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Analysis of Retinal Nerve Fiber Layer Thickness in Diabetic Patients without Diabetic Retinopathy and in Non Diabetic Patients: A Comparative Study

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Abstract

Purpose: To assess retinal nerve fibre layer (RNFL) thickness in diabetic patients without DR and in nondiabetic age matched controls. To compare the results of RNFL thickness between the 2 groups.

Methods: Cross sectional study was conducted on 100 eyes diagnosed with Diabetes mellitus without diabetic retinopathy and 100 eyes of non diabetic age matched controls. All patients underwent visual acuity, best corrected visual acuity, intraocular pressure measurement, slit lamp examination, dilated fundus examination and OCT.

Results: In our study, the mean age is 55.82±11.47.The RNFL thickness was thinner in temporal quadrant followed by nasal, inferior and superior quadrant in patients with diabetes with no DR when compared to normal age matched controls.

Conclusion: Diabetic patients have thinner RNFL as compared to their age matched controls which is due to the neurodegeneration which precedes retinopathy. OCT is an effective tool to assess functional damage even before the occurrence of microvascular damage.

Keywords: Optical coherence tomography, RNFL thickness, neurodegeneration, Type 2 diabetes mellitus

Introduction

Diabetic retinopathy is a leading cause of blindness in both developing and developed countries. Early detection of diabetic retinopathy (DR) is essential for patients with Diabetes Mellitus. Conventional methods like slit lamp biomicroscopy and stereoscopic fundus examination are used to assess the microvascular damage that occurs in DR. However retinal functional impairment may occur early in the course of diabetes and in patients without any signs of diabetic retinopathy, suggesting a role for neuroretinal damage in the pathogenesis of DR. All these changes precede evident vascular lesions associated with DR and suggest that diabetes compromises the function of retinal neuronal cells before the blood–retinal barrier is significantly altered.[1]

Detection of these early changes may offer new perspectives for early diagnosis, treatment and follow up.

OCT (Optical coherence tomography) is a new diagnostic procedure which studies the in vivo changes in retinal layers. It produces high resolution cross sectional images of the posterior pole. The OCT method provides detailed information about the histological changes, and is also referred to as an 'optical biopsy'.[2]

It has a very high resolution and has been proposed as a powerful tool for retinal measurement. Retinal nerve fiber layer (RNFL) thickness around the papilla can be quantitatively analyzed by OCT.[3]Using such advanced technologies, several phenomenon which relate to microvascular retinal changes have been detected even in patients with no DR.

Diabetic retinopathy (DR) is considered as one of the most frequent causes of blindness in the working age population. As the prevalence of diabetes mellitus (DM) is increasing globally and patients are living longer, the development of DR as a microvascular complication of DM is also rising.[4]While the microvascular changes can be assessed by conventional methods, studies reveal that early evidence of neuronal retinal damage is seen even in patients with apparently normal retinas. Therefore, assessment of neuronal damage by RNFL analysis using OCT may detect the functional changes that occurs in diabetic patients. This may enhance our knowledge in managing these patients more effectively in order to prevent irreversible vision loss secondary to DR.

Objectives of the Study

1. To assess retinal nerve fibre layer(RNFL) thickness in diabetic patients without DR and in Non diabetic age matched controls
2. To compare the results of RNFL thickness between the 2 groups.

Materials and Methods

Source of Data and Materials

Patients diagnosed with diabetes without DR and normal non diabetic patients in outpatient department of Ophthalmology, HIMS Teaching Hospital, Hassan were included during the study period of June 2020 to December 2020

Method Of Collection of Data (include sampling procedure, if any) Study was conducted in about 100 patients diagnosed with diabetes without DR and 100 normal non diabetic patients attending outpatient department of Ophthalmology at HIMS Teaching Hospital, Hassan.

Study type: Cross sectional study

Sampling type: Convenience non random sampling

Study period: June 2020 to December 2020

Sample size: All patients who attended outpatient department of Ophthalmology at HIMS Teaching

Hospital, Hassan diagnosed as diabetes without DR and normal non diabetic patients applying inclusion criteria were included in the study.

Probable number of patients attending ophthalmology outpatient department in coming 6 months=16x6=96 ~ 100 patients.

Sample size: 100

Sampling method: Convenience non-random sampling (Sample size is around 100 in each group. Based on data available as per opd register of Ophthalmology, HIMS, Hassan for past 6 months patients were registered per month)

Inclusion criteria

1. Patients with established diabetes mellitus type 2 on treatment
2. Either sex of age more than 20 years
3. Diabetes of 2 years duration
4. No evidence of DR on fundus examination

Exclusion criteria

1. Recently diagnosed patients with DM
2. Patients with DR
3. Other vascular occlusive diseases
4. Glaucoma
5. Patients with high myopia
6. Other associated conditions like uveitis, retinal dystrophies
7. Cataract or media opacities
8. Morbid patients in whom its difficult to perform OCT

Methodology

Patients fulfilling the inclusion criteria were included into the study.

The aims and objectives of the intended study was properly explained to the patients and informed consent was taken.

Diabetic patients without retinopathy was considered as group 1 and normal non diabetic patients considered as group 2.

Equal number of age matched controls who had no history of diabetes mellitus and other ocular co morbidities were taken as controls.

Enrollment of the patient is done as and when they come to the opd.

Data collected as per the proforma.

Detailed history of diabetes, duration, control status and medications taken.

Patients ophthalmic workup was done as follows: Visual acuity, Best corrected visual acuity, Intraocular pressure measurement, Slit lamp examination, dilated fundus examination.

RNFL profile was done using Zeiss Cirrhus HD OCT 500 after dilatation in diabetic patients and in age matched controls.

Outcome was assessed based on RNFL thickness in group 1 and group 2 and comparison between the results of the two groups was done.

Results

Table 1: Age in years - Frequency distribution in two groups of patients studied

Age in Years	Group 1	Group 2	Average age
Mean ± SD	55.82±11.5	55.82±11.5	55.82±11.47

The mean age is 55.82±11.47.

Table 2: Right Eye- Comparison in two groups of patients studied

Right Eye	Group 1	Group 2	Average
Superior	92.21±22.61	120.03±13.69	106.12±23.28
Inferior	98.45±32.11	118.7±20.79	108.58±28.83
Nasal	65.88±14.41	72.59±14.18	69.24±14.65
Temporal	59.83±11.37	64.67±11.27	62.25±11.55

The mean RNFL thickness is lesser in temporal quadrant in right eye in patients with Diabetes with no DR when compared to age matched controls.

Table 3: Left Eye - Comparison in two groups of patients studied

Left Eye	Group 1	Group 2	Average
Superior	97.83±20.59	113.99±14.22	105.91±19.42
Inferior	95.15±24.63	107.45±20.26	101.3±23.33
Nasal	67.22±17.54	69.28±13.15	68.25±15.5
Temporal	59.02±13.46	63.41±15.41	61.22±14.6

The mean RNFL thickness is lesser in temporal quadrant in left eye in patients with Diabetes with no DR when compared to age matched controls.

Table 4: Combined - Comparison in two groups of patients studied

Combined	Group 1	Group 2	Average
Superior	95.02±19.75	117.01±10.32	106.02±19.2
Inferior	96.8±26.03	113.08±18.09	104.94±23.8
Nasal	66.55±12.16	70.94±11.33	68.74±11.93
Temporal	59.43±9.04	64.04±8	61.73±8.82

The mean RNFL thickness is lesser in temporal quadrant followed by nasal, inferior and superior quadrants.

Discussion

Diabetic retinopathy (DR) is a major complication of diabetes and the leading cause of decreased vision in working-age people.[1] Retinal functional impairment may occur early in the course of diabetes and in patients without any signs of DR, suggesting a role for neuroretinal damage in the pathogenesis of DR.

Therefore, we intended to take up this study to know about the neuroretinal damage in patients with DR without retinopathy and age matched controls.

In our study, the RNFL was thinner in temporal quadrant followed by nasal, inferior and superior. Our results are consistent with the study conducted by MA Mehboob et al[5].In a similar study conducted by Sugimoto M et al in which they concluded that RNFL thickness significantly decreased (p = 0.02) in the superior areas.[3]

In our study, on comparison between the diabetic patients with the age matched controls, the RNFL thickness was the thinnest in both the groups in temporal quadrants followed by nasal, inferior and superior quadrants. In a similar study conducted by T Oshitari et al in which they concluded that the mean, superior, and

inferior RNFL thicknesses were thinner than the corresponding sectors of the control group.[6] In a study conducted by Sohn EH and associates, it was revealed that patients with DM but no diabetic retinopathy had thin ganglion cell layer and RNFL, as compared to age matched control group.[7]

Conclusion

Diabetic patients have thinner RNFL as compared to their age matched controls which is due to the neurodegeneration which precedes retinopathy. OCT is an effective tool to assess functional damage even before the occurrence of microvascular damage. Our study may help in further studies for in depth understanding of DR.

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