Visual Fields

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Part 3 of 4
(Visual Field Analysis and Examples)

Review: See handout

Data Plots: Total Deviation versus Pattern Deviation
Global Indices: Mean Deviation versus Pattern Standard Deviation
Field Types: Humphrey versus Octopus

Lesion locations: See handout
1) Paracentral and nasal step - 50%
2) Paracentral - 25%
3) Nasal step - 25%
4) Temporal wedge - 2% (myopes)

Criteria for Abnormality / Progression

Anderson’s criteria: See handout

NTG Study Group Criteria: Easiest to remember (Some details left out)

1) Pupil > 2.5 mm
2) Reliable field (FP ≤ 15%, FN ≤ 30%, FL < 15% but if FL < 10% then FN rate between 30-50% acceptable)
3) Minimal defect: cluster of 3 adjacent points depressed by at least 5 dB from normal age values (Total Deviation Plot) with one of these values depressed by at least 10 dB.
4) These must coincide on one side of the horizontal midline and there had to be points elsewhere that were at least 10 dB higher than the densest point in the scotoma.
5) Progression:
   • Deepening of an existing scotoma
   • Expansion of an existing scotoma
     • These 2 progression criteria were met if 2 adjacent points in a baseline defect declined 10 dB from their initial average of the three baseline values
     • Points could not be peripheral or cross nasal meridian
     • The decline must be 3x the SF
   • A new or expanded threat to fixation
   • A fresh scotoma in a previously normal part of the field

Other Analyses: See handout
• Change Analysis
• Change Probability
• Overview Analysis

<table>
<thead>
<tr>
<th>Parvocellular (P) (X) pathway</th>
<th>Magnocellular (M) (Y) pathway</th>
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<tbody>
<tr>
<td>80% of retinal fibers</td>
<td>20% of retinal fibers</td>
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<tr>
<td>Small soma, axon size, receptive fields</td>
<td>Large soma, axon size, receptive field</td>
</tr>
<tr>
<td>Midget cells</td>
<td>Parasol cells</td>
</tr>
<tr>
<td>Properties</td>
<td>Results of lesion</td>
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<tr>
<td>------------------------------------</td>
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<tr>
<td>See color</td>
<td>Reduced color vision</td>
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<tr>
<td>See fine detail</td>
<td>Reduced texture perception</td>
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<tr>
<td>Sensitive to high contrast</td>
<td>Reduced pattern perception</td>
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<tr>
<td>Slow, sustained response</td>
<td>Reduced acuity</td>
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<tr>
<td>Driven mostly by cones</td>
<td>Reduced contrast perception</td>
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<tr>
<td>Function: color vision and visual acuity</td>
<td>Normal flicker perception</td>
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<tr>
<td>Fovea</td>
<td>Function: movement and depth perception</td>
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<tr>
<td>LOW temporal frequency</td>
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<tr>
<td>HIGH spatial frequency</td>
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Glaucoma Theories:
- **Selective loss of M pathway only** (“Selective loss hypothesis”)
  - Need large and/or low contrast flickering target (test motion & flicker)
- **Selective large fiber loss** (includes M pathway and blue-cone pathway)
  - “Reduced redundancy or undersampling hypothesis”
  - Need large and/or low contrast flickering target and/or a blue target
  - Test cells with minimal receptive field overlap thus any absence is detected easier (less redundancy or masking of the loss)
- **Diffuse loss of all fiber types** (“Population response hypothesis”)
  - Need complex stimulus as the combined connections of many cell types are needed or the transmission of information fails

Current Visual Field Limitations:
- Luminance threshold of static perimetry is not subserved by large fibers but rather the smallest fibers, which are least likely to be affected in glaucoma
- Kinetic perimetry (Goldmann) uses luminance threshold but at least motion is detected (yet limited sensitivity due to patient, instrument and operator factors)
- **SWAP: Short Wavelength Automated Perimetry** or “Blue-on-yellow” visual field: Undersampling hypothesis tested with a large (size V) blue stimulus (440 nm) on a yellow background but done with static perimetry, 15% longer than standard white-on-white perimetry, affected greatly by the blue filter of a cataract.
- **FDP: Frequency Doubling Perimetry**: Also undersampling hypothesis tested by flickering stimulus (My cells tested); very fast, less affected by media, pupil diameter less important, ambient illumination and optical blur less important, can detect defects missed with white-on-white perimetry, specificity as high as 99%