

Understanding Glaucoma

**Elective Course: Clinical
Ophthalmology**

*For Medical Students, State
University of New York at Stony
Brook*



Glaucoma Awareness

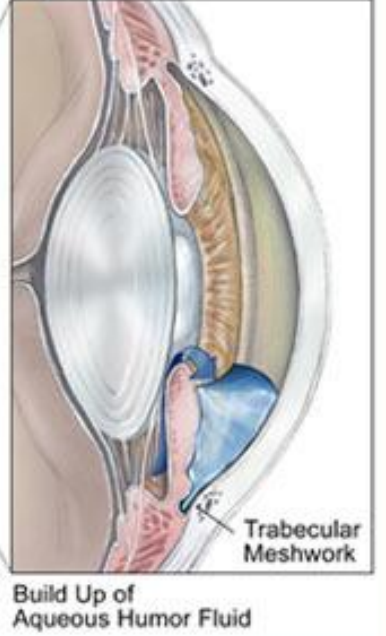
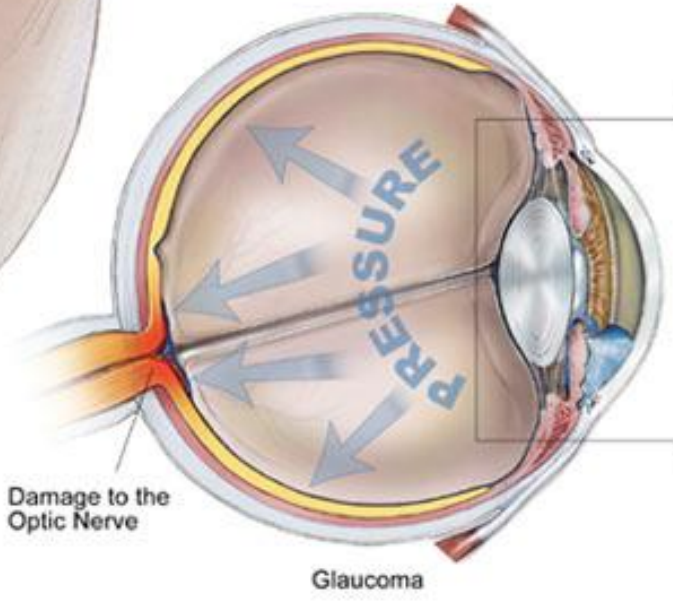
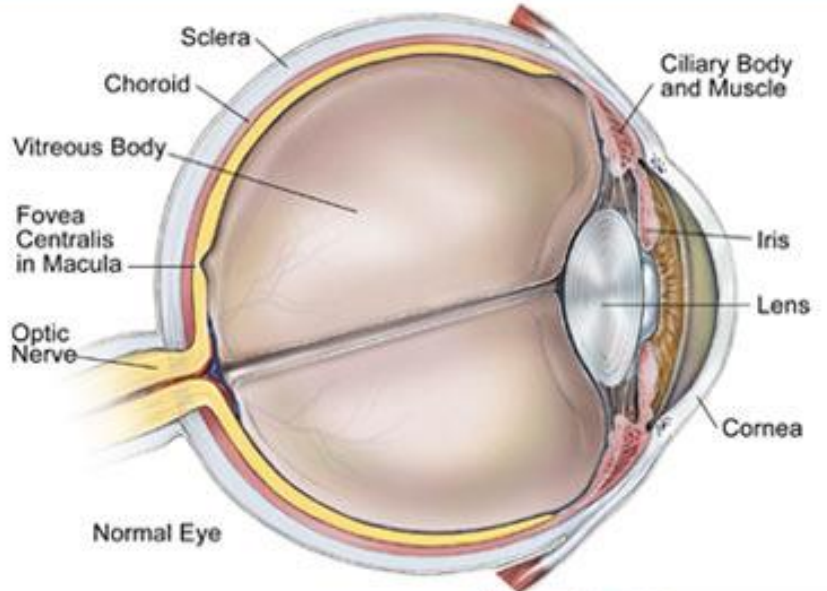
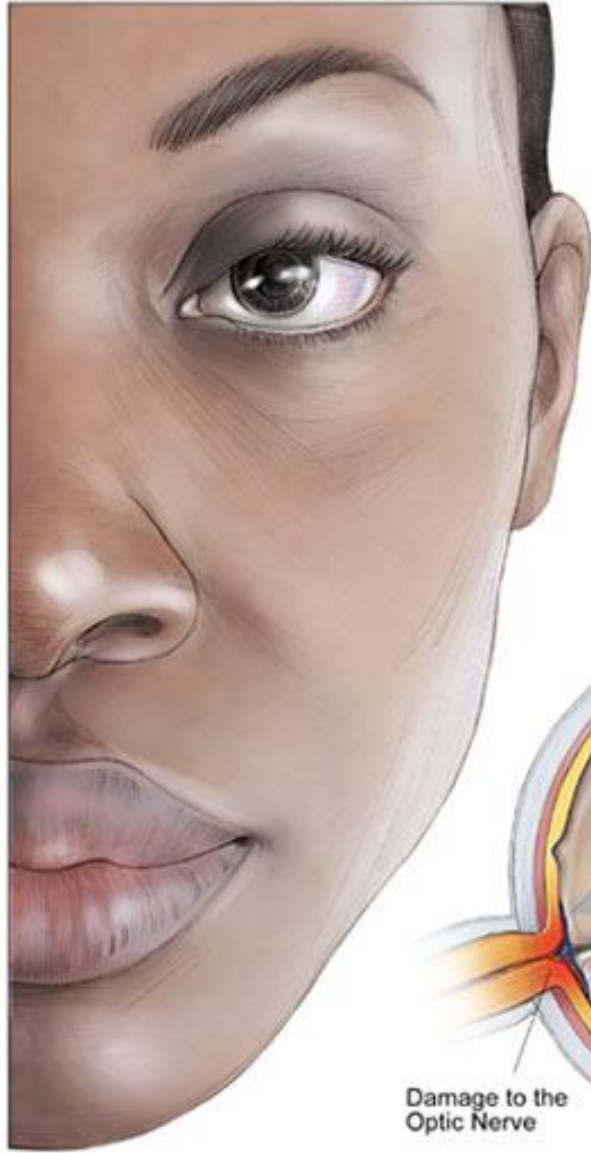
- What is glaucoma?
- Why do we care so much about glaucoma?
- Who is at risk for developing glaucoma?
- How do I recognize glaucoma?
- How is glaucoma treated?
- What should I know about treatment side effects?



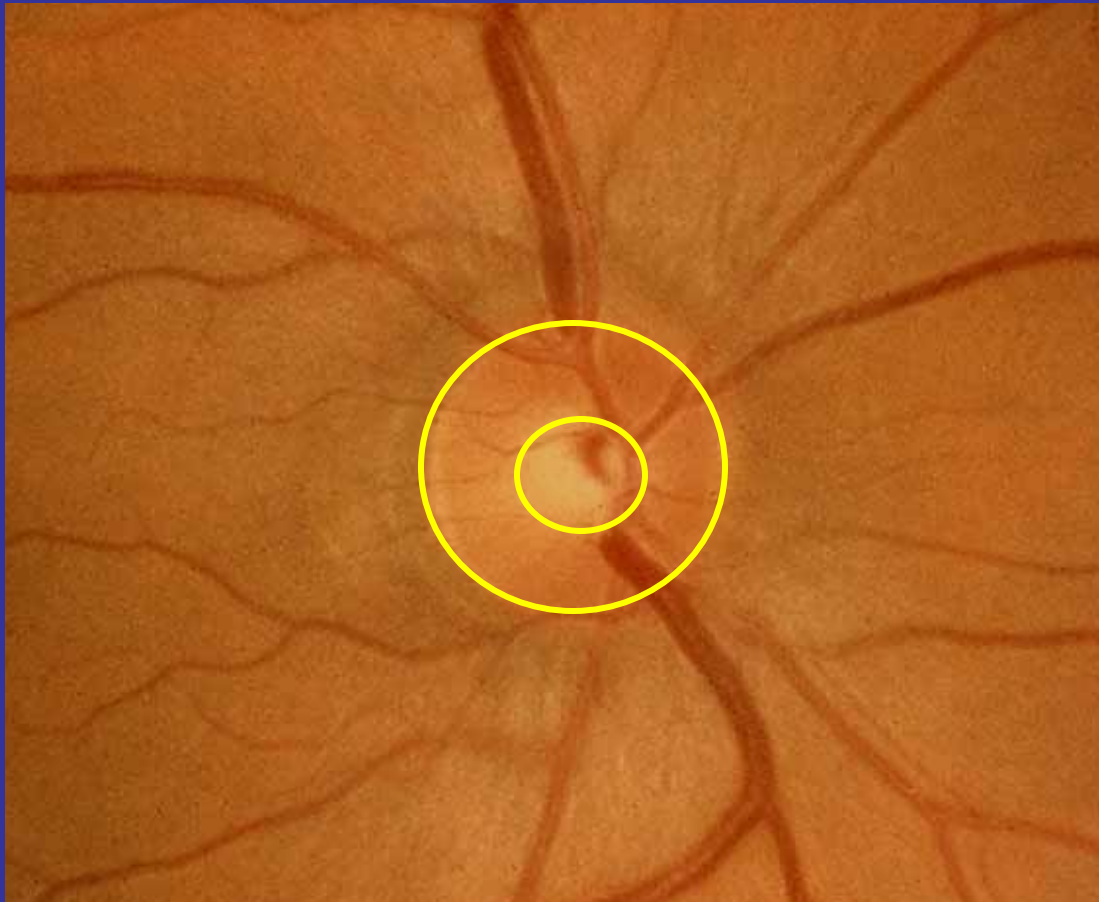
Glaucoma

- A group of diseases with characteristic damage to
 - the optic nerve (structural damage)
 - the visual field (functional damage)
- Commonly, but not always, associated with a **high** intraocular pressure

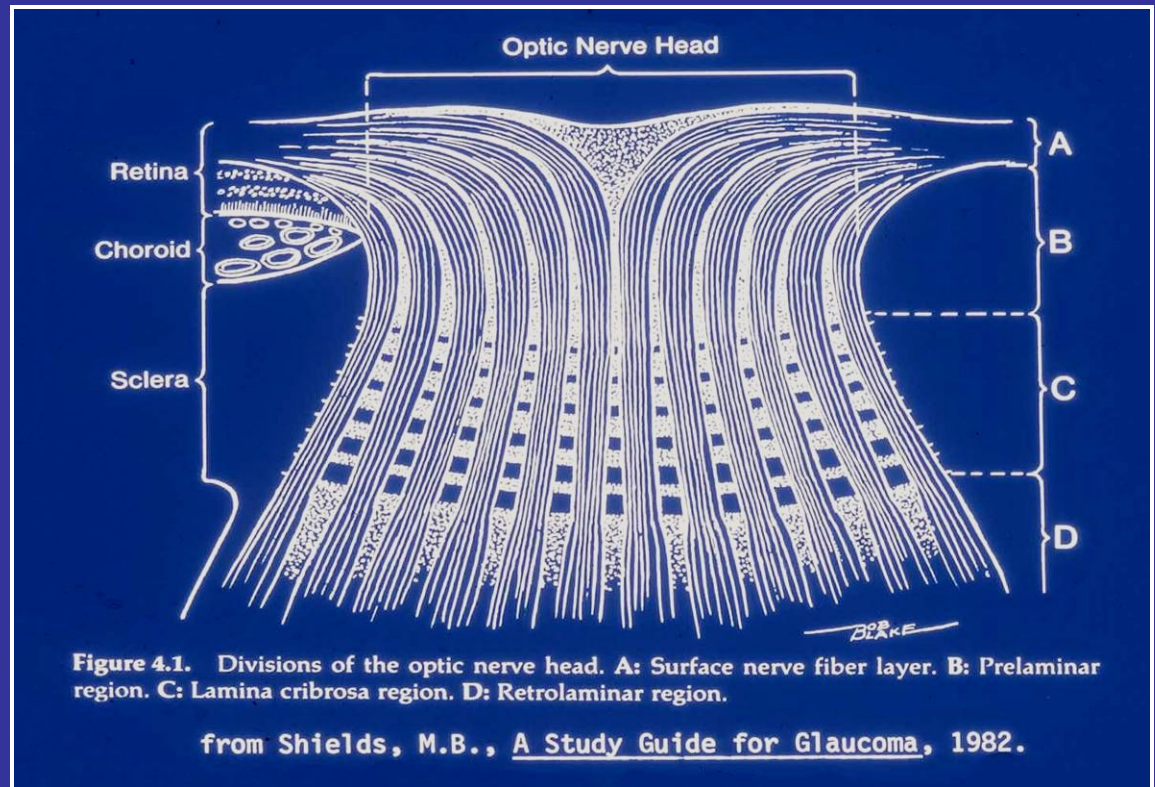
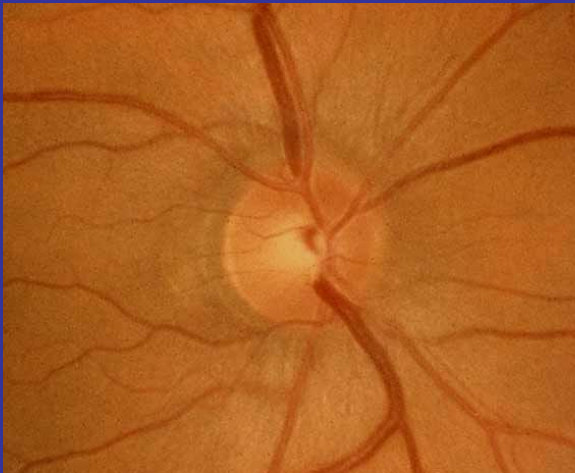




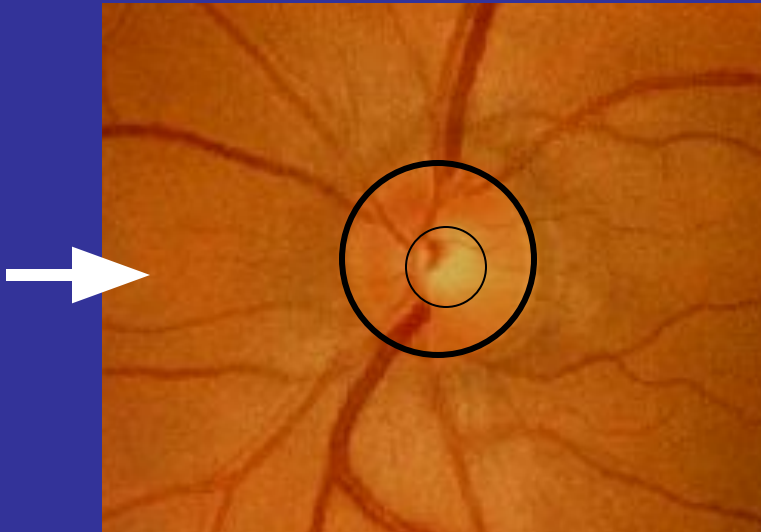
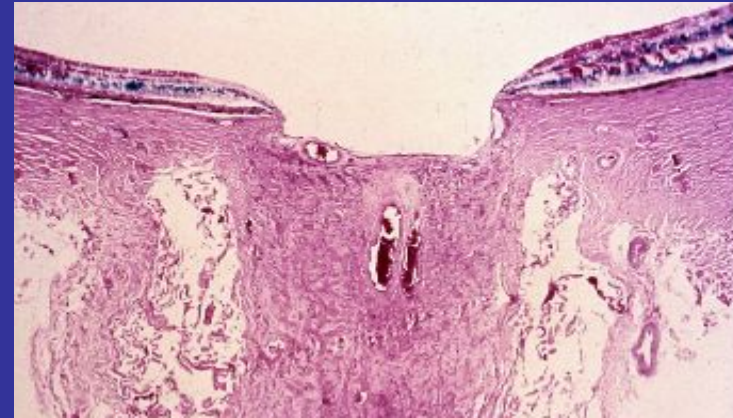
Optic Nerve Head

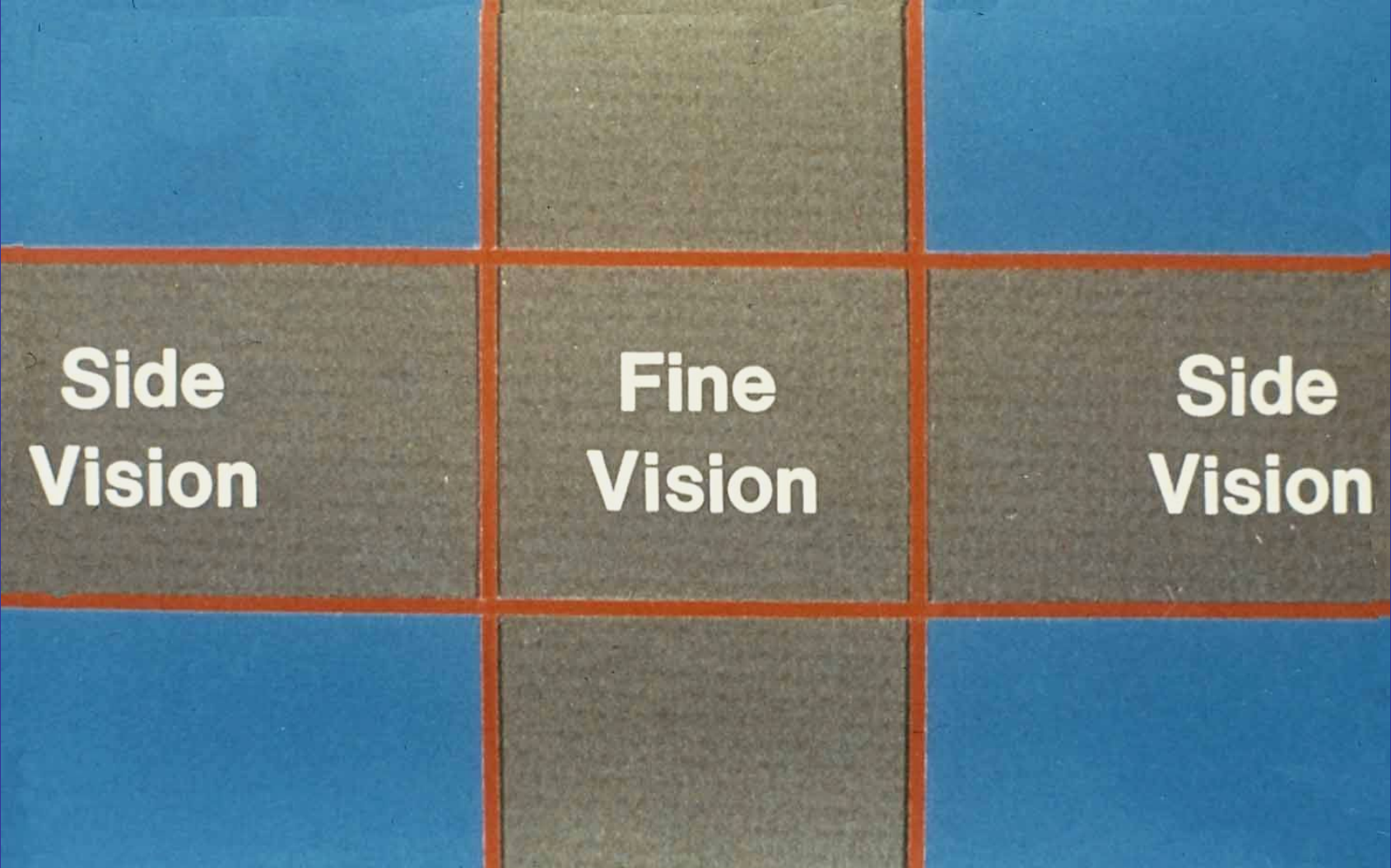


Optic Nerve Head Anatomy



Glaucomatous Optic Atrophy: Histological vs. Clinical Anatomy





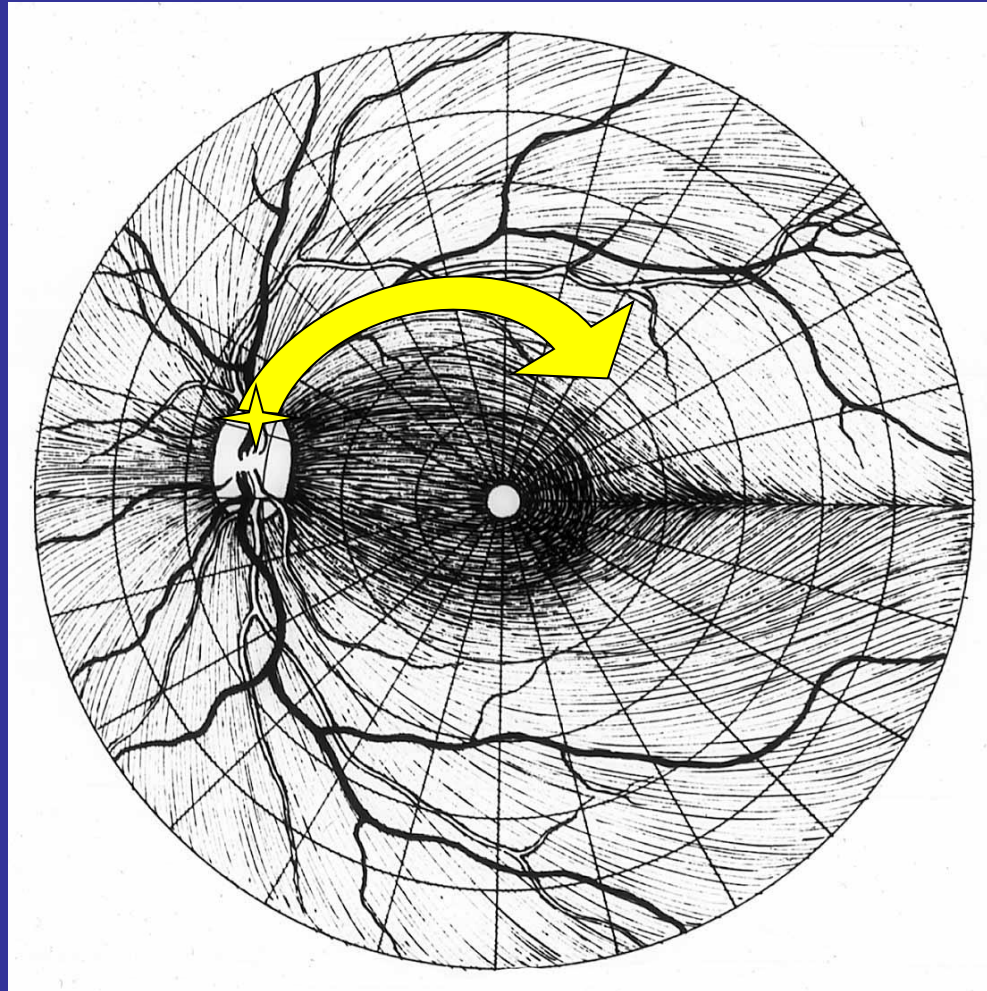
**Side
Vision**

**Fine
Vision**

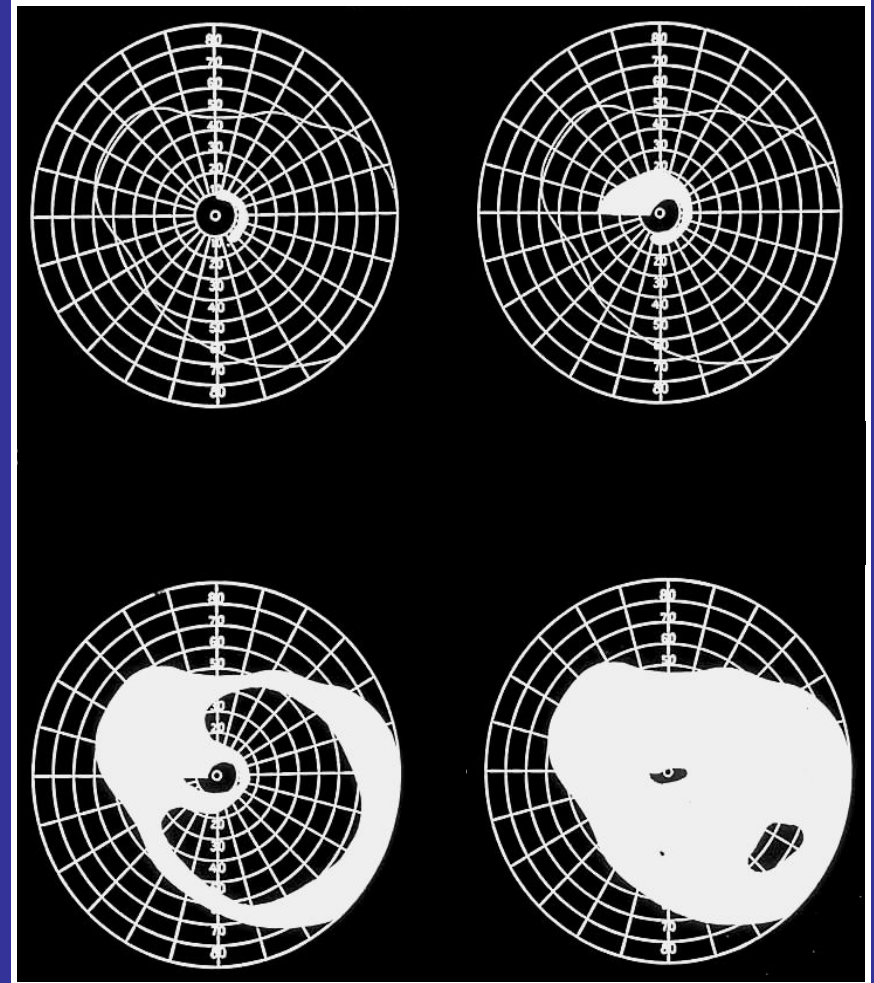
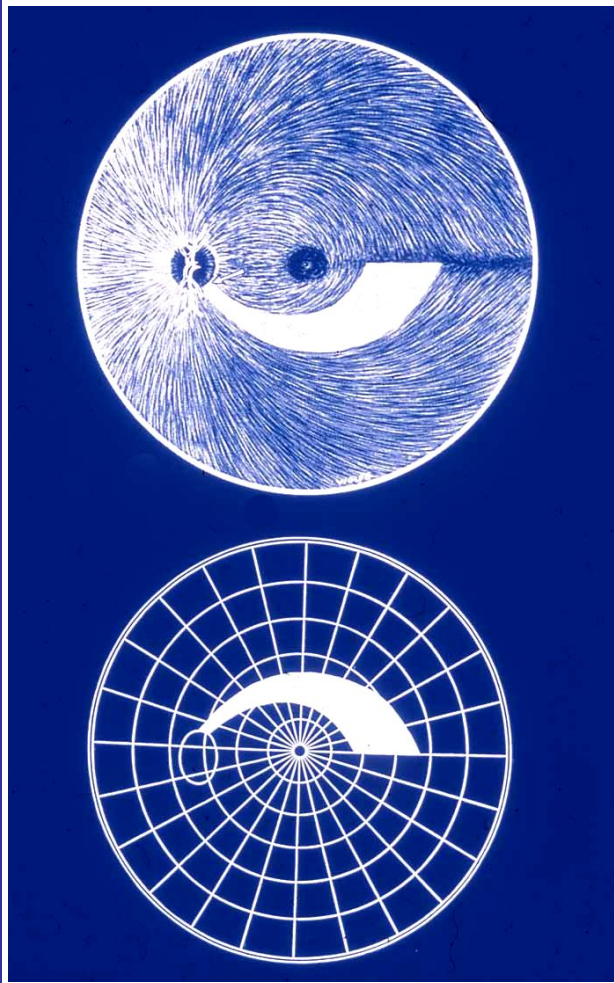
**Side
Vision**



Relating the Visual Field to the Fundus



Visual field loss in glaucoma reflects the pattern of nerve fiber layer loss.

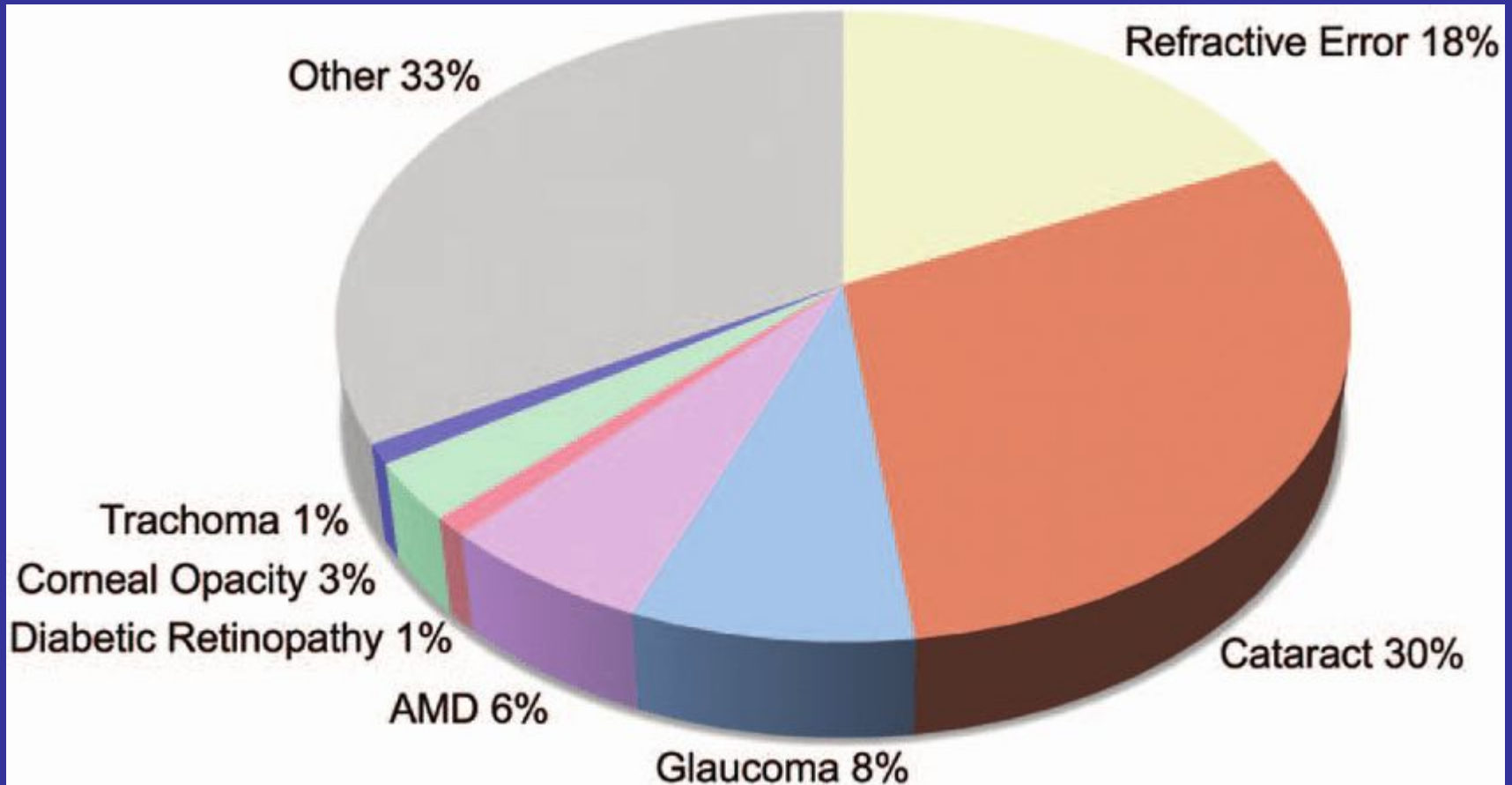


Glaucoma Awareness

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World-wide Causes of Blindness



Lancet Glob Health 2017; 5: e1221-e1234.



World-Wide Glaucoma

- 2020: 76 million
- 2040: 111.8 million
- Global prevalence total: 3.54%
- Global prevalence (POAG): 2.2% (approx. 57.5 million)

- Bilateral blindness from glaucoma:
 - 4.5 million in 2010
 - 11 million in 2020



Glaucoma Epidemiology in the USA

- Over 3 million Americans affected (2020 estimate)
- Second most prevalent cause of US blindness overall
- Most important cause of blindness in African Americans (up to 25% of all blindness is from glaucoma)
- Half of glaucoma patients are probably unaware they have the disease
- Early Diagnosis is the key



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High Risk Patients for Glaucoma

- Increasing age
- Family history of glaucoma
- Race, relative predispositions
 - African or Afro-Caribbean descent: open-angle glaucoma
 - Blindness 5x more common than in Caucasians, 10% prevalence in >70yo age-group
 - Progresses more rapidly, more advanced stage and earlier age when discovered
 - Asians, Eskimos: narrow angle glaucoma
- Refractive errors
 - Myopia (nearsightedness): open-angle glaucoma
 - Hyperopia (farsightedness), especially more extreme degrees: narrow-glaucoma
- Vascular disease; Diabetes (?)



Screening for Glaucoma

- Typical approach: intraocular pressure screening
- Detects < 50% of glaucoma patients
 - Diurnal fluctuations in intraocular pressure
 - “Normal” tension glaucoma
 - Inaccurate pressure readings
- >70% of patients with suspicious intraocular pressures will not have glaucoma



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Recognizing Glaucoma

- Open-angle glaucoma
- Closed-angle (narrow-angle) glaucoma
- Congenital glaucoma

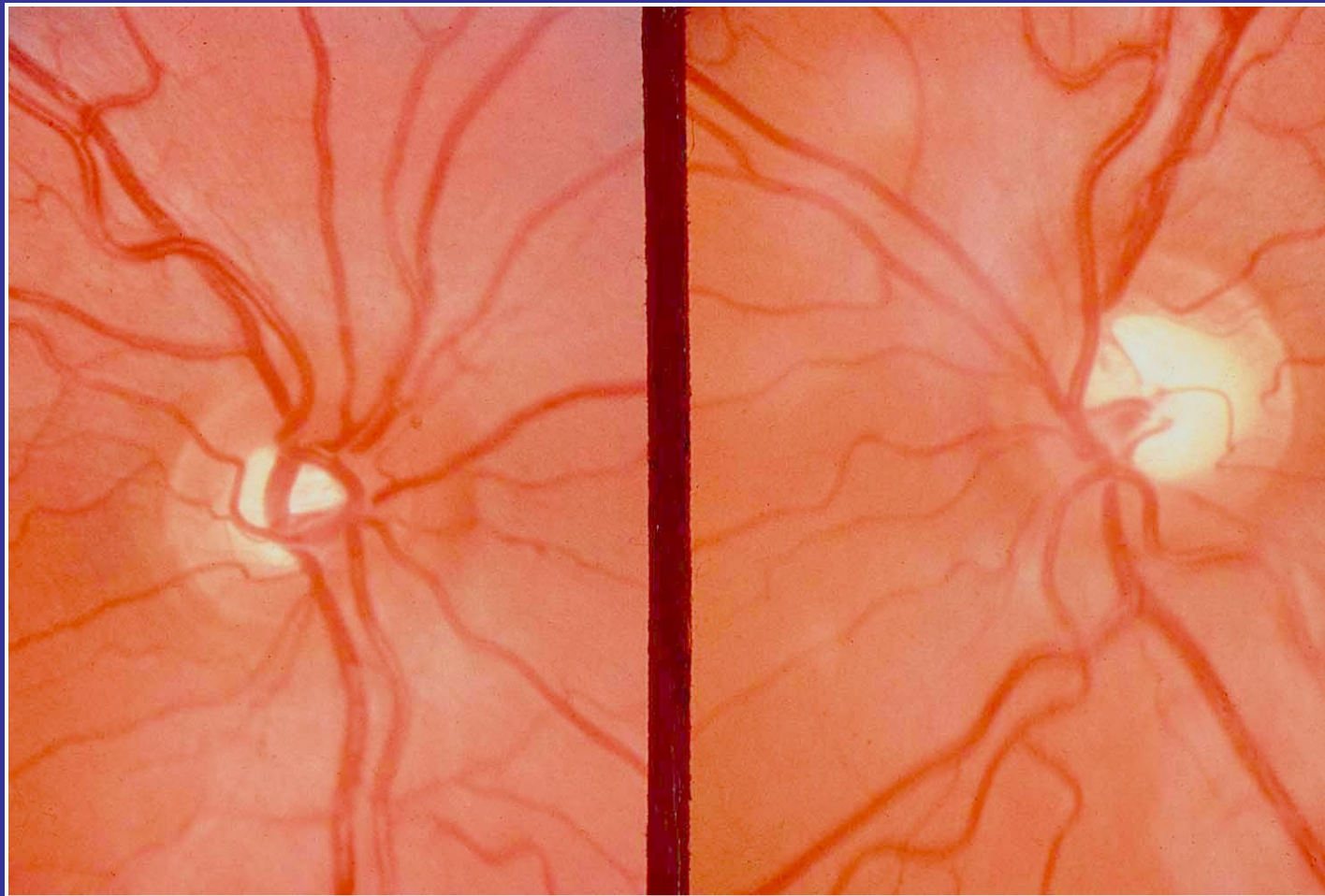


Suspicious Cupping

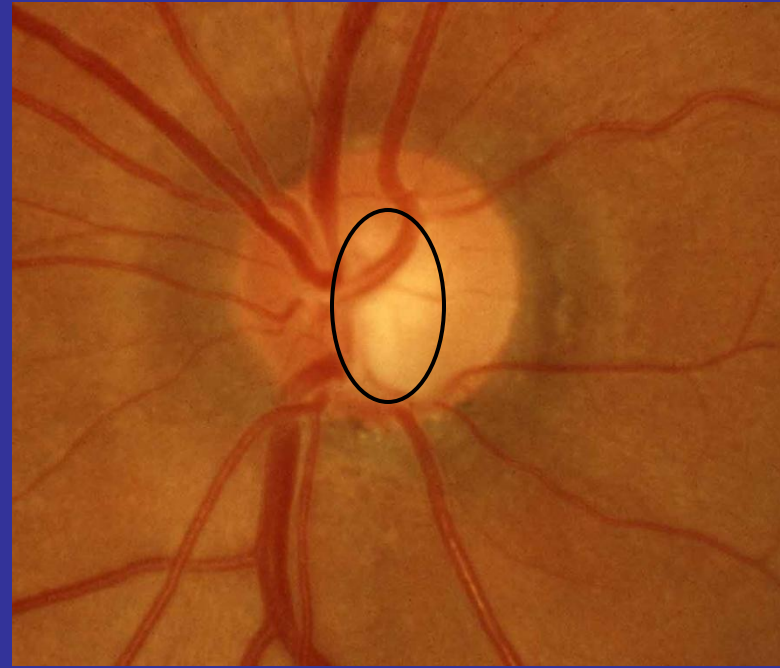
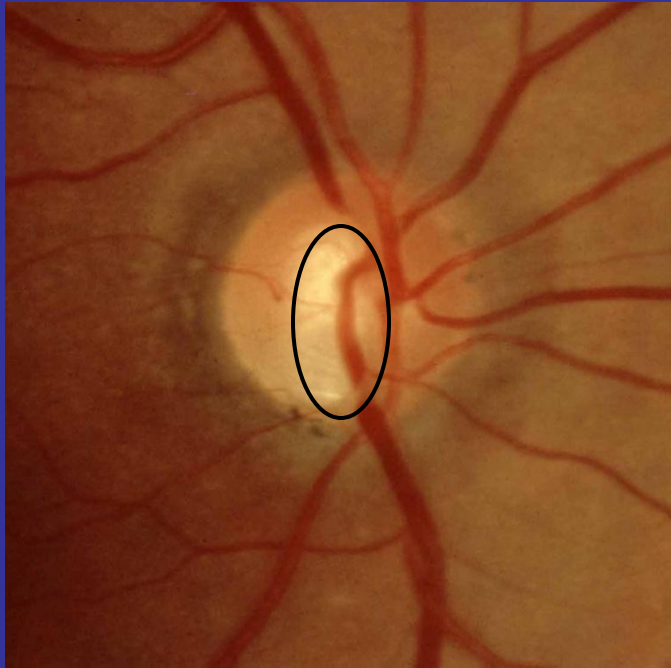
- Size:
 - >0.6 times the disc diameter
- Shape:
 - Diffusely enlarged
 - Focal enlargement - notching
- Right-left asymmetry:
 - >0.1 disc diameters
- Superficial hemorrhages at disc margin



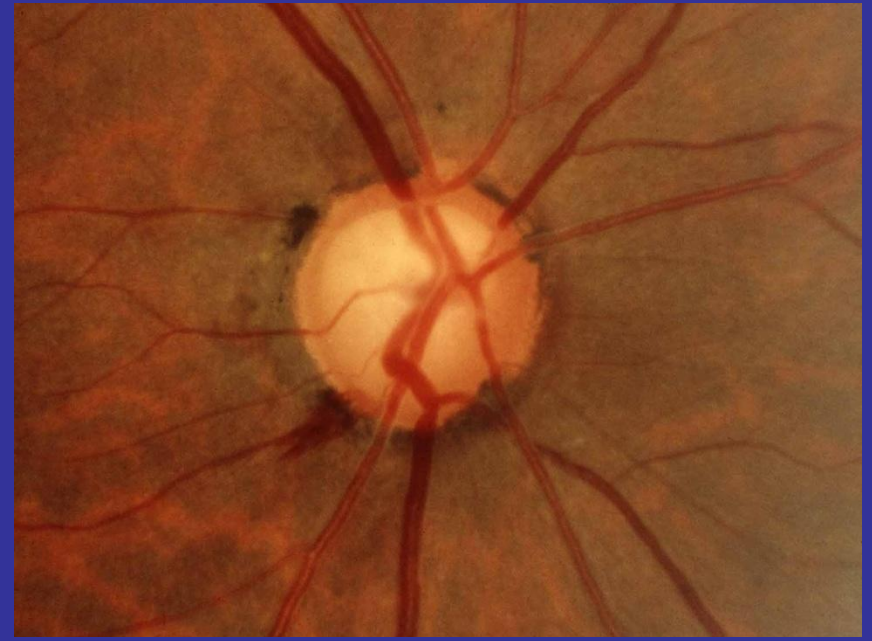
Asymmetric Optic Disc Cupping



Glaucomatous Optic Atrophy: Focal Atrophy



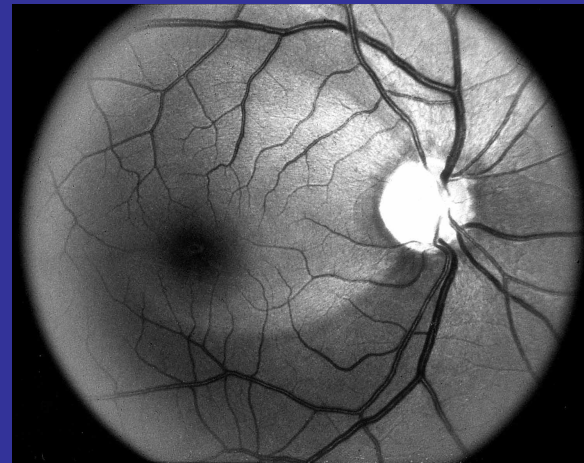
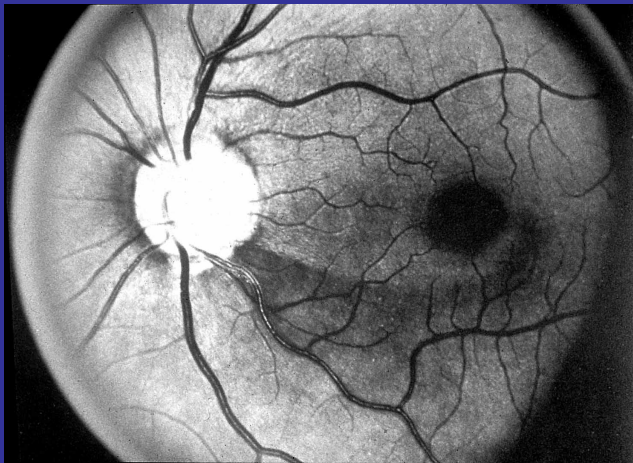
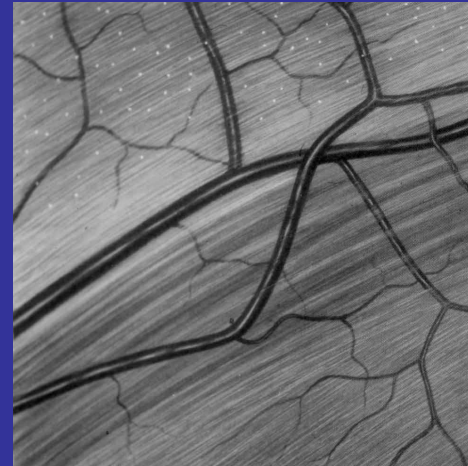
Glaucomatous Optic Atrophy: Disc Hemorrhages



Abnormal Optic Disc Cupping



Nerve Fiber Layer Loss in Glaucoma

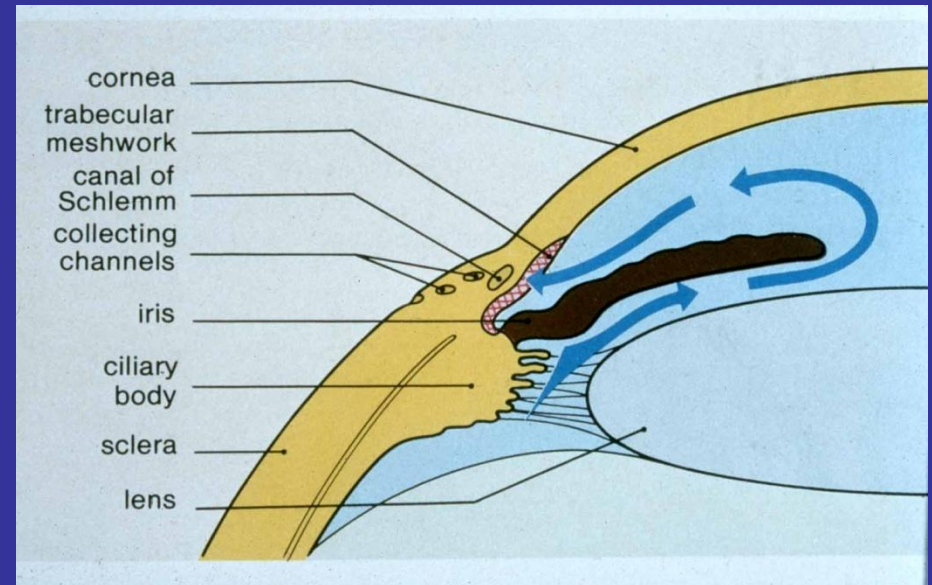


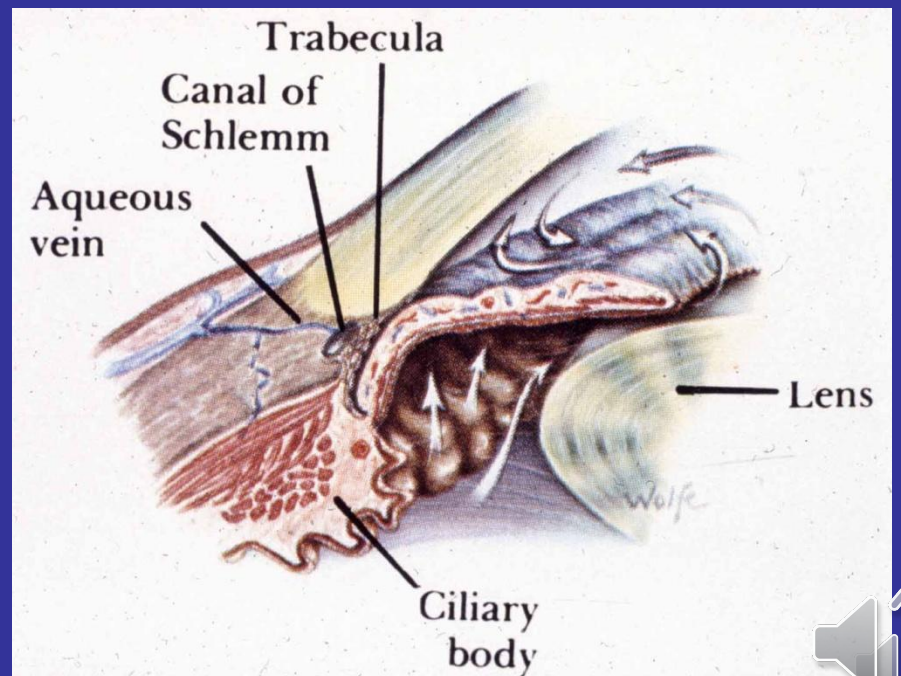
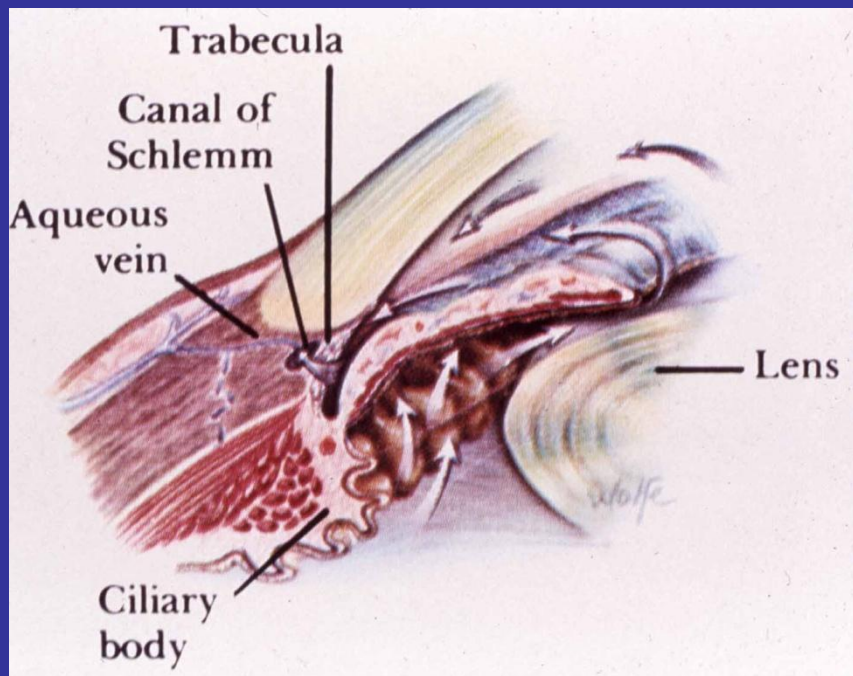
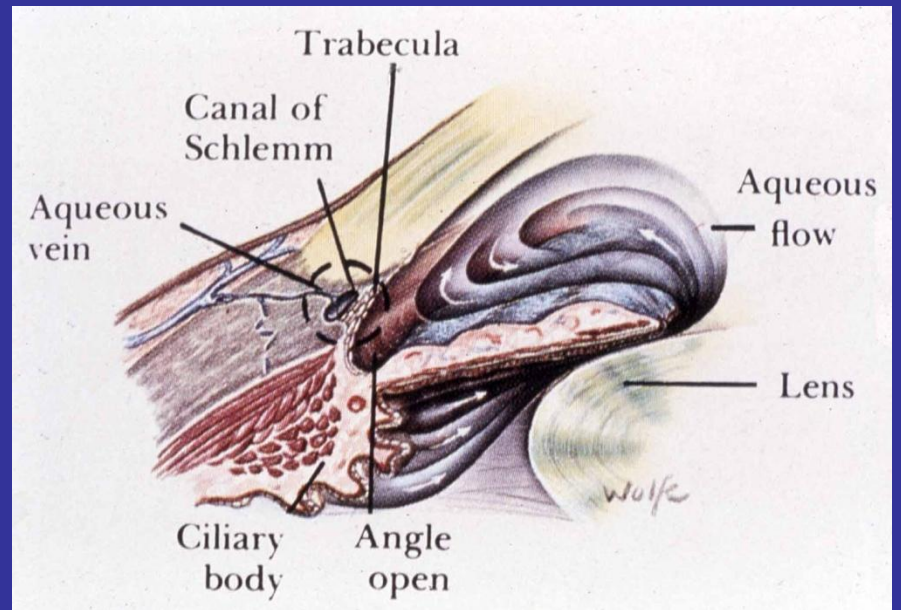
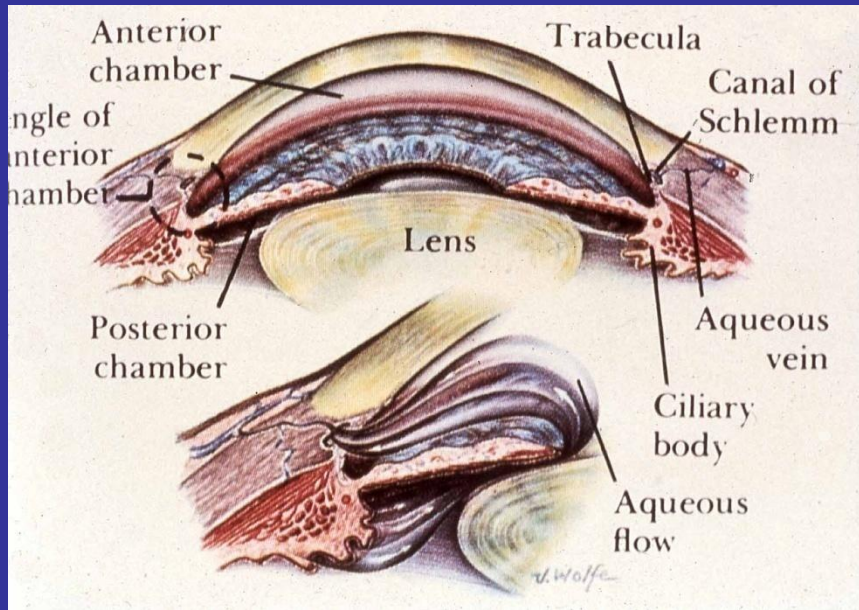
Pathophysiology of Elevated Intraocular Pressure

- Impaired aqueous humor outflow
- Three major mechanisms
 - Open-angle glaucoma: cellular or functional abnormality in trabecular meshwork region
 - Angle closure glaucoma: obstruction by the iris
 - Congenital glaucoma: developmental angle anomaly



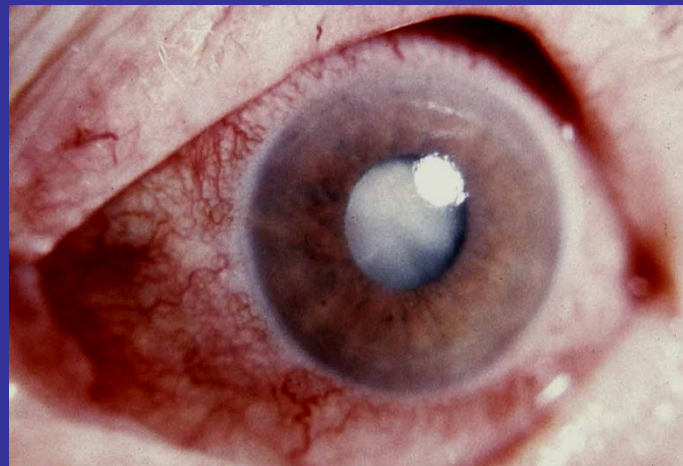
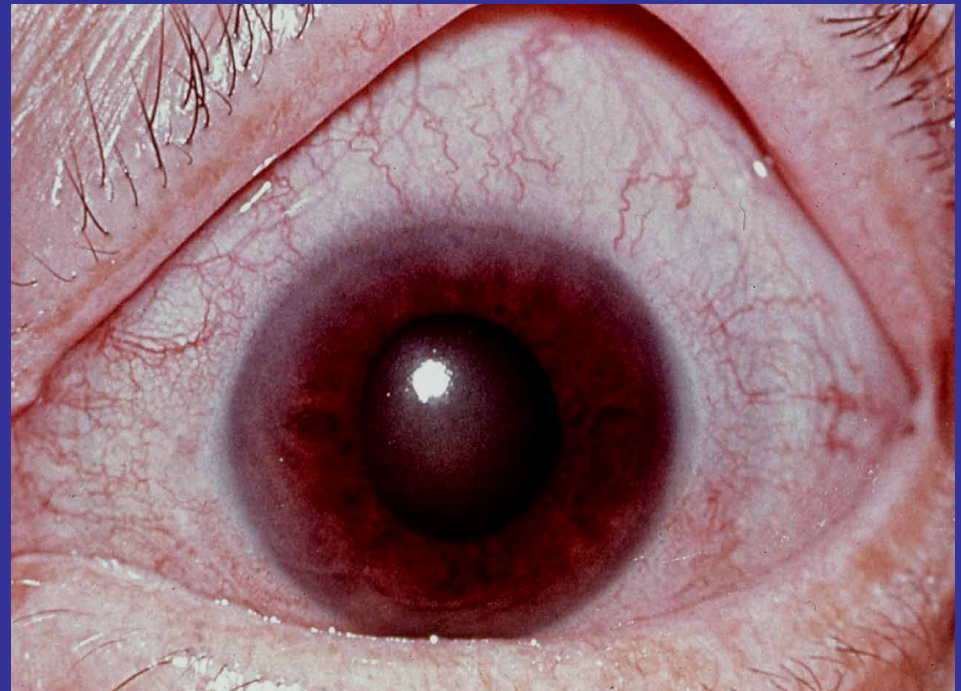
The Angle





Acute Angle-Closure Glaucoma

- Severe eye pain
- Headache
- Red eye – ciliary flush
- Corneal haze
- Fixed mid-dilated pupil
- Blurred Vision
- Halos around lights
- Nausea and vomiting



Precipitating Acute Angle Closure Glaucoma

- **Narrow anterior chamber angles predispose to acute angle closure glaucoma**
- **Pupil dilation can precipitate acute angle closure glaucoma**
 - **Topical drops: muscarinic antagonists, alpha adrenergic receptor agonists**
 - **Systemic medications: with similar actions, including antihistamines, anti-Parkinson drugs, anti-psychotics, GI spasmolytic agents, etc.**
- **Dim illumination**
- **Emotional stress**



Congenital Glaucoma



Presenting signs: large cloudy cornea
high intraocular pressures
tearing
blepharospasm



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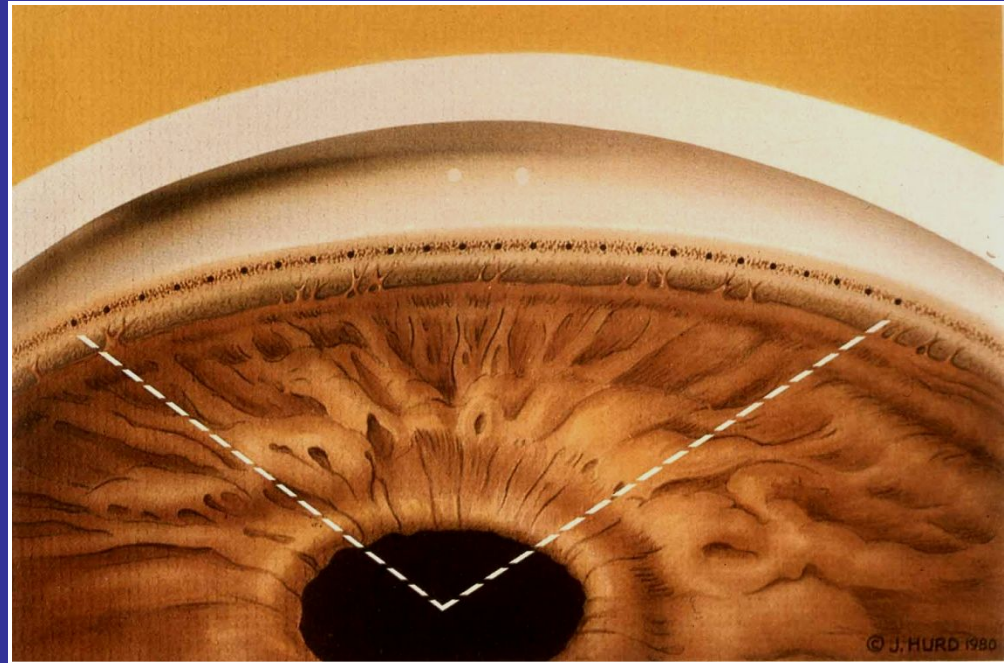


Treating Glaucoma

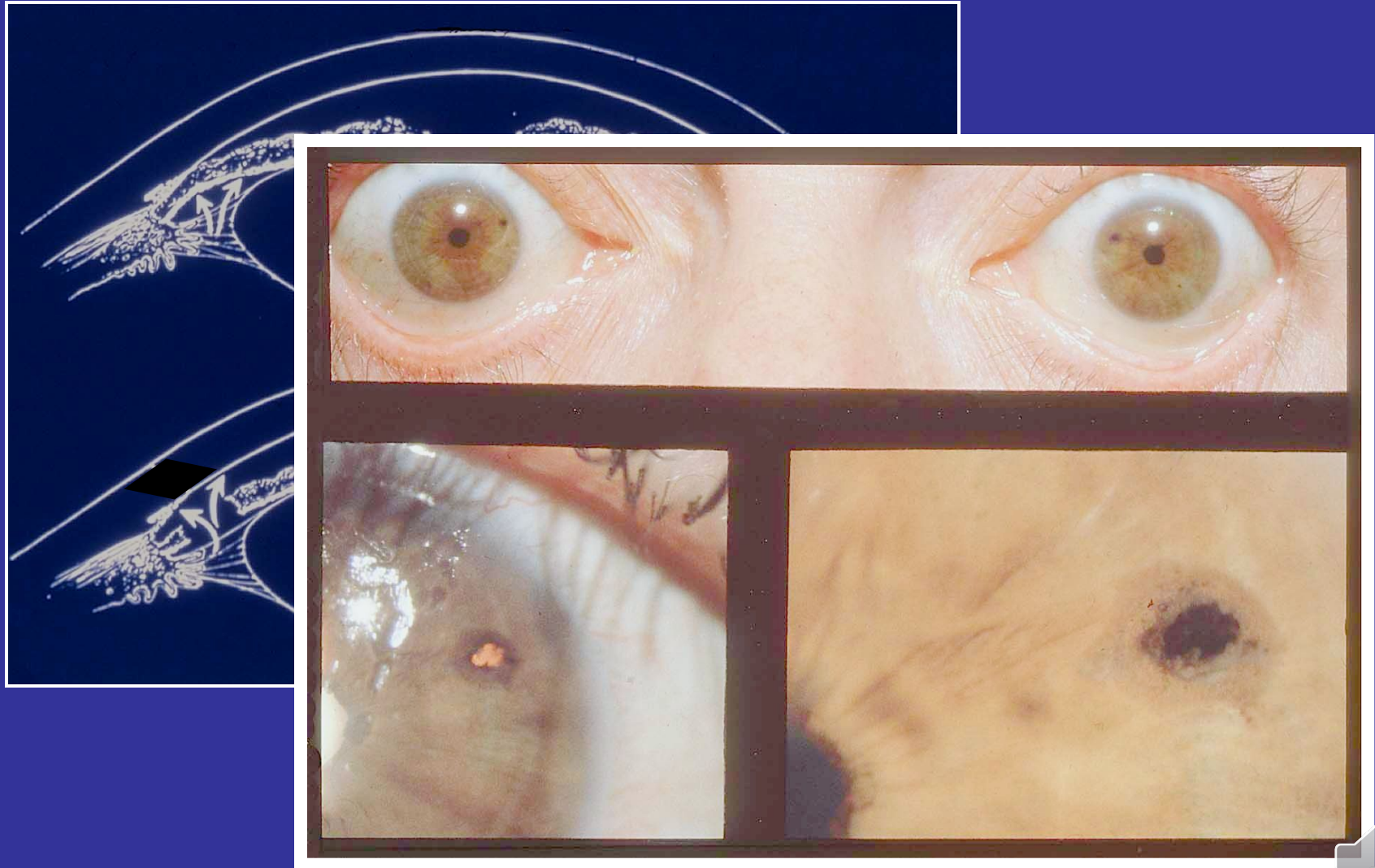
- **Medications – topical & systemic (oral)**
 - Many medications available
 - Dosage: 1, 2, 3, 4 times a day
 - Regimen: single, multiple
 - Many drug classes and mechanisms of action
- **Laser treatment**
 - Open angle – trabeculoplasty
 - Narrow angle- peripheral iridotomy
 - Either - cyclophotocoagulation
- **Surgery**



Open-Angle Glaucoma: Laser Therapy



Angle-Closure Glaucoma - Iridectomy

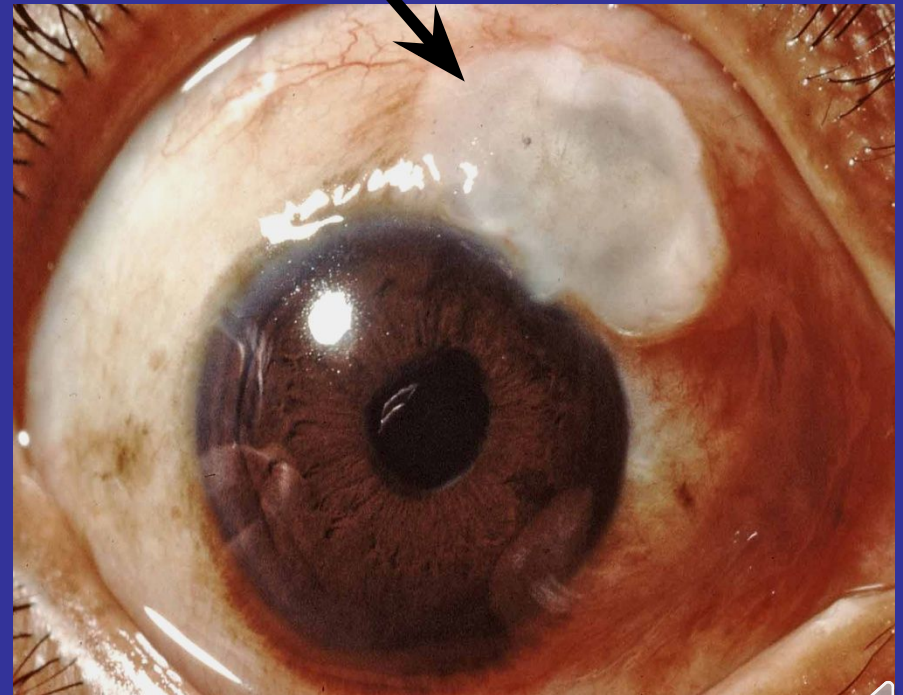
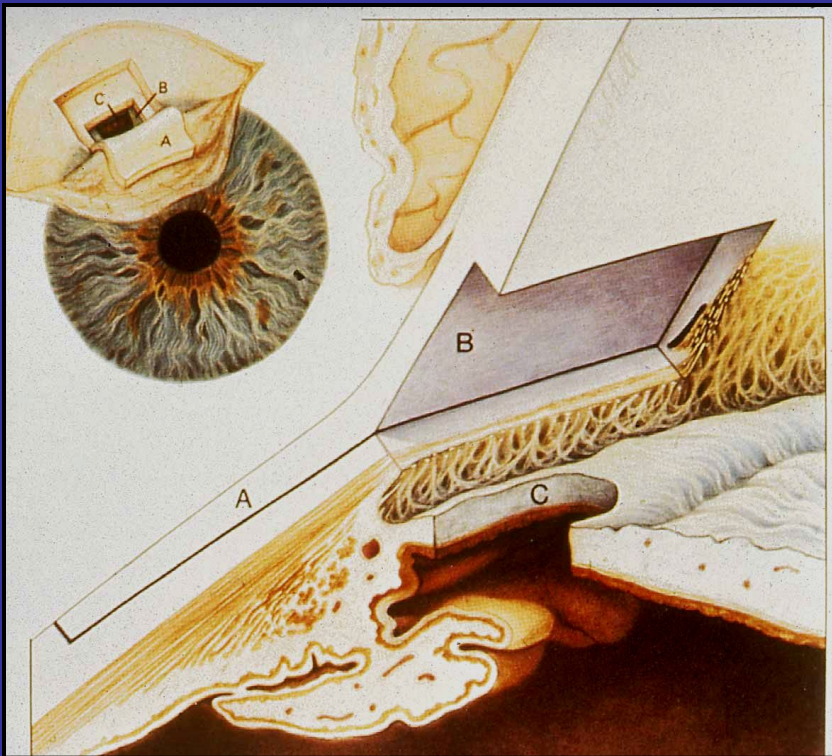


Glaucoma Surgery

Filtration surgery: most common approach

- channel from anterior chamber to subconjunctival space

bleb



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Topical Anti-glaucoma Drugs: Systemic Side Effects

Beta Adrenergic Receptor Blockers

- Congestive heart failure
- Brochospasm
- Bradycardia
- Depression, confusion
- Impotence
- Worsening of myasthenia gravis

Adrenergic Receptor Agonists

- Increased BP
- Tachyarrhythmias
- Tremor
- Headache
- Anxiety



Topical Anti-glaucoma Drugs: Systemic Side Effects/Contraindications

Carbonic Anhydrase Inhibitors

- Transient: paresthesia, urinary frequency
- Metallic taste in the mouth
- Urolithiasis
- GI upset
- Hypokalemia
- Blood dyscrasia
- Rare systemic effects with topicals
- Sulfa allergy
- Sickle cell

Parasympathetics

- Rare with standard doses
- Diaphoresis
- Pulmonary edema
- Leukocytosis
- Bronchospasm



Topical Anti-glaucoma Drugs: Systemic Side Effects

Prostaglandins

- Eyelash growth
- Darker iris color
- Hyperpigmentation of skin around eyes
- Orbital fat atrophy
- Not to be used in pregnancy

Rho Kinase inhibitors

(Rhopressa/netarsudil)

- Injection
- Verticillata



Topical Corticosteroid Drops

- **Complications – any age**
 - **Increased intraocular pressure**
 - Glaucoma patients
 - Relatives of glaucoma patients
 - Many others
 - **Corneal infections**
 - Reactivating latent herpes simplex
 - Bacterial
 - **Cataracts**
- **Same complications from systemic use**
- **Do *NOT* prescribe topical corticosteroids unless you are prepared to diagnose and treat their complications**
- **For all eye drops: Allergy, redness, blurring, stinging, dryness**



Glaucoma Awareness

- **Complex, under-diagnosed but common blinding diseases.**
- **Pay attention to the optic disc cup, or to the neurosensory rim of the disc.**
- **Eye drops are systemic medications.**
- **Systemic medications can affect the eye.**
- **Only ophthalmologists should prescribe topical corticosteroids.**
- **Encourage periodic routine eye exams.**

