Commentary: Linear discriminant score for differentiating early primary open angle glaucoma from suspects

Diagnosing glaucoma suspects is a challenge and it is important to be able to recognize the ones most likely to progress to glaucoma. To this end, there has been a search for appropriate tools to be able to discriminate between glaucoma suspects who may actually be early glaucoma and those who may be normal. Because no one parameter is often adequate, there have been attempts to combine parameters in an attempt to provide greater discriminative capability.

The advent of spectral-domain optical coherence tomography (SD-OCT) technology has allowed advanced macular imaging protocols to play an important role in the diagnosis and monitoring of glaucoma.[1-4] The ganglion cell analysis (GCA) obtained by the Cirrus HD-OCT® system (Zeiss) segments and measures the thickness of the ganglion cell-inner plexiform layer (GC-IPL), thereby potentially increasing its diagnostic accuracy compared to conventional peripapillary retinal nerve fiber layer (RNFL) thickness measurement.

Published studies have reported comparable values for area under receiver operating characteristic curves (AROCs) of GCA and RNFL thickness for discriminating early glaucoma from normal.[2-5] Once there is a visual field defect, such a differentiation is not difficult. The challenge comes in differentiating a glaucoma suspect from normal in the presence of normal visual fields.

In this article,[6] the authors have used the SD-OCT to study the RNFL thickness and GCA and used a linear discriminant score as a discriminator between glaucoma suspects and early glaucoma patients. They found better accuracy than individual ganglion cell complex (GCC) and optic nerve head (ONH) and RNFL parameters and deduced that it could be used for the diagnosis of glaucoma.

One explanation for the lower AROC of GCA could be that the GCA in its present form only measures an annulus of 4.3 × 4.0 mm around the macula. Though this region contains 50% of retinal ganglion cells (RGCs),[7] the loss that is picked up depends upon the location of the RNFL defect. Recent studies have pointed out that the topographic profiles of RNFL defects affect the diagnostic performance of macular scans in preperimetric glaucoma.[8] Because of the arrangement of the arcuate fibres, in cases of RNFL defects which are closer to the poles, RNFL atrophy may not be reflected by RGC loss in the GCA in the machine simply because it is further away from the measurement circle. The diagnostic ability of macular ganglion cel inner plexiform layer (GCIPL) parameters was comparable to that of peripapillary RNFL and ONH parameters in pre-perimetric glaucoma (PPG). The inner directional angle of RNFL defects, but not the angular width, affects the diagnostic sensitivity of macular GCIPL parameters.

As for all technology, the GCA analysis also needs to be interpreted with caution, keeping the clinical setting in mind. In a cohort of healthy eyes, Kim *et al*.[9] reported abnormal diagnostic classifications in 40.4% and 30.8% on GCA and RNFL maps, respectively, especially in eyes with long axial lengths, large fovea-disc angles, and small optic discs. It is also important to keep in mind that conditions such as diabetic macular edema and age-related macular degeneration, which are common comorbidities in the age group of glaucoma patients, may affect the macular RGC thickness.

At present, the GCA measurements do not appear to outperform average RNFL measurements to discriminate between glaucoma suspects and established early glaucoma or normal subjects. In that sense the linear discriminant score appears to be a viable additional tool in our armamentarium of imaging. However, applicability in the clinical setting and easy incorporation in commercially available machines would be required before it could be widely used in clinical practice.

Sushmita Kaushik

Glaucoma Services, Advanced Eye Centre, Postgraduate Institute of Medical Education and Research, Chandigarh, India

Correspondence to: Prof. Sushmita Kaushik,
Glaucoma Services, Advanced Eye Centre,
Postgraduate Institute of Medical Education and Research,
Chandigarh, India.
E-mail: sushmita_kaushik@yahoo.com

References

1. Kotowski J, Folio LS, Wollstein G, Ishikawa H, Ling Y, Bilonick RA, *et al*. Glaucoma discrimination of segmented cirrus spectral domain optical coherence tomography (SD-OCT) macular scans. Br J

Ophthalmol 2012;96:1420-5.
2. Tan O, Li G, Lu AT, Varma R, Huang D. Mapping of macular substructures with optical coherence tomography for glaucoma diagnosis. Ophthalmology 2008;115:949-56.
3. Ganekal S. Ganglion cell complex scan in the early prediction of glaucoma. Nepal J Ophthalmol 2012;4:236-41.
4. Morooka S, Hangai M, Nukada M, Nakano N, Takayama K, Kimura Y, *et al.* Wide 3-dimensional macular ganglion cell complex imaging with spectral-domain optical coherence tomography in glaucoma. Invest Ophthalmol Vis Sci 2012;53:4805-12.
5. Kaushik S, Kataria P, Jain V, Joshi G, Raj S, Pandav SS. Evaluation of macular ganglion cell analysis compared to retinal nerve fiber layer thickness for preperimetric glaucoma diagnosis. Indian J Ophthalmol 2018;66:511-6.
6. Deshpande GA, Bawankule PK, Raje DV, Chakraborty M. Linear discriminant score for differentiating early primary open angle glaucoma from glaucoma suspects. Indian J Ophthalmol 2019;67:75-81.
7. Hebel R, Hollander H. Size and distribution of ganglion cells in the human retina. Anat Embryol (Berl) 1983;168:125-36.
8. Kim MJ, Jeoung JW, Park KH, Choi YJ, Kim DM. Topographic profiles of retinal nerve fiber layer defects affect the diagnostic performance of macular scans in preperimetric glaucoma. Invest Ophthalmol Vis Sci 2014;55:2079-87.
9. Kim KE, Jeoung JW, Park KH, Kim DM, Kim SH. Diagnostic classification of macular ganglion cell and retinal nerve fiber layer analysis: Differentiation of false-positives from glaucoma. Ophthalmology 2015;122:502-10.

Access this article online

Quick Response Code:

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_1506_18

Cite this article as: Kaushik S. Commentary: Linear discriminant score for differentiating early primary open angle glaucoma from suspects. Indian J Ophthalmol 2019;67:81-2.