Holes, Hoses & Snorkels
Surgical Options in Glaucoma

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Holes, Hoses & Snorkels

Surgical Options in Glaucoma

• Definition and classification of glaucoma
• How do we manage glaucoma?
• Treatment options
  - goals
  - inherent problems
• Surgical procedures
• The future of glaucoma treatment
Magnitude of Glaucoma

• Leading cause of irreversible blindness in world
• 67 million people affected (6.7 bilat blind)
• 2nd leading cause of permanent blindness in US (#1 in AA)
• 2.3 million cases in U.S. with 100,000 bilat blind
• Half of cases in U.S. undiagnosed!
GLAUCOMA

• Progressive optic neuropathy (damage to the optic nerve)
• Initially leads to peripheral loss of vision, and if uncontrolled can cause complete irreversible blindness
• There are different types of glaucoma
• ASYMPTOMATIC (most cases)
GLAUCOMA

• Risk factors include:
  – Increased intraocular pressure
  – Older Age
  – Family history
  – African-American

• Usually treated with pressure lowering eye drops

• Laser or surgery might be needed
High IOP is the major risk factor causing ONH damage. Lowering IOP currently is the only means we have to slow glaucoma damage.
Classification

• Congenital vs acquired
• Open vs closed
• Primary vs secondary to ocular or systemic causes
How Do We Diagnose Glaucoma?

• Past medical & ocular history
• Family history, risk factor profile
• Vision (myopic, hyperopic)
• Pupils & external assessment
How Do We Diagnose Glaucoma?

- Pachymetry
- Gonioscopy
- Slit lamp (cornea, anterior chamber, iris, lens, vitreous)
- Fundus exam (optic nerve, retina, vessels)
Optic Nerve Assessment

• Structural (drawings, photos, other imaging techniques)
• Functional (visual fields)
Glaucoma Findings
Treatment of Glaucoma

- Establish baseline (ONH, VF, IOP, old records)
- Stage disease
- Develop individual risk profile
- Evaluate structure & function to detect progression
Glaucoma Treatment

• Usually patients need continuous monitoring (every 4-6 months)

• Check:
  – Eye pressure
  – Visual fields
  – Optic nerve analysis
Treatment of Glaucoma

- Observation
- Medication
- Laser
- Surgery
- Supportive/palliative
Laser Indications

- Primary diagnosis (ex: narrow angles)
- Medications alone not adequate
- Medication intolerance
- Poor compliance
Laser Options

• ALT/SLT
• LPI
• Gonioplasty/iridoplasty
• Cyclodestruction (CPC, ECP)
• Adjunctive procedures (ex: laser suture lysis, goniopuncture, malignant glaucoma)
Laser Complications

- IOP
- Iritis
- Bleeding
- Corneal abrasions
- PAS
- Optical aberrations
Surgical Management

• If laser is insufficient to control glaucoma then surgery is done (filter or tube)

• Glaucoma surgery may also be done in combo w/ cataract surgery

• Ultimate goal is to prevent visual field loss and/or progression
Surgical Indications (Incisional)

• Failed or inadequate medical & laser therapy
• Acute decrease IOP needed
• Advanced disease
• Poor compliance
• Concomitant surgery
• Primary pediatric glaucoma
How Do We Lower IOP Surgically?

- Decrease aqueous production
- Increase aqueous outflow
- Extrasceral drainage (bleb forming) vs. enhanced physiologic outflow
Historical Perspective

- 1856 Iridectomy (von Graefe)
- 1891 Goniotomy (Taylor)
- 1906 Iridencleisis (Sugar)
- 1968 Trabeculectomy (Cairns)
- 1969 modern Tube Shunt (Molteno)
- 2004 Canaloplasty (Stegmann)
- 2005 Trabectome (Baerveldt), Ex-Press (Dahan), iStent (Glaukos Corp), Solx Gold Shunt (Solx Inc)
HOLES!!!
Trabeculectomy

• Major limitation in post-op success is body’s tendency to heal by fibroblast proliferation

↑ success w/ anti-metabolites & anti-VEGF to block mitogenesis, angiogenesis & endothelial cell survival
Trabeculectomy Post-Op Exam

- IOP (multiple)
- Bleb & cornea (Seidel, vessels, extension, dellen, epitheliopathy)
- Anterior chamber (depth, cells)
- Gonioscopy
- Posterior segment (choroidals, maculopathy)
Trabeculectomy Post-Op Drops

- Cessation of ocular anti-hypertensives
- Aggressive steroids (4-6 weeks)
- Antibiotics (1-4 weeks)
- Cycloplegia
Trabeculectomy Post-Op Manipulation

- Digital pressure
- Suture release
- Injections (TPA, steroids, 5-FU, Avastin)
- Bandage contact lens
- Hypotony precautions
Trabeculectomy

Post-op is a **Labor of Love**!
Average 10 visits over 6 weeks
Trabeculectomy Complications (Early)

10↑↓ IOP

• Seidel
• Corneal epitheliopathy
• Inflammation
• Choroidals
• Hypotony maculopathy, CME
• Infection
Trabeculectomy Complications (Early)

- Flat anterior chamber (overfiltration, mg)
- Hyphema
- Pain
- Loss of fixation
HOSES!!!
Glaucoma Drainage Devices

- Drainage tube connected to end-plate
- Tube inserted into ant or post segment via scleral fistula
- Aqueous flows tube → end-plate → bleb
- Bleb surrounded by fibrous capsule → periocular capillaries/lymphatics → venous circulation
Glaucoma Drainage Devices

Indications

• Previously failed trabeculectomy
• Trabeculectomy expected to fail
  scarring, active neo, uveitis, epithelial
downgrowth
• High risk for blebitis
  OCP, S-J, severe k. sicca
• High risk for suprachoroidal hemorrhage
  Sturge-Weber, nanophthalmos
Glaucoma Drainage Devices

Vary in design, material, size & surface area

- Valved—provides resistance IOP 8-12
  Ahmed, Krupin

- Non-valved—resistance by fibrous capsule at 4 weeks. Surgical modification needed prior to capsule formation (ligature, rip-cord, dissolving suture, laser)
  Baerveldt, Molteno
Potential Complications Just To Name A Few…

- Hypotony/flat chamber
- Suprachoroidal hemorrhage
- Choroidal effusions
- Wound leak
- Erosion (tube or plate)

- Corneal decompensation
- Diplopia
- Dysasthesia
- Endophthalmitis
SNORKELS!!!
MIGS

Minimally Invasive Glaucoma Surgery
MIGS

• We want a procedure that will decrease IOP but with a favorable safety profile
• We want a procedure that will not preclude future glaucoma operations
• If we have a low risk procedure (c/w standard glaucoma operations) then we can intervene earlier in glaucoma cases
Minimally Invasive Glaucoma Surgery (MIGS)

- Ike Ahmed, MD coined term several years ago
- Described new class of ab interno microstent procedures
- Usage of term exploded to include many new procedures that really were more than “minimally invasive”
- “Microinvasive”
Minimally Invasive Glaucoma Surgery (MIGS)

• Term clarified by Drs. Ahmed and Saheb
• Must have the following criteria:
  ✔ ab interno approach
  ✔ cause minimal tissue trauma
  ✔ superior safety/complications vs. filter
  ✔ lowers IOP at least modestly
  ✔ quick post-op recovery
Who Should Be Considered for MIGS?

- Mild to moderate glaucoma
- Conservative IOP reduction goal
- Medication intolerance/load
- Compliance difficulties
- Having cataract surgery on 1 or more meds
- Third World??
Who Should Not Be Considered for MIGS?

- Severe disease
- Goal IOP needs to be in low teens or lower
- Poor view of TM landmarks
Conventional Glaucoma Surgery vs. MIGS

- Complexity of surgical technique
- Complications
- Complexity of post-operative period
MIGS

**TM Bypass**
- AqueSys
- Hydrus
- Trabectome
- iStent

**Suprachoroidal**
- CyPass Micro-Stent
- iStent Supra
AqueSys (AqueSys, Inc.)

- First ab interno subconjunctival approach
- Soft permanent gelatin implant
- 118 subjects at 1 year mean IOP 23 → 15.4 with reduction of meds, low diffuse bleb
- Currently, multicenter studies in US, Canada, Europe, Asia, Australia, South America
AqueSys
Hydrus Microstent (Ivantis)

- Intracanalicular scaffold
- Made of nitinol
- Dilates Schlemm’s Canal and bypasses TM
Trabectome (NeoMedix Corp.)

- FDA 2004
- Ab interno cautery electrode that strips 60-100° of TM (inner wall of Schlemm)
- Direct gonio view through 1.8 mm temp clear corneal incision
- IOP cannot be reduced below episcleral vp thus avoiding cx of hypotony
Trabectome
Trabectome

Trabecular Meshwork Removed with Trabectome
Trabectome

• Most of the literature shows 30-40% IOP reduction to level of mid teens and 1-2 meds
• Trabectome vs trabeculectomy w/ MMC much less success of IOP reduction but no complications of hypotony or wound leak
• Most common cx is transient hyphema or need for further sx
iStent Trabecular Micro-Bypass Stent (Glaukos)

• FDA 2012 for use with phaco, smallest implantable medical device!
• Heparin-coated titanium snorkel-shaped device implanted ab interno into Schlemm’s Canal
• Lowers IOP 2-3mmHg more than cataract surgery alone
iStent Trabecular Micro-Bypass
iStent® Surgical Procedure

- The iStent® is inserted ab interno through the clear, cornea phaco-incision and can be performed under topical anesthesia.

- The physiological preservation of the trabecular meshwork ensures a natural episcleral back pressure of 8 to 11 mm Hg, ensuring minimal to no risk for hypotony.

iStent® Surgical Procedure
iStent

Doubles a patient’s chance of getting off IOP-lowering meds without adding significant more complications or morbidity compared to cataract surgery alone
CyPass Micro-Stent (Transcend Medical)

• 6.35 mm polyimide tube inserted on guidewire to the suprachoroidal space to establish flow through uveal-scleral route
• 1.5 mm corneal incision
• 35-40% IOP reduction
• Medications reduced 1.9 ➔ 1.3
  European study at 6 months
Transcend CyPass™ System:
Ab-interno, conjunctiva-sparing

CyPass Device

Delivery Device
The CyPass Micro-Stent Delivery

- Conjunctiva-sparing procedure
- Ab interno approach
CyPass Micro-Stent (Transcend Medical)
The Future for MIGS

• 3.3 million cataract surgeries/year. 20% have OHT or glaucoma ➔ 700,000 potential candidates/year
• Earlier intervention may make MIGS more first line
• Third World use ??
MIGS: What Is It and Who Should Have It?

• There is a new generation of glaucoma devices that are minimally invasive, ab interno approach, excellent safety profile

• These MIGS devices offer conservative IOP reduction and may be appropriate for patients with mild to moderate glaucoma

• Cataract surgery combined with MIGS can help our patients be less med-dependent and improve quality of life
The Future in Glaucoma Treatment

- Earlier diagnosis
- Earlier treatment
- Better understanding of pathophysiology for new drug intervention
- Sustained-release drug delivery
- Standard incisional surgeries
- MIGS
Conclusion

• Glaucoma is an optic nerve disease that affects millions of people worldwide
• Treatment includes observation, medication, laser and surgery
• Surgical options range from minimally invasive to implanting shunts (holes, hoses & snorkels)
• There are many different indications for which procedure to use
Conclusion

• The type of glaucoma and history of previous surgery can dictate which procedure is best for that patient.

• Post op care is a “labor of love” and requires frequent visits and manipulations.

• As our understanding of the pathophysiology of glaucoma improves so will our ability to treat.
Thank You!!