e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2022; 14(11); 788-798

Original Research Article

Screening & Management of the Undetected & Neglected Cases of Diabetic Retinopathy in Reach-in Camp Patients in a Tertiary Care Hospital in Southern Odisha

Sarita Panda[1], Deepika Priyadarshini[2], Prativa Behera[3], Ankita Kumari[4]

[1] Associate Professor, Department of Ophthalmology, M.K.C.G Medical College & Hospital, Berhampur, Odisha, India.
[2] Senior Resident, Department of Ophthalmology, M.K.C.G Medical College & Hospital, Berhampur, Odisha, India.
[3] Postgraduate, Department of Ophthalmology, M.K.C.G Medical College & Hospital, Berhampur, Odisha, India.
[4]Postgraduate, Department of Ophthalmology, M.K.C.G Medical College & Hospital, Berhampur, Odisha, India

Received: 25-09-2022 / Revised: 23-10-2022 / Accepted: 25-11-2022
Corresponding author: Dr. Prativa Behera
Conflict of interest: Nil

Abstract

Background: A Prospective Cross-sectional study of the undetected and neglected cases of Diabetic Retinopathy was conducted for early diagnosis and timely management of the sight threatening disease.

Aim: Studying the profile of Diabetic Retinopathy, its association with various factors affecting it, and awareness about the effects of diabetes. To determine the plan for Treatment of those cases.

Materials and Methods: A Prospective Cross-sectional study was done in a tertiary care center from 1st August to 30th September 2022 of all patients attending the camp including the pre-existing diabetic retinopathy patients.

Results: Out of 200 patients attending the camp, 40% were males and 60 % were females; majority of which belong to the age group of 50-60 years. 76 new cases were diagnosed, treated and followed up.

Conclusion: Early screening for DR, early diagnosis and early treatment for Retinopathy can reduce the incidence of severe loss of vision in a high percentage of patients with DR.

Keywords: Diabetic Retinopathy, Sight Threatening Disease, Undetected, Neglected, Awareness.

Introduction

Diabetes mellitus (DM) imposes a tremendous burden on healthcare and economies worldwide. [1] Uncontrolled diabetes leads to significant macrovascular and microvascular complications. [2,3]

Diabetic retinopathy (DR) is the leading cause of visual disability in diabetics due to progressive damage to the retinal microvasculature. [4] Risk also increases the longer someone has diabetes.

Therefore, duration of diabetes also play a major role in determining the progression of DR. It can cause blindness if left undiagnosed and untreated. The early stages of diabetic retinopathy usually don't have any symptoms. Some people notice changes in their vision, like trouble reading or seeing faraway objects. These changes may come and go. Late stages may lead to gross diminution of vision and floaters. Over time, about 1 in 15 people with diabetes will develop Diabetic Macular Edema and Neovascular Glaucoma. Women who develop gestational diabetes — are at high risk for getting diabetic retinopathy; therefore dilated fundus examination is must in pregnancy. Social and economic factors have a fundamental impact on the visual prognosis of diabetic eye disease.

The Early Treatment of Diabetic Retinopathy Study (ETDRS)scale is commonly used to classify DR into two stages based on the extent of microvascular damage and ischemia. [5] These are nonproliferative diabetic retinopathy (NPDR) and the more advanced, proliferative diabetic retinopathy (PDR). [3] Fundus findings in the non-proliferative stage include microaneurysms, intraretinal hemorrhages, cotton wool spots, hard exudates, venous abnormalities, and intraretinal microvascular abnormalities. PDR is a serious condition that encompasses neovascularization of the retina, optic disc, and/or angle, and advanced eye diseases such as vitreous hemorrhage, rubeosis, and tractional retinal detachment. The ETDRS also defined clinically significant macular edema (CSME), which is caused due to vascular leakage and is a major cause of decreased vision in these patients.

NPDR can be subclassified into mild, moderate, and severe NPDR. Sight-threatening diabetic retinopathy comprises severe NPDR, PDR (including advanced diabetic disease), or Clinically Significant Macular Edema (CSME). The diagnosis of diabetic macular edema has evolved with the introduction of stereoscopic photography of the posterior pole and optical coherence tomography (OCT). The presence of any edema and clinically significant edema (CSME) by the modified EDTRS classification has been investigated in multiple hospital series and population-based studies. The introduction of intravitreal anti-VEGF drugs and corticosteroid implants revolutionized the management of DME. The variability in the rate of progression to vision-threatening retinopathy and particularly in the response to treatment was noted from the onset of clinical and epidemiological studies in diabetic patients and has been attributed to the effect of genetic predisposition together with systemic and socioeconomic factors.

The Diabetic Retinopathy Vitrectomy Study validated the superiority of vitrectomy over observation; however, despite the fact that the trial did not include patients with macula, involving traction, the visual outcome was low. Subsequent studies on vitrectomy for PDR reported that between 10 and 20% of the patients did not improve their visual acuity above hand motion or less.

The shortage of skilled human resources, including ophthalmologists, has been reported as a major challenge for the implementation of Diabetic Retinopathy Screening in India. [6] In absence of a state-run screening program for DR and its related complications, the early identification of DR is solely determined by the health-seeking behavior of the population and their knowledge and attitude toward the disease. The limited resources and unequal distribution of healthcare facilities where the majority of the centers' cluster in and around urban establishments, coupled with higher illiteracy rates deprives the rural

population of elementary health care facilities. [7,8]

It is predicted that the number of people living with Diabetes Mellitus' (PLWD) will increase to more than 700 million by the year 2045. [9] Increasing awareness about DR among diabetics is of paramount importance to ensure a prompt diagnosis, prevent vision loss due to sight-threatening retinopathy, and reduce the eventual financial burden. [10] It is already known that maintaining good metabolic control and periodic screening is crucial in the prevention of sight-threatening DR (STDR). [11-14] Involvement of the family, community, diabetic patients' organizations, and social media in patient care, adherence to treatment, prevention of physical and mental disability, and improvement of quality of life may help in the awareness of DR.

The aim of systematic diabetic retinopathy screening is to reduce the risk of vision impairment and blindness among asymptomatic people with diabetes through the prompt identification and effective treatment of sight threatening diabetic retinopathy. People who develop new symptoms of vision impairment should seek care and be managed in existing eye services as normal, not through a screening programme. However, several investigators have expressed their concerns regarding the prevalent knowledge gap among the patients as well as their treating physicians on the importance and implications of screening methods for early detection of DR. [15]

Diabetic retinopathy is a rapidly developing field. Policy-makers will need to ensure they are referring to the most up-to-date evidence and are planning a programme that can respond to changing evidence and new technology. New types of technologies, such as automated image-grading systems and hand-held cameras, are being developed alongside diabetic retinopathy screening techniques and may offer new methods for screening in the future.

Aims & Objectives

Studying the profile of Diabetic Retinopathy, its association with various factors affecting it, and awareness about the effects of diabetes on the eye in undetected & neglected cases of Diabetic Retinopathy in reach-in camp patients in a tertiary care hospital in southern Odisha. To determine the plan for Treatment of those cases.

Materials and Methods

Study Design: Prospective Cross-sectional study

Sample size: 200 patients

Inclusion Criteria: All patients attending the camp including the pre-existing diabetic retinopathy patients

Exclusion Criteria: The patients who did not give consent for participation in the study & the patients with other ocular diseases.

A detailed history was taken from all the patients. A comprehensive ocular examination was carried out which includes – Visual Acuity, Intra-Ocular Pressure, anterior & posterior segment examination. Investigations were done on the same day. Appropriate management & referral was done as per protocol.

Statistical Analysis

The statistical analysis was performed using SPSS version 22. The Student's t-test was used for comparing the normally distributed quantitative data. Chi-square test/Fisher's exact test was used for comparing the categorical data and for testing the association between different variables. $P < 0.05$ was considered statistically significant.

Results

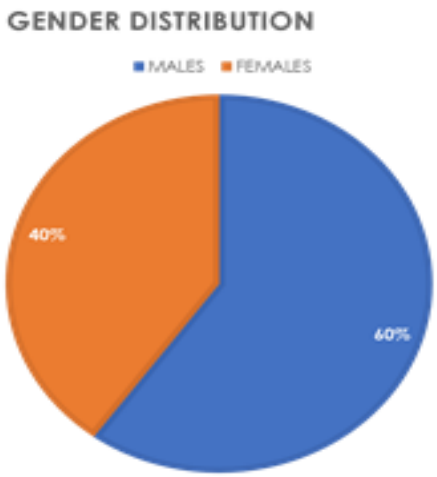

Figure 1

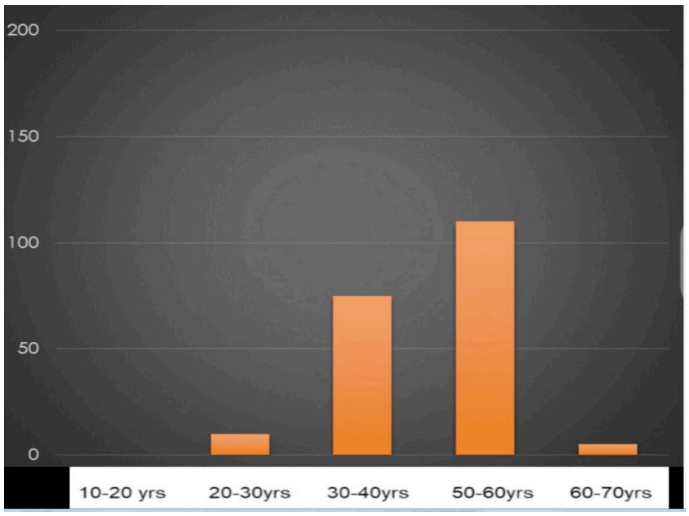

Figure 2: Age Distribution

Table 1: Baseline characteristics of patients (n=200)

Parameters	No. of patients	Males	Females
Pre-existing Diabetic:	22 {Type 1=2, Type 2=20}	16	6
Undetected diabetic cases:	76 {Type 2}	48	28
Non-diabetic:	102	79	23
Hypertension:			
Present	78	42	36
Absent	122	74	48
Pregnant females/ GDM	-		
Diabetes + hypertension:	62	46	16
Diabetes only:	36	29	7
Treatment being received:			
Insulin only	4	3	1
Combination of insulin and OHAs	6	5	1
OHAs only	12	8	4
Smoking status:			
Smokers	58	58	-
Non-smokers	142	94	48

Table 2: Clinical profile of patients with diabetes (n=98)

Features	Pre-existing cases	Newly detected cases
Diminution of vision	20	76
Mild NPDR	14	51
Moderate NPDR	8	16
Severe NPDR	-	7
PDR	-	2
Macular edema	1	4
Sub-hyaloid haemorrhage	-	1
Retinal detachment	-	1
Other diabetic complications:		
Diabetic Nephropathy	2	-
Diabetic Neuropathy	6	-

Table 3: Presenting Visual Acuity of the DR patients

Presenting Visual Acuity	Pre-existing DR	Newly detected DR
6/6-6/18	16	22
6/18-6/60	5	38
6/60-1/60	1	14
1/60-HM+	--	2

Table 4: Distribution of cases according to the duration of diabetes who are known cases of DR

Duration of diabetes	Pre-existing diabetic pts.
0-5 yrs.	11
1-5 yrs.	5
5-10 yrs.	4
10-15 yrs.	2
15-20 yrs.	1

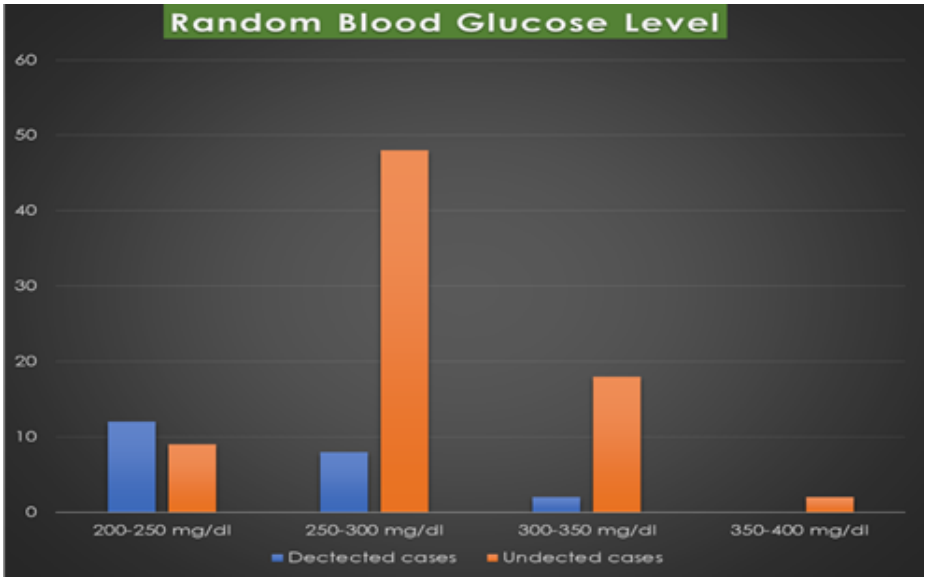

Figure 3: Distribution of cases as per Random Blood Sugar level in pre-existing as well as newly diagnosed DM patients.

(a) Moderate NPDR showing flame-shaped & dot-blot haemorrhages; (b) Moderate NPDR showing scattered hemorrhages with exudates; (c) Severe NPDR showing hemorrhages in all quadrants with a fibrotic bands present temporal to macula. An artifact is present centrally; (d) Severe NPDR with subhyaloid haemorrhage involving macula.

Figure 4: Fundus photographs of patients with Newly detected Diabetic Retinopathy, who were unaware of the effects of diabetes on the eye.

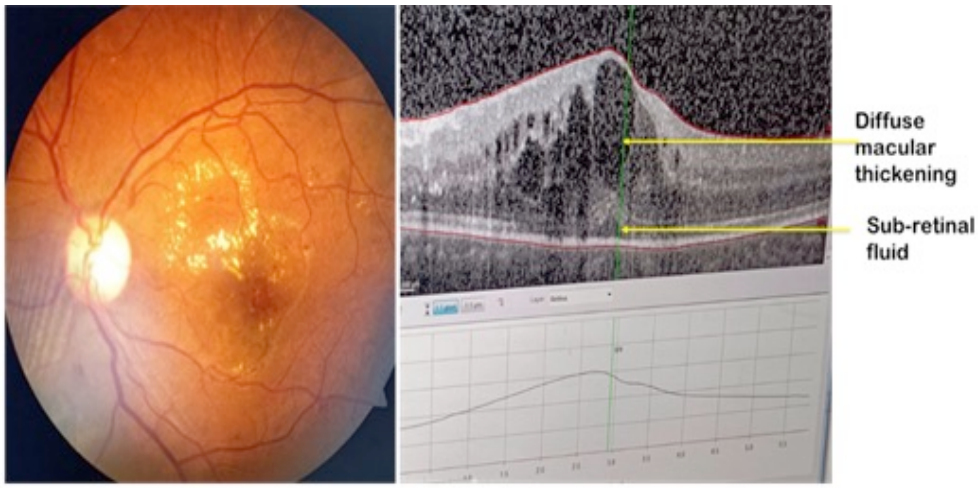

Figure 5 : Fundus photograph of Moderate NPDR with Grade 3 Diabetic Macular edema : can be correlated with OCT picture (Cental Macular T hickness= 570 µm)

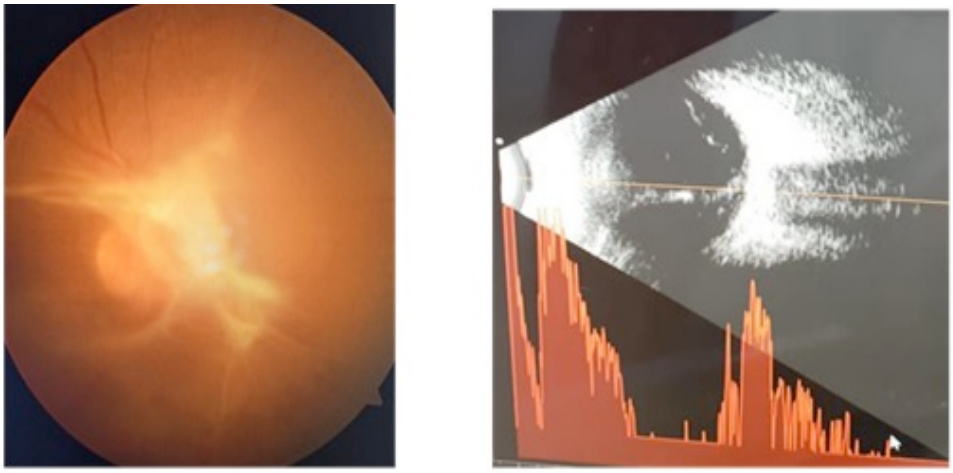

Figure 6: Fundus photograph of Retinal Detachment in a Advanced Diabetic Eye Disease patient : can be correlated with B-Scan picture showing funnel-shaped TRD.

Table 5: Management and outcome of the management after 2 months

Parameters	Treatment	Outcome after 2 months
Mild NPDR	Strict glycemic control & observation	No/ minimal progression
Moderate NPDR	Strict glycemic control & observation	Minimal progression with resolving exudates in some cases
Severe NPDR	Strict glycemic control & observation	Resolving haemorrhages & exudates in some cases
PDR	Anti-VEGF Therapy {single dose of intravitreal Ranibizumab: 0.5mg/0.1ml}	Vision improvement {1 line} & resolving haemorrhages & exudates in some cases
Macular edema	Anti-VEGF Therapy {single dose} + Nepafenac eye drop (0.1%)	Improvement in vision {2 lines} & Resolving edema
Sub-hyaloid haemorrhage	Observation + Nepafenac eye drop	Resolving haemorrhage
Retinal detachment	Referred for RD surgery	Improvement in vision {4 letters}

Table 6: Awareness of diabetic retinopathy among all patients with DM (n=98)

Can diabetes affects the eyes?	
Yes	30
No	81
Don't know	89
Do you think your diabetes in controlled?	
Yes	98
No	40
Don't know	62
Can diabetes cause blindness?	
Yes	48
No	102
Don't know	50
Do you think eye check-ups are necessary?	
Yes	52
No	89
Don't know	59

200 patients with Diabetic Retinopathy were enrolled in the study. Out of which; 80 (40%) were females and 120 (60%) were males. Majority of cases belong to age group of 50-60 years. 22 (11%) were having Pre-Existing Diabetic Retinopathy, 76 (38%) were newly detected cases and rest 102 (51%) were non-diabetic.

22 (11%) of the patients are known to have pre-existing Diabetic Retinopathy. Out of which 2 were having type 1 Diabetes Mellitus and rest 20 patients had type 2 DM. Out of 22, 16 were males and 6 were females.11 patients out of 22 had a history of DM for 0-5 years, 5 patients for 1-5 years, 4 patients for 5-10 years, 2 patients for 10-15 years and 1 for 17 years. 16 of them had visual acuity of 6/6-6/18; 5 have 6/18-6/60; 1 had visual acuity of Hand movement. 20 out of 22 cases had diminution of vision. 14 patients had mild Non-Proliferative Diabetic Retinopathy (NPDR); 8 had moderate NPDR; 1 patient had macular edema. 2 patients had a history of Diabetic Nephropathy and 6 had Diabetic Neuropathy. Random Blood glucose level of 12 patients lie in the range of 200-250mg/dl, 8 had 250-300mg/dl and 2 patients had 300-350mg/dl.

76 (38%) patients out of 200 were newly detected as Diabetic Retinopathy ;who

belong to type 2 DM and had diminution of vision. out of 76, 48 patients were males and 28 were females. 22 of them had visual acuity of 6/6-6/18 ; 38 have 6/18-6/60; 14 had 6/60-1/60; 1 had counting finger close range and 1 had visual acuity of Hand movement. Out of 76 newly detected cases; 51 patients had mild Non-Proliferative Diabetic Retinopathy (NPDR); 16 had moderate NPDR; 7 had severe NPDR; 2 had Proliferative Diabetic Retinopathy (PDR); 4 patients had macular edema; 1 had sub-hyaloid haemorrhage and 1 had retinal detachment. The random blood sugar of newly detected cases were : 8 had 200-250mg/dl, 48 had 250-300mg/dl, 18 had 300-350mg/dl and 2 had 350-400mg/dl.

Out of 200 patients; 78 (39%) patients were having hypertension { 46 males and 156 females}. 62 (31%) patients were having diabetes and hypertension {46 were males and 16 were females}. 36 (18%) were having only diabetes {29 were males and 7 were females}. 4 (2%) were on insulin. 6 (3%) on combination of insulin and oral hypoglycemic drugs. 12 (6%) on oral hypoglycemic drugs only. 58 (29%) were smokers whereas 142 (71%) were non-smokers {94 males and 48 females}.

Mild non-proliferative diabetic retinopathy cases were kept under observation with strict glycemic control and had no/ minimal progression of diabetic retinopathy after 2 months. Moderate NPDR cases were kept under observation with strict glycemic control and had minimal progression in some cases (around 30%). Severe NPDR cases also were kept under observation with strict glycemic control and had resolving haemorrhages and exudates (both hard and soft) in around 27 % cases. Proliferative Diabetic Retinopathy (PDR) cases were given Anti-VEGF therapy (Injection Intra-Vitreal Ranimizumab 0.5mg/0.1ml) and had vision improvement of 1 line in Snellen's chart and resolving haemorrhages and exudates when followed up after 3 months. Patients with Macular edema were also treated with Anti-VEGF therapy (Injection Intra-Vitreal Ranimizumab 0.5mg/0.1ml) along with eye drop Nepafenac and these patients had vision improvement of 2 lines in Snellen's chart when followed up after 3 months. patients with sub-hyaloid haemorrhage were given Nepafenac eye drops only and observed for 3 months, after which we found that haemorrhage was resolving. Patients with Retinal Detachment were referred for RD surgery and had vison improvement of 4 letters.

Knowledge attainment, patient attitude, regarding DM and DR:

A Questionnaire was being prepared to assess the awareness of Diabetic Retinopathy. out of 200, 30 (15%) knew that diabetes affects the eyes, 81 (40.5%) said diabetes didn't affect eyes. 89 (44.5%) didn't know whether eyes are affected by diabetes or not. 98 (49%) knew that diabetes can be controlled, 40 (20%) said No – diabetes cannot be controlled, 62 (31%) didn't know whether diabetes could be controlled or not. 48 (24%) knew that diabetes can cause blindness, 102 (51%) said No – diabetes cannot cause blindness and 50 (25%) didn't know whether blindness is related with diabetes or not. 52 (26%) said eye check-ups are necessary, 89 (44.5%) said No- eye check-ups are not necessary and 59 (29.5%) doesn't know whether eye check-ups are necessary or not.

Awareness that diabetes can affect eyes showed a significant association with age, gender, educational status, duration of diabetes, glycemic status, DR, and STDR ($P < 0.001$ for all). Awareness that diabetes can cause blindness showed a significant association with age, duration of diabetes, glycemic status, and DR ($P < 0.0001$ for all).

Discussion

In our study, despite a high prevalence of DR, the risk factors associated with DR & late presentation lead to complications. A significant association between DR and other diabetes complications was seen & therefore referred to endocrinologist. Duration of diabetes and poor metabolic control are established risk factors for the progression of DR that worsen with time and was also noted in our study. Our study also showed that the presence of hypertension in diabetic patients increases the risk of developing DR as well as loss of vision due to DR. This supports the findings of the UKPDS that aggressive BP control decreased the development of DR and subsequent blindness than less aggressive BP control. [16] As such, hypertension needs to be paid adequate attention in diabetic patients as its inadequate control may accelerate the rate of loss of vision due to DR. DR has been reported as an independent risk factor for cardiovascular diseases and cardiovascular mortality in previous studies. [17]

Shah et al. [18] observed DR in 65% of around 6000 diabetics, NPDR in 28.58%, and PDR in 19.51% diabetics. Risk factors for DR observed by them, such as male gender, age >40 years, smoking, hypertension, poor glycemic control, and reluctance in using insulin, were also observed in our study except for smoking. Aggarwal et al. [19] reported NPDR in 79.8% of patients and PDR in 14.6% of patients in a hospital-based study like ours. Sapkota et al. [20] observed at a specialist eye clinic in China that among the patients who significantly delayed the treatment for DR, 80% of patients had Sight Threatening DR and patients presented with late-stage retinopathy with vision loss.

Difficulty in accessing health facilities could be a major reason for the late presentation of patients with DR, besides other factors such as illiteracy, low socioeconomic status, and lack of explanation by the physician regarding the need for proper control of blood sugar. A majority of the patients belonged to the low socioeconomic group followed by the lower middle class.

A majority of patients showed a lack of awareness about diabetes complications, it is vital that patients be informed about the same during the early stages of the disease. A significant association of awareness regarding eyes being affected by diabetes with age, gender, educational status, duration of diabetes, glycemic status, DR, and STDR ($P < 0.001$ for all) is supported by another study from Jordan, which showed a significant association between awareness of DR and variables such as gender, education, literacy, and blood glucose control.[21] However, a significantly higher number of patients having awareness about the possibility of eyes being affected by diabetes in the DR group implies that these patients probably developed some awareness after having suffered from DR with or without loss of vision and not because they were more health-conscious. [22]

In our study, 90% of first-time visitors did not know whether diabetes affected eyes. Many of the diabetic patients who had earlier visited the ophthalmologist were also unaware of eye-related complications from diabetes. This reflects on the chasm between the awareness of DM and DR and also highlights the need for a more robust program to increase public awareness regarding the two entities, especially DR. The same logic applies to the presence of a higher number of diabetic patients having the awareness that diabetes can cause blindness among patients with advancing age, increasing duration of diabetes, uncontrolled glycemic status, and DR; this warrants a strong emphasis on proper control of diabetes. Therefore, promoting the awareness and knowledge regarding the development of DR due to uncontrolled diabetes among diabetic patients can help in preventing the

development of DR by motivating diabetic patients to ensure proper control of diabetes.

Conclusion

Early regular screening for DR, early diagnosis and early treatment for Retinopathy can reduce the incidence of severe loss of vision in a high percentage of patients with DR. This can be achieved only by promoting awareness and knowledge regarding diabetes and its sight-threatening complications at the community level, particularly among patients with DM. Patients should be encouraged to visit the ophthalmologist regularly according to need and as per recommendations. This can be an effective measure towards prevention of DR and can reduce the incidence of severe loss of vision.

The treating physicians, endocrinologists and ophthalmologists form a trio and play a pivotal role in supplementing information and motivating patients, which may help to reduce the disease burden in diabetic patients. General ophthalmologists must perform a dilated fundus examination for all newly diagnosed or previously diabetic patients irrespective of the presenting visual acuity.

Patient Consent

Written informed consent was taken from all patients for their participation in the study. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Treatment of all patients in M.K.C.G Medical College and Hospital, Berhampur, Odisha is borne by Odisha Government, India, and the study did not require any special funding.

References

1. American Academy of Ophthalmology. Diabetic retinopathy preferred practice pattern guideline updated 2019. Available from: https://www.aao.org/preferred-practice -pattern/ diabetic-retinopathy-ppp. [Last accessed on 2022 Jul 30].
2. Satapathy J, Minj A, Chakrabarti K, Gupta P. Knowledge, awareness and prevalence of diabetic retinopathy among patients of type 2 DM on their first visit to eye department in a tertiary health care center-A hospital-based cross-sectional study. J Evid Based Med Healthc. 2020; 7:1770–5.
3. 4. World Health Organization (WHO). International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD10) WHO Version for Internet. 2016.
4. 5. Ong GL, Ripley LG, Newsom RS, Cooper M, Casswell AG. Screening for sight-threatening diabetic retinopathy: Comparison of fundus photography with automated color contrast threshold test. Am J Ophthalmol 2004; 137:445–52.
5. Deepa M, Bhansali A, Anjana R, Pradeepa R, Joshi S, Joshi P, et al. Knowledge and awareness of diabetes in urban and rural India: The Indian Council of Medical Research India Diabetes Study (Phase I): Indian Council of Medical Research India Diabetes 4. Indian J Endocrinol Metabol. 2014; 18:379-85.
6. Gudlavalleti VS, Shukla R, Batchu T, Malladi BVS, Gilbert C. Public health system integration of avoidable blindness screening and management, India. Bull World Health Organ. 2018; 96:705-15.
7. Hamzeh A, Almhanni G, Aljaber Y, Alhasan R, Alhasan R, Alsamman MI,

et al. Awareness of diabetes and diabetic retinopathy among a group of diabetic patients in main public hospitals in Damascus, Syria during the Syrian crisis. BMC Health Serv Res. 2019; 19:549.
8. Anitha B, Sampathkumar R, Balasubramanyam M, Rema M. Advanced glycation index and its association with severity of diabetic retinopathy in type 2 diabetic subjects. J Diabetes Complications. 2008; 22:261-6.
9. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. Diabetes Res Clin Pract. 2019; 157: 107843.
10. Xie XW, Xu L, Jonas JB, Wang Y×. Prevalence of diabetic retinopathy among subjects with known diabetes in China: The Beijing Eye Study. Eur J Ophthalmol. 2009; 19:91-9.
11. Jonas JB, Nangia V, Khare A, Matin A, Bhojwani K, Kulkarni M, et al. Prevalence and associated factors of diabetic retinopathy in rural central India. Diabetes Care 2013;36: e69.
12. Gadkari SS, Maskati QB, Nayak BK. Prevalence of diabetic retinopathy in India: The All-India Ophthalmological Society Diabetic Retinopathy Eye Screening Study 2014. Indian J Ophthalmol. 2016; 64:38-44.
13. Glover SJ, Burgess PI, Cohen DB, Harding SP, Hofland HW, Zijlstra EE, et al. Prevalence of diabetic retinopathy, cataract and visual impairment in patients with diabetes in sub-Saharan Africa. Br J Ophthalmol. 2012; 96:156-61.
14. Bourne RR, Stevens GA, White RA, Smith JL, Flaxman SR, Price H, et al. Causes of vision loss worldwide, 1990-2010: A systematic analysis. Lancet Glob Health 2013;1: e339-49.
15. Raman R, Gella L, Srinivasan S, Sharma T. Diabetic retinopathy: An epidemic at home and around the world. Indian J Ophthalmol. 2016; 64:69-75.
16. UK Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. UK Prospective Diabetes Study Group. BMJ. 1998; 317:703–13.
17. Pearce I, Simó R, Lövestam-Adrian M, Wong DT, Evans M. Association between diabetic eye disease and other complications of diabetes: Implications for care. A systematic review. Diabetes Obes Metab. 2019; 21:467–78.
18. Shah K, Gandhi A, Natarajan S. Diabetic retinopathy awareness and associations with multiple comorbidities: Insights from DIAMOND study. Indian J Endocrinol Metabol. 2018; 22:30-5.
19. Aggarwal RP, Ranka M, Beniwal R, Gothwal SR, Jain GC, Kochar DK, et al. Prevalence of diabetic retinopathy in type 2 diabetes in relation to risk factors: Hospital-based study. Int J Diab Dev Ctries. 2003; 23:16–9.
20. Sapkota R, Chen Z, Zheng D, Pardhan S. The profile of sight-threatening diabetic retinopathy in patients attending a specialist eye clinic in Hangzhou, China. BMJ Open Ophthalmol. 2019;4: e000236.
21. Bakkar MM, Haddad MF, Gammoh YS. Awareness of diabetic retinopathy among patients with type 2 DM in Jordan. Diabetes Metab Syndr Obes. 2017; 10:435–41.
22. Arellano A., Arellano A., Arellano D. Gluteoplasty Implants and Lipotransfer Technique. Journal of Medical Research and Health Sciences. 2022; 5(11): 2329–2338.