PUBLISHED ABSTRACT

Optical Coherence Tomography Summary Metrics Perform Poorly for Assessing Progression in Early Glaucoma

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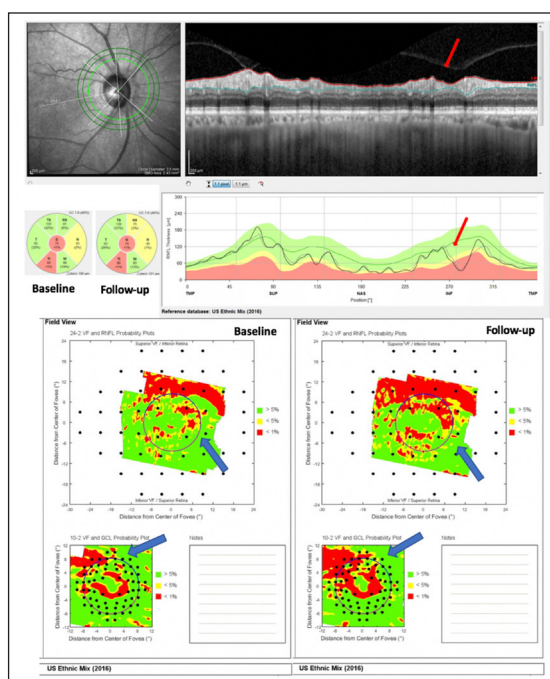Corresponding author: Melvi del Valle Eguia (eguiamelvi@gmail.com)

Purpose

To evaluate methods, based on summary metrics, for assessing progression in glaucoma suspects and early glaucoma (24–2 visual field mean deviation better than –6 dB) using optical coherence tomography (OCT) scans.

Methods

Spectral-domain OCT circle (3.5 mm) scans of the disc from 89 eyes with an average of 3.28 [range 2–5] scans within 6 months formed a variability (V) group; 47 eyes were early glaucoma or suspects and 42 were healthy controls. 159 eyes from 100 patients (early glaucoma or suspects) with 2 OCT circle scans, 1.7 ± 0.55 yrs. apart, formed the long-term group. All scans were taken with Heidelberg GPME, which acquires follow-up circle scans based on baseline. Circumpapillary retinal nerve fiber layer (cRNFL) thickness measures were obtained for global (G), temporal (T), temporal inferior (TI), and superior (TS) regions. Quantile regression was applied on all metrics of the V group, with the independent variable being the baseline values and dependent variable all follow-up values. The 95% and 5% confidence limits (CI) of each metric defined "statistical progressors" and "statistical improvers" of the long-term group. For the reference standard (RS), 4 experts identified progressors by evaluating all OCT and 10–2 and 24–2 VF information, including OCT reports with probability maps (**Figure 1**).

Figure 1: Gray line corresponds to baseline scan.

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Table 1: Assessment of progression by Quantile progression analysis and by the Reference standard.

| Sector | Quantile Regression Analysis N = 159 | | Reference Standard 56 Prog. and 103 No Prog. | |
	"Progressors"	"Improvers"	False Negatives	False Positives
G	53	11 (6.9%)	26 (46.4%)	23 (22.3%)
T	48	7 (4.4%)	30 (58,5%)	22 (21.3%)
TI	55	11 (6.9%)	21 (37,5%)	20 (19.4%)
TS	50	11 (6.9%)	28 (50%)	22 (21.3.%)

Results

The G and TI metrics showed the highest number of "statistical progressors", 53 (33%), and 55 (34%) (**Table 1**). Based upon the RS, 56 eyes were defined as progressors. The 4 metrics missed many of these 56 statistical progressors; false negative (FN) rates of 37.5% to 58.5%. And, based upon the RS, 103 eyes were defined as non-progressors. All 4 metrics, identified over 20% of these 103 eyes as progressors, false positive (FP) rates of 19.4% to 22.3%.

Conclusion

Summary metrics of the cRNFL are not adequate for detecting progression in eyes with early glaucoma. These metrics resulted in FPs based on a clinically relevant RS, and also miss eyes that are clearly progressing on probability maps (Fig, lower panel). Factors contributing to FN and FP included subtle local thinning, segmentation errors, and other pathologies (schisis, ERMs).