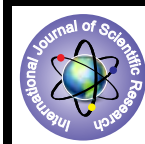


The Visual Field in Normal Tension and Hyper Tension Glaukoma



Clinical Research

KEYWORDS: normal tension glaucoma, hyper tension glaukoma, visual field, pattern defect, overall defect

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ABSTRACT

The aim of the study was to determine whether normal tension glaucoma (NTG) is different from hypertension glaucoma (HTG) in global indices –with regard to the pattern defect (PD) and overall defect (OD) of the visual field. 25 NTG patients with an average age of 62.8 years and 25 HTG patients with an average age of 62.5 years were included in the study. All patients underwent a visual field examination using the Medmont M700 fast threshold glaucoma program. Both groups had approximately the same impairment of the visual field. No patient had other ophthalmological or neurological diseases. Subsequently, we compared PD and OD in both groups. Statistical analysis was performed using the paired t-test, which showed that PD is statistically higher than OD ($p = 0.0001$) in patients with NTG. On the contrary, patients with HTG showed statistically higher OD values when compared to PD ($p = 0.000$). Conclusion: We found that both groups of diseases show significantly different visual field findings.

Introduction

It is generally acknowledged that there are differences between NTG and HTG, not only in terms of intraocular pressure but also in terms of the nature of changes to the field of vision; changes, for example, which extend more to wards the centre and result in a more significant decrease in insensitivity [1, 2, 3, 4].

Some of the typical differences include :a greater interference of nerve fibres with the centre of the retina in addition to focal characteristics [5] ;a larger and deeper excavation in contrast to the lamina cribrosa, which is thinner [6,7] ;vasospasms [8] ;night systemic hypotension, reduced ocular pulse amplitude and fluctuation of ocular perfusion pressure [9,10,11,12] ;narrowed retinal veins ;worsening Hem or Hologic blood quality [13,14] ;etc. The idea that the diseases may not be the same is a problem we have been dealing with for years. So far, we have managed to prove differences at the level of visual pathway damage [15]. This conclusion is also supported by our studies of different FMRI changes in patients with HTG and NTG [16,17].

Based on the above information, we suggest that visual field changes in NTG and HTG may be associated with different values of global indices –with regard to pattern defect (PD) and overall defect (OD).

PD statistics are based on spatial correlation and are a measure of the clustering and depth of the defects. They are a scaled mean value of the product of a point's HoV deviation and that of its neighbours. They are qualified by the extent to which the deviations are spatially correlated or clustered. For example, if deviations from the patient's HoV are distributed more or less randomly throughout the field, then the PD will be small. As deviations tend to cluster, the index will increase, particularly in cases where both absolute deviations and clustering are high.

Age	Pattern defect	Seriousness marked by asterisks
1-45	>1.5	*
46-60	>4.5	**
61- >>7.5		***

Table 1: PD values and the seriousness with regard to the patient's age

OD is the mean difference between the age-normal hill of vision (HoV) and the mean deviation or patient-based HoV. This number is negative if the patient's HoV is less than the age-normal HoV. Up to three asterisks are appended to this number as a severity indication.

Age	*	**	***
1-45	-2.6	-3.75	-4.92
46-60	-2.8	-4.05	-6.10
60+	-3.2	-5.92	-8.91

Table 2: The relationship between OD severity and the number of asterisks.

Materials and Methods

25 NTG patients (20 women and 5 men) with an average age of 62.8 years (44-75) and 25 HTG patients (17 women and 8 men) with an average age of 62.5 years (35-83) were included in the study.

The inclusion criteria were as follows: the diagnosis was based on a comprehensive ophthalmological examination consisting of pattern electroretinography and visual evoked potentials. For all patients, we conducted the visual field examination using the Medmont M700 (manufactured by Medmont International Pty Ltd, Australia) fast threshold glaucoma program. Both groups had approximately the same changes in the visual fields. All patients were followed for at least ten years and visual field results were based on the final examination. None of them had any other ophthalmological or neurological diseases. The criteria for reliable visual field results were fewer than 20% for fixation losses and 15% for false positives and false negatives. Other inclusion criteria were: visual acuity of 1.0 or better, a refractive error not exceeding 6.00 diopters sphere and/or 2.00 diopters cylinder, clear ocular media with no clinically significant cataracts, open angle and no previous ocular surgery aside from uncomplicated

cataract extraction.

In both diagnostic groups, we compared the global indices - PD and OD. Table 3 (NTG) and Table 4 (HTG) show summary data on age, gender and PD/OD values.

Results

25 patients (50 eyes) were evaluated in each group. We mutually compared PD and OD results.

NTGI				
sex/age	RE-PD	RE-OD	LE-PD	LE-OD
F/44	9.3	2.3	2.8	3.3
M/45	2.4	4.7	1.5	3.9
F/51	12.8	4.7	12	3.8
F/53	4.9	3.2	2.3	2.2
M/53	2.1	3.9	1.5	4.1
F/54	2.4	3.4	1.9	2.9
M/58	4.9	2.5	7.4	2.2
F/58	6.3	2.3	2.4	2.2
F/59	2.8	3.6	2.1	3.8
F/61	2.3	5.1	1.7	4.7
F/63	4.1	2.5	4.9	2.3
F/63	1.2	3.3	2.4	3.9
F/65	2.4	3.8	6.8	2.6
M/65	1.9	2.9	1.8	2.7
F/67	5.2	3.1	5.9	0.5
F/67	6.3	2.6	4.2	1.3
F/68	2.8	3.5	9.5	2.8
F/70	9.9	3.1	5.7	0.5
F/70	5.2	2.9	1.8	1.7
M/71	18.1	2.8	6.7	2.8
F/71	6.9	1.9	4.3	1.4
F/72	14.4	0.5	11.8	2.4
F/73	4.5	1.0	4.2	0.6
F/74	5.1	1.0	2.4	1.9
F/75	3.1	1.5	3.1	1.9

Table 3: Summary data on age, sex and PD/OD values in patients with NTG

HTGI				
sex/age	RE-PD	RE-OD	LE-PD	LE-OD
M/35	1.5	2.5	1.5	1.7
F/36	1.8	3.5	1.5	1.7
M/43	2.2	3.2	2.5	2.9
F/48	1.3	8.3	1.9	8.4
F/56	2.4	3.4	1.9	2.9
F/57	2.2	4.4	1.9	2.9
M/57	2.0	3.9	1.8	3.0
F/59	1.9	3.5	1.4	1.8

F/59	1.8	3.4	1.6	1.9
F/59	1.2	3.8	2.4	2.9
M/61	2.8	3.6	2.8	3.1
F/63	2.4	3.9	1.2	3.3
F/66	2.9	5.4	1.9	3.9
F/66	2.6	3.7	1.9	2.9
M/68	0.8	4.6	1.3	3.9
F/68	1.4	3.7	1.8	3.2
F/69	2.9	4.1	1.3	3.2
M/69	3.9	4.2	1.8	5.2
F/70	2.1	2.9	1.9	2.5
M/71	1.3	3.2	1.6	4.9
F/72	1.5	5.2	2.2	4.2
F/73	2.4	2.6	2.3	3.1
F/76	2.8	5.8	1.3	3.3
M/79	1.2	3.1	1.9	2.2
F/83	2.7	2.8	0.9	2.2

Table 4 : Summary data on age, sex and PD/OD values in patients with HTG

The paired t-test was used for statistical analysis. Comparison of both global indices showed that PD values were statistically significantly higher than OD values in patients with NTG(p= 0.000165).

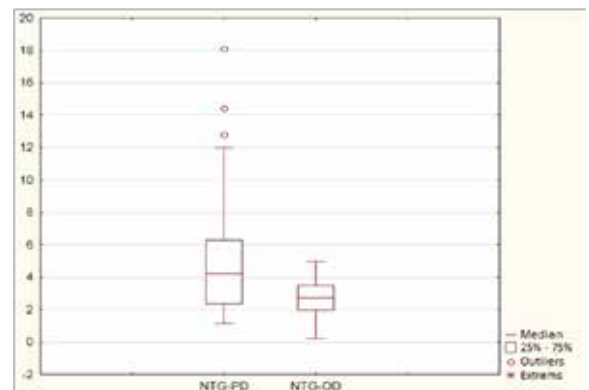


Figure 1: Box chart shows PD and OD values measured in patients with NTG

Similarly, we also used the paired t-test to compare individual, monitored parameters in patients with HTG. The comparison showed that OD values were statistically significantly higher in patients with HTG than OP values (p = 0.0000).

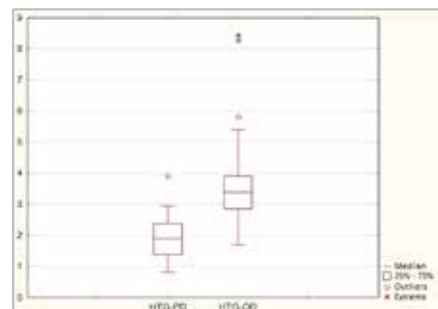


Figure 2: Box chart shows PD and OD values measured in patients with HTG.

Discussion

NTG is a condition consisting of typical glaucomatous disc and visual field changes, along with the presence of open angle glaucoma and IOP within a statistically normal range [18]. Zeiter et al. and Araie et al. compared changes in visual fields in NTG and HTG and came to the conclusion that the changes were different in both groups. Changes in patients with NTG were predominantly localised closer to the centre [1,19]. Caprioli and Spaeth showed that scotomas in NTG had a steeper slope, were significantly closer to fixation compared to HTG and exhibited greater depth [20]. Greve and Geijssen detected differences in the distribution of the visual field defects between HTG and NTG. In the latter group, defects were more frequently in the upper half of the visual field [21]. Other authors such as Drance did not find any differences in the characteristics of the visual fields of HTG, NTG or ischaemic anterior optic neuropathy using Goldmannperimetry [22]. Many other studies are available in the literature and some authors have argued that HTG and NTG produce different visual field defects and ONH damage [23,24], while others have found that optic disc and visual field appearances are similar between the two subgroups [25,26]. More recent studies rather point to different visual field findings in both diagnostic groups [2,3]. Thonginnetra et al. evaluated NTG and HTG patients using functional and structural tests and found functional differences between these two groups. The results had clinical implications for the evaluation of visual field defects in NTG and HTG eyes. Because a higher prevalence of visual field defects in the central region was found, they recommended that intensive testing of the central 10-degrees of the visual field (10-2 strategy) should be performed on patients with NTG [3]. Lester et al. suggested that there was no relevant difference in pointwise analysis between NTG and HTG; however, when visual field areas were compared, no difference in paracentral areas was found between NTG and HTG, but superior nasal step and inferior and superior scotomata proved to be deeper in HTG than in NTG [4]. Changes in the field of vision in NTG are characterised by deeper defects with a tendency to form clusters, whereas HTG is associated with a decrease in sensitivity throughout the entire visual field and this decrease is not as pronounced. That is why our aim was to specifically compare PD and OD. PD statistic are based on spatial correlation, and are a measure of the

clustering and depth of defects. OD is the mean difference between the age-normal hill of vision (HoV) and the mean deviation or patient-based HoV. The results of this comparison demonstrate the correctness of this assumption. The paired t-test demonstrated that PD is statistically higher than OD in NTG ($p = 0.0001$). On the contrary, statistically higher OD compared to PD was found in HTG ($p = 0.000$). We did not find a similar comparison in the literature. Changes in the visual field in both diagnostic groups have different etiopathogeneses. This conclusion is also supported by our previous work [16].

We believe that, based on the results of numerous studies, it will be necessary to reconsider the inclusion of NTG in the range of glaucoma diseases.

The study protocol was approved by the local Ethics Committee and the study was performed in accordance with Good Clinical Practice and the Declaration of Helsinki.

Conflict of interest statement

The authors state that there are no conflicts of interest regarding the publication of this article.

Conclusion

Changes in the visual field of patients with NTG are different from those in patients with HTG. PD is significantly higher than OD in NTG. HTG is associated with opposite findings.

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