

AWARENESS AND KNOWLEDGE OF DIABETIC EYE DISEASE AMONG DIABETIC PATIENTS PRESENTING TO EYE OPD IN CENTRAL INDIA

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ABSTRACT

BACKGROUND

Diabetic eye disease can lead to permanent visual impairment or blindness if medical attention is delayed. Awareness and knowledge of diabetes-related eye complications is important for early medical presentation and maximisation of visual prognosis.

The aim of the study is to study the level of awareness and knowledge of diabetic eye disease among diabetic patients presenting to eye OPD in central India.

MATERIALS AND METHODS

A hospital-based study was conducted on 300 diabetic patients presenting to eye OPD. A questionnaire was provided to the patients based on their awareness and knowledge of diabetic eye disease. On the basis of their response, answers were categorised into three groups for awareness (fully, partially and not aware) and for knowledge (good, fair and poor knowledge).

RESULTS

Out of 300, the mean age of participants was 50.3 ± 12.4 years (range 20-79 years) from which 123 (41%) were males and 177 (59%) were females. 106 (35.3%) were from rural area and 194 (64.7%) were from urban area. 164 (54.7%) were literate and 136 (45.3%) were illiterate. Maximum patients 172 (57.3%) were diabetic since last 5 years with the average duration being 5.9 ± 4.1 years. Out of 300 patients, only 89 (29.7%) were found to be fully aware and only 66 (22.0%) had good knowledge ($p < 0.001$). There was little knowledge of retinopathy risk factors or the need for routine eye examination. Most of the patients 152 (50.7%) were not advised by their physician for screening.

CONCLUSION

The present study showed that there is poor awareness and knowledge among a larger portion of the sample among the illiterate patients, patients from rural area and those who were recently diagnosed diabetics. There is therefore a need for increasing awareness about diabetes in patients and physicians and providing access to retinopathy screening services to the patients.

KEYWORDS

Awareness; Diabetic Retinopathy; Diabetes Mellitus; India; Epidemiology.

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BACKGROUND

World Health Organisation (WHO) has predicted that roughly 422 million adults were living with diabetes globally in 2014 compared to 108 million in 1980. The global prevalence of diabetes has nearly doubled since 1980 rising from 4.7% to 8.5% in the adult population.¹

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India has emerged as the diabetic capital of the world. According to the WHO, 69.2 million people were affected by Diabetes Mellitus (DM) (8.7%) in India in the year 2015.¹ This figure is estimated to rise to 79.4 million by 2030, the largest number in any nation in the world. Almost, two-third of all type 2 and all type 1 diabetics are expected to develop Diabetic Retinopathy (DR) over a period of time.²

The reported prevalence of DR in India ranges from 17.6% to 28.2%.^{3,4,5,6,7} The most recent and comprehensive study for the prevalence of DR in India was done by Salil S Gadkari et al.⁸ The prevalence reported in their study was 21.27% with a range of 12.27% in the central zone and 34.06% in the north zone. With this prevalence, the number of people with DM is expected to increase from current 69.2

million to 79.4 million and patients with DR would increase to 22.4 million in another two decades.⁹

Due to the social disease burden and subsequently the economic implication as a result of the diabetic eye disease, a high level of awareness is needed to educate diabetic patients with regards to this debilitating complication. A previous study assessing the awareness of diabetes complications in Australia found that only 37% of the diabetic population were aware of the association between diabetes and eye disease, whereas a study from the U.S.¹⁰ found that 65% of people with diabetes were aware of the association between diabetes and eye disease.¹¹ Anupama et al¹² in 2015 found only 45.3% awareness about DR and only 25.3% of the subjects had knowledge regarding the risk factors of DR.

Diabetes is rapidly increasing in our country and thus the need for awareness of diabetes and its related complications is necessary. Earlier studies.^{10,11,12} have also shown that there is paucity of awareness in the population about diabetes-related eye complications. As very little has been reported about the awareness of diabetes and its related complications among the Indian patients, thus we tried to assess the awareness level of diabetic patients in this part of the country.

MATERIALS AND METHODS

Three hundred individuals with diabetes visiting the Ophthalmological Outpatient Department of People's College of Medical Sciences and Research Centre were included in the study. The study was conducted for a duration of three months.

The following formula was used to work out the sample size.

$$n = z^2 \cdot p(1-p) / d^2$$

Where;

n=Desired sample size.

Z=Standard error of the mean, which corresponds to 95% confidence level (1.96).

P=Prevalence of condition being studied. In this case is 21.27%.

d=Precision with which p is determined (0.05).

Hence, the value of n=254. So, the desired sample size is 254, so we took 300 patients for this study.

Inclusion Criteria- Patients who were diagnosed with diabetes, those who were willing to participate and had age greater than 18 years were included in the study.

Exclusion Criteria- Patients with any systemic disorder that might hamper their cognitive functions and would prevent the patient from answering the questionnaire like poor general condition, Alzheimer's disease, senile dementia and stroke were excluded from the study. Patients who were under the age of 18 years were also excluded.

All the participants were enrolled after explaining the purpose of the study and were asked to fill the questionnaire after informed consent. Illiterate patients were explained verbally the questionnaire and the need for the study. The questionnaire focussed on the level of awareness and

knowledge of participants regarding diabetes and its related eye complications. The questionnaire was prepared after detailed literature research of previous studies on the awareness and knowledge of diabetic eye disease among diabetic patients.

This questionnaire was validated by pretesting on a sample group of a representative population. The responses were analysed to assess whether the questions were understood or not and necessary modifications were incorporated in the questionnaire accordingly.

Determinants of knowledge on diabetes and diabetic retinopathy such as age, gender, literacy and duration of diabetes were taken into consideration.

The questionnaire contained specific questions related to the awareness and knowledge regarding diabetes and its related eye complications. It was divided into two parts; first part consisted of three questions on awareness. The second part of the questionnaire consisted of six questions on knowledge.

The questionnaire is as follows-

Questionnaire-

Questions on Awareness-

1. Are you aware that diabetes directly affect the eye? Yes/No.
2. Are you aware that poorly-controlled diabetes can affect organs other than eyes? Yes/No.
3. Are you aware that diabetes can lead to permanent blindness? Yes/No.

Questions on Awareness-

1. Is your blood sugar level well controlled? Yes/No.
2. Do you know that tight control of blood sugar can delay complications? Yes/No.
3. Do you know that people having diabetes should undergo regular eye examination? Yes/No.
4. Did your physician advise you for regular eye examination? Yes/No.
5. Do you know the treatment for diabetic retinopathy is with lasers/injections? Yes/No.
6. Do you know that other diseases like hypertension, dyslipidaemia can lead to progress of diabetes? Yes/No.

The criteria set for adjudging the awareness of the patients was-

Fully aware - if he/she answered all the questions of awareness;

Partially aware - if he/she answered 1 to 2 questions correctly out of 3;

Not aware - if he/she had not answered any question correctly out of 3.

The criteria set for adjudging the knowledge of the patients was-

Good - if answered all 6 questions correctly;

Fair - if answered 3 to 5 questions correctly out of 6;

Poor - if answered 2 or less than 2 questions correctly out of 6.

All the patients consented to participate in the study. The data thus collected was statistically analysed using SPSS version 23. Along with reporting the percentages, we also analysed the data for any relationship between awareness levels and social indices like age, sex, habitat and literacy as well as relationship between awareness levels and the duration of diabetes in the subjects. For analysis, the 2 x 2 Pearson Chi-square test was applied and a 'p' value of <0.05 was taken as significant.

We strictly adhered to the guidelines of Declaration of Helsinki. The study was approved by the Institutional Ethics Committee of People's College of Medical Sciences and Research Centre (PCMS and RC), bypass road, Bhanpur, Bhopal.

RESULTS

A total of 300 patients were recruited to fill out the questionnaire. The mean age of participants was 50.3 ± 12.4 years (range 20-79 years) from which 123 (41%) were males and 177 (59%) were females. Maximum patients were from urban area 194 (64.7%) and rest were from rural area 106 (35.3%). Out of 300 patients, there were more literate patients 164 (54.7%) in our study than the illiterate patients 136 (45.3%). Maximum patients 172 (57.3%) were diabetic since the last 5 years, 79 (26.3%) who had diabetes since 6 to 10 years, 39 (13%) who had diabetes since 11 to 15 years and only 2 (0.6%) who had diabetes more than 15 years. The average duration being 5.9 ± 4.1 years (range 1 month - 20 years).

Out of 300 study subjects, 193 (64.3%) were aware that diabetes directly affects the eye, 145 (48.3%) were aware that poorly-controlled diabetes can affect organs other than eyes and 168 (56%) were aware that diabetes can lead to permanent blindness (Figure 1).

Out of 300 study subjects, 138 (46.0%) had knowledge that their blood sugar level was well controlled and 163 (54.3%) had knowledge that individuals with controlled diabetes can also have eye problems. 145 (48.3%) knew that people having diabetes should undergo regular eye examination, 152 (50.7%) were advised by their physician to get their routine eye examination and 114 (38.0%) had

knowledge that the treatment for diabetic retinopathy is with lasers/injections (Figure 2).

Out of 300 study subjects, 89 (29.7%) were fully aware, 112 (37.3%) were partially aware and 99 (33.0%) were not aware about diabetes and its eye disease (Figure 3). More number of illiterate subjects and females were not aware about this. There was statistically significant difference in the awareness regarding diabetes and its eye complications according to gender, literacy and locality among study subjects (p<0.05) (Table 1).

Out of 300 study subjects, only 66 (22.0%) had good knowledge, 89 (29.7%) had fair knowledge and most of them 145 (48.3%) had poor knowledge regarding diabetes and its eye disease (Figure 4). Knowledge was especially poor among the females and the illiterate subjects. There was statistically significant difference in knowledge regarding diabetes and its eye disease according to gender, literacy and locality among study subjects (p<0.05) (Table 2).

Among 300 study subjects, there was statistically significant difference found between the duration of diabetes and its awareness. Out of the subjects who had duration of diabetes between 0 to 5 years 71 (41.3%) were not aware, between 6 to 10 years 24 (30.4%) were not aware, between 11-15 years only 4 (10.3%) of them were not aware and in subjects having duration greater than 15 years 0 (0%) were not aware. The awareness was more in the subjects who had diabetes for a longer period than the subjects who had diabetes for a shorter period (p<0.05) (Table 3).

There was also statistically significant difference between the knowledge of the subject about the disease and the duration of diabetes. Out of the subjects who had duration of diabetes between 0 to 5 years 107 (62.2%) had poor knowledge, between 6 to 10 years 25 (31.6%) had poor knowledge, between 11-15 years only 13 (33.3%) of them had poor knowledge and in subjects having duration greater than 15 years 0 (0%) had poor knowledge. The longer the duration of diabetes, the better was the knowledge about the disease and its eye complications (p<0.05) (Table 4).

Gender	Awareness			Total	Chi-Square Value	p-Value
	Fully Aware (n=89)	Partially Aware (n=112)	Not Aware (n=99)			
Male	47 (38.2%)	38 (30.9%)	38 (30.9%)	123	7.726	0.021
Female	42 (23.7%)	74 (41.8%)	61 (34.5%)	177		
Literacy						
Literate	76 (46.4%)	68 (41.4%)	20 (12.2%)	164	83.010	0.001
Illiterate	13 (9.6%)	44 (32.4%)	79 (58.0%)	136		
Locality						
Rural	13 (12.3%)	47 (44.3%)	46 (43.4%)	106	24.257	0.001
Urban	76 (39.2%)	65 (33.5%)	53 (27.3%)	194		

Table 1. Distribution of Awareness Regarding Diabetes and its Eye Complications According to Gender, Literacy and Locality Among Study Subjects

Gender	Knowledge			Total	Chi-Square Value	p-Value
	Good (n=66)	Fair (n=89)	Poor (n=145)			
Male	25 (20.3%)	46 (37.4%)	52 (42.3%)	123	6.049	0.049
Female	41 (23.2%)	43 (24.3%)	93 (52.5%)	177		
Literacy						
Literate	46 (28.0%)	59 (36.0%)	59 (36.0%)	164	22.300	0.001
Illiterate	20 (6.7%)	30 (10.0%)	86 (28.7%)	136		
Locality						
Rural	12 (4.0%)	36 (12.0%)	58 (19.3%)	106	10.899	0.004
Urban	54 (18.0%)	53 (17.7%)	87 (29.0%)	194		

Table 2. Distribution of Knowledge Regarding Diabetes and its Eye Disease According to Gender, Literacy and Locality Among Study Subjects

Duration of Diabetes	Awareness			Total	Chi-Square Value	p-Value
	Fully Aware (n=89)	Partially Aware (n=112)	Not Aware (n=99)			
0-5 years	42 (24.4%)	59 (34.3%)	71 (41.3%)	172	35.931	0.001
6-10 years	34 (43.0%)	21 (26.6%)	24 (30.4%)	79		
11-15 years	8 (20.5%)	27 (69.2%)	4 (10.3%)	39		
>15 years	5 (50.0%)	5 (50.0%)	0 (0.0%)	10		

Table 3. Distribution of Awareness Regarding Diabetes and its Eye Disease According to Duration of Diabetes

Duration of Diabetes	Knowledge			Total	Chi-Square Value	p-Value
	Good (n=89)	Fair (n=112)	Poor (n=99)			
0-5 years	28 (16.3%)	37 (21.5%)	107 (62.2%)	172	56.131	0.001
6-10 years	30 (38.0%)	24 (30.4%)	25 (31.6%)	79		
11-15 years	8 (20.5%)	18 (46.2%)	13 (33.3%)	39		
>15 years	0 (0.0%)	10 (100%)	0 (0.0%)	10		

Table 4. Distribution of Knowledge Regarding Diabetes and its Eye Disease According to Duration of Diabetes

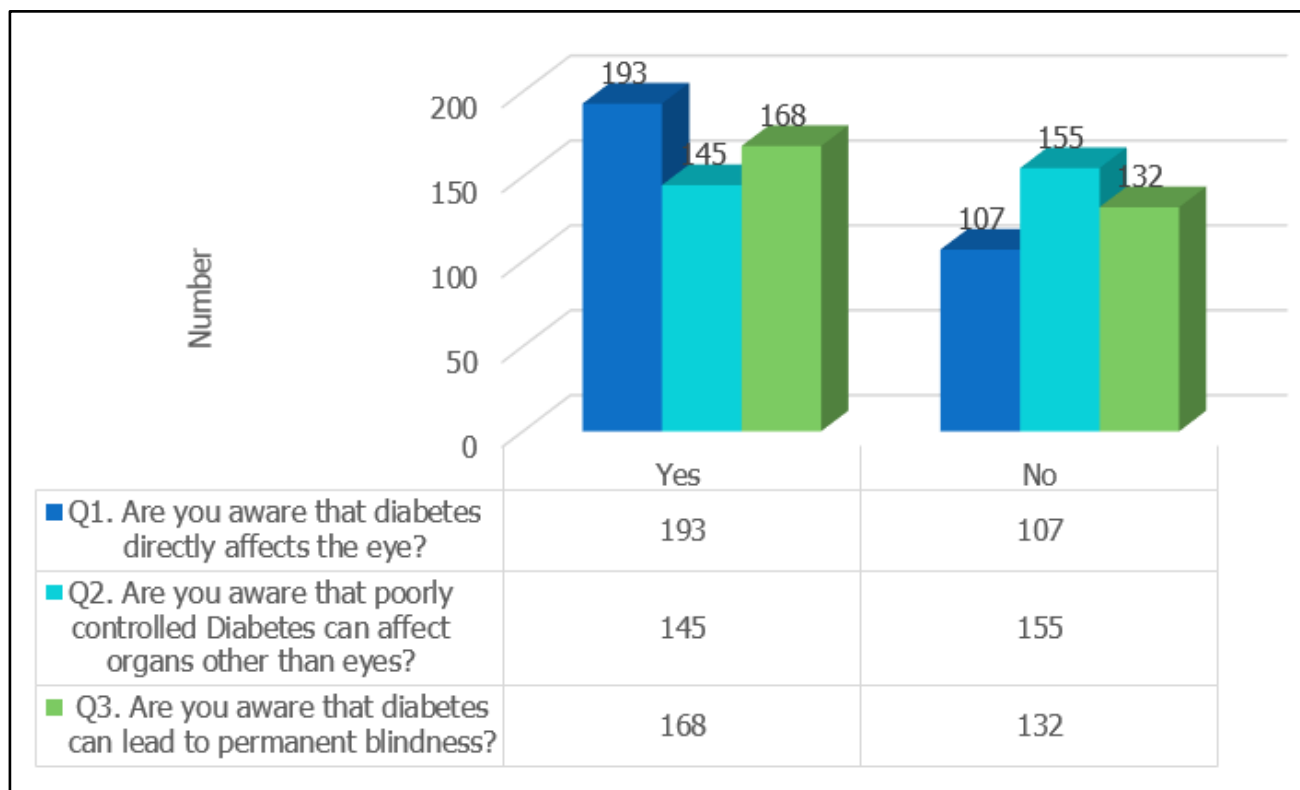


Figure 1. Frequency Distribution of Awareness Regarding Diabetes and its Eye Complications

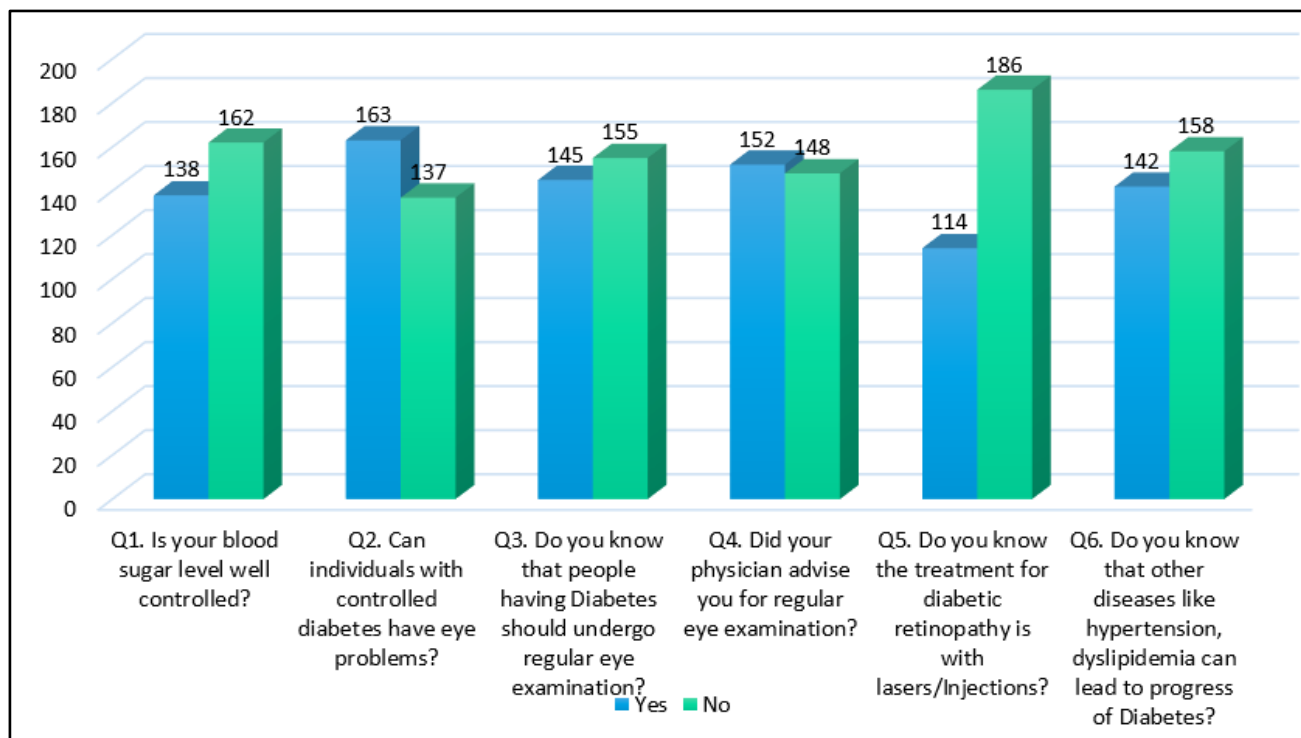


Figure 2. Frequency Distribution of Knowledge Regarding Diabetes and its Eye Complications

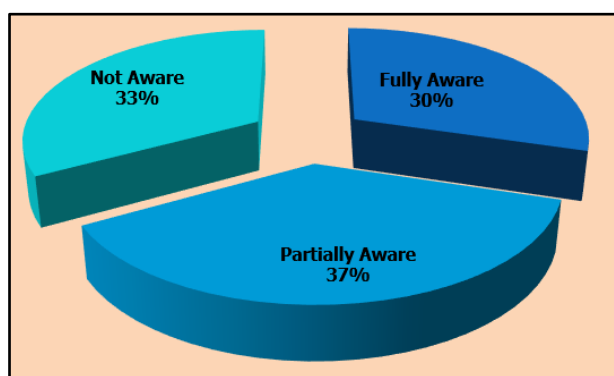


Figure 3. Distribution of Awareness Regarding Diabetes and its Eye Complications

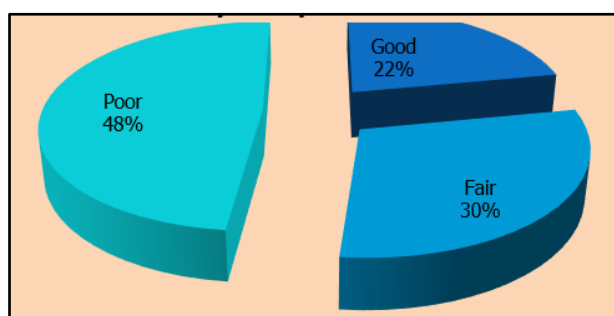


Figure 4. Distribution of Knowledge Regarding Diabetes and its Eye Complications

DISCUSSION

Prolonged duration of diabetes results in various disease associated complications, especially retinopathy. It occurs mainly as a result of ignorance of regular eye examination and poor disease control. The main objective of this study was to ascertain the awareness level and the knowledge of the people regarding diabetes and its related eye disease

keeping in mind the literacy level, locality, gender and the duration of diabetes.

In India, majority of the data published on the awareness of diabetes and its eye complications are from Southern India. As far as our knowledge, no studies had been done in the Central Zone, which made us pursue it. The results of our study found that only 29.7% of our subjects were fully aware and only 22% had good knowledge about diabetes and its related eye complications, which was comparable to other studies. Various studies have shown different findings at country and global level. Anupama et al¹² in 150 subjects found only 45.3% awareness about DR and only 25.3% of them had knowledge regarding the risk factors of DR, the importance of routine eye examination and available treatment options. In a study done in South Africa,¹³ they found that the subjects had 74.8% knowledge about diabetes and its ocular complications. Other studies reported that the level of awareness about eye complications due to DM was 72% in Oman,¹⁴ 96% in Australia,¹⁵ 52% in USA¹⁶ and 98% observed in Japan.¹⁷

Sabri et al¹⁸ assessed the awareness of diabetes mellitus among rural and urban diabetics and found the urban diabetics to be more educated about the disease. In our study, we also found a positive relationship between the locality and the level of awareness about diabetes and its eye disease ($p < 0.05$) with the urban population having 39.2% awareness as compared to 12.3% in rural and 18% knowledge as compared to 4% in rural population. This can be attributed to a number of factors like easy accessibility to both general practitioners as well as ophthalmologists in urban areas and more exposure to mass media platforms.

In our subjects, 56.4% were literate, while 43.6% were illiterate. We found significant relationship between literacy

and awareness with 46.4% literates being fully aware, while only 9.6% illiterates were fully aware. Also, literates had more knowledge with 28% as compared to 6.7% for the illiterates. Bimalka Seneviratne¹⁹ in Sri Lanka found that 49.5% literate patients had good knowledge about DR, while only 12.5% illiterate patients.

We also found significant difference between the awareness of males as compared to females in which 38.2% males were aware as compared to 23.7% females, though the knowledge of the disease was almost same. This could be due to males being more aware as they are more literate in comparison to females in India and have greater social interaction.

In our study, 64.3% were aware that diabetes directly affects the eye, which is less than the results found in Turkey²⁰ where they found that 88.1% of their subjects were aware about diabetes affecting the eye. In a study done by N Balasubramaniyam et al,²¹ the awareness among the diabetics about its effect on the eyes was 74.3%.

When they were asked whether diabetes affects organs other than eyes, only 48.3% were aware, while 56% were aware that poorly-controlled diabetes can lead to permanent blindness. N Balasubramaniyam et al²¹ concluded in their study that 76.2% were aware that diabetes has systemic complications.

According to our study, only 46% had knowledge that their diabetes was well controlled, while only 54.3% had knowledge that well-controlled diabetes can also lead to diabetic eye disease. This shows that most of the subjects did not know that controlled diabetes can also lead to retinopathy.

Routine eye check-up in diabetic patients is important. On asking whether people with diabetes should undergo regular eye check-up, only 48.3% were aware, while rest of them were unaware, which was comparable to other studies. Saikumar et al²² in their study found that 50.8% of the patients knew that routine eye check-ups were necessary in spite of good control of DM, while the rest thought that if DM is well controlled, routine eye examination is not necessary. In a study by Hussain et al,²³ they found that 75% of their subjects felt that they need to undergo frequent eye check-ups.

General practitioners and physicians are usually the first access points of the patients with DM. Only 50.7% of our subjects said that they had information from their treating doctors, while in another study reported by Murugesan et al,²⁴ only 22% subjects were informed by their physicians. Raman et al²⁵ had observed low levels of awareness among general practitioners and suggested programs for updating and training them.

When asked whether they know that diabetic retinopathy is treated with lasers/injections, only 38% had knowledge about it, while 62% were lacking it. Namperumalsamy P et al²⁶ in their study showed that over 75% of respondents were not aware of either laser or surgery as an intervention for retinopathy, which was similar to our study. Only 47.3% had knowledge that other diseases

like hypertension and dyslipidaemia may lead to progression of diabetes.

We also found significant relationship between the awareness and knowledge of the patient with the duration of the disease. Subjects having diabetes for a longer duration had more awareness and knowledge than those who had it for a shorter duration. This may be due to the increased number of visits to the physician and hence greater chances of being better aware of diabetic eye disease. In a study conducted by Bimalka Seneviratne¹⁹ in Sri Lanka, they found that 76.3% patients having diabetes for less than 5 years had poor knowledge regarding DR, while 58.5% patients having diabetes for more than 5 years had good knowledge.

Diabetes mellitus along with its complications is reasonably common in India, but the awareness about the disease in our patients is not satisfactory. The awareness levels regarding different aspects of diabetes and Diabetic Retinopathy (DR) in our study were considerably less, accentuating the need for better strategies to improve the same.

We found that most of the patients in our study were inadequately informed by their treating physicians regarding the different aspects of diabetic retinopathy. We also found that less number of people were adequately aware about the need for an annual fundus examination and the treatment modalities for DR. This leads to the fact that a positive intervention on the part of the physician to prevent DR would in fact be a big step forward in decreasing the prevalence of diabetic retinopathy.

Limitation of the Study

The major limitation of this study is that it has been conducted in a single referral center, which involves patients attending an eye care facility and therefore may not be representative of the entire population.

CONCLUSION

We would like to suggest stronger and more intensive programmes right from the physician to the ophthalmologist for not only increasing the awareness concerning diabetic retinopathy, but also improving the patients' attitude in order to decrease the prevalence of diabetic retinopathy among the diabetics.

REFERENCES

- [1] World Health Organisation. Global report on Diabetes. Geneva: WHO 2016.
- [2] Guidelines for the comprehensive management of diabetic retinopathy in India. A VISION 2020 the Right to Sight India Publication 2008.
- [3] Raman R, Rani PK, Racheppalle SR, et al. Prevalence of diabetic retinopathy in India: Sankara Nethralaya diabetic retinopathy epidemiology and molecular genetics study report 2. *Ophthalmology* 2009;116(2):311-318.

- [4] Rema M, Premkumar S, Anitha B, et al. Prevalence of diabetic retinopathy in urban India: the Chennai Urban Rural Epidemiology Study (CURES) eye study, I. Invest Ophthalmol Vis Sci 2005;46(7):2328-2333.
- [5] Namperumalsamy P, Kim R, Vignesh TP, et al. Prevalence and risk factors for diabetic retinopathy: a population-based assessment from Theni District, south India. Postgrad Med J 2009;85(1010):643-648.
- [6] Narendran V, John RK, Raghuram A, et al. Diabetic retinopathy among self-reported diabetics in Southern India: a population based assessment. Br J Ophthalmol 2002;86(9):1014-1018.
- [7] Dandona L, Dandona R, Naduvilath TJ, et al. Population based assessment of diabetic retinopathy in an urban population in southern India. Br J Ophthalmol 1999;83(8):937-940.
- [8] 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(1):38-44.
- [9] Agrawal RP, Ranka M, Beniwal R, et al. Prevalence of diabetic retinopathy in type 2 diabetes in relation to risk factors: Hospital based study. Int J Diabetes Dev Ctries 2003;23:16-19.
- [10] Livingston PM, Wood CA, McCarty CA, et al. Awareness of diabetic retinopathy among people who attended a diabetic retinopathy screening program. Med J Aust 1998;169(2):117.
- [11] Merz CN, Buse JB, Tuncer D, et al. Physician attitudes and practices and patient awareness of the cardiovascular complications of diabetes. J Am Coll Cardiol 2002;40(10):1877-1881.
- [12] Shetgar AC, Patil B, Salagar MC, et al. Assessment of awareness of diabetic retinopathy among diabetics: a clinical survey. Indian Journal of Clinical and Experimental Ophthalmology 2015;1(4):260-263.
- [13] van Staden D, Deutshmann LP, Ganas S, et al. Knowledge of diabetes mellitus and its ocular complications amongst diabetic patients attending private and public hospitals in eThekweni municipality, KwaZulu-Natal province, South Africa. Afr Vision Eye Health 2015;74(1):1-6.
- [14] Khandekar R, Harby SA, Harthy HA, et al. Knowledge, attitude and practice regarding eye complications and care among Omani persons with diabetes - a cross-sectional study. Oman J Ophthalmol 2010;3(2):60-65.
- [15] Schmid KL, Schmid LM, Pedersen C. Knowledge of the ocular effects of diabetes among the general population of Australia and the members of diabetes Australia. Clin Exp Optom 2003;86(2):91-103.
- [16] Muñoz B, O'Leary M, Fonseca-Becker F, et al. Knowledge of diabetic eye disease and vision care guidelines among Hispanic individuals in Baltimore with and without diabetes. Arch Ophthalmol 2008;126(7):968-974.
- [17] Funatsu H, Hori S, Shimizu E, et al. Questionnaire survey on periodic ocular examination in Japanese diabetic patients. Am J Ophthalmol 2003;136(5):955-957.
- [18] Sabri AA, Qayyum MA, Saigol NU, et al. Comparing knowledge of diabetes mellitus among rural and urban diabetics. McGill J Med 2007;10(2):87-89.
- [19] Seneviratne B, Prathapan S. Knowledge on diabetic retinopathy among diabetes mellitus patients attending the Colombo south teaching hospital, Sri Lanka. Journal of US-China Medical Science 2016;13:35-46.
- [20] Cetin EN, Zencir M, Fenkci S, et al. Assessment of awareness of diabetic retinopathy and utilization of eye care services among Turkish diabetic patients. Prim Care Diabetes 2013;7(4):297-302.
- [21] Balasubramaniyan N, Ganesh KS, Ramesh BK, et al. Awareness and practices on eye effects among people with diabetes in rural Tamil Nadu, India. Afri Health Sci 2016;16(1):210-217.
- [22] Saikumar SJ, Giridhar A, Mahesh G, et al. Awareness about eye disease among diabetic patients: a survey in south India. Community Eye Health 2007;20(61):16-17.
- [23] Hussain R, Rajesh B, Giridhar A, et al. Knowledge and awareness about diabetes mellitus and diabetic retinopathy in suburban population of a south Indian state and its practice among the patients with diabetes mellitus: a population-based study. Indian J Ophthalmol 2016;64(4):272-276.
- [24] Murugesan N, Snehalatha C, Shobhana R, et al. Awareness about diabetes and its complications in the general and diabetic population in a city in southern India. Diabetes Res Clin Pract 2007;77(3):433-437.
- [25] Raman R, Paul PG, Padmajakumari R, et al. Knowledge and attitude of general practitioners towards diabetic retinopathy practice in south India. Community Eye Health 2006;19(57):13-14.
- [26] Namperumalsamy P, Kim R, Kaliaperumal K, et al. A pilot study on awareness of diabetic retinopathy among non-medical persons in south India. The challenge for eye care programmes in the region. Indian J Ophthalmol 2004;52(3):247-251.