Janaki Medical College Journal of Medical Sciences (2024); Vol.12 (3):39-45

JMCJMS

Research Article

Assessment of the prevalence and severity of Diabetic Retinopathy in Type 2 Diabetes mellitus in retina department of Lumbini Eye Institute and Research Center: A Cross-sectional study

Bishnu Prasad Nau[1], Ramesh Chandra Giri[1], Dikshya Khadka[1], Chandrajeet Kumar Yadav[2*], Raman Kumar Gurmaita[3]

Author's Affiliations

[1]Lumbini Eye Institute, Bhairahawa, Rupandehi, Nepal

[2]National Medical College & Teaching Hospital, Birgunj, Parsa, Nepal

[3]Student, Universal College of Medical Sciences, Bhairahawa, Nepal

Correspondence to:
Chandrajeet Kumar Yadav
Assoc. Professor
Department of pharmacology
National Medical College & Teaching Hospital, Birgunj, Parsa, Nepal
E-mail: chandrajity2046@gmail.com

ABSTRACT

Background & Objectives: One of the most dangerous microvascular effects of diabetes mellitus is diabetic retinopathy, which harms the blood vessels that supply the light-sensitive tissue in the rear of the eye. The changing pattern of lifestyle and advancement of technology, type 2 diabetes mellitus has become more common. Thus, this study was aimed to determine the prevalence and severity of diabetic retinopathy in individuals with type 2 diabetes who visited the Lumbini Eye Institute and Research Center retina department.

Materials and Methods: A sum of 725 individuals who visited the retina department of Lumbini Eye Institute and Research Center in Bhairahawa, Nepal, participated in a descriptive cross-sectional study. A structured questionnaire was used to gather the information such as age, the length of time diabetes mellitus was initially diagnosed, and the duration of diabetes was collected. Visual acuity was measured using Snellen's chart. Subjective refraction was performed after objective refraction, based on the patient's response. Following tropicamide mydriasis, a slit light was used to examine the front region, and a +90D was used to examine the posterior segment.

Results: It was found that 115 of the 725 participants in the study had type 2 diabetes. The average age of participants was found as 54.6 ±8.889 years. Among 115 type 2 diabetic patients, 15.86% of participants were observed having diabetic retinopathy. The 34.8% of participants

had history of less than five, and 65.2% had history of more than five years, of type 2 diabetes. The prevalence of diabetic retinopathy was more common in men than in women. Out of the 230 eyes, 57.82% had diabetic maculopathy, 20.9% had proliferative diabetic retinopathy, 7.4% had Advanced Diabetic Eye Disease, and 8.7% had non-proliferative diabetic retinopathy.

Conclusion: The present study found that people with type 2 diabetes had a higher prevalence and severity of diabetic retinopathy with a higher male-to-female ratio.

Keywords: Advanced diabetic eye disease, diabetic retinopathy, non-proliferative diabetic retinopathy, proliferative diabetic retinopathy, refractive error, type 2 diabetes, visual acuity

INTRODUCTION

A significant microvascular consequence of diabetes mellitus, diabetic retinopathy (DR) is brought on by injury to the blood vessels supplying the light-sensitive tissue in the back of the eye [1]. In patients of working age groups, it is the primary cause of legal blindness and visual impairment [2]. All individuals with type 1 diabetes and most people with type 2 diabetes eventually acquire diabetic retinopathy [3]. An estimated 4% of people worldwide are thought to have diabetes mellitus, while about 50% of South Asian, African, Latin American, and indigenous have diabetic retinopathy to some [1] extent at any given moment [4]. Diabetic retinopathy is dependent on the prevalence of diabetes, which is rapidly increasing in Asian countries in the coming generations [3].

The most prevalent complication of diabetes mellitus, diabetic eye disease, is caused by an increase in blood glucose levels that damages the retinal blood vessels [5].Hyperlipidemia, hyperglycemia, hypertension, length of diabetes mellitus, puberty, pregnancy, and cataract surgery are risk factors linked to DR[2].Diabetic retinopathy can be broadly classified into two types: proliferative diabetic retinopathy (PDR), which is the most severe variety, and non-proliferative diabetic retinopathy (NPDR), which is the most prevalent [1].Microaneurysms, deep and superficial retinal hemorrhages, exudates, venous anomalies, and retinal edema are linked to non-proliferative diabetic retinopathy[1].The optic disc and other areas are linked to neovascularization in proliferative diabetic retinopathy [6].

The potential threat to patients' visual acuity and functioning is diabetic retinopathy, which is becoming more and more of a global health concern[2].Globally, adults with diabetes mellitus have a prevalence of DR, proliferative diabetic retinopathy (PDR), diabetic macular edema (DME), and visually threatening diabetic retinopathy (VTDR) of 34%, 7.0%, 6.5%, and 10.2%, respectively, according to a study done in 35 populations[2].A global assessment on the prevalence of diabetic retinopathy found that during the 1980s, the number of people with the condition has increased by 58% in women and 110% in males, respectively, 9% and 7.9% in 2014. It is currently predicted that there are 422 million people with the condition, and by 2045, that number is expected to rise to 629 million[5].According to a study conducted at United States, among 10.2 million US populations aged 40 years and above with diabetes, the prevalence rates for retinopathy and vision-threatening retinopathy were 40.3% and 8.2%, respectively[7]. Research conducted on a mixed-race and black population on a Caribbean island found that 28.5% of the population had retinopathy, with 19.8% having minimal changes and 7.7% having

moderate changes. 8.6% of patients had clinically significant macular edema and 0.9% had severe retinopathy[8].According to research conducted in Chennai, India, 18.0% of diabetes patients have diabetic retinopathy, with the length of diabetes being the biggest predictor[9].In a cross-sectional study involving 6218 people with known diabetes, the prevalence of DR was found to be 22.18% [10].

A study done in Nepal at Tilganga institute of ophthalmology shows that the prevalence of diabetic retinopathy was 83.3% among those with diabetes for over 20 years, vision threatening diabetic retinopathy was 9.5% higher in males [11]. Similarly, another study conducted in Nepal Eye Hospital, Tripureshor, Kathmandu, the prevalence of non-proliferative diabetic retinopathy, proliferative diabetic retinopathy, and total vision loss was 9.1%, 0.5%, and 0.3%, respectively, with over half of the population being female (50.2%) [12].

Thapa R et.al have identified the different characteristics associated with different types of diabetes mellitus in different age groups. These parameters include the state of refractive error, visual acuity, laterality, religions, age, gender, and diabetic retinopathy. However, our study aimed to determine the kinds and prevalence of diabetic retinopathy in patients with type 2 diabetes who were exclusively visited the LEIRC retina department.

MATERIALS & METHODS

This descriptive cross-sectional study was conducted in patients attending the RD in Lumbini Eye Institute and Research Center, Bhairahawa between April 2023 to October 2023. All of the patients with diabetic retinopathy who attended LEIRC were included in the study population. This includes 115 (230) eyes with type 2 diabetes. Purposive sampling was used. Ethical approval was obtained from Institutional Review committee of Lumbini Eye Institute & Research Centre dated 27th April 2023 (Ref. No: 41/022/023) Informed verbal and written consent and assent were obtained from all the participants and their guardian's before enrolling into the study. The gender, length of diabetes, age at which type 2 diabetes was diagnosed, diabetic retinopathy in the eye, history of glasses uses, history of surgery, family history of diabetes, history of any systemic disorders, and medications were all recorded in a thorough Performa. After obtaining both written and verbal agreement, the data collection procedure was conducted in the patients' and their visitors' native tongue with their help. Snellen's chart was used to measure visual acuity [13]. Objective refraction followed by subjective refraction was done with patient response. Anterior segment had examined with the help of slit lamp and posterior segment with +90D after mydriasis with tropicamide.

The analysis was performed using Statistical Package for the Social Sciences version (SPSS) 20.0, after all the data had been entered. Every missing data point was eliminated. The computation of descriptive statistical measures included the calculation of frequency and percentage for categorical variables and mean and standard deviation for continuous variables. During the analysis, appropriate pie charts, bar graphs, histograms, and dummy tables were used.

RESULTS

During the study period, 115 patients were identified who had previously been

Table 1: Prevalence and pattern of Diabetic retinopathy

Diagnosis	Frequency	Percent (%)
Mild NPDR	13	5.7
Moderate NPDR	45	19.6
Severe NPDR	64	27.8
Very severe NPDR	11	4.8
PDR	48	20.9
ADED	17	7.4
Diabetic maculopathy	20	8.7
NA	12	5.2
Total	230	100

diagnosed with diabetes mellitus and presented to the LEIRC Retina section. Among of 725 patients, 230 eyes (115, or 15.86%) have diabetic retinopathy due to type 2 diabetes. Of the 115 patients in this study, 70 (60.9%) were male and 45 (30.1%) were female. The mean age of the patients was 54.65±8.889 and the standard deviation was 8.889. Among 115 patients out of 725 in our study, 40 (34.8%) had diabetes for less than duration of five years, and 75 (65.2%) had

Table 2: Visual impairment category in patients with diabetic retinopathy (n=115 patients)

		Diagnosis								Total
		Mild NDPR	Moderate NDPR	Severe NDPR	Very Severe NDPR	PDE	ADED	Diabetic Maculopathy	NA	
Best corrected visual acquity (BCVA)	Mild 0.00-0.47	7	25	16	3	15	3	4	4	77
	Moderate 0.47-1.0	0	0	9	2	5	1	4	2	23
	Severe 1.0-1.30	0	1	4	0	1	1	0	0	7
	Blindness 1.30-1.77	0	0	2	0	2	2	0	0	6
	Blindness -PL 1.77-2.48	0	0	0	0	0	2	0	0	2
Total		7	26	31	5	23	9	8	6	115

Table 3: Visual acuity in different types of diabetic retinopathy (n= 230 eyes)

BCVA (Best corrected visual acuity**)**						
Diagnosis	Mild number (%)	Moderate number (%)	Severe number (%)	Blindness number (%)	Blind-Perception of light number (PL) (%)	Total
Mild NPDR	12 (92.3)	0 (0)	0 (0)	1 (7.7)	0 (0)	13
Moderate NPDR	37 (82.2)	4 (8.9)	1 (2.2)	2 (4.4)	1 (2.2)	45
Severe NPDR	27 (42.2)	16 (25)	9 (14.1)	11(17.2)	1 (1.6)	64
Very severe NPDR	5 (45.5)	2 (18.2)	1 (9.1)	2 (18.2)	1 (9.1)	11
PDR	25 (52.1)	11 (22.9)	1 (2.1)	7 (14.6)	4 (8.3)	48
ADED	0 (0)	3 (17.6)	1 (5.9)	4 (23.5)	9 (52.9)	17
Diabetic maculopathy	4 (20)	7 (35)	0 (0)	6 (30)	3 (15)	20
NA	8 (66.7)	1 (8.3)	0 (0)	1 (8.3)	2 (16.7)	12
Total	118 (51.3)	44 (19.1)	13 (5.7)	34 (14.8)	21 (9.1)	230 (100%)

diabetes for more than duration of five years.

Table 1 shows that among 230 DR eyes had 13(5.7 mild NDPR %), 45(19.6) had moderate NDPR %, 64(27.8 %) had severe NDPR, 11(4.8%) had very severe NDPR, 17 (7.4%) had ADED, 48(20.9%) had PDR, 20(8.7%) had ADED and 20(8.7%) had diabetic maculopathy.

Table 2 shows that among 115 patients, 77 patients had present under mild visual acuity category, 23 patients had under moderate, 7 patients had presented with severe, 6 patients had present with blindness and 2 patents had present with blind-Perception of light number category. Visual impairment category in patients with diabetic retinopathy are as shown in Table 3.

DISCUSSION

Diabetic retinopathy is the leading cause of visual impairment and blindness among people of working age groups [14]. A total of 115 individuals who had previously been diagnosed with diabetes mellitus and presented to the LEIRC Retina department throughout the study period were identified. Of them, 15.86% had diabetic retinopathy. Of them, 20.9% showed PDR, 47% had DME, 7.4% had ADED, 8.7% had diabetic maculopathy, 5.2% had others in each eye, and 57.82% had NPDR. In contrast to our study, the prevalence of PDR and DME was lesser in a study done by Poudyal et al because the Tilganga Institute of Ophthalmology study included people with all forms of diabetes, but our study only included people with type 2 diabetes. Additionally, our study had a smaller sample size and a shorter study time [15].In a similar vein, Zheng et al. study in Singapore on the global epidemic of diabetic retinopathy found that the prevalence of PDR, DME, and Visual Threatening Diabetic Retinopathy (VTDR) among individuals with diabetes mellitus was 7.0%, 6.5%, and 10.2%, respectively. West et al. study in America and Gadkari et al. also found a higher prevalence of DR in patients with diabetes mellitus due to their larger sample size, longer study period, and inclusion of individuals with all forms of the disease [10,16].

In our study, male (60.9%) were more prevalent which is similar to the study done by Poudyal et.al at Tilganga Institute Of Ophthalmology, Kathmandu which found that male individuals with hypertension, type 2 diabetes, and interval from diagnosis of DM to initial eye consultation were significantly associated with the presence of DR[14].Similarly, a study done by Zeng et al in Singapore also showed that male were more prevalent and stated that male were at higher risk of hyperglycemia, hypertension, dyslipidemia, duration of diabetes , cataract surgery etc. [2]. Additionally, study done by Cheloni et al in Italy showed that male were more prevalent [5].Moreover, in a study done in Nepal under the prevalence of diabetes mellitus and associated risk factors also showed that male were more prevalent because the urban residents were almost twice higher, participants with high blood pressure, overweight and obesity, increase triglyceride and body mass index etc. were higher [17]. In contrast, a cross-sectional study done by Wong et al in Singapore showed that Malay eye had more female which may be because of lower education level, higher BMI, and higher level of lipids in their study [18]. In our study, 66.95% of patients detected with DR had a visual acuity 6/18 or better in worse eye but in another study done by Gadkari et al in India had

lesser prevalence which may be because of only type 2 diabetes patients included in the study [10]. Similarly in another study done by Jain and Gupta in India, Rajasthan had none of DR patient among100 new diagnosis of diabetes because they concluded that hyperopic changes are highly dependent on the magnitude of plasma glucose concentrations, and rapid correction of hyperglycemia is strictly correlated with complete recovery of refraction[19].Similarly, a research conducted in the United States had fewer people with VA 6/18 or better with the best correction in the worse eye, because all of the diabetic patients were post-operative and suspected of having glaucoma[20]. Likewise, the study done by Jurangal et al in India had 30% of patients with visual acuity 6/18 or better in worse eye because they included the individuals of diabetes with history up to 6 years only [21].

CONCLUSION

Diabetic retinopathy was more prevalent and severe in people with type 2 diabetes. Males were more likely than females to have severe NPDR, which was more common than PDR and moderate NPDR. The limitations of this study include the small sample size, short study period, and focus on only type 2 diabetes. Also, it was a hospital-based study and it may not reflect the status of DR in the community.

ACKNOWLEDGEMENT

We would like to thank Mr. Ramesh Chandra Giri, senior optometrist for helping us editing the manuscript and largely correcting English language.

Conflict of interest: None declared

Funding: None

Author's Contribution: Concept, design, supervision, materials, data collection, processing, analysis and interpretation, literature review, writing of manuscript- **BPN, RCG, DK;** Concept, design, supervision, materials, data collection, processing, analysis and interpretation- **BPN, RCG, DK CKY, RKG.** All authors involved in the drafting, editing, and critical review processes of the article. Furthermore, every author gave their final consent for the version that was planned to be published.

REFERENCES

1. Sivaprasad S, Gupta B, Crosby-Nwaobi R, Evans J. Prevalence of diabetic retinopathy in various ethnic groups: a worldwide perspective. Survey of ophthalmology 2012;57(4):347-70.
2. Zheng Y, He M, Congdon N. The worldwide epidemic of diabetic retinopathy. Indian journal of ophthalmology 2012;60(5):428-31.
3. Paudyal G, Shrestha M, Meyer J, Thapa R, Gurung R, Ruit S. Prevalence of diabetic retinopathy following a community screening for diabetes. Nepal Med Coll J 2008;10(3):160-3.
4. Rema M, Pradeepa R. Diabetic retinopathy: an Indian perspective. Indian journal of medical research 2007;125(3):297-310.
5. Cheloni R, Gandolfi SA, Signorelli C, Odone A. Global prevalence of diabetic retinopathy: protocol for a systematic review and meta-analysis. BMJ open 2019;9(3):e022188.
6 .Khurana A, Khurana A, Khurana B. Comprehensive ophthalmology. New Delhi: Jaypee. The Health Sciences Publisher; 2015.
7. Kempen JH, O'Colmain BJ, Leske MC, Haffner SM, Klein R, Moss SE, et al. The prevalence of diabetic retinopathy among adults in the United States. Archives of ophthalmology (Chicago, Ill: 1960) 2004;122(4):552-63.
8. Leske MC, Wu S-Y, Hyman L, Li X, Hennis A, Connell AM, et al. Diabetic retinopathy in a black population: the Barbados Eye Study. Ophthalmology 1999;106(10):1893-9.
9.Raman R, Rani PK, Rachepalle SR, Gnanamoorthy P, Uthra S, Kumaramanickavel G, Sharma T. Prevalence of diabetic retinopathy in India: Sankara Nethralaya diabetic retinopathy epidemiology and molecular genetics study report 2. Ophthalmology 2009;116(2):311-8.

10. Gadkari SS, Maskati QB, Nayak BK. Prevalence of diabetic retinopathy in India: The all India ophthalmological society diabetic retinopathy eye screening study 2014. Indian journal of ophthalmology 2016;64(1):38-44.
11. Thapa R, Twyana SN, Paudyal G, Khanal S, van Nispen R, Tan S, et al. Prevalence and risk factors of diabetic retinopathy among an elderly population with diabetes in Nepal: the Bhaktapur Retina Study. Clinical ophthalmology2018:561-8.
12. Mishra S, Pant B, Subedi P. The prevalence of diabetic retinopathy among known diabetic population in Nepal. Kathmandu Univ Med J 2016;14(2):134-9.
13. Azzam D, Ronquillo Y. Snellen chart. Treasure Island (FL): StatPearls Publishing; 2024.
14.Purola PK, Ojamo MU, Gissler M, Uusitalo HM. Changes in visual impairment due to diabetic retinopathy during 1980–2019 based on nationwide register data. Diabetes Care 2022;45(9):2020-7.
15. Paudyal G, Shrestha MK, Poudel M, Tabin GC, Ruit S, Thomas BJ. Prevalence and severity of diabetic retinopathy among diabetic patients presenting to a tertiary eye hospital in Nepal. Middle East African Journal of Ophthalmology2019;26(4):210-5.
16. West SK, Klein R, Rodriguez J, Muñoz B, Broman AT, Sanchez R, Snyder R. Diabetes and diabetic retinopathy in a Mexican-American population: Proyecto VER. Diabetes care 2001;24(7):1204-9.
17. Shrestha N, Karki K, Poudyal A, Aryal KK, Mahato NK, Gautam N, et al. Prevalence of diabetes mellitus and associated risk factors in Nepal: findings from a nationwide population-based survey. BMJ open 2022;12(2):e060750.
18. Wong TY, Cheung N, Tay WT, Wang JJ, Aung T, Saw SM, et al. Prevalence and risk factors for diabetic retinopathy: the Singapore Malay Eye Study. Ophthalmology 2008;115(11):1869-75.
19. Jain S, Gupta CP. Relationship between Refractive Error and Diabetes Mellitus. Journal of Mahatma Gandhi University of Medical Sciences and Technology 2018;3(2):39-40
20.Shah D, Krishnan A, Albanis C, Dwyer M, Ernest J. Visual acuity outcomes following vitreous loss in glaucoma and diabetic patients. Eye 2002;16(3):271-4.
21.Jurangal A, Singh A, Dhaliwal R. Assessment of visual acuity among diabetic patients. Int J Contemp Med Res 2017;4(6):1311-4.