Cataract Surgery in Glaucoma Patients
Concomitant Cataract & Glaucoma Patients - US

Significant Treatment Opportunity
One in five Cataracts Eyes on OHT Medication

20.5% Cataract + Minimum of 1 OHT Med

718K

3.5M US Cataract Procedures

79.5% Cataract Only
Concomitant Cataract and Glaucoma

- Key determinants in deciding best option:
  - Severity of disease
  - Current treatment
  - Goal IOP
**Stage 1: High Risk Ocular Hypertension**
- IOP: 20-30 mmHg
- Goal: Control IOP, eliminate non-compliance and drug burden.

**Visual Field**
- Visual Function: Intact

**Physiologic Changes**
- No measurable or observable change

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**Stage 2: Mild Glaucoma**
- IOP: 20-35 mmHg
- Goal: Significant, steady and sustained IOP control. Minimize non-compliance and drug burden.

**Visual Field**
- Central Arcuate Field Loss

**Physiologic Changes**
- C.D. ≤ 0.7 Documented Expansion and Deepening of Cup

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**Stage 3: Moderate/Advanced Glaucoma**
- IOP: > 30 mmHg
- Goal: Control IOP, maximize outflow. Minimize non-compliance, drug burden and chronic morbidity.

**Visual Field**
- Expanded Arcuate Field Loss in up to 2 Quadrants

**Physiologic Changes**
- Deep Focal Notches or C.D. > 0.7 with Documented Expansion and Deepening of Cup

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**Stage 4: Refractory/Complicated & Normal Tensive Glaucoma**
- IOP Uncontrolled
- Goal: Control IOP

**Visual Field**
- Significant Visual Field Loss in up to 3 Quadrants

**Physiologic Changes**
- C.D. > 0.9 Severe Expansion and Deepening of Cup
Surgical Options - Staging

- Ocular Hypertension/Glaucoma Suspect
  - Cataract surgery alone
- Mild-Moderate Glaucoma
  - MIGS
- Moderate-Severe Glaucoma
  - Trabeculectomy
  - Tube implant
Surgical Options – Current Treatment

• No medications
  – Cataract surgery alone
• 1-2 medications
  – MIGS
• 3-4 medications
  – Trabeculectomy
  – Tube implant
Surgical Options – Goal IOP

- Mid teens or higher
  - Cataract surgery alone
  - MIGS
- Low teens
  - Trabeculectomy
  - Tube implant
- Also dependent on pre-operative IOP
Cataract Surgery Alone

- Best in patients with Ocular Hypertension or who are Glaucoma Suspects
- Also good option in patients currently on no medication or who do not require extremely low post-operative IOP
- Strongest predictor of significant IOP reduction after cataract surgery was higher starting IOP
IOP Reduction in Hypertensives After Cataract Surgery Alone

Graph showing IOP (mmHg) over time with control group and cataract surgery group. The graph indicates a decrease in IOP in the cataract surgery group compared to the control group, with a split point where the decrease is significant.

- **Control Group**
  - 24 months: 24 mmHg
  - 12 months: 24.5 mmHg
  - 0 months (split point): 23.5 mmHg
  - 12 months post-surgery: 22 mmHg
  - 24 months post-surgery: 21 mmHg
  - 36 months post-surgery: 20 mmHg

- **Cataract Surgery Group**
  - 24 months: 23 mmHg
  - 12 months: 22 mmHg
  - 0 months (split point): 21 mmHg
  - 12 months post-surgery: 20 mmHg
  - 24 months post-surgery: 19 mmHg
  - 36 months post-surgery: 18 mmHg

**Number of eyes**
- 36 months: 52 eyes (611 total)
- 24 months: 57 eyes (639 total)
- 12 months: 59 eyes (685 total)
- Split point: 63 eyes (703 total)
- 12 months post-surgery: 46 eyes (460 total)
- 24 months post-surgery: 31 eyes (257 total)
- 36 months post-surgery: 22 eyes (102 total)
Considerations in Patients with both Cataract and Glaucoma

• Glaucoma subsets that have shown the best pressure-lowering effects after phaco are:
  – Ocular Hypertension
  – Pseudoexfoliation Syndrome
  – Primary Angle-Closure
  – Primary Open-Angle (lesser extent)
MIGS

- Best in patients with mild-moderate Glaucoma
- Also effective in patients controlled on 1-2 medications or who do not require extremely low post-operative IOP
- Currently available options:
  - iStent
  - Trabectome
  - Endoscopic Cyclophotocoagulation
MIGS

- MIGS procedures are ab interno using a micro-incisional approach
  - Rapid recovery with minimal impact on quality of life
- Conjunctiva is unharmed leaving potential for future surgical options if needed
- Avoid serious complications associated with trabeculectomy and tube shunts
iStent®
Therapeutic Objectives

iStent implanted during cataract surgery designed to:

- Reduce intraocular pressure (IOP)
- Avoid serious complications associated with end-stage filtration and shunt procedures
- Spare the conjunctiva and sclera
- Safely preserve potential for future treatment options.
iStent® Bypasses the Primary Source of Resistance

iStent bypasses the TM

- Due to the higher density of collector channels in the inferonasal quadrants, *ab interno* placement of iStent in this region helps restore continuous physiologic outflow through Schlemm’s canal.

iStent reduces the risk for hypotony

- The physiological outflow system provides a natural episcleral back pressure of 8 to 11 mmHg, resulting in minimal risk of hypotony.
iStent® Surgical Procedure

iStent in combination with cataract surgery:

- Is inserted *ab interno* through the same phaco incision
- Is micro-invasive and astigmatically neutral
- Can be performed under topical anesthesia
- Utilizes the same medications and instruments
- Preserves future glaucoma surgery options
• Advance the iStent and position the tip of the stent over the top third of the trabecular meshwork.
• iStent positioning is just above the scleral spur.
**iStent® Surgery**

- The rails of the iStent should be seated against the scleral wall of Schlemm’s canal.
- The snorkel should be parallel to the iris plane.
iStent® Surgery

- Increase magnification before withdrawing the inserter and view stent to ensure correct positioning.
- Snorkel shaft must be completely surrounded by meshwork and the tip of the snorkel must be unobstructed.
At 12 months, 72% of iStent® subjects with IOP ≤ 21 mmHg without medication vs. 50% with cataract surgery alone (P<0.001).
US IDE Trial
Secondary Efficacy Endpoint

Percent of Subjects with M12 ≥ 20% IOP Reduction Without Medication Use

At 12 months, 66% of iStent® subjects with ≥ 20% IOP reduction without medication vs. 48% with cataract surgery alone (P=0.003).

P/N: 400-0049-2011-US Rev 0
Release Date: 12/06/2011
Indications for Use

The iStent® Trabecular Micro-Bypass Stent Model GTS100R/L is indicated for use in conjunction with cataract surgery for the reduction of IOP in adult patients with mild to moderate open-angle glaucoma currently treated with ocular hypotensive medication.
Contraindications

The iStent® is contraindicated in eyes with primary or secondary angle closure glaucoma, including neovascular glaucoma, as well as in patients with retrobulbar tumor, thyroid eye disease, Sturge-Weber Syndrome or any other type of condition that may cause elevated episcleral venous pressure.
Trabectome®

- Ab interno trabeculotomy
- FDA-approved and minimally invasive surgical treatment for adult and juvenile open angle glaucoma
- Electrocautery used to ablate approximately 60°- 120° of trabecular meshwork and inner wall of Schlemm’s canal
- Allows aqueous direct access to Schlemm’s canal and aqueous collector channels
- Can be combined with cataract surgery
Trabectome®
Console/handpiece for
Trabeculotomy ab interno
Trabectome®
Handpiece Key Features
Histology

- Cleft between two ends of trabecular meshwork
- Direct access of aqueous into Schlemm’s canal
- Very limited damage to surrounding tissue
Scanning Electron Microscope of Trabectome Excision of TM

**BEFORE**
- SEM of Trabecular Meshwork and Schlemm’s Canal

**AFTER**
- Exposed CC
- Exposed outer wall of SC
- Trabectome excision exposes collector channels
Patient Selection for Trabectome

- All open angles!
- Primary Open Angle Glaucoma
- Pseudo-exfoliative Glaucoma
- Pigmentary Glaucoma
- Uveitic Glaucoma (without significant PAS)
- Infantile and Juvenile Glaucoma
- Normal Tension Glaucoma
Contraindications

- No view or poor view of angle
- Neovascular glaucoma
- Elevated episcleral venous pressure
- Plateau iris syndrome
- Low target pressure (< 15 mmHg)
Trabectome: IOP over 72 Months
Trabectome: Use of Medications

![Graph showing the mean number of medications over months after surgery](image)
Complications

• Transient hyphema most common (20%)
  – To be expected as back bleeding from aqueous collector channels
  – All resolved within one week
  – Minimized by suturing wound and/or air tamponade

• Corneal epithelial defect
  – Majority in diabetic patients with vulnerable epithelium
  – Thought to be due to gonio lens trauma

• Post operative IOP spikes
  – Occurred in 14/201 cases (7%)
  – Typically 1-3 days post- op
  – Uncertain etiology
ECP

- Selective ablation of pigmented ciliary body epithelium tissue, by direct imaging, to decrease aqueous production resulting in controlled IOP
- Lowers IOP via aqueous suppression and does not require device implantation or conjunctival disruption
ECP - Indications

• Patients with a visually significant cataract and coexisting glaucoma
  – uncontrolled with medications
  – medically controlled with difficulty affording, administering or tolerating their medications
ECP - Contraindications

• Pseudoexfoliation glaucoma
  – due to buildup of fibrillar material on the ciliary processes that minimizes laser uptake

• Caution in patients with history of inflammatory eye disease
  – risk of significant postoperative inflammation and cystoid macular edema (CME) or hypotony
ECP
ECP

- Up to 300° treatment from a single incision
- Thorough removal of viscoelastic must be completed to prevent postoperative IOP spike
ECP - Results

• Commonly see decrease in IOP around 20-40% from pre-ECP levels
• Patients usually able to eliminate one to two medications post-operatively
ECP - Complications

- Fibrinous uveitis (11.1%)
- Acute or chronic IOP elevation (3.2% and 7.9%, respectively)
- CME occurred (3.2%)
Severe Glaucoma
Trabeculectomy and Tube Shunts

- Remains an important option for patients who are at high risk for functional impairment:
  - severe glaucoma
  - maximal medical therapy
  - poor compliance
  - extreme IOP
  - medication intolerance
  - aggressive progression

- Best options when need extremely low post-operative IOP
Trabeculectomy

- Remains the most common incisional glaucoma procedure performed today
- Aqueous humor exits anterior chamber through or around scleral flap forming bleb
Trabeculectomy Indications

- Open angle glaucoma
- Closed angle glaucoma
- Childhood glaucoma
Trabeculectomy Contraindications

- Cases likely to respond to less invasive treatments
- Eyes with previous failed trabeculectomy
- Eyes with severely scarred conjunctiva
- Neovascular glaucoma
- Uveitic glaucoma
Trabeculectomy

- Able to lower IOP to very low levels
- Use of anti-metabolites to suppress scar formation and preserve the patency of filtering fistula
- Intensive post-op care to evaluate bleb appearance, IOP, and anterior chamber status
Intra-operative Complications

- Conjunctival buttonhole or tear
- Subconjunctival hemorrhage
- Scleral flap buttonhole, tear, or disinsertion
- Premature entry into the anterior chamber
- Crystalline lens injury
- Hyphema
- Imperforate sclerostomy
- Vitreous loss
- Intraoperative choroidal effusion/suprachoroidal hemorrhage
- Imperforate peripheral iridectomy
- Inadvertent sector iridectomy
- Cyclodialysis/iridodialysis
- Intraoperative aqueous misdirection syndrome
Glaucoma Tube Shunt
Glaucoma Tube Shunt

• Create an alternate aqueous pathway from anterior chamber by channeling aqueous out of eye through a tube to a subconjunctival bleb

• Tube is usually connected to an equatorial plate under the conjunctiva

• Being used more frequently in the treatment of glaucoma that is not responding to medications and trabeculectomy operations.
Glaucoma Tube Shunt Indications

• Extremely useful in managing refractory cases of glaucoma
  – Neovascular glaucoma
  – Uveitic glaucoma
  – Congenital or juvenile glaucoma
  – Failed filtering surgery or extensive scarring
Glaucoma Tube Shunt Complications

• Hypotony
• Hypertensive phase
• Tube obstruction or retraction
• Tube or end-plate exposure
• Diplopia
• Suprachoroidal hemorrhage
• Endophthalmitis
Special Considerations
Pseudoexfoliation Syndrome and Cataract

• Numerous intra-operative and post-operative issues potentially need to be managed
• Zonular weakness and poor pupillary dilation are most significant risk factors for surgical complications
Pseudoexfoliation Syndrome and Cataract

- Zonular weakness attributed to deposition of PXE material on zonular fibers and ciliary processes
- Results in proteolytic disintegration of the zonule
Pseudoexfoliation Syndrome and Cataract

- Poor pupillary dilation a result of infiltration of iris stroma with excessive extracellular matrix
- Causes mechanical obstruction during mydriasis
Pseudoexfoliation Syndrome and Cataract

• Pre-operatively it’s important to determine if there is any zonular weakness
• Careful examination should be done to assess for subtle lens subluxation, zonular dialysis, or phacodonesis
Pseudoexfoliation Syndrome and Cataract

• Other factors associated with zonular instability:
  – Age
  – Shallow AC depth
  – Cataract density
  – Pupil size
  – IOP/glaucoma status
  – Atrophy of pupillary ruff
  – Pigment in the angle

• Degree of PXE material visible does not always correlate with degree of zonular weakness
Zonular Dialysis

- Weak or absent zonules present a serious challenge during cataract surgery
- Increased risk of capsule rupture, vitreous prolapse, retained lens material, and post-operative dislocation of IOL
- Capsular bag can be stabilized with capsular tension ring or by anterior-posterior stabilization using capsule/iris retractors
Capsular Tension Ring

- Expands the capsular equator and buttresses the area of poor zonular support
- Provides relatively equal distribution of stress over remaining zonules
- Provides counter-traction and tautens posterior capsule so the circular contour of capsular bag is maintained which increases centration
Capsular Tension Ring
Small Pupils

- Successful cataract surgery requires good access and visualization
- Miosis reduces visualization and increases chance for complication
- Small pupils can be managed in a variety of safe, quick, and practical ways
- Any iris manipulation will increase breakdown of blood-aqueous barrier, resulting in increased post-operative inflammation
Pre-Operative Strategies

• Pharmacological
  – Cycloplegics
  – Mydriatics
  – Topical NSAIDs
Intra-Operative Strategies

- Sphincter sparing
  - Intracameral Lidocaine
  - Viscoelastics
  - Synechiolysis

- Pupil expanders
  - Malyugin ring
  - I-Ring
Pupil Expanders

- Malyugin Ring
- I-Ring
White and Brunescent Cataracts

• Can lead to complications secondary to poor ability to perform capsulorrhexis and possibility for posterior capsular rupture
• Use of Trypan Blue helpful for capsulorrhexis
Trypan Blue
Presbyopia Correcting Lenses
Presbyopia Correcting Lenses

- Cataracts can be removed, but glaucoma is present for a lifetime and can be progressive.
- Need to consider many factors when deciding on type of intraocular lens to implant in glaucoma patients.
- Glaucoma patients deserve best IOL technology, but are presbyopia correcting lenses an option?
Presbyopia Correcting Lenses

- Chief factor that potentially complicates good vision in glaucoma patients is contrast sensitivity
Presbyopia Correcting Lenses

- Consider presbyopia correcting IOL in glaucoma suspect or mild glaucoma
- Small peripheral VF defect
- History of long-term follow-up who have not shown rapidly progressive disease
- Informed consent is important so that they know and understand the pros and cons
Presbyopia Correcting Lenses

- Be hesitant to use multifocal IOLs in patients with pseudoexfoliation because weak zonules might cause poor centration of the lens.
Presbyopia Correcting Lenses

• Accommodative IOLs are not associated with some of the contrast sensitivity issues of the refractive and diffractive lenses, but they are contraindicated in patients with pseudoexfoliation or zonule problems.
Conclusions

• Improved phaco techniques and newer technologies allow for treatment of full range of glaucoma continuum and concomitant cataract

• Choosing best option determined by severity of disease, current treatment, and goal IOP
Conclusions

• Usually best to choose least invasive surgical option as possible
• Be prepared for complications that may arise more commonly in glaucoma patients
• Be hesitant in placing presbyopia correcting IOLs in patients with advanced disease and visual field loss
Thank you!