

To Evaluate Effects of Primary Open Angle Glaucoma and Ocular Hypertension on Visual Functions

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Abstract

Background And Aims: To evaluate effect of Primary open angle glaucoma (POAG) and Ocular hypertension (OHT) on visual functions. **Material And Methods:** A prospective cross-sectional study on 116 eyes of 58 patients (20 normal patients, 28 POAG patients and 10 OHT patients) attending the out-patient's department of a tertiary eye care hospital was carried out. All patients underwent a complete ophthalmic examination including visual acuity measurement, visual field examination, contrast sensitivity measurement, colour vision testing and stereopsis. **Results:** 58 patients with a mean age of 44.2 (\pm 9.17) years were enrolled in the study. Mean visual acuity was 0.0181 log unit (\pm 0.027); contrast sensitivity 1.79 log unit (\pm 1.14) and stereopsis 117 secs of an arc (\pm 59.92) in the normal group with normal colour vision and visual fields. The same was 0.09 log unit (\pm 0.07), 1.36 log units (\pm 0.16) and 270 seconds of an arc (\pm 106.45) respectively, colour vision defective in 60.71% and visual field defects in 87.50% amongst the POAG group. Mean visual acuity was 0.0291 log unit (\pm 0.03), contrast sensitivity 1.537 log unit (\pm 0.06), stereopsis 204 seconds of an arc (\pm 57.96), defective colour vision in 25% cases and no patient with visual field defects amongst the patients having OHT. **Conclusion:** Visual functions are affected in patients with POAG and OHT.

Key Words: Primary open angle glaucoma, ocular hypertension, visual functions.

Introduction

Glaucoma is a chronic progressive optic neuropathy which causes irreversible visual loss. Glaucoma is the second common cause of blindness all over the world and accounts for 14% of total blind population. In a systematic meta-analysis of 2014, global prevalence of glaucoma was 3.54% with the highest prevalence in Africa. The number of people with glaucoma worldwide (ages 40-80 years) was projected to increase from 64.3 million in 2013 to 111.8 million in 2040, disproportionately affecting people residing in Asia and Africa. It is the leading cause of irreversible blindness and accounts for 7 million blind population in the world. Visual factors namely visual acuity, contrast sensitivity, colour vision, visual field and stereopsis play a major role in daily routine life. People with visual problems face significant challenges such as recognizing objects and people, difficulty in reading, driving, mobility, socialising, working and taking care of daily needs.⁽¹⁾

Majority of studies done in glaucoma patients focuses on visual acuity only. There are very few studies conducted to evaluate other visual functions which are as important as visual acuity. This study was undertaken to evaluate all parameters of visual functions in normal, POAG (Primary open angle glaucoma) and OHT (ocular hypertension) patients and to compare the changes in visual functions amongst the three different groups.

Material and Methods:

A prospective cross sectional observational study was conducted on 116 eyes of 58 patients at a tertiary eye

care hospital. The study was conducted for period of 18 months. This study protocol adhered to the tenets of Declaration of Helsinki. Written informed consent was obtained from all patients. Out of 58 patients, 20 were normal persons, 28 were POAG patients and 10 were patients with OHT. Patients more than 18 years of age and willing to participate in the study and fulfilling inclusion criteria were included in the study. Established cases of POAG and OHT (on treatment) with the best corrected visual acuity of 20/40 or more, having cataract not more than NS 2 grade (according to LOCS classification) and refractive error $< \pm 5.00$ D were included in the study. Patients with any systemic illness, ocular pathologies other than glaucoma, history of eye surgery or trauma, on topical pilocarpine eye drops and those having advanced visual field defects in late stages of glaucoma were excluded from the study.

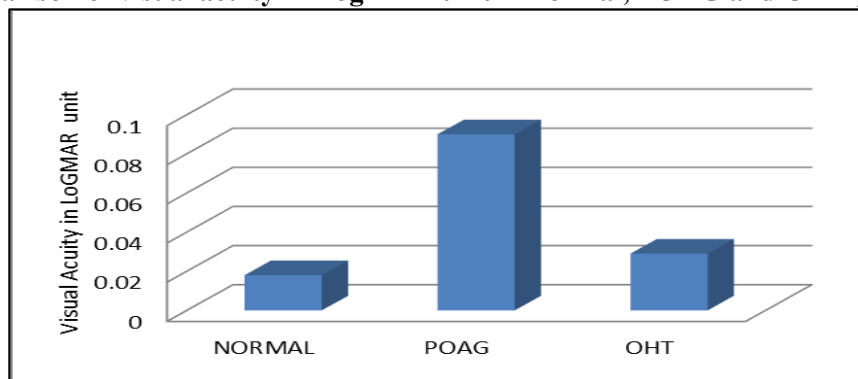
All enrolled participants underwent a complete anterior segment evaluation including a medical history, visual acuity recording for distance and near using Log Mar chart, objective and subjective refraction, intra ocular pressure measurement using Goldman Applanation Tonometer, fundus examination using +90 lens, visual field examination using Humphery field analyzer, contrast sensitivity measurement using Pelli-Robson contrast sensitivity chart, colour vision testing with Farnsworth Dichotomos Panel D -15 and stereopsis with TNO test. The normal group recorded a normal intra ocular pressure reading on two occasions, normal fundus and normal visual fields.

Statistical analysis was done using the non parametric Kruskal-Wallis test. The student unpaired t test was used to compare the normal with POAG and OHT patients.

Results

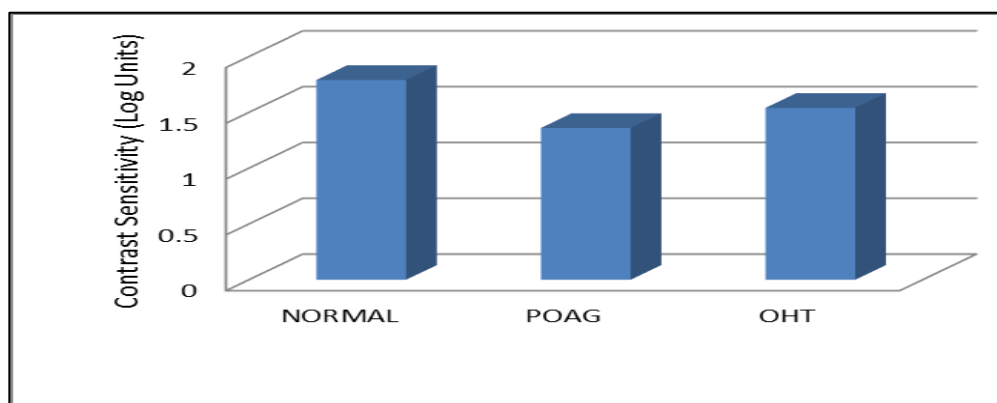
A total of 116 eyes of 58 patients were examined (25 males,33 females) out of which 40 eyes were normal, 56 eyes had POAG and 20 had OHT. In the age group of 20-40 years 8 patients were normal, 9 patients had POAG and 6 had OHT, while in the age group of 41-60 years the same were 12,19 and 4 respectively. In normal patients, male and female were 10 each, while in patients with POAG 11 were male and 17 were female and in patients with OHT, 4 patients were male and 6 were female patients.

Figure 1: Comparison of visual acuity in LogMAR unit in normal, POAG and OHT patients



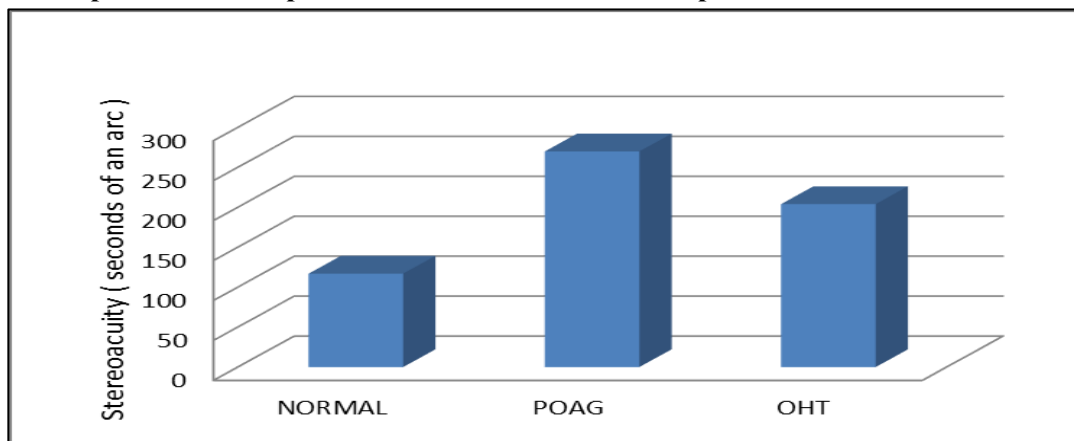
The mean visual acuity by LogMAR chart was 0.018 in normal patients, while it was 0.029 in patients with OHT and decreased to 0.09 in patients with POAG (Figure 1).

Figure 2: Comparison of contrast sensitivity in normal, POAG and OHT patients



Mean contrast sensitivity measured in normal participants were 1.79 Log Units, while it was 1.54 Log Units in patients with OHT and 1.36 Log Units in patients with POAG (Figure 2).

Figure 3: Comparison of stereopsis in normal, POAG and OHT patients



Regarding stereopsis, mean was 117 seconds of arc in normal patients, 204 seconds of arc in patients with OHT and 270 seconds of arc in patients with POAG(Figure 3).

All normal patients were having normal colour vision while colour vision was defective in 25% patients with OHT and 60.71% patients with POAG. Visual field defects in patients with POAG were superior isolated scotoma in 7 eyes, superior arcuate scotoma in 6 eyes, inferior isolated scotomas in 5 eyes, inferior arcuate scotoma in 4 eye, superior and inferior arcuate scotomas in 16 eyes, nasal step in 4 eyes, superior paracentral scotoma in 4 eyes and enlargement of blind spot in 3 patients.

Table – 1: Comparison of Different Visual functions in normal, POAG and OHT patients

Visual function	Comparative groups	Statistical significance	P value
Visual acuity	POAG and normal patients	27.973×10^{-3}	<0.001
	OHT and normal patients	9.038	>0.05
	OHT and POAG patients	-18.963	>0.05
Contrast sensitivity	POAG and normal patients	-59.411×10^{-3}	<0.001
	OHT and normal patients	-33.750×10^{-3}	<0.001
	OHT and POAG patients	-25.661×10^{-3}	<0.001
Stereopsis	POAG and normal patients	-24.236×10^{-3}	<0.001
	OHT and normal patients	-16.675×10^{-3}	<0.05
	OHT and POAG patients	7.561	<0.05

There was statistically significant difference in visual acuity between normal patients and patients with POAG ($p < 0.001$), while it was not statistically significant between OHT and POAG group and OHT and normal patients group. We found statistically significant difference in the contrast sensitivity between POAG and normal patients, OHT and normal patients and POAG and OHT patients ($p < 0.001$). Regarding stereopsis, statistically significant difference was found between POAG and normal patients ($p < 0.001$). While it was not the same in other two comparison groups(Table 1).

Discussion

Visual function tests are at the core of current disability determination practices. Studies in the past have

shown that visual functions are affected in patients of primary open angle glaucoma. As the prevalence of POAG increases with age, cases which we selected were in the age group of 20 to 60 years. Though visual acuity assessment provide data about percentage of visual impairment, it is decreased only in the advance glaucoma. That's why it is not useful to determine the progress of glaucoma in early or moderate glaucoma cases. In patients with early glaucomatous damage, changes in contrast sensitivity has been reported⁽²⁾. There is a correlation between contrast sensitivity and the activity performance. Assessment of contrast sensitivity can help us to know how glaucomatous nerve damage can affect daily tasks.

Various reports have been published about the affection of visual functions in primary open angle glaucoma. J.E. Ross et al concluded that monocular as well as binocular distance visual acuity was significantly decreased in POAG patients⁽³⁾. Bassi CJ et al measured the contrast sensitivity by Pelli-robson contrast sensitivity chart and concluded that there was a significant loss of contrast sensitivity in the POAG patients compared to the ocular hypertension and control subjects⁽⁴⁾. Je Ross , Ajbron at al also concluded that contrast sensitivity results were abnormal in OHT patients and so contrast sensitivity test may be used as a criterion for therapy in OHT⁽⁵⁾. R. Gockeln et al concluded that damage of retinal ganglion cells and their axons often leads to a significant decrease in global stereopsis by measuring it with random - dot-contours⁽⁶⁾. N Gupta et al concluded that there were depth perception deficits in glaucoma suspects and glaucoma patients on measuring their stereopsis with Frisby stereo test⁽⁷⁾. Stefan C et found acquired colour vision defects in early stages of POAG and in patients at risk for glaucoma⁽⁸⁾. He concluded that there was a decrease in colour discriminating sensitivity in the short wavelength part of the visible spectrum and a positive correlation between blue yellow colour vision defects and perimetric changes in glaucomatous eyes. M.Pachecocutillas et al also concluded that blue -yellow colour vision defects are detected because the short wave length cones and their neuronal corrections are less able to resist the effect of raised IOP⁽⁹⁾. N Gupta et al found out normal visual fields with OHT patients⁽⁷⁾; while J.E.Ross et al⁽³⁾concluded that visual field plots revealed typical glaucomatous loss which varied in severity from mild field loss, that is central depression and nasal step to severe loss that is absent central field and gross constriction. A small sample size is a limitation of our study. In our further studies,we would like to take into consideration the visual field index (VFI) ; which is a measure of the patient's overall visual function as compared to an age adjusted normal population⁽¹⁰⁾. It would enable us to study the visual functions of glaucoma patients at a glance and also provide us with a quick overview of the changes, either deterioration or improvement overtime in long term glaucoma management.

Conclusion

All parameters of visual functions were affected in POAG patients significantly in our study. In OHT pateints, only contrast sensitivity &stereoacity were affected. Contrast sensitivity was the first parameter to get hampered and so it is important to first evaluate contrast sensitivity in OHT patients and try to preserve the remaining visual functions. We conclude that regular follow up and assessment of visual functions along with glaucoma workup in all POAG & OHT patients is important to preserve the patient's precious visual functions which are an important tool for daily activities.

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