urnal oc	Original Research Paper	Ophthalmology
PARIPET	To study the optic disc & visual f patients with glaucoma & its	ield changes in correlation.
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Purpose: To study the optic disc & visual field changes in patients with glaucoma & its correlation. Materials and methods: A cross sectional, observational study was conducted on 50 patients with primary glaucoma. Patient uncooperative for visual fields, with nystagmus, vein occlusion or macular degeneration were excluded. Visual acuity, IO measurement, slit-lamp examination, gonioscopy, optic nerve head evaluation & perimetrywere done. Statistical analysis was done by Chi-square test with p value<0.001 considered as significant. Results: The visual field defect corresponded to the optic disc changes. The DDLS correlated with visual field indices i.e, mea deviation and pattern deviation (p value< 0.001). Also, vertical C:D ratio & DDLS staging correlated with Modified HPA stagin		

which was statistically significant (p value<0.001).

**Conclusion:** There is a correlation between the structural and functional changes in glaucoma.

	KEYWORDS	
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Glaucoma, DDLS, HPA staging

## Introduction

Glaucoma is a heterogeneous group disease which exhibits a characteristic optic neuropathy that may result in progressive visual field loss.<sup>1,2</sup> The diagnosis depends on a combination of clinical signs i.e, elevated intraocular pressure (IOP) (>21 mm of Hg)<sup>3</sup>, appearance of the optic disc or nerve fibre layer suggestive for glaucomatous damage, & corresponding visual field defect. Optic nerve changes include increased vertical cup to disc ratio (CDR), thinning of the neuroretinalrim(NRR), notching of the rim, retinal nerve fibre layer (RNFL) haemorrhage, etc.Visual field changes include paracentral scotoma, nasal step defects, arcuate scotoma extending nasally from the blind spot, temporal wedge defects, etc. The Disc Damage Likelihood Scale (DDLS) incorporates the evaluation of disc size and rim width in clinical grading of disc.<sup>4</sup>It has been shown to be a reliable and reproducible method of estimating glaucomatous optic nerve damage. Our studyendeavours to study correlation of visual field changes in relation of optic disc evaluation by DDLS.

# **Materials & Methods**

This cross sectional study included 50 patients seen in Ophthalmology outpatient department of tertiary hospital during 2011 to 2012. The study was approved by Institutional Ethics Committee. Patients with age 40 years and above diagnosed as primary glaucomabased on appearance of glaucomatous disc or RNFL, visual field defect & raised IOP were included.Patients with normal IOP but glaucomatous cupping, visual field loss, open angles and no history of eye disease were considered as normal tension glaucoma(NTG).<sup>5</sup>Patients with history of tobacco habit and optic nerve changes, having nystagmus, or with retinal pathology like pathological myopia, age related macular degeneration, vein occlusion, previous or concurrent optic nerve pathology, secondary glaucoma, cerebrovascular accident & uncooperative for visual field testing were excluded. Written informed consent was taken. Family history of glaucoma or any systemic ailments were noted.

On examination, best corrected visual acuity was recorded.Mean IOP was measured.Gonioscopy was done and angles were graded according to Shaffer grading system.<sup>6</sup>

Slit lamp biomicroscopy with 78D lens & Stereoscopic fundus photography of optic nerve head was done to recorddisc size, vertical CDR, NRR, rim: disc ratio, DDLS staging, RNFL defect in red free filter and splinter haemorrhage. The vertical size of the discs and the cup to disc ratio (CDR) was assessed. The graticule on the slit lamp (Haag-Streit) indicated the size in mm. The reading was multiplied by1.1 for 78 D lens to get the actual reading.

For DDLS staging, disc size was measured and the neuroretinal rim to disc ratio in whichever axis the rim was thinnest was assessed. In the absence of rim tissue, the angular distance of absent rim was measured. The disc was then staged from 0-7, as read from the DDLS staging.<sup>4</sup>

DDL	Narrowest width of rim (rim / disc ratio)		
S	For Small Disc	For Average Size	For Large Disc
Stag	< 1.50 mm	Disc 1.50 – 2.00	>2.00 mm
е		mm	
0a	0.5 or more	0.4 or more	0.3 or more
0b	0.4 to 0.49	0.3 to 0.39	0.2 to 0.29
1	0.3 to 0.39	0.2 to 0.29	0.1 to 0.19
2	0.2 to 0.29	0.1 to 0.19	Less than 0.1
3	0.1 to 0.19	Less than 0.1	0 for Less than 45°
4	Less than 0.1	0 for Less than 45°	0 for 46° to 90°
5	0 for less than 45°	0 for 46° to 90°	0 for 91° to 180°
6	0 for 46° to 90°	0 for 91° to180°	0 for 181° to 270°
7a	0 for 91° to 180°	0 for 181° to 270°	0 for more than 270°
7b	0 for more than	0 for more than	
	180°	270°	

Visual fields were done using SITA STANDARD 24-2 on Humphrey automated perimeter. The pattern of visual field defect, Mean Deviation (MD), pattern standard deviation (PSD) were noted.

Grading of the field was done using modified Hodapp-Parrish-Anderson (HPA) staging.<sup>7</sup> This staging categorises each field into one of four groups : Normal, Early ,Moderate , or Severe change.

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Defe ct	MD	Number of points depressed on Pattern deviation plot	Central 5° sensitivity
Early	< 6dB	< 25% (18) points below 5% and < 10 points below 1%	All points have sensitivity 15dB
Mod erate	< 12 dB	< 50% (37) points below 5% and <20 points below 1%	No points have sensitivity 0 dB or only one hemifield may have point with sensitivity <15dB.
Sever e	> 12 dB	> 50% (37) points below 5% or > 20 points below 1%	At least one point has sensitivity 0 dB. Or both hemifield have points with sensitivity <15dB

### Results

In our study the mean age was60years with same prevalence for males and females .We had6, 78 & 16 patients with small, average and large disc size respectively. Out of 16 eyes with large disc, 68.75% of patients had DDLS stage 3 – 5 whereas only 12.5% of patients with large disc had DDLS stage 6 – 7b. Large optic disc was found only in 7.69% of advanced glaucoma. The pattern of visual field defect corresponded to the changes in the optic disc in majority of the patients. In our study; 84 eyes (93.33%) with optic disc changes had visual field defects while (6, 6.67%) eyes with optic disc changes had normal visual fields. The patients with higher IOP had higher DDLS staging and higher visual field defects.



In our study, (14, 93.33%) eyes with 0.9 cup had severe field defect; whereas (5, 33.33%) with 0.5 cup, (13, 72.22%) with 0.6cup, (11, 47.82%) with 0.7cup, (16, 72.72%) with 0.8cup had moderate field defect as per Modified HPA staging, with Chi Square: 92.77, dF –15, p value<0.001while (6 eyes, 85.71%) with 0.4 cup had normal fields.



In our study, all eyes with MD of >19 had DDLS staging 6–7b; while(18, 94.74 %) with MD of 2–7.99 & (40, 76.92%) with MD of 8-13.99 had DDLS staging 0–2 & 3-5 respectively with Chi Square: 124.86, dF – 6, p value<0.001.



In our study, all eyeswith PSD of 2–5.99 had DDLS staging 0–2; while (26, 65%) with PSD of 6-9.99& (19, 41.30%) with PSD of 10-13.99 had DDLS staging 3 -5& (27, 58.70%) with PSD of 10-13.99 had DDLS staging 6 – 7b with Chi Square: 81.19, dF – 4, p value<0.001



In our study, all eyes with normal field had DDLS staging 0–2. Out of 19 eyes with early field defect (10, 52.63 %) & (9, 47.37 %) eyes had DDLS staging of 0–2 & 3-5 respectively. Majority of eyes with moderate visual field defect (39, 84.78 %) had DDLS staging 3–5 & (26, 86.67%) with severe visual field defect had DDLS staging 6-7b with Chi Square:134.26, dF – 6.p value<0.001.

### Discussion

In this study, optic disc and visual field changes were evaluated in patients with primary glaucoma. Patients with high vertical CDR had moderate to severe HPA staging (p value<0.001). Glosteretal, showed<sup>8</sup> that there was a rapid increase in the incidence of field defects when the vertical CDR attains 0.7.We also observed that with increase in MD & PSD, the DDLSstaging increased&moderate to severe visual field defects were present with higher DDLS staging. All 3 correlations were found to be statistically significant (p value<0.001).

Various studies have demonstrated correlation between DDLS and visual field indices.

H V Danesh-Meyer, B J Gaskin, et al demonstrated that DDLS is an excellent method to distinguish between glaucoma and normal eyes, and it outperformed CDR.<sup>9</sup>

In AIOC proceedings 2008; Pandey N et al found that DDLS correlates more closely with visual field indices and HPA staging system. It appears to be superior to CDR for disc evaluation. Bayer A et al showed that in the 282 eyes studied, the DDLS strongly correlated with both MD &PSD (P <.001). The HPAstaging also strongly correlated with the DDLS (Spearman r =0.711, P <.001).11 The DDLS was devised by Spaethet al to incorporate the evaluation of disc size and rim width in clinical grading. Compared to vertical CDR, DDLS is an objective & sensitive method to evaluate the degree of disc damage.<sup>4</sup>The CDR has several shortcomings like it only indirectly examines the NRR. concentrating on the cup rather than surrounding rim, focal thinning in an oblique axis may be overlooked, & disc size is not considered. Hence, large discs with larger CDR are likely to be classified as glaucomatous &small discs with small CDR are likely to be classified as normal, whether they actually have glaucoma or not.Previous research has demonstrated that NRR correlates more strongly with field damage than CDR.<sup>12</sup>

The two major advantages of DDLS is that it considers disc size & residual NRR. By categorising discs as small, medium, or large, the expectation of rim thickness is adjusted. This reduces misclassification bias based on disc size. The examiner is forced to examine the rim throughout its circumference, documenting the area of greatest thinning. Thus, DDLS scale correlates more closely with visual field indices.

### Conclusion:

The structure-function relation is seen to be linear. Thus, the evaluation of the glaucoma patient is incomplete without ensuring agreement between the appearance of the optic disc and state of the visual field.

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