Perimetry, a technique of assessing a person’s visual field (VF), is important in the diagnosis of glaucoma, and as a means of determining progression of glaucomatous damage. VF loss may precede, be concurrent with, or follow, optic nerve damage in the early stages of glaucoma.

Once diagnosed, perimetry is considered the gold standard for monitoring glaucoma progression. It is therefore important to use a consistent examination strategy when repeating VF tests.

Standard white-on-white automated perimetry (SAP), an extensively researched and well-established technique to quantify VF sensitivity, is considered the reference standard for VF examination of patients with glaucoma. SAP, with a fixed testing matrix of at least the central 24 degrees, is recommended.

Literature on progression analysis is only available for white-on-white SAP, and it therefore remains the gold standard for measuring progression. Research into VF progression by alternative measures, such as frequency doubling perimetry (FDT) and motion perimetry, is needed.

The role of FDT perimetry in the diagnosis and management of glaucoma is yet to be defined adequately, and there is currently no compelling evidence to support the replacement of SAP.

Grading glaucoma

The use of a standard classification of glaucoma severity can promote clear communication between health care providers.

The continuum of glaucoma severity can be graded by VF results (Table 1). These grading scales are based on the Humphrey Visual Field Analyser (HVFA).

Glaucoma Staging System (GSS)

GSS is a method of measuring glaucoma progression, in patients already diagnosed, using the HVFA.

By clearly defining the stages of disease, the effectiveness of treatment at each stage can be better assessed (Table 2).

Frequency of testing

VF results can be impacted by inherent variabilities and patient learning curves. At least 2-3 VF tests should be conducted in the first year after glaucoma diagnosis to accommodate patient learning. The best of these early tests should be used as the baseline.

More frequent testing may be required depending on the patient’s clinical risk factors for progression, or if a significant change is suspected.

Detection of progression

Major clinical trials, such as OHTS (Ocular Hypertension Treatment Study), require two baseline and three abnormal VFs, with the last taking place within 8 weeks of the second failed test (using HVFA results that meet reliability criteria).

The criteria for progression from normal to glaucomatous are:

- GHT (Glaucoma Hemifield Test) at P<0.03. Therefore ‘borderline’ at P<0.03 or ‘outside normal limits’ at P<0.01 are both fail criteria; and/or
- Corrected Pattern Standard Deviation (CPSD) at P<0.05.

Event analysis and trend analysis are the two main approaches to identifying VF changes.

Event analysis

Event analysis detects progression and is usually performed by comparing follow-up fields with baseline fields. It is useful for detecting conversion of suspected glaucoma to diagnosed glaucoma.

To flag progression, confirmed deterioration is required with consecutive tests. Focal/ regional metrics show the location of the progression, while summary/global metrics show the overall progression over time.

Glaucoma Change Probability is a form of event analysis which is commercially available with the Statpac program of the HVFA.

Manual detection can also be used. For example, the progression from Stage 0 to Stage 1 is an event determined by examining for changes in global indices and local depressions, expressed in probability values (Table 2).

According to guidelines by the (previous) Optometrists Registration Board of Victoria (ORBV), at least four or five VF tests may be required to establish stability/progression (Table 3).

Practitioners need to show at least twice that an unaffected area is now affected, or has definitely changed. Therefore, two fields are needed to establish baseline and two are needed to confirm progression.

Practitioners monitoring advanced glaucoma or low tension glaucoma will need to use a test pattern that can identify threats to fixation.

Event analyses generally detect progression earlier than trend analysis.

Trend analysis

Trend analysis is used to measure/quantify progression. It is usually performed by measuring the rate of change in a visual field index, typically mean deviation (MD) over time.

**TABLE 1: A CONTINUUM OF GLAUCOMA SEVERITY BASED ON VISUAL FIELDS**

<table>
<thead>
<tr>
<th>No glaucomatous impairment</th>
<th>No VF defects</th>
<th>Glaucoma suspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild glaucoma</td>
<td>Unilateral VF defect</td>
<td>Receiving treatment</td>
</tr>
<tr>
<td>Moderate glaucoma</td>
<td>Up to five missed points (&lt;10 dB mean deviation or average loss) in binocular central 20° of VF</td>
<td></td>
</tr>
<tr>
<td>Severe glaucoma</td>
<td>≥ Six adjoining missed points (&lt;10 dB) and any additional separate missed point(s), or a cluster of ≥ four adjoining missed points (&lt;10 dB), either of which is wholly or partly within the central 20° superior or inferior hemifield</td>
<td></td>
</tr>
</tbody>
</table>
In general, rate-based analyses are used later in the follow-up, when a greater number of VFs are available over a sufficient period of time to measure the rate of progression.

Additional computer software and analysis of the regression is required for trend analysis, such as the Glaucoma Progression Analysis (GPA) software on the HVFA.

This type of analysis allows for easier prediction of the time to reach severe visual loss.

The ability to detect a given rate of visual field change expressed in MD/year depends on the variability of MD over time, the number of examinations and the amount of change to detect.

Table 4 illustrates time (in years) to detect various rates of MD change with 80% power in visual fields with low, moderate and high variability.

In a reliable patient (low variability of MD) with two annual VF exams, it would take three years to detect an annual progression of -1.00 dB in MD.

As a general rule, 0 to -0.5 dB/year is considered no or minimal progression; >-0.5 dB/year to <-1.5 dB/year is moderate and >-1.5 dB/year is high progression.

**TABLE 2: GLAUCOMA STAGING SYSTEM (GSS) DEFINITIONS AND SEVERITY CRITERIA**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Humphrey MD Score</th>
<th>Additional Criteria (at least one of the listed criteria must apply)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 0: No or Minimal Defect</td>
<td>≥ -6.00 dB</td>
<td>• A cluster of ≥ 3 points on the pattern deviation plot in an expected location of the visual field depressed below the 5% level, at least one of which is depressed below the 1% level.</td>
</tr>
<tr>
<td>Stage 1: Early Defect</td>
<td>≥ -6.00 dB to -12.00 dB</td>
<td>• ≥ 25% but &lt; 50% of points on the pattern deviation plot depressed below the 5% level, and ≥ 15% but &lt; 25% of points depressed below the 1% level.</td>
</tr>
<tr>
<td>Stage 2: Moderate Defect</td>
<td>-12.01 dB to -20.00 dB</td>
<td>• ≥ 50% but &lt; 75% of points on pattern deviation plot depressed below the 5% level and ≥ 25% but &lt; 50% of points depressed below the 1% level.</td>
</tr>
<tr>
<td>Stage 3: Advanced Defect</td>
<td>-20.00 dB</td>
<td>• ≥ 75% of points on pattern deviation plot depressed below the 5% level and ≥ 50% of points depressed below the 1% level.</td>
</tr>
<tr>
<td>Stage 4: Severe Defect</td>
<td>-20.00 dB</td>
<td>• ≥ 75% of points on pattern deviation plot depressed below the 5% level and ≥ 50% of points depressed below the 1% level.</td>
</tr>
<tr>
<td>Stage 5: End-Stage Disease</td>
<td>Unable to perform HVFA in worst eye due to central scotoma OR worst eye VA 6/60 or worse due to POAG. Fellow eye may be at any stage.</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 3: GUIDELINES FROM THE OPTOMETRIST’S REGISTRATION BOARD OF VICTORIA**

<table>
<thead>
<tr>
<th>Initial VF</th>
<th>Action</th>
<th>Follow-up VF</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 dB loss in three adjacent points</td>
<td>Test again in 2-6 weeks</td>
<td>3 x 15 dB loss</td>
<td>Consult with ophthalmologist</td>
</tr>
<tr>
<td>10 dB loss in three adjacent points</td>
<td>Test again in 2-6 weeks</td>
<td>3 x 10-15 dB loss</td>
<td>Test again every 6-12 weeks until worsens or improves</td>
</tr>
<tr>
<td>Repeatable loss in a previously normal field, 3 points each with &gt;10 dB</td>
<td></td>
<td></td>
<td>Consult ophthalmologist (evidence of progression)</td>
</tr>
<tr>
<td>Two neighbouring points adjacent to an existing scotoma that decline by more than 10 dB.</td>
<td></td>
<td></td>
<td>Consult ophthalmologist (evidence of progression)</td>
</tr>
</tbody>
</table>

*In 2010 the ORBV integrated with the Optometry Board of Australia. These guidelines are similar to those of the Collaborative Normal Tension Glaucoma Study (CNTGS) and Clinical Scoring System (CSS).*
References


