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Original Research Article

Comparison of visual field defects between newly detected chronic simple glaucoma and normotensive glaucoma

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Abstract

Objective: To study and compare the visual field defects in subjects with newly detected primary open angle glaucoma and normotensive glaucoma using Humphrey field Analyzer 30-2 swedish interactive threshold algorithm(SITA) standard technique and to establish specific visual field loss patterns in each group and establish varied pathomechanisms.

Methods: A prospective study 37 eyes of 25 patients with normal tension glaucoma (NTG) and chronic simple glaucoma (CSG). Patients were subjected to visual field testing using Humphrey field Analyzer (HFA) 30-2, SITA (Swedish interactive threshold algorithm) standard method.

Results: There was significant preponderance of early visual field defects in patients with NTG in comparison to patients with CSG (64% compared to 32.4%). Strong statistical differences were found in number of patients with scotomas falling with 6 degrees of central fixation ($p \leq 0.001$) in NTG comparing with CSG.

Conclusion: results suggest that field defects between chronic simple and normotensive glaucoma do not differ in most aspects except for those in NTG group being closer to fixation and should not be used to underline different pathomechanisms in the two groups.

Keywords: Visual field defect, Normotensive glaucoma (NTG), Chronic simple glaucoma (CSG).

1.Introduction

The modern understanding of glaucoma dates to the mid 19th century and the concepts have evolved over the last 100 years. Today the entity refers to a diverse group of disorders that have different presenting symptoms, pathophysiology, clinical signs and treatment. They share a common end point in optic neuropathy resulting in its atrophy and corresponding visual field defects. Raised intra ocular pressure (IOP) is only the most significant risk factor while there is a clinical variant where optic neuropathy occurs and progresses at normal values of IOP. This variant which may have additional pathomechanisms and is termed as NTG earlier termed as low tension glaucoma[1]. The IOP in NTG is lesser than that seen with primary open angle glaucoma(POAG) but tend to be higher than that recorded in normal individuals[2].Also patients with NTG have wider diurnal fluctuations than general healthy population[2].IOP spikes that might be occurring during nights in these subjects should also be kept in consideration which is missed in routine office hour testing[3]. The NRR is found to be significantly thinner in patients with NTG, especially inferiorly and inferotemporally[3]. Also some studies have found higher incidence of optic disk haemorrhages in NTG group. The retinal nervefibre layer shows more localized defects, closer to macula in the NTG group[4].

2.1 Visual field abnormalities

Differences have been reported in the nature of visual field loss between patients of NTG and those with CSG who have similar optic nerve damage. The NTG sub group has been shown to have deeper, steeper and more localized[5]. It is also found that these defects are closer to fixation and progress more rapidly when compared to CSG[6].The automated perimetry which has stood the test of time, because of its standardization, repeatability and little

inter observer variation remains the GOLD STANDARD in diagnosis of these diverse group of disorders. The fact that glaucomatous optic neuropathy takes place and progresses under normal IOP makes one realise that there are underlying factors beyond an elevated IOP that could be causing damage. Also it is necessary to believe that multi factorial pathogenesis is expanding as newer studies reveal additional factors.

3. Methodology

37 eyes of 25 patients with CSG and 37 eyes of 25 patients with NTG who attended the outpatient department of Dr SMCSI Medical College (between November 2011 and December 2012) were used for this study to make a comparison of visual fields in this prospective study. Inclusion Criteria were Glaucomatous cupping**,** IOP not greater than 21 mmHg in NTG group and greater than 21mmHg in CSG group with diurnal variation < 5mmHg**,** open angles on gonioscopy**,** visual acuity better than 6/12**,** reliable baseline field charting performed with the HFA (30-2 program).

Patients treated previously with anti glaucoma medicines**,** systemic beta blockers, patients with history of shock, cardiovascular disease and those with angle abnormalities including peripheral anterior synechiae, cataract, diabetic retinopathy and previous intra ocular surgery were excluded from the study

At glaucoma clinic all patients underwent visual acuity testing, refraction, color vision assessment, IOP with Applanation tonometer, slit lamp biomicroscopy of anterior segment including gonioscopy and dilated fundoscopy with 90Diopter(D)/78D lens, HFA 30-2 SITA standard program testing and diurnal IOP measurement lasting 12 hours. After full correction with dilated pupillary refraction automated perimetry was done in all patients using SITA 30-2 standard program. Unreliable fields (fixation loss > 20%, false positive/negative error's > 33%) were excluded from the study and a single reliable field was taken for analysis according to Anderson's criteria. The field defects were then classified into early, moderate and severe according to the expanded version of visual severity scale proposed by Hodapp, Anderson, and Parrish, the Hodapp-Anderson-Parrish system 6.

A subgroup analysis where similar field defects in each group i.e, field defects in the early subgroup of NTG were compared with those in early sub group of CSG group , moderate in CSG group with those in NTG group so on and so forth. Similarly a whole group analysis was made where overall comparison between all field defects in each group was done. Pattern standard deviation was used as a marker to determine if there was a higher incidence of field defects which were more localized and less generalized. Higher PSD meant that the visual field defects were more localized and less generalized. A hemifield was considered to be involved if PSD plot showed at least 3 more contiguous totally black probability plots (p=0.005) in that half of visual field. Chi square test was used for qualitative analysis.

Descriptive statistical analysis has been carried out in this study. Results on continuous measurements are presented on MEAN +/- SD and results on categorical measurements are presented in number (%). Significance is assessed at 5% level of significance. Independent't' test has been used to find the significance of parameters on continuous scale between two groups. Chi square test has been used to find out the significance of parameters between qualitative variables.

3. Results

A total of 74 eyes were studied. 37 eyes of 25 patients with NTG were compared with 37 eyes of 25 patients with CSG. A whole group analysis; where differences between the two groups as well as a sub group analysis where the severities of defects in each group were matched.

3.1 Whole group analysis

All 37 eyes in the NTG were compared with all 37 eyes in the CSG group, irrespective of the severity of the field defects. There was no major difference in the age or gender between the two groups p=0.529, p= 0.564 respectively. The differences in the mean IOP in the NTG group (18.27±2.457) when compared to CSG group (25.86±3.441) was statistically significant (p=0.001). The average cup disc ratio in the NTG group was 0.635±0.094 compared to0.657±0.1191 in the CSG group. This difference was not statistically significant with p value of 0.39.(Table 1). There was significant preponderance of early visual field defects in patients with NTG in comparison to patients with CSG(Table 1).Highly significant(p<_0.01) statistical differences were found in number of patients with scotomas falling with 6 degrees of central fixation in NTG group (p = 0.009) comparing with CSG group. (Figure 1)

Although the CSG group has larger pattern standard deviation than the NTG group overall (6.7473±3.282) vs. (5.524±2.759) respectively, thus difference was not statistically significant (p=0.087).When comparing the amount of superior to inferior hemifield involvement CSG group showed more involvement of the superior hemifield but this

data could not be used since very few number of patients had hemifield involvement and was hence not significant statistically

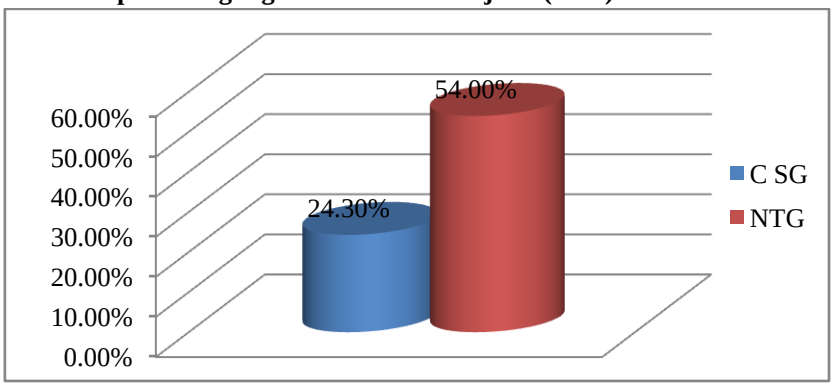
3.2 Subgroup Analysis

Mild defects in23 eyes in the NTG group had early defects compared to 12 eyes in CSG group. CSG group had a younger mean age than NTG group and the difference was moderately significant (p=0.038). CSG group had a larger mean cup/ disc ratio for the given amount of field loss than the NTG. Moderate defects in 8 eyes (21.6%) in NTG group had moderate defects compared to 7 eyes (18.6%) in CSG group. In this sub-group, the CSG group had a larger cup/disc ratio as compared to NTG. In this subgroup of defects, CSG group, had a higher PSD, showing more localized defects compared to the NTG group. Severe defects in CSG group had a higher incidence of severe field defects (38.6%) compared to the NTG group (16.2%). This sub group showed a high involvement of central 6 degrees of fixation in NTG group (100%) as compared to CSG group (50%). Superior hemifield was more involved (38.8% amongst the severe subgroup) in CSG group where as NTG group had an equal involvement of superior and inferior hemifield (33.3 % each). None of these were statistically significant.

Table 1: Overall variables

Variables	CSG	NTG	T test/ chi square test	p value
No. of patients	25	25		
No. of Eyes	37	37		
Mean Age	60.52 Years	62.64 Years	-0.634 (t)	0.529
M: F Ratio Gender	14:11	16:9	0.333(ch)	0.564
Mean IOP	25.6+/-3.441	18.27+/-2.457	10.926(ch)	<0.001
Mean CD Ratio	0.657+/-0.11	0.635+/-0.09	0.863(t)	0.39
Early defects	12(32.4%)	23(62.1%)	9.524(ch)	0.009
Moderatedefects	7(18.9%)	8(21.6%)		
Severe defects	18(38.6%)	6(16.2%)		
Scotomas within 6 DEG	9(24.3%)	20(54%)	6.861(ch)	0.009
Mean PSD(db)	6.747	5.524	1.73(t)	0.087
Superior Hemifield	7(18.9%)	2((5.4%)		
Inferior Hemifield	2(5.4%)	2(5.4%)		

Figure 1: NTG Group showing higher number of subjects (54%) with defects closer to fixation



4. Discussion

The description of NTG or Low tension glaucoma dates long back in history. Ever since then there have been numerous studies and research analyses to find out if there was a difference in the aetiopathogenesis from that of CSG. The final common result being the same has led few of them to believe that both share common pathological pathways with only difference in risk factors for their development while others believed that NTG group carried a different subset of underlying pathology[7].

A different pattern of visual of visual field loss in these two populations raises the possibility of a different mechanism of optic nerve damage in the pathogenesis of normal-tension and chronic simple glaucoma.[8] Unfortunately, there has been little agreement on what type of differences in the visual field loss exists between these two group patients.

The visual fields in the present study were found to be closer to fixation in a statistically very significant number of patients with 54% (<0.01) of them falling within the 6 degree from fixation. This is in accordance with the outcomes given in the study conducted by Caprioli and Spaeth.

The scotomas in the CSG group that were nearer to fixation were entirely from those belonging to severe group which in itself explains higher incidence of field defects closer to fixation in that group.When the whole group analysis was done it was found that the NTG group had a higher number of defects that were graded early in severity (62.1%).

Since the samples are age matched it could be said that the NTG group had higher preponderance to developing early visual field defects 34.8% of which were closer to fixation.

In this study there was not statistical difference in the PSD values of the two sub groups, hence there was no pattern attributed to each groups whether localized or generalized. Hemifield analysis from this study showed that there was no statistical difference in the incidence of hemifields between the two groups. The methods used to analyze and interpret the visual fields also could be an important factor for the difference in opinion. There is hence a need for a uniform approach in the generation and analysis of visual fields.

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