Original Article

# Screening of Diabetic Retinopathy in a Diabetic Medical Center

Saher Khalid, Mohammad Moin, Muhammad Imran Hasan Khan

*Pak J Ophthalmol 2015, Vol. 31 No. 3*

See end of article for authors affiliations

Correspondence to:
Saher Khalid
PGR, Eye Unit II
Lahore General Hospital
Lahore
Email:viakhan123@gmail.com

**Purpose:** To estimate the prevalence of diabetic retinopathy on the posterior pole of newly diagnosed diabetic patients using a non-mydriatic fundus camera.

**Materials and Methods:** Descriptive case series of 822 patients (male: female 29.4:70.6), screened during 10 months (August 2014-May 2015) was done in Diabetes Endocrine and Metabolic Centre (DEMC) using a single posterior pole photograph centered on the fovea using a non-mydriatic fundus camera. Without pupil dilation, grading of diabetic retinopathy was done using Airlie House classification which divides diabetic retinopathy (DR) into 5 grades i.e. background DR, pre-proliferative DR, proliferative DR, maculopathy and advanced disease. After grading, patients were referred to eye outpatient department for further management. Newly diagnosed diabetics, including pregnant and hypertensive patients were studied. Patients with hazy media, cataracts and evisceration were excluded.

**Results:** 170 (20.6%) out of 822 patients showed diabetic retinopathy in which 10 patients had type 1 (5.8%) while 160 patients (94.1%) had type 2 diabetes at presentation. Highest distribution of diabetic retinopathy belonged to the age group 50 (21.7%) (Mean 50.4, Std. Deviation 9.76). Out of 170, 98 patients showed background diabetic retinopathy (57.6%), 31 patients showed pre-proliferative (18.25%), 20 patients showed proliferative diabetic retinopathy (PDR) (11.7%), 12 showed maculopathy (7.05%) and only 9 patients (5.2%) showed advanced disease. Patients with vitreous hemorrhage, tractional retinal detachment and neovascular glaucoma were considered as having advanced disease. These results were totally based on posterior pole findings of diabetic patients. Out of 170 patients, 8 had nephropathy (4.7%), 122 had neuropathy (71.7%) and 99 patients (58.2%) had preexisting hypertension.

**Conclusion:** Fundus photograph with a non mydriatic camera in a diabetic medical center is a very useful tool to guide patients for early treatment, to prevent blindness.

**Key words:** Diabetes Mellitus, Fundus camera, Diabetic retinopathy screening.

Diabetes mellitus is now a leading cause of morbidity and mortality throughout the world. Diabetes is associated with high rates of hospitalization, blindness, renal failure and non-traumatic amputation[1]. It is one of the most common non communicable disease globally.

According to Pakistan National Diabetes survey, Pakistan ranks 7th highest worldwide in the prevalence of diabetes and it will be 4th largest by the year 2030.[2] World Health Organization (WHO) has estimated that global number of people with diabetes will be double over the next 25 years period[3]. A diabetic can have serious eye disease and not even know until complication has occured[4]. Diabetic retinopathy is a leading cause of blindness in adults aged 20-74 years.

The rationale of our study is to find the burden of

diabetic retinopathy in newly diagnosed patients with diabetes mellitus in a tertiary care diabetic medical center using a non-mydriatic fundus camera. This can lead to early detection of complications to eye and help in prevention of visual loss.

## MATERIAL AND METHODS

The study was descriptive case series conducted between august 2014 – May 2015. Diabetic patients of both gender, aged 20 years and above, pregnant and hypertensives, were included in the study. Critically ill, those with opaque media like corneal opacity, cataract and eviscerated eye patients were excluded from the study.

As a first step, patients were screened in DEMC of Lahore General Hospital with a single posterior pole photograph centered on the fovea using a non-mydriatic fundus camera with undilated pupils. Informed consent was taken before fundus photograph and full counselling about diabetes was done in diabetic eye clinic of Lahore General Hospital. Fundus photograph was taken by an ophthalmic technician and photograph read by an ophthalmologist. Grading of diabetic retinopathy was done using Airlie House classification grading system which divides diabetic retinopathy into 5 grades i.e. background, pre-proliferative, proliferative, maculopathy and advanced disease and then patients with any above mentioned grade of diabetic retinopathy were referred to eye out patient department for further evaluation and treatment. Patients with no retinopathy were called for followup photograph at 6 months intervals.

## RESULTS

We screened a total of 822 patients in duration of 10 months from August 2014 to May 2015. The male (29.4%) to female (70.6%) distribution were 1:3.3 (Table 1). Out of them, 170 (20.6%) had diabetic retinopathy, 10 had type 1 diabetes (5.8%) and 160 had type 2 diabetes (94.1%) (Table 2). Highest distribution of diabetic retinopathy belonged to the age group 50 (mean 50.4, Std. Deviation 9.76) (Table 3, Fig. 1). The commonest presentation of diabetic retinopathy was background diabetic retinopathy that is 98 patients (57.6%) followed by pre-proliferative diabetic retinopathy 31 patients (18.2%), proliferative diabetic retinopathy 20 patients (11.7%), maculopathy 12 patients (7.05%) and only 9 patients showed advanced disease (5.2%) (Table 4). Patients with vitreous hemorrhage, tractional retinal detachment and neovascular glaucoma are considered as having

**Table 1:** Gender distribution among diabetic patients.

| Gender | Frequency (n (%) |
|---|---|
| Male | 37 (21.7) |
| Female | 123 (72.3) |
| Total | 170 (100) |

**Table 2:** Diabetic retinopathy by type of diabetes.

| Type of Diabetes | Frequency (n (%) |
|---|---|
| Type 1 | 10 (5.8) |
| Type 2 | 160 (94.1) |

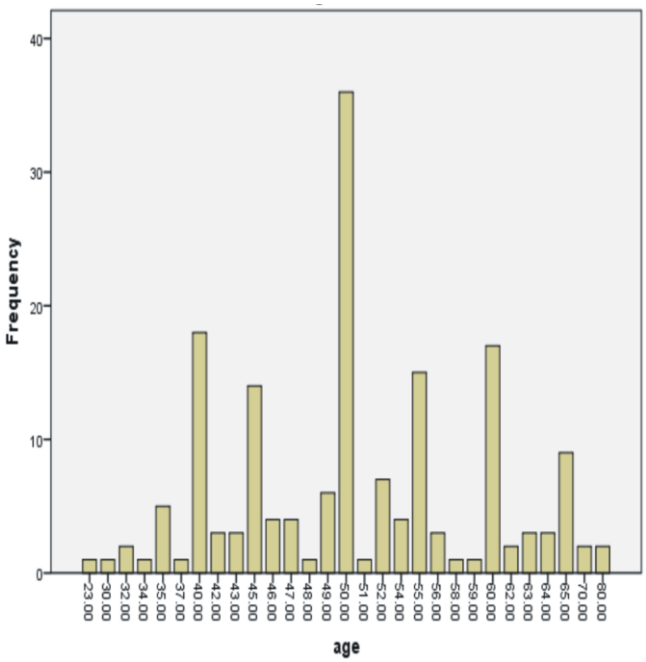


**Fig. 1:** Age distribution chart.

**Table 3:** Age distribution.

| Statistics | |
|---|---|
| **Age** | |
| Total | 170 |
| Mean | 50.4824 |
| Std. Deviation | 9.76603 |

**Table 4:** Clinical presentation of diabetic retinopathy (n = 170).

| Grade of Diabetic Retinopathy | Frequency n (%) | Nephropathy n (%) | Neuropathy n (%) | Hypertension n (%) |
|---|---|---|---|---|
| Background DR | 98 (57.6) | 1 (1) | 73 (74.4) | 63 (64.2) |
| Pre-proliferative DR | 31 (18.2) | 1 (3.2) | 24 (77.4) | 12 (38.7) |
| Proliferative DR | 20 (11.7) | 5 (25) | 19 (95) | 14 (70) |
| Maculopathy | 12 (7.05) | 0 (0) | 5 (41.6) | 7 (58.3) |
| Advanced disease | 9 (5.2) | 1 (11.1) | 1 (11.1) | 3 (33.3) |
| Total | 170 (100) | 8 (4.7) | 122 (71.7) | 99 (58.2) |

advanced disease. Out if 170 patients, 8 had nephropathy (4.7%), 122 had neuropathy (71.7%) and 99 patients (58.2%) had preexisting hypertension (Table 4). In our study, patients with hypertension and diabetes are more than diabetes without hypertension (Table 5).

## DISCUSSION

Diabetes mellitus is a chronic metabolic disorder that has emerged as a great socioeconomic burden for the developing world. Over the past two decades, there has been a significant rise in the prevalence of this devastating illness and is presenting as an alarming issue. Currently diabetes affects 240 million people worldwide and this number is projected to increase to 380 million by 2025[5]. Pakistan belongs to high prevalence area, currently having 6.9 million affected people, expected to double by 2025 and affect 11.5 million people. This alarming situation can have serious repercussions and presents as a challenge for health care providers and health care policy makers in the country. A diabetic patient is 25 times more likely to become blind than non-diabetic.[6]

Diabetes is the 4th leading cause of death in most developed countries with Pakistan currently ranking at 7th position in the list of countries with major burden of diabetes and if the current situation continues, it will definitely come to 4th position by 2025.[2] Diabetic retinopathy is the most common cause of blindness in the working age group. It is one of the few ophthalmic diseases where there is a role of preventive measure to delay the progression of disease and visual loss.[7]

In a study done by Hansen et al, 83 patients with type 1 and 2 diabetes were screened using non mydriatic fundus camera. They found its sensitivity of about 89.9% when used on patients without pupil dilation[8]. In another study 4318 diabetic patients were screened using non mydriatic fundus camera and the incidence of diabetic retinopathy was 15.8%[9] (Table 6) summarizes the results of various studies on diabetic retinopathy in developing countries. Ghana[10] and Spain[11] showed a significantly lower prevalence of 17.9% and 12.3% respectively ($P < 0.01$). The prevalence's reported from Saudi Arabia,[12] Sri Lanka[13] and Brazil[14] reported a prevalence of 30%, 31.3% and 35.4% respectively, Kashmir[16] (27%) and South Africa[17] (40.3%) are significantly higher ($P < 0.05$) from our findings. This could be due to younger age of that population and the shorter duration of disease. Egypt[15] (20.5%) showed similar results to our study. The reported prevalence among 3000 diabetics from Karachi[18] (26.1%) is significantly higher while from India (18%),[19] Malaysia (14.9%) and Victoria[20] (18%) is significantly lower than our findings. A local study done in 2001 shows 33.3% prevalence of diabetic retinopathy.[21]

**Table 5:** Grading of diabetic retinopathy.

| | Frequency (n (%) |
|---|---|
| Patients with diabetes and hypertension | 99 (58.2) |
| Patients with diabetes alone | 71 (41.7) |

**Table 6:** Comparison of prevalence of diabetic retinopathy in different countries.

| Country | Prevalence of Diabetic Retinopathy |
|---|---|
| Israel | 15.8% |
| Ghana | 17.9% |
| Spain | 12.3% |
| Saudi Arabia | 30% |
| Sri Lanka | 31.3% |
| Brazil | 35.4% |
| Egypt | 20.5% |
| Kashmir | 27% |
| South Africa | 40.3% |
| Karachi | 26.1% |
| India | 18% |
| Malaysia | 14.9% |
| Victoria | 18% |
| Lahore | 33.3% |
| Present study | 20.6% |

In our setup, we have screened 822 diabetics patients in 10 months interval. Type 1 and type 2 diabetics were both included. Frequency of diabetic retinopathy among diabetics was 20.6% (170 patients) which is higher in most of the countries but lower in local study[21] which was done in 2001. The most prevalent type of diabetic retinopathy in our study was background diabetic retinopathy 57.6%. Non proliferative DR accounts for 18.2% which is consistent with those of Kayani H in 2001 who observed NPDR in 21.5% diabetics.[21] We found a low frequency of proliferative diabetic retinopathy (11.8%) and local study also showed same prevalence[21]. Prevalence of advanced diabetic retinopathy was (5.3%). In our study prevalence of nephropathy with DR is 4.7% which is lower than the prevalence in Spain[11] (8.6%). So nephropathy is well correlated with diabetic retinopathy. As far as neuropathy is concerned, our study shows a prevalence of 71.7% which is quiet high as compared to studies 29.2%,[23] 28%[24] and 2.3%[25] and slightly lower than another study 78.1%[26]. In present study, preexisting hypertension was present in 58.2% of patients while 38% prevalence is shown by study Gillow JT et al[27] and 53.5% prevalence by one local study done in Peshawar by Rahman S et al.[28]

Hypertension is a well – known risk factor for several chronic conditions in which lowering blood pressure has proven to be beneficial. The available evidence supports a beneficial effect of intervention to reduce blood pressure with respect to preventing diabetic retinopathy for up to 4 to 5 years[29]. The Appropriate Blood Pressure Control in Diabetes (ABCD) Trial is a prospective randomized blinded clinical trial that compares the effects of intensive versus moderate blood pressure control on the incidence and progression of type 2 diabetic complications like retinopathy, neuropathy and nephropathy.[30]

One limitation of our study is the use of old grading system of diabetic retinopathy that is not universally used in epidemiological studies now a days. We have chosen this classification because the patients included in our study were non-dilated and we took only the posterior pole images of these patients as we have already said. The modified Airlie House classification needs 5-6 pictures of whole fundus involving the periphery so we could not use this new classification system. Secondly, this study is limited to those who attended DEMC out patient clinic only, so it is likely that the rates may be an underestimation because our study is hospital based and not population based with low sample size, and actual prevalence may be different. Main limitation of the study is that we have taken the fundus photograph of the posterior pole only, so the peripheral findings might have been missed. We are planning to rectify this in future by taking two photographs, centered on macula and disc with non mydriatic fundus camera.

## CONCLUSION

Diabetic retinopathy screening using non mydriatic fundus camera improved the quality of care for our diabetic patients. This screening method identified patients requiring prompt referral to the ophthalmologist for further complete eye examination. Extending this screening program to other areas of country should be considered. Pakistan needs such screening programs for early identification of the condition with its associated complications, to provide appropriate timely treatment to reduce the burden of blindness due to diabetes. Lastly, the development of an integrated health and social care pathway, including further education and better communication

between all relevant parties, may be helpful in reducing the prevalence of diabetic retinopathy.

**Author's Affiliation**

Dr. Saher Khalid
PGR, Eye Unit II
Lahore General Hospital, Lahore

Prof. Mohammad Moin
Professor of Ophthalmology
Eye Unit II, Post Graduate Medical Institute
Lahore General Hospital, Lahore

Dr. Muhammad Imran Hasan Khan
Associate Professor of Medicine
Medical Unit 1, Post Graduate Medical Institute
Lahore General Hospital, Lahore

**Role of Authors**

Dr. Saher Khalid
Main Data Collection and Result Compilation.

Prof. Mohammad Moin
Research Design and Research Supervision.

Dr. Muhammad Imran Hasan Khan
Data Collection and Result Analysis.

**REFERENCES**

1. **Cowic CC, Eberhardt MS Eds. Alexandria, VA.** American Diabetes Association; Diabetes 1996: Vital Statistics. American Diabetes Association 1996.
2. National society to prevent blindness: vision problem in the US: facts and figures. The American academy of ophthalmology preferred practice pattern series: diabetic retinopathy 1993; 18-20.
3. **Amos AJ, McCarty DJ, Zimmet P.** The rising global burden of diabetes and its complications; estimates and projections to the year 2010. Diabetic Medicine, 1997; 14 (suppl):S7 - S84.
4. **Iqbal F, Naz R.** patterns of diabetes mellitus in Pakistan: an overview of the problem. J Pak Med Res. 2005; 44:123-50.
5. Diabetes atlas 3rd ed. Brussels, Belgium. International diabetes federation: 2006.
6. **Carty MC A.** Use of eye care services by people with diabetes. Br J Med. 1998; 82: 410-4.
7. **Stuebiger N, Smiddy W, Wang J, Jiang H, DeBuc DC.** Assesment of Conjunctival Microangiopathy in a Patient with Diabetes Mellitus Using the Retinal Function Imager. J Clin Exp Ophthalmol. 2015; 6: 400.
8. **Hensen AB, Hartvig NV, Jensen MS, Borch-Johnsen K, Lund-Andersen H, Larsen M.** Diabetic retinopathy screening using digital non mydriatic fundus photography and automated image analysis. Acta Ophthalmol Scand. 2004; 82: 666-72.
9. **Levy J, Lifshitz T.** screening of diabetic retinopathy with a mobile non mydriatic fundus camera in southern Israel. Isr Med Assoc J. 2011; 13:137-40.
10. **Rotimi C, Daniel H.** Prevalence and determinants of diabetic retinopathy and cataracts in West African type 2 diabetes patients.Ethn Dis. 2003 Summer;13(2 Suppl 2):S110-7
11. **Rodriguez-Poncelas A, Miravet-Jiménez S.** Prevalence of diabetic retinopathy in individuals with type 2 diabetes who had recorded diabetic retinopathy from retinal photographs in Catalonia (Spain).Br J Ophthalmol. 2015 Jun 18.
12. **Khan AR.** Prevalence and Determinants of Diabetic Retinopathy in Al Hasa Region of Saudi Arabia: Primary Health Care Centre Based Cross-Sectional Survey, 2007–2009. Middle East Afr J Ophthalmol. 2010; 17: 257–63.
13. **Fernando DJ.** Prevalence of retinopathy in a Sri Lankan diabetes clinic. Ceylon Med J. 1993; 38: 120-3.
14. **Schellini SA, Carvalho GM, Rendeiro FS, Padovani CR, Hirai FE.** Prevalence of diabetes and diabetic retinopathy in a Brazilian population. Ophthalmic Epidemiol. 2014; 21: 33-8.
15. **Macky TA, Khater N, Al-Zamil MA, El Fishawy H, Soliman MM.** Epidemiology of diabetic retinopathy in Egypt: a hospital-based study. Ophthalmic Res. 2011; 45: 73-8.
16. **Qureshi T, Abdullah N.** Prevalence of diabetic retinopathy in Kashmir india. A hospital based study. Global journal of medicine and public health. 2013; 2: 1.
17. **Rotchford AP et al.** Diabetes in rural South Africa-an assessment of care and complications. S Afr Med J. 2002; 92: 536-41.
18. **Khan AJ.** Prevalence of diabetic retinopathy in Pakistan subjects. A pilot study. J Pak Med Assoc. 1991; 41: 49-50.
19. **Raman R, Rani PK.** Prevalence of diabetic retinopathy in India: Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study report 2. Ophthalmology, 2009; 116: 311-8.
20. **Harper CA.** Screening for diabetic retinopathy using a non-mydriatic retinal camera in rural Victoria. Aust N Z J Ophthalmol. 1998; 26: 117-21.
21. **Kayani H, Rehan N.** Frequency of retinopathy among diabetics in a teaching hospital of Lahore.
22. Pedro RA, Ramon SA, Marc BB, Juan FB, Isabel MM. Prevalence and relationship between diabetic retinopathy and nephropathy, and its risk factors in the North – East of Spain, a population – based study. Ophthalmic Epidemiol. 2010; 17: 251-65.
23. **Bansan D, Gudala K.** Prevalence and risk factors of development of peripheral diabetic neuropathy in type 2 diabetes mellitus in a tertiary care setting. J Diabetes Investig. 2014; 5: 714–21.
24. **Tesfaye S, Stevens LK, Stephenson JM.** Prevalence of diabetic peripheral neuropathy and its relation to glycaemic control and potential risk factors: the EURODIAB IDDM Complications Study. Diabetologia. 1996; 39: 1377-84.

25. **Fedele D, Comi G, Coscelli C.** A multicentre study on the prevalence of diabetic neuropathy in Italy. Diabetes Care. 1997; 20: 836-43.
26. **Abdollahi A, Moghimi S, Tabasi A, Rajabi MT, Sabet B.** Neuropathy and retinopathy in diabetes: is there any association. Int J Ophthalmol. 2009; 2: 1.
27. **Gillow JT, Gibson JM, Dodson PM.** Hypertension and diabetic retinopathy-what's the story? Br J Ophthalmol 1999; 83: 1083-7.
28. **Rahman S, Nawaz R, Khan GJ, Aamir AH.** Frequency of diabetic retinopathy in hypertensive diabetic patients in a tertiary care hospital of Peshawar, Pakistan. J Ayub Med Coll Abbottabad. 2011; 23.
29. **Do DV, Wang X, Vedula SS, Marrone M, Sleilati G, Hawkins BS, Frank RN.** Blood pressure control for diabetic retinopathy. Cochrane Database Syst Rev. 2015; 1: CD006127.
30. **Estacio RO, Jeffers BW, Gifford N, Schrier RW.** Effect of blood pressure control on diabetic microvascular complications in patients with hypertension and type 2 diabetes. Diabetes Care, 2000; 2: B54-64.