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Original Research Paper

Comparison of pseudoexfoliation patients structurally and functionally in different glaucomatous stages

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ABSTRACT:
Aim: to compare functional staging using perimetry with structural results using Hiedelberg Retinal Tomograph (HRT), in pseudoexfoliation (PXS) patients. **Methods**: 110 eyes of 55 patients with bilateral PXS, and 60 eyes for 60 patients with unilateral PXS, and 50 right eyes of age matched controls were studied. Each participant was studied using perimetry to test visual field, and HRT to study optic nerve head (ONH). The measured parameters were mean sensitivity (MS), mean defect (MD), mean retinal nerve fiber layer (RNFL) thickness and in six sectors around ONH. The tested eyes were categorized based on visual field results into non-glaucomatous PXS, early pseudoexfoliation glaucoma (PXG), moderate PXG and severe PXG. The RNFL thicknesses were compared between groups. **Results**: MS, MD results were (21.7 dB, 1.45dB in controls, 20.9 dB, 1.54dB in non-glaucomatous PXS, 19.4 dB, 4.1 dB in early PXG, 13.5 dB, 9.4 dB in moderate PXG, and 9.1 dB and 13.4 dB in severe PXG). With significant difference between groups except between non-glaucomatous PXS and controls. Mean RNFL thickness and of superotemporal, inferotemporal and temporal sectors were significantly different between non-glaucomatous PXS and controls. Mean RNFL thickness and of superotemporal and inferotemporal sectors were significantly different between early PXG and non-glaucomatous PXS. Mean RNFL thickness and of all sectors except nasally and temporally were significantly different between early and moderate PXG, and mean RNFL thickness and of all sectors were significantly different between moderate and severe PXG. **Conclusion**: There was a general agreement between visual field and RNFL thickness in glaucoma stages. however, RNFL thickness altered earlier in non-glaucomatous PXS.

Keywords: Pseudoexfoliation, visual field, HRT

INTRODUCTION:

Pseudoexfoliation syndrome (PXS) is an age-related condition characterized by the presence and accumulation of gray-white substance in different ocular and extra-ocular structures [1]. It is more common in elderly and rare under 50 years of age. Scandinavian and Mediterranean regions are thought to have high rates of PXS[2]. PXS is the most common cause of secondary open angle glaucoma, and up to 50% of PXS patients develop eventually glaucoma[3]. Visual field testing is the gold standard for diagnosing and staging glaucoma [4]. However, it is a subjective method, requiring high patient cooperation to give accurate results. Additionally, up to 50% of ganglion cells could be lost prior to detecting defects in visual field [5]. Hiedelberg Retinal Tomograph (HRT) (Heidelberg Engineering, Germany) is an objective method to assess optic nerve head (ONH). It measures mean retinal nerve fiber layer (RNFL) thickness around optic disc and in six sectors. It is proven to be accurate in detecting glaucomatous RNFL defects [6], [7].

This study aims to compare parameters of visual field and HRT in PXS patients and controls to compare their changes in different glaucoma stages.

MATERIALS AND METHODS:

110 eyes of 55 patients with bilateral PXS, and 60 eyes for 60 patients with unilateral PXS, in addition to 50 right eyes of age matched controls were studied. PXS was diagnosed based on presence of exfoliates on pupillary edge and\or anterior lens surface. Each participant had full ophthalmic and systemic history taking, visual acuity assessment with and without best correction, slit lamp examination after pupillary dilation to see the full pattern of exfoliates precipitation, biomicroscopy, intra-ocular pressure (IOP) measurment,

perimetry to test visual field, and HRT to measure RNFL thickness.

Visual Field: the used method was white on white 30-2 glaucoma program using Octopus A900 perimetry. The examined participant was told to relax, look straight and press the button when he saw a light in the periphery. Correcting glasses were used according to distance from the dome of the perimeter. Test was accepted when false positive and false negative were below 20%, otherwise it was re-done.

The measured parameters were mean sensitivity (MS) and mean defect (MD). Glaucoma severity was assessed according to Hodapp-Parish-Anderson (HPA) classification, and participants were divided into five groups: group 1 of controls, group 2 of non-glaucomatous PXS, group 3 of early PXG, group 4 of moderate PXG, and group 5 of severe PXG.

HRT: the participant was seated and told to look on the flashing light in the nasal field of vision to consequential ONH images making a 3-D ONH image. Disc contour was drawn at the margin of the scleral rim. The measured parameters were mean RNFL thicknes and RNFL thickness in six sectors around ONH (Superotemporal, inferotemporal, temporal, superonasal, inferonasal, and nasal). The RNFL thicknesses were compared between the five groups.

Statistical Analysis: Quantitative variables were compared as means and standard deviations (SD), T student test was done to compare means of two independent groups, IBM SPSS V23 was used to perform statistical calculations, P value < 5% was considered significant.

RESULTS:

Mean age of bilateral PXS patients was significantly higher than unilateral PXS with no significant difference between patients and controls (table 1).

Table 1: mean age of participants

	Bilateral PXS	Unilateral PXS	controls	P1	P2
Mean age (years)	74.56±8.75	70.22±9.04	72.5±8.47	0.038	0.11

P1: significance of difference between unilateral and bilateral PXS, P2: significance of difference between PXS and controls

Regarding visual field, 39 eyes out of 170 eyes had glaucoma (22.94%), with significant difference between groups (table 2)

Table 2: Visual field parameters in study groups

P	Group1	Group2	Group3	Group4	Group5	P (ANOVA)
count	50	132	14	12	13	**<0.001**
MS (dB)	21.7±1.22	20.9±1.34	19.4±3.28	13.5±4.32	9.1±4.11	
MD (dB)	1.45±0.36	1.54±0.44	4.1±1.89	9.4±3.88	13.4±5.76	

RNFL thickness changed between all of the study groups according to table 3

Table 3: RNFL thickness of study groups:

	Group 1	Group 2	Group 3	Group 4	Group 5	P1	P2	P3	P4
Global (µm)	264.4±72.5	230.4±47.2	204.9±43.3	170.5±41.1	113.5±71	**0.003**	**0.005**	**0.02**	**0.002**
Temporal (µm)	115.7±35.6	92.9±23.3	87.9±21.9	85.8±16.2	68.9±16.6	**0.02**	0.12	0.2	**0.01**

Superotemporal (µm)	325.3±33.6	302.6±47.2	262.7±59.4	205.8±83.4	132.8±104	**0.02**	**0.008**	**<0.001**	**<0.001**
Inferotemporal (µm)	336.4±36.8	302.2±55.3	233.1±69.9	205.7±72.8	130.5±94.3	**0.008**	**<0.001**	**0.01**	**<0.001**
Nasal (µm)	163.7±26.7	156.2±25.3	146.7±29.5	133.3±23.7	102.3±27.5	0.08	0.07	0.06	**0.01**
Superonasal (µm)	325.4±37.6	310.9±41.2	287.6±37.4	230.8±30.8	126.2±74.4	0.09	0.06	**0.002**	**<0.001**
Inferonasal (µm)	319.7±27.8	304.5±55.4	284.7±50.3	232.2±48.6	158.4±23.2	0.1	0.06	**0.002**	**<0.001**

P1: significance of difference between groups 1 and 2, P2: significance of difference between groups 2 and 3, P3: significance of difference between groups 3 and 4, P4: significance of difference between groups 4 and 5.

DISCUSSION:

170 PXS eyes and 50 control eyes were studied using perimetry and HRT. According to visual field results, patients were divided into controls, non-glaucomatous PXS, early PXG, moderate PXG and severe PXG. There was significant difference between groups 1 and 2 in mean and superotemporal, inferotemporal and temporal RNFL thickness, between groups 2 and 3 in mean, superotemporal and inferotemporal RNFL thickness, between groups 3 and 4 in mean and all sectors except nasal and temporal RNFL thickness, and between groups 3 and 4 in mean and RNFL thicknesses in all sectors.This study agreed with Xie et al [8] in comparison of glaucoma stages with different RNFL thickness values due to OCT used instead of HRT. However, they didn't study non glaucomatous PXS.

Sandhya et al [9]found significant difference in RNFL thickness in primary open angle glaucoma (POAG) patients in superior and inferior quadrant between early and moderate glaucoma, and in all sectors between moderate and severe glaucoma. Also Sihota et al [10]. found difference in POAG patients between glaucoma grades in all sectors and especially average and inferior RNFL. The difference in results from our study may be due to different patient's specifications (non PXS) and different device used (OCT). This study found thinning in RNFL thickness in PXS patients (even in absence of glaucoma) as many studies found effect of PXS on extracellular matrix, and the first sectors to be affected were temporal, inferotemporal and superotemporal, followed by inferonasal and superonasal, and finally nasal in severe glaucoma.

CONCLUSION:

RNFL thickness changes agreed with visual field parameters in grading glaucoma in PXS patients, and changed earlier in non-glaucomatous PXS.

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