TO STUDY THE CORRELATION OF RETINAL NERVE FIBRE LAYER AND GANGLION CELL LAYER THICKNESS WITH GLYCEMIC CONTROL IN DIABETIC PATIENTS"

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ABSTRACT

Purpose: To study the correlation of retinal nerve fibre layer and ganglion cell layer thickness withglycaemic control in patients of diabetes mellitus

Methods: This cross-sectional study was carried out on 100 eyes of 100patients of type 2 diabetes . Diabetic patients with evidence of macular oedema were excluded. Demographic data and relevant medical details were documented and all study subjects underwent a comprehensive ophthalmic evaluation.Glycosylatedhaemoglobin(HbA1c) was estimated for all individuals using venous blood sample. Peripapillary RNFL andmacular GC-IPL thickness were assessed for all study participants by SD-OCT (Carl Zeiss Cirrus HD-OCT). Pearson coefficient was used to study the correlation of RNFL and GC-IPL thickness withglycaemic control.

Results: Only a weak negative correlation was seen between glycaemic status and RNFL thickness as well as GC-IPL thickness for both controlled diabetics as well as poorly controlled diabetics. This weak negative correlation was statistically insignificant.

Conclusion: No significant correlation could be established with HbA1c levels either with RNFL thickness or GC-IPL thickness in diabetic patients.

Keywords: Diabetic retinopathy, Retinal nerve fibre layer , Ganglion cell layer, Spectral domain optical coherence tomography, Glycosylated hemoglobin.

INTRODUCTION:

Diabetic retinopathy (DR) is a chronic, progressive sight threatening complication of diabetes mellitus and has been primarily attributed to retinal micro vasculopathy. However, it is becoming more and more evident that DR also affects neuronal retinal cells, resulting in their malfunction and aging [1], as DR impairs neurovascular coupling, degrades endothelial-mural cell connections, triggers Muller cell gliosis, and affects immune cell activation.[2]

The introduction of Spectral domain Optical Coherence Tomography (SD-OCT) enables noninvasive visualization of retinal morphology. Its high resolution allows enhanced screening of the retinal layers and provides accurate measurement of their thickness, including the retinal nerve fibre layer (RNFL) and ganglion cell layer (GCL).Various studies have reported a significant thinning of the RNFL and macular ganglion cell complex (GCC) in diabetic patients as compared to normal subjects. Furthermore, this thinning was found to be more, though not significantly in patients with retinopathy as against those with no retinopathy. [3-8]

High blood sugar level(hyperglycemia) in diabetes mellitus is considered the most causative etiology for DR [9]. Glycosylated haemoglobin (HbA1c) provides a reliable measure of chronic glycemia and correlates well with the risk of long-term diabetes complications, like DR. [10]The HbA1c test gives proof of a person's average blood glucose levels during the past two to three months. Diabetes Control and Complications Trial (DCCT) revealed that improved glycaemic control was linked to a significantly lower risk of microvascular retinopathy onset and progression [11].Studies have been done in the past to assess if a correlation exists between level of glycaemic control and retinal neurodegeneration in diabetic patients, but with conflicting results. [5, 12, 13, 14,

15].Hence, the present study was done with an objective to determine whether an association exists between HbA1c level and thinning of RFNL and GCC in diabetic subjects.

METHODS-

The present cross-sectional,observational study was conducted in the department of a tertiary health center of central India from January 2021 to September 2022.A total of 100 eyes of 100 patients who were more than 40 years of age, having type 2 diabetes either with no DR or with mild DRas per ICDRDSS classification[16] were included. Patients with type 1 diabetes mellitus,those with diabetic macular oedema and history of retinal laser and/or intra-vitreal injection as well as those having any neuro-degenerative ocular or systemic disorders that could affect RNFL /GCC thickness were excluded. Also excluded were patients with history of any intraocular surgery within 6 months,those having refractive errors in excess of 6D and any media opacity that resulted in a signal strength of <6/10 on SD-OCT.After taking written informed consent, a detailed clinical history was taken with special reference to the studycriteria.For all study subjects, glycaemic status was assessed by estimating glycosylated Hb (HbA1c) and peripapillary RNFL and GCC thickness was measured using SD-OCT. depending on the HbA1c values, patients were divided into two groups- those with HbA1c less than 6.5% (controlled diabetics; group 1)andthose with HbA1c equal to or more than6.5% (uncontrolled diabetics; group 2). Pearson coefficient was used to study the correlation of RNFL and GCL thickness with glycaemic control.

RESULTS-

A total of 100 eyes of 100patients were included in this study. The maximum number of diabetic patients belonged to the age group of 51-60years (n=54) with a mean age of 55.13±3.94 years. Males outnumbered the females accounting for 63% cases.The mean HbA1c of the whole study group was 6.80+1.11%. with 55% cases having HbA1c of 6.5% or more. For group 1 i.e., patients with controlled diabetes, the mean HbA1c was 5.85+0.42, while for group 2 patients, it was 7.78+0.85.

Table 1: Comparative RNFL thickness values in patients with controlled and uncontrolled diabetes

RNFL THICKNESS	GROUP 1 (HbA1c <6.5%)	GROUP 2 (HbA1c > 6.5%)
Average	81+15.11	79.37+15.46
Superior	99.20+21.39	100.72+26.41
Nasal	66.32+11.79	62.89+14.32
Inferior	105.79+26.98	99.11+28.69
Temporal	58.48+9.73	57.32+12.99

The comparative mean peripapillary RNFL thickness of both groups is shown in table no. 1.

It was observed that the mean peripapillary RNFL thickness values, both average as well as quadrant wise were lesser in those patients who exhibited poor glycaemic control, except for the superior quadrant, which showed a marginally higher value for group 2.

Table 2: Correlation of RNFL thickness with glycaemic control in patients with controlled and uncontrolled diabetes

RNFL Thickness	HbA1C < 6.5		HbA1C >6.5	
	Correlation coefficient	p-value	Correlation coefficient	p-value
Average	-0.203	0.152	-0.161	0.203
Superior	-0.133	0.351	-0.204	0.109
Nasal	-0.030	0.834	-0.098	0.446
Inferior	-0.005	0.973	-0.014	0.912
Temporal	-0.022	0.879	-0.005	0.970

Table 2 shows the Pearson's correlation coefficient of HbA1c with mean peripapillary RNFL thickness. In both groups only a weak negative correlation was observed between mean glycosylated Hb values for average as well as quadrant wise RNFL thickness and this negative correlation did not reach statistical significance for any RNFL thickness value.

Table 3: Comparative GCL thickness values in patients with controlled and uncontrolled diabetes

GCL thickness	GROUP 1 (HbA1c < 6.5%)	GROUP 2 (HbA1c > 6.5%)
Average	69.45+16.91	69.33+13.68
ST	70.06+16.16	71.15+16.08
S	70.86+17.86	69.61+16.85
SN	70.80+17.76	68.75+16.71

IN	70.23+18.80	68.54+16.44
I	71.80+16.43	65.79+17.97
IT	73.34+19.62	69.42+15.99

Table no.3 shows Comparing the GCL thickness between both groups, the mean supero- temporal segment value was slightly lesser in the controlled diabetic group, but for the average, superior, supero nasal, infero nasal, inferior and infero temporal, the thickness values were lower in the poorly controlled diabetic group.

Table 4: Correlation of GCL thickness with glycaemic control in patients with controlled and uncontrolled diabetes

GCL Thickness	HbA1C < 6.5		HbA1C >6.5	
	Correlation coefficient	p-value	Correlation coefficient	p-value
Average	-0.119	0.405	-0.049	0.704
ST	-0.158	0.280	-0.021	0.871
S	-0.075	0.610	-0.062	0.637
SN	-0.111	0.449	-0.038	0.774
IN	-0.083	0.571	-0.081	0.534
I	-0.009	0.954	-0.026	0.845
IT	-0.070	0.632	-0.072	0.580

Table no. 4 shows the correlation of GCL thickness with the level of glycaemia. It was observed that for patients with mean HbA1C <6.5, only a weak negative correlation was seen for both average as well as sector wise thickness values which was statistically not significant. Similar results were also seen for those diabetic patients having value >6.5.

DISCUSSION-

The GC-IPL and RNFL thicknesses were assessed in diabetic patients in this cross-sectional study using SD-OCT, with the purpose of evaluating their relationship with glycemicstatus. For the entire study population, the mean HbA1c was 6.80+1.11%. The percentage of patients having HbA1c of 6.5% or more was 55%. The mean HbA1c for group 1 i.e., patients with controlled diabetes /were 5.85+0.42, while for group 2 patients, it was 7.78+0.85.

The present study showed only a weak negative correlation for both average as well as quadrant RNFL values with HbA1c level, for both group of patients which was statistically not significant. Our findings are in accordance with Pekel E et al [17], Barooah M et al [5], and Menezes V et al[18] who also documented an insignificant correlation. However, Afef M et al [8]reported a significant negative correlation while Mikhail MEA et al[19]found a significant negative correlation between RNFL values (superior, inferior, nasal and average) and HbA1C, but only for with value less than 9% only.Nor-Sharina et al[20], who used scanning laser polarimetry, found that the level ofHbA1c had no significant relation with the reduction of RNFL thickness.

Analysing the correlation between glycaemic status and GCL thickness, the Pearson's correlation coefficient showed only a weak negative correlation for both controlled diabetics as well as poorly controlled diabetics and for both groups, this was statistically insignificant. Similar observations were also made byPekel E et al [17], Barooah M et al [5]butAfef M et al[8] reported a statistically significant correlation between mean GCL thickness and HbA1C level.

Our study was limited by the small sample size and the difference between both groups in terms of age, gender, duration of disease and severity of retinopathy was not considered.

The current study could not establish a significant correlation between GCL thickness and HbA1C levels in both groups of patients i.e., those with levels less than 6.5 or more than or equal to 6.5.

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