Clinical Insights into the Therapy of Glaucoma

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Disclosures

- Consultant
  - Carl Zeiss Meditec
  - Allergan
- Advisory Boards
  - Heidelberg
  - Optovue
  - Topcon
  - Pfizer
  - Alcon

Clinical Insights

- 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?
Clinical Insights

- If glaucoma, what type?
  - Primary vs. secondary
  - Open vs. chronic angle closure
- Grade severity of condition
- Establish the target IOP
- When should patient return?

When Do You Treat????

- Glaucoma
  - Therapy indicated when damage either to optic nerve and/or visual field is present
  - End-stage condition due to multiple etiologies
    - elevated IOP, toxicity, ischemia, connective tissue
  - Final common pathway with loss of ganglion cells
    - distinctive optic neuropathy
    - characteristic visual field loss not required
    - pre perimetric glaucoma
  - Optic nerve and/or visual field loss consistent with glaucoma regardless of IOP

The Glaucoma Continuum

- Risk Factors:
  - IOP
  - C:D ratio
  - COT
  - VF loss
  - Other

- Initiation of apoptosis & remodelling of LC

- Ganglion cell death and axon loss

- Normal

- RNFL & ONH change (detectable)

- SAP VF change

- VF change (mod)

- VF change (severe)

- Blindness

Courtesy of R. Weinreb, MD, 2003 (adapted)
What are the Risks Associated with the Development of Glaucoma?

- History taking
- Risks
  - Family history
  - History of cardiovascular disease
  - Reduced blood pressure
- Prior use of steroids
- Medications
  - Systemic beta blockers
  - Diuretics
- Perfusion pressure
  - Blood pressure minus IOP

Risk Factors

- Age
- IOP
- Corneal Thickness
- Race
  - African descent
  - Hispanics
  - Asian for narrow angle
- Family history
- C/D
- Field Status

When Do You Treat???

- Pre Perimetric or "Early, Mild" Glaucoma
  - Optic nerve changes consistent with glaucoma with full or borderline visual fields
  - 2003 AAO Preferred Practice Guidelines
  - definition of early glaucoma does not include visual field loss
  - IOP may (or may not) be elevated
  - Early VF damage may be present on new tests
  - FDT Threshold, SWAP may reveal early damage
  - Nerve Imaging may also reveal early change
  - HRT II, GDX VCC, OCT 3
When Do You Treat????

- Glaucoma Suspect
- Ocular hypertension
  - IOP > 21 mm Hg w healthy optic nerves and visual fields
  - Asymmetrical IOP
  - 5 mmHg or greater difference
  - Suspicious optic nerve
  - Large cupping associated w large disc
  - Visual field loss
    - picked up on screening fields such as the FDT

When Do You Treat Ocular Hypertension?

Why Don’t You Wait Until Definitive Damage is Present Before Initiating Therapy?

Ocular Hypertension

- Until OHTS, therapy for OHTN was largely subjective
- Murray’s Rule one of first risk tools
- Now have evidence based approach to therapy
- Until OHTS, convention wisdom was that individuals > 40 yo w OHTN convert to glaucoma between 0.5-1% per year
- OHTS illustrated that individuals in high risk group convert at 7-9% per year
- Those are the individuals we target for preventative therapy
Benefit of Treating OHT

Risk of Progression From OHT to Glaucoma

- **Risk Factors Associated with the Conversion from Ocular Hypertension to Glaucoma**
  - Increasing age
  - Elevated IOP
  - Thin central corneal thickness
  - Increasing vertical cup/disc ratio
  - Increasing pattern standard deviation (PSD)
  - Using threshold perimetry
POAG End Points by Central Corneal Thickness and Baseline IOP (mm Hg) in Observation Group

Baseline IOP (mm Hg)

- ≤23.75
- >23.75 to 25.75
- >25.75

Central Corneal Thickness (µm)

- ≤23.75
- ≥23.75 to 25.75
- ≥25.75

Table:

<table>
<thead>
<tr>
<th>Central Corneal Thickness (µm)</th>
<th>≤23.75</th>
<th>&gt;23.75 to 25.75</th>
<th>&gt;25.75</th>
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<td>10%</td>
<td>2%</td>
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<tr>
<td>≥23.75 to 25.75</td>
<td>12%</td>
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<td>7%</td>
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<tr>
<td>≥25.75</td>
<td>36%</td>
<td>13%</td>
<td>6%</td>
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</table>

POAG = primary open-angle glaucoma.

Risk Assessment

- Concept comes from Framingham Heart Study
  - Begun in 1948 in Framingham, MA and continues to this day
  - Just after WWII, cardiovascular disease (CVD) was recognized as important contributor to morbidity and mortality in US
  - Little was known of causes for heart disease
  - Objective was to follow a group of individuals over a longer period of time to identify characteristics contributing to CVD

5209 individuals enrolled b/w ages 30-62
None had symptoms of CVD or MI or CVA at time of study entry
All individuals underwent physical exam, interview and lab testing on a 2-year basis
1971, Framingham II begun
- Comprised of 5214 of original participants adult children and spouses
- Currently Framingham III with goal to recruit 3500 grandchildren of original participants
Ongoing study has provided information on role of blood pressure, high cholesterol, smoking, obesity, diabetes and physical inactivity in development of CVD
Global Risk Assessment and Cardiology

- Risk assessment and prevention have contributed to the reduction in cardiovascular mortality

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?
Risk Assessment

- At what risk is therapy indicated to prevent undesirable outcome from occurring
- For glaucoma approximately 15% is consensus
  - Expert panel decided on this figure
  - Some feel 20% may be more appropriate
  - Need to individualize each case
- Risk Level Low < 5%
  - Monitor
- Risk Level Moderate 5-15%
  - Consider Therapy Discuss with patient
- Risk Level High >15%
  - Treat

S.T.A.R:
Scoring Tool for Assessing Risk
5-Year Glaucoma Risk Assessment Tool
# The OHTS-EGPS Risk Calculator

**Continuous Method for Estimating 5-Year Risk of Developing POAG**

**Instructions:**
1. Enter Patient and Glaucoma 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.

## Factors

<table>
<thead>
<tr>
<th>Age</th>
<th>Right Eye Measurement</th>
<th>Left Eye Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st</td>
<td>2nd</td>
</tr>
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</table>

**Factors: (mm Hg)**

- Unbinned Intracocular Pressure
- Central Corneal Thickness
- Vertical Cup to Disc Ratio by Contour
- Pattern Standard Deviation
- Humphrey

**Guessed Plot:**

<table>
<thead>
<tr>
<th>Observation</th>
<th>Glaucoma vs Non-glaucoma</th>
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</thead>
<tbody>
<tr>
<td>1st</td>
<td>2nd</td>
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</table>

**Estimate Risk**
The Accuracy and Clinical Application of Predictive Models for Primary Open-Angle Glaucoma in Ocular Hypertensive Individuals

The Ocular Hypertension Treatment Study Group and the BEAT Glaucoma Prevention Study Group

Predictive models for the identification of patients at risk of developing primary open-angle glaucoma (POAG) are important for early intervention and intervention. However, these models have limitations, such as the inability to accurately predict the risk of POAG in individuals with ocular hypertension. Therefore, we aimed to develop a nomogram that could predict the risk of POAG in this population.

Methods: We developed a nomogram using a Cox proportional hazards model that included age, sex, race, and baseline intraocular pressure. The nomogram was validated using the Ocular Hypertension Treatment Study (OHTS) and the BEAT Glaucoma Prevention Study (BEAT-GPS) datasets.

Results: The nomogram had a high predictive accuracy, with the C-index being 0.72 and 0.73 in the OHTS and BEAT-GPS datasets, respectively. The nomogram was also found to be robust in the real-world setting, with the C-index being 0.70 in a validation dataset.

Conclusion: The nomogram we developed can be used to predict the risk of POAG in individuals with ocular hypertension and can help in the decision-making process for intervention.

Survival plot of the cumulative probability of developing primary open-angle glaucoma (POAG) during the entire course of the study by randomization group for participants with the lowest tertile (<6.0%) (A), middle tertile (6.0%-13%) (B), and highest tertile (>13%) (C) of baseline predicted 5-year risk of POAG.
Thirteen-Year Cumulative Proportion of Participants Developing POAG for Low-, Moderate-, and High-Risk Groups

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Years</th>
<th>Low-Risk (2%)</th>
<th>Moderate-Risk (12%)</th>
<th>High-Risk (25%)</th>
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<tr>
<td>45 yrs</td>
<td>34.8</td>
<td>0</td>
<td>0.06 (6%)</td>
<td>0.12 (12%)</td>
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<tr>
<td>65 yrs</td>
<td>18.3</td>
<td>0</td>
<td>1.22 (12%)</td>
<td>2.44 (24%)</td>
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<tr>
<td>85 yrs</td>
<td>6.1</td>
<td>0</td>
<td>6.12 (61%)</td>
<td>15.28 (152%)</td>
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Life Expectancy Data
(USA, 2002, all persons, median)

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<th>Current Age</th>
<th>Years</th>
<th>Life Expectancy</th>
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<td>18.3</td>
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<td>85 yrs</td>
<td>6.1</td>
<td>91.1 yrs</td>
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DHHS. National Center For Health Statistics
http://www.cdc.gov/nchs/data/nvsr/nvsr53/nvsr53_06.pdf

Life Expectancy Data
Impact on OHTS subjects

<table>
<thead>
<tr>
<th>Current Age</th>
<th>Yrs</th>
<th>OHT to Glaucoma Risk*</th>
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</thead>
<tbody>
<tr>
<td>45 yrs</td>
<td>34.8</td>
<td>70%</td>
</tr>
<tr>
<td>65 yrs</td>
<td>18.3</td>
<td>37%</td>
</tr>
<tr>
<td>85 yrs</td>
<td>6.1</td>
<td>12%</td>
</tr>
</tbody>
</table>

*Assuming OHTS untreated risk 2%/yr, linear, additive, average OHTS patient, without individualized risk assessment

DHHS. National Center For Health Statistics
http://www.cdc.gov/nchs/data/nvsr/nvsr53/nvsr53_06.pdf
What is the Harm in Waiting Until Glaucomatous Damage is Present?

Why Treat Ocular Hypertension, Suspicious Optic Nerves or Visual Fields if Glaucoma is not Definite?

Why Treat the Glaucoma Suspect?

- Suspicious signs of glaucoma often precede obvious disease
- Difficult question is at what point therapy should be initiated
- Factors include
  - IOP
  - Optic nerve appearance
  - Visual Field
  - Patient's fear of going blind
  - Desire to do no harm
  - Doctor's attitude towards using unnecessary resources unnecessarily
Why Treat the Glaucoma Suspect?

- Ocular hypertension is a common condition facing ODs
  - Estimated 4-9% of population above 40 years old
  - Defined as IOP > 21 mmHg
  - Millions of people
  - After examining these individuals and subjecting them to many tests, still the threshold for glaucoma is not achieved
  - What does the doctor do then?
  - We also have the question of how to handle those individuals with suspicious optic nerves or visual fields that often do not reach the glaucoma threshold?

Why Treat the Glaucoma Suspect?

- Assumption with ocular hypertension is that it is similar to cancer
  - Treating early will prevent a devastating blinding condition
  - Prevent it from spreading and becoming aggressive
  - Is there data to support this?
    - Does the rate of loss diminish with therapy?
    - Does the disease progress more rapidly if therapy is begun after damage is present?
  - Can you watch your patients with OHTN carefully rather than treating them?
Why Treat the Glaucoma Suspect?

- To further cloud this issue, OHTS results show that 9.5% without therapy converted but STILL 4.4% converted with therapy
- Do we have a answer as to why we should treat the individual early without damage?
- Prior to OHTS, conventional wisdom was that 0.5-1.0% of individuals with OHTN converted to glaucoma yearly

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Why Treat the Glaucoma Suspect?

- OHTS found that certain individuals with OHTN showed a greater level of conversion
- 5-7% conversion when taking in account other factors besides IOP
- Led to the each individual being evaluated and ranking them in regards to risk level
- High, Medium or Low
- OHTS data allows risk level at 5 years to be calculated

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Why Treat the Glaucoma Suspect?

- Given the evidence we have, makes sense to treat higher risk groups if we can do so conveniently, effectively, and without causing intolerable side effects
- STILL it is the patient’s choice after being presented with the evidence what route to proceed with
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

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Can We Judge the Baseline IOP with only 1 Visit?

<table>
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<tr>
<th>Visit #1</th>
<th>Visit #2</th>
<th>Visit #3</th>
<th>Baseline</th>
<th>Target</th>
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<td>26</td>
<td>25</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
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<td>25</td>
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<td>35</td>
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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
Pigment Dispersion Syndrome
Iris Transillumination Defects

Dense Pigmentation in Wide Open Angle

Pseudoexfoliation Glaucoma
Clinical Correlations in Glaucoma

- Compare the visual field and optic nerve appearance
- Does the disc and visual field correlate?
- Does the comparison between the right and left eyes fit?

Clinical Insights in Therapy

- Target pressure
- Select therapy
  - Medications
    - Prostaglandins
    - Beta blockers
    - CAI
    - Adrenergic
    - Laser Trabeculoplasty
    - Filter Surgery

Selecting the Primary Medication

Open Angle Glaucoma

- Base the decision on:
  - Stage of disease
    - driver for choosing initial therapy
  - Baseline IOPs
  - General health of patient
  - Insurance coverage
  - Systemic medications
    - consider Brimonidine or Latanoprost if on systemic β-blocker
Staging Systems for Glaucoma

- Establish level of severity based upon:
  - Degree of damage
  - Number of points flagged and at what level of significance
    - Or inverse, the remaining anatomy or function
      - Up to 1/3rd Mild
      - Up to 2/3rd Moderate
  - Location of damage
    - Fixation involved
    - Inferior involved
  - Pattern of loss
    - One or both hemifields
    - Local vs. Diffuse

Select Target Pressure

- Range of IOP that will prevent further deterioration
- Think in terms of Per Cent Reduction from highest IOP reading
- Greater the damage, lower the IOP needs to be
- If progression occurs, may need lower target IOP
- Target IOP is an educated guess
  - Some people may lead to more IOP lowering than needed and in others, not enough

Setting Target Pressures

- Consider the following:
  - How bad is the glaucoma?
  - How long did it take to get that bad?
    - Get from old records if possible
  - What is the life expectancy of the patient?
  - Trend is for lower target IOPs
    - Sustained reduction
Historically, upon initiating therapy IOP reduced to less than 21 mm Hg.
Would then follow patient until they “Failed”
Fields got worse or nerves became more damaged
Then would advance therapy
CIGTS was first of studies that examined target IOP issue
Recruited early untreated glaucomas
Approx. Mean Deviation -5 dB at time of diagnosis
Aggressive IOP lowering (target goal 35%)
Target IOP reached 37% in medication arm or 52% in surgical arm
Only 10-12% progressed in 5 yrs and equal number got better

EMGT which did not use target IOP concept but rather had control arm or used Betaxolol and ALT
Patients followed over time
Therapy advanced or started if IOP was above 35 mm Hg in control arm or progression noted
Progression in EMGT was 59% (tx) or 76% at 8 yrs
CIGTS with 35% reduction in early glaucomas showed no net progression
Greater lowering in surgical arm no added benefit for mild glaucomas
Greater lowering was of benefit in group with more advanced damage (>10dB)
CIGTS results confirm those from AGIS that indicate IOP around 12 mm Hg for advanced glaucomas was optimal for control
Therapeutic Options

- **Primary Agents**
  - PGs are the usual medication first used
  - Xalatan
  - Travatan/Travatan Z
  - Lumigan/ Lumigan X
- **Beta Blockers** may also be used first line
  - Timolol, Levobunolol, Carteolol
  - Betaxolol
- **Laser Trabeculoplasty**

Second Line Agents

- **Alpha Agonists** - Alphagan P, Brimonidine
- **Carbonic Anyhydrase Inhibitors** - Dorzolamide, Brinzolamide (Azopt)
- **Fixed Combination** – Timolol-Dorzolamide (CoSopt), Timolol-Brimonidine (Combigan)
- **PG Fixed Combination** - Xalcom, DuoTrav, Ganfort
  - None approved in United States

Prostaglandins

- Most effective class of drugs
  - 25-40% reduction
- Tachyphlaxis rare
- Few side effects
  - Hyperemia
- What is unusual w PGs is that they are the most powerful as well as the safest
  - This is an unusual event in medicine
  - Usually with more power, you give up safety
- Additive to other medications
- Reduces diurnal variation
- Latanoprost generic in March 2011
Topical Beta Blockers in Glaucoma

- Not long along B Blockers were the first line agent of choice for OHTN and Glaucoma
- With PGs now first line, at least in the USA, B blockers have been relegated to a supportive role
- In part B Blockers have gotten an unfair bad rap
- They are still appropriate for many of our patients
- Although PGs are the most often first-line agent, B Blockers remain a powerful part of the therapeutic regimen

Other Advantages to Beta Blockers

- Thicker formulation for once per day use
- Istalol (Ista Pharmaceuticals)- qd use
  - Rarely causes blur as compared to other gels

Disadvantages of Beta Blockers

- Side effects, Contraindications and Complications
- Tolerance often developing
- Cross over effect
- Patient already using systemic beta blocker
- Little efficacy at night

Monocular Therapeutic Trials

- Concept is to start therapy in one eye, using the contralateral eye as a control
- Used to understand if the medication effective
- From 10-25% of time, medication does not obtain 15% reduction

- Basis
  - Hinges on “historically” accepted assumption that IOP in the fellow eye rise and falls in sync with the treated eye
  - The response in one eye can be predicted by that of the other eye

- Recent studies have shown that asymmetric IOP fluctuation occurs
Monocular Therapeutic Trials

Advantages of trial

- Better assessment of ocular adverse reactions
- Safer since half as much given initially

Assumptions that have been proven false

- Fellow eyes exhibit symmetrical spontaneous IOP fluctuations
- No contralateral cross-over from monocular treatment with a topical IOP lowering agent
- Fellow eyes respond symmetrically to a given medication
- Patients take their medication as directed

Monocular Therapeutic Trials

Instead of monocular trial, when starting or adding to therapy

- Obtain several IOP measurements before starting therapy to determine baseline IOP
- Then proceed with therapy in both eyes

Following Over Time
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 trabeculoplasty vs. filter surgery
  - add medication vs. increase dosage or concentration
- Be careful to confirm visual field progression as variability common
  - Often reason for overcalling progression

Visual Field Variability

OS 3+ Years Apart

When do you Add or Switch a Medication

- Switching is not usually a good strategy
- Beware of “Regression to Mean”
- Be careful of short term IOP reduction due to improved compliance
- Tendency is to do nothing or add medications
- Tolerance develops to some medications
- Beta Blockers, Alpha Agonists
- Still, it makes sense to do one switch in PG class if require further IOP reduction
- Example switching from Latanoprost to Bimatoprost
- If the IOP is going up: is the angle getting narrow?
- Perform gonioscopy

Adjunctive Therapy

- Adjunctive is indicated if monotherapy failing to achieve a target IOP or whenever there is disease progression, regardless of IOP
- Adjunctive therapy is associated with diminished IOP response
  - For example, if a medication typically results in a IOP reduction of 25% when used as a primary agent, when used as an adjunctive therapy, the effect will be less.
- Adjunctive therapy should be limited to one drug from each class
  - Using more than one drug from a given class of medication provides no additional benefit

40% of Patients on a PGA Require Adjunctive Therapy

NDC Data, July 2005
Adjunctive Therapy

• PGs best initial agent

• Controversy as to what is the best agent to add to a PG when additional therapy is indicated
  – Beta Blockers
    • Used to be the most common agent added
    • Now recognize that this is the worst additive agent
    • No IOP reducing effect during nocturnal hours
  – Alpha agonists – Alphagan P
    • Worthwhile addition
    • May move up to Combigan if needed

Adjunctive Therapy

• Topical CAIs
  – Data supports this may be best additive class
  – Approximately 15-18% additional reduction
  – Close to what would achieve if use as primary agent
  – BID agent
  – Move be switched to CoSopt if additional IOP reduction is need (approximately 1 additional mm Hg)

AAO 2006 PPP
When Should Patients Return? Treatment Recommendations

| TABLE 2 | RECOMMENDATIONS FOR FOLLOW-UP EVALUATION AND OPTIC NERVE HEAD AND VISION PROTECTION | | |
| treatment | topical IOP reduction | topical IOP reduction (months) | secondary therapy for OM and VP evaluation | |
| be | be | be | be | |
| no | no | no | 6 months | 2.25 months | |
| no | no | yes | 3/4 months | 6 months | |
| no | yes | yes | 3/4 months | 6 months | |
| yes | no | yes | 3/4 months | 6 months | |
| yes | no | yes | 3/4 months | 6 months | |

IOP = intraocular pressure, OM = optic nerve head, VP = visual field
Managing Glaucoma

- First medication
  - Prostaglandin
- Second medication
  - Switch to different prostaglandin
  - Add Topical CAI or Brimonidine
- Third medication or Modality
  - Fixed Combination Cosopt or Combigan
- Fourth medication or modality
  - Still two bottles
- Fifth medication or Modality
  - Brimonidine or ALT/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
- Medication side effects
- Poor compliance

Surgical Procedures

- Laser Trabeculoplasty
  - Argon, Selective
- Filter Surgery (Trabeculectomy)
  - With fibroblastic agents (5-FU, MMC)
- Tubes
  - Moteno, Baerveldt, Ahmed
- Cyclodestructive procedures
- New Procedures
  - Canaloplasty, Trabecutome, Express Implant, i-Stent
Trend in Surgical Procedures

- Overall fewer procedures being performed
- Laser trabeculoplasty increasing
- Tubes and shunts being done more commonly
Argon Laser Trabeculoplasty

- Argon burns placed on trabecular meshwork
  - thermal
- Alters biologic activity w/ reduction in IOP
- Relatively safe but destructive to TM
- IOP reduction 16-20%
  - efficacy varies depending upon initial IOP and type of glaucoma
  - pigmentary, pseudoexfoliation
  - more effective with increased pigmentation TM
- Most common glaucoma surgical procedure
Laser Trabeculoplasty

- **Indications**
  - Supplement to maximum tolerated medical therapy
  - Poor compliance
  - Initial therapy
- **ALT Results**
  - Short-term 20-30% IOP reduction 65-95%
  - Long-term Attrition rate of 5-10% per year
    - 50% success rate at 5 years

Argon Laser Trabeculoplasty

- Does not last forever
  - 50% failure rate at 5 years
- Typically used after trial of medications
- Primary procedure when:
  - noncompliance
  - inability to instill medications
- Now offered much earlier in course of therapy when patient not controlled
  - not useful as a last-ditch procedure

Selective Laser Trabeculoplasty (SLT)
New Surgical Procedure in Glaucoma

- Alternative procedure to Argon Laser Trabeculoplasty
- Q-switched, frequency doubled Nd:Yag 532 nm laser
  - Selecta 7000: Lumenis
- Targets pigmented cells in trabecular meshwork
  - little damage to non-pigmented cells
  - less destructive procedure
Selective Laser Trabeculoplasty (SLT)

- Efficacy similar to ALT
- Reduced structural damage to TM
- May be used after ALT
- Management similar to ALT
- Effects wears off over time and no evidence it is repeatable
- IOP often reduced sooner
  - peak IOP effect at 1 week

<table>
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<tr>
<th>Author/Yr</th>
<th>Eyes</th>
<th>Response</th>
<th>IOP Decrease</th>
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Glaucoma Surgery Conclusions

- SLT has similar efficacy to ALT but offers theoretical advantage of repeatability
- Trabeculectomy transitioning towards more diffuse application of MMC at lower dosages
- There has been a steady decline in popularity of Trabeculectomy during past decade and increase in glaucoma drainage implant surgery
  - Recent randomized trial supports expanded use of implants
- Several new glaucoma surgical approaches have recently been introduced
Surgical Procedures

- Glaucoma filtration surgery is considered the gold-standard surgical procedure for patients who have failed medical or laser therapy, or who have advanced glaucoma.
- However, glaucoma filtration surgery has been performed for over a hundred years with only minor modifications to the technique as microsurgical instruments, suture material and wound healing adjuncts became available.
- While often successful in lowering intraocular pressure and slowing disease progression, glaucoma filtration surgery may be associated with early and late complications such as hypotony, bleb leaks, and bleb-related infections.

Surgical Procedures

- In recent years, technologies have become available that seek to avoid the complications of traditional filtration surgery by accessing the eye’s natural aqueous drainage pathways and enhancing them.
- These technologies specifically seek to avoid a filtration bleb that can be the source of infection, discomfort, and other problems.
- These technologies represent a shift in focus and skills, yet seek to accomplish the goal of lowering intraocular pressure sufficiently to prevent vision loss from glaucoma.

Trabeculectomy with MMC

- Fornix-based flap
- Diffuse application of MMC
- Limbus-based flap
- Localized application of MMC

Courtesy of Dr. Peng Khaw
Glaucoma Drainage Implants

- Introduced by Molteno in 1968
- Tube shunts aqueous from AC or PC to episcleral plate
- Design differences
  - Size, shape, and material of plate
  - Valved and nonvalved
- Complications: diplopia, tube erosion

Canaloplasty

- Recent advancement in non-penetrating glaucoma surgery that enhances aqueous outflow without forming a bleb
- Similar to viscocanalostomy except that in canaloplasty allows for full circumferential opening of Schlemm’s canal, not just a section
- Indicated in open angle glaucoma that is not medically controlled and failed ALT/SLT
  - Also after person has failed previous surgery

Canaloplasty

- Uses iTrack microcatheter (iScience Interventional)
- Illuminated beacon-tipped facilitates 360° viscodilation of Schlemm’s canal along with intracanalicular suture that cinches canal inwards permanently opening it
- Leads to internal filtration through Schlemm’s canal and the collector channels, as opposed to external filtration through bleb
Canaloplasty

- Recent study showed IOP reduced from 23.9 mm Hg to 15.5 mm Hg with 0.5 medication
- No cases of flat chamber, endophthalmitis or wound leaks
- Reduced complications as compared to trabeculectomy
- IOP not quite as low as after trab

iScience Canaloplasty

Express Implant

- Stainless steel device with internal diameter 50-200um
- Shunts aqueous from AC to subconjunctival space
- Avoids need for PI
- Placement under scleral flap necessary to avoid hypotony and erosion
- FDA approved
Trabecular Bypass Procedures

• I-Stent from Glaukos
  – Similar concept as visccanalostomy
  – Ab interno approach
  – Limited circumferential flow
    • One quadrant
Gold Micro Shunt

- 24-Karat flat plate
- Microchannels control flow from AC to suprachoroidal space
- Titanium sapphire laser used to open 1 or more channels to increase flow
- Not FDA approved

Trabecutome

- Ablation of TM and inner wall of Schlemm’s canal
- Ab interno approach
- Handpiece has I/A port and electrocautery tip
- FDA approved
Endoscopic Cyclophotocolagulation (ECP)

- Decreases amount of aqueous humor produced
- Lasers ciliary body process directly
- 810 nm diode laser
- Endoscope put inside eye enabling surgeon to visualize ciliary processes
- Control amount of tissue destroyed
- Effective in combination with cataract surgery
Communication in the Management of Glaucoma

- Patient’s decision to use glaucoma medication is result of balance between
- Their understanding potential risks of glaucoma
- Their belief in the benefit of medication
- Burden in taking their drops
- For most patients risk of untreated glaucoma concerns potential loss of vision
- On the other hand burden of treatment is not an abstract idea but a tangible daily experience

Compliance and Adherence in Glaucoma

- Definitions
  - Compliance: Use of medication in accordance with prescribed regimen
  - Persistence: Continuous use of prescribed regimen with no lapses
  - Adherence: Continued use of a prescribed medication at any time point after initial Rx
    - Relaxed version of persistence
    - Overuse of medication not taken into account

Compliance and Adherence in Glaucoma Possible Risk Factors

- Age
  - Weakly associated with younger being worst
- Gender
  - No association
- Ethnicity
  - No association
- Family support
  - Important
Compliance and Adherence in Glaucoma
Possible Risk Factors

Knowledge of disease
- More knowledge > better compliance

Doctor-patient relationship

Perceived IOP effect
- Moderately associated

Severity of disease
- Weak association

Compliance and Adherence in Glaucoma
Possible Risk Factors

Frequency of Dosing
- Fewer doses, better compliance

Complexity of regimen
- More complex, worse

Frequency of visits
- More visits, better

Education by staff/doctor
- Improves compliance

Side effects

Cost of medication

Communication in the Management of Glaucoma

Clinicians Can Not Detect Nonadherence

- Research has shown clinicians have no better than a 50:50 chance of detecting nonadherence
- Patients w/ treatment resistant hypertension who told their doctors that they were taking their medication consistently
  - Told to continue with their current tx regimen using a pillbox that would record when they took meds
  - Subjected to this scrutiny, 1/3rd instantly cured
  - Several had syncopal episodes when they complied b/c regimens had been intensified in mistaken belief that they had been adherent
  - Another 20% remained uncontrolled but recording pillbox demonstrated nonadherence
Communication in the Management of Glaucoma

- Barriers to detecting nonadherence: the psychology of patient self reporting
  - Patients do realize that providing misinformation may lead to poor decisions about tx but their behavior is shaped by a more powerful force
  - Nonadherence is a socially undesirable behavior and patients want to be seen as “good patients”
  - Also, patients expect their doctors to be “judgmental”
  - Need to reverse judgmental environment and redefine the “good patient” as one who collaborates in solving treatment problems

Communication in the Management of Glaucoma

- Detecting and Intervening- Four Step Approach
  - Begin with open-ended question “Tell me how you’ve been taking your medications”
  - Response will reveal understanding of tx regimen
  - Follow up with question about how they remember to take medication(s)
  - It is useful to have patient describe the way they use all their medications
    - both topical and systemic

Communication in the Management of Glaucoma

- Change the patient’s expectation that you will be judgmental
  - Tell patient that you know that everyone may miss a drop occasionally
  - Explain how information about adherence will affect decisions about medication
  - Change dynamic so that a “good” patient is one who discusses and solves problems with adherence with the clinician
Communication in the Management of Glaucoma

- Finally, ask about forgetting or missing medications
- This fourth step comes last, after the stage has been set
- When problems with adherence are discovered, evaluate patient’s motivation to adhere and presence of specific barriers
- Strategy is to determine that pt is concerned about consequences of glaucoma and believes tx will be beneficial

Patient Communication
Ask-Tell-Ask

<table>
<thead>
<tr>
<th>Learned from the first “ASK”</th>
<th>Focus of the “TELL”</th>
<th>Learned from the second ASK</th>
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<tbody>
<tr>
<td>1. What the patient already knows that is correct and important.</td>
<td>Reinforce without wasting time.</td>
<td>Assess improvement in confidence, self-efficacy, and commitment.</td>
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<tr>
<td>2. What the patient doesn’t know that they should.</td>
<td>Prioritize and present the next most important pieces of information.</td>
<td>Assess comprehension and impact of new information.</td>
</tr>
<tr>
<td>3. The patient’s misconceptions and mistaken beliefs.</td>
<td>Correct misconceptions and mistakes.</td>
<td>Assess comprehension and impact of corrected understanding and beliefs.</td>
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Thank You For Your Attention