My Favorite Cases: A Clinical Guide to the Management of Glaucoma
My Favorite Cases

• Diagnosing and managing Ocular Hypertension and Glaucoma requires a series of decisions be made over the course of the lifetime of care
  – Is disease present?
    • What tests should be performed to aid in establishing diagnosis?
  – If disease is present, what type?
    • OHTN vs. Glaucoma
  – Is therapy required?
    • What therapy?
  – If glaucoma, what type?
    • Primary vs. secondary
    • Open vs. chronic angle closure
  – Grade severity of condition
  – Establish the target IOP
  – When should patient return?
What is Risk Assessment?

- 1961- Framingham Heart Study gave medicine the term “risk factor”
- Identification of risk factors for coronary artery disease
How Can This Strategy Be Applied to Glaucoma?

- Identify patients at moderate to high risk of converting from ocular hypertension to glaucoma
- Direct therapy at those who are at greatest risk
- Which risk factors should be considered?
PERSPECTIVE

Risk Assessment in the Management of Patients With Ocular Hypertension

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• PURPOSE: To develop a model for estimating the global risk of disease progression in patients with ocular hypertension and to calculate the "number-needed-to-treat" (NNT) to prevent progression to blindness as an aid to practitioners in clinical decision making.
• DESIGN: Development of a mathematical model for estimating risk of glaucoma progression.
• METHODS: Population-based studies of patients with ocular hypertension and glaucoma were reviewed by a panel of glaucoma specialists. Measures of disease progression risks derived from three long-term studies and assumptions based on the available data were used to estimate the risk of progression from ocular hypertension to glaucoma and glaucoma to unilateral blindness for untreated and treated patients over a 15-year period. Using these estimates, the NNT (1/absolute risk reduction on treatment) to prevent unilateral blindness in one patient with ocular hypertension was calculated.

Results: In untreated patients, the estimated risk of progression from ocular hypertension to unilateral blindness was 20.4% to 10.5% and in treated patients, the estimated risk of progression was 0.3% to 2.4% over 15 years. From these estimates, between 12 and 83 patients with ocular hypertension will require treatment to prevent one patient from progressing to unilateral blindness over a 15-year period.

• CONCLUSION: Global risk assessment that incorporates all available data plays a vital role in managing patients with ocular hypertension. A more precise understanding of long-term vision loss should be factored into decisions pertaining to the initiation of glaucoma therapy. Meticulously, these estimates will evolve and change with the availability of new population-based epidemiologic information and improvements in multivariable model testing. (Am J Ophthalmol 2004;138: 458–467. © 2004 by Elsevier Inc. All rights reserved.)

The publication of the 5-year results of the Ocular Hypertension Treatment Study (OHTS),1 has caused some ophthalmologists to reassess the ways in which they evaluate and manage patients with ocular hypertension. According to the OHTS findings, the cumulative probability of developing glaucoma after 5 years is 9.5% in eyes with untreated ocular hypertension.1–2 However, only a subset of patients who develop glaucoma is expected to lose functional vision during their lifetime. Despite the valuable contributions from the OHTS, particularly in identifying risk factors for progression to glaucoma, precise calculations of risk for disease progression to visual impairment in individual patients over given time periods, or perhaps more importantly over a patient's lifetime, are not yet available. Consequently, questions remain as to how best apply these new findings in deciding which patients to treat and how vigorously and when to initiate treatment.1 A method of assessing risk of progres-
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• RESULTS: In untreated patients, the estimated risk of progression from ocular hypertension to unilateral blindness was 1.5% to 10.5% and in treated patients, the estimated risk of progression was 0.3% to 2.4% over 15 years. From these estimates, between 12 and 83 patients will require treating to prevent one patient from progressing to unilateral blindness over a 15-year period.
• CONCLUSION: Global risk assessment that incorporates all available data plays a vital role in managing patients with ocular hypertension. A more precise understanding of long-term vision loss should be factored into decisions pertaining to the initiation of glaucoma therapy. Undoubtedly, these estimates will evolve and change with the availability of new population-based epidemiologic information and improvements in multivariable model testing. (Am J Ophthalmol 2004; 138: 458-467. © 2004 by Elsevier Inc. All rights reserved.)
Risk Assessment

• Consider number of risks individual has that puts them at risk for
  – conversion of ocular hypertension to the development of glaucomatous damage OR
  – from early glaucomatous damage to blindness

• Based upon evidence
• Studies include Ocular Hypertension Treatment Study
• What risk is too much and therapy is indicated prophylactically?
• Uses concept from Framingham Heart Study and Cardiovascular disease
Risk Assessment

• In cardiovascular disease, risk factors are evaluated to understand who is at risk for conversion to outcome such as MI or CVA
  – Risks include hypertension, obesity, elevated cholesterol, smoking, family history, sedentary lifestyle

• Similar risk factor assessment used to understand who may convert from OHTN to glaucoma
Risk Assessment

- Age
- IOP
- Corneal Thickness
- Vertical Cup/Disc Ratio
  - Optic Nerve healthy
- PSD Visual Field
  - Global Indice
  - Field full
Risk Assessment

• At what risk is therapy indicated to prevent undesirable outcome from occurring
• For glaucoma approximately 15% is consensus
• If cardiovascular disease, risk is approx 5%
Risk Assessment

- **Risk Level Low** < 5%
  - Monitor
- **Risk Level Moderate** 5-15%
  - Consider Therapy Discuss with patient
- **Risk Level High** >15%
  - Treat
The OHTS-EGPS Risk Calculator

Available for free as PDF download at
http://ohts.wustl.edu/risk/
We present a method for estimating the 5-year risk that an individual with ocular hypertension will develop primary open angle glaucoma (POAG).

The method may be useful to clinicians and patients in deciding the frequency of tests and examinations and the potential benefit of starting treatment.

More information is available in the manuscript, "A Validated Prediction Model for the Development of Primary Open Angle Glaucoma in Individuals with Ocular Hypertension," published in Ophthalmology 2007; 114(1):10-19. A list of publications from the OHTS and the EGPS is available in our publications section.

View the abstract here.

*New* OHTS Calculator iPhone Application

This website and glaucoma prediction model are not designed to, and do not, constitute medical advice. Results are not intended to be a substitute for professional medical evaluation, diagnosis, treatment or clinical judgement. The results of this prediction model are not deemed accurate for individual diagnosis. Any medical concerns regarding your eyesight should be directed to a medical professional.
CONTINUOUS METHOD FOR ESTIMATING 5-YEAR RISK OF DEVELOPING POAG

INSTRUCTIONS:
1. Enter Patient Age and Ocular Data. (At least one measurement must be entered in each row.)
2. Click "Estimate Risk" to obtain the predicted 5-year risk of developing POAG.
3. Tooltips can be viewed by moving your mouse over any question mark.

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>RIGHT EYE MEASUREMENTS</th>
<th>LEFT EYE MEASUREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
</tr>
<tr>
<td>? Untreated Intraocular Pressure (mm Hg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>? Central Corneal Thickness (microns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>? Vertical Cup to Disc Ratio by Contour</td>
<td></td>
<td></td>
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<tr>
<td>? Pattern Standard Deviation</td>
<td>Humphrey (dB)</td>
<td>Octopus loss variance (dB)</td>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>68</td>
<td>68</td>
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<tr>
<td>Untreated Intraocular Pressure (mm Hg)</td>
<td>25 25 27</td>
<td>24 25 26</td>
</tr>
<tr>
<td>Central Corneal Thickness (microns)</td>
<td>515 520 522</td>
<td>515 518 515</td>
</tr>
<tr>
<td>Vertical Cup to Disc Ratio by Contour</td>
<td>6.00</td>
<td>.7</td>
</tr>
<tr>
<td>Humphrey (dB) Octopus loss variance (dB)</td>
<td>1.8 1.7</td>
<td>1.6 1.7</td>
</tr>
</tbody>
</table>

[Buttons: Estimate Risk, Print, Reset]
Life Expectancy Among Glaucoma Suspects

• American Geriatrics Society recommends that a patient’s life expectancy be incorporated in medical decision making.

• Calculating the benefits of treatment of a chronic disease needs to account for possibility that a patient will die before developing any symptoms from chronic disease.
Life Expectancy Data

(USA, 2002, all persons, median)

<table>
<thead>
<tr>
<th>Current Age</th>
<th>Years</th>
<th>Life Expectancy</th>
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</thead>
<tbody>
<tr>
<td>45 yrs</td>
<td>34.8</td>
<td>79.9 yrs</td>
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<tr>
<td>65 yrs</td>
<td>18.3</td>
<td>83.3 yrs</td>
</tr>
<tr>
<td>85 yrs</td>
<td>6.1</td>
<td>91.1 yrs</td>
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</table>

DHHS. National Center For Health Statistics
http://www.cdc.gov/nchs/data/nvsr/nvsr53/nvsr53_06.pdf
Six Important Questions in Managing OHTN or POAG

• What is the risk to our patient’s visual function if condition is not treated?
• If we accept that OHTN and glaucoma has a natural history, how early must we treat to alter natural history and preserve vision?
• What are the downsides to treatment?
• Which treatment is best?
• How are the results of the treatment best measured?
• What risk factors help most in making the best management decisions?
Five Rules for Assessment of the Optic Disc in Glaucoma

1. Observe the scleral *Ring* to identify the limits of the optic disc and its size
2. Identify the size of the *Rim*
3. Examine the *Retinal nerve fiber layer*
4. Examine the *Region of parapapillary atrophy*
5. Look for *Retinal and optic disc hemorrhages*
Initial Medical Management of OAG

• Before starting therapy
  – obtain several IOP readings
    • either done on one day (diurnal curve) or over 2-3 days at different times
    • need detailed pretreatment information
      – medical and ocular
  – grade severity of glaucoma
    • based upon nerve appearance, fields and highest IOP
Describe and Understand Condition

• Open vs. Narrow Angle
  – Chronic angle closure glaucoma resembles open angle forms
    • detect with gonioscopy
    • Asians

• Primary vs. Secondary forms
  – detect with slit lamp evaluation
  – secondary glaucomas
Clinical Correlations in Glaucoma

- Compare the visual field and optic nerve appearance
- Does the disc and visual field correlate?
  - Often the structure – function analysis does not correlate
- Does the comparison between the right and left eyes fit?
- Ask “How will optic nerve and visual field appear in twenty years”
- Lower target IOPs
Clinical Decisions in Glaucoma

• Target pressure
• Select therapy vs. No therapy
  – Medications
    • Prostaglandins- most common first line agent
    • Beta blockers
    • CAI
    • Adrenergic
  – Laser Trabeculoplasty
  – Filter Surgery
# Topical Glaucoma Treatments

<table>
<thead>
<tr>
<th>BRAND NAME/ MNFR</th>
<th>GENERIC NAME</th>
<th>CONCENTRATION/BOTTLE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beta Blockers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Betagan/Allergan</td>
<td>levobunolol HCL</td>
<td>0.25% - 5mL, 10mL; 0.5% - 2mL, 5mL, 10mL, 15mL</td>
</tr>
<tr>
<td>Betimol/Vistakon</td>
<td>timolol hemihydrate</td>
<td>0.25% - 5mL; 0.5% - 5mL, 10mL, 15mL</td>
</tr>
<tr>
<td>Betoptic-S/Alcon</td>
<td>betaxaolol HCL</td>
<td>0.25% - 2.5mL, 5mL, 10mL, 15mL</td>
</tr>
<tr>
<td>Istalol/Ista</td>
<td>timolol maleate</td>
<td>0.5% - 5mL</td>
</tr>
<tr>
<td>Timoptic/Aton Pharma</td>
<td>timolol maleate</td>
<td>0.25% - 5mL, 10mL, 15mL; 0.5% - 5mL, 10mL, 15mL</td>
</tr>
<tr>
<td>Timoptic (preservative-free)/Aton Pharma</td>
<td>timolol maleate</td>
<td>0.25% - unit dose; 0.5% - unit dose</td>
</tr>
<tr>
<td>Timoptic-XE/Aton Pharma</td>
<td>timolol maleate</td>
<td>0.25% - 2.5mL, 5mL; 0.5% - 2.5mL, 5mL</td>
</tr>
<tr>
<td><strong>Prostaglandin Analogs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lumigan/Allergan</td>
<td>bimatoprost</td>
<td>0.01% - 2.5mL, 5mL, 7.5mL</td>
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<tr>
<td>Rescula/Sucampo</td>
<td>unoprostone</td>
<td>0.15% - 2.5mL, 5mL</td>
</tr>
<tr>
<td>Travatan Z/Alcon</td>
<td>travoprost</td>
<td>0.004% - 2.5mL, 5mL</td>
</tr>
<tr>
<td>Generic</td>
<td>latanoprost</td>
<td>0.005% - 2.5mL</td>
</tr>
<tr>
<td>Zioptan/Merck</td>
<td>Tafluprost</td>
<td>2.5mL</td>
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<tbody>
<tr>
<td><strong>Alpha Agonists</strong>&lt;br&gt;Generic</td>
<td>brimonidine</td>
<td>0.1%, 0.15% - 5mL, 10mL, 15mL</td>
</tr>
<tr>
<td>Alphagan P/Allergan</td>
<td>brimonidine</td>
<td>0.1%, 0.15% - 5mL, 10mL, 15mL</td>
</tr>
<tr>
<td>Iopidine/Alcon</td>
<td>apraclonidine</td>
<td>0.5% - 5mL, 10mL; 1% - unit dose</td>
</tr>
<tr>
<td><strong>Carbonic Anhydrase Inhibitors</strong>&lt;br&gt;Azopt/Alcon</td>
<td>brinzolamide</td>
<td>1% - 5mL, 10mL, 15mL</td>
</tr>
<tr>
<td>Trusopt/Merck</td>
<td>dorzolamide</td>
<td>2% - 5mL, 10mL</td>
</tr>
<tr>
<td><strong>Combination Glaucoma Medications</strong>&lt;br&gt;Combigan/Allergan</td>
<td>brimonidine/timolol</td>
<td>0.2%/0.5% - 5mL, 10mL</td>
</tr>
<tr>
<td>Simbrinza/Alcon</td>
<td>Brinzolamide/brimonidine</td>
<td>1%/0.2% - 8 mL</td>
</tr>
<tr>
<td>Cosopt PF/Merck Generic</td>
<td>dorzolamide/timolol</td>
<td>2%/0.5% - 5mL, 10mL</td>
</tr>
</tbody>
</table>
Selecting the Primary Medication
Open Angle Glaucoma

• Base the decision on:
  – PG usually the first medication selected
  – Stage of disease
    • driver for choosing initial therapy
  – Baseline IOPs
  – General health of patient
  – Insurance coverage
  – Systemic medications
Select Target Pressure

- Think in terms of Per Cent Reduction from highest IOP reading
- Greater the damage, lower the IOP needs to be
- Consider How bad is the glaucoma?
  - How long did it take to get that bad?
- What is the life expectancy of the patient?
- Trend is for lower target IOPs
  - sustained reduction
Target Pressures

• Setting the target IOP, consider highest IOP
  – IOP in 40 with some cupping, asymmetry and early field loss
    • IOP in low 20s may work
  – Same amount of damage but presenting IOP of 20
    • need to be more aggressive
Modifying the Medical Regimen
Lack of Control

• IOP too high
  – Reverse Monocular Trial
• IOP Variability
• Optic Nerve Progression
• Visual Field Loss
• Adding a medication
  – medications vs. laser vs. filter surgery
  – add medication vs. increase dosage or concentration
## Risk Factors for the Progression of Glaucoma

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Older age$^{1-3}$</td>
</tr>
<tr>
<td>Higher IOP (baseline)$^{2}$</td>
</tr>
<tr>
<td>Higher IOP (over follow-up)$^{2}$</td>
</tr>
<tr>
<td>IOP fluctuation$^{4}$</td>
</tr>
<tr>
<td>VF status at baseline$^{2}$</td>
</tr>
<tr>
<td>Race (nonwhite)$^{3,5}$</td>
</tr>
<tr>
<td>Disc hemorrhage$^{2,5}$</td>
</tr>
<tr>
<td>Pseudoexfoliation$^{2}$</td>
</tr>
</tbody>
</table>
When do you **Add** or **Switch** a Medication

- Tendency is to do nothing
- Tolerance develops to some medications
  - Beta Blockers, Alpha Agonists
- Is the angle getting narrow?
  - Perform gonioscopy
  - Person can develop forms of glaucoma
Managing Glaucoma

• Initial medication
  – Prostaglandin

• Second medication
  – Topical CAI or Beta Blocker or Alpha agonist
  – Or switch to different prostaglandin

• Third medication or Modality-
  – Fixed Combination
  – Try to not exceed two bottles

• Fourth medication or modality
  – SLT

• Fifth modality- Surgery
When is surgery indicated?

- Poor control
  - progression noted in optic nerve or v. fields
  - account for variability on visual fields
    - repeat test to confirm change
- IOP above target pressure
  - exhausted several or all medical options
  - Account for IOP variability
- Medication side effects
- Poor compliance
Surgical Options

• Laser trabeculoplasty
  – Argon, Selective
• Filter surgery (trabeculectomy)
  – With anti-fibroblastic agents
• Setons and valves
  – Molteno, Ahmed
• New surgical procedures such as MIGS
  – Canaloplasty, Express implant, Trabectome, iStent