Optic Disc & Visual Function
Red – Blue Stereo Glasses: Red lens over Left eye

Optic disc: 3D structure containing 1 million retinal nerve fibers that take a 90 degree turn, group into 1000 bundles, & exit to the brain
Visual field: psychopx test of lt sensitivity that measures function (or dysfct) of 1 million nerve fibers supplying our central & side vision

Normal
Severe Glaucoma

Glaucoma Pitfall: Disc Proper Anomalies
• Mask presence or obscure progression of glaucoma damage
• Cause neuroretinal rim or arcuate VF loss similar to glaucoma

Optic Disc & Color images in 2D
Black & white anaglyphs in 3D with red-blue glasses

A Typical Day in the Life of a Glaucoma Specialist
• Glaucoma diagnosis, differential dx, & classification
• Stage severity of dz & set target goals for pressure control
• Rx glaucoma with meds, laser, & incisional surgery
• Manage compliance & psychosocial issues of vision loss

OPTIC DISC ANOMALIES & PATHOLOGY:
Confound Our Assessment of the Glaucomatous Disc

Glaucoma Pitfall: Disc Proper Anomalies
Tilted Disc Optic Pit Coloboma Disc Drusen
All may mask the presence of glaucoma damage or progression
**OPTIC DISC DRUSEN**

- Hyaline granules that slowly replace the optic nerve substance
- Cause progressive nerve fiber atrophy & variety of VF defects
- Obscure glaucomatous disc damage & etiology of VF progression

**Glaucoma Pitfall: Peripapillary Anomalies**

- Myelinated Nerve Fibers
- Juxtapapillary Choroidopathy
- Bergmeister’s Papilla
- Peripapillary Staphyloma

**BERGMEISTER’S PAPILLA**

- Rare, incomplete regression of glial sheath around hyaloid artery
- White fibrous tissue overlying & obscuring optic disc; VF WNL

**BERGMEISTER’S PAPILLA**

- 1996 - 2000 develop IT notch & vessel displacement into excavation
- BP may obscure both presence & progression of glaucoma damage

**Glaucoma Pitfall: Disc Vascular Anomalies**

- Prepapillary Vascular Loop
- Opto-Ciliary Shunt
- Disc - Retinal Collaterals
- Neovascular Frond

- Rare, anomalous blood vessel projecting from disc into vitreous
- Most arterial; if volvulus, causes BRAO, OA, & altitudinal VF loss
- May confound both glaucomatous disc damage & VF loss

**PREPAPILLARY VASCULAR LOOP**

- Case 1
- Case 2
**Glaucoma Pitfall: Optic Atrophy**

- Diffuse Optic Atrophy
  - Traumatic
  - Post CRVO
  - Segmental Optic Atrophy
  - IAION
  - AAION

  Pathologic "cupping" & arcuate VF defects may occur with any etiology.

**Optic Atrophy Misdiagnosed as Glaucoma**

- 50 yo F treated for POAG OU x 2 yrs & ↓ VA OS x 3 months
- VA 20/25 OD & CF 1' OS; Ta 16 OU on 2 glaucoma meds OU

**Optic Atrophy & Physiologic Enlarged Cups**

- Brain MRI next day: 4 x 6 cm enhancing mass centered in sella
- Large pituitary adenoma surgically removed 2 days later
- 2 wks po, pVA OS to 20/20 & 5 months po, VF almost WNL OU
- All glaucoma rx tapered off & no evidence of glaucoma OU

**Glaucoma Pitfall: Optic Disc Swelling**

- Papilledema
- Optic nerve
- Optic neuritis

**Optic Disc Swelling: Artifactual ↓ C/D**

- 1994: Very early POAG with peak untreated IOP 36 mm Hg
- 2000: Developed papilledema due to subdural hematoma
- Disc edema reduces C/D & pallor & obscures glaucoma damage
**Optic Disc Swelling Resolves: Artifactual ↑ C/D**

- Optic disc swelling reduces the true physiologic cup size
- When disc swelling resolves, the optic cup increases
- Artifactual ↑ C/D may be misinterpreted as glaucoma progression

**Glaucoma Classification** (color in 3D)

- Not a single disease; over 40 types of disorders with widely diverse clinical & histopathologic manifestations
- Common denominator is dysfunctional or obstructed aqueous outflow causing elevated intraocular pressure

**Glaucoma Classification: Gonioscopy (mag 10,000x)**

- A clinical biomicroscopic technique using mirrored contact lens
- Allows stereoscopic examination of the anterior chamber angle
- Essential to classify glaucomas as open or closed angle, 1° or 2°

**Variations in Open Angle Glaucoma: Pigment**

**Variations in Open Angle Glaucoma: Layers**

- WHITE CELLS:
  - Infection
  - Inflammation
  - Steroids
- RED CELLS:
  - Trauma
  - Diabetic retinopathy
  - Vascular occlusive dz
- SILICONE OIL:
  - Severe RD repair

**Variations in Angle Closure Glaucoma**

- PRIMARY ANGLE CLOSURE
- INFLAMMATORY - IRITIS
- PPD: Corneal Dystrophy
- Mature Cataract: Pupillary Block
Variations in PAS: Anterior Mechanism

- Inflammatory
- Neovascular
- Plateau Iris
- Aniridia
- Iridoschisis

Variations in PAS: Anterior Membranes

- Chandler's
- PPD

Variations in PAS: Posterior Mechanism

(With Pupillary Block)

- Iris Bombé with 360° Posterior Synechiae
- Vitreous AC-IOL Pupil Block

(Without Pupillary Block)

- Nanophthalmos
- Uveal Melanoma
- Cilio-Choroidal Effusion

Glaucoma Damage Staging

- Early
- Moderate
- Advanced
- End

- After dx & classification, the extent or stage of glaucoma damage is single most impt management consideration
- Primary determinant which drives most rx decisions:
  1) Target goal for IOP control
  2) Magnitude of treatment
  3) Timing imperative
  4) Visual prognosis

Early Glaucoma Damage

Case 1

Case 2

Case 3

Case 4
Moderate Glaucoma Damage

Case 1                        Case 2                          Case 3                       Case 4

Advanced Glaucoma Damage

Case 1                        Case 2                         Case 3                        Case 4

End Stage Glaucoma Damage

Case 1                          Case 2                        Case 3                        Case 4

PITFALL: Parapapillary Chorioretinal Atrophy

• Occurs more commonly with aging, high myopia, & glaucoma
• Causes significant underestimation of cupping & damage staging
• Vessel course under & over disc margin is key sign of absent rim

High Tension Glaucoma: Target Goals for Pressure Control

<table>
<thead>
<tr>
<th>Stage</th>
<th>Early</th>
<th>Moderate</th>
<th>Advanced</th>
<th>End</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lower of ≤ 21-24 or IOP 20-25%</td>
<td>≤ 18-20 throughout the day</td>
<td>≤ 15-17 throughout the day</td>
<td>≤ 14 throughout the day</td>
</tr>
</tbody>
</table>

Glaucoma Treatment

6 Classes of Medications
Laser Treatment
Filtering Bleb
Transcorneal Laser
Trabeculectomy & Shunt
Glaucoma Medical Rx

<table>
<thead>
<tr>
<th>Medication</th>
<th>Route/Frequency</th>
<th>Potential Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostaglandin</td>
<td>Eyedrop once/day</td>
<td>Eye redness, eyelid darkening</td>
</tr>
<tr>
<td>Beta-blocker</td>
<td>Eyedrop 1-2x/day</td>
<td>Worsen asthma &amp; bronchitis</td>
</tr>
<tr>
<td>Alpha agonist</td>
<td>Eyedrop 2-3x/day</td>
<td>Dry mouth, dizzy, 20% allergy</td>
</tr>
<tr>
<td>Topical CAI</td>
<td>Eyedrop 3-4x/day</td>
<td>Bitter taste, severe stinging</td>
</tr>
<tr>
<td>Miotic</td>
<td>Tablet 2-4x/day</td>
<td>Tiredness, weakness, tingling, Metallic taste of soda &amp; beer</td>
</tr>
<tr>
<td>Oral CAI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Variations in Laser Rx of Angle & Iris

- **TRABECULOPLASTY**
- **IRIDOTOMY**
- **IRIDOPLASTY**

Glaucoma Fistulizing Sx: Trabeculectomy

- Indicated when medical & laser therapy fail to control dz
- Incisional sx creates fistula or channel thru the sclera into the eye
- Creates alternate pathway for aqueous to escape, from inside the eye thru the fistula to outside the eye, beneath the upper eyelid

Glaucoma Drainage Implants

- Drainage devices shunt aqueous from inside the eye to equatorial plate placed outside & behind the eye
- Connecting tube positioned in anterior chamber & drains aqueous onto plastic plate of various shapes & designs

Glaucoma Monitoring: Adjusting Target Goals & Rx

<table>
<thead>
<tr>
<th>Optic Disc Progression</th>
<th>Visual Field Progression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage Stage:</td>
<td></td>
</tr>
<tr>
<td>Peak IOP + Risk Factors:</td>
<td></td>
</tr>
<tr>
<td>Target Pressure:</td>
<td></td>
</tr>
<tr>
<td>Rx Changes:</td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>Early/Moderate</td>
</tr>
<tr>
<td>32</td>
<td>26</td>
</tr>
<tr>
<td>≤ 24</td>
<td>≤ 21</td>
</tr>
<tr>
<td>Timoptic</td>
<td>Timoptic + Xalatan</td>
</tr>
<tr>
<td>+ Cosopt Xalatan + ALT</td>
<td></td>
</tr>
</tbody>
</table>

Classic Glaucomatous Progression

- Focal ST or IT neural rim loss
- Increased C/D & develop notch
- New arcuate NFL defect
- Increased pallor
- Circumlinear vessel baring
- Vessel course change
Classic Glaucomatous Progression


- Focal ST or IT neural rim loss
- Increased C/D & develop notch
- New arcuate NFL defect
- Vessel course change

Glaucoma: Severe Progression
due to Acute Pressure Rise from Steroid Use

1986                        1986

1988                        1988

Glaucoma: Severe Progression
due to Non-Compliance

1984                       1984

1988                       1988
Non-Compliance in Glaucoma

PsychoSocial Profiles
1. Unstable job, finances, or marriage
2. Chemical dependency or mental illness
3. Young adults & Unbelievers
4. Fear of ophthalmologists, hospitals

Types of Counseling or Help
- Social Services, Marital Counseling, Job Placement, Rx Assistance Programs
- Psychiatric, Community & State Drug & Alcohol Programs
- Social, Family, & Clergy counseling
- Psychological & Family counseling

Glaucoma’s Impact on Visual & Health-related Quality of Life

• Severe dz: ↑ anxiety, ↑ depression, & reduced quality of life
• Employment issues (fear of loss of job & health insurance)
• Social issues (impact on relationships, sexuality, & hobbies)
• Loss of independence (difficulty walking, reading, & driving)

Services for Blind & Visually Impaired: CAB, Clovernook Center

- Instructional Services: Daily Living Skills, Orientation & Mobility
- Social Services: Housing assitance, community support, mental health
- Low Vision Services: magnification aids, enhanced lighting
- Adult Vocational Rehabilitation & Community Employment

All About Glaucoma: A Typical Day in the Life of a Glaucoma Specialist

1. Glaucoma diagnosis, differential dx, & classification
2. Damage staging & target goals for pressure control
3. Rx glaucoma with meds, laser, & incisional surgery
4. Manage compliance & psychosocial issues of vision loss