Managing Patients with Advanced Glaucoma
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This case details the diagnosis and management of a series of patients with advanced and end stage glaucoma. Medical and surgical options in patients that are visually disabled from glaucoma are discussed. There will be detailed presentations of low vision options and training for mobility and activities of daily living. Additionally, there will be instruction on certifying a patient with visual disability and the options of disability benefits available to these patients. At the end of this course, the attendee will have a better understanding not only of the clinical management of the disease, but how to assist the patient better navigate the world when visually disabled by glaucoma.

Advanced Glaucoma Intervention Study (AGIS)\textsuperscript{1,2}

- **Major Purpose of Study:** To determine the long range outcomes of glaucoma surgery in advanced cases that has failed medical therapy. Enrolled 776 eyes of 581 patients. Wanted to determine if laser or surgery was the most appropriate step after medication failure and to see if the type of surgery and subsequent was impacted by race. A minor purpose of the study examined the role of pressure reduction on progression.
- Looks at both trabeculectomy and trabeculoplasty
- ATT vs TAT protocols
  - Argon Trabeculoplasty- Trabeculectomy- Trabeculectomy or Trabeculectomy- Argon Trabeculoplasty- Trabeculectomy
- Results:
  - Black patients with advanced glaucoma should receive laser first.
  - White patients with advanced glaucoma should receive surgery first
- Side arm of study looked at role of IOP reduction
  - Patients were grouped into categories based upon the percentage of study visits where the IOP was below 18mm Hg. In each group, an average IOP was determined.
  - Patients with average IOP > 17.5 mm Hg had more worsening of visual fields than those with average IOP < 14 mm Hg
  - Patients who presented with 100% of study visits below 18mm Hg had, on average, little deterioration of their visual fields over six years. The patients in this group had an average IOP of 12.3mm Hg.
  - Patients who had fewer than 50% of study visits in which IOP was below 18mm Hg had much more significant visual field deterioration. These patients had an average IOP of 20.2mm Hg.
- Conclusion: Low IOP is associated with reduced progression of visual field defects

Comparison of glaucoma outcomes in black and white patients within treatment groups.

Clinical Pearl: While the below 14mm Hg group experienced visual field changes that were nearly zero, this represents an average change which incorporates patients who actually had improvement in their visual fields throughout the study. This means that there were also patients in this low-IOP group who did experience visual field deterioration. Please be aware that an IOP of 12-14mm Hg does not guarantee that the patient will not experience further glaucomatous losses.

The Myth of 21
- There is no guarantee that IOP less than 21 will preserve a patient’s vision or greater will result in blindness.
- The greater the degree of damage, the lower the IOP needs to be due to fragility of the already damaged nerve.
- Past progression predicts future progression unless IOP is lowered
- Determining initial target pressure
  - Existing disc damage
  - Extent of field damage
  - Risk of imminent/ future functional disability- this is the most important consideration
  - Patient age and life expectancy
  - Peak IOP

Setting a target pressure

Two Methods
- Absolute Value
  - Risk of over-treating or under-treating patients
- Percentage decrease from baseline
  - What constitutes an acceptable decrease?
- What pressure is ideal for everyone?
  - One size fits all… doesn’t
- Can the studies guide us?
- Clinical trials provide Evidence and Guidelines
  - Take care to apply the correct study to the correct population
  - OHTS 20% IOP reduction: 4.4% progressed
  - EMGT 25% IOP reduction: 45% progressed over 6yrs and 59% progressed over 11 yrs
  - CNTGS 30% IOP reduction: 12% progressed
  - CIGTS 35% (meds) and 48% (surgical) IOP reduction: No progression
  - AGIS < 18 all visits No progression
Target Pressure Conclusions

- A target pressure is that pressure at which the sum of the impact of the glaucomatous vision loss upon the patient and the impact of treatment upon the patient is minimized.
- Once treatment is started, the goal is not to make the IOP ‘normal’, but safe for the patient.
- Demand greater reductions than before
  - 40-50% vs 20-30%
- Don’t over-treat those at minimal risk of vision loss
- Don’t under-treat those at high risk of vision loss
- Don’t focus on the IOP to the exclusion of other factors
- Remember to treat the patient, not a number

Surgical Options

- Laser trabeculoplasty
- Argon laser trabeculoplasty (ALT)
- Selective laser trabeculoplasty (SLT)
- Trabeculectomy with an antifibrotic agent
- Tube shunt
- Newer glaucoma surgical procedures

Laser Trabeculoplasty

- Argon laser trabeculoplasty (ALT)
- Potential mechanisms of action
  - Shrinkage of collagen in TM pulls open intertrabecular spaces between treatment sites
  - Stimulates trabecular endothelial cells to divide and migrate
  - Stimulates trabecular endothelial cells to produce an altered extracellular matrix with less outflow-obstructing properties
- Results
  - Short-term results
  - Initial success: 65-95%
  - Reduction in IOP: 20-30%
    - Long-term results
  - Attrition rate: 5-10% per year
  - 5-year success rate: 50%
- Factors influencing response
  - Aphakia/pseudophakia
  - Pre-treatment IOP
  - Age
  - Race
  - Type of glaucoma
- Reduced success with repeat ALT and risk of paradoxical IOP rise
- Selective laser trabeculoplasty (SLT)
- Nd:YAG laser
  - Produces less structural damage to the trabecular meshwork
- Results
  - Initial success: 62-96%
  - IOP decrease: 20-30%
- Prospective randomized clinical trials comparing ALT and SLT have not detected any significant difference in efficacy and safety between the two procedures
- SLT retreatment has been shown to be as effective as initial treatment

**Trabeculectomy with an antifibrotic agent**
- Antifibrotic agents inhibit fibroblast proliferation
- Adjunctive antifibrotic agents
- 5-fluorouracil (5-FU)
  - Intraoperative dosage: 50 mg/ml for 5 minutes
  - Postoperative dosage: 5 mg subconj
- Mitomycin C (MMC)
  - 100 times more potent than 5-FU
  - Intraoperative dosage: 0.2-0.5 mg/ml for 2-5 minutes
- Indications for adjunctive use of an antifibrotic agent
- Refractory secondary glaucomas (e.g. neovascular glaucoma, uveitic glaucoma)
- Previous ocular surgery
- African American race
- Young age
- Need for a low IOP (e.g. advanced glaucoma, normal tension glaucoma)

**Tube Shunt**
- Share a common design consisting of a tube connected to an end plate
- Implants in common use
- Ahmed glaucoma valve
- Baerveldt glaucoma implant
- Molteno implant
- Indications for a tube shunt
- Refractory secondary glaucomas (e.g. neovascular glaucoma, uveitic glaucoma)
- Previous ocular surgery
- Conjunctival scarring
- Congenital glaucoma refractory to angle surgery
- Aphakia
- Tube Versus Trabeculectomy (TVT) Study
- Inclusion criteria
  - Age 18-85 years
  - IOP ≥ 18 mm Hg and ≤ 40 mm Hg
  - Previous trabeculectomy, cataract extraction with IOL implantation, or both
- Enrollment
  - 212 patients
  - 17 clinical centers
Surgical procedures
- 350-mm² Baerveldt glaucoma implant
- Trabeculectomy with MMC

Results [Gedde, Am J Ophthal 2012]
- Tube shunt surgery had a higher success rate compared with trabeculectomy with MMC
- Similar mean IOP and number of medications with both surgical procedures
- No significant difference in the rate of serious complications

Newer Glaucoma Surgical Procedures
- Several new glaucoma surgical procedures have recently been introduced into clinical practice
- Procedures
  - Canaloplasty
  - Trabectome
  - Glaukos iStent
  - Endocyclophotocoagulation
- May have improved safety profile over trabeculectomy and tube shunt surgery, but appear to be less effective in IOP reduction

Definitions
- Low vision rehabilitation
  - An optical and functional evaluation to determine if a person’s visual acuity can be enhanced to participate in desired activities
- Legal blindness
  - Visual acuity of 20/200 or less, best corrected, better seeing eye or visual field of 20 degrees or less in the widest diameter in the better seeing eye
- Low vision
  - WHO definition - visual acuity less than 6/18 (20/60) and equal to or better than 3/60 (20/400) in the better eye with best correction.

Low vision acuity measurement
- Distance
  - Snellen
  - Feinbloom
  - ETDRS
  - Finger counting is not appropriate
- Near
  - Single letter near cards
  - Continuous text near cards
    - Give better estimation of reading ability

Predicting addition power lens
- Difference between magnification and diopters
• Limitations of magnification
  ▪ As magnification increases working distance decreases and field of view decreases

• Deciding on the device
  o Near magnification
    ▪ Hand held magnifiers
    ▪ Stand magnifiers
    ▪ Electronic magnifiers
    ▪ Telescopes with reading caps
  o Distance magnification
    ▪ Hand held telescopes
    ▪ Binocular telescopes

• Field measurement
  o Acceptable tests for determination of legal blindness
    ▪ Humphrey 30-2 or 24-2
      ▪ 24—2 will not determine visual impairment
    ▪ Humphrey SSA
      ▪ Kinetic testing
      ▪ Visual efficiency score
    ▪ Goldmann
    ▪ All tests must use a white size III4e stimulus
      ▪ 10 dB stimulus is equivalent to a 4e stimulus

• Glare concerns
  o Filters
    ▪ Corning, etc
  o Use of amber or brown tinted lens reduces amount of light entering eye but doesn’t decrease contrast as much as gray lens
  o Use of adequate lighting while reading
    ▪ Day-lite bulbs
  o Minimization of background glare
    ▪ Typoscopes
    ▪ Tablecloths
    ▪ Rugs

• Driving concerns
  o Georgia law mandates at least 20/60 in one eye and a field vision of at least 140 degrees.
  o Florida law mandates 130 degrees of uninterrupted visual field
    ▪ Must be measure with Goldmann III4e or equivalent or Humphrey Estermann
Section 322.126 (2), (3), Florida Statutes, provides that “Any physician, person, or agency having knowledge of any licensed driver’s or applicant’s mental or physical disability to drive…is authorized to report such knowledge to the Department of Highway Safety and Motor Vehicles… The reports authorized by this section shall be confidential… No civil or criminal action may be brought against any physician, person or agency who provides the information herein.”

Transportation services available for those who don’t meet driving requirements
- [https://www.disability.gov/transportation#map](https://www.disability.gov/transportation#map)

- Orientation and Mobility Training
  - Blindness Agencies

- Other Services/Agencies
  - Georgia Vocational Rehabilitation Services
  - Georgia Council of the Blind
  - Florida Division of Blind Services
  - Social Security disability determination
  - [http://www.socialsecurity.gov/dibplan/dapply.htm](http://www.socialsecurity.gov/dibplan/dapply.htm)

- 211
  - Additional resources
  - Daily phone calls