RECENT ADVANCES IN THE MEDICAL AND SURGICAL TREATMENT OF GLAUCOMA

Brett J. Teague, M.D.
Big Country Eye Center
Abilene, Texas

Disclosure

- I developed the course material/information independently
- No relevant financial relationship exists by anyone in control of presentation content

Glaucoma

Chronic Open Angle Glaucoma
  - Elevated IOP
  - Glaucomatous Optic Neuropathy
  - Vision Loss

Prevalence by year 2020
  - Worldwide: 76 million
  - United States: 3.6 million
IOP Measurement
- Applanation Tonometry
  - Corneal Thickness
- iCare
- Tonopen
- Schiotz
- Palpation

Glaucomatous Optic Neuropathy
- Cupping
- Pallor
- Disc Hemorrhage
- Bayoneting
- Nasalization of Vessels

Vision Loss
Glaucoma Treatment Algorithm

- Medication
- Laser
- Incisional Surgery

Medical Therapy

- Prostaglandins
- Beta Blockers
- Alpha Adrenergic Agents
- Carbonic Anhydrase Inhibitors
- Combination Medications
- Miotic Agents

Prostaglandins

- First Line Therapy
- Increase Uveoscleral Outflow
- 30% IOP Reduction
- Convenient
- Few Comorbidities
- Hypertrichosis
- Conjunctival Hyperemia
- Iris/Lid Pigmentation
- Decreased Lid Adipose Tissue
- Xalatan, Lumigan, Travatan Z, Zioptan, Rescula
**Beta Blockers**
- Decreases Aqueous Production
- 25% IOP Reduction
- Comorbidities
  - Bradycardia
  - COPD/Asthma
  - Diabetes
- Dosing Dependent on Iris Color
- “Cheap as Dirt”
- Timoptic, Betoptic, Betimol, Betagan, Istalol…

**Alpha Adrenergic Agents**
- Dual Mechanism of Action
  - Decreases Aqueous Production
  - Increases Uveoscleral Outflow
- Neuro-Protective Effect
- 20 to 25% IOP Reduction
- Follicular Conjunctivitis
  - Purite
- Crosses Blood Brain Barrier
  - Contraindicated under the age of 2
- Alphagan, Alphagan P, Bromonidine, Propine
- Texas Tech Connection

**Carbonic Anhydrase Inhibitors**
- Decreases Aqueous Production
- 15 to 20% IOP Reduction
- Stings (Dorzolamide)
- Sulfur Allergy
- Dysgeusia
- Corneal Pathology
- Trusopt, Azopt
- Diamox, Neptazane
Combination Agents

- Cosopt - Timolol/Dorzolamide
  - 33% IOP Reduction
  - Generic, Preservative Free
- Combigan - Timolol/Brimonidine
  - 33% IOP Reduction
- Simbrinza - Brinzolamide/Brimonidine
  - 33% Reduction

Miotic Agents

- Increases Aqueous Outflow Through TM
- 20% Reduction from Baseline
- Significant Comorbidities
  - Hyperemia, Conjunctival Fibrosis, Miosis, HA, Myopia, Angle Closure, N/V, Salivation
- Inconvenient
  - QID Dosing
- Pilocarpine, Carbachol, Phospholine Iodide
- Rarely Used

Recent Medical Therapies

- Vyzulta
Future Medical Therapies

- Pharma Very Tight Lipped
- Drug Delivery Systems
  - Punctal Plug
  - Intravitreal Injection
- Combination Medications
  - Alcon, Allergan
- Novel Medication
  - Shire

Laser Trabeculoplasty

- Argon Laser Trabeculoplasty (ALT)
  - 1979- J. B. Wise, MD
- Selective Laser Trabeculoplasty (SLT)
  - 1999
    - Q-switched, frequency doubled Nd:YAG laser
    - Less Thermal Damage to TM- Repeatable
Laser Trabeculoplasty

- Office Procedure
- Topical Anesthesia
- Contact Lens

IOP Reduction - 20% from Baseline
66% Success Rate
IOP Reduction Persists 2 to 7 years
Treat 180 Degrees
Success Related to Pigmentation in TM
Better Results in PXF & Pigmentary Glaucoma
SLT can be repeated in previously treated areas but less effective

Micropulse Diode Laser Applied via Handheld Probe to the Peri-Limbal Area
Laser Causes Changes in Ciliary Processes thus Decreasing Aqueous Production
May Also Cause Structural Changes to Scleral Collagen increasing Uveoscleral Outflow
**Cyclo G6 Pulse Laser**
- Non-incisional
- Must be done in the OR with Local Anesthesia
- 33% IOP Reduction from Baseline
- Minimal Post Op Inflammation
- Repeatable

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**Diode Laser Cyclophotocoagulation**
- Same laser as G6 Cyclo
- Higher Laser Power
- Non-invasive
- Outpatient- Local Anesthesia
- Destruction of Cells in Ciliary Processes
- Profound Decrease in Aqueous Production
- Repeatable

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**Diode Laser Cyclophotocoagulation**
- Post-Op Inflammation
- CME
- Decreased VA
- Most Appropriate for End Stage Glaucoma
- Neovascular Glaucoma
Incisional Glaucoma Surgery

- Traditional Procedures
  - Trabeculectomy
  - Aqueous Shunt Devices
- New Procedures
  - MIGS
    - Stents
    - Canaloplasty
  - Trabectome

Trabeculectomy

- Gold Standard Incisional Glaucoma Surgery
- Profound Reduction in IOP
- Out-Patient/Local Anesthesia
- Technically Simple Procedure
- Many Potential Complications
Trabeculectomy - Complications
- Hypotony
- Bleb Failure/Fibrosis
  - Mitomycin C
- Bleb Dysesthesia
- Hyphema
- Progression of Cataract
- Bleb Leak
- Blebitis/Endophthalmitis

Aqueous Shunt Devices
- Most Invasive Glaucoma Surgery
- Last Resort
  - Exception - Neovascular Glaucoma
- Out-Patient/Local Anesthesia
- Multiple Devices on the Market
  - Ahmed - one way valve
  - Molteno - multiple plates
  - Baerveldt - multiple plates

Ahmed Valve
Ahmed Valve

Aqueous Shunt Device-Complications
- Hypotony
- Fibrosis Over Plate
- Iris Incarceration into Tube
- Tube Retraction
- Erosion of Tissue over Tube/Plate
- Corneal Decompensation
- Diplopia
- Dyesthesia
- Cosmetic

Trabectome
- Ab interno electrode tip used to open Trabecular Meshwork and increase Aqueous Outflow
- 30% Reduction of IOP
- Can be performed Independent of Cataract Sx
- No Controlled Studies
- Start Up Costs Expensive
- Insurance Coverage
MIGS

- Minimally Invasive Glaucoma Surgery
- ABiC
- iStent
- CyPass
- Xen Gel Stent
Canaloplasty
- Viscoelastic used to Open Schlemm’s Canal
- Promotes outflow of aqueous via the natural outflow pathway / Trabecular Meshwork
- Viscocanalostomy
  - Ab Externo/Cannula
  - Limited Length of SC/TM treated
- Canaloplasty
- ABiC

Canuloplasty
- Canuloplasty
  - Ab Externo
  - Catheter Introduced to treat close to 360 Degrees of Schlemm’s Canal/Trabecular Meshwork

Canuloplasty
- ABiC
  - AB Interno Canuloplasty
  - Microcatheter Introduced 360 Degrees and Viscoelastic Injected as Catheter Withdrawn
Canaloplasty

- Never Performed Procedure
- Advantages
  - Can be Performed Independent of Cataract Sx
  - Less Invasive
- Disadvantages
  - Learning Curve
  - Start Up Cost
  - Efficacy - ABIC 38% IOP Reduction

iStent

- Titanium Microstent inserted into the Trabecular Meshwork/Slemm’s Canal
- 36% IOP Reduction
- FDA restricts insertion only in combination with Cataract Surgery
Advantages
- Minimally Invasive

Disadvantages
- Learning Curve
- Must be Done with Cataract Surgery
- Limited to One Stent per Eye
- Efficacy
- Insurance Coverage
Titanium Microstent Inserted Through Ciliary Body Face into Suprachiliary Space

72.5% treated with the CyPass achieved a ≥20% reduction in IOP vs 58.0% with cataract surgery alone.
**CyPass**

- **Advantages**
  - Better IOP results as compared to iStent
  - “Easier” compared to iStent
- **Disadvantages**
  - FDA-approved only with Cataract Surgery
  - Learning Curve
  - Hyphema
  - Hypotony
  - Insurance Coverage

**Xen Gel Stent**

- Recently Approved by FDA
- 6 mm Gel stent inserted ab interno to establish aqueous outflow to the subconjunctival space
- Can be Performed Independent of Cataract Sx
- 76.3% achieved ≥ 20% IOP reduction

**Xen Stent**
**Xen Stent**
- First Procedures Scheduled January 30
- Advantages
  - Minimally Invasive
- Disadvantages
  - Learning Curve
  - Insurance Coverage

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**Case Study- Early OAG**
58 yo WM presents for routine eye exam
FHX OAG- mother, maternal GF
VA sc 20/20
IOP 28 OU, CCT 550 microns
C/D- 0.6/0.5
VF- WNL OU
OCT- Borderline NFL thinning OD/WNL OS
Management - ?

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**Case Study- Moderate OAG**
- 67 yo BF referred for large cups/elevated IOP
- RF’s- Diabetes, African American
- BCVA- 20/40 OU
- Moderate Nuclear Cataracts OU
- IOP 32 OU, C/D 0.8 OU, CCT- 525 OU
- OCT moderate NFL thinning OU
- VF- Superior Nasal Steps OU
- Management - ?
Case Study- LTG
- 42 yo LAF referred for LTG
- FHX- OAG, maternal GM “went blind”
- BCVA 20/30
- IOP 14, CCT 555 OU
- C/D 0.85 OU w/ Pallor
- OCT advanced NFL loss OU
- VF- Paracentral Scotomas OU
- Management ?

Case Study- NVG
- 38 yo WF referred for Neovascular Glaucoma
- Type I Diabetes since age 17-poorly controlled
- BCVA- 20/200 OU
- IOP 62 OU, CCT 610 OU
- Severe Rubesois OU, mild K Edema
- Gonio- NVA OU
- Fundus- PDR, NVD, mild VH
- Management ?