

ORIGINAL ARTICLE

DIABETIC RETINOPATHY CHALLENGES IN DEVELOPING COUNTRIES: AWARENESS AND SEVERITY AT PRESENTATION OF DIABETIC RETINOPATHY AND BARRIERS TO ITS TREATMENT

Imran Ahmad, Nazli Gul, Bilal Khan, Jawad Humayun, Jahandad Khan

Department of Ophthalmology, Khyber Medical College/ Khyber Teaching Hospital, Peshawar, Pakistan

ABSTRACT

Background: Diabetic retinopathy is a common cause of visual loss in diabetic patients. Diabetic population is increasing throughout the world and Pakistan ranked third in the world in terms of diabetic population. Pakistan is having the highest 26.7% prevalence of diabetes 2022. The objective of the study was to document the first presentation of severity of diabetic retinopathy, presence of macular edema, referral and the patient awareness about the risk factors of development and progression of diabetic retinopathy in our population presenting to Khyber Teaching Hospital, Peshawar.

Materials & Methods: It was a descriptive study carried out in Ophthalmology Department of Khyber Teaching Hospital Peshawar from June 2023 to November 2023. Patients who presented for the first time to ophthalmologists were included in the study. Total of 340 patients with 680 eyes were enrolled in the study.

Results: There was no diabetic retinopathy in 189 eyes (27.8%), mild non-proliferative diabetic retinopathy in 213 eyes (31.3%), moderate non-proliferative diabetic retinopathy in 104 (15.29%) eyes, proliferative diabetic retinopathy in 76 (11.2%) and advanced diabetic eye disease (ADED) in 37 (5.4%) eyes. Only 19.70% patients were referred by endocrinologist, 12.25% by physician and 3.52% by general physician. The most common barrier to the treatment of diabetic retinopathy was lack of awareness about the disease (71.17%) followed by affordability (42.94%), transportation (21.17%), dependency (12.64%).

Conclusion: Health education about diabetic retinopathy is important for the patient but along with patients treating physician and endocrinologist need to be made aware about this blinding disease for proper referral and timely management.

KEY WORDS: Diabetic retinopathy; Awareness; Severity of retinopathy; Barriers.

Cite as: Ahmad I, Gul N, Khan B, Humayun J, Khan J. Diabetic retinopathy challenges in developing countries: awareness and severity at presentation of diabetic retinopathy and barriers to its treatment. *Gomal J Med Sci* 2024 Jul-Sep;22(3):220-25. <https://doi.org/1046903/gjms/22.03.1573>

INTRODUCTION

Diabetic retinopathy is a common preventable cause of visual loss in diabetic patients. The diabetic population is increasing day by day and it is estimated that the diabetic population will affect 600 million people by the year 2030 worldwide.¹ Pakistan ranked 4th in terms of diabetic population and now ranked 3rd in

the world after China and India. Pakistan also has the highest prevalence of diabetic retinopathy of 26.7% in the year 2022 which was 11.7% in 2016.² In Pakistan the patients affected by diabetes crossed the figure of 27 million in 2022.³ Diabetes is the leading cause of death in Pakistani population under the age of 60 years. About 26.9% of diabetics in Pakistan are undiagnosed that further increases the burden on health system of a developing country.⁴

With increasing prevalence of diabetes, the rate of diabetic retinopathy also increases.⁵ This problem is further increased by the lack of health education and proper screening for diabetic retinopathy in developing countries including Pakistan.⁶ Due to poor socioeconomic status of the people, there is lack of proper treatment due to deficient human resource, trained retinal surgeons, poverty and lack of infrastructure.⁷ This problem is further aggravated

Corresponding Author:

Dr. Nazli Gul
Assistant Professor
Department of Ophthalmology
Khyber Medical College/ Khyber Teaching Hospital
Peshawar, Pakistan

E-mail: drnazli83@gmail.com

Date Submitted: 04-12-2023

Date Revised: 10-06-2024

Date Accepted: 01-07-2024

by underutilized and under developed health system with lack of basic treatment facilities and screening in rural areas of Pakistan.⁸ Most of time patients presents late with advanced diabetic retinopathy and diabetic macular edema due to limited access to health care facilities.⁹ Vitreo-retinal procedures are expensive and are not available in every hospital due to high cost of machines, consumables and lack of trained and experience surgeons.¹⁰ The problem is further aggravated in our settings by lack of facilities as only 3 hospitals of our province is providing vitreo-retinal services with long waiting periods due to huge back-log causing visual loss and disability leading to poor quality of patient's life and financial burden on our health system.

The visual prognosis in patients with diabetic retinopathy is closely related to the stage of disease presentation, barriers to treatment and availability of screening system. The affordability, lack of trained retinal surgeons and infrastructure for treating diabetic retinopathy is big issue in the already overburdened public sector hospitals in developing countries¹¹. In the resource limited countries like Pakistan, much emphasize should be on the prevention of the diseases and its complications with proper screening and counselling of diabetic patients rather than treatment of the retinopathy which is quite expensive with lack of trained personnel and facilities.

The aim of the study is to find out the awareness about diabetic retinopathy and the risk factors responsible for the progression of the disease in our population. In our study we checked the stage of diabetic retinopathy at first presentation, presence of macular edema, referral for diabetic retinopathy screening by their treating physician or endocrinologist, barriers to the treatment of diabetic retinopathy and effect of visual loss on the patient quality of life. By knowing about the awareness level of our population we can make actionable steps for the awareness of diabetic patients at diagnosis of diabetes, screening recommendations, counselling and also to stimulate physicians/ endocrinologists for diabetic patient education which will affect the compliance, early detection of disease with the reduction in diabetic retinopathy severity, visual loss and burden on our health system. The objective of the study was to document the first presentation of severity of diabetic retinopathy, presence of macular edema, referral and the patient awareness about the risk factors of development and progression of diabetic retinopathy in our population presenting to Khyber Teaching Hospital, Peshawar.

MATERIALS AND METHODS

The study was carried out in the department of Ophthalmology Khyber Teaching Hospital, Peshawar. It was an observational study of 6 months duration. Patients were collected by consecutive convenience sampling method. All diabetic patients presented for

the first time to outpatient department of Ophthalmology with decrease vision were included in the study. Patients who were already under treatment for diabetic retinopathy were excluded from the study as they were already diagnosed and treated for retinopathy and were counselled about complications of diabetic retinopathy and risk factors for progression

Data collection: The data collection using proforma was started after taking ethical approval from the hospital IERB. Patients were selected from the outpatient department and also from institution-based practice (IBP) of Khyber teaching Hospital. Detail ocular examination was done including visual acuity, best corrected visual acuity, anterior segment examination, pupillary reactions and then dilated fundoscopy. The diabetic retinopathy was staged as per the Early Treatment of Diabetic Retinopathy Study (ETDRS) classification. The macular edema was classified as center involving diabetic macular edema if the edema is present within sub-foveal 1000 microns in ETDRS chart and non-center involving DME if edema is outside sub-foveal 1000 microns detected on optical coherence tomography (OCT). The patients were asked about their knowledge about diabetic retinopathy, its association with visual loss and the risk factors involved in its progression. The patients were also asked about their referral by treating physician or endocrinologist, barriers to treatment of diabetic retinopathy and effect of patient routine activities. All the data was recorded in a proforma.

RESULTS

A total of 340 patients were examined. Age range was from 31 years to 80 years with a mean age of 58.53 ± 10.19 years. Most of the patients were in the range of 40-60 years accounting for 53.52% of the total patients. The total number of male participants were 177 (52.05%) and female were 163 (47.94%) as shown in table 1.

Table 1. Demographic table of participants (n=340)

| Age range (Years) | Number of patients | %age | Gender | |
|-------------------|--------------------|-------|--------|--------|
| | | | Male | Female |
| 31-40 | 29 | 8.53 | 17 | 12 |
| 41-50 | 93 | 27.35 | 54 | 39 |
| 51-60 | 89 | 26.17 | 41 | 48 |
| 61-70 | 77 | 22.64 | 42 | 35 |
| 71-80 | 52 | 15.29 | 23 | 29 |
| Total | 340 | 100 | 177 | 163 |
| | | | 340 | |

At presentation 72.2% of patients were having diabetic retinopathy on their first screening, with 31.3% of patients were having mild non-proliferative diabetic retinopathy, 11.2% proliferative diabetic

retinopathy and 5.4% with advanced diabetic eye disease (ADED) as shown in table 2. Diabetic macular edema (DME) was present in 56.2% of the eyes, with centre involving 39% and 61% with non-centre involving diabetic macular edema as shown in table 3. Most of the patients were not having any awareness about the risk factors for diabetic retinopathy progression (Table 4). More than half of the patients (52.35%) presented to ophthalmologist

for decrease vision. Endocrinologist referred 19.7% of the patients for retinopathy screening, physician 12.35% and general practitioner referred only 3.52% of the patients for diabetic retinopathy screening (Table 5). The most common barriers to diabetic retinopathy screening are lack of awareness of patients about diabetic retinopathy accounting for 71.17% of patients followed by non-affordability (42.94%) as shown in the table 6. Regarding effect

Table 2. Stage of diabetic retinopathy (n=680) eyes

| Stage of diabetic retinopathy | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|-----------|---------|---------------|--------------------|
| No diabetic retinopathy | 189 | 27.8 | 27.8 | 27.8 |
| Mild non-proliferative diabetic retinopathy | 213 | 31.3 | 31.3 | 59.1 |
| Moderate non-proliferative diabetic retinopathy | 104 | 15.3 | 15.3 | 74.4 |
| Severe non-proliferative diabetic retinopathy | 61 | 9.0 | 9.0 | 83.4 |
| Proliferative diabetic retinopathy | 76 | 11.2 | 11.2 | 94.6 |
| Advanced diabetic eye disease (ADED) | 37 | 5.4 | 5.4 | 100.0 |
| Total | 680 | 100.0 | 100.0 | |

Table 3. Diabetic Macular Edema (DME) (n=680) eyes

| | | Frequency | Percent | Cumulative percent |
|--------|------------|-----------|---------|--------------------|
| DME | Ci-DME | 149 | 21.9 | 56.2% |
| | Non Ci-DME | 233 | 34.3 | |
| No DME | | 298 | 43.8 | 100.0 |
| Total | | 680 | 100.0 | |

Table 4. Awareness about risk factors for diabetic retinopathy progression (n=340)

| Risk factors | Awareness absent | Awareness present |
|---|------------------|-------------------|
| Diabetic retinopathy causes visual loss | 258 (75.88%) | 82 (24.11%) |
| Hyperglycemia | 234 (68.82%) | 106 (31.13%) |
| Hypertension | 312 (91.76%) | 28 (8.24%) |
| Hyperlipidemia | 322 (94.70%) | 18 (5.29%) |
| Duration of diabetes | 218 (64.11%) | 122 (35.88%) |
| Smoking | 286 (84.11%) | 54 (15.88%) |
| Nephropathy | 326 (95.88%) | 14 (4.11%) |
| Cataract surgery | 332 (97.64%) | 08 (2.35%) |

Table 5. Reason for retinopathy screening (n=340)

| Reasons for screening | Number of patients | Percentage |
|---|--------------------|------------|
| Referred by endocrinologists | 67 | 19.70% |
| Referred by physician | 42 | 12.35% |
| Referred by general practitioner | 12 | 3.52% |
| Visual effects due to diabetic retinopathy | 178 | 52.35% |
| Decrease vision due to diseases other than diabetic retinopathy | 72 | 21.18% |
| Knows about diabetic retinopathy screening | 52 | 15.29% |

Table 6. Barriers to diabetic retinopathy screening (n=340)

| Barriers to diabetic retinopathy treatment | Number of patients | Percentage |
|--|--------------------|------------|
| Lack of awareness about diabetic retinopathy | 242 | 71.17% |
| Non affordability | 146 | 42.94% |
| Transportation issues | 72 | 21.17% |
| Dependency | 43 | 12.64% |
| Physical disability | 32 | 9.41 |
| Facility not available in near hospital | 62 | 18.23% |
| No barriers | 48 | 14.11% |

of diabetic retinopathy 56.47% responded that it effected their life style. Day to day activities were badly affected in 38.82%. In 10.59% of the patient decrease vision effected their diabetic control due to inability to inject insulin or to make it available for themselves. Other negative effects on of diabetic retinopathy were effect on job status (13.53%), social problems (15.29%), effect on physical activities (21.17%) and psychological issue (8.23%).

DISCUSSION

Diabetic retinopathy is a common disease affecting mostly the working population in the age range from 41 to 60 years. In our study, more than half of the patients (76.16%) with diabetic retinopathy at presentation were in the age range of 41-70 years. The same observation was made by Middleton TL et al in their article that the retinopathy is more aggressive and associated with higher rate of vascular complications in young patients.¹²

Diabetic retinopathy is the most common retinal vascular disease. In developing countries where health services are meager with poor resources for treatment this disease is more vision threatening. In developing countries due to lack of health education the patients are unaware of their diabetic status and usually have advance retinopathy at first presentation.¹³ In our study we find out that 72.2% of the patients were having diabetic retinopathy at first presentation to ophthalmologists. The prevalence of diabetic retinopathy at first presentation in developing countries is variable and are in the range from 38% to 78%.¹⁴ In our study at first presentation 11.2% of patients were having proliferative diabetic retinopathy and 5% of the patients with advanced diabetic eye diseases (ADED) at which stage the patient need treatment on emergency basis to prevent permanent visual loss. Advanced diabetic eye disease is a stage when complications of proliferative diabetic retinopathy start including tractional retinal detachment, neovascular glaucoma, persistent non-resolving vitreous hemorrhage. The problem is further aggravated by the fact that in low resource countries like Pakistan the treatment option is not available everywhere and only a few hospitals can

offer the treatment to these patients with diabetic retinopathy. Avidor D et al. in their article made the same observation that in developing countries the health care facilities are not available everywhere and the patients have poor access to health care resources.¹⁵ In developing countries, the patients are unaffordable as the treatment of retinopathy is costly and out of reach for the poor patients. Diabetic macular edema is the most common cause of visual loss in diabetic patients and our study showed that 52.6% of the patients were having diabetic macular edema at presentation. The same conclusion was made by Browning DJ and Stewart MW in their article on diabetic macular edema.¹⁶ The diabetic macular edema can be centre involving or non-centre involving. Out of 52.6% of the patients having diabetic macular edema 39% were having centre involving diabetic macular edema and 61% with non-centre involving diabetic macular edema. The treatment for centre involving DME is intravitreal anti-vascular endothelial growth factors (VEGF). The most common anti-VEGF used in developing countries is bevacizumab and the world 67% of the population is dependent on this drug for ocular use.¹⁷ The cluster infections have been reported throughout the world with the use of bevacizumab including Pakistan which leads to stoppage of the drug in some parts of the country making the disease more complicated and a serious threat to vision of the diabetic patients. Despite of these circumstances the better option with the patients is prevention of the disease. We are also facing some serious challenges in the prevention of the disease. The most common reason is the awareness of diabetic patients about retinopathy. Most of the patients in our study were not aware about the risk factors responsible for the progression of diabetic retinopathy like hyperglycemia, hypertension, hyperlipidemia, smoking, nephropathy and cataract surgery. Rizwan A et al. observed in her study that lack of awareness was the leading cause of visual loss in diabetic patients in developing countries.¹⁸ Another challenge is that the primary treating physician is not referring the patients for diabetic retinopathy screening as per protocols that type II diabetic should be screened at diagnosis. Diabetic retinopathy can

be prevented or timely treated by proper screening and early detection of disease. Our study showed that endocrinologist referred only 19.70% of the patients, physician 12.35% and general practitioner 3.52%. It leads to the delayed presentation of the patients with advanced diabetic retinopathy when vision deterioration starts and the patient report to ophthalmologist. Kumar A and Agarwal D also suggested in their article that the limited knowledge of physician about diabetic retinopathy, poor referral system of patients from physician to ophthalmologist for diabetic retinopathy screening is responsible for poor control and timely treatment of diabetic retinopathy.¹⁹ In developing countries there are so many barriers to proper treatment and screening of diabetic retinopathy. In our study the main reason was health education and awareness of the patients to come for screening of diabetic retinopathy. In our study 71.17% of the patients were unaware about diabetic retinopathy screening, leading to delayed presentation of the disease. Other than awareness other reasons for delayed presentation were unaffordability, transportation issues, dependency on others family members and physical disability. The lack of awareness is not only problem of developing countries but in developed countries also faces the same problem. Reported lack of awareness about diabetic retinopathy in 73% in united states and 83% in Singapore.²⁰

The diabetic retinopathy is also affecting the day-to-day activities of the patients in 38.82% of patients, physical activities affected, social issues as the patients were unable to recognize people in social gathering, the vision also effect their diabetic control due to drugs availability and administration, with loss of jobs in some patients due to poor vision.

CONCLUSION

Health education of the patients about diabetic retinopathy is very important in developing countries to decrease burden of disease on health system with meager health resources. Along with patients treating physician and endocrinologist need to be made aware about this blinding disease for proper referral and timely management as per protocols. Its only through multidisciplinary team approach that we can combat this blinding disease.

Limitations of study: It was a single center study so in order to generalize the results, we need to carry out multi-centered studies and in different regions of the country with larger sample size.

Future plan: The cost-effective strategy for our patients is prevention of the disease through initiation and implementation of proper and rigorous screening programs throughout at the country. Pilot projects can be started first in tertiary care hospital and then extend the screening program to the district levels. Due to lack of trained human resource artificial in-

telligence is the way forward without need of human resource and many software has been approved by FDA for developing countries.

REFERENCES

1. Dugalic S, Petronijevic M, Vasiljevic B, Todorovic J, Stanisavljevic D, Jotic A. Trends of the prevalence of pre-gestational diabetes in 2030 and 2050 in Belgrade cohort. *Int J Environ Res Public Health*. 2022;19(11):6517. <https://doi.org/10.3390/ijerph19116517>
2. Azeem S, Khan U, Liaqat A. The increasing rate of diabetes in Pakistan: A silent killer. *Ann Med Surg*. 2022;79:103901. <https://doi.org/10.1016/j.amsu.2022.103901>
3. Bhutta ZA, Haq ZU, Basit A. Diabetes in Pakistan: Addressing the crisis. *Lancet Diabetes Endocrinol*. 2022;10(5):309-10. [https://doi.org/10.1016/S2213-8587\(22\)00102-4](https://doi.org/10.1016/S2213-8587(22)00102-4)
4. Akhtar H, Hassan F, Saqlain SR, Ali A, Hussain S. The prevalence of peripheral neuropathy among patients with diabetes in Pakistan: a systematic review and meta-analysis. *Sci Rep*. 2023;13(1):11744. <https://doi.org/10.1038/s41598-023-39037-1>
5. Servat OS, Hernandez C, Simo R. Diabetic retinopathy in the context of patients with diabetes. *Ophthalmic Res*. 2019;62(4):211-7. <https://doi.org/10.1159/000499541>
6. Kumar R, Rehman S, Baloch GM, Vankwani M, Somrongthong R, Pongpanich S. Effectiveness of health education intervention on diabetes mellitus among the teachers working in public sectors schools in Pakistan. *BMC Endocr Disord*. 2022;22(1):194-8. <https://doi.org/10.1186/s12902-022-01110-7>
7. McMaughan DJ, Oloruntoba O, Smith ML. Socioeconomic status and access to healthcare: Inter-related drivers for healthy aging. *Front Public Health*. 2020;8:231-4. <https://doi.org/10.3389/fpubh.2020.00231>
8. Wali AS, Rafique R, Iftikhar S, Ambreen R, Yakoob MY. High proportion of overt diabetes mellitus in pregnancy and missed opportunity of early detection of diabetes at a tertiary care center of Pakistan. *Pak J Med Sci*. 2020;36(1):S38-S43. <https://doi.org/10.12669/pjms.36.ICON-Suppl.1723>
9. Al-Shehri AM, Aldihan KA, Aljohani S. Reasons for the late presentation of diabetic retinopathy in Saudi Arabia: A survey of patients who presented with advanced proliferative diabetic retinopathy to a tertiary eye hospital. *Clin Ophthalmol*. 2022;16:4323-33. <https://doi.org/10.2147/OPHTH.S394146>
10. Piyasena PN, Murthy VS, Yip JL, Gilbert C, Zuurmond M, Peto T, et al. Systematic review on barriers and enablers for access to diabetic retinopathy screening services in different income settings. *PLoS One*. 2019;14(4):e0198979. <https://doi.org/10.1371/journal.pone.0198979>
11. Piyasena PN, Murthy VS, Yip JL, Gilbert C, Zuur-

- mond M. A qualitative study on barriers and enablers to uptake of diabetic retinopathy screening by people with diabetes in the western province of Sri Lanka. *Trop Med Health*. 2019;47:9. <https://doi.org/10.1186/s41182-019-0160-y>
12. Middleton TL, Constantino MI, Molyneaux L, Souza MD, Twigg SM, Wu T, et al. Young onset type 2 diabetes and younger current age: increased susceptibility to retinopathy in contrast to other complications. *Diabet Med*. 2020;37(6):991-9. <https://doi.org/10.1111/dme.14238>
 13. Javed A, Rehman HU. The association of elevated serum lipid with occurrence and severity of diabetic retinopathy in type II diabetics presenting in a tertiary care hospital. *J Coll Physicians Surg Pak*. 2022;32(3):401-3. <https://doi.org/10.29271/jcpsp.2022.03.401>
 14. Mohammadi M, Raiegani AAV, Jalali R, Ghobadi A, Salari N. The prevalence of retinopathy among type 2 diabetic patients in Iran: A systematic review and meta-analysis. *Rev Endocr Metab Disord*. 2019;20(1):79-88. <https://doi.org/10.1007/s11154-019-09490-3>
 15. Avidor D, Loewenstein A, Waisbourd M, Nutman A. Cost-effectiveness of diabetic retinopathy screening programs using telemedicine: a systematic review. *Cost Eff Resour Alloc*. 2020;18:16-20. <https://doi.org/10.1186/s12962-020-00211-1>
 16. Browning DJ, Stewart MW, Lee C. Diabetic macular edema: Evidence-based management. *Indian J Ophthalmol*. 2018;66(12):1736-50. https://doi.org/10.4103/ijo.IJO_1240_18
 17. Furino C, Boscia F, Reibaldi M, Alessio G. Intravitreal therapy for diabetic macular edema: An update. *J Ophthalmol*. 2021;6654168. <https://doi.org/10.1155/2021/6654168>
 18. Rizwan A, Sufyan A, Asghar A, Khan H, Ahmad B, Rabbani MH. Awareness of diabetic retinopathy among diabetic patients. *J Pak Med Assoc*. 2021;71(2):651-5.
 19. Kumar A, Agarwal D, Kumar A. Diabetic retinopathy screening and management in India: Challenges and possible solutions. *Indian J Ophthalmol*. 2021;69(3):479-81. https://doi.org/10.4103/ijo.IJO_2357_20
 20. Wong TY, Sabanayagam C. The war on diabetic retinopathy: Where are we now? *Asia Pac J Ophthalmol*. 2019;8(6):448-56. <https://doi.org/10.1097/APO.0000000000000267>

CONFLICT OF INTEREST

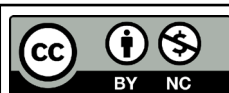
Authors declare no conflict of interest.
GRANT SUPPORT AND FINANCIAL DISCLOSURE
None declared.

AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design: IA, NG
Acquisition, Analysis or Interpretation of Data: IA, NG, BK, JH, JK
Manuscript Writing & Approval: IA, NG, BK, JH, JK

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



Copyright © 2024. Imran Ahmad, et al. This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License, which permits unrestricted use, distribution & reproduction in any medium provided that original work is cited properly.