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Disc damage likelihood scale: its correlation with field indices and its accuracy in diagnosis of glaucoma

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ABSTRACT

Background: To find a correlation of the disc damage likelihood scale (DDLS) scale with visual field indices and its diagnostic power in cases of glaucoma.
Materials and Methods: The study enrolled 198 patients suffering from primary open angle glaucoma. The patients were investigated using Humphreys perimetry and ocular coherence tomography (OCT). The DDLS scoring for each patient was done which was then correlated with visual field indices and the accuracy of DDLS in scoring different stages of glaucoma was studied.
Design of Study: Single center, prospective, observational study.
Results: The DDLS showed a strong correlation with cup-disc ratio, a good correlation with visual field index and mean deviation values and a weak correlation with foveal sensitivity. Also, the scale showed 68.9%, 82.6% and 100% diagnostic accuracy in cases of mild, moderate and severe glaucoma respectively.
Conclusion: The DDLS is a strong adjunctive diagnostic tool that has helped in the diagnosis of glaucoma.

1. Introduction

Glaucoma is a progressive optic neuropathy [1–4] which is one of the leading causes of blindness all over the world.[5,6] To tackle the disease various methodologies, devices and scoring systems have been developed for its diagnosis and early and appropriate treatment of the disease. In this study we analyze a scale known as the disc damage likelihood scale (DDLS) which was described by Spaeth in 2002.[7,8]

We traditionally focus on the cup to disc ratio in glaucoma patients but the DDLS, which is a relatively newer concept, uses the rim to disc ratio which measures the width of the neuroretinal rim at the thinnest point compared to the disc diameter along the same axis. Thus, giving more importance to the existing neural tissue, the rim, that is present rather than focusing on the area of absent tissue which is the cup.

There have been many studies analyzing DDLS but today we shift our focus on critically analyzing the correlation of this scale with visual field indices and also evaluate its diagnostic power in cases of glaucoma.

2. Materials and Methods

The study is a single center, prospective, observational study which evaluated 198 diagnosed cases of open angle glaucoma who visited the institutional glaucoma specialty clinic. The study was done under the tenets of the Declaration of Helsinki. And the study was only started after proper written and informed consent from the patient.

The study included only known cases of primary open angle glaucoma and involved recording their data followed by analyzing how the DDLS scale performed by putting it against the visual field indices and finding its

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accuracy in staging these cases of glaucoma. The study involved recording the patient's visual fields by Humphreys perimetry and ocular coherence tomography. The patients were then graded into mild, moderate and severe grades of glaucoma by mean deviation (MD) severity staging method. Where mild stage: below 6 dB MD, moderate: 6dB to 12 dB MD and severe: above 12 dB MD.

Their visual field indices were recorded and the patient's DDLS score was evaluated from OCT data. Then correlation was found between DDLS score and the visual field indices. Cases diagnosed by DDLS scale as glaucoma were recorded and as all the cases were known cases of glaucoma the percentage accuracy of the scale to diagnose glaucoma was calculated. The statistical analysis was done by SPSS software.

3. Results

The study enrolled 198 patients of which 120 were males and 78 females. The mean age of the study group participants was 45.35 ± 15.42 years.

On data analysis the correlation between the DDLS and cup disc ratio was found to be very strong (r= 0.81, positive correlation, Figure 1), DDLS and visual field index (VFI) of the patients were found to be good (r= -0.52, negative correlation, Figure 2), DDLS and MD was also found to be good (r= -0.49, negative correlation, Figure 3) and the DDLS and foveal sensitivity were weakly correlated (r= -0.35, negative correlation, Figure 4).

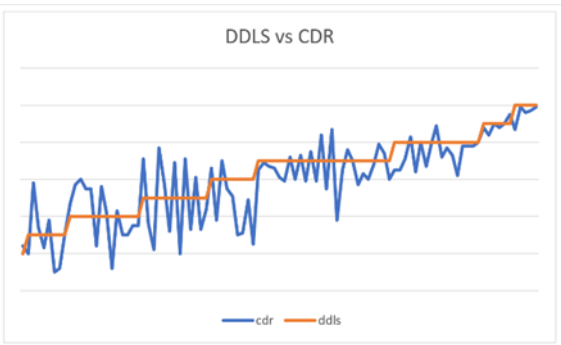

Fig. 1: Correlation between DDLS and cup-disc ratio

When the patients were graded using DDLS, of the 116 patients having mild glaucoma: 36 were graded as at risk, 64 as glaucomatous damage and 16 as glaucoma disability. 46 moderately diseased patients were graded as follows: 8 at risk patients, 28 as glaucomatous damage and 10 as glaucoma disability. And finally, 36 severe glaucoma patients had 6 patients as glaucomatous damage and 30 as glaucoma disability.

Now taking into account that all the patients evaluated were glaucoma patients the percentage diagnosis in each grade by DDLS in our study was 68.9% with mild disease,

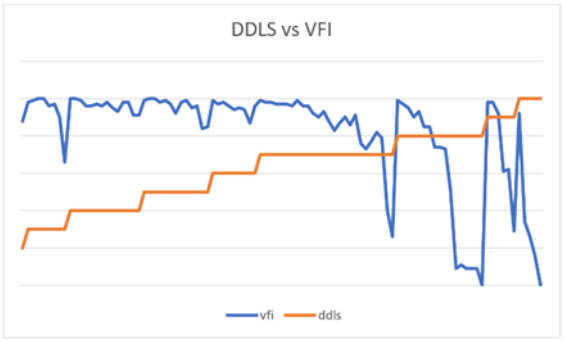

Fig. 2: Correlation between DDLS and visual field index

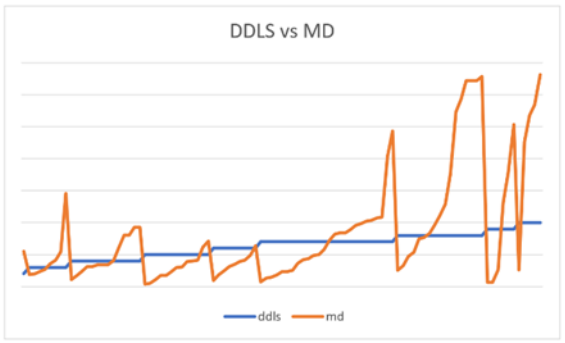

Fig. 3: Correlation between DDLS and MD

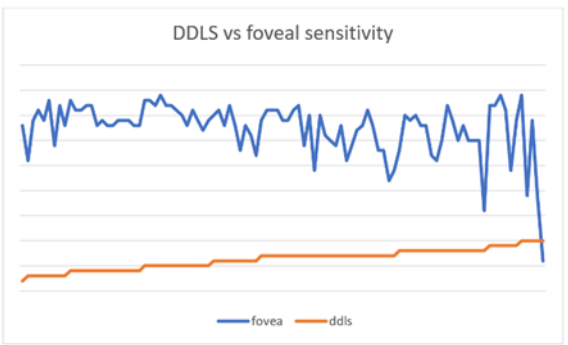

Fig. 4: Correlation between DDLS and foveal sensitivity

82.6% with moderate disease and 100% with severe disease were diagnosed accurately as having glaucoma.

4. Discussion

Glaucoma is a chronic disease that has taken centerstage in ophthalmology as it is one of the leading causes of blindness in the world. Thus, proper diagnosis and treatment has become imperative to tackle it. In this study we evaluate the DDLS, which is a strong diagnostic tool. The scale utilizes rim to disc ratio as opposed to cup to disc (CD) ratio[9] which has been used since long. This concept embraces the importance given to the neuro-retinal rim that is preserved

in glaucomatous individuals rather than focusing on the area of absent tissue that is the cup (which logically seems to be counterintuitive when using cup to disc ratio). Also, compared to CD ratio the inter observer (85% versus 74%) and intra observer (98% versus 85%) were far superior in the rim to disc ratio which the DDLS utilizes as has been shown in a study.[10]

In our study, DDLS staging shows a very strong correlation with CD ratio, a good correlation with VFI and MD and weak correlation with foveal sensitivity. Which was also observed by Lutaka et al who observed significant correlation between visual field index and MD.[11]

The European Optic Disc Assessment Trial[12] reported the accuracy of different methods in the diagnosis of glaucoma where stereoscopic photographs had 80.5% accuracy, Heidelberg Retina Tomograph (HRT) I 89.8% and GDx 92.3%.[13] In our study the accuracy ranged according to the stage of disease suffered by the patient: 68.9% with mild disease, 82.6% with moderate disease and 100% with severe disease were accurately diagnosed by DDLS as having glaucoma.

The important point that needs to be noted is that even though patients had moderate glaucoma, 8 patients were diagnosed as being at risk thus not diagnosing them as glaucoma. And 16 patients with mild glaucoma were staged as having glaucoma disability even though the foveal sensitivity was greater than 30 dB and a visual field index greater than 90%, giving us a false impression that the patients had severe disability due to glaucoma. This has also been observed in another study where this scale overestimated visual field damage and doesnot correlate well with the structural and functional status of the patient.[14,15] Thus pointing out the fact that DDLS does not correlate well with the visual performance of the patient.

What needs to be understood is that through this study we have tried to better understand the usefulness of DDLS as a predictor of glaucoma, its accuracy and its correlation with the visual field indices. DDLS is a strong predictor of glaucoma and correlates well with disc damage and becomes an even stronger tool when used with other diagnostic procedures for glaucoma. The shortcoming of the study was the smaller sample size of the study, and the fact that only known cases of open angle glaucoma were used.

5. Conclusion

DDLS is a strong predictor of disc damage as it utilizes rim to disc ratio for evaluating damage. It also correlates well with visual field indices but it does not help to assess the functional status of the patient as it tends to overestimate the disease in the mild stage.

As there is no single test for the diagnosis of glaucoma, it is an add on to the battery of tests that helps makes the diagnosis of glaucoma more strongly.

6. Source of Funding

None.

7. Conflict of Interest

None.

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