The All India Ophthalmological Society - Academic and Research Committee pan-India diabetic retinopathy project “Fixing the missing link”: Prevalence data from Madhya Pradesh and Chhattisgarh

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Purpose: To determine the prevalence of diabetic retinopathy (DR) and its risk factors among diabetic patients in the states of Madhya Pradesh (MP) and Chhattisgarh (CG). Methods: Diabetic patients were screened in the treating diabetologist/physician’s clinic by a team that included an ophthalmologist, an optometrist, and a counselor. Demographic details, diabetic control, compliance to eye checkup, awareness regarding diabetic blindness, and visual acuity were recorded using a questionnaire. DR was graded both by indirect ophthalmoscopy and fundus photo taken with a portable fundus camera. Results: In total, 602 subjects were screened across five selected locations of MP and CG. The prevalence of DR was 13.62%. No significant difference with gender was seen. The presence and grade of DR were related to age, diabetic age, and diabetic control. Conclusion: This study provides the prevalence data for DR among diabetic patients from the states of MP and CG and highlights important barriers to DR screening in our country.

Key words: Diabetic retinopathy, prevalence, risk factors

Diabetic retinopathy (DR) is one of the most dreaded complications of diabetes mellitus (DM) and is the leading cause of visual impairment and blindness among the working-age population all over the world.\(^1\,^2\) Although the prevalence of DR among diabetics in India is lower than that in western countries, the sheer number of people affected by DM makes it a major health concern in our country. Most of the DR prevalence studies in India have been done in the southern Indian population, while very limited literature is available from central India.\(^3\,^4\)

The Pan India Diabetic Retinopathy Project named “Fixing the Missing Link” was envisioned by the Academic and Research Committee (ARC) of the All India Ophthalmological Society (AIOS) in association with the Vitreo Retina Society of India (VRSI) to gather DR prevalence data from different parts of the country and to promote an association between treating diabetologists or physicians (TDP) and ophthalmologists.

The methodology of the project has been previously described in our study from West Bengal,\(^5\) here, we present prevalence data from the states of Madhya Pradesh (MP) and Chhattisgarh (CG).

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Methods

The objective of the study was to determine the prevalence of DR and its various risk factors among the diabetic population in MP and CG. A total of five locations (Bhopal, Gwalior, Khargaon, Raipur, and Bilaspur) were selected for the study.

In short, the study methodology included conducting screening camps in association with the TDP either at their own clinic or organized by them elsewhere. On the day of the camp, a team consisting of an ophthalmologist, an optometrist, and a counselor visited the campsite to collect the data. All patients with a known history of DM were included in the study. Patients with significant media opacity where fundus evaluation was not possible were excluded.

The counselor filled in a questionnaire containing demographic details, pertinent history of DM, and ophthalmological complaints, if any. Diabetes mellitus age (or DM age), patient’s diabetic control, and awareness regarding DM as a possible cause of blindness were enquired. Last eye checkup was noted which must have included retinal screening.

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The optometrist recorded the best-corrected distance visual acuity (BCDVA) by using Snellen’s distance vision chart. The on-field ophthalmologist examined the fundus with an indirect ophthalmoscope and recorded DR grading. Simultaneously, a fundus photograph was taken using the fundus-on-phone non-mydriatic camera (Remidio Innovative Solutions Pvt Ltd, Bangalore, India). The fundus photographs taken by the camera were later analyzed by a retina specialist, and DR grading was noted for each eye, masked to the on-field ophthalmologist’s grading. Images that were defocused or did not adequately represent the posterior pole area were excluded as being “ungradable.” DR was graded according to the International Classification of Diabetic Retinopathy and Diabetic Macular Edema given by the International Council of Ophthalmology (ICO).[31]

Statistical analysis was done using statistical software R version 3.6. Statistical tools used were Pearson’s Chi-squared test, test for equality of proportions, Fisher’s exact test for count data, Spearman’s rank correlation test, multiple logistic regression, and Kaplan–Meier survival estimates. P < 0.05 was considered to be significant.

**Results**

A total of nine camps were conducted over five locations (four urban and one rural) in MP and CG from June 2019 to September 2019. A total of 602 subjects were included for study purposes, which included 58.64% males and 41.36% females. Demographic details are mentioned in Table 1.

Prevalence of DR in our study was 13.62%, with mild NPDR constituting 5.32%, moderate NPDR 6.15%, severe NPDR 0.83%, and PDR 1.33%. Prevalence of DR went up significantly with age (P = 0.03), DM age (P < 0.01), and loss of control of systemic disease (P = 0.02). No significant difference was found with gender (P = 0.92), area (P = 0.42), last eye checkup (P = 0.13), and DM awareness (P = 0.18) [Table 2]. Severity of DR was significantly correlated with age (r = -0.13, P = 0.001), DM age (r = 0.2, P < 0.01), noncompliance to yearly eye checkup (r = -0.09, P = 0.03), loss of DM control (r = 0.12, P = 0.004), and loss of BCDVA (r = -0.28, P < 0.01) [Table 3].

Control of DM over the last 3 months was variable, with 32.39% having well-controlled disease, 36.71% having moderately uncontrolled disease, and 30.9% having severely uncontrolled disease. Control of DM was found to be much better in urban areas (34.27%) as compared to rural areas (18.31%) (P = 0.0035).

Severely uncontrolled systemic disease was significantly higher with age (P = 0.03) and DM age (P = 0.001). No difference was seen between males and females (P = 0.18).

Further, 79.24% of subjects screened were aware of DM as a cause of blindness, while 20.76% had never been informed about it. There was no statistically significant difference in the level of awareness between males and females (P = 0.29). Level of awareness also increased significantly with DM age (P = 0.04).

Moreover, 51.99% of subjects did not have a comprehensive eye checkup in the last 1 year, of which 32.23% had either never had an eye checkup since DM detection or did not have it since more than 5 years. A significant negative correlation was seen between the level of awareness and duration since the last checkup (r = -0.20, P = 0.0001). No comprehensive eye checkup since more than 5 years or since DM detection was significantly higher among subjects having no awareness of DM blindness (48.8% vs. 27.88%). The duration of last checkup did not vary significantly between males and females (P = 0.06).

Compliance to yearly eye checkup went significantly up as age (r = -0.16, P < 0.01) and DM age increased (r = -0.14, P < 0.01).

Loss of BCDVA was significantly correlated to DM age (r = 0.14, P = 0.0004), age of the patient (r = 0.3, P < 0.01), and severity of DR (P < 0.01). Percentage of subjects with good visual acuity (VA) was significantly higher in urban areas (68.17% vs. 35.21%, P < 0.01, r = -0.19). Subjects who exhibited good control of DM had better VA (71.79%) when compared to those who had moderately uncontrolled (63.8%) or severely uncontrolled disease (56.99%) (P = 0.01, r = 0.11). Loss of VA was significantly higher for those who did not have yearly eye checkup (r = -0.12, P = 0.002). Again, there was no significant variation between males and females (P = 0.34).

| Characteristics | Number (%) |
|-----------------|------------|
| **Area**        |            |
| Rural           | 71 (11.79%)|
| Urban           | 531 (88.21%)|
| **Sex**         |            |
| Male            | 353 (58.64%)|
| Female          | 249 (41.36%)|
| **Age (Years)** |            |
| <40             | 44 (7.31%)  |
| 40-50           | 145 (24.09%)|
| 50-60           | 203 (33.72%)|
| 60-70           | 174 (28.9%) |
| ≥70             | 36 (5.98%)  |

| DR (n (%)) | P       |
|-----------|---------|
| Sex       |         |
| Male (n=353) | 49 (13.88%) | 0.9199 |
| Female (n=249) | 33 (13.25%) |
| Area      |         |
| Rural (n=71) | 7 (9.86%) | 0.4238 |
| Urban (n=531) | 75 (14.12%) |
| DM Age (Years) |         |
| <5 (n=261) | 17 (6.51%) | <0.01 |
| 5-10 (n=167) | 29 (17.37%) |
| 10-15 (n=79) | 12 (15.19%) |
| 15-20 (n=46) | 12 (26.09%) |
| ≥20 (n=46) | 19 (41.30%) |
| DM Control |         |
| Well-controlled DM (n=195) | 17 (8.72%) | 0.02416 |
| Moderately Uncontrolled DM (n=221) | 31 (14.03%) |
| Severely Uncontrolled DM (n=186) | 34 (18.28%) |

### Table 1: Demographic characteristics of study (n=602)

### Table 2: Diabetic retinopathy prevalence in different groups
Discussion

Madhya Pradesh is the second-largest and fifth-most populous state in India.\(^{[22]}\) The prevalence of DM in MP, specifically the Gwalior–Chambal region has been recorded to be 11.4% in a 2019 study.\(^{[23]}\) DR is currently the leading cause of visual impairment and blindness among the working-age population globally.\(^{[2]}\)

Numerous studies have been done in the past to estimate the prevalence of DR in states of southern and western India, while three major pan-India DR prevalence studies have been done.\(^{[3‑19]}\) Prevalence rates of DR among the diabetic population vary from 10.3% to 26.8% in population-based studies, while in ophthalmological clinic-based studies, it ranges from 21.7% to 34.1%. Our previous study from West Bengal showed the prevalence to be 21.51%,\(^{[20]}\)

Till now, prevalence data for DR has been insufficient from central India. The only data available is from the AIOS 2014 study, which reported the prevalence of DR in the central zone to be 12.27%.\(^{[11]}\) The prevalence of DR in our study was found to be 13.62%.

The present study reiterates the findings of our WB study, bringing to light several interesting risk factors for DR among diabetic patients [Table 4]. A fifth of the patients screened (20.76%) remained unaware that uncontrolled DM can be a cause of blindness. The awareness increased substantially as their DM age increased, highlighting the need to educate young diabetics about the long-term complications of DM.

Prevalence and severity of DR, awareness regarding diabetic eye disease, compliance to eye checkup, and duration since last checkup 

Table 3: DM age and Control of DM wise Severity of DR

| DM Age (Years) | Mild NPDR | Moderate NPDR | Severe NPDR | PDR |
|---------------|-----------|---------------|-------------|-----|
| <5 (n=261)    | 7 (2.68%) | 6 (2.3%)      | 1 (0.38%)   | 3 (1.15%) |
| 5-10 (n=167)  | 10 (5.99%)| 17 (10.18%)   | 1 (0.6%)    | 1 (0.6%) |
| 10-15 (n=79)  | 6 (7.59%) | 5 (6.33%)     | 1 (1.27%)   | 0 (0%)   |
| 15-20 (n=46)  | 5 (10.87%)| 4 (8.7%)      | 2 (1.27%)   | 2 (4.35%) |
| 20-25 (n=31)  | 3 (9.68%) | 3 (9.68%)     | 1 (3.23%)   | 2 (6.45%) |
| ≥25 (n=15)    | 1 (6.67%) | 2 (13.33%)    | 0 (0%)      | 0 (0%)   |

DM Control

| Well Controlled DM (n=195) | 8 (4.1%) | 6 (3.08%) | 2 (1.03%) | 1 (0.51%) |
|---------------------------|---------|-----------|-----------|-----------|
| Moderately Uncontrolled (n=221) | 15 (6.79%) | 15 (6.79%) | 1 (0.45%) | 0 (0%)    |
| Severely Uncontrolled DM (n=186) | 9 (4.84%) | 16 (8.6%) | 2 (1.08%) | 7 (3.76%) |

DM - Diabetes mellitus; DR - Diabetic retinopathy; NPDR - Non-proliferative diabetic retinopathy; PDR - Proliferative diabetic retinopathy

Table 4: Correlation of various risk factors and their impact on DR

| Variables | Correlation coefficient (r) | P     | Remarks | Inference |
|-----------|----------------------------|-------|---------|-----------|
| Age and time since last eye check-up | -0.1641 | 5.24e-05* | Significantly Negative | More frequent checkup at older age |
| DM awareness and time since last eye check-up | -0.2048 | 4.015e-07* | Significantly Negative | More frequent checkup with better DM awareness |
| Urbanization and loss of vision | -0.1933 | 1.77e-06* | Significantly Negative | More Loss of vision in Rural areas than Urban |
| Age and loss of vision | 0.3072 | 1.27e-14* | Significantly Positive | More Loss of vision at older age |
| Time since last eye check-up and loss of vision | -0.1237 | 0.0024* | Significantly Negative | More Loss of vision with less frequent eye checkup |
| Loss of DM control and loss of vision | 0.1182 | 0.0037* | Significantly Positive | More Loss of DM control leads to greater loss of vision |
| Age and DR severity | 0.1301 | 0.0014* | Significantly Positive | Higher grade of DR seen with older age |
| Time since last eye check-up and DR severity | -0.0886 | 0.0297* | Significantly Negative | More frequent eye checkup leads to lesser severity of DR |
| Loss of DM control and DR severity | 0.1165 | 0.0042* | Significantly Positive | More Loss of DM control leads to higher grades of DR |
| Severity of DR and loss of vision | 0.2806 | 2.37e-12* | Significantly Positive | More severe DR leads to more loss of vision |
| DM age and loss of DM control | 0.1946 | 1.56e-06* | Significantly Positive | Higher DM age leads to more loss of DM control |
| DM age and time since last eye check-up | -0.1354 | 0.00088* | Significantly Negative | Higher DM age associated with more frequent eye checkup |
| DM age and loss of vision | 0.1444 | 0.00039* | Significantly Positive | Higher DM age leads to more loss of Vision |
| DM age and severity of DR | 0.2043 | 4.49e-07* | Significantly Positive | Higher DM age leads to more severe DR |

DR - Diabetic retinopathy; DM - Diabetes mellitus
eye checkup were all found to be similar among both the sexes in our study in rural as well as urban areas. This is similar to the global META-EYE analysis,\textsuperscript{[21]} as well as our previous findings from the WB study.\textsuperscript{[20]}

In our study, more than half (51.99\%) of the patients had not had an eye checkup within the last year. ICO recommends eye checkups with retinal screening for all diabetic patients at least once in 1–2 years.\textsuperscript{[21]} This highlights the fact that diabetic patients in these states remain unaware of the benefits of screening and early disease detection. Thus, ophthalmologists encounter these patients with more advanced levels of diabetic eye disease, where vision salvage becomes difficult. If the war against DR has to be won, it is imperative that the battle be started early, whereby prevention of vision loss can be achieved.

Because all patients recruited in our study were known diabetics seeking treatment under a TDP, the findings become even more relevant. The question which arises is, what makes these patients more vigilant in monitoring their DM but averse to a more non-invasive eye checkup to save their precious vision? A review of literature helps to identify the barriers to DR screening in these patients. A survey among ophthalmologists revealed that the most important barrier was the lack of awareness among patients about the significance of regular eye screening.\textsuperscript{[25]} It is reported that more than half of patients report to an ophthalmologist after vision loss has already set in.\textsuperscript{[20]}

The DR Barometer phase II study further probed physicians and diabetologists regarding their perspective on low DR screening among their patients.\textsuperscript{[23]} More than one-third of the physicians accepted that they did not discuss eye screening with their patients on a regular basis. Only 22\% of them reported that the patient education material they had with them contained adequate information about diabetic eye disease and its prevention.

In a recently published online questionnaire-based study from India, physicians identified lack of compliance, no ocular symptoms, time constraint for the patient, and lack of motivations as the main patient-related barriers for DR screening. The preferred practice pattern of physicians for referral for DR screening was dependent on the duration of the disease and severity of the systemic disease.\textsuperscript{[27]}

Equally concerning was the data that over two-thirds of ophthalmologists did not adequately discuss management of DM or hypertension with their patients, which can directly impact the management of diabetic eye disease they were treating. Diabetologists also identified a lack of feedback from their ophthalmologist colleagues and a lack of referral system as an important barrier.\textsuperscript{[25,28]}

The patients, on the other hand, identified the following as barriers to eye checkup: long waiting time to schedule an appointment with a specialist, financial barriers, long waiting time on the day of checkup, lack of adequate facilities in their areas, cost of travel, disparity in urban and rural services, lack of family support, long and complicated referral process, lack of motivation for checkup in the absence of symptoms, and misconceptions or lack of awareness regarding the importance of asymptomatic screening.\textsuperscript{[25,28,30]}

A recent study performed on sight-threatening diabetic retinopathy (STDR) patients at a tertiary eye care center in Central India probed the reasons for delayed presentation with relation to their knowledge, attitudes, and practices (KAP) regarding DM and DR. It was seen that the STDR changes were more prevalent in patients with lower educational qualification. One of the main reasons for poor compliance for undergoing a dilated fundus examination by the ophthalmologist was that the patients did not feel the need because they continued enjoying good vision.\textsuperscript{[29]}

All these factors need to be taken into consideration, and “fixing the missing link” between TDPs and ophthalmologists has become a necessity. As the findings of the project come to the fore, we feel it is essential for robust DR awareness programs to be drawn up, targeting the young diabetic population to prevent the epidemic of DR blindness that India is standing on the verge of today.

Limitations of our study include small sample size, heterogenous rural-urban representation, not classifying patients into type 1 and type 2 DM, and not being able to assess inter-observer variability between the various on-field ophthalmologists. The study included only those subjects who were aware of their diabetic status; thus, it may not be a true representation of the general population.

Conclusion

The prevalence of DR among known diabetics in MP and CG was found to be similar to previous data available from central India and lower than the prevalence in WB as seen in our previous study. The study highlights the low awareness regarding diabetic blindness and low uptake of DR screening, particularly among the young diabetic population. “Fixing the missing link” between TDPs and ophthalmologists remains the need of the hour to address this grim situation.

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Conflicts of interest

There are no conflicts of interest.

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