

Ocular Manifestations in Patients with Type 2 Diabetes Mellitus: Relationship with duration and severity of the Disease

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Abstract:

Background: Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by hyperglycemia. Ocular manifestations are among the most common and debilitating complications of T2DM

Objective: The objective of this study is to find out different ocular manifestations in patients with Type 2 Diabetes Mellitus of a duration of 0 - 5 years and its relation with the duration and severity of the disease.

Methods: A prospective observational study of ocular manifestations in patients with Type 2 Diabetes Mellitus (T2DM) of duration 0-5 years attending tertiary care center, Bhubaneswar for 12 months. Detailed history, complete ocular examination, and relevant investigations were done on 560 eyes of 280 patients.

Results: Out of 280 patients evaluated 130 (46.42%) were male and 150 (53.57%) were female. The most common ocular manifestation was cataract 121 (21.6%), followed by Diabetic retinopathy 48(8.57%), POAG 6(1.07%), Diabetic papillopathy 4(0.7%), BRVO 2(0.3%), 3rd Nerve palsy(0.3%). The most common type of cataract found was posterior subcapsular cataract 12(44.4%) among patients of T2DM of duration less than one year, nuclear type 64% among patients of T2DM of duration 1 to 5 years.

Conclusion: These ocular findings suggest that an annual eye examination should initiated at the time of diabetes diagnosis, as it will help reduce visual morbidity.

Keywords: Type 2 Diabetes Mellitus, Duration 0 - 5 Years, Ocular Complications, Cataract, Diabetic Retinopathy, Diabetic Papillopathy.

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Introduction

According to WHO November 2024 report the number of people living with Diabetes Mellitus in 2022 is 830 million worldwide. Prevalence has been rising more rapidly in low- and middle-income countries. [1] The Indian Council of Medical Research - India Diabetes (ICMR-INDIAB) 2023 study shows the prevalence of Diabetes in India 11.4% among individuals aged 20 years and above. [2] According to the International Diabetes Foundation (IDF) 8.8% of the adult population have diabetes, with men having a slightly higher rate (9.6%) than women. [3] Current global statistics show that 463 million and 374 million individuals have diabetes and impaired glucose tolerance (IGT) a prediabetic condition. These are estimated to increase million people with IGT by 2045, which represents a 51% increase compared to 2019.[3] Type 2 Diabetes, which constitutes 90% of all cases of diabetes, earlier considered to be a disease of affluent Western countries, has now spread globally and has become a major cause of disability and affects even younger age groups. [3] The manifestation of DM is

progressive, resulting from chronically high blood levels of glucose caused by impairment in insulin metabolism such as carbohydrate, lipid, protein, and nucleic acid. [4] Chronic complications of DM are caused largely by hyperglycemia-induced cellular molecular impairment of neural and vascular structure and function. Hyperglycemia-induced neuropathy and angiopathy in them may lead to dysfunction of cells, tissue, and organ systems. [5] Diabetic retinopathy may be the most common microvascular complication of diabetes. It is responsible for nearly 10,000 new cases of blindness every year in the United States alone. [6] The risk of developing diabetic retinopathy or other microvascular complications depends on both the duration and severity of hyperglycemia. Development of Diabetic retinopathy in patients with type 2 Diabetes was found to be related to both the severity of hyperglycemia and the presence of hypertension in a UK prospective study. [7] Retinopathy may begin to develop as early as 7 years before the diagnosis of diabetes in patients of type 2 DM.[8] Skyler et al have

demonstrated that HbA1c level correlates in direct relationship with relative risk of diabetic microvascular complication. [8] The burden of blindness due to diabetic retinopathy can be ameliorated by intervening at an early stage of Diabetic retinopathy. [9] An appropriate strategic model needs to be developed with the available cost-effective early screening method. [9] The national program of control blindness in India suggests opportunistic screening for early identification of Diabetic retinopathy. [10] Few studies have been conducted on the ocular manifestation of Type 2 DM for five years, so we planned this study.

Material and Methods

A hospital-based observational study that included 280 patients attended the Ophthalmology OPD of a tertiary care Hospital, in Bhubaneswar over one year from December 2023 to November 2024. The study was approved by the Institutional Ethical Committee. Patients aged 30 years more with type 2 diabetes mellitus (T2DM) of duration 5 years or less were included in the study.

All T2DM patients were recruited based on history, and blood investigation. Patients were labelled as T2DM based on criteria laid down by the American diabetes association. An informed consent was taken from all study populations. A complete ocular examination was done among all study populations. Best corrected visual acuity (BCVA) was recorded by Snellen's chart. The anterior segment was evaluated with a slit lamp biomicroscope, posterior segment was visualized with a +90D lens. Fundus photograph was taken of all patients. Diabetic Retinopathy (DR) was graded by the Early Treatment of Diabetic Retinopathy

Study (ETDRS) scale. [11] IOP was measured with a noncontact tonometer (NCT). Gonioscopy was done as and when required. Visual field analysis was done using Humphrey perimeter and OCT was done whenever needed. Examination of random blood sugar, fasting blood sugar, post-prandial blood, and HbA1c was done. Urine sugar, albumin, and microscopy were done.

Inclusion Criteria

Patients diagnosed with T2DM of duration 0 - 5 years, age of patients 30 or more years.

Exclusion Criteria

- Type 1 DM.
- Diagnosis of T2DM duration of more than 5 years.
- Patients having retina disease other than diabetic retinopathy.
- Patients with known eye diseases not related to diabetes.
- Patients requiring hospitalization
- Patients taking steroids in any form, immunosuppressant.
- History of ocular trauma

The data collected were analyzed statistically using SPSS for Windows version 23.0 software. The continuous variables were stated as median values, categorical variables as number (n) and percentage(%). A value of $p < 0.05$ was accepted as statistically significant.

Results

A total of 560 eyes from 280 patients were included in our study, out of this 130(46.42%) were male and 150(53.57%) were female.

Table 1: Demography of study population

AGE in years	Male, n (%)	Female, n(%)	Total, n (%)
30-40	19(14.61%)	21(14%)	40(14.28%)
41-50	31(23.84%)	49(32.66%)	80(28.5%)
51-60	68(52.30%)	72(48%)	140(50%)
> 60	12(9.23%)	8(5.33%)	20(7.24%)
Total	130(46.42%)	150(53.57%)	280(100%)
Duration of type 2 DM			
YEARS	Male	Female	Total
0 -< 1 year	33(47.14%)	37(52.8%)	70(25%)
1 - 3 years	39(44.31%)	49(55.68%)	88(31.4%)
> 3 -5 years	58(47.54%)	64(52.45%)	122(43.5%)
HbA1 C LEVELS	No of patients		
HbA1c levels >7.5%	69 (24.64%)		
HbA1 c levels <7.5%	211(75.35%)		
Patients taking medications		No of patients (%)	
Regular		252 (90%)	
Irregular		28 (10%)	

In our study 50% population were in age group 50 to 60 years. 25% of the study population had a

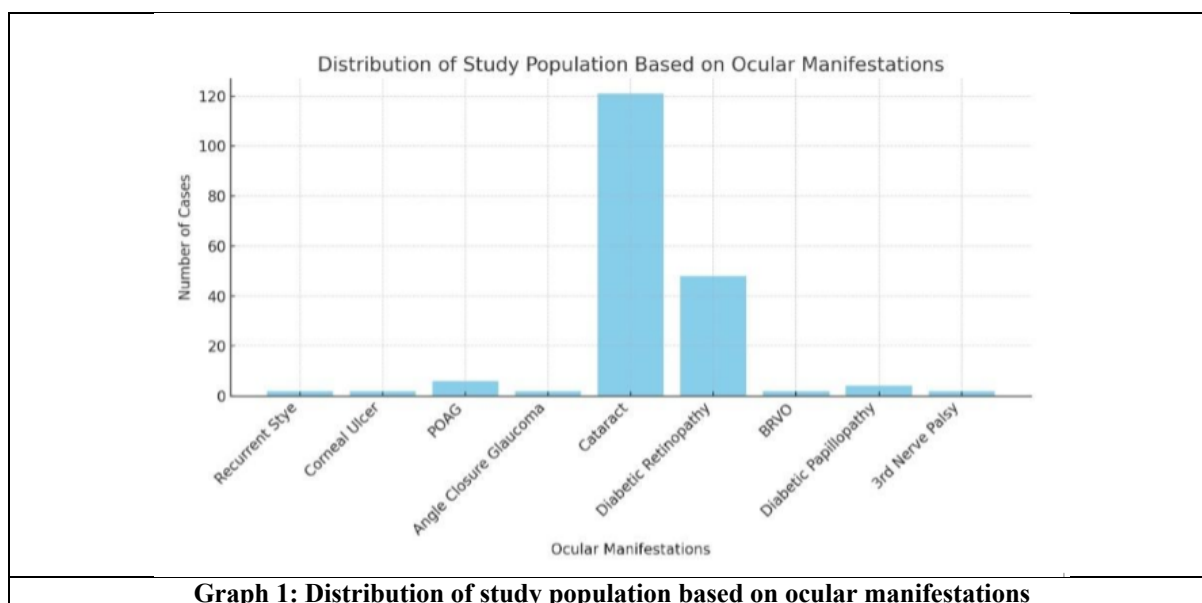
duration of T2DM less than one year and 31% had T2DM 1 to 3 years. 24.64% of the study population

had HbA1c > 7.5. 10 %of our study population had an irregular treatment history.

Table 2: Distribution of study population based on Best corrected visual acuity (BCVA)

BCVA	Number of eyes (%)
6/6 -6/9	275 (49%)
6/12 - 6/36	229 (40.89%)
6/60 - CF 3 m	47 (8.39%)
< CF 3 m	9 (1.6%)
Total	560 (100%)

Best-corrected visual acuity (BCVA) was recorded in 560 eyes of 280 patients. BCVA of 49% of eyes studied was 6/6 to 6/36.



Out of 560 eyes 280 patients of T2DM were studied. We found that 121 (21.6%) eyes had cataract, Diabetic retinopathy was found in 48 (8.57%) eyes, POAG in 6 eyes (1.07%)

Table 4: Distribution of cataract based on duration of T2DM

Types of Cataracts	0 - < 1 years (n=140)	1 - 3 years (n=176)	> 3 - 5 years (n=244)
Posterior subcapsular cataract (PSC)	12 (44.4%)	10 (22.2%)	8 (16%)
Posterior polar cataract (PPC)	10 (37%)	4 (8.8%)	4 (8%)
Nuclear sclerosis	6 (22%)	29 (64.4%)	31 (63%)
Advance cataract	1 (3.7%)	2 (4.4%)	6 (12.2%)
Total (n=121)	27 (19.2%)	45 (25%)	49 (20.8%)

We evaluated 560 eyes, among them 121 eyes had cataract. 19.2% patient of T2DM duration less than one year had cataract. Among this group, 44.4%

had posterior subcapsular cataract. Of the patients who had 1 to 3 years of T2DM among them, 25% had cataract.

Table 5: Distribution of Diabetic Retinopathy (DR) based on Duration of T2DM

Types of DR	0 - < 1 year (n=140)	1 - 3 years (n=176)	>3 - 5 years (n=244)
No DR	133 (95%)	160 (90.9%)	205 (84%)
NPDR Mild (nonproliferative diabetic retinopathy)	6 (4.2%)	12 (6.8%)	20 (8.1%)
NPDR Moderate	1 (0.71%)	2 (1.1%)	6 (2.4%)
NPDR Severe	0	0	1 (0.4%)
Diabetic Macular edema (DMO)		2 (1.1%)	12 (4.9%)

Classification of diabetic retinopathy done based on ETDRS classification

Out of 560 eyes 48 (8.57%) eyes develop DR. Significant majority of patients fall into the no diabetic retinopathy category, especially in shorter

duration groups e.g. 95% and 90.9% for 0 to <1 year and 1 to 3 years respectively. The prevalence of DR increases with the duration of T2DM.

Discussion

There is a growing epidemic of Type 2 DM in India. So, this study will help us to know the different ocular manifestations of T2DM. From our study it is evident that 53.57% were female and 46.2% were male. According to a study by Kautzky et al diabetes is more common among females. [12] According to Deepa R et al study from Tamilnadu 54.4% study population was female and 45.5% were male. [13] In our study 70 (25%) had T2DM less than one year, 88 (31.4%) had a T2DM duration of 1 to 3 years, and 43.5% study population had 3 to 5 years of T2DM. We evaluated the BCVA of 560 eyes of 280 patients. 49% had BCVA 6/6 to 6/9, 40.89% had 6/12 to 6/36. 1.6% patient had BCVA < 3 meter. Mohammed et al study found that 37.58%. [14] Sankar et al study showed visual impairment was 4% among diabetes patients. [15] The above study shows the risk factors associated with the presence of visual impairment included female gender, age greater than 60 years, low socioeconomic status, hypertension, microalbuminuria, and use of insulin and alcohol. [15]

In our study population, the cause of visual impairment was due to cataract mostly posterior subcapsular cataract and diabetic macular edema.

The most common ocular manifestation of our study group was cataract 121 (21.6%), diabetic retinopathy 48 (8.57%), POAG 6 (1.07%), BRVO, and 3rd Nerve palsy each 0.3%. Two (0.3%) eyes had corneal ulcer. Nietson et al found that the prevalence of POAG was 6.0%, ocular hypertension 3%, and 2-3% neovascular glaucoma in all DM patients. [16] But in our study, we found only 1.01% had POAG, this value may be less as we are taking only patients T2DM duration of 5 years only.

In our study 4 (0.7%) eyes had diabetic papillopathy. Zyrrin et al study shows disc swelling may be unilateral or bilateral and associated with good visual prognosis. [17]

In our study, 3rd N palsy was in 2 eyes (0.3%) of the study population.

Diabetes predisposes to infection in different body parts. Shilpa et al study shows recurrent styes (4%), blepharitis (3.7%), conjunctivitis (1.7%), and dacryocystitis (2.6%). [18] Kruse et al have confirmed in their case-control study that diabetes is a risk factor for acute infections like conjunctivitis, with an odd's ratio of 1.24 in Diabetes. [19] In our study 2 eyes (0.3%) had corneal ulcer.

Among our study population 121 (21.6%) eyes had cataract. Among those who had DM < 1 year among them 27 (19.2%) eyes cataract, out of this 44.4% of eyes had posterior subcapsular cataract, 37% had posterior polar cataract and 3.7% had advanced cataract. That patient who had DM 1-3 years among that population 45 (25%) eyes developed cataract and that patient who had DM >3-5 years among them 49 eyes (20.8%) developed cataract. From our study, we found that cataract develops within one year of diagnosis of DM. Shilpa et al study found that the cortical type of cataract was 41.2%, senile posterior cortical cataract was 29%. [18] Rman et al study found a 65.7% prevalence of cataract among DM patients. The prevalence of cataract was higher in women. Mixed type of cataract more common than the monotype. [20] Lathika et al study shows incidence of cataract in patients of DM 0-5 years is 37.5%. [21] In our study we found that PSC and PPC are more common among recently diagnosed T2DM.

Various studies from India reported the prevalence of Diabetic Retinopathy (DR) varies from 20% to 31%. The Aravind Eye Disease survey in southern India reported retinopathy prevalence of 27% among the population aged 30 years or older with self-reported diabetes. [22] The prevalence of retinopathy in our study was 8.57% (48 eyes). That patient had DM <1 year among them mild NPDR was only 4.2%, moderate NPDR 0.7%. In the group of patients who had a duration of DM >3 to 5 years among them 8.1% had mild NPDR, 2.6% had moderate NPDR, 0.4% had severe NPDR, and 4.9% had DME. Out of 560 eyes of our study population, we could not detect any PDR (proliferative DR). Shilpa et al study shows a prevalence of NPDR of 26.1% who had DM < 5 years. [18] 4.9% of our study population with DM for more than 3 years had DMO (diabetic macular edema). Increased incidence of CSME with increased duration of DM was noted in a study by Klein R et al. [23]

The strength of our study was the number of the population, less study was done among patients with T2DM duration equal to or less than 5 years.

Conclusion

The study highlights the intricate relationship between the duration and severity of T2DM and the occurrence of ocular manifestations. Prolonged hyperglycemia and poorly controlled T2DM are major contributing factors to complications. The findings emphasize the importance of regular eye examinations. Furthermore, more patient education on the severity of ocular morbidity plays a crucial role.

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