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A Clinical Study to Correlate Visual Field Defects with Optic Disc Changes in 100 Patients with Primary Open Angle Glaucoma in A Tertiary Eye Care Hospital

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Abstract: *The aim of the study was to correlate the optic disc changes with visual field defects in Primary Open Angle Glaucoma(POAG). It was undertaken in 100 patients who attended the Ophthalmology OPD, GGH, Guntur. All the patients underwent a comprehensive ocular examination i.e. Visual acuity recording, Slit lamp examination, Gonioscopy, IOP with Goldmann Applanation Tonometry, Fundus examination with +78D, +90D lens, recording of visual fields on Humphrey's Automated Field Analyser and diagnosed as having POAG in one or both eyes. And the correlation between the optic disc changes and the visual field defects was studied .*

Keywords: *POAG, Optic cup/disc ratio, Neuro-retinal rim (NRR),NRR width, Arcuate scotomas, Field defects.*

I. Introduction

POAG is typically a chronic, slowly progressive optic neuropathy with characteristic patterns of optic nerve damage and visual field loss.(1)Risk factors for the pathogenesis of POAG are age above 40 yrs, heredity, myopia, Diabetes mellitus (2). Usually most of the patients will have an elevated IOP >21mm Hg on more than two occasions. Obstruction to axoplasmic flow may be involved in the pathogenesis of POAG. As Spaeth suggested, there are multiple factors involved like, mechanical, vascular or other alterations. And ischaemia may be the predominant factor in those glaucomas with lower end of IOP scale, where as a more direct mechanical effect of the pressure may prevail in cases with higher IOP. (3)

Correlation between optic nerve head and visual field defects:

In most patients with glaucoma, clinically recognizable disc changes precede detectable field loss (4). Quigley and co-workers attempted to correlate axon loss in the ONH with VFD. Their work suggested that, not only does nerve fibre loss occur before reproducible field defects in some patients with elevated IOP, but the extent of axonal loss may be much greater than the corresponding visual field change. With standard perimetric techniques, 25% to 35% of the retinal ganglion cells may be lost by the time reproducible early visual field defects can be detected (5) and 10% or fewer axons may remain in advanced stage of POAG with severe field loss. When correlating RGC atrophy with automated perimetry in glaucoma patients, a 20% loss of cells, especially large ganglion cells in the central 30^0 of the retina, correlated with 95-dB sensitivity loss, while a 40% loss corresponded with a 10-dB decrease and some ganglion cells remained in areas with 0-dB sensitivity.

The ONH cupping can also be used to predict the type of field loss. Extensive or focal absence of neural rim tissue, especially at inferior or superior poles, is the most reliable indicator of visual field disturbance (6) and is usually associated with a field defect in the corresponding arcuate area. In some cases, field loss may occur before the pallor reaches the disc margin, and unusual cases have been reported with field damage despite round symmetric cups (7).

The parameters that correlate best with visual field loss are magnification – corrected measurements of neuro-retinal rim area. and defects in the retinal nerve fibre layer. Diffuse structural changes in ONH are associated with diffuse depression of visual function, where as localized changes correlate more with localized visual field changes. The correlation between ONH and VFD in glaucoma is close enough to prompt a search for other underlying disease processes, such as neurologic disorders. The absence of perfect correlation indicates that both disc and field examinations are essential in managing the glaucoma patient.

ONH changes and visual field defects :(8)

Assessment of the thickness, symmetry and colour of the NRR, is important. The subtypes of glaucomatous damage are

i. Focal ischemic (type 1)-- Focal tissue loss at superior/inferior poles (polar notching) and relatively intact NRR – The notch may be associated with localized field defects near to fixation – a large reduction of IOP may be beneficial.
ii. Myopic glaucomatous (type 2) – Polar notching and a temporal crescent in the absence of degenerative myopia. – associated with dense superior and inferior scotomas, which threaten fixation in 50% of cases. Progression of damage is frequent and may be rapid.
iii. Senile sclerotic (type 3) – Characterised by a shallow, saucerised cup and a gently sloping NRR, a moth-eaten appearance, variable parapapillary atrophy and peripheral visual field loss.
iv. Concentrically enlarging (type 4) – Characterised by thinning of the entire NRR without notching and is frequently associated with diffuse visual field loss. At presentation IOP is often elevated.
v. Mixed: At least two-thirds of eyes have a mixed appearance, due to multiple pathogeneses.

Non-specific signs of glaucomatous damage:
1. Baring of circumlinear blood vessels
2. Bayonetting
3. The laminar dot sign
4. Disc haemorrhages.

Aims & Objectives:

A total no. of 100 cases who attended Ophthalmic OPD, GGH, Guntur were included in the study. All the 100 patients have undergone a comprehensive ophthalmic examination including the glaucoma work-up. And the main focus was on the significance of visual field defects in relation to the optic disc changes in POAG.

II. Materials & Methods

A comparison of visual fields with optic disc changes in POAG was done in this study, which was done on patients attending the ophthalmology OPD, GGH, Guntur. This is a hospital based cross-sectional study, done on 200 eyes of 100 patients.

Inclusion Criteria:

Male/female patients, between 40 & 65 years with POAG with IOP of atleast 22mm hg on more than two occasions.

Exclusion Criteria:
1. Patients with corneal opacities, and significant cataracts.
2. Patients with aphakia.
3. Patients who underwent Anti-Glaucoma surgeries.
4. Patients with any previous ocular trauma.
5. One eyed patients.

III. Methodology

(After taking consent), complete evaluation is done with detailed history taking, followed by systemic and ocular examination. Visual acuity was measured by Snellens chart and BCVA was noted. Slit lamp examination was done, IOP measured by Goldmann's Applanation Tonometer, Gonioscopy was done by Goldmann Gonioscope, disc evaluation was done by both direct and Slit lamp bio-microscopy using +78D lens. Fundus photography was takenby Zeiss Visucam. Visual field examination by Humphrey's automated visual field analyser type-II – 720 I series standard white on white perimetry, SITA with 30-2 for diagnosis, 24-2 for follow-up, 10-2 for advanced loss cases.

Observation and results:

The eyes were divided in to 3 groups:

Group 1:

Eyes with upto 0.5 cupping and early changes in the Neuro-retinal rim:

Total no of eyes in this group are 64, of them 30 eyes had healthy NRR & no field defects in HFA i.e the HFA fields are normal.The remaining 34 eyes had – Superior /Inferior NRR notching/sloping and they had corresponding superior/inferior paracentral scotoma or partial arcuate scotomas on HFA , which appears to be correlating .

Group 2:

Eyes with 0.6-0.7 cupping and NRR thinning and narrowest rim width < 0.1 in atleast one quadrant:

Total no of eyes incuded in this category are 90.Most of the eyes have early to moderate field defects.Along with OD cupping, other changes noted are- superior and or inferior NRR thinning, superior and or inferior NRR notching,Temporal NRR thinning etc which correlated well with the field defects like- Superior and or inferior para central scotomas, seidels scotomas and arcuate scotomas.

Group 3:

Eyes with 0.7 and above cupping and NRR thinning and narrowest rim width < 0.1, in more than one quadrant:

Total no of eyes included in this category are 46.Most of the eyes in this group have moderate to advanced field defects. Along with OD cupping , the changes noted are superior and or inferior thinning ,notching , wedge defects, peripapillary atrophy and superficial splinter hemorrhages at the disc margins in some cases. The corresponding field defects which are correlating with the fundus changes, are- superior and or inferior arcuate scotomas, and advanced visual field defects in some cases with only tubular vision remaining .

Number of eyes	Fundus changes	Visual field defects
Group 1 (64)	Eyes with upto 0.5 cupping and early changes in the Neuro-retinal rim(Superior /Inferior NRR notching/sloping)	superior/inferior paracentral scotoma or partial arcuate scotomas on HFA(half of the eyes here had no field defects)
Group 2 (90)	Eyes with 0.6-0.7 cupping and NRR thinning and narrowest rim width < 0.1 in atleast one quadrant	Superior and or inferior para central scotomas, seidels scotomas and arcuate scotomas
Group 3 (46)	Eyes with 0.7 and above cupping and NRR thinning and narrowest rim width < 0.1, in more than one quadrant	superior and or inferior arcuate scotomas ,and advanced visual field defects in some cases with only tubular vision remaining .

IV. Discussion

All the eyes have more or less correlating fundus changes and field changes, consistent with the literature. Disc cupping increased proportionately with rise in IOP. Optic nerve head changes are thought to be seen prior to the development of visual field loss. The changes commonly seen in the ONH in glaucoma are asymmetry of cup:disc ratio (>0.2) between two eyes, optic cup to disc ratio >0.5mm ,a localized notch /thinning of neuroretinal rim, ,pallor of NRR, superficial disc hemorrhages and parapapillary atrophy. The common Visual field abnormalities in glaucoma are relative paracentral scotomas, seidel scotoma, arcuate scotomas and advanced visual field defects in some cases with only tubular vision remaining.

RNFL defects, occurs prior to visual field loss & ONH changes (9). As OCT and other diagnostics like GDX,HRT are expensive and not cost effective ,Testing of Visual fields is the primary method of assessing visual function in glaucoma patients & glaucoma suspects. Automated static perimetry using white stimulus projected on to a white background is most commonly performed Visual Field test in glaucoma with Humphrey field analyser.(10)

V. Conclusion

In the present study in which 100 patients were examined who have attended our OPD were diagnosed as having POAG basing on the Applanation tonometry, Optic disc changes and Automated Perimetry. We have divided the patients in to three groups basing on the stage of disease i.e the amount of optic disc changes and visual field defects, and we have found that the optic disc changes and visual field defects are correlating with each other and consistent with the literature and other studies.

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