COMPARISON OF RETINAL NERVE FIBER LAYER THICKNESS IN PATIENTS OF PRIMARY OPEN ANGLE GLAUCOMA AND HEALTHY ADULTS

Samar Fatima, Qamar ul Islam*, Mazhar Ishaq*, Muhammad Saleem Bajwa, Jehangir Ahmed Afridi

Combined Military Hospital Gujranwala Pakistan, *Armed Forces institute of Ophthalmology Rawalpindi Pakistan

ABSTRACT

Objective: To compare the mean retinal nerve fiber layer (RNFL) thickness in Primary open angle glaucoma (POAG) patients and healthy age matched adults.

Study Design: Case control study.

Place and Duration of Study: Armed Forces Institute of Ophthalmology, Rawalpindi from 12th December 2011 to 17th October 2012.

Material and Methods: Sixty subjects were included in the study, 30 cases and 30 controls, by non-probability consecutive sampling. In group A, patients of POAG were included and in group B, healthy adults having normal intraocular pressure were included. Mean retinal nerve fiber layer thickness (RNFL) measurements and mean of three intraocular pressure (IOP) readings of 30 patients of POAG were taken. RNFL thickness was obtained by spectral domain optical coherence tomography. IOP readings were taken with calibrated Goldman applanation tonometer.

Results: Mean RNFL thickness of 66.19 ± 14.83 microns in group A eyes was significantly lower than mean RNFL thickness of 96.46 ± 14.76 microns in normal adults (p<0.001).

Conclusion: The overall thinner mean retinal nerve fiber layer thickness in POAG patients as compared with normal age matched individuals highlights the importance of early diagnosis and prompt intervention in such patients to reduce the morbidity related to potentially blinding but treatable disease like glaucoma.

Keywords: Intraocular pressure, POAG, RNFL thickness, Tonometer.

INTRODUCTION

Glaucoma is an optic neuropathy with characteristic changes in optic nerve head morphology, accompanied by thinning of the nervefiberlayer, and eventual loss of retinal ganglion cells and visual field deficits[1]. Early diagnosis and initiation of treatment are important factors in minimizing the progression of disease and reducing its burden[2].In Pakistan, it accounts for 7.1% of the total cases of blindness[3].There are about 60 million people worldwide being affected with glaucoma and 8·4 million being bilaterally blind[4].Worldwide, POAG is the second leading cause of blindness; there are 45 million people today with POAG and bilateral blindness is present in 4.5 million of these[5].In routine clinical practice,intraocular pressure(IOP) is one of the most important parameters in the detection and monitoring of glaucoma[6]. Goldman applanation tonometry (GAT) has been the international "gold standard" for IOP measurements[7]. The normal IOP varies from 10-20mmHg[7]. The gold standard for detecting functional damage in glaucoma is currently threshold-estimating automated static grid perimetry[8].Retinal nerve fiberlayer (RNFL) thickness is a key structural measure for diagnosing and following glaucomatous optic neuropathy[9]. Recent studies have shown that peripapillary RNFL defects can precede the development of detectable visual field loss in cases of early glaucomatous optic neuropathy[10].Retinal nerve fiber layer thickness measured in microns by Optical coherence tomography is decreased in POAG.

RNFL thickness measurement helps in early diagnosis and monitoring of disease progression. The aim of this study was to compare RNFL thickness in POAG patients with healthy age matched adults using spectral domain OCT.

MATERIAL AND METHODS

This case control study was conducted at Armed Forces Institute of Ophthalmology,

Correspondence: Dr Samar Fatima, Graded Eye Specialist, CMH Gujranwala, Pakistan
Email: samarfatima88@gmail.com
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Rawalpindi, from 12th December 2011 to 17th October 2012. A total of 60 subjects were included in the study, 30 cases and 30 healthy controls by non-probability consecutive sampling. In group A, patients of POAG were included and in group B, healthy adults having normal intraocular pressure were included.

Inclusion criteria for group A was, an IOP more than 22 mmHg on at least two diurnal curves, open angle, glaucomatous optic disc, at least two Humphrey visual field tests confirming glaucomatous defects and OCT optic nerve head with good image quality. Group B included subjects with no evidence of ocular pathologies, an IOP less than 21mmHg at three different successive measurements, openangle, normal optic disc and Humphrey visual field tests and no family history of glaucoma. Patients withocular diseases other than glaucoma, refractive error >± 5 diopters, previous intraocular surgery or laser photocoagulation treatment, presence of secondary glaucoma, large peripapillary atrophy and media opacities were excluded.

Prior approval of hospital ethical committee was obtained. Patients and controls were taken from outpatient department of AFIO. After informed consent, all patients underwent a comprehensive ophthalmic assessment consisting of history regarding refractive errors, glaucoma, use of topical steroids, and history of any ocular surgery. Best corrected visual acuity was obtained followed by slit lamp examination to ensure strict adherence to inclusion and exclusion criteria to eliminate bias in our study. Three consecutive IOP measurements were taken in both eyes using same calibrated Goldmann applanation tonometer and mean were top recorded for data analysis. All readings will be taken by first author between 0900-1200 hrs to eliminate the effect of diurnal variation. Peripapillary RNFL thickness was measured with Spectral Domain OCT machine (Top Con 3D Mark II-1000). After dilating the pupils and patient looking in primary position of gaze, peripapillary RNFL thickness was measured in all four quadrants, that is, superior, inferior, nasal and temporal and their average was used for analysis. Data had been entered in the specially designed proforma. Data analysis was done with SPSS version 14.Descriptive statistics were used to describe the results. Independent sample t-test was applied to compare the age and RNFL thickness between Group A and Group B. A *p* value <0.05 was considered significant while chi-square test was applied to compare gender.

RESULTS

A total of 30 patients of primary open angle glaucoma (POAG) were included in group A. Mean age of patients in group A was 47.97 ± 8.58 years. In group B, a total of 30 controls were included. Mean age of group B was 45.16 ± 8.38 years. Both the groups are comparable with respect to age (*p*= 0.165) and majority of patients in each group were in their 5th- 6th decade of life (fig-1). Gender distribution was similar in both groups with a male to female ratio of 3:1 (*p*=1.000).

Table: Comparison of RNFL thickness between Group A and Group B.

	Mean ± SD (microns)	95% CI (microns)	*p* value
Group A (n=30)	66.19 ± 14.83	60.88-71.5	0.000*
Group B (n=30)	96.46 ± 14.76	91.18-101.75	<.001

In group A, mean IOP was 28.56 ± 3.76 mm of Hg, whereas, mean IOP in group B was 15.73 ± 2.01 mm of Hg. Mean IOP of group A was significantly higher than that of group B (*p*<0.001).

The overall mean RNFL thickness in group A was 66.19 ± 14.83 microns with a range of 35.75 to 94.62 microns, whereas, mean RNFL thickness in group B was 96.46 ± 14.76 microns with a range of 68.37 to 154.50 microns (table-1).These results suggested significantly thinner RNFL in glaucomatous eyes as compared to normal eyes (*p*<0.001).

DISCUSSION

RNFL thickness measured on OCT may serve as useful adjunct in accurately and more objectively distinguishing normal from glaucomatous eyes, even in the early stages of

glaucoma and may help to differentiate various severities of glaucoma.This study quantified and compared RNFL thickness in normal eyes and glaucomatous eyes by using spectral domain OCT which was significantly thinner in glaucomatous eyes as compared with normal eyes.

In this study, there was significant male preponderance in POAG group which coincides with results of study conducted by Alicja et al[11] who concluded that men are more likely to have open angle glaucoma as compared to women.

In this study, we found that average RNFL thickness being 30% lesser in glaucomatous eyes compared with normal eyes, which corresponds to the study by Moschoseet al[12] in which mean RNFL thickness in glaucomatous eyes was 33% lesser as compared to healthy adults having normal intraocular pressure.

Our results provide some insight into the ability of OCT to categorize eyes glaucomatous or normal. We found considerable overlap in RNFLthickness among study groups. However, it is most likely not a limitation of OCT technologyitself, but rather a by-product of large individual differencesin RNFL thickness. Studies conducted by Zangwill et al[13] and Nakla et al[14] showed that OCT is as good as scanning laserpolarimetry (SLP) and Heidelberg retinal tomography (HRT) in differentiating glaucomatous eyes from normal eyes despite the fact that OCT image analysis is based on 100 data points rather than several thousand in SLP and HRT. Further more,all our patients were of Asian origin.Several studies have shown racial differences in measurements of optic disc parameters, including differences in RNFL thickness[15-17].

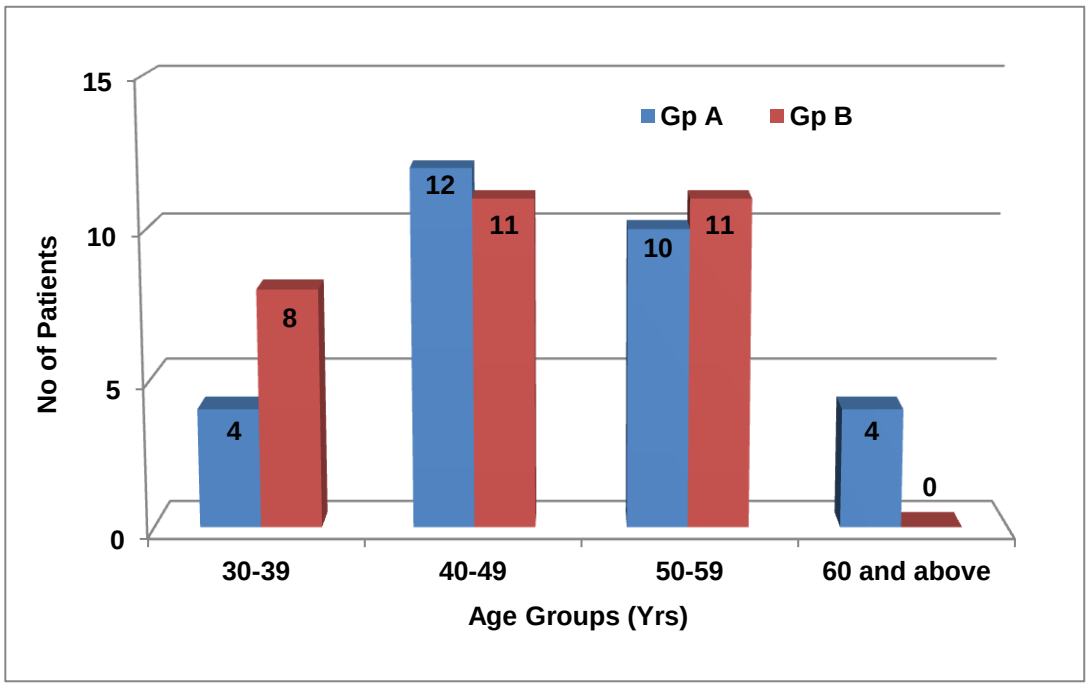

Figure: Age spectrum of patients in group A and B.

Differencesin RNFL thickness between glaucomatous and normal eyes are well documented[18,19]. The overall mean RNFL thickness in the POAG group was 66.190 ± 14.839 microns with a range of 35.75 to 94.62 microns .The overall mean RNFL thickness in the control group was 96.464 ± 14.769 microns with a range of 68.37 to 154.50 microns. This was close to the study conducted by Lee JY et al[20] which showed average RNFL thickness in normal eyes to be 94.4 ± 4 microns.

Similarly, study on Chinese population showed a mean RNFL thickness of 64.6 ± 28.8 microns in glaucomatous eyes[21].The above mentioned study, like ours, also showed a significant difference in RNFL thickness between the normal and glaucomatous groups.

A study conducted in India in 2006 showed a significant difference in all RNFL thickness parameters between normal and all glaucoma subgroups[22]. The average RNFL in control subjects, early glaucoma, moderate glaucoma, severe glaucoma and blind glaucoma were 102.30 ± 10.34, 77.68 ± 15.7, 66.07 ± 15.5, 53.65 ± 14.2, and 44.93 ± 4.95 microns, respectively.

Study by Ramakrishna et al[23] showed normal average RNFL thickness in Indian population to be 104.8 + 38.81 microns nearly corresponds to the normative data of our study which is 96.46 ± 14.76 microns. There was no significant difference in measurements between males and females in the above mentioned study like ours.

CONCLUSION

Mean RNFL thickness was significantly lower in POAG as compared to normal adults having normal intraocular pressure. Measurement of RNFL thickness by OCT serves as useful adjunct in accurately and objectively distinguishing normal from glaucomatous eyes, even in early stages of glaucoma and may help to differentiate various severity of glaucoma. The RNFL thickness measurement by OCT should be routinely done in diagnosis and management of POAG.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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