Interpreting Visual Fields

Advice on using staging systems to make informed treatment decisions.

BY JEFFREY D. HENDERER, MD

Much recent excellent work has focused upon the optic nerve and nerve fiber layer. Although a careful analysis of the nerve will provide valuable information about a patient's disease, it may not provide the physician with an adequate understanding of the patient's condition. For example, individuals who have far advanced, diffuse neuroretinal rim loss in each eye can seem to function perfectly well, whereas others with small, localized rim notches are debilitated by vision loss. How can the eyes with less rim tissue "see" better? The answer is field loss. Glaucoma affects patients, not by the nerve damage per se, but by the location of the damaged peripheral vision. Although nerve damage and field loss are nothing more than pathology and its functional manifestation, there can be a disconnection between how the physician perceives the disease's severity (the nerve examination) and how seriously the disease is affecting the patient (the field loss).

The goals of an eye examination are identifying the problem, determining its cause, and attempting to provide a solution. The myriad ways in which glaucoma can occur make it worth bearing this framework in mind. As George Spaeth, MD, of Wills Eye Hospital in Philadelphia teaches, the optic nerve examination determines if the patient has glaucoma, gonioscopy indicates the type of glaucoma, and the history and field examination reveal how the disease is affecting the patient. In combination, these results yield information about disease severity and thus help to guide treatment decisions. This article focuses on the interpretation and staging of visual fields as means by which to determine the amount of glaucomatous damage that a patient has suffered.

GENERAL THOUGHTS

When evaluating fields, I like to follow a checklist that I learned from Donald Budenz, MD, of the Bascom Palmer Eye Institute in Miami. The list is as follows:

1. What are the patient's demographics and clinical characteristics?
2. What type of visual field test was performed?
3. How reliable is the visual field?
4. Is the visual field abnormal?
5. What is the pattern of the abnormality?
6. Is the field worsening?
7. Is the abnormality/worsening due to disease or artifact?

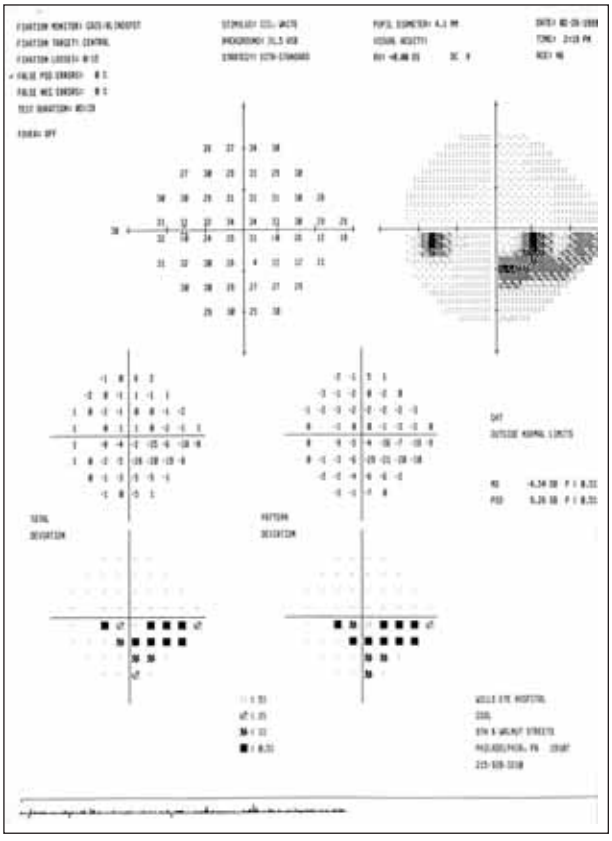

Figure 1. This field shows a glaucomatous defect that would be designated as moderate according to the Hodapp-Parrish-Anderson scale or stage 4 per the Field Damage Likelihood Score. Information from the gaze tracker appears at the bottom of the printout. Vertical lines emanating from the central horizontal line indicate saccades. Few saccades in this case indicate good fixation.

TABLE 1. THE HODAPP-PARRISH-ANDERSON STAGING SYSTEM

Stage*	Definition
Minimal	1. Abnormal glaucoma hemifield test 2. Corrected pattern standard deviation depressed at the *P*<5% level (or pattern standard deviation of *P*<5% on a SITA field) 3. A cluster of three non-edge points (for a 30-2 field) in an expected location for glaucoma, all of which are depressed on the pattern deviation plot at the 5% level (or greater) and at least one of which is depressed at the 1% level (or greater)
Early	1. Mean deviation <-6 dB 2. No point at 5° from fixation is less than 15 dB 3. The total number of points depressed at the 5% level or worse on the pattern deviation plot is less than one quadrant, while the number of points depressed at the 1% level or worse is less than one-half of a quadrant or one-eighth of the field
Moderate	1. Mean deviation between -6 and -12 dB 2. One point at 5° from fixation measures <15 dB 3. The total number of points depressed at the 5% level or worse on the pattern deviation plot is less than two quadrants, while the number of points depressed at the 1% level or worse is less than one quadrant
Severe	1. Mean deviation >-12 dB 2. One point at 5° from fixation of 0 dB 3. One point in each hemifield at 5° from fixation measures <15 dB 4. The total number of points depressed at the 5% level or worse on the pattern deviation plot is greater than two quadrants, while the number of points depressed at the 1% level or worse is greater than one quadrant

**Only one of the various definitions needs to be met in order to be of a given stage.*

FIELD RELIABILITY

Reliability is one problem with perimetry. The Swedish Interactive Testing Algorithm (SITA) on the Humphrey Field Analyzer (Carl Zeiss Meditec Inc., Dublin, CA) measures reliability in terms of fixation losses, false positives, and false negatives. Fixation losses are measured by projecting a stimulus into the blind spot. If the patient responds, one can assume that he was not looking at the fixation target. Ideally, the number of fixation losses should be small. If there are few false positives and false negatives, however, I will accept some fixation losses—perhaps a rate as high as 50%. The gaze tracker can be used to monitor fixation on a more continuous basis (Figure 1).

False positives are defined as erroneous patient responses when no stimulus was presented. A high rate of false positives makes the field appear artificially good. To me, a rate greater than 10% to 15% indicates that the field is unreliable. False negatives occur when the patient fails to respond to a stimulus he previously saw. Some false negatives are to be expected for patients with advanced field loss, but, in general, these errors make the field look artificially bad.

INTERPRETATION

Staging Systems

After deeming the field to be reliable, one must next decide if a field abnormality is glaucomatous. If it is, staging

the field will reveal the amount of field loss and help one to determine which treatments to employ. Although there is no universally agreed upon set of criteria to define glaucomatous field loss, every ophthalmologist understands the meaning of the term *nasal step*. I suspect that many ophthalmologists learned during their residency what a glaucomatous field "looks" like and still operate by an "I know it when I see it" or "that's bad field loss" set of interpretational criteria. I think this approach is insufficient. Unfortunately, however, there is no universally accepted definition of what constitutes mild, moderate, or severe field loss.

Multiple staging systems have been designed, but none is in wide use. The scales for the Advanced Glaucoma Intervention Study[1] and Collaborative Initial Glaucoma Treatment Study[2] were designed as research tools and are too complicated to be clinically useful. Two other staging scales seek to balance ease of use (fewer stages) with sufficient detail to enable the detection of change (more stages). They are the Hodapp-Parrish-Anderson (HPA)[3] and Spaeth Field Damage Likelihood Score (FDLS) staging systems.[4,5]

The HPA system is based on the Humphrey STATPAC printout and is easy to use, but it is probably best applied when determining baseline damage. Because it only contains three broad stages, the system is not able to detect all cases of progression. Different criteria to assess progression have therefore been developed. Table 1 presents an explanation of the staging system, slightly modified for SITA testing. One problem with the HPA system is that cataract can depress the mean deviation and thereby render the field score worse than it really is. One way to correct for the effect of cataract is to adjust the mean deviation by the foveal threshold. If the foveal threshold is depressed 3 dB, then add 3 dB to the mean deviation, thus making it less negative.

The FDLS system was developed for use with the Humphrey perimeter pattern deviation plot, but it is not specific for automated perimetry. For that reason, it can be used to track patients who may have had a variety of kinetic and static tests over the course of many years. Although simple to use, the system's employment of eight stages (Table 2) means that movement to a different stage is triggered by smaller field changes when compared with the HPA system. The FDLS system also appears to agree with an independent assessment of field change more often than does the HPA system. It is important to recognize that the former grades the field only by the number and location of depressed points. The system does not necessarily detect deepening of an existing scotoma. Neither can it easily classify the occasional patient who has only a central island of vision, a uniformly depressed total deviation plot, and yet a rela-

TABLE 2. THE FIELD DAMAGE LIKELIHOOD SCORE*

Stage	Grading by Visual Field Area	Grading by Number of Abnormal Points
0 (no loss)		0
1 (minimal loss)	Early nasal step	1 to 3
2 (mild loss)	Less than one-half of one quadrant lost	4 to 6
3 (mild-to-moderate loss)	Approximately one quadrant lost	7 to 12
4 (moderate loss)	Approximately one to two full quadrants lost	13 to 22
5 (marked loss)	Approximately two to three full quadrants lost	23 to 32
6 (advanced loss)	More than three quadrants lost	33 to 42
7 (far advanced loss)	Residual island <25° or central island <4°	43 or higher

**The visual field standard is the Humphrey 24-2 threshold test. The four points at the upper and lower extremes of the field are ignored for the purposes of this staging system. An abnormal point is defined as a point depressed at the 1% level or more on the corrected pattern standard deviation plot. If any of the central four points is depressed at the 1% level, it is counted three times (tripled). The worst possible score is 54, 42 abnormal points in the peripheral field (the eight points in the vertical extremes are ignored) and 12 for the four central points.*

TABLE 3. TARGET IOP REDUCTION (%) BY FIELD DAMAGE AND RISK FACTORS FOR GLAUCOMATOUS DETERIORATION*

NUMBER OF RISK FACTORS	STAGE OF FIELD LOSS†			
	0 to 1	2 to 3	4 to 5	6 to 7
3	30%	40%	50%	60%
2	20%	30%	40%	50%
1	0	20%	30%	40%
0	0	0	20%	30%

**Adapted from George Spaeth, MD. The risk factors for glaucomatous deterioration include (1) IOPs of 20 to 30 mm Hg (1 point), 30 to 40 mm Hg (2 points), or >40 mm Hg (3 points); (2) a family history of glaucoma (0.5 points); (3) African American descent (0.5 points); and (4) pseudoexfoliation (0.5 points). Other risk factors may apply.*

†According to the FDLS staging system.

tively normal pattern deviation plot.

Despite their limitations, these two staging systems agree well with each other and provide helpful information about damage.[6]

Other Factors in Interpretation

Neither the HPA nor the FDLS staging system provides a complete picture of the disease's impact upon the patient's visual perception. Although both give the physician a good sense of an individual eye's functional impairment, they do not reflect the fact that patients use their eyes simultaneously. Glaucomatous defects often occur in the nasal field, and the patient's fellow eye can frequently compensate for this impairment (even in cases of advanced loss), because the two nasal fields overlap. The physician can use binocular field tests such as the Esterman in order to assess real-life impairment. This suprathreshold examination available for the Humphrey perimeter tests 150° of horizontal field. Results can be entered directly into the *Physicians Desk Reference*'s ophthalmic disability calculations and can provide helpful information about a patient's ability to meet the minimal horizontal field requirements for a driver's license. Nevertheless, binocular field status is only one determiner of glaucoma-related visual disability and quality of life.[7-9]

CONCLUSION

The reasons to perform visual field testing are to understand glaucoma's effect on the patient and make informed treatment decisions. When interpreting fields, one should first assess their reliability, then determine the likelihood that they are demonstrating pathology, and, finally, identify the cause of that pathology. At that point, one may use a staging system in order to quantify the amount of glaucomatous damage. This information will be helpful in formulating a treatment strategy and establishing a baseline for monitoring the efficacy of treatment. Table 3 presents one option, but other investigators have created similar algorithms.[3]

At present, I do not feel it is possible to fully understand a glaucoma patient's situation without visual field information. Certainly, fields are fraught with problems such as insufficient sensitivity to detect early glaucoma, long-term fluctuation, and poor reliability. These issues can limit the usefulness of current field technology. Aside from the medical history, however, physicians have no other way of measuring glaucoma's impact on their patients' lives. ❑

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