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Original Research

Assessment of retinal nerve fiber layer changes in patients with newly diagnosed diabetes using SD-OCT

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ABSTRACT

Background: In the ophthalmic outpatient department (OPD), diabetes mellitus (DM) is a frequently observed microvascular disorder. The present study was conducted to assess retinal nerve fiber layer changes in patients with newly diagnosed diabetes using SD-OCT.

Materials & Methods: Sixtypatients with diabetic retinopathy of both genderswere divided into 3 groups of 20 each. Group I consisted of diabetics without retinopathy (NDR) group and had 40 eyes. Group II was the non- proliferative DR (NPDR) group that consisted of 40 eyes. Group III was the proliferative DR (PDR) group that consisted of 40 eyes and group IV was control group (20) without diabetes. Peripapillary RNFL thickness was assessed using optical coherence tomography.

Results: The mean retinal nerve fibre layer in group I was 88.4, in group II was 91.2, in group III was 95.8 and in group IV was 99.4. The difference was non- significant (P>0.05). The mean inferior retinal nerve fibre layer in group I was 108.1, in group II was 113.6, in group III was 117.2 and in group IV was 120.4. The difference was non- significant (P>0.05). The mean superior retinal nerve fibre layer in group I was 88.4, in group II was 91.2, in group III was 95.8 and in group IV was 99.4. The difference was non- significant (P>0.05). The mean nasal retinal nerve fibre layer in group I was 71.6, in group II was 73.1, in group III was 78.5 and in group IV was 80.4. The difference was non- significant (P>0.05). The mean temporal retinal nerve fibre layer in group I was 69.7, in group II was 69.9, in group III was 73.3 and in group IV was 76.2. The difference was non- significant (P>0.05).

Conclusion: The thickness of the peripapillary RNFL was diminished in cases of diabetic retinopathy when compared to normal controls, and this thinning became more pronounced as DR severity increased.

Keywords: diabetes mellitus, diabetic retinopathy, retinal nerve fiber

Introduction

In the ophthalmic outpatient department (OPD), diabetes mellitus (DM) is a frequently observed microvascular disorder.[1] The epidemiology of this disorder indicates a swift rise in both diagnosed and undiagnosed cases, with projections suggesting that around 191 million individuals could be affected by it by 2030.[2] Diabetic retinopathy (DR), the most prevalent eye-related outcome of DM, is a primary factor in vision impairment among individuals aged 20–74 years.[3,4] It can advance from mild to moderate or severe non- proliferative disease, which may subsequently lead to proliferative disease.[5]

Retinal neuronal apoptosis happens at the onset of the disease, leading to a decrease in thickness of both the inner retinal layers and the retinal nerve fiber layer (RNFL).[6] A subsequent study that showed thinner inner retinal and photoreceptor layers in metabolic syndrome patients corroborated the discovery that neurodegenerative processes in the retina begin prior to the onset of diabetes.Even when diabetic retinopathy (DR) is not visible, optical coherence tomography (OCT) can reveal the thinning of the retina's inner layers.[7] The RNFL and macular ganglion cell-inner plexiform layer (GCIPL) thickness can be evaluated using OCT to assess retinal neurodegeneration. OCT is a technique that images retinal tissue safely, effectively, and without contact or invasion. OCT is the most accurate technique for measuring retinal thickness in vivo.[8,9]The present study was conducted to assess retinal nerve fiber layer changes in patients with newly diagnosed diabetes using SD-OCT.

Materials & Methods

The study was carried out 60 patients with diabetic

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retinopathy of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Patients were divided into 3 groups of 20 each. Group I consisted of diabetics without retinopathy (NDR) group and had 40 eyes. NDR was defined as the absence of all features of DR in diabetic eyes. Group II was the non- proliferative DR (NPDR) group that consisted of 40 eyes. NPDR was defined as the presence of microaneurysms, hard exudates, dot and blot hemorrhages, cotton wool spots, venous beading, and intraretinalmicrovascular abnormalities (IRMA). Group III was the proliferative DR (PDR) group that consisted of 40 eyes and group IV was control group (20) without diabetes. Peripapillary RNFL thickness was assessed using optical coherence tomography.Results thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table: I Assessment of average retinal nerve fiber layer

Groups	Mean	P value
Group I	88.4	0.25
Group II	91.2	
Group III	95.8	
Group IV	99.4	

Table I shows that mean retinal nerve fibre layer in group I was 88.4, in group II was 91.2, in group III was 95.8 and in group IV was 99.4. The difference was non- significant (P>0.05).

Table: IIAssessment of inferior retinal nerve fiber layer

Groups	Mean	P value
Group I	108.1	0.62
Group II	113.6	
Group III	117.2	
Group IV	120. 4	

Table II shows that mean inferior retinal nerve fibre layer in group I was 108.1, in group II was 113.6, in group III was 117.2 and in group IV was 120.4. The difference was non- significant (P>0.05).

Table: III Assessment of superior retinal nerve fiber layer

Groups	Mean	P value
Group I	104.3	0.37
Group II	109.6	
Group III	112.5	
Group IV	118. 4	

Table III shows that mean superior retinal nerve fibre layer in group I was 88.4, in group II was 91.2, in group III was 95.8 and in group IV was 99.4. The difference was non- significant (P>0.05).

Table: IVAssessment of nasal retinal nerve fiber layer

Groups	Mean	P value
Group I	71.6	0.37
Group II	73.1	
Group III	78.5	
Group IV	80.4	

Table IV shows that mean nasal retinal nerve fibre layer in group I was 71.6, in group II was 73.1, in group III was 78.5 and in group IV was 80.4. The difference was non- significant (P>0.05).

Table: VAssessment of temporal retinal nerve fiber layer

Groups	Mean	P value
Group I	69.7	0.69
Group II	69.9	
Group III	73.3	
Group IV	76.2	

Table V, graph I shows that mean temporal retinal nerve fibre layer in group I was 69.7, in group II was 69.9, in group III was 73.3 and in group IV was 76.2. The difference was non- significant (P>0.05).

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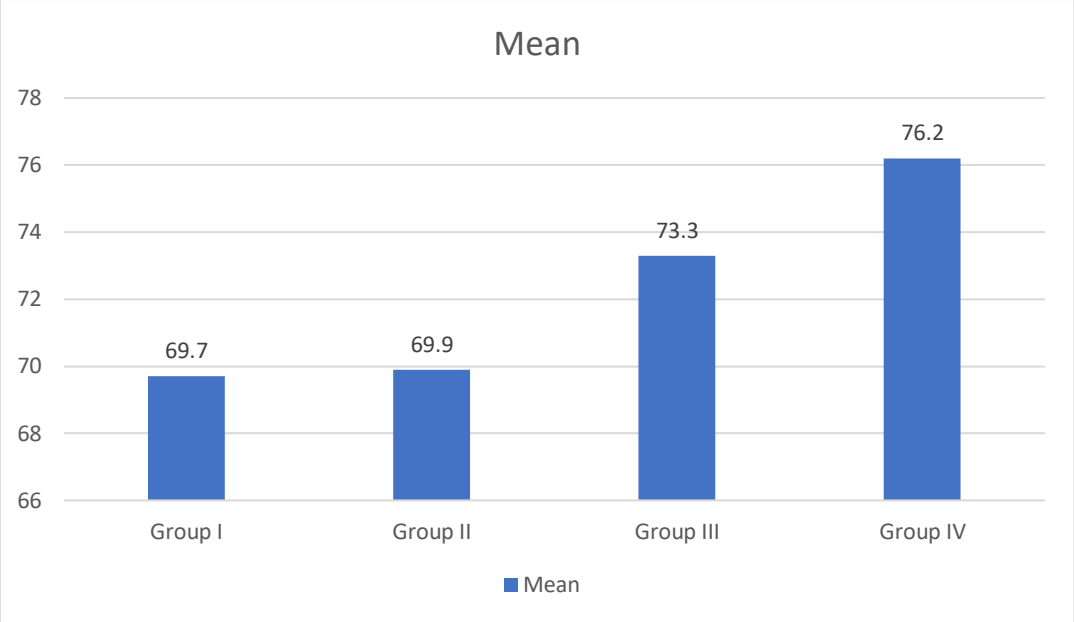

Graph: I. Assessment of temporal retinal nerve fiber layer

Discussion

Diabetes can also damage the nonvascular cells of the retina. In autopsy samples, retinal ganglion cells are lost, at least in part, through apoptosis.[10,11] Histological studies of the retina's neural components have revealed that diabetes-induced biochemical mechanisms can potentially cause neural cell degeneration have also shown that modifying different diabetes metabolic pathways triggers functional defects and failure of multiple retinal cell types, including ganglion cells, bipolar cells, and ultimately photoreceptors.[12,13]The present study was conducted to assess retinal nerve fiberlayer changes in patients with newly diagnosed diabetes using SD-OCT.

We found that mean retinal nerve fibre layer in group I was 88.4, in group II was 91.2, in group III was 95.8 and in group IV was 99.4. Ahmed et al[14]assessed the effect of DR on the retinal nerve fiber layer (RNFL) thickness prepan and postpan retinal photocoagulation (PRP). This study was carried out on 100 eligible eyes in 62 consecutive patients. The authors performed a complete ophthalmologic examination, including best-corrected visual acuity using the early treatment diabetes retinopathy analysis charts, intraocular pressure measurement, slit-lamp biomicroscopic examination, fundus examination, and fluorescein angiography. The RNFL (inferior and total) thickness at every follow-up visit was increased significantly from baseline to 1 month, and 6 months post-PRP and then decreased significantly at follow-up from 1 month to 6 months ($P < 0.001$). There was a significant increase in superior RNFL from baseline to 1-month post-PRP and then decreased at the 6-month follow-up ($P < 0.001$). In contrast, there was no significant change from the 1-month to the 6-month follow-up ($P > 0.05$). In conclusion, an increase in the macular ganglion cell thickness and RNFL at follow-up after 1 month may be correlated to laser-induced intraretinal inflammation, resulting in increased capillary permeability and axonal edema due to cytokine release.

We found that mean inferior retinal nerve fibre layer in group I was 108.1, in group II was 113.6, in group III was 117.2 and in group IV was 120.4. We found that mean superior retinal nerve fibre layer in group I was 88.4, in group II was 91.2, in group III was 95.8 and in group IV was 99.4. We found that mean nasal retinal nerve fibre layer in group I was 71.6, in group II was 73.1, in group III was 78.5 and in group IV was 80.4. We found that mean temporal retinal nerve fibre layer in group I was 69.7, in group II was 69.9, in group III was 73.3 and in group IV was 76.2. Bhaskaran A et al[15]assessed and compared the changes in peripapillary retinal nerve fiber layer (RNFL) thickness in nondiabetics and diabetics with various stages of diabetic retinopathy (DR).The study subjects were divided into four groups based on their diabetic status and findings, namely, controls (normal subjects without diabetes [NDM]), diabetics without retinopathy (NDR), nonproliferative DR (NPDR), and proliferative DR (PDR). Peripapillary RNFL thickness was assessed using optical coherence tomography. One-way analysis of variance (ANOVA) with the post-Tukey HSD test was done to compare RNFL thickness in different groups. There was statistically significant difference in measured average RNFL ($F = 14.8000$, $P < 0.05$), superior RNFL ($F = 11.7768$, $P < 0.05$), inferior RNFL ($F = 12.9639$, $P < 0.05$), nasal RNFL ($F = 12.2134$, $P < 0.05$), and temporal RNFL ($F = 4.2668$, $P < 0.05$) across the different study groups. Pairwise comparison showed that there was a statistically significant difference in RNFL measured (average and all quadrants) in patients with DR (NPDR and PDR) and the NDM control group ($P < 0.05$). In diabetics without

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retinopathy, the RNFL measured was reduced compared to controls, but it was statistically significant only in the superior quadrant ($P < 0.05$). Average RNFL and RNFL in all quadrants showed a small negative correlation with the severity of DR and it was statistically significant ($P < 0.001$).
The shortcoming of the study is small sample size.

Conclusion

Authors found that the thickness of the peripapillary RNFL was diminished in cases of diabetic retinopathy when compared to normal controls, and this thinning became more pronounced as DR severity increased.

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