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Original Research Paper

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COMPARISON OF RETINAL NERVE FIBER LAYER THICKNESS(RNFL) IN NORMAL AND GLAUCOMA PATIENTS WITH OPTICAL COHERENCE TOMOGRAPHY(OCT)

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ABSTRACT

Optical coherence tomography (OCT) has proved to be valuable in the detection of glaucomatous damage. With its high resolution and proven measurement reproducibility, OCT has the potential to become an important tool for glaucoma detection. This manuscript presents the capabilities of the OCT technology evaluate retinal nerve fiber layer thickness in normal and glaucoma patients

Method: -A prospective, non-randomized, observational cross-sectional study was done at Rotary eye hospital, Navsari, from September 2019 to March 2020. Groups were divided in Control and glaucoma group and further Glaucoma patients were also subdivided in to Glaucoma Suspect, OHT, NTG and POAG. Patient went under comprehensive examination and selected patient went undergone measuring average retinal nerve fiber layer thickness (RNFL) was by using ZEISS CIRRUS HD OCT.

Results: - In overall 120 eyes of patients, 60 eyes of control group & 60 eyes of glaucoma groups were analysed. The average RNFL measurement were significantly thinner in glaucoma group with compared control groups were 80±14 and 89±12, ($P<0.01$). All four quadrant RNFL thickness were analysed in Glaucoma Suspect, OHT, NTG and POAG which was statistically highly significant. Superior quadrant RNFL thickness among groups were 105±17, 112±16, 90±17 and 85±18 m respectively (p= < 0.01).Mean RNFL thickness showed a decrease in thickness from Non-Glaucoma to Primary Open angle glaucoma (POAG) shows statistically significant difference.

Conclusions: OCT is important instrument for measuring RNFL thickness. Study shows difference in normal and glaucoma patients and different types of glaucoma patients. OCT measurement will help in early detection of glaucoma as well as in keeping an eye on progression of glaucoma.

KEYWORDS : Retinal nerve fiber layer (RNFL), OCT, Glaucoma

INTRODUCTION

Glaucoma is considered to be the second leading cause of blindness in the world after cataract and refractive error[1]. Glaucoma is a term describing a group of ocular disorders with multi-factorial aetiology united by a clinically characteristic raised intraocular pressure associated progressive optic neuropathy resulting in a characteristic appearance of the optic disc and irreversible field defect that is visual.

Globally, there are more than 60 million cases of glaucoma and it shall increase to 80 to 111.8 million from 2020 to 2040.Currently prevalence of glaucoma is 2.65% in people above 40 yrs[1,2]. In India, more than 11.2 million individuals above 40 yrs. and older suffer from glaucoma. POAG and PACG is estimated to affect 6.48 and 2.54 million people respectively[3]

Glaucoma is the chronic progressive optic neuropathy which is caused by typical optic disc and retinal nerve fiber layer (RNFL) change with correcting visual field defects where in IOP is risk factor that is major. The diagnosis of glaucoma depends on visual field loss (VF) or the appearance of the disc, measurement of IOP or changes in the nerve that is retinal layer (RNFL)[2].

Nowadays, it is widely believed that primary angle that is open (POAG) represents a glaucoma continuum, where there is progressive retinal nerve fiber layer loss as the disease progresses through the stages of clinically undetectable disease in which the patient is apparently normal, early preperimetric glaucoma with nerve fiber defects and/or ocular hypertension (OHT), and manifests POAG. RNFL defects are clinically demonstrated earlier than the field that is visual, and objective RNFL thickness measurement is now possible with newer investigative modalities and technologies like optical coherence tomography (OCT).

The appearance of the glaucomatous was defined as vertical cup > 0.5focal or diffuse thinning of the rim that is neuroretinal asymmetry of the cup disc ratio >0.20 between two eyes. Quigley reported that up to 40-50% of the RNFL could be lost before visual field defects are detected by conventional perimetry. The early detection of NFL changes is crucial for all patients with glaucoma, hence RNFL assessment is an parameter that is important preperimetric diagnosis of glaucoma.[2,4]

Numerous studies have reported Retinal nerve fiber layer was significantly thinner in glaucomatous eyes than in ocular hypertensive and eyes that are normal 360° and in all quadrants[5].

Purpose of this study was to determine loss that is RNFL comparing across different glaucoma groups with the help of OCT.

METHOD

Two Groups were included Control group and Glacuoma group. In overall 120 eyes, 60 eyes of control group and 60 eyes of glaucoma groups participated (76 Male, *Mage*= 57.2,*SDage* = 9.90) participated in this study. Patients age more than 30 having Primary open angle glaucoma(POAG), Glaucoma Suspect, Ocular Hypertension (OHT) and Normal Tension glaucoma (NTG) were included in study, where Patients were excluded due to primary angle closure glaucoma, secondary glaucoma and previous history corneal transplant or corneal opacity

Design

A Prospective cross-sectional study was performed between September 2019 to March 2020 in Rotary Eye Hospital, Navsari. The study was to compare the RNFL readings in control and glaucoma patients by OCT.

Methodology

The protocol was reviewed and approved by the institute review board according to Helsinki Declaration. Initial demographic details with informed consent were taken from all patients participated. Comprehensive eye examination

was performed which include History, Torch light examination, Refraction and Fundus examination.All patients went under glaucoma workup which includes IOP measurement with applanation tonometer,gonioscopy, OCT, perimetry, +78D lens for measuring Cup-disc ratio, pachymetry and specular microscopy,based on all investigation patient diagnosis were confirmed and analysis were conducted.

STATISTICAL ANALYSIS

Statistical analysis was done using IBM SPSS software version 26.Control and Glaucoma group analysis was done using Independent t Test and One way ANOVA was performed in different groups of glaucoma.

RESULTS

Total 120 patients were participated. Two groups of 60 eyes were divided in each Control and glaucoma group. Out of 60, 33(55%) were males, 27(45%) were females in control and 43(72%) were males and 17(28%) were females in glaucoma group. Out of 63% male, 28% non-glaucoma, 12% Glaucoma Suspect,6% OHT, 5% NTG and 13% were POAG patients.

Table 1: Mean Comparison of RNFL thickness in Control and Glaucoma Group

RNFL Thickness (μm)	Control 60(N)	Glaucoma 60(N)	p-value
Average RNFL Thickness	89±12	80±14	*P*<0.01
Superior RNFL Thickness	110±19	96±20	*P*<0.01
Inferior RNFL Thickness	115±22	99±29	*P*<0.01
Temporal RNFL Thickness	60±10	54±10	*P*<0.01
Nasal RNFL Thickness	73±13	68±13	*P*=0.05

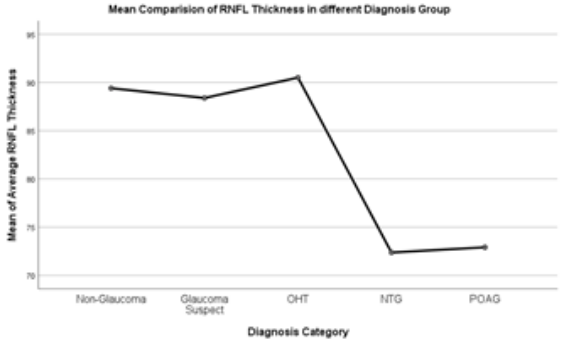
Independent t-test showed RNFL thickness Stastical significant result in control and glaucoma group

Table 2: Mean Comparision of RNFL thickness(μm) in different diagnosis

Diagnosis	Average RNFL	Superior RNFL	Inferior RFNL	Temporal RNFL	Nasal RNFL	value
Non Glaucoma	89±12	110±19	115±22	60±10	73±13	*P*<0.01
Glaucoma Suspect	88±12	105±17	115±19	60±11	73±13	*P*<0.01
OHT	91±14	112±16	124±25	55±10	71±16	*P*<0.01
NTG	72±10	90±17	81±14	45±5	63±11	*P*<0.01
POAG	73±12	85±18	82±27	53±8	65±9	*P*<0.01

Annova Test showed RNFL thickness Stastical significant result in different diagnosis.

An independent sample t test reported a signficant difference in Average RNFL thickness in Control and Glaucoma group $t(118) = 3.70, p < .001$, 95% *C.I.* (4.18, 13.80) as shown in table 1. An analysis of variance showed that the effect of Average RNFL was significant, $F(4,115) = 11.08, p < .001$. as shown in table 2.



Graph1: *Mean Comparison of Average RNFL thickness decreases from Non-Glaucoma to POAG patient.*

DISCUSSION

Technology provides realtime, rapid, high resolution in vivo scans of ocular tissues and thus facilitates the assessment of retinal nerve fiber layer.Studies have previously established normative OCT measurements in healthy population as well as consistently shown that both peripapillary retinal nerve fiber layer (pRNFL) thickness are lower in glaucomatous eyes[6].

As shown in Table 1, Average RNFL thickness in Control group was 89±12 and Glaucoma group were 80±14, p<0.01. Khanal et al in 2014 suggested mean (95% CI) RNFL thickness decreased significantly from normal, 109.8 m (106.7-112.9), and GS, 102.0 (98.57-105.6)[7]

Similar studies conducted by Satya Prakash, Vinai, Arun Kumar, Shivangi, Kamaljeet and Jagriti on Comparison of Retinal Nerve Fibre Layer Thickness by SD- OCT in POAG,NTG and Glaucoma Suspect. 124 eyes were enrolled in this study. The RNFL that is average thickness POAG, NTG and GS groups were 55.26±19.75, 70.1±17.81 and 82.29±10.66 μm respectively, (p= 0.0002) which is similar to our study shows RNFL that is average in, NTG, GS and OHT as 73±12, 72±10, 88±12, 91±14 respectively, (p<0.01) as shown in table 2.

Our study shows Superior quadrant RNFL thickness among 4 groups were 85±18, 90±17, 105±17 and112±16 in POAG, NTG, GS and OHT (P<0.01), results agrees with early studies shows a higher deviation that is standard previous studies 65.45±27.86, 77.8±30.58 and 106.75±16.47 μm respectively, (p =0.0002), Studies suggest lower RNFL thickness in nasal and temporal quandrants in all groups comparatively[8].Most limitation that is important of study was sample size were less in different diagnosis group. Glaucoma is group of condition where cup disc ratio, RNFL and field that is visual suggest the severity of the condition. Current study was focuses only on RNFL thickness and not the other factors. Future studies to work on correlation of all factors in glaucoma patients.

Summary & conclusion

In the present article, RNFL thickness is very important parameter for diagnosing glaucoma patients. This study shows decrease in RNFL thickness in Glaucoma patients and also in Primary open angle glaucoma patients. Future studies to work on correlation of all factors in glaucoma patients for diagnosing and providing an effective treatment in glaucoma patients.

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