



CLINICAL PRESENTATION
OF GLAUCOMA

DR. FAISAL ALMOBARAK
ASSISTANT PROFESSOR AND CONSULTANT
DEPARTMENT OF OPHTHALMOLOGY
COLLEGE OF MEDICINE AND KING SAUD UNIVERSITY
SAUDI ARABIA

INTRODUCTION

- Glaucoma is a heterogenous group of diseases with characteristic ONH damage and VF changes
- IOP is the single factor to be controlled

INTRODUCTION

AQUEOUS HUMOR

Produced by the non-pigmented ciliary epithelium

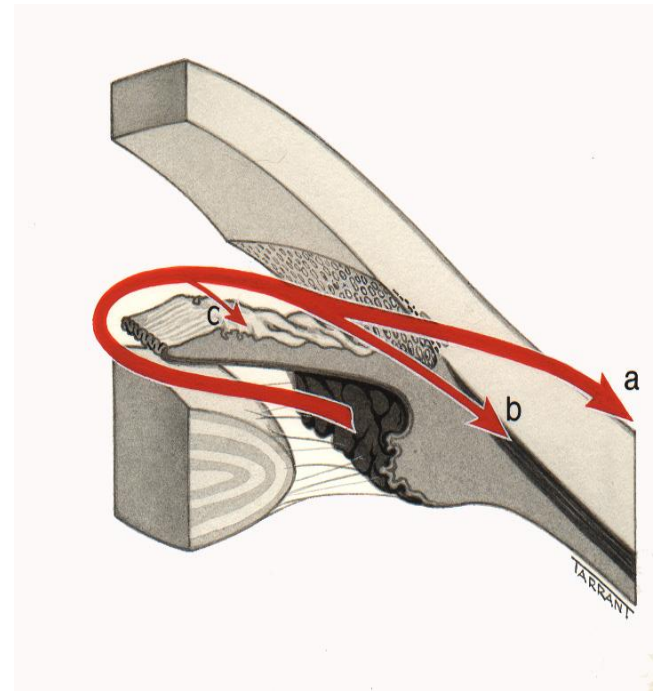
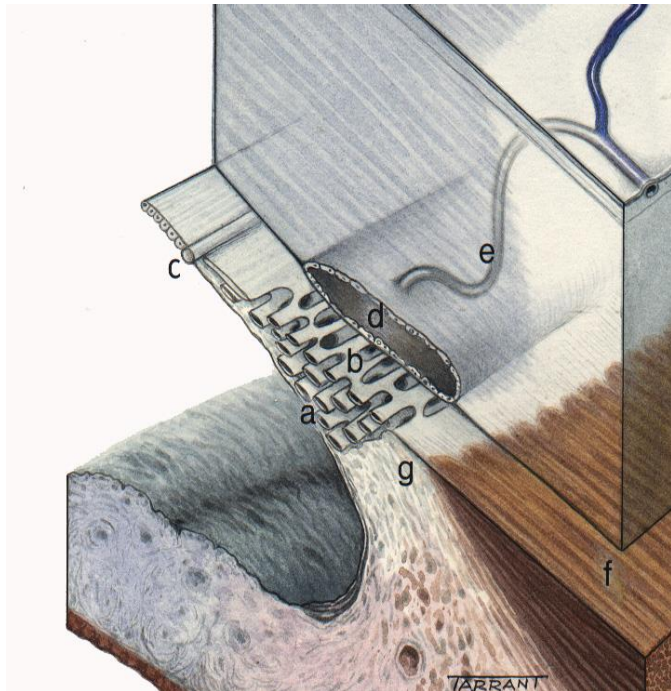
- Active secretion:
 1. Na/K ATPase
 2. Cl secretion
 3. Carbonic anhydrase
- Passive secretion
 1. Ultrafiltration
 2. Diffusion

Production rate is 2-3 μ L/min

INTRODUCTION

AQUEOUS HUMOR

Aqueous outflow



INTRODUCTION

CLINICAL ASSESMENT

- VA
- IOP
- SLE
- Gonioscopy
- ONH assessment
- Diagnostics: VF, OCT, Pachymetry...

INTRODUCTION

IOP

Aqueous secretion = Aqueous outflow

$$P_o = (F/C) + P_v$$

Symbol	Means	Value	Measurement
P_o	IOP	10-21 mmHg	Tonometry
F	Aqueous production	2-3 $\mu\text{L}/\text{min}$	Fluorophotometry
C	Outflow facility	0.22-0.28 $\mu\text{L}/\text{min}/\text{mmHg}$	Tonography
P_v	Episcleral venous pressure	8-12 mmHg	

INTRODUCTION

IOP Measurement

Applanation

- Imbert-Fick principle: $P=F/A$

1. Goldmann



2. Perkins



3. Tonopen



4. Pneumotonometer



Indentation

- Schiotz



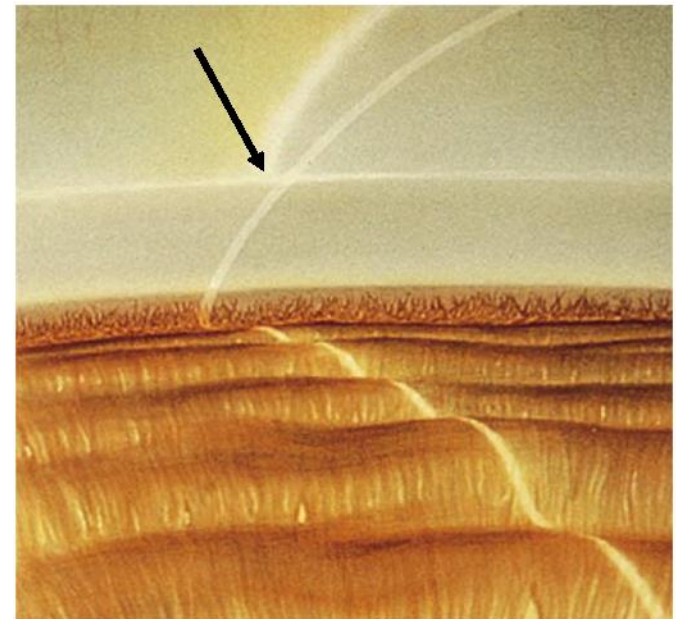
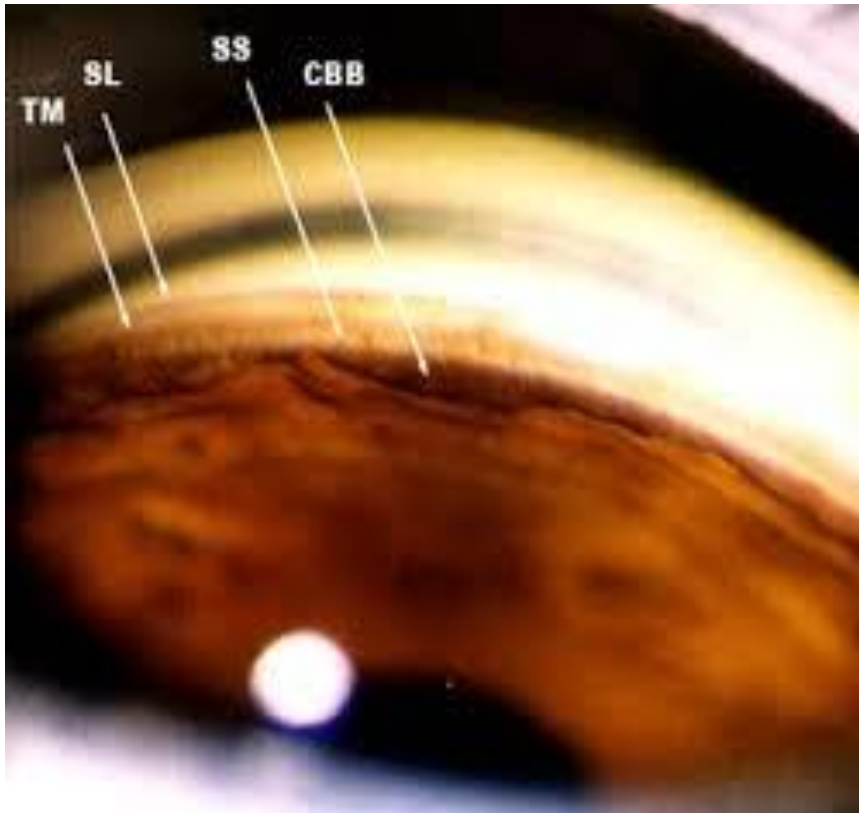
Noncontact

- Air puff



INTRODUCTION

Gonioscopy

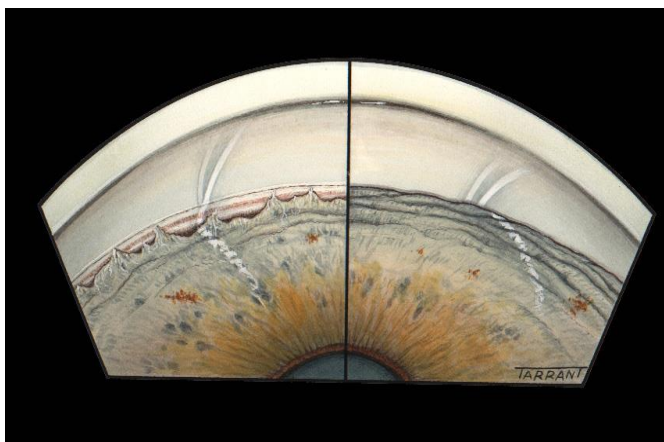


INTRODUCTION

Gonioscopy

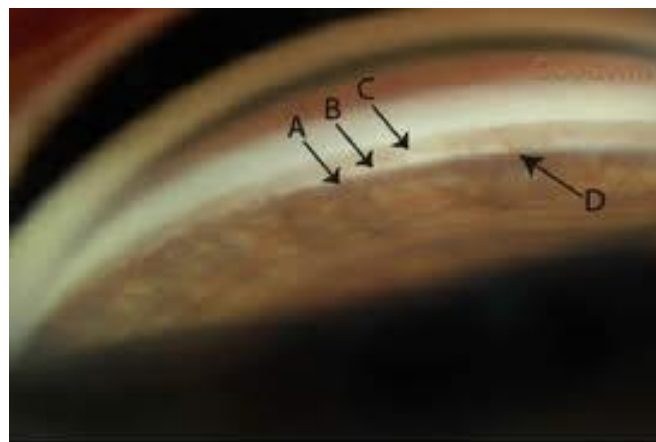
IS THE IRIS

Covering TM



CLOSED

Not covering TM



OPEN

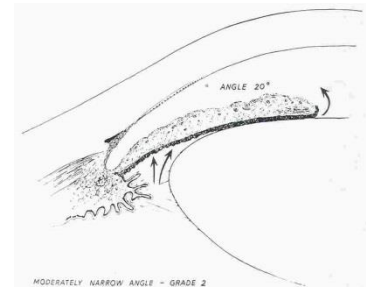
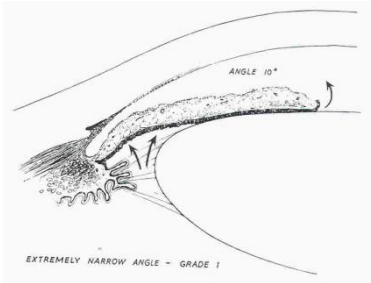
INTRODUCTION

Scheie:

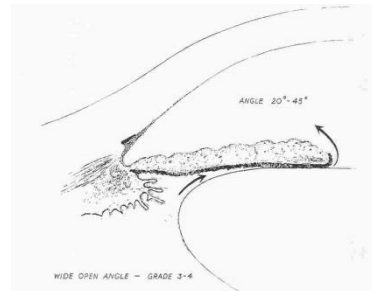
1. Grade 1: CB seen
2. Grade 2: SS seen
3. Grade 3: ATM seen
4. Grade 4: TM not seen

Shaffer

1. Grade 1: 10% open
2. Grade 2: 20% open



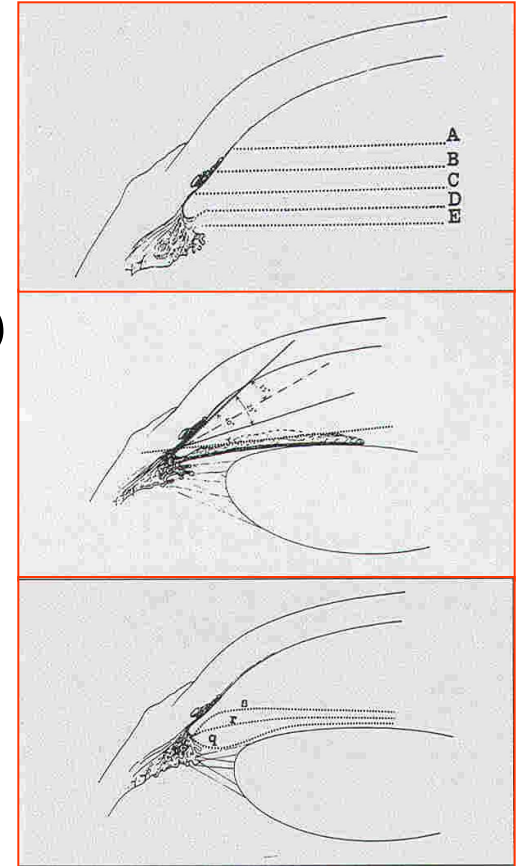
3. Grade 3: 30% open
4. Grade 4: 40% open



INTRODUCTION

Spaeth

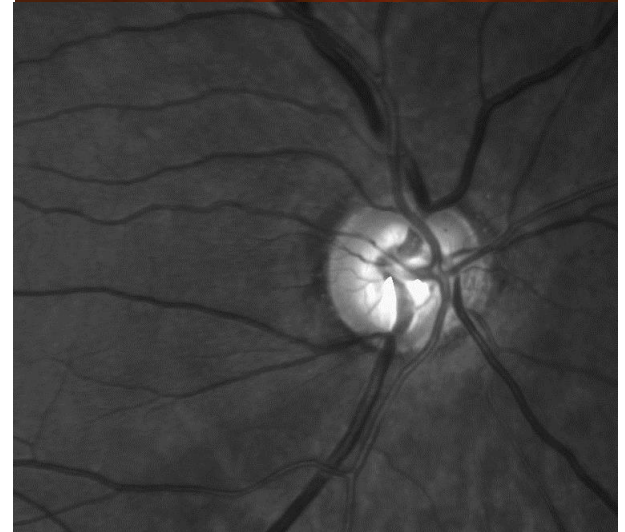
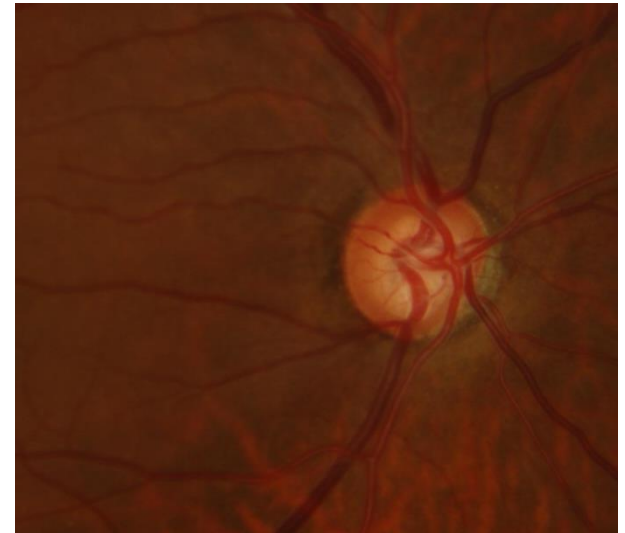
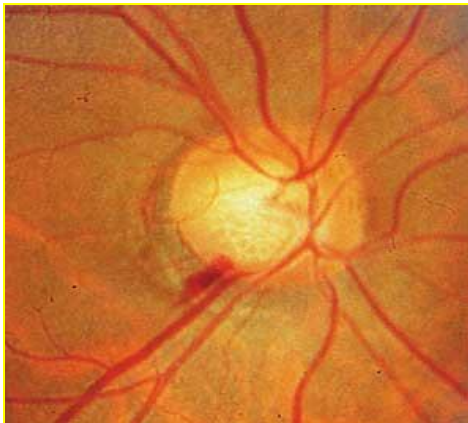
1. Iris insertion: A, B, C, D, E
2. Iridocorneal angle width in degrees (5-45)
3. Peripheral iris configuration: r, s, q
4. TM pigmentation: 0-4



INTRODUCTION

ONH complex evaluation

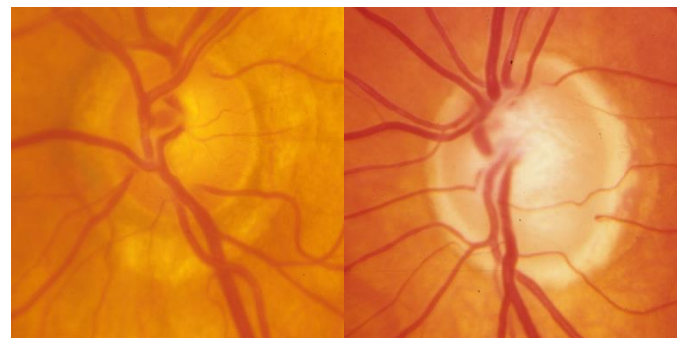
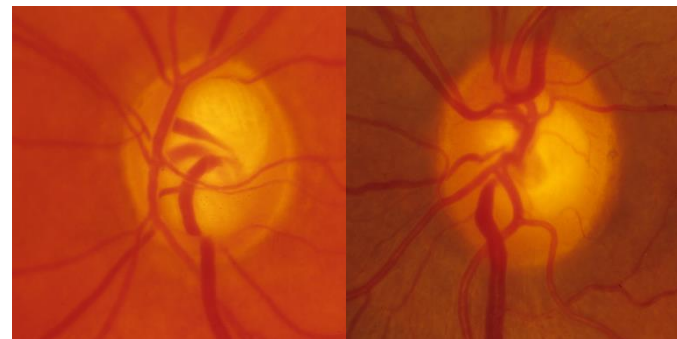
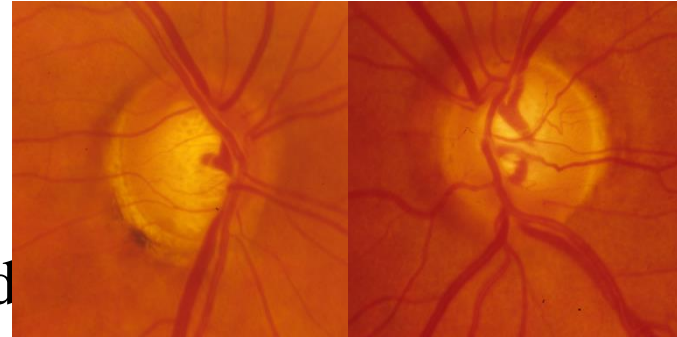
- Disc margin and disc diameter
- Neuroretinal rim
- Cup/disc ratio
- Disc size
- PPA
- NFL defect
- Optic disc haemorrhage



INTRODUCTION

ONH patterns

- **Focal**: areas of localized loss of rim in superior and/or inferior poles, the remaining rim relatively well preserved
- **Diffuse**: concentric enlargement of the cup with no localized loss. Small PPA can be present
- **Sclerotic**: saucerized, shallow cup with pale rim and moth-eaten appearance. PPA surrounding most of the disc.



Classification of Glaucoma

Aetiology



Primary

- No detectable reason
- Often bilateral

Secondary

- Predisposing factor
- Often unilateral

Angle



Open

Closed

Combined Mechanism

Primary Open Angle Glaucoma

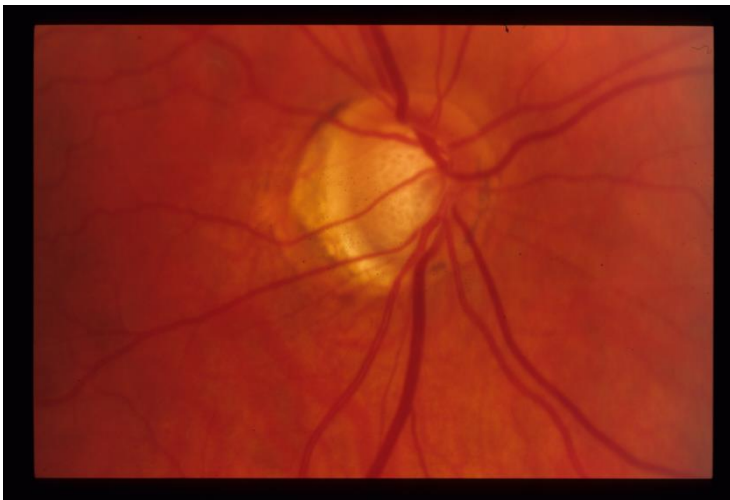
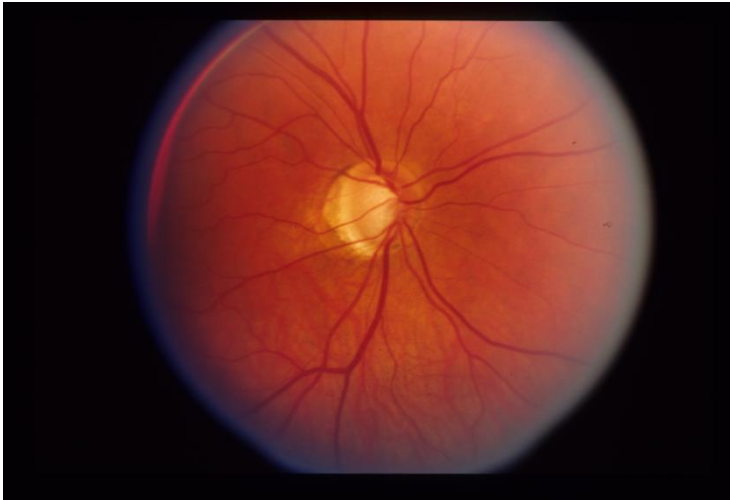


IOP > 21 mmHg

IOP ≤ 21 mmHg
(NTG)

- Progressive bilateral asymptomatic disease. Vision later !
- **Risk factors:**
 - Age
 - Race
 - Family history
 - DM
 - Low perfusion pressure
 - Myopia
 - Retinal diseases

Primary Open Angle Glaucoma

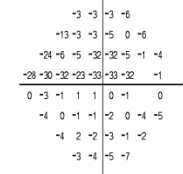
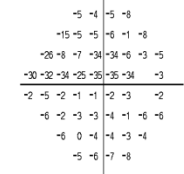
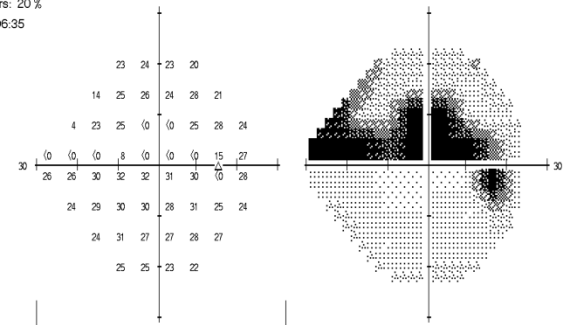


Single Field Analysis Eye: Right
 Name: LOCKE, STEVEN J DOB: 17-01-1961
 ID: 1040300

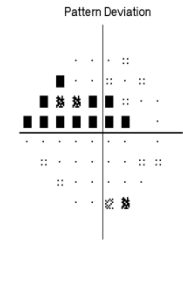
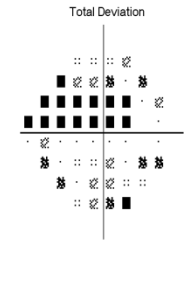
Central 24-2 Threshold Test

Fixation Monitor: Gaze/Blind Spot	Stimulus: III, White	Pupil Diameter: 5.3 mm	Date: 16-01-2006
Fixation Target: Central	Background: 31.5 ASB	Visual Acuity: 6/6	Time: 10:18 AM
Fixation Losses: 0/17	Strategy: SITA-Standard	RX: +0.00 DS DC X	Age: 44
False POS Errors: 0%			
False NEG Errors: 20%			
Test Duration: 06:35			

Fovea: 37 dB



GHT
 Outside Normal Limits
 VFI 69%
 MD -10.19 dB P < 0.5%
 PSD 12.77 dB P < 0.5%



:: < 5%
 ○ < 2%
 ◐ < 1%
 ■ < 0.5%

Visual Function 2111
 Ophthalmology Research

TOLERATED WELL

Secondary Open Angle Glaucoma

Pre-Trabecular

(Membrane on TM)

- Fibrovascular
- Endothelial
- Epithelial
- Fibrous
- Inflammatory

Trabecular

(Particle clogging TM)

- RBC, degenerated
- WBC
- Proteins
- Pigments
- PXF
- OVD-Silicon
- Lens material
- Vitreous

(TM changes)

- Edema (uveitis)
- Tear, scar
- Toxicity
- Laser

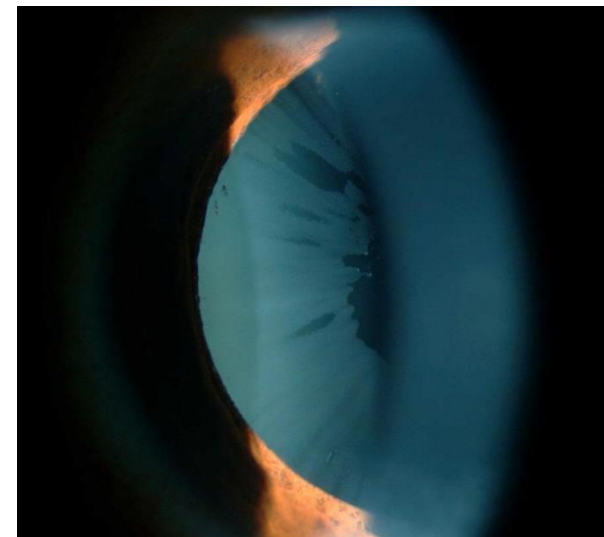
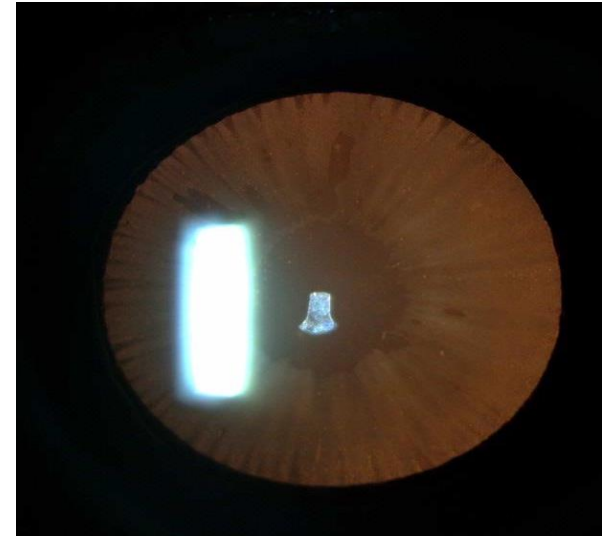
Post-Trabecular

(Increased ESVP)

- SVC obstruction
- C-C fistula
- Sturge-Weber syndrome
- Thyroid eye disease

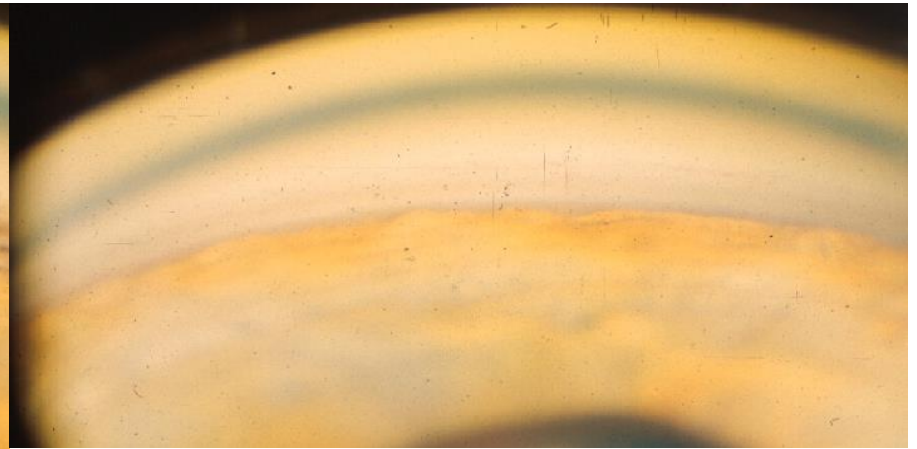
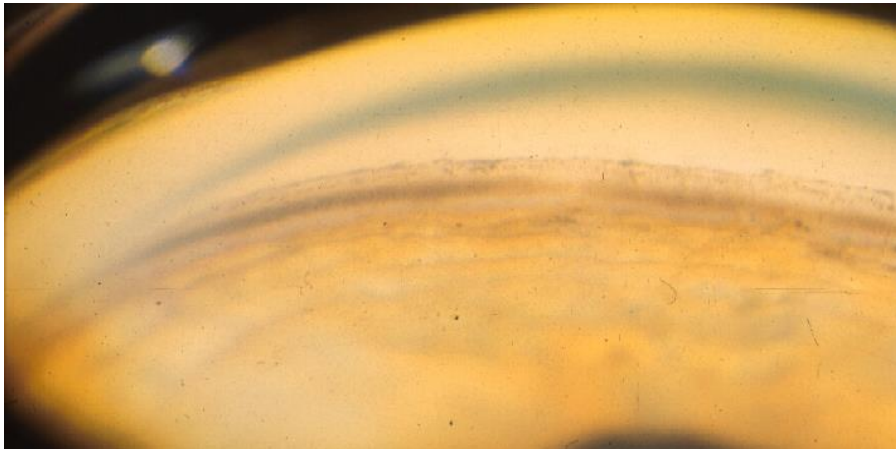
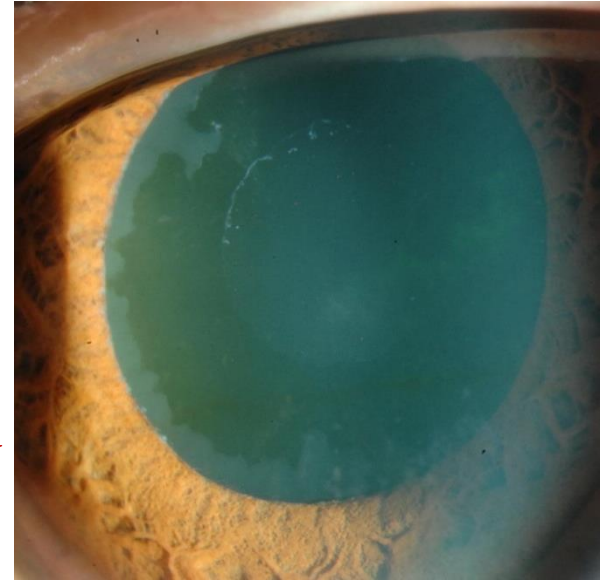
PXF Glaucoma

- Unilateral (mostly) or bilateral
- 6th-7th decade
- asymptomatic, later vision drops.
- PXF more in females
- Males are at higher risk for glaucoma
- Fibrillogranular, extracellular matrix material
- Higher initial IOP than POAG
- Can have spikes despite open angle



PXF Glaucoma

- Cornea: guttata, pigments (krukenberg)
- AC: mild flare
- Iris: PXF on pupil margin, moth-eaten TID
- Gonioscopy:
 - I. Open angle: patchy, dark hyperpigmented TM, dandruffs, Sampaolesi's line
 - II. Closed angle: combined mechanism



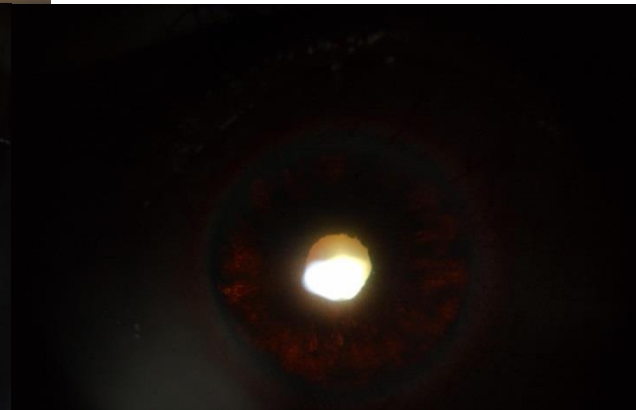
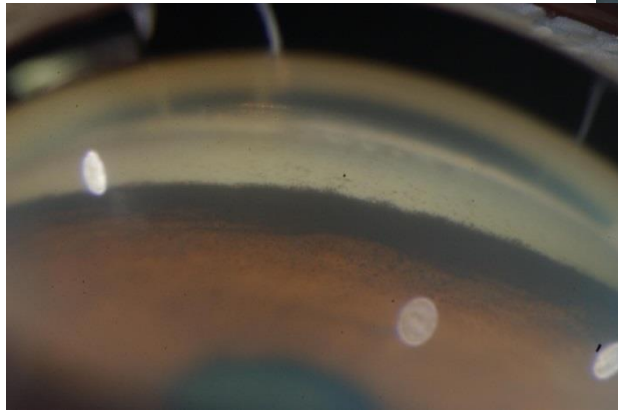
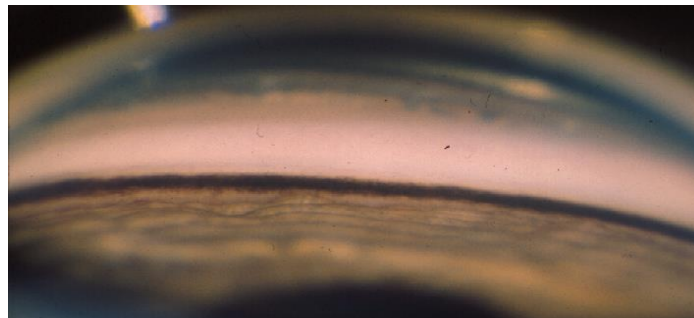
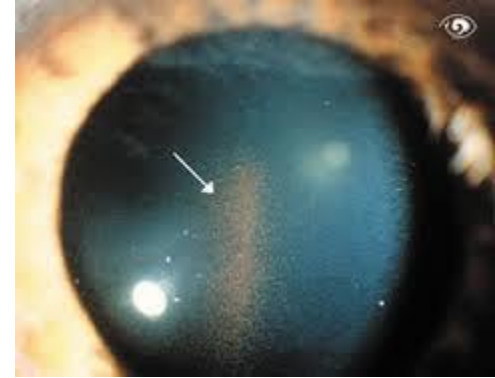
Pigmentary Glaucoma

- Bilateral
- White, myopic males (M:F, 2:1)
- 3rd-4th decade
- Reverse pupillary block: mechanical rubbing of posterior pigment layer of iris against the zonules.
- Pigments obstructs TM, denudation, collapse and sclerosis
- Sudden liberation of pigments cause halos, corneal edema, pain
- Unstable IOP with wide fluctuations



Pigmentary Glaucoma

- Cornea: krukenberg's spindle
- AC: very deep, pigments
- Iris: peripheral TID, pigments
- Asymmetrical pupils
- Gonioscopy: widely opened with hyperpigmented TM all over

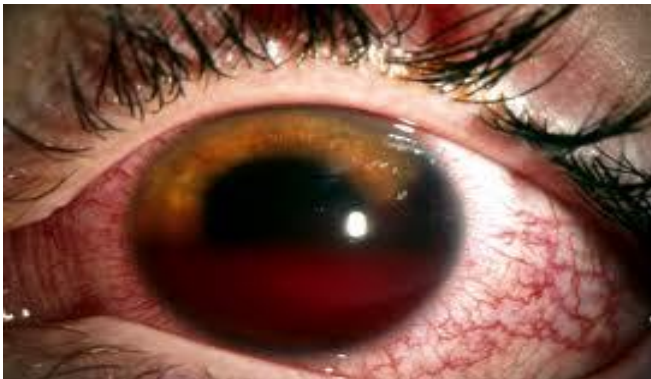


Steroid Induced Glaucoma

- Risk factors:
 - Open angle glaucoma
 - Family history of glaucoma
 - DM
 - High myopia
- Topical steroids have greater IOP rising effect than systemic steroids
 - High IOP
 - Open angle
 - Glaucomatous disc damage

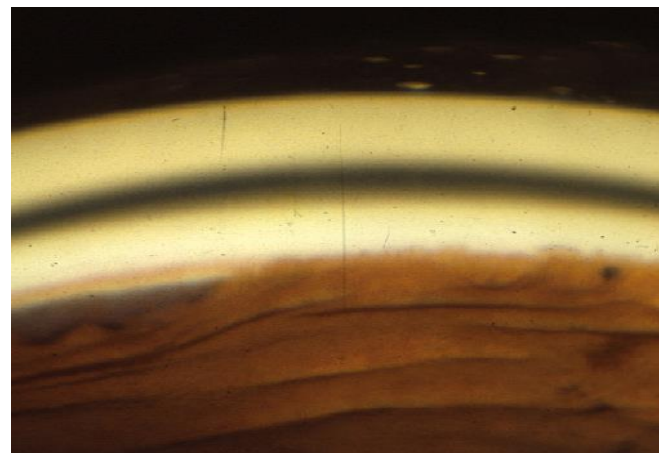
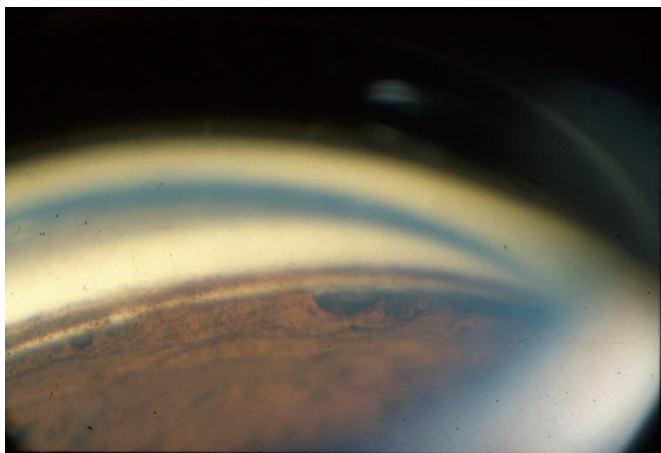
Red Cell Glaucoma

- Trabecular blockage by RBCs
- Usually follows trauma
- Sicklers at higher risk of complications
- The larger the size, the higher the incidence of glaucoma:
 - I. 27% risk with $\frac{1}{2}$ AC hyphema
 - II. 52 % risk with total hyphema
- Need to R/O angle recession
- GONIOSCOPY



Angle Recession Glaucoma

- Tear between longitudinal and circular fibers of ciliary muscles
- Breaks in posterior TM result in scarring
- 60-90% of traumatic hyphema
- 5% develop glaucoma
- High IOP
- Open angle, enlarged CB band, torn iris processes
- Glaucomatous disc damage



Primary Angle Closure Glaucoma

PAC

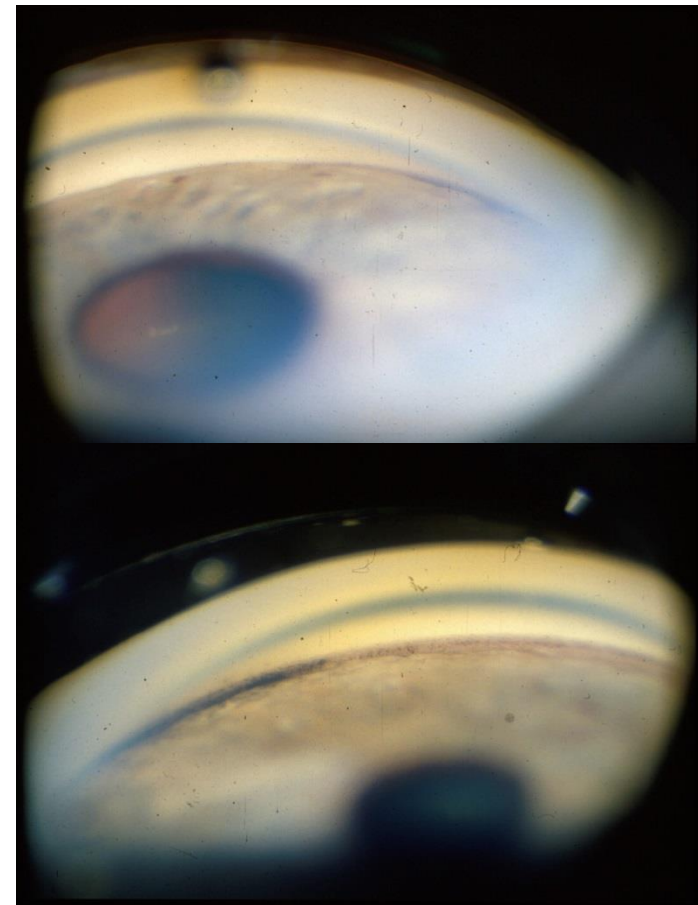
- Anatomically predisposed eye

PACG

- PAC
- ONH damage

Anatomic factors

- Anterior location of iris-lens diaphragm
- Shallow AC
- Narrow angle
- Short AL
- Hyperope
- Small corneal diameter
- Lens size



Primary Angle Closure Glaucoma

Classification

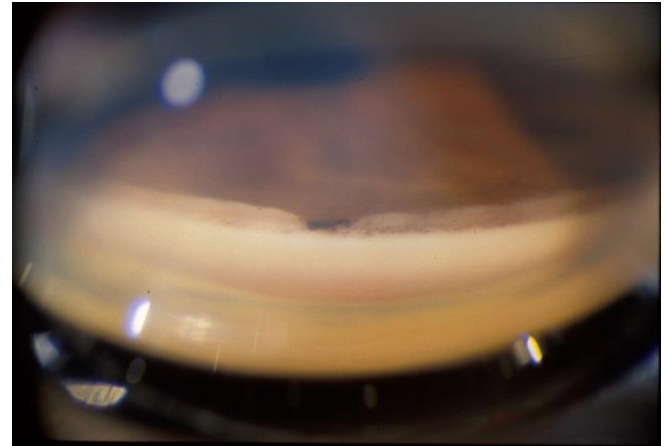
- Angle closure suspect
 - Asymptomatic
 - Anatomically predisposed eye
 - Shallow AC
 - Appositionally closed angle, open with indentation
- Intermittent angle closure glaucoma
 - Rapid closure of angle with pupillary block and high IOP
 - Spontaneously relieved
 - Transient blurry vision and halos
 - No redness

Primary Angle Closure Glaucoma

- Acute angle closure glaucoma
 - Visual loss with sudden pain and redness
 - Nausea and vomiting
 - High IOP
 - Ciliary flush
 - Corneal edema
 - Shallow AC with peripheral IC contact
 - AC cells and flare
 - Fixed, mid-dilated pupil
 - Closed angle. GONIOSCOPE THE OTHER EYE

Primary Angle Closure Glaucoma

- Primary (chronic) angle closure glaucoma
 - Asymptomatic
 - Gradual closure of angle cause slow IOP rise
 - Have large VF loss
 - Gonioscopy: variable amount of angle
 - ONH damage (pallor!)



Plateau Iris



```
graph TD; A[Plateau Iris] --> B[Configuration]; A --> C[Syndrome];
```

Configuration

- Anterior position of CP results in:
 - Deep AC
 - Narrow angle
 - Flat iris plane

Syndrome

- Younger age than pupillary block ACG
- Acute angle closure post pupil dilation or spontaneously
- Punched up peripheral iris after dilation and closing TM:
 - **Patent PI**
 - Deep AC
 - Flat iris

Uveitic Glaucoma

- IOP rise: transient Vs. persistent
- Chronicity and severity of disease
- Topical steroids role !!
- IOP fluctuation is significant
- CB shutdown: especially with acute exacerbation of chronic anterior uveitis. Permanent angle damage
- Miotic pupil and media opacities affect disc assessment

Uveitic Glaucoma

Uveitic Angle Closure Glaucoma With Pupillary Block

- Inflamed iris easily stick to pupil causing 360° posterior synechia
- Anterior bowing of peripheral iris (iris bombé) cause the peripherally inflamed iris to easily stick to TM and cornea and the development of PAS
- Uncommon
- IOP mostly normal (CB shutdown)
- iris bombé
- Shallow AC
- Gonioscopy: PAS
- ONH damage

Uveitic Glaucoma

Uveitic Angle Closure Glaucoma Without Pupillary Block

- Deposition of inflammatory cells and debris in angle
- Contraction of inflammatory membrane will pull peripheral iris over TM and cause progressive PAS
 - Deep AC
 - Gonioscopy: extensive PAS
 - ONH damage



Uveitic Glaucoma

Uveitic Open Angle Glaucoma

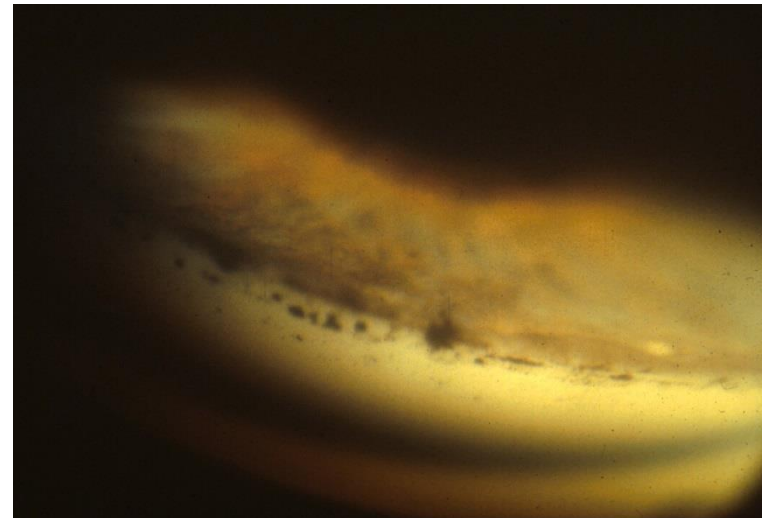


Acute Anterior Uveitis

- CB shutdown
- IOP is usually normal
- Steroid effect
- **Trabecular obstruction:**
- ✓ inflammatory cells and debris
- ✓ Increased aqueous viscosity
- **Acute trabeculitis:**
- ✓ Inflammation and edema of TM

Chronic Anterior Uveitis

- Chronic trabeculitis cause trabecular scarring/sclerosis
- Gelatinous exudate in angle
- Might have PAS later



Uveitic Glaucoma

- Posner-Schlossman syndrome
 - Recurrent attacks of unilateral, acute high IOP with mild uveitis
 - Acute trabeculitis. ?? Viral
 - More in males
 - IOP rise hours to days
 - May shift to chronic course
 - Mild discomfort, halos and blurry vision
 - Corneal edema
 - High IOP (> 40 mmHg)
 - White KPs
 - Few cells and flare
 - Gonioscopy: open angle

Uveitic Glaucoma

- Fuchs uveitis syndrome
 - No posterior synechia
 - Stellate KPs
 - Mild uveitis
 - Gonioscopy
 - ✓ Fine radial vessels
 - ✓ Small irregular PAS
 - ✓ Membrane covering the angle

Neovascular Glaucoma

- Severe, chronic retinal ischemia produces VEGF in an attempt to re-vascularize ischemic areas
- VEGF diffuses to AC
- Causes:
 - DR
 - Ischemic CRVO
 - Chronic RD
 - Chronic inflammation
 - CRAO
 - Carotid occlusive disease
 - Intraocular tumors

Neovascular Glaucoma

Rubeosis irides

(Early stage)

- Tiny capillary tufts at pupil margin
- Grows toward the angle
- Normal IOP
- Open angle
- RVO,CRAO: might have NVA without NVI

2°OAG

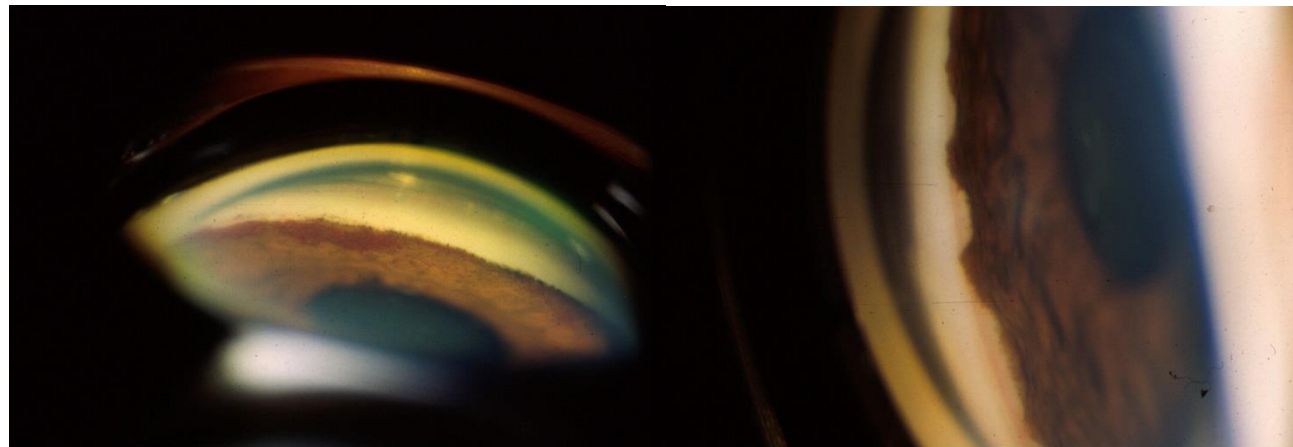
(Intermediate stage)

- NV grows over iris root
- FV membrane over CB and scleral spur to angle
- FV membrane block TM
- High IOP
- Open angle

2°ACG

(Advance stage)

- Contraction of FV membrane cause PAS
- Progress in zipper-like fashion
- ✓ Sever visual loss
- ✓ Pain and redness
- ✓ Very high IOP



Lens Related Glaucoma

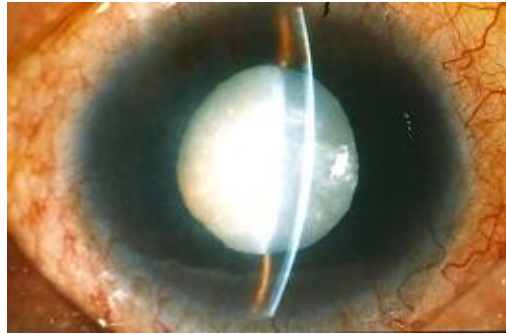
Lens protien

- Hypermature cataract
- HMW protein leak through intact capsule + macrophage containing lens proteins blocks TM
- ✓ Pain, already poor VA
- ✓ Corneal edema
- ✓ Deep AC with white particles and pseudohypopyon
- ✓ Open angle



Phacomorphic

- Increased size of intumescent cataract
- Pupillary block
- ✓ Symptoms like AACG
- ✓ Same findings as AACG + intumescent cataract



Phaco-anaphylactic

- Leaking lens material through opened lens capsule

