Visual Fields and Treatment Strategies in Glaucoma

Michael Chaglasian, OD, FAAO
Illinois Eye Institute
Illinois College of Optometry
mchaglas@ico.edu

Disclosure

- Michael Chaglasian, OD is a paid advisor, consultant or researcher for the following commercial/industry groups:
  - 1. Advisory Boards: Allergan, Inc., Alcon Labs, Bausch+Lomb, Carl Zeiss Meditec, Merck, Sucampo

Outline

- Visual Fields
  - Standard Automated Perimetry (SAP)
    » Diagnosis of glaucoma
    » Progression Analysis (SAP)
  - Selective Functional Perimetric Tests
    » Frequency Doubling / Matrix
- Cases

Case OB

- 53 yo, woman,
- GAT: ~ 23 – 25 mmHg
- CCT: ~ 568 µ
- Neg Family history glaucoma
- + hypertension

- Early Glaucoma or Not?

Initial Photos

HFA 2005
Conclusion

- Identifying progression in glaucoma is difficult
- Requires a combination of photography, VFs and OCT
  - and use of latest updates for progression analysis

VF: has to be repeated 3 times

Functional Assessments for Glaucoma: Standard Visual Field Tests

OHTS: 85.9% of abnormal and “reliable” fields were not confirmed on retest!

VF: has to be repeated 3 times

The Global Glaucoma Network

Function

WGA

1. A method for detecting abnormality and documenting functional status should be part of routine clinical management of glaucoma.
2. It is unlikely that one functional test assesses the whole dynamic range.
3. Standard Automated Perimetry (SAP) as usually employed in clinical practice, is not optimal for early detection.

Function

WGA

5. With appropriate norms, there is emerging evidence that SWAP and possibly also FDT may accurately detect glaucoma earlier than SAP.
   Updated comment 2007: SAP-SITA has similar sensitivity to detect visual field abnormalities as SWAP-full threshold.

6. Little evidence to support the use of a particular selective visual function test in clinical practice as there are few studies with adequate comparisons.
   Updated comment 2007: FDT N30 may provide better sensitivity than SAP-SITA or SWAP-full threshold. Evidence concerning the sensitivity of SWAP-SITA and FDT Matrix 24-2 is not yet available.

The Global Glaucoma Network
Standard Automated Perimetry

- Clinical Gold Standard
- Oldest, most documented test of visual function
- >3000 refs since 1980 (VF and glaucoma)
- Standardized testing parameters
- Comparison with normal data
- Assumed relationship between loss of visual function and retinal ganglion cell loss

Humphrey® Field Analyzer (HFA)

- A long term favorite for perimetry
- STATPAC™ proprietary computerized analysis tool to simplify visual field interpretation
- Decades of validation
- Enhancements to the gold standard platform to further improve patient care:
  - Glaucoma Progression Analysis (GPA) expert tool to improve decision making

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Five Rules (the “5Rs”) for Interpretation of Visual Fields

1. **Right test**
2. **Reliability**
3. **Review probability plots**
4. **NFL pattern of loss**
Five Rules (the “5Rs”) for Interpretation of Visual Fields

1. Right test
2. Reliability
3. Review probability plots
4. RNFL pattern of loss
5. Re-affirm the diagnosis

Visual Field Progression: Functional Changes

Event Analysis

Glaucoma Progression Analysis (GPA)

GPA Criteria for Identifying Progression in Visual Fields

- Minimum of 3 tests required: 2 baseline and 1 follow-up exam
- Each follow-up compared to averaged thresholds of 2 baseline exams
- Additional follow-up compared both to baseline and to 2 most recent follow-ups
- Symbols:
  - ▼ = Progression at 95% significance level
  - ▲ = Progressing point repeated in 2 consecutive exams
  - ▲▲ = Progressing point repeated in 3 consecutive exams
- GPA Alert: 3 ▲ in 1 exam denote “Possible Progression” and 3 ▲▲ indicate “Likely Progression”

Single Field Analysis With GPA Results

- GPA printout is the preferred method for event analysis
- Technician must set up single-page printout for GPA
- Clinician must choose baseline fields to be used
Visual Fields and Treatment Strategies

Limitations of GPA

► May overcall progression
  – Requires multiple confirmation
► May undercall progression
  – Floor effect in advanced disease
► Algorithm failure

Computer-assisted decision making is required for evaluation of visual field

Conclusions

► Evaluate and document Optic Nerve and VF to:
  – Diagnose glaucoma
  – Determine disease severity
  – Evaluate progression
► Set target pressure based on risk factors and optic nerve appearance
  – Aim for lower targets
► Prescribe therapy with best ability to achieve and maintain target IOP (or lower)
► Re-evaluate structure/function critically as patient is followed
► Readjust target IOP and treat more effectively when subtle progression is noted

Case GS

■ 55 yo C, F, Seeking second opinion
■ History of being treated for glaucoma
  – Currently on PGA and beta blocker
  – Was recommended to have laser trabeculoplasty
■ No insurance
■ IOP = 17 mmHg; PreTx IOP = 21
■ CCT = 555µ

FDT Matrix

Case WJ

■ 58 yo, AA, M
■ History of OTHN
■ Pre Tx IOPs = 34 mmHg
■ Now = 24-26
  – With PGA
■ Pachs = 505 µ
■ Need Additional Treatment?

GPA Visual Fields
CASE WS
- 65 yo Patient
- POAG:
  - OD worse than OS
- Pre Tx IOP: 32 OD; 24 OS
- Currently: 22 OD; 21 OS
- ONHs and VFs =>

Functional Assessments for Glaucoma: Standard Visual Field Tests
- Is disease present?
- How bad is it?
- Is it getting worse?

Factors Affecting the Measurement of Progression
1. Difficulty in detecting change in a chronic, slowly progressive disease
2. Patients are usually treated so it is difficult to establish the natural history of progression
3. Normal test-retest variability vs. progression

GPA for HFA helps identify progression easily
- Simple to use:
  - Default settings for seamless workflow
  - Single page printout with GPA Summary
  - Common language reporting
  - Automatic baseline selection

GPA Minimizes Effects of Variability
- Using data from multi-center clinical trials, HFA variability was quantified at the 95% confidence level.
- The grey zone represents test-retest variability.
  - Points inside this zone reflect variability.
  - Points below the grey zone are flagged in GPA as progressing, if they meet EMGT criteria.
- Doctors can accurately identify and appropriately treat progression.
Most recent innovations in GPA for HFA

- Improved metric of visual field loss
- New graphical trend display
- VF index plotted against age
- Single page printout
- Available 2007

Central points weighted more heavily than those on periphery
Reduces cataract contribution to the measurement of VF loss

VFI = 90%
VFI = 81%

B has more damaged central points and lower VFI than A.

Event analysis (GPA alert) indicates “Likely Progression”.
- Slope is nearly flat and the confidence interval is narrow.
- Patient is 75 years old.

EXAMPLE

Rate of Progression

Visual Function

Earlier intervention
Fast Progression
Later intervention
Level of visual disability

Can this predict future VF loss?

Prediction of Glaucomatous Visual Field Loss by Extrapolation of Linear Trends

Arch Ophthalmol 2009 127:1610

How Often to Repeat VF?

Practical recommendations for measuring rates of visual field change in glaucoma

Arch Ophthalmol 2009 127:1610
VF Testing Guidelines = 3/yr!

**Selective Functional Testing**

1. Frequency Doubling (FDT)
2. Flicker Defined Form (HEP, new)

**Frequency Doubling Perimetry**

Functional diagnostic instruments for early glaucoma detection and management

- Fast
- Accurate
- Easy to use

As the sole perimeter or as an additional device to your HFA, a frequency doubling perimeter can efficiently help you detect or confirm early glaucomatous loss.

**OCTOPUS 300/900 & EYESUITE**

**Case EG**

- 67 yo, AA male, Retired school teacher
- Good health, no medications
- + Family History of glaucoma
- OHTN/Early Glaucoma
- CCT = 567, 571
- Pre-Tx IOP ~ 30 mmHg OD, OS
- With PGA:
  - Always 20-23 mmHg x 5+yrs
  - Good Compliance

**FDT Emphasizes Magnocellular Responses**

- FDT emphasizes responses of the magnocellular RGCs
- Flicker stimulus mimics motion across the retina
- Emphasizing one pathway increases sensitivity
Frequency Doubling Technology

Clinical Findings

- Detects glaucomatous loss up to four years earlier than standard white on white perimetry
- High sensitivity and specificity
- Fast, patient- and tech-friendly, efficiently placed in any office, and concordant with HFA results, frequency doubling perimeters are effective screening devices

Humphrey Matrix

- Clinically-validated age-related normative database
- Advanced management tools
  - Enhanced defect characterization
    - Up to 69, 5° x 5° stimuli
  - Statistical analysis package
    - PSD plots, GHT, global indices
  - Video eye monitoring
  - 40GB hard, CD/RW, floppy drives
  - Keyboard, Color printer
- Central vision threshold testing

Frequency Doubling Technology

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<tr>
<th>Clinical Finding</th>
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<tr>
<td>Detects glaucomatous loss up to four years earlier than standard white on white perimetry</td>
<td>Medeiros FA, Sample PA, Weinreb RN. “Frequency Doubling Technology Perimetry Abnormalities as Predictors of Glaucomatous Visual Field Loss.” Am J Ophthalmol. 2004 May;137(5):863-71</td>
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Visual Fields and Treatment Strategies

Recent Comparison

**CONCLUSIONS.** The performance for glaucoma detection was comparable between FDT perimetry and SAP. FDT perimetry had a higher sensitivity for detecting glaucoma than did SAP at a comparable level of specificity.

FDT Matrix

- Can be a good general perimeter – Size, Ease, Networking
- Can may higher sensitivity for disease vs. SAP
- Significant (10-20%) False Positives
- Defects MUST be repeated/confirmed
- Not well proven for ongoing glaucoma care and management

CASE JB

- 75 yo, male
- Several year history of glaucoma
- Pre Tx IOP = 27-29 mmHg
- On PGA and CAI
- GAT = 20 / 20 OD and OS
- Open angles

Current Perimeters are Highly Variable

- After one abnormal visual field test:
  - 86% of patients test within normal limits on next exam
- After two consecutive abnormal test results:
  - 66% of patient test within normal limits on next exam

The Heidelberg Edge Perimeter (HEP)

- With Flicker Defined Form (FDF)
- Not Yet Available for Sale in the USA

Heidelberg Edge Perimeter

- New “Flicker Defined Form” Stimulus
- Overcomes limitations in Frequency Doubling Technology
- True targeting of M-cell visual pathway
- Less test-retest variability
- Direct link to HRT optic disc assessment
- Also offers SAP in same “Box”
Structure & Function Map

Inner Ring:
HRT MRA
Structure Classification

Outer Ring:
HEP
Function Classification

Legend:
- Within Normal Limits
- Borderline
- Outside Normal Limits

Questions / Discussion

mchaglas@ico.edu