Study of Field Defects in Advanced Optic Disc Cupping in Patients on Treatment for Primary Open Angle Glaucoma

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ABSTRACT

BACKGROUND

A good number of primary open angle glaucoma patients present with advanced optic nerve head cupping. An understanding of the relationship between the structural and functional damage is important at this stage of glaucoma. We wanted to study the field defects in advanced optic nerve cupping in patients with Primary Open Angle Glaucoma (POAG) on treatment.

METHODS

26 eyes of 19 Primary Open Angle Glaucoma (POAG) patients having optic nerve head cupping with Cup Disc Ratio (CDR) of 0.9 by slit lamp biomicroscopic examination, who were on treatment, attending Glaucoma Clinic in Government Medical College, Thrissur were evaluated. Patients with Narrow Angle Glaucoma and Secondary Glaucoma were excluded. They were subjected for 24-2 Protocol of Humphry Field Analyser. Grading of field defects was done according to Hodapp-Parrish-Anderson Glaucoma Grading Scale. The field defects of these patient were categorized under the headings of Early, Moderate, Advanced and Severe. Analysis of grading of field defects was then performed.

RESULTS

Males and females were in the ratio 1.1:1. Majority of the patients were in the age group 60-69 years. Severe field loss was seen in 46% of our study population. They were in the age group 60-69 years. Advanced field defects were seen in 35%. They were in the age group 50-59 years and 60-69 years. Even moderate field defects were in 15%. They were in the age group 50-59 years and 60-69 years. 4% showed early field defects.

CONCLUSIONS

With the same optic disc cupping, patients can have different grades of field defects. Even with advanced cupping, (CDR 0.9 and above), the field defects may not be always severe or worse. So, there is hope for visual function in these patients with proper treatment and follow up.

KEYWORDS

Advanced Optic Disc Cupping, POAG, Humphry Field Analysis, Hodapp-Parrish-Anderson Glaucoma Grading Scale

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BACKGROUND

Glaucoma is a chronic progressive optic neuropathy characterized by loss of retinal nerve fiber layer (RNFL). It is clinically recognized by characteristic optic nerve head changes and visual field (VF) defects. Glaucoma burden estimates show that 4.5 million people have become bilaterally blind due to primary open-angle glaucoma (POAG) by 2010 and are expected to rise up to 5.9 million by 2020.[1] It is already well known that there is a structure to function correlation between loss of neuro retinal rim (NRR) and VF changes in POAG. The standard protocol for detection of disease and its progression is clinical assessment of the optic nerve head and its documentation and automated perimetry (e.g. Humphrey 24-2 VF) Nowadays, many instruments such as Heidelberg retinal tomography (HRT), scanning laser polarimetry (SLP), optical coherence tomography (OCT), etc., have been designed to detect early structural changes, but each has a special flaw - a nonreproducible parameter which reduces its usefulness. For example, HRT needs the operator to manually outline the disc margin and the use of a reference plane in the calculation of many stereometric parameters. SLP instruments such as GD_X are affected by anterior and posterior segment pathologies. OCT image quality is affected by ocular opacities and Stratus OCT cannot ensure that the measurements are obtained from the same location in baseline and follow-up scans.[2] Hence, direct visualization of optic disc and recording the changes is the best possible way to detect early glaucomatous damage.

A significant proportion of patients with POAG, especially in the developing world, present late, with advanced stage of the disease. With the development of new diagnostic test procedures, for structural analysis of the optic nerve head and nerve fiber layer, the necessity of visual field testing in the management of glaucoma, especially at its earlier stage is often questionable. But, a recent publication indicates, that perimetry and visual field testing remain as a vital portion of the clinical glaucoma examination procedure, and that structural and functional assessment of individuals with glaucoma or at risk of developing glaucoma are both necessary and provide complementary information to the practitioner.

Unlike glaucoma in the early or moderate stage, patients with advanced glaucomas are symptomatic and as the field loss increases, they may notice increased functional impairment. Sometimes, in advanced glaucomas, visual acuity may be normal, but with very much constricted field. At that situation, field charting will be absolutely necessary to assess progression. The gold standard for detecting the functional deficit and evaluation of progression of glaucomatous damage is standard white on white automated perimetry. Glaucomatous damage has been staged into mild, moderate, advanced and severe categories in order to enhance management. By that, careful assessment of clinical damage and their documentation are possible. It also facilitates monitoring for stability versus progression, which is very important for both clinical and research purposes.

The relationship between the functional and structural measures in primary open angle glaucoma (POAG) should be studied for grading the severity of the diseases. It also helps in understanding the natural history of the disease. But this is often a matter for discussion in early stages of POAG. A large number of glaucoma patients present to us with advanced cupping of the optic disc. Assessment of visual prognosis with respect to the functional deficit in these set of patients is often challenging for a Glaucoma clinic.

We wanted to study the field defects in advanced optic nerve cupping in patients with Primary Open Angle Glaucoma (POAG) on treatment.

METHODS

This was an observational study done between September 2013 and August 2014. The study was performed after getting informed written consent from the patients and approval by the institutional review board. 26 eyes of 19 Primary Open Angle Glaucoma (POAG) patients having optic nerve cupping with Cup Disc Ratio (CDR) of 0.9 by slit lamp biomicroscopic examination, who were on treatment, attending Glaucoma Clinic in Government Medical College, Thrissur were evaluated. Treatment included surgical/medical or both. Optic disc examination was done with 90 D lens by one examiner and fundus drawings were documented by the same. Stereo fundus photographs were also taken. Patients with narrow angle glaucoma, secondary glaucoma or high myopia were excluded from the study.

Stage	Humphrey MD Score	Additional Criteria (at least 1 of the listed criteria must apply)
Stage 1: Early Defect	≥ -6.00 dB	- a cluster of ≥ 3 points on the pattern deviation plot in an expected location of the visual field depressed below the 5% level, at least one of which is depressed below the 1% level - CPSD/PSD significant at P<00.5 - GHT Outside Normal Limits""
Stage 2: Moderate Defect	≥ -6.00 to -12.00 dB	- ≥ 25% but <50% of points on the Pattern deviation plot depressed below the 5% level, and ≥15% but <25% of points depressed below the 1% level - at least 1 point within the central 5° with sensitivity of <15 dB but no points in the central 5° with sensitivity of <0 dB - only 1 hemifield containing a point with sensitivity <15 dB within 5° of fixation
Stage 3: Advanced Defect	≥ -12.01 to -20.00 dB	- ≥ 50% but <75% of points on pattern deviation plot depressed below the 5% level and ≥25% but <50% of points depressed below the 1% level - any point within the central 5° with sensitivity <0 dB - both hemifields containing a point(s) with sensitivity <15 dB within 5° of fixation
Stage 4: Severe Defect	≥ -20.00 dB	- ≥ 75% of points on pattern deviation plot depressed below the 5% level and ≥50% but <50% of points depressed below the 1% level - at least 50% of points within the central 5° with sensitivity <0 dB - both hemifields containing >50% of points with sensitivity <15 dB within 5° of fixation

Table 1. Hodapp-Parrish-Anderson Glaucoma Grading Scale[3]

PSD=Pattern Standard Deviation, POAG=Primary Open Angle Glaucoma

Visual field tests were conducted with a Humphrey Visual Field Analyzer II(HFA II) (SITA) standard set for the

central 24-2 threshold test, size III white stimulus, and full threshold strategy, with the foveal threshold test turned on. The 24-2 protocol of the Humphrey Visual Field Analyzer records data from 55 locations in the Visual Field. Reliable fields of these patients were considered for evaluation. Grading of field defects were done according to Hodapp-Parrish-Anderson Glaucoma Grading Scale. The field defects of these patients were categorized under the headings of Early, Moderate, Advanced and Severe. Analysis of grading of field defects was then performed.

RESULTS

Majority of the patients were in the age group 60-69 years. Severe field loss was seen in 46% of our study population. They were in the age group 60-69 years. Advanced Field defects were in 35%. They were in the age group 50-59 years and 60-69 years. Moderate field defects were there in 15%. They were in the age group 50-59 years and 60-69 years. Even early field defects were seen, in 4%.

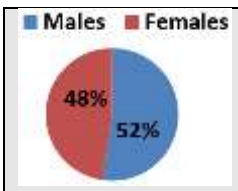

Figure 1. Sex Distribution

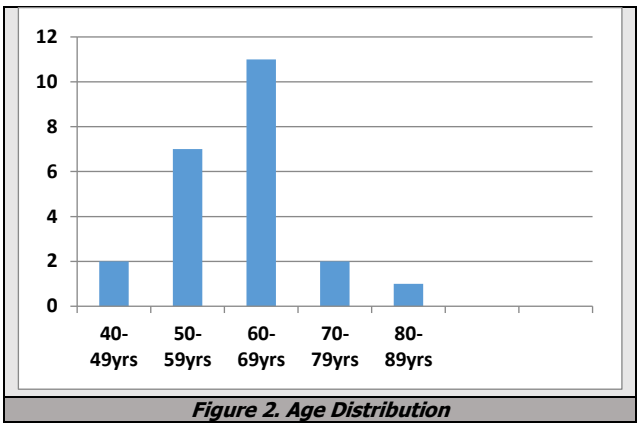

Figure 2. Age Distribution

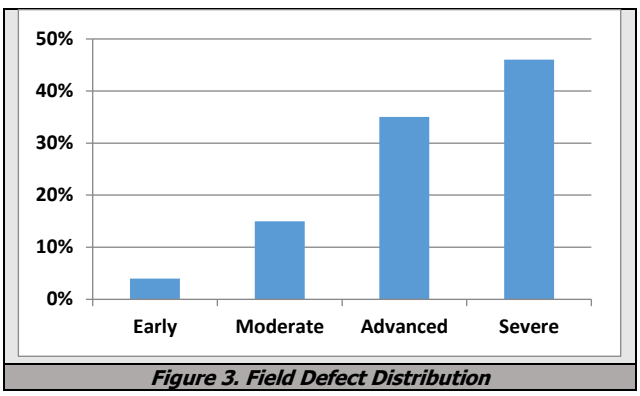

Figure 3. Field Defect Distribution

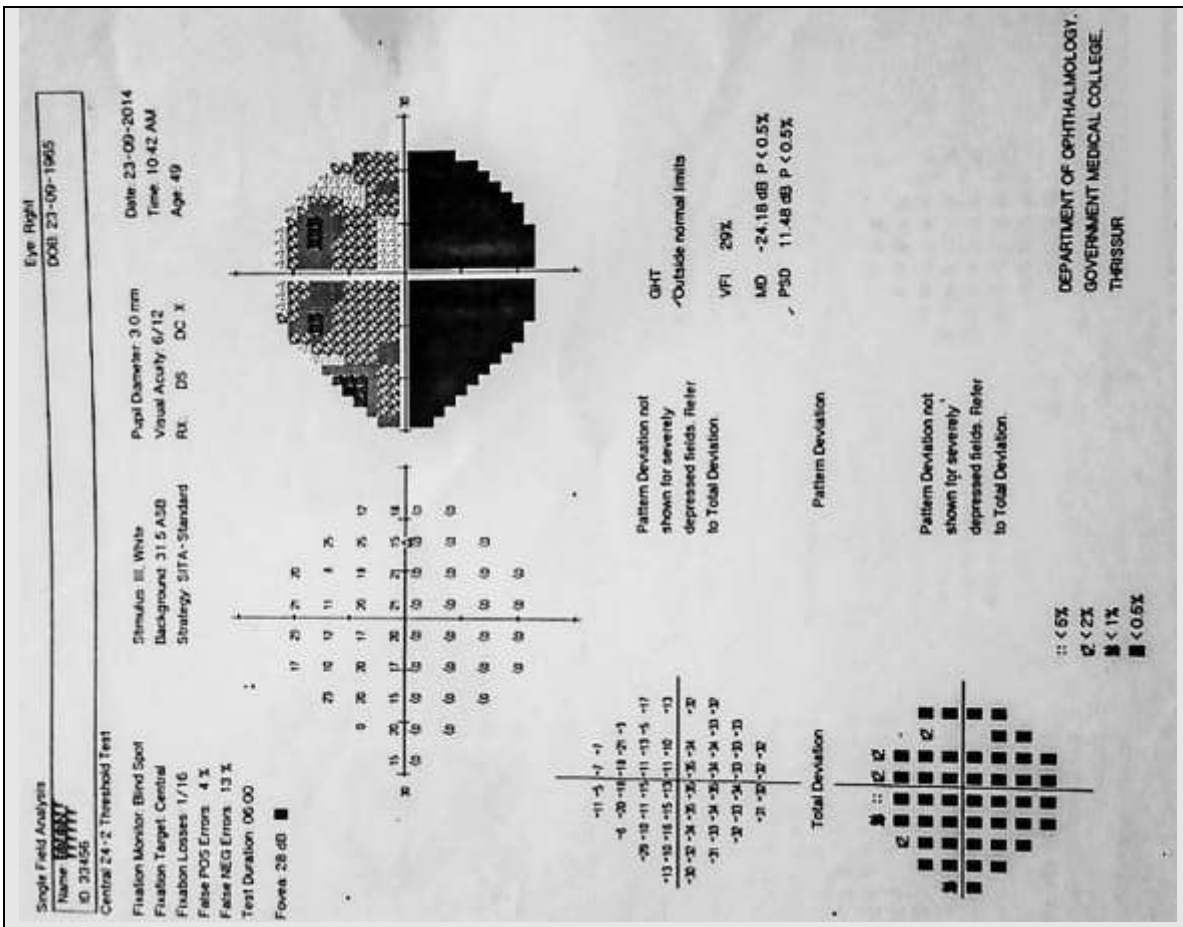

Figure 4. 24-2 with Severe Field Defect

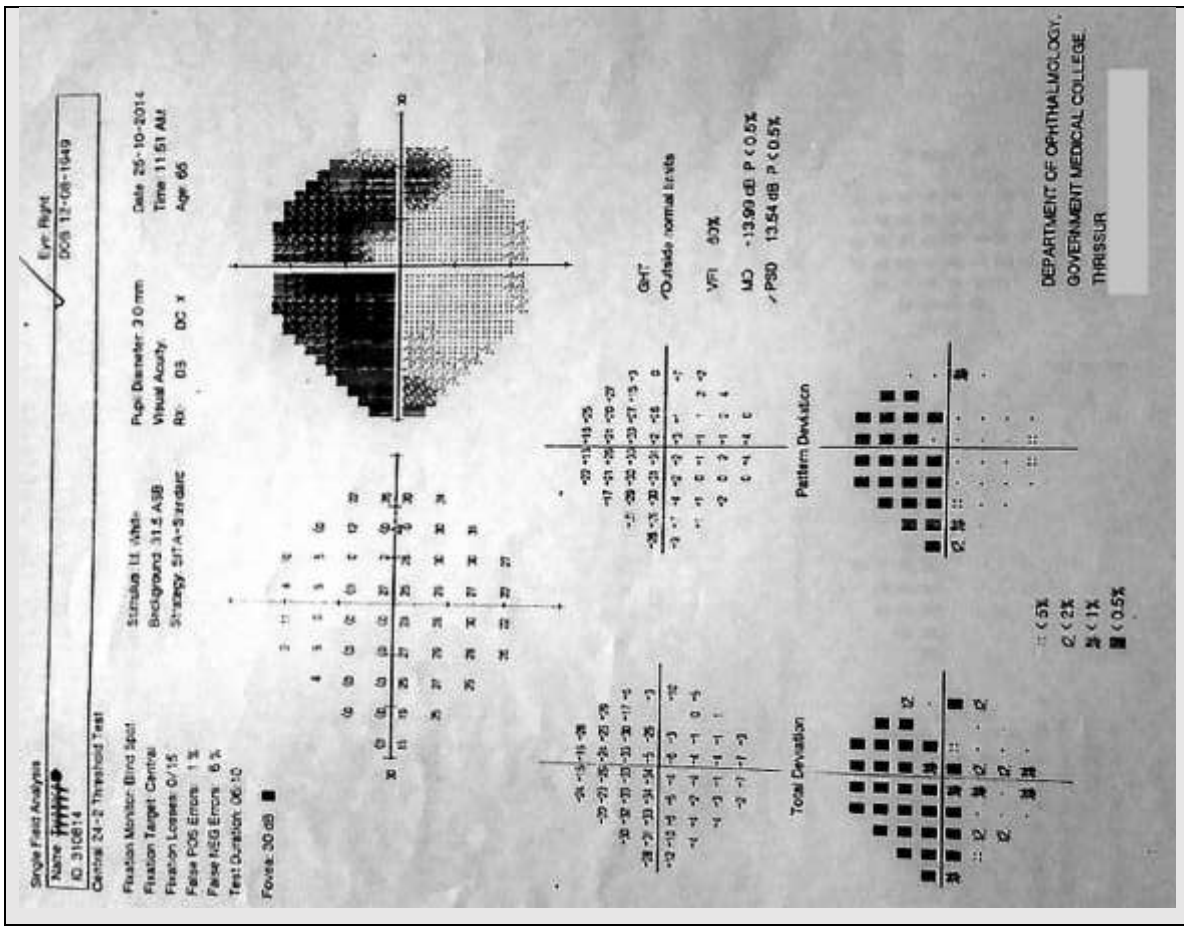

Figure 5. 24-2 with Advanced Field Defect

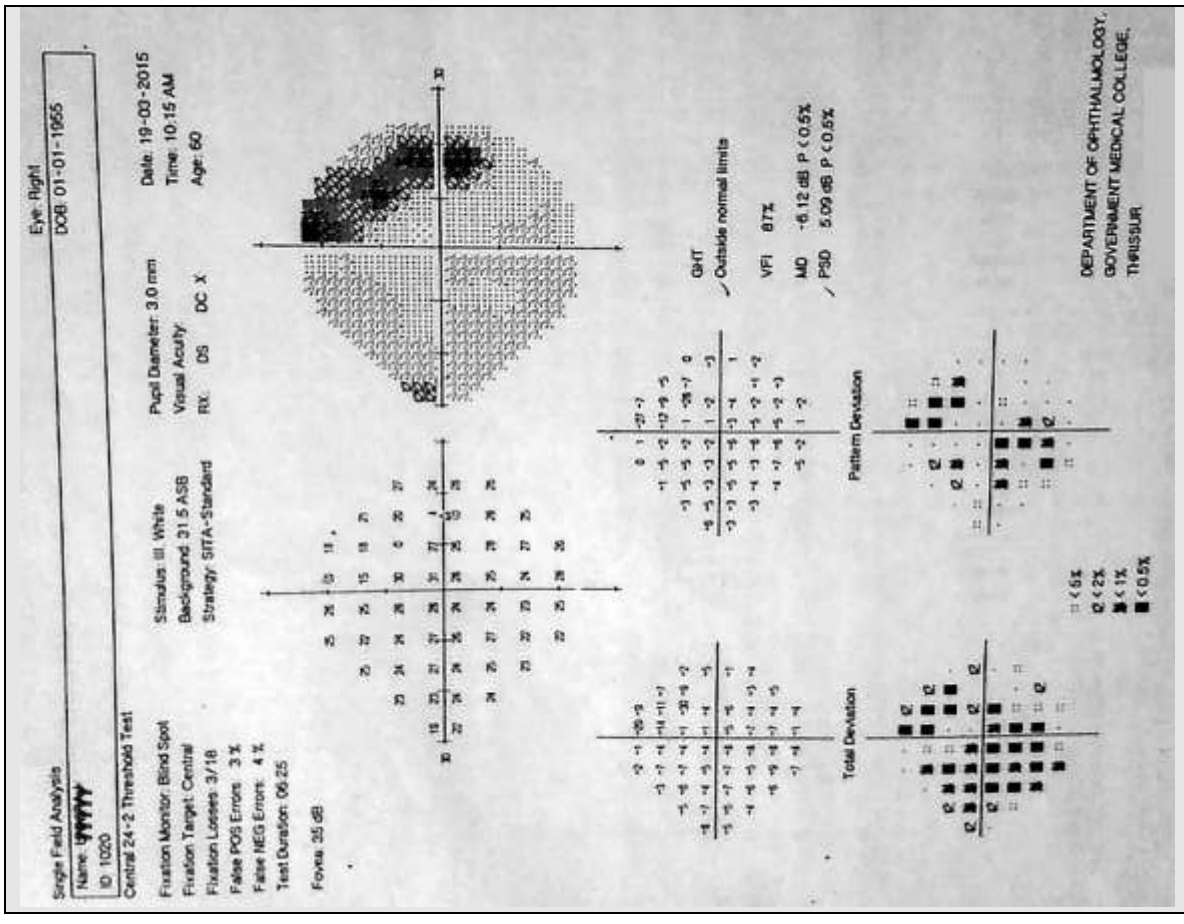

Figure 6. 24-2 with Moderate Field Defect

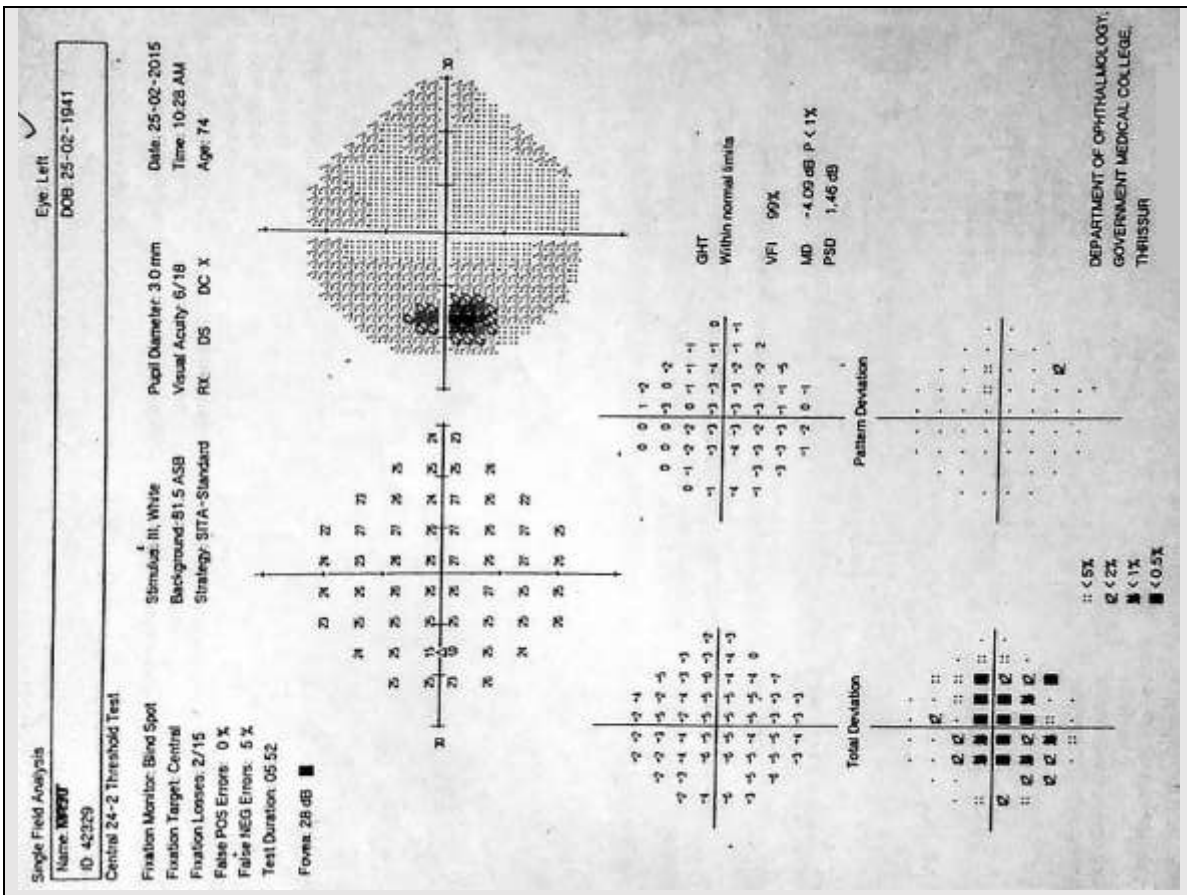

Figure 7. 24-2 with Early Field Defect

DISCUSSION

The deterioration of a patient's vision caused by glaucoma is a result of the progressive, pathologic loss of the retinal ganglion cells (RGCs) and their axons that form the optic nerve.[4,5] Automated static perimetry is the benchmark for testing visual field function in glaucoma. Staging glaucoma damage into mild, moderate, advanced and severe categories enhance management of the disease. As shown by many International and Indian studies, there is not much gender difference in patients with primary open angle glaucoma.[6,7,8,9] This is applicable to glaucoma patients with advanced cupping also. With advanced Cup Disc (C: D) Ratio of 0.9 we expect a field defect to be advanced or severe. 46% of our study group showed severe field defects, and 35% advanced defect. They are in the older age group. This is in accordance with Harwerth lab translated clinical visual field and RNFL thickness data to a common neuronal count in which it was found that the structural and functional damage were in general agreement.[10]

But approximately 20% of eyes in our study population showed mild to moderate field defects. Clinical measurements of structure and function, even in clinically advanced stage, exhibit a wide variability between individuals and on repeated measurements, so the true extent of damage is often difficult to ascertain. The severity of functional damage may not be often, what the structural damage indicates. Study by Rizwan Malik et al[11] also derives the same conclusion. There are not much number of studies similar to the present one and hence comparable results are lacking. An alternative integrated approach using structural and functional test results to monitor the overall progression must be required as in Bayesian hierarchical model[12] for a more accurate assessment.

CONCLUSIONS

With the same optic disc cupping, patients can have different grades of field defects. Even with advanced cupping, (CDR 0.9 and above), the field defects may not always be severe or worse. Approximately 20% eyes showed mild to moderate field defects. Such eyes can be salvaged. So, there is hope for stabilization of visual function in these patients, even when they are detected late, with adequate, proper, treatment and more frequent follow up.

Limitations

Our study population was small. So, it requires a large sample size for further clarification. The system used for staging of field defects was Hodapp-Parrish-Anderson Glaucoma Grading Scale.[3] This system has some limitations as it does not help much to assess the depth of the defect.

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