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ASSESSING RELATIONSHIP BETWEEN MACULAR THICKNESS AND CLINICALLY GRADED DIABETIC RETINOPATHY

Ophthalomology

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ABSTRACT

Methods: Four hundred and thirty-eight eyes were undertaken for the observational study divided into 6 groups. The groups of Diabetic Retinopathy (DR) were graded with the help of ICDR staging. The groups were non-diabetic, diabetic with No DR, Mild NPDR (non-proliferative DR), Moderate NPDR, Severe NPDR, Proliferative DR. They underwent slit lamp examination, ophthalmoscopic evaluation, OCT examination. The Central Subfield Thickness (CST) of all eyes was recorded and the mean CST of all groups were compared. **Results:** As the severity grading of Diabetic Retinopathy increased, the Mean CST also increased. There was very little difference in mean CST values between non-diabetics and diabetics with no retinopathy, whereas mild DR also had a similar mean CST value. There was not enough statistical evidence to suggest an association between gender and DR in our study. **Conclusion:** Macular thickness was greater in diabetics than non-diabetics and tended to increase with DR severity. OCT of non-diabetics and no DR were similar, suggesting no reason for routine OCT examination in initial diabetic stages. An earlier detection of DME is preferred with the aim of preserving the normal anatomical retinal structure and physiological function.

KEYWORDS

Diabetic Retinopathy, OCT, CST

Introduction

Diabetic retinopathy (DR), a major cause of avoidable blindness, has been increasing in incidence with increased disease burden of diabetes mellitus. Patients with diabetic retinopathy are 25 times more likely to become blind than non-diabetics.[1] Hence it is important to screen and treat it at the earliest to reduce the risk of visual impairment. The risk factors include duration of diabetes, glycaemic control, age, hypertension, serum lipid levels, nephropathy and genetics.[2]

Macular edema or retinal thickening is a common manifestation of diabetic retinopathy. Diabetic macular edema (DME) is the most common cause of visual impairment in diabetes patients. DME occurs when fluid builds up in the macula due to abnormal vascular permeability. DME is common among eyes with more advanced diabetic retinopathy but may develop in patients with DR of any severity. The fluid comes from leaking microaneurysms or breakdown of blood retinal barrier. Angiogenesis and inflammation have been shown to be involved in the pathogenesis of this disease.[3]

Materials and Methods

Four hundred and thirty-eight eyes of patients were included in the study coming to the ophthalmologic department of Mata Gujri Memorial Medical College and L.S.K. Hospital, Kishanganj, Bihar. The patients enrolled in the study were examined between June 2023 to January 2024. They were divided into six groups for the study. It included 65 normal eyes of patients without diabetes, 73 eyes of diabetic patients without DR, 75 eyes with mild non-proliferative diabetic retinopathy (NPDR), 94 eyes with moderate NPDR, 78 eyes with severe NPDR, and 53 eyes of diabetics with proliferative DR (PDR).

A control group of 65 normal eyes from nondiabetic patients without macular abnormalities was studied to arrive at clinic-specific normals for our OCT machine.

The patients included in the study were all those diagnosed with diabetes or having random blood glucose > 200 mg/dl and with signs of DR with or without macular edema. Patients having media opacity like cataract or vitreous haemorrhage obstructing the view of macula or any other macular pathology were excluded from the study.

The ICDR staging, which is based on ETDRS was used to divide the patients into the following categories – [4]

This was a prospective observational study of data extracted from the clinical charts and OCT records of the patients, who were included in the study after consent. They underwent slit lamp examination, ophthalmoscopic evaluation and OCT. We used Topcon 3D OCT-1 Maestro 2 OCT Machine. The Central Subfield Thickness (CST) of each eye was recorded along with the grade of DR and sex of the patient. The mean of CST values in each group was recorded and data compared. A chi square test was conducted between mean CST values of males and females in all groups.

TABLE 1. INTERNATIONAL CLINICAL DIABETIC RETINOPATHY & DIABETIC MACULAR EDEMA DISEASE SEVERITY SCALES

Stage	Dilated Ophthalmoscopy Observable Findings	Severity
I	No abnormalities	No DR
II	Micro-aneurysms only	Mild non-proliferative DR
III	Any of the following: - micro-aneurysms - retinal dot and blot haemorrhages - hard exudates or cotton wool spots No signs of severe non-proliferative diabetic retinopathy	Moderate non-proliferative DR
IV	Any of the following: - more than 20 intra-retinal hemorrhages in each of 4 quadrants - definite venous beading in 2 or more quadrants - prominent intra-retinal microvascular abnormality (IRMA) in 1 or more quadrants No signs of proliferative retinopathy	Severe non-proliferative DR
V	One or both of the following: - Neovascularization - Vitreous/pre-retinal hemorrhage	Proliferative DR

Results and Discussion

Central Subfield Thickness (Mean ± Standard Deviation) with p values were as follows –

Grade of Diabetic Retinopathy	Mean C.S.T	P value
Non-Diabetics	205.43 ± 12.65	< 0.00001
Diabetics with no DR	201.23 ± 20.59	< 0.0054
Mild NPDR	211.51 ± 22	< 0.0018
Moderate NPDR	258.4 ± 37.6	< 0.00001
Severe NPDR	338.71 ± 67.5	< 0.000026
Proliferative DR	513.86 ± 80.12	< 0.0009

The p value was significant (< 0.05) for all groups and highly significant for non-diabetics, moderate NPDR and severe NPDR group.

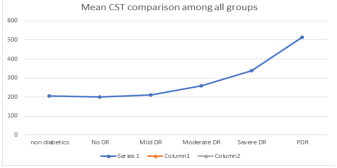

Table 1: The graph shows comparison of different grades of DR along the X axis (Non-diabetic, No DR, Mild DR, Moderate DR, Severe DR and PDR) and mean CST values in micrometres in the Y axis. The mean CST values increases as the severity of DR increases in ascending order.

As the severity grading of Diabetic Retinopathy increased, the Mean CST also increased.

Retinal vascular permeability and blood–retinal barrier breakdown increases with the severity of retinopathy. This could explain the pattern of increased macular thickness with increased severity of DR.

There was very little difference in mean CST values between non-diabetics and diabetics with no DR. The diabetic group with no DR had a slightly lesser CST average compared to non-diabetics, which could be attributed to the thinning of nerve fibre layer due to increased apoptosis in early diabetes.[5] The mild DR group also had mean CST in the similar range.

For increasing retinopathy severity, the extreme values of macular thickening detected by OCT increased. This could be measured by the standard deviation which was greatly increased in severe NPDR and proliferative DR.

For all groups, mean CST was larger in males than in females. For each group the male and female mean CST values were compared, resulting in a p-value of 0.9916. We did not find enough statistical evidence to suggest an association between gender and DR in our study.

Lattanzio et al [6] also concluded that macular thickness was greater in diabetics than controls and tended to increase with DR and DME severity, which are similar findings to our study.

Browning et al [7] found that eyes with mild or moderate NPDR did not differ from normals, but that severe NPDR and PDR eyes had more macular thickening than normal eyes on average. In both females and males, they found a significant difference between CST in the severe NPDR and PDR groups. Whereas in our study, we found moderate NPDR also had increased retinal thickening and no significant differences across genders.

Rao et al [8] also found that there was a significant increase in macular thickness in all grades of retinopathy when compared with non-diabetics. In eyes of more severe grades of retinopathy there was a mean increase in the CST, compared to parafoveal increase in milder grades.

Conclusions

Macular thickness was greater in diabetics than non-diabetics and tended to increase with diabetic retinopathy severity. OCT is a sensitive technique for detecting early diabetic macular abnormalities and detecting any changes in macular edema.

As retinopathy severity increases, the probability of subclinical edema rises. The data suggest that there is little reason to routinely obtain OCT in eyes of diabetics with no DR and mild DR when clinical examination fails to show macular edema. However, OCT can be used as a baseline for future comparison because the range of normal values for CST is wide.

Treatments for DME are more effective in preventing progression of DME than they are at restoring normal macular thickness. Therefore, earlier detection of DME is preferred with the aim of preserving nerve fibre layer and photoreceptors at early disease stages and thereby retaining central visual acuity.

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