The GPA Software

Advice for making the most of this diagnostic tool.

BY DONALD BUDENZ, MD, MPH

The Glaucoma Progression Analysis (GPA) software has been available for the Humphrey Field Analyzer (HFA) II (both Carl Zeiss Meditec Inc., Dublin, CA) for just over 1 year. The program is designed to facilitate the diagnosis of glaucomatous progression by means of visual field criteria and a sound statistical method based partly on the Early Manifest Glaucoma Trial (EMGT).[1] The software is analogous to the old Glaucoma Change Probability software of the HFA I (both Carl Zeiss Meditec Inc.). That program analyzed individual points in the visual field for worsening and produced an easily readable printout detailing the probability of an individual point's worsening (Figure 1). Whereas the Glaucoma Change Probability program analyzed total deviation, the GPA software analyzes pattern deviation.

ROOTS IN THE EMGT

Understanding how the GPA software works entails knowing how the EMGT defined progression of the disease. The study was designed to determine whether treating patients with early glaucoma helped to delay or prevent its progression, and reports appearing in the literature during the past 2 years have demonstrated that this is indeed the case.[2] The two endpoints used in the EMGT were a change in the optic disc's appearance as determined by flicker chronography or a change in visual field, for which the investigators developed their own criteria based on the old GPA software of the HFA I.

As part of the development of the GPA software, a group of patients with glaucoma and a group of normal subjects underwent full-threshold, Swedish Interactive Threshold Algorithm (SITA) Standard, and SITA Fast testing four times over the course of 2 months. In its definition of progression, the GPA software follows the EMGT's criteria by looking for three or more points that show worsening at the 5% level in the exact same location on three or more consecutive visual field examinations. If the criteria are met, the message *likely progression* appears on the GPA printout.

USING THE GPA SOFTWARE

The GPA software averages the first two reliable full-threshold or SITA Standard visual fields for a patient and creates a baseline. The program then compares subsequent visual fields to this baseline. If a particular value falls outside the range of noise, that individual point is labeled as *possibly worse* ($P<5\%$ deterioration) with a designator of an open triangle. Studies have shown that visual fields fluctuate a lot and that practitioners should not base their determination of progression on a single visual field.[3]

> "The first visual field to indicate progression generally is not a cause for alarm, because variability in testing is common and the next visual field may revert to the baseline."

The decision of when to perform subsequent visual field testing depends on how serious the clinician thinks the damage to the visual field is or how rapidly the disease seems to be progressing. A strong suspicion of severe or rapid progression motivates me to conduct repeat testing in the next 1 to 2 weeks and a possible escalation of therapy. For glaucoma suspects or patients with early glaucoma who have no other indications of worsening, waiting longer may be all right. Again, the first visual field to indicate progression generally is not a cause for alarm, because variability in testing is common and the next visual field may revert to the baseline.

On the second confirmatory visual field, the open triangles will be filled halfway with black if the same points show change from the baseline. If three or more half-filled triangles appear on the second follow-up field, the software will label the result *possible progression*. Many patients' results will revert to the baseline after two fields that seem to demonstrate worsening. As shown in the Collaborative Normal Tension Glaucoma Trial, more than two visual fields are necessary to demonstrate worsening.[3]

Black triangles will appear if the same points exhibit change from the baseline on the third follow-up visual

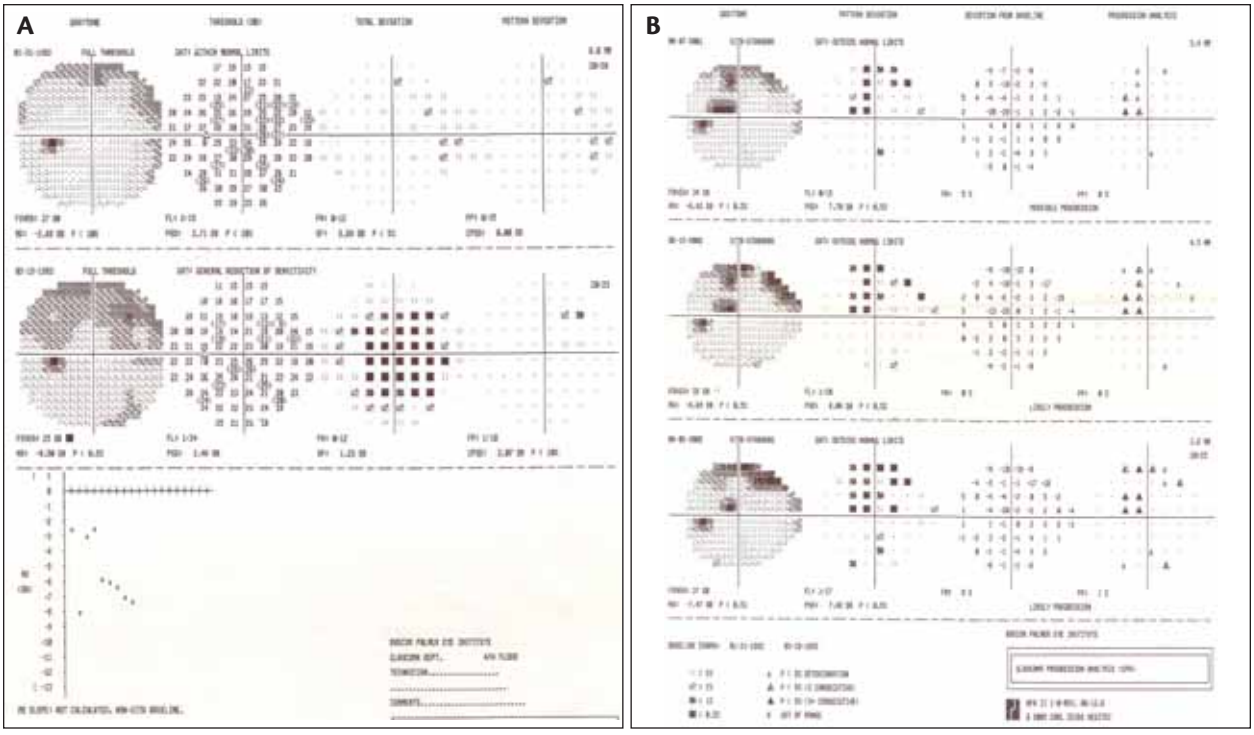

Figure 1. The GPA software has selected two baseline fields (A). Follow-up visual fields indicate possible and, finally, likely progression in a patient with glaucoma (B).

field as did on the first and second follow-up visual fields. If three or more black triangles appear on the third follow-up, the program will label the result *likely progression*, and the patient will have reached the endpoint of glaucomatous progression according to the EMGT.

One of the GPA software's strengths is that it can compare follow-up SITA fields to full-threshold baseline visual fields. The program cannot compare a new full-threshold visual field with older SITA tests, however.

DIFFERENTIAL DIAGNOSIS

One caveat is that not all worsening of visual fields is due to glaucoma. A complete ocular examination is necessary to rule out retinal disease (eg, vascular occlusive disease) and other diseases of the optic nerve such as compressive neuropathy or ischemic optic neuropathy. If these alternate causes are absent, however, glaucomatous progression is the probable diagnosis.

The GPA software assists clinicians in determining whether worsening of the visual field is due to glaucoma or another cause. It takes into account age-related changes that lessen sensitivity and changes in the field due to diffuse depression from cataract or other media opacity such as corneal edema or vitreous hemorrhage. The program subtracts these other factors and focuses on localized changes, which are more characteristic of glaucomatous progression.

PEARLS

Clinicians must be careful in their selection of baseline fields. The GPA software will automatically choose the earliest two reliable visual fields and average them to create a baseline. The program is not as good as the practitioner at recognizing artifacts (eg, from small pupils, edge artifact, or lid artifact). The clinician should therefore review the two baseline visual fields selected by the software to ensure that they are appropriate choices. If they are not, it is easy to select two different baseline fields.

In cases of glaucomatous progression involving the setting of a new target IOP or after glaucoma surgery, it is important to reselect the baseline visual fields. In other words, one should compare future testing with a visual field taken at the time of progression rather than before it occurred. Otherwise, the GPA software will flag every subsequent visual field as positive for progression.

THE FUTURE

The GPA software has not been tested against a comparable gold standard, partly because none exists. Neither does the literature contain a study that clearly

demonstrates whether the program works. My colleagues and I, therefore, are conducting a study to test the software on two groups of patients, one with progressing glaucoma and the other in whom the disease is stable. The study will analyze the specificity of the GPA software. We have performed SITA testing five times over 2 months in 50 patients with glaucoma. We will review the results to determine if the software erroneously flags any subjects as progressing.

> "[Our study has] two groups of patients, one with progressing glaucoma and the other in whom the disease is stable. The study will analyze the specificity of the GPA software."

Determining the GPA software's sensitivity is more difficult. We plan to identify a group of patients whose disease has definitely progressed by other standard visual-field criteria and then put these fields through the GPA software to check if the program recognizes the progression.

CONCLUSION

Currently, I do not use the GPA software for every patient but rather reserve it for individuals whose disease I suspect to be progressing. The program helps me to determine the status of their glaucoma with some statistical probability. We are moving toward using the GPA in the routine management of glaucoma patients at the Bascom Palmer Eye Institute in Miami, however. ❑

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