status or the complications of diabetes.[6,7]

Blindness and visual impairment due to DR is preventable,[8] but requires adequate screening for both diabetes and DR to identify and treat those patients at risk. We recently screened diabetic patients at our institution and found a high prevalence of DR at 44.7%.[9] However, this number represents only DR in known diabetics and does not take into account DR in undiagnosed diabetic patients. The following study was conducted to examine the prevalence of diabetic retinopathy among the general population over age forty who attended diabetes screenings in two semi-urban Village Development Committees (VDC's) of Nepal.

MATERIALS AND METHODS

SUBJECTS AND SETTING:- A community-based, cross-sectional study was designed to screen for diabetes in all patients age forty and older in the Mulpani and Gothatar VDC's in Kathmandu, Nepal. Study subjects were recruited using posters, pamphlets, and phone calls to residents to inform them of a free community-based diabetes screening. Patients who met the plasma glucose criteria for diabetes or impaired fasting glucose and patients previously diagnosed with diabetes were referred to the Tilganga Eye Centre for a comprehensive eye exam.

This study was performed according to the guidelines of the declaration of Helsinki. Verbal consent was taken at the time of enrolling the patients after explaining the risks, benefits, and alternatives to study participation. Appropriate treatment was offered to all patients with detected eye disease.

BLOOD GLUCOSE TESTING:- Patients were instructed to fast for at least 8 hours prior to blood glucose testing. Venous samples were collected in

Table-1: Distribution of general characteristics

Characteristics		Frequency	%
Age of patients (Years) (n= 1475)	40-49	575	38.98
	50-59	410	27.80
	60-69	271	18.37
	70+	219	14.85
Sex (n=1475)	Male	603	40.88
	Female	872	59.12
Ethnicity (n= 1475)	*Brahman*	816	55.32
	Chhetri	431	29.22
	Newar	106	7.19
	Rai/Gurung/Limbu	54	3.66
	Tamang/Sherpa	41	2.78
	Others	27	1.83

sodium fluoride tubes and plasma glucose was estimated by the glucose oxidase method using the same personnel, methodology and equipment. We defined impaired fasting glucose as fasting plasma glucose of 110 to 125 mg/dl. Diabetes was defined as a fasting plasma glucose of ≥126 mg/dl or random plasma glucose ≥200 mg/dl.[10,11] Patients with impaired fasting glucose or diabetes had their blood sugar levels retested upon presentation to the eye centre to verify the presence of their blood sugar abnormality.

EXAMINATION METHODS:- A general health questionnaire was completed and blood pressure was measured after ten minutes at rest in the seated position. Hypertension was defined as ≥140/100. A complete ophthalmic history was obtained using a questionnaire and verbal interview.

A comprehensive eye examination was performed and included assessment of visual acuity and detailed examination of the anterior segment and fundus. The visual acuity (VA) of each eye was tested separately using a Snellen distance vision chart at 6 meters. The anterior segment was evaluated by slit lamp and a retinal examination was carried out with a +90 diopter lens and indirect ophthalmoscope after pupil dilation with tropicamide 0.5% and phenylephrine 5.0%. All patients received examination of the fundus by a retinal specialist and color fundus photography.[11] Diabetic retinopathy was classified as no retinopathy, mild non-proliferative diabetic retinopathy (NPDR), moderate NPDR, severe NPDR, very severe NPDR, early proliferative diabetic retinopathy (PDR), high risk PDR, advanced PDR, and presence or absence of clinically significant macular edema (CSME).

DATA ANALYSIS:- Collected data were edited, classified, and coded on the same day to ensure accuracy of the data. The data were entered into two databases to minimize errors. Statistical analysis was performed using the Statistical Package for Social Science version 11.5 software. Non-parametric comparisons were by the Fisher Exact test and parametric comparisons by the Student *t*-test. Significance was set as $P < 0.05$.

Table-2: Characteristic of diabetic patients presenting for an eye exam following referral from a community diabetes screening

Number of diabetic patients	57
Newly diagnosed diabetes at screening	16 (28.07%)
Known diabetic patients	41 (71.93%)
Mean Age ± SD	58.25 ± 12.90 years
Mean duration of diabetes among previously diagnosed patients (n=41) ± SD	6.87 ± 5.90 years
Number by type of treatment	None - 16, Diet - 7, Oral Medication - 14, Diet+Oral-18, Oral+insulin-1, Insulin-1

SD- Standard Deviation

RESULTS

A total of 5,270 individuals age ≥40 were identified as residing in the Mulpani and Gothatar VDC's at the time of the 2007-voting census. At 14 screenings within these VDC's, a total of 1,475 patients age ≥40 were screened for diabetes with a mean age of 54.7 ± 12 years with sex ratio of 0.69 male per female (Table-1).

Thirty-four patients were found to have impaired fasting glucose and sixty patients (16 cases diagnosed during our screening and 44 known diabetics) had diabetes based on blood glucose levels at the time of screening.

A total of 57 diabetic patients (out of 60) from the screening presented to the Tilganga Eye Centre for a comprehensive eye exam and are generally described in Table-2. All patients had type II (non-insulin dependent) diabetes mellitus and this was the first ever eye exam for 34 of the patients.

Table-3: Age and sex distribution of diabetic patients

Age group (Yrs)	Sex		Total
	Female	Male	
40-49	5(8.77%)	12(21.05%)	17(29.8%)
50-59	8(14.04%)	8(14.04%)	16(28.1%)
60-69	4(7.02%)	11(19.30%)	15(26.3%)
70-79	1(1.75%)	2(3.51%)	3(5.3%)
80+	3(5.26%)	3(5.26%)	6(10.5%)
Total	21(36.84%)	36(63.16%)	57(100.0%)

The prevalence of DM among the persons who had their blood tested was 4.1% (60). All together, 6.4% (94) of those screened had an abnormal blood sugar level.

The prevalence rate of diabetes according to age group is seen in Table-3. More than two–thirds of cases had an age of onset within the 40-69 age range after which the rate decreased with age. The prevalence of diabetes in males was significantly higher than in females. No significant differences were found when looking at the prevalence of diabetes according to ethnicity.

Retinal examination:- 85.4% (35) of the known diabetic patients (had never had their eyes checked for the effect of diabetes.

One-third of the diabetes patients had hypertension ranging in duration from one month to twenty-five years since diagnosis.

Duration of diabetes:- The duration of diabetes ranged from newly diagnosed to 24 years with a mean of 6.87 ± 5.91 years. More than two-thirds of patients were between 40 and 59 years old at the onset of diabetes (Table-4).

Diabetic retinopathy:- Of the 57 patients, the prevalence of diabetic retinopathy was 19.3% (11). Among eleven DR patients, all had evidence of mild NPDR in one or both eyes and no evidence of DR was seen in the remaining 87 eyes examined. No cases of PDR were identified. Only one person had CSME requiring laser therapy.

The prevalence of hypertension was not different among patients with evidence of diabetic retinopathy (37.0%) compared to patients without diabetic retinopathy (36.4%) (p=1.00). The prevalence of cataracts was also the same (62.5%) in those patients with and without DR.

About 72.0% (82) of the eyes of diabetic patients had an uncorrected visual acuity of 6/18 or better where as 92.1% (105) of eyes had similar best corrected distance visual acuity (Table-5).

Table-4: Age at onset of diabetes

Age group (Yrs)	n	%
<40	6	10.5
40-49	19	33.3
50-59	19	33.3
60-69	5	8.8
70-79	5	8.8
80+	3	5.3
Total	57	100.0

Table-5: Distribution of visual acuity of diabetes patients

Visual acuity	Uncorrected		Corrected	
	n	%	n	%
6/6-6/18	82	71.93	105	92.1
<6/18-6/60	25	21.93	5	4.4
<6/60-3/60	5	4.39	2	1.7
<3/60-PLPR	2	1.75	2	1.8
Total	114	100.00	114	100.0

DISCUSSION

The results of this community-based screening showed a low rate (<4.0%) of DR among the general population in two semi-urban VDC's of Nepal. The rate of diabetes and impaired glucose tolerance was also lower than previously reported rates in urban and semi urban populations of Nepal.[5,12] The rates in this study population were closer to those found in rural populations of Nepal, suggesting that diet and lifestyle may account for these differences.

Despite a low rate of diabetes among the studied population, one of sixteen (6.2%) patients with newly diagnosed diabetes did have evidence of DR. This number is too small to draw any definite conclusions, but suggests that for patients with diabetes in Nepal, there may be significant periods of unrecognized disease. Among those with known diabetes, 24.4% had evidence of diabetic retinopathy. Excluding one patient who had been diagnosed with diabetes 24 years prior, the average duration of diabetes in known diabetics was 6.44 ± 5.30 years, which is less than the approximately 10 years required to develop evidence of DR (Guidelines of American Diabetes Association) further suggesting either years of unrecognized disease, poor blood sugar control, or both. Unrecognized diabetes has been identified as a problem in nearby China, where retinopathy was found in conjunction with diabetes in 21.0% of individuals at the time of diagnosis.[13] In the rural areas of India, where two-thirds of the population lives, more than 70% of diabetic subjects remain undiagnosed.[14]

Although only ten patients were asked about their knowledge of DR, five of them had no awareness of DR or that diabetes could affect their eyes. This, along with the fact that it was the first eye exam for 85.4% of the known diabetics, suggests that knowledge of diabetic retinopathy in this population is low. Similar findings have been reported from India, where only 6.7% of those who were aware of their diabetic status had visited an ophthalmologist.[15] This is a concern since treatment is vision-preserving rather than curative, making early detection vital to obtaining optimal visual outcomes.

Additionally, patients with vision-threatening diabetic retinopathy may not have symptoms, making them less likely to seek medical attention.[13,16]

When cases of DR are detected, low follow-up for treatment may be a problem, even when offered free of charge. In our cohort, 95.0% of the detected patients presented for an eye exam, but many of them only came after repeated personal phone calls and visits to the home by community health workers. Low uptake of services has also been observed as a problem in India.[17,18]

Diabetic retinopathy is a public health challenge and is not like other preventable or treatable causes of blindness. Although screening for and treating diabetic retinopathy has been shown to be highly cost effective.[19] It is more expensive than treating other causes of blindness such as cataracts or refractive error. [20-22]

In addition, proper screening and treatment requires extended follow-up by patients and can be time consuming for the physician. These are significant barriers to screening and treating DR in countries where ophthalmologic resources and funding are limited. One need is increased community awareness about diabetic retinopathy. In our cohort, 34 patients were receiving oral medicine and insulin and likely see a physician for their diabetes; however, most of them had never received an eye exam. Increased patient awareness could be accomplished through education by primary care physicians or increased referrals of diabetic patients for yearly eye examinations.[19]

REFERENCES

1. Keen H, Lee ET, Russell D *et al*. The appearance of retinopathy and progression to proliferative retinopathy: The WHO multinational study of vascular disease in diabetes. *Diabetologia* 2001(Suppl); 44: S22-30.
2. Sacha E. Diabetic retinopathy. Current opinion on pathophysiology, diagnostics and therapy. *Przegl Lek* 2005; 62: 238-42.
3. Wild S, Roglic G, Green A *et al*. Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabet Care* 2004; 27: 1047-53.
4. Editorial. Epidemic of Diabetes in Urban Nepal - Time to Act. *J Nepal Med Assoc* 2003; 42: 224-9.
5. Singh DL, Bhattarai MD. High prevalence of diabetes and impaired fasting glycaemia in urban Nepal. *Diabet Med* 2003; 20: 170-1.
6. Dandona R, Dandona L, John RK, McCarty C A, Rao GN. Awareness of eye diseases in an urban population in southern India. *Bull WHO* 2001; 79: 96-102.
7. Murugesan N, Snehalatha C, Shobhana R, Roglic G, Ramachandran A. Awareness about diabetes and its complications in the general and diabetic population in a city in southern India. *Diabet Res Clin Pract* 2007; 77: 433-7.
8. Kanski JJ. Diabetic retinopathy—a preventable cause of blindness. *Practitioner* 1985; 229: 343-8.
9. Shrestha MK, Paudyal G, Wagle RR *et al*. Prevalence for and factors associated with diabetic retinopathy among diabetic in Nepal: A Hospital Based Study. *Nepal Med Coll J* 2007; 9: 225-9.
10. American Diabetes Association. Report of the expert committee on the diagnosis and classification of diabetes mellitus. *Diabet Care* 1997; 20: 1183–97.
11. Alberti KGMM, Zimmet PZ (for the WHO Consultation). Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO consultation. *Diabet Med* 1998; 15: 539–53.
12. Ono K, Limbu YR, Rai SK *et al*. The prevalence of type 2 diabetes mellitus and impaired fasting glucose in semi-urban population of Nepal. *Nepal Med Coll J* 2007; 9:154-6.
13. Liu DP, Molyneaux L, Chua E *et al*. Retinopathy in a Chinese population with type 2 diabetes: Factors affecting the presence of this complication at diagnosis of diabetes. *Diabet Res Clin Pract*. 2002; 56: 125-131.
14. Ramachandran A, Snehalatha C, Viswanathan V. Explosion of type 2 diabetes in the Indian subcontinent. *Int'l Diabet Monitor* 2003; 15: 1-6.
15. Early Treatment Diabetic Retinopathy Study Research Group. Grading diabetic retinopathy from stereoscopic color fundus photographs: an extension of the modified Airlie House classification. Early treatment diabetic retinopathy study (ETDRS) report 10. *Ophthalmol* 1991; 98: 786-806.
16. Kristinsson JK. Diabetic retinopathy. Screening and prevention of blindness. A doctoral thesis. *Acta Ophthalmol Scand* 1997 *(Suppl)*; 223: 1-76.
17. Fletcher AE, Donoghue M, Devavaram J *et al*. Low uptake of eye services in rural India: A challenge for programs of blindness prevention. *Arch Ophthalmol* 1999; 117: 1393-9.
18. Namperumalsamy P, Nirmalan PK, Ramasamy K. Developing a screening program to detect sight-threatening diabetic retinopathy in south India. *Diabet Care* 2003; 26: 1831-5.
19. Parnes RE, Singerman LJ. Diabetic retinopathy. Preserving your patients' sight. *J Fla Med Assoc* 1994; 81: 236-9.
20. Javitt JC, Aiello LP, Chiang Y *et al*. Preventive eye care in people with diabetes is cost-saving to the federal government. Implications for health-care reform. *Diabet Care* 1994; 17: 909–17.
21. Javitt JC, Aiello LP. Cost-effectiveness of detecting and treating diabetic retinopathy. *Ann Intern Med* 1996; 124: 164–9.
22. Dasbach EJ, Fryback DG, Newcomb PA *et al*. Cost-effectiveness of strategies for detecting diabetic retinopathy. *Med Care* 1991; 29: 20–39.