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Association between Optic Disc Changes and Visual Field Defects by Automated Perimetry in Primary Open Angle Glaucoma

DR.Sanikommu Sreedhanya[1], DR.G.Sirisha[2] ,DR.M .Jagruthi[3] ,DR.N.Lakshmi chowdary [4]

1.*Postgraduate Ophthalmology , Nri Medical College And General Hospital, Chinakakani Guntur*
2.Professor , Nri Medical College And General Hospital, Chinakakani Guntur
3. Postgraduate Ophthalmology , Nri Medical College And General Hospital, Chinakakani Guntur
4.Professor And HOD , Nri Medical College And General Hospital, Chinakkaani Guntur
Corresponding Author: DR.N .Lakshmi chowdary

Abstract:
*Glaucoma is the leading cause of irreversible blindness in the world**.** The aim of the study was to describe the association between the optic disc changes with visual field defects in Primary Open Angle Glaucoma(POAG). It was donein 100 patients who attended the Ophthalmology OPD, NRIGH,Mangalagiri, 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 association between the optic disc changes and the visual field defects was studied.*

Key Word*: Glaucoma ,optic nerve head ,neuro retinal rim (NRR),Visual fields ,Intraocular pressure*

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I. Introduction

• PRIMARY OPEN-ANGLE GLAUCOMA[1] is a type of primary glaucoma, where there is no obvious systemic or ocular cause for rise in the intraocular pressure. Primary open-angle glaucoma (POAG), also known as chronic simple glaucoma of adult onset, is typically characterised by slowly progressive raising intraocular pressure (>21 mm Hg) associated with,

- Open normal appearing anterior chamber angle,
-Characteristic optic disc cupping, and
- Specific Glaucomatous changes in the optic disc which can be described as early changes, advanced changes and glaucomatous optic atrophy.

Early glaucomatous changes	Advanced glaucomatous changes
1. Vertically oval cup due to selective loss of neural rim tissue in the inferior and superior poles 2. Asymmetry of the cups with a difference of more than 0.2 between two eyes is significant. 3. Large cup, i.e., 0.6 or more (normal cup size is 0.3 to 0.4) may occur due to concentric expansion. 4. Splinter haemorrhages on or near the optic disc margin. 5. Pallor areas on the disc with visual field defects. 6. Atrophy of retinal nerve fibre layer on red free filter	1. Marked cupping (cup size 0.7 to 0.9), with excavation reaching the disc margin, wherein the sides are steep and not shelving 2. Thinning of neuroretinal rim 3. Nasal shifting of retinal vessels which have the appearance of being broken off at the margin which is an important sign (Bayonetting sign). 4. Pulsations of the retinal arterioles may be seen at the disc margin 5. Lamellar dot sign

Visual field defects in glaucoma are initially observed in Bjerrum's area (10–25 degree from fixation) [2] and correlate with optic disc changes. The natural history of the progressive glaucomatous field loss, more or less, takes the following sequence:

1**. Isopter contraction**. It refers to mild generalised constriction of central as well as peripheral field, an earliest visual field defect occurring in glaucoma .

2. **Small wing-shaped paracentral scotoma**. It is the earliest clinically significant field defect which appears either below or above the blind spot in Bjerrum's area (an arcuate area extending above and below the blind spot between 10° and 20° of fixation point).

3. **Seidel's scotoma.** With the passage of time paracentral scotoma joins the blind spot to form a sickle-shaped scotoma known as Seidel's scotoma
4. **Arcuate or Bjerrum's scotoma.** It is formed at a later stage by the extension of Seidel's scotoma in an area either above or below the fixation point to reach the horizontal line
5. **Ring or double arcuate scotoma.** It develops when the two arcuate scotomas join together
6. **Roenne's central nasal step**. It is created when the two arcuate scotomas run in different arcs and meet to form a sharp right-angled defect at the horizontal meridian .
7. **Advanced glaucomatous field defects.** The visual field loss gradually spreads centrally as well as peripherally, and eventually only a small island of central vision (tubular vision) and an accompanying temporal island are left.

II. Material And Methods

This is a cross sectional study in which 100 patients were taken for comparison of optic disc changes and visual field defects

Inclusion Criteria:

1. Male / female patients between the age of 40 to 65 years with POAG.
2. Intraocular pressure more than 22 mm of Hg
3. Open angles in Gonioscopy
4. Known cases of open angle glaucoma

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
6. Angle-closure glaucoma
7. Blunt trauma, injuries
8. Congenital anomalies of the eye.

Methods of examination:

After relevant history of the patient was taken ,Visual acuity was measured by Snellen's visual charts and Refraction correction was given if needed. A slit-lamp examination was done to evaluate the anterior segmentand Intra Ocular pressurewas measured by Goldman applanation tonometry. Gonioscopy is done by Goldman three-mirror Goinoscope/Zeiss four mirror gonioscope. Disc was done evaluation by both direct ophthalmoscopy and slit-lamp biomicroscopy using 78D and 90D lens.Fundus photography by a canon fundus camera. Visual field examination by Humphreys Automated Field Analyzer – II series standard white on white perimetry was done by , SITA strategy.

III. Result

Table 1: Sex distribution

Sex	Total No.Of Patients	Percentage
Male	50	50
Female	50	50

Table 2 :Age-specific prevalence of POAG.

AGE IN YEARS	NO.OF PATIENTS	PERCENTAGE
40-45	6	6
45-50	21	21
50-55	28	28
55-60	26	26
60-65	19	19

Table 3: Strong relationship between intraocular pressure and glaucoma

Iop in mm of hg	No.of eyes	Percentage
22-25	51	25.5
26-30	71	35.5
31-35	60	30
>35	18	9

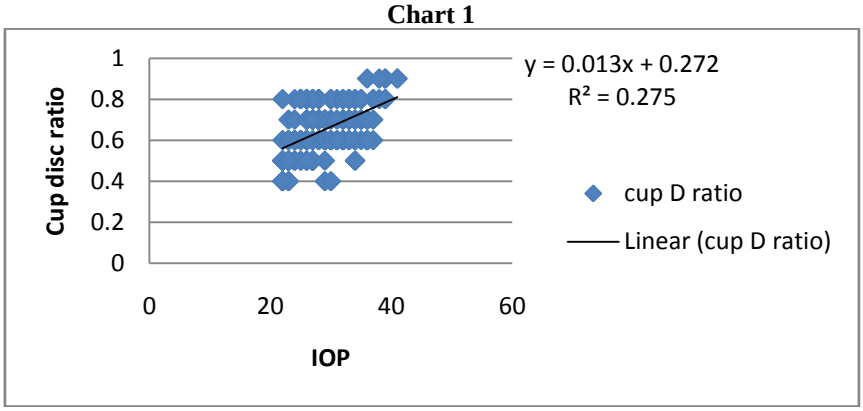
Table 4 :Types of visual field defects

Type Of Field Defects	No.of Eyes	Percentage
Isolated field defects	10	6.09
Seidels Scotoma	13	7.9
Arcuate Scotoma	53	32.3
Bi Arcuate Scotoma	62	37.8
Tubular Vision	26	15.8

Table 5 : Prevalence of NRR thinning and advanced cupping are in increased prevalence compared to other disc changes in primary open-angle glaucoma.

Optic disc changes	No.of eyes	Percentage
Superior Rim Notching	13	8.02
Inferior Rim Notching	9	5.5
Superior NRR thinning	22	13.5
Inferior NRR thinning	41	25.3
Advances cupping total loss NRR.	66	40.7
Disc Haemorrhage	6	3.7
Arteriolar Narrowing	5	3.08

Chart 1



There is a statistically significant moderate positive correlation between IOP and cup disc ratio. If one increases, the other also increases. The p-value is 0.00001.

Table 6: Comparsion of disc changes with visual fields in patients with primary open angle glaucoma

Disc changes with visual field defects	No.of Eyes	Percentage
C:D ratio corresponding visual fields	138	69%
C:D ratio ahead of visual fields	22	11%
Visual fields ahead of C:D ratio	40	20%

IV. Discussion

The present cross sectional study included 200 eyes with primary open angle glaucoma who fulfilled inclusion criteria. In the present study, the peak prevalence of primary open-angle glaucoma is found in 40-65 years age group. In a study on glaucoma in a rural population of Southern India (The Aravind comprehensive eye survey) by Ramakrishnan et al[2] .multi variant analysis POAG was associated with increasing age, male gender, myopia greater than one diopter, pseudoexfoliation.. In a study on Risk factors for primary open-angle glaucoma in African people by Paul F et al [4]. There is an increased risk with increased age, high refractive error, both myopia as well as hypermetropia ,thin central corneal thickness, a large optic disc diameter.

In the present study, male to female percentage is 50% each, which shows no sex predilection among PAOG patients, which is in concordance with other studies.

In a study about Gender and glaucoma by Thasarat S et al[5], concerning biological factors (gender difference), women are at risk for PACG. Still, there is no clear preference for POAG. Of particular interest, it is possible that female sex hormones might provide some protective effect to the optic nerves. After menopause, women may lose this protective effect, and therefore their risk for PAOG reaches that of men.

In the present study, there is a strong dose-response relationship between intraocular pressure and glaucoma. The prevalence of primary open-angle glaucoma increased with intraocular pressure. Disc cupping increased proportionately with an increase in intraocular pressure, thus establishing primary open-angle glaucoma progression with a rise in IOP. The same has been shown in prevalence surveys and longitudinal studies on incidence and progressions.

In a study on Aggregate Effects of Intraocular Pressure and Cup-to-Disc Ratio by Tham YC et al.[6] Participants with GRSs in the top tertiles had a 5.5-fold increased risk of glaucoma compared with those in the bottom tertiles. Higher I.O.P., VCDR-specific G.R.S.s were associated with a greater risk of glaucoma. In a study on the relationship between intraocular pressure and primary open-angle glaucoma among white and black Americans by Sommer A et al [7] the IOP in glaucomatous eyes tended to rise follow-up, in contrast with the non-glaucomatous eye. Results confirmed that IOP is an important factor in glaucoma. In a study on Risk factors for predicting visual field progression in Chinese patients with primary open-angle glaucoma by Hung KH [8] , chinese patients with treated POAG who experienced a high peak IOP during follow up were more likely to have VF deterioration.

Among optic disc changes, inferior NRR thinning (25.3%) and total cupping (40.7%) were in increased prevalence in the present study, associated with high intraocular pressure and older age group patients.

Among the visual field defects in the present study, arcuate scotomas (32.3%) and bi arcuate scotomas (37.8%) increase prevalence, most of them correlated with NRR thinning.

In the present study, Arcuate scotomas were of increased prevalence. Most of these patients are asymptomatic and presented to the hospital when the considerable loss of vision has set in. The inferior NRR thinning and advanced cupping are of increased prevalence compared to other disc changes. Disc hemorrhages were seen in 3.7% of POAG patients. In a study on the correlation between the appearance of the optic disc with the visual field by Hitchings RA et al. [9], the examination of stereoscopic optic disc photographs allowed accurate prediction of glaucomatous and normal fields to be made in 82 and 95% of eyes respectively and for visual field loss to be correctly located in the upper and lower half in 83 and 91% of cases respectively which showed that there is a high correlation between visual fields and optic disc changes. In a study on Optic nerve head parameters by Lee KH et al. [10], optic disc changes correlated significantly with the visual field indices. The rim area of the superior and inferior quadrants correlated significantly with the visual field defects in corresponding sectors.

V. Conclusion

The correlation between optic nerve head and visual field defects in glaucoma is close enough to prompt a search for underlying disease process such as neurologic disorders. If a correlation is not found, the absence of a perfect correlation indicates that both disc and field examinations are essential in managing the glaucoma patient.

In general, optic nerve head changes have their greatest value in the early stages of glaucoma. In contrast, progressive visual field loss becomes a more useful guide to therapy in advanced cases.

The disc changes have their importance in the early stages of glaucoma. The visual field defects in correlation with disc changes are of significance in the prognosis and progression of POAG.

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