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Original Research Article

A study of ocular manifestations of type 2 diabetes mellitus at tertiary eye care centre in South India

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ABSTRACT

Aim: The main purpose of our study is to provide a general view of various ocular manifestations observed in type 2 diabetes mellitus patients. Ocular manifestations observed in our study not only include cataract and retinopathy but also other anterior and posterior segment ocular manifestations and their epidemiology. We wanted to evaluate the different ocular manifestations in type 2 diabetes mellitus, its clinical profile, and its relationship between various risk factors.

Materials and Methods: All cases with a known case of type 2 diabetes mellitus presented to the Tertiary Eye Care Centre, Telangana, in South India were examined in detail to know the various ocular manifestations. A prospective observational study was done. Patients who presented with diabetes were examined in detail, diabetes history, and further investigated to know anterior and posterior segment ocular manifestations. The study was conducted on 500 patients over 18 months from December 2018 to June 2020.

Results: All 500 patients were examined in detail. Ocular manifestations observed in type 2 Diabetes mellitus include cataract, diabetic retinopathy, glaucoma, keratitis, retinal vascular occlusion, ophthalmoplegia, lid lesions, ischemic optic neuropathy, age-related macular degenerations.

Conclusions: Diabetes mellitus is an important health problem that causes significant morbidity due to specific microvascular complications such as retinopathy, nephropathy, and neuropathy, and macrovascular complications such as ischemic heart disease, and peripheral vasculopathy. Ocular manifestations were more likely to occur in both eyes in diabetes patients. Treatment and visual rehabilitation vary for different ocular manifestations. A thorough early ocular evaluation of patients and management is of utmost importance to prevent further visual impairment.

1. Introduction

Ocular manifestations associated with Diabetes mellitus are progressive and rapidly becoming the most significant cause of morbidity and are preventable with early detection and timely treatment. The purpose of this study is to assess various ocular manifestations in Type 2 Diabetes mellitus patients in a study population of 500 patients at the tertiary eye care centre in Telangana, South India to evaluate the age and sex distribution, distribution in urban and rural areas, duration of diabetes, uncontrolled diabetes mellitus patients, laterality of eyes, and also to determine various risk factors and systemic diseases associated with the patients.

2. Materials and Methods

The study was conducted on 500 patients. Patients diagnosed to have type 2 diabetes mellitus with ocular manifestations are included. Type 1 diabetes mellitus and patients who are terminally ill are excluded. A prospective observational study was done from December 2018 to June

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2020. Written informed consent was obtained from all patients. A brief history of diabetes was recorded including type, duration, family history, present treatment for diabetes, and history of associated systemic diseases. Best-corrected Visual acuity Intraocular pressure measurement, slit-lamp examination, and fundus examination were done and documented. Basic investigation like FBS, PPBS, blood pressure, Urine examination, and specific investigation of ocular pathologies such as FFA, OCT, KOH, Fluorescein stain, Schirmer's test, and lacrimal sac syringing was done.

3. Results

Of 500 patients in the study, 261 (52.2%) were male and 239 (47.8%) were female. Most of the Type 2 diabetes patients 180 patients (36 %) belong to the 60 -69 years of age group. The age group of 20 -29 years was least affected only 7 cases (1.4%). Hypertension was a predominant systemic disease associated with patients. They constituted about 298 cases (59.6%). Most of the patients were from rural areas 271 cases (54.2%) while the patients from urban areas were 229 cases (45.6%). In our study, cataract was the most common manifestation in 221 patients (42.2%) followed by diabetic retinopathy in 157 patients 31.4%. Most of the manifestations were observed in patients who had a history of diabetes between 6 to 10 years of duration 317 patients (63.4%). Patients with an increased duration of diabetes had increased ocular manifestations. In our study, we classified patients into two groups, those with good diabetic control (FBS<126 mg/dl and PPBS <200mg/dl) and those with bad diabetic control (FBS>126mg/dl and PPBS, RBS > 200mg/dl), out of 500 patients, 355 patients had good glycaemic control and 145 patients had poor glycaemic control. Our study aims to analyze the clinical profile of Type 2 DM patients with ocular manifestations. (Table 1) We concentrated mainly on the clinical features from adnexa, anterior segment to posterior segment on different stages or types of cataract, retinopathy, vascular occlusions, glaucoma, lid lesion, keratitis, and also the significance of early detection and bilateral eye examinations. (Table 2).

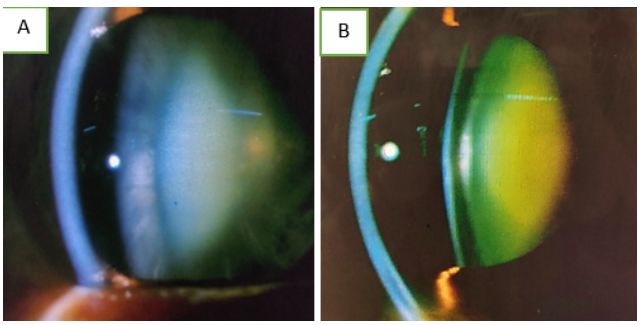

Fig. 1: Slit lamp picture showing;**A**: Nuclear sclerosis grade 2 with cortical cataract; **B:** nuclear sclerosis grade 3.

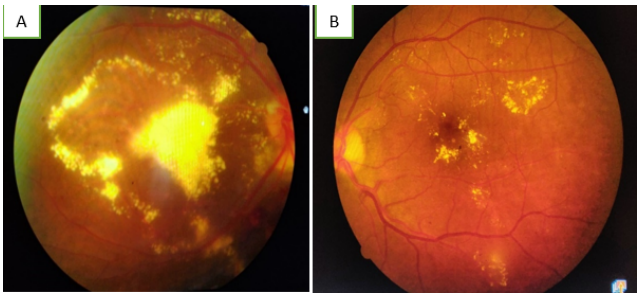

Fig. 2: A: Fundus picture showing clinically significant macular edema; **B:** Non-proliferative diabetic retinopathy with macular edema.

Fig. 3: OCT picture showing both eyes diabetic macular edema.

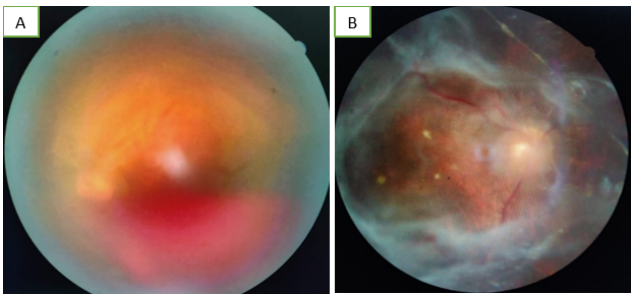

Fig. 4: Fundus picture showing; **A:** Vitreous hemorrhage; **B:** Tractional retinal detachment.

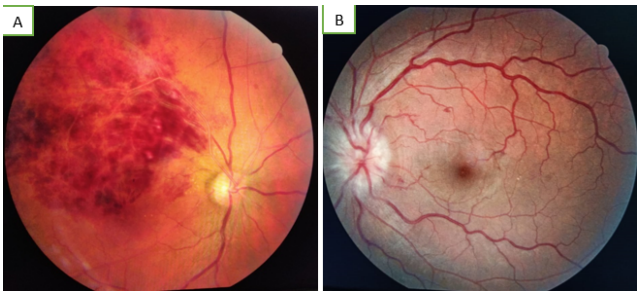

Fig. 5: Fundus picture showing; **A:** Superio-temporal branched retinal vein occlusion; **B:** Anterior ischemic optic neuropathy.

Table 1: Clinical profile

S.No.	Clinical profile (study sample 500 patients)		Number of patients (%)
1.	Age	20-29	7(1.4%)
		30-39	13(2.6%)
		40-49	109(21.8%)
		50-59	166(33.2%)
		60-69	180(36%)
		70-79	25(5%)
2.	Gender	Male	261(52.2%)
		Female	239(47.8%)
3.	Demography	Urban	229(45.8%)
		Rural	271(54.2%)
4.	Duration of diabetes	<6yrs	91(18.2%)
		6-10yrs	317(63.4%)
		>10yrs	92(18.4%)
5.	Glycemic control	Good control	355(71%)
		Bad control	145(29%)
6.	Laterality based on patient symptoms	Unilateral RE	218(43.6%)
		Unilateral LE	210(42%)
		Bilateral	72(14.4%)
7.	Laterality based on signs	Unilateral	97(19.4%)
		Bilateral	403(80.6%)
8.	Systemic diseases association (n=341) (68.2%)	Hypertension	298(59.6%)
		Coronary artery disease	17(3.4%)
		CKD	5(1%)
		CVA	7(1.4%)
		Hypothyroidism	11(2.2%)
		Others(SLC, CML, Dyslipidemia)	3(0.6%)

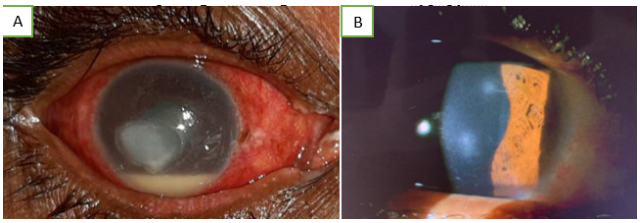

Fig. 6: Slit lamp image;**A**: Fungal keratitis with hypopyon; **B**: Viral keratitis

4. Discussions

Cataract was found to be the most common manifestation. Studies showed an increased prevalence and incidence of posterior subcapsular cataracts in diabetic patients and the relationship between impaired fasting glucose and cataract.[1] In our study, Mature cataract was found to be more 59 patients (11.5%) followed by combined nuclear, cortical, post sub capsular cataract 52 patients (10.4%), combined nuclear and cortical cataract 30 patients (6%) while Nuclear cataract grade 1,2,3 and 4 accounts 2.8%, 2.2%, 2.4%, 4.4% respectively. Combined cortical cataract and posterior subcapsular cataract were 11 patients (2.2%). Numerous studies show there is an association between cataract and diabetes mellitus, however, cataract is also more prevalent in old age. In our study patients above 50 years of age with type 2 diabetes mellitus with increased duration of disease were found to have cataracts. We cannot preciously tell which risk factor is attributed to cataracts, whether it's increased age or diabetes mellitus. Patients can develop a cataract in their old age without a history of diabetes mellitus which is known as a senile cataract. However, in our study, both old age and increased duration of type 2 diabetes mellitus were to be the causative factor.[2] (Figure 1)

The second most common manifestation is diabetic retinopathy in our study. The most common cause of reduced vision in diabetic retinopathy patients are diabetic macular edema, vitreous hemorrhage, and Tractional Retinal Detachment.[3–5] CSME is identified by the presence of hard exudates and edema, they were reported to be associated with high lipid levels. OCT helps in the assessment of macular edema and also the effect of vitreous traction on macula. Vitreous hemorrhage and TRD are the complications of high-risk PDR.[6] Vitreous synchysis and syneresis are induced by abnormal collagen crosslinking and non-enzymatic glycation which leads to PVD. New vessels from the retinal layers project into the posterior vitreous and changes within the vitreous may exert traction on the vessels resulting in VH. TRD is caused by progressive contraction of the fibrovascular membrane.

Table 2: Ocular manifestations

S.No.	Manifestations		Number of patients (%)
1.	Cataract (n=211) (42.2%)	Mature cataract	59(11.8%)
		NS1	14(2.8%)
		NS2	11(2.2%)
		NS3	12(2.4%)
		NS4	22(4.4%)
		NC+CC	30(6%)
		CC+PSC	11(2.2%)
		NC+CC+PSC	52(10.4%)
2.	Diabetic retinopathy (n=157) (31.4%)	NPDR	17(3.4%)
		NPDR+DME	24(4.8%)
		Early PDR	29(5.8%)
		PDR+DME	15(3%)
		High risk PDR+VH	29(5.8%)
		High risk PDR+TRD	17(3.4%)
		PDR+VH+TRD	18(3.6%)
3.	Vascular occlusions (n=21) (4.2%)	SHH	8(1.6%)
		CRVO	7(1.4%)
		BRVO	14(2.8%)
4.	Glaucoma (n=43) (8.6%)	Neovascular glaucoma	8(1.6%)
		Primary open angle	16(3.2%)
		Primary angle closure	19(3.8%)
5.	Lid lesions (n=27) (5.4%)	Hordeolum externum	5(1%)
		Blepharitis	12(2.4%)
		Chalazion	10(2%)
6.	Keratitis (n=21) (4.2%)	Bacterial	6(1.2%)
		Fungal	14(2.8%)
		Viral	1(0.2%)
7.	ARMD		8(1.6%)
8.	AION		5(1%)
9.	Ophthalmoplegia		7(1.4%)

Most of the patients presenting with diabetic retinopathy were also found to have associated risk factors like hypertension in 298 patients (55.6%) followed by coronary artery disease in 17 patients (3.4%). High risk Proliferative diabetic retinopathy with Vitreous hemorrhage (Figure 4A) and Early Proliferative diabetic retinopathy in 29 patients (5.8%) followed by Nonproliferative diabetic retinopathy with macular edema (Figures 2 and 3) in 24 patients (4.8%). Subhyloid hemorrhage was the least manifestation in 8 patients (1.6%). Patients with complication tractional or combined retinal detachment (Figure 4B) showed poor prognosis, while patients with Nonproliferative diabetic retinopathy and diabetic macular edema showed a good prognosis after treatment.[7]

Diabetic patients often exhibit increased red blood cell and platelet aggregation along with the increased synthesis of fibrinogen and alpha 2 globulin. The hypercoagulable state of diabetic patients and hypertension leads to an increase in turbulent flow and predisposes to the development of vascular occlusion.[8] Retinal vascular occlusion (Figure 5A) was found in 21 patients (4.2%) out of which the most common was branched retinal vein occlusion in 14 patients (2.8%) followed by central retinal vein occlusion in 7 patients (1.4%)

Diabetic Mellitus is reported as a risk factor for open-angle glaucoma along with other risk factors such as elevated IOP, older age, family history of glaucoma, and duration of type 2 DM.[9] Diabetes is also a risk factor for angle-closure glaucoma, diabetic patients have a shallower anterior chamber than Non-diabetic patients. Patients undergoing treatment for diabetic retinopathy with laser photocoagulation could also cause angle-closure glaucoma.[10] Neovascular glaucoma is a complication of PDR that is thought to develop as a result of VEGF-induced neovascularization of the iris and angle. The newly formed blood vessels and fibrous tissue form anterior synechiae which block aqueous outflow from the anterior chamber leading to angle closure and raised IOP.[11] Glaucoma was identified in 43 patients (8.6%). In our study, primary angle-closure glaucoma was found in 19 patients (3.8%), primary open-angle glaucoma in 16 patients (3.2%), and neovascular glaucoma in 8 patients (1.6%).

Uncontrolled diabetes patients are more prone to infection. They are at higher risk of developing several

corneal complications including superficial punctate keratitis, recurrent corneal erosion, and corneal endothelial damage. These complications have been linked to tear secretion abnormalities, reduced corneal sensitivity, and poor adhesion between epithelial cells and the basement membrane.[12] In our study, keratitis (Figure 6A & B) was found in 21 patients (4.2%). Most of the patients (n=14, 2.8%) had fungal growth in culture. These patients were also found to have uncontrolled diabetes mellitus and a long duration of diabetes. Redness and pain followed by a diminution of vision were the most common complaints by the patient.

Lid lesions such as blepharitis in 12 patients (2.4%) followed by chalazion in 10 patients (2%) and hordeolum externum in 5 patients (1%). Similar to keratitis, these patients were also found to have uncontrolled diabetes.

Cranial nerve mononeuropathies are a well-known diabetic complication, specifically those affecting the third, fourth, sixth, and seventh cranial nerves. Cranial nerve mononeuropathy classically presents with an abrupt onset and is characterized by transient pain, absence of other neurologic involvement, and spontaneous recovery in 3 to 6 months. The abducens nerve was most frequently involved followed by the oculomotor and trochlear nerves.[13] The development of mononuclear palsies is attributed to the history of microvascular ischemia. In our study, 7 patients (1.4%) were affected by diabetic ophthalmoplegia.

In our study, most of the patients who presented to the hospital had complaints in one eye. For instance, patients with symptoms in the Right eye were 218 (43.6%) and in the Left eye 210 (42%), they have major complaints such as diminution of vision 85.6%. After proper history these patients were examined under a slit lamp, Indirect ophthalmoscopy was done. Patients with hazy media were subjected to B scan. Further investigations such as fundus fluorescence angiography, optical coherence tomography, Gonioscopy, and culture sensitivity were done. After proper investigation, these patients were found to have manifestations in Both eyes 403 patients (80.6%) of which patients were unaware. The significance of the above finding is that bilateral ocular manifestation is likely in diabetes patients so it is always important to examine both eyes and explain the prognosis to the patients to prevent further ocular complications.

5. Conclusion

The ocular manifestation was more likely to occur in both eyes in diabetes patients so it is vital to examine both eyes and prevent ocular complications. Most of the manifestations were seen in the patients having diabetes of increased duration, so it is important to educate the patients about ocular complications in diabetes and should undergo periodic ocular examinations to prevent further complications and visual impairment. It is also important to diagnose type 2 Diabetes mellitus early enough to prevent ocular morbidity, these can be done by a physician or diabetologist. Once diagnosed it is of utmost importance to send newly diagnosed patients to an ophthalmologist as soon as possible. Once they were found to have any mild ocular manifestation, they can be advised to come for a regular follow-up to prevent unwarranted complications. These can be done by proper counseling of the patients, advice for a proper diet, lifestyle modifications, strict glycaemic control, and monitoring the treatment compliance and response to treatment.

6. Conflict of Interest

The authors declare that they have no conflict of interest.

7. Source of Funding

None.

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