GLAUCOMA

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Department of Ophthalmology
GMCH-32

What is Glaucoma?

- Glaucoma is a progressive optic neuropathy with characteristic appearance of the optic disc and specific pattern of visual field defects , irrespective of IOP level .

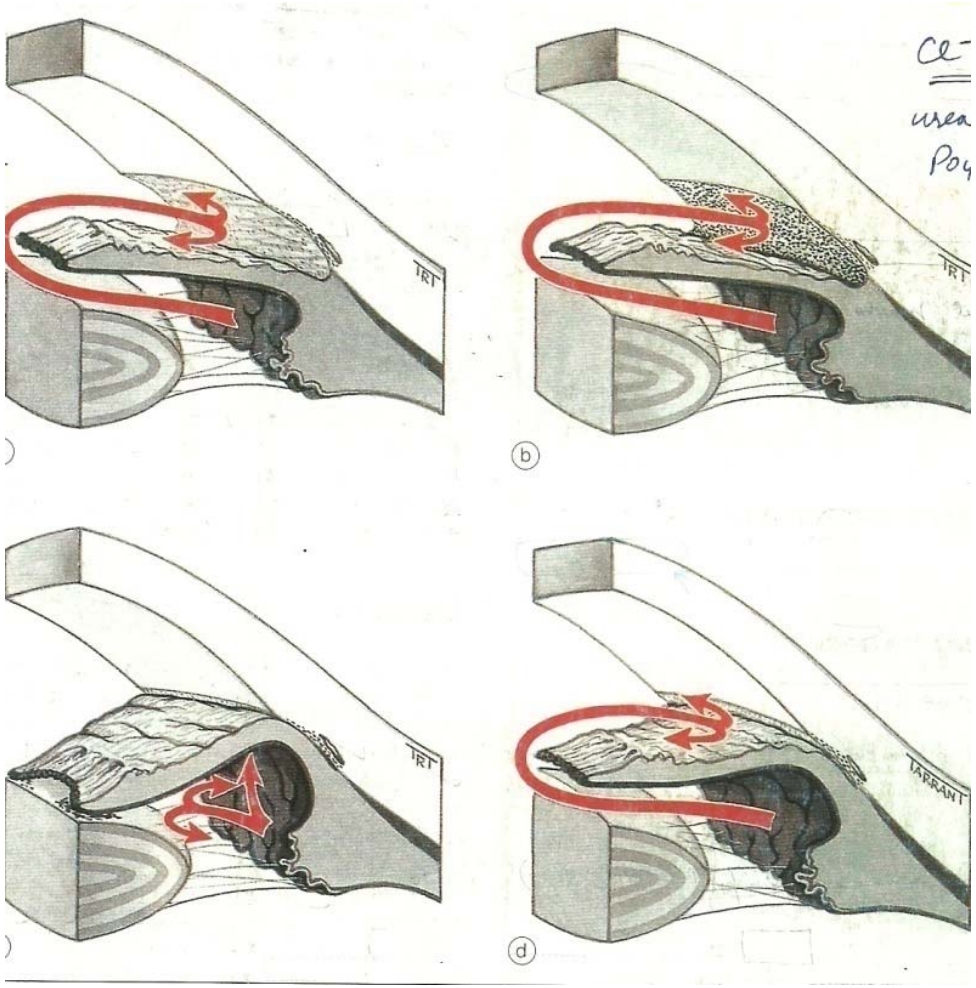
Physiology of aqueous production

CiliaryBody: Ant Pars plicata (2mm wide)
Post Pars plana (4mm wide)

Aqueous humor is actively secreated by non pigmented epithelium of ciliary processes

Trabecular Meshwork: Uveal meshwork
Corneoscleral meshwork
Endothelial(juxtacanalicular)meshwok

Pathogenesis of Sec. Glaucoma



Outflow of aqueous

- Posterior chamber – via pupil – Anterior chamber – exits eye by 2 routes :
  - Trabecular (conventional) route : 90%
  - Uveoscleral (unconventional) route : 10%

Factors determining IOP

- Rate of aqueous secretion
- Rate of aqueous outflow – difference between the IOP and episcleral venous pressure
- Normal range of IOP 11-21mm Hg

Investigations

- Visual acuity and refractive state
- Slit-lamp biomicroscopy (optic disc; 90D)
- Goldmann Applanation tonometry
- Gonioscopy
- Perimetry
- OCT

Tonometry

- Indentation tonometry : Schiotz
- Applanation tonometry :
  - Goldmann
  - Perkin
  - Mackey Marg
  - Tonopen
- Non contact tonometry : Airpuff

  Pulsair 2000 Keeler

- Applaanation tonometry based on Imbert-Fick principle : For an ideal, dry, thin walled sphere, pressure inside sphere (P) equals force needed to flatten its surface(F) divided by area of flattening (A) - 3.06mm Goldmann tonometry

Angle of anterior chamber

- Formed by root of iris , anterior most part of ciliary body , scleral spur , trabecular meshwork and schwalbe line.

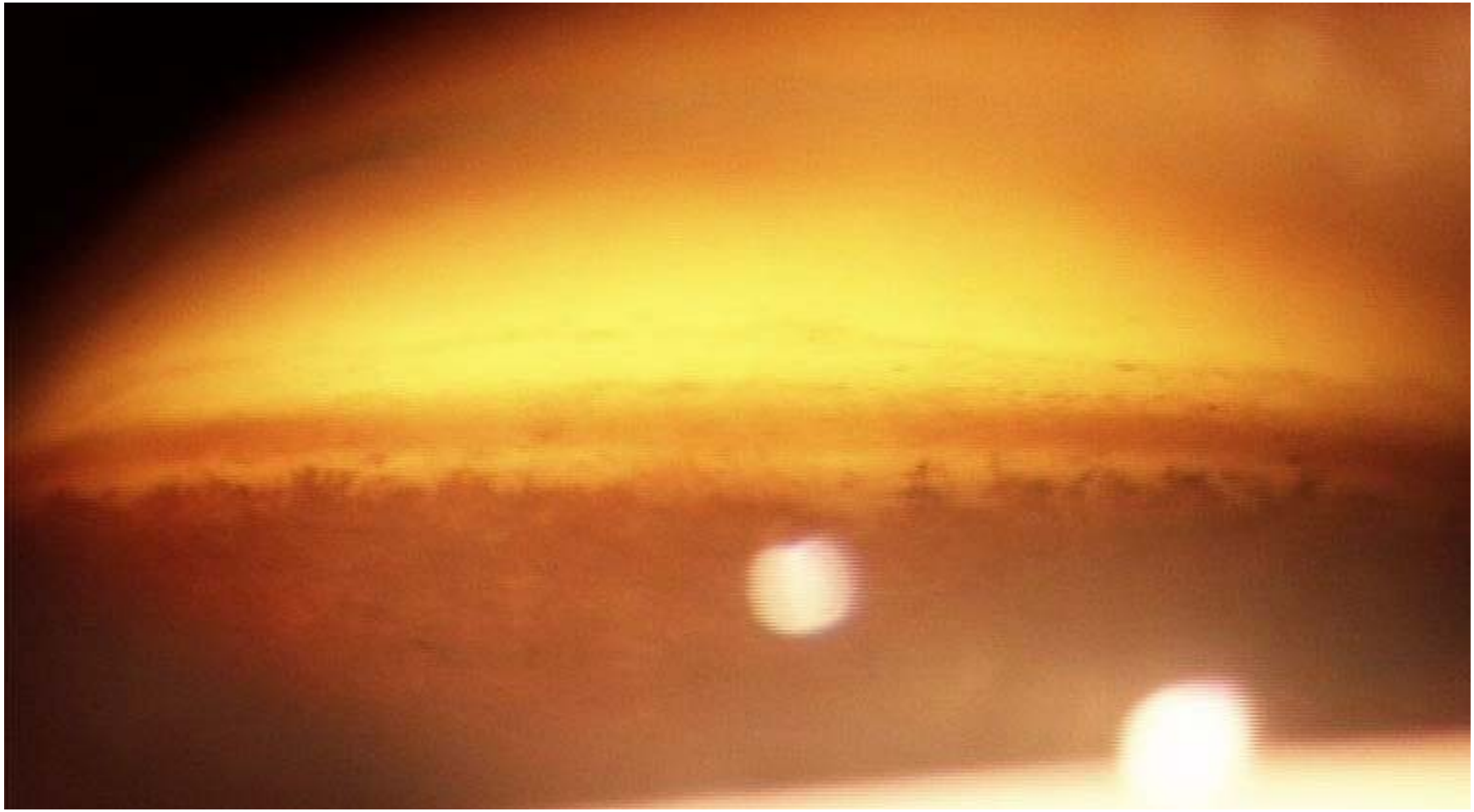
- Aqueous humor fills (0.25ml) of anterior chamber and (0.06ml) of posterior chamber

Gonioscopy

- Biomicroscopic visualisation of angle of anterior chamber using goniolens

Types of Goniolens

- Direct : Koeppe goniolens
  Swan -Jacob
- Indirect : Goldmann three mirror
  Zeiss goniolens
  Posner and Sussman



Angle structures

Root of iris

Ciliary body

Scleral spur

Trabecular meshwork schlemms canal

Schwalbe line

Grading of angle width

SHAFFER GRADING SYSTEM

Grade 0 – closed angle(0)

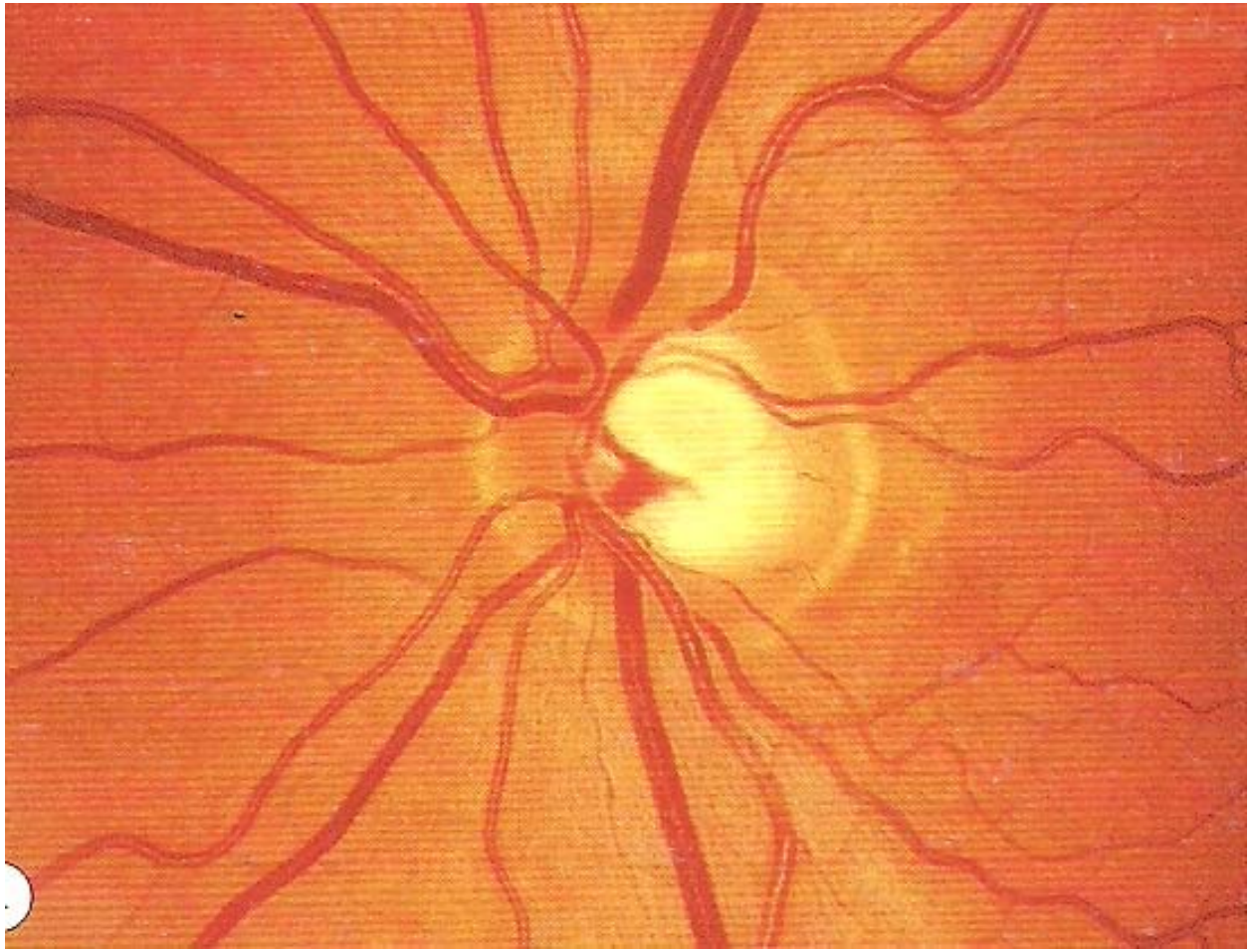
Slit angle

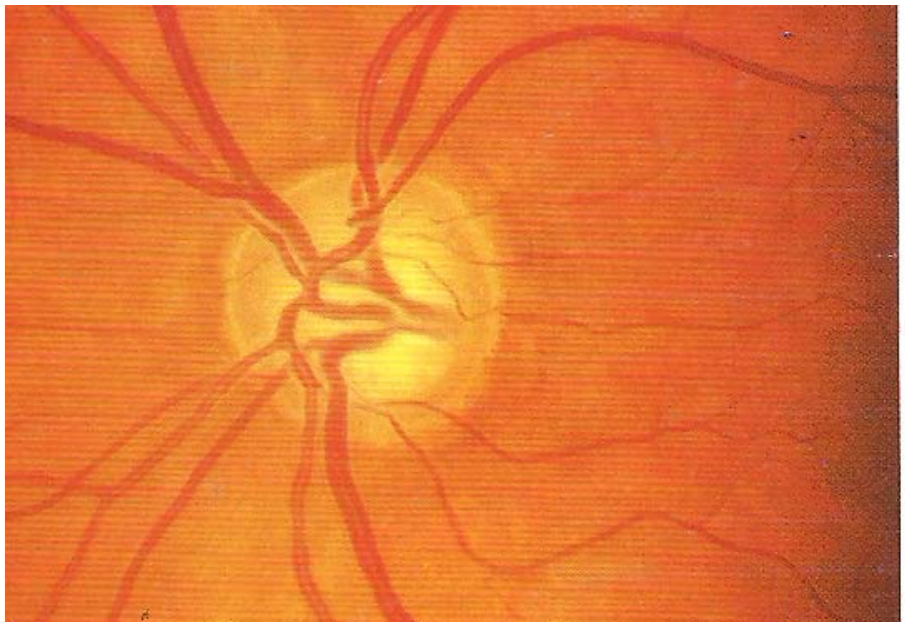
Grade 1 – Schwalbe line(10)

Grade 2 – Trabecular meshwork(20)

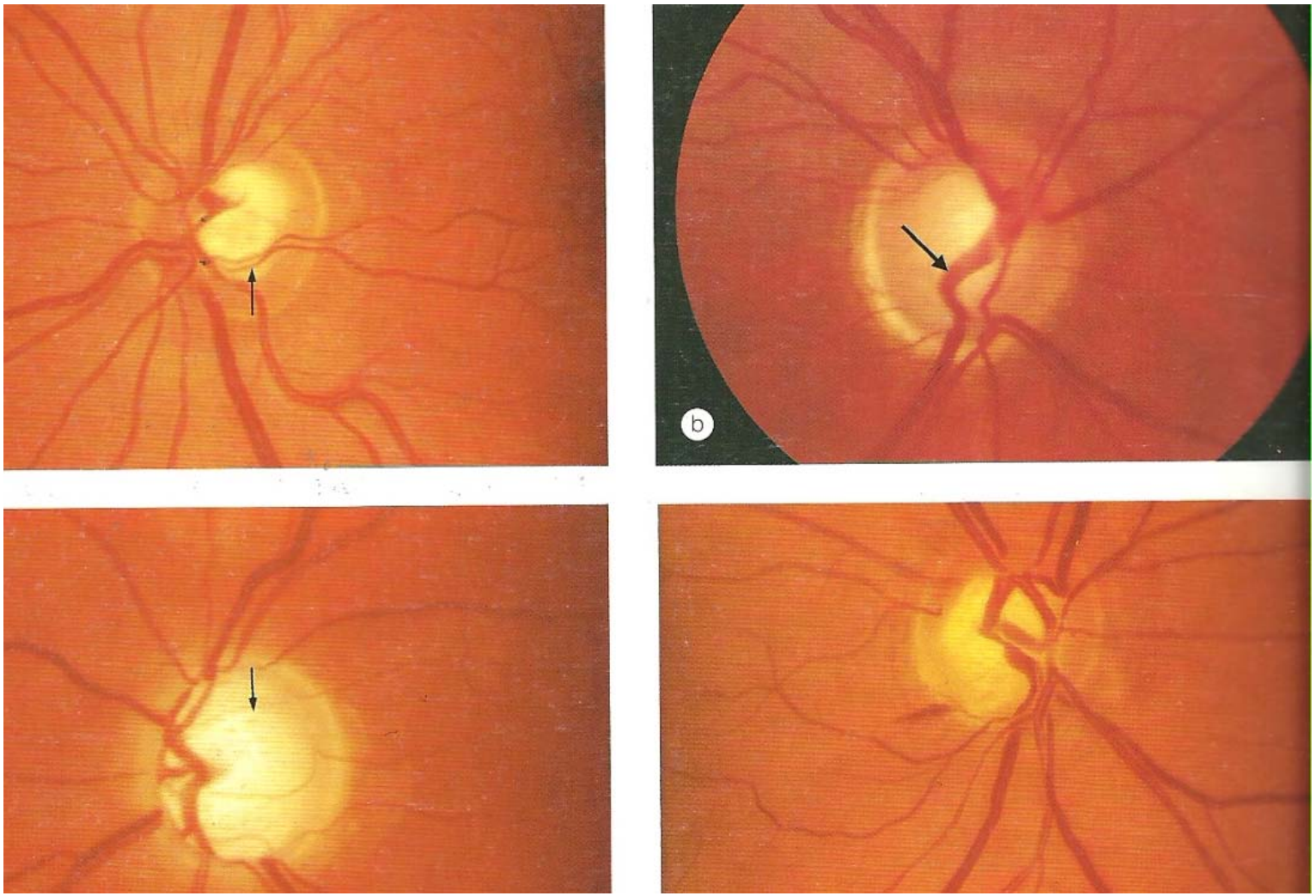
Grade 3 – Scleral spur (25-35)

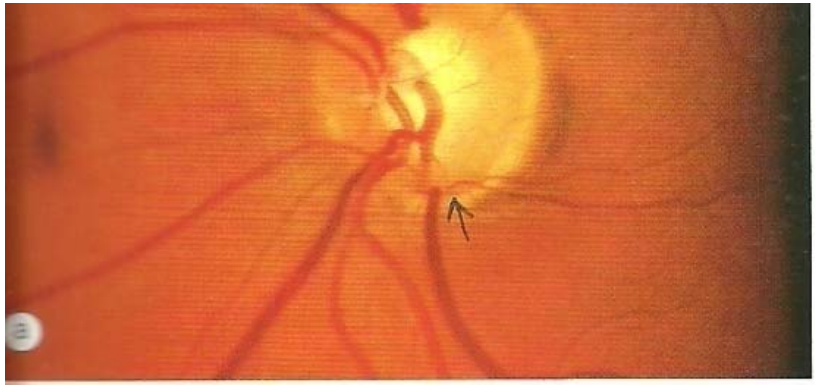
Grade 4 – Ciliary body(35-45)

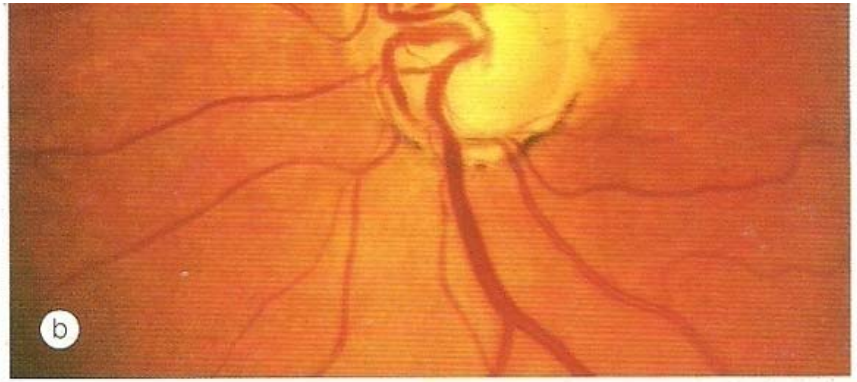




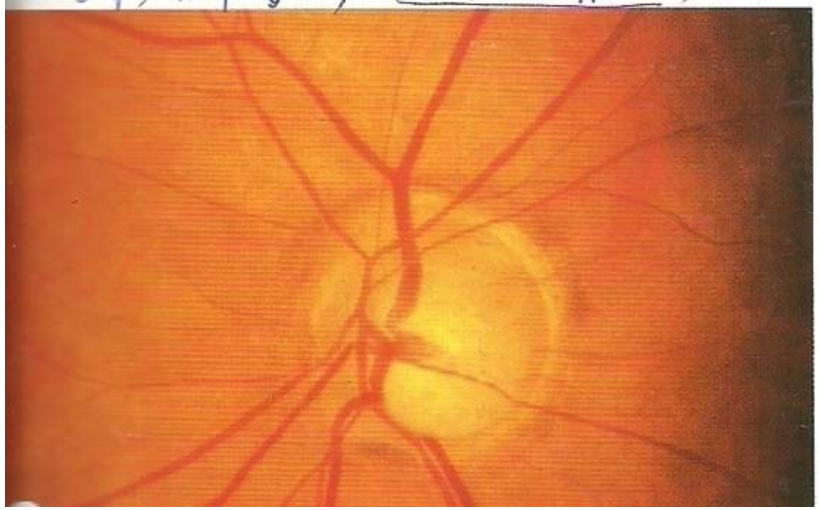
Optic disc signs

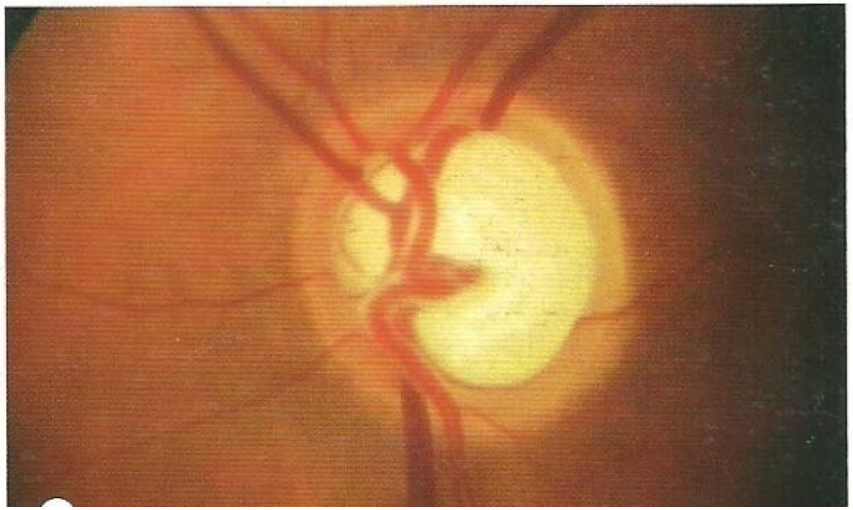




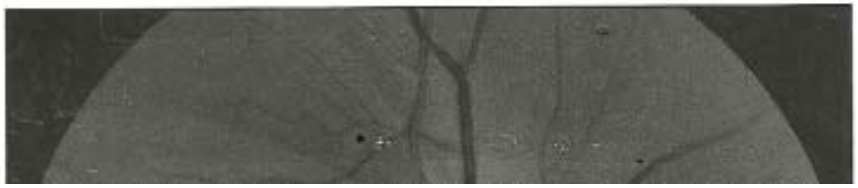


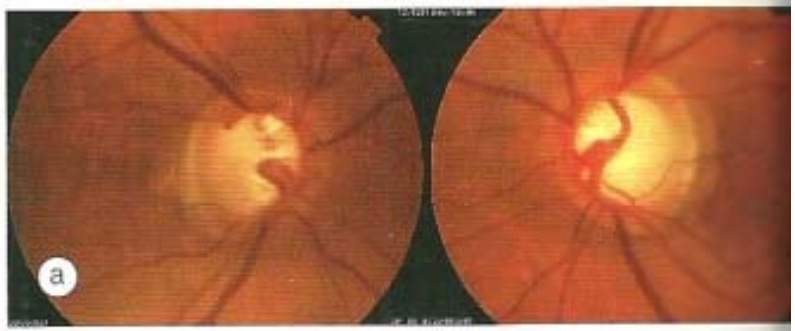
Cup, sloping ⊕, moth eaten appearance)






a

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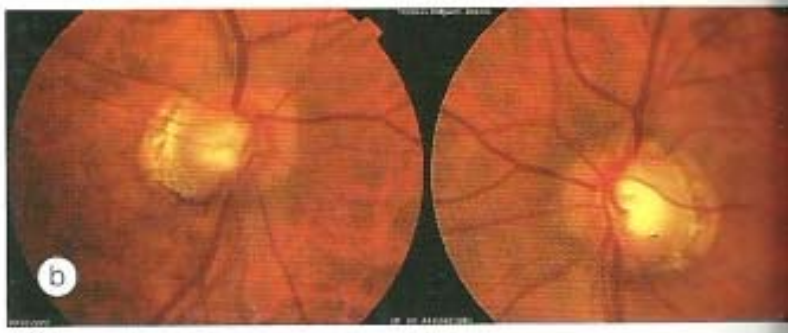
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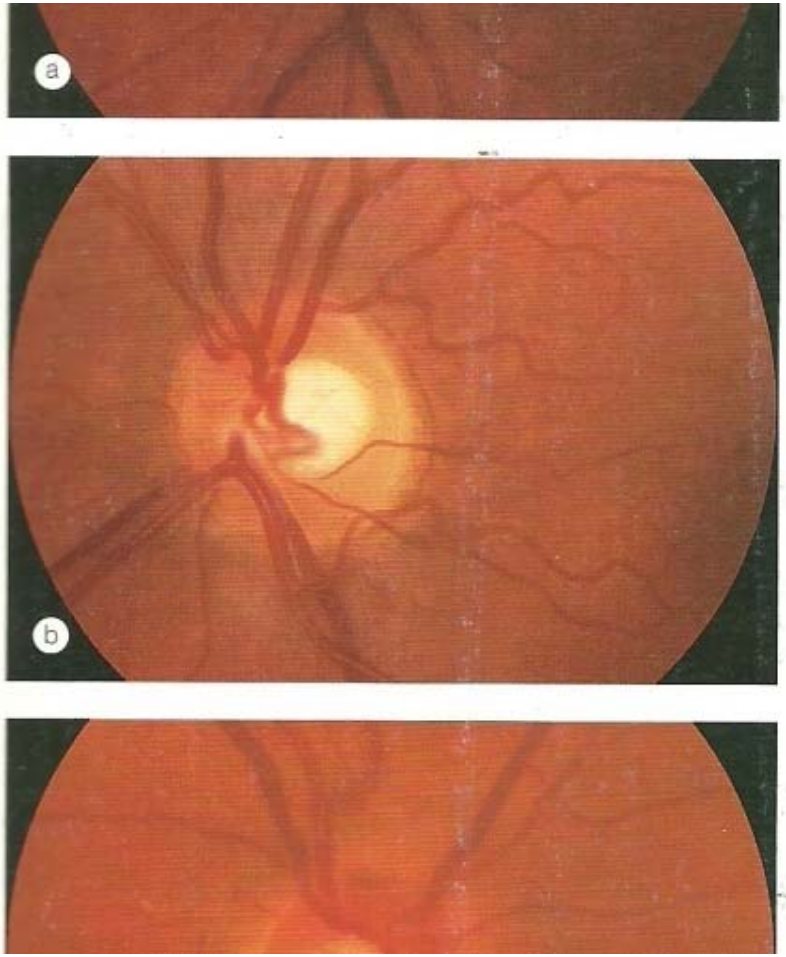


Fig. 13.6
Cup-disc ratio (C = cup; arrowheads = edge of optic disc)
(Courtesy of J Salmon)

damage. Approximately half of all ocular hypertensive eyes that convert to POAG exhibit progression of parapapillary atrophic changes.

Optic nerve head

Optic disc damage is superimposed upon physiological cupping present prior to the onset of raised IOP. If an eye with a small cup develops glaucoma the cup will increase in size, but during the early stages its dimensions may still be smaller than that of a large physiological cup. An estimation of cup size alone is therefore of limited value in the diagnosis of early glaucoma, unless it is found to be increasing. Glaucomatous cups are usually larger than physiological cups, although a large cup is not necessarily pathological. Assessment of the thickness, symmetry and colour of the

Imaging techniques

- Perimertry
- Heidelberg retinal tomograph
- Optical coherence tomography
- Scanning laser polarimetry

Single Field Analysis — Eye: Right

Name: kaur swaranjit — ID: gl 8457 — DOB: 01-11-1939

Central 24-2 Threshold Test

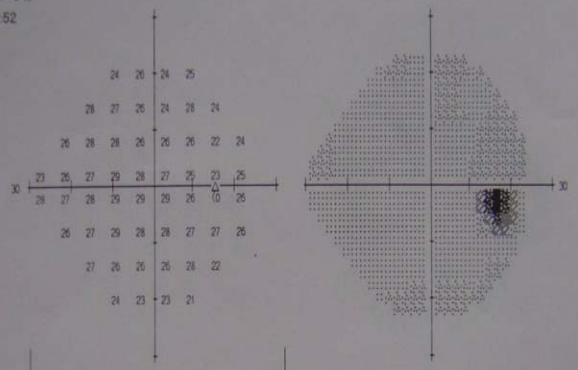
Fixation Monitor: Gaze/Blindspot
Fixation Target: Central
Fixation Losses: 0/16
False POS Errors: 0 %
False NEG Errors: 0 %
Test Duration: 05:52

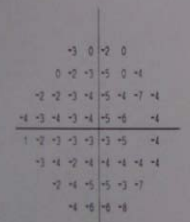
Fovea: 34 dB

Stimulus: III, White
Background: 31.5 ASB
Strategy: SITA-Standard

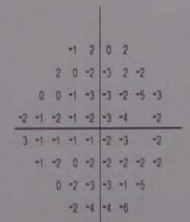
Pupil Diameter: 3.2 mm
Visual Acuity:
RX: DS DC X

Date: 27-10-2004
Time: 3:18 PM
Age: 64





Total Deviation



Pattern Deviation

GHT
Borderline

MD -3.69 dB P < 1%
PSD 1.75 dB

:: < 5%
Ø < 2%
▒ < 1%
■ < 0.5%

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INDIA

PRIMARY OPEN ANGLE GLAUCOMA

POAG

- Bilateral , not always symmetrical
- Adult onset > 40 years
- IOP > 21mmHg
- Open angle on gonioscopy
- Glaucomatous optic nerve head damage
- Visual field loss
- Most common 1 in 100 prevelance

Risk factors and associations

- Age : older patients >40 years
- Race : black people more than white
- Family history and inheritance :

  Multifactoral inheritance

  Ist degree relatives and siblings(10%)

  Myopia and Diabetes

  Retinal diseases : CRVO ,Rheg RD, RP

Steroid responsiveness

- Normal population divided into 3 Groups IOP response to 6wk course of topical betamethasone

High responders(>30mmHg) 5%

Moderate responders(22-30mmHg) 35%

Non responders(no change) 60%

Pathogensis of glaucoma

- Ischaemic theory
- Direct mechanical theory

  -Increased ressistance to aqueous outflow in trabecular meshwork

  -Apoptosis of retinal ganglion cells

  -Preterminal event is calcium influx into cell body andincrease in intracellular nitric oxide

Symptoms

- Insidious and asymptomatic
- Mild headache and eyeache
- Frequent change of presbyopic glasses
- Delayed dark adaptation

Signs

Raised IOP

Diurnal fluctuation of IOP(DVT)

- Variation of6-8mmHg
- Asymmetry of 5mmHg in 2 eyes

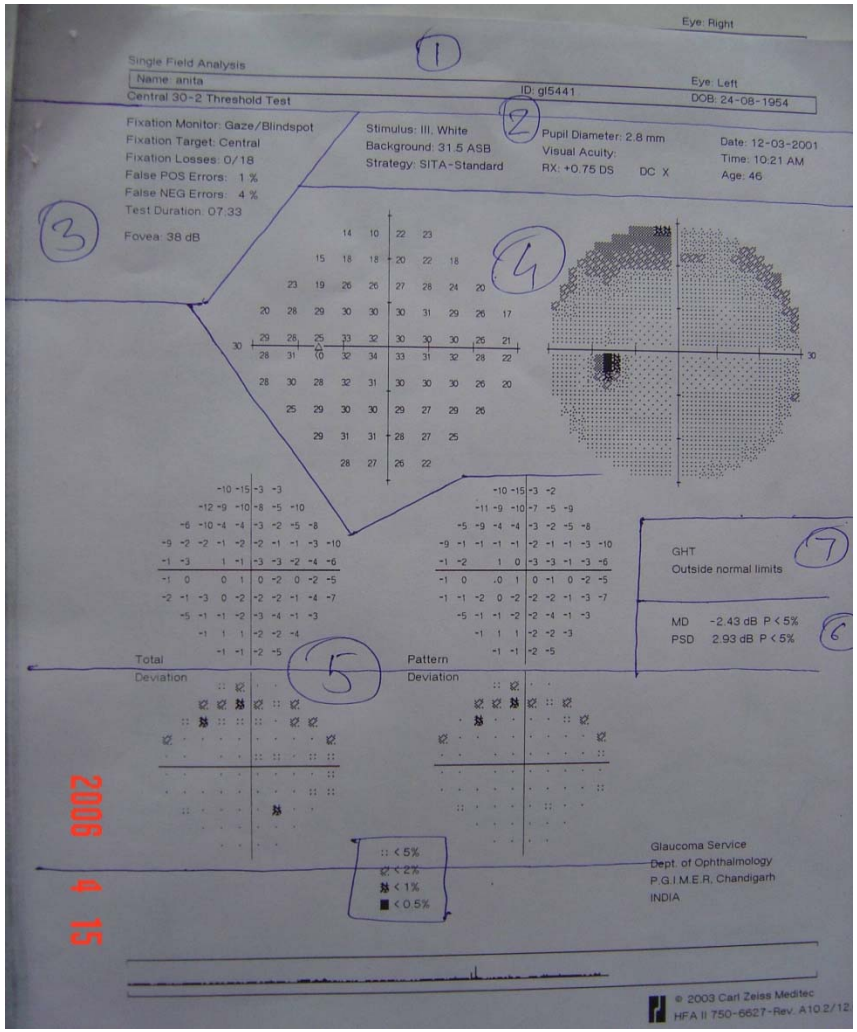
Optic disc changes

- Vertically oval cup
- Asymmetry of cups 0.2 bn 2 eyes
- Large cup
- Splinter haemorrhages
- Pallar of NRR
- atrophy of retinal nerve fibre layer

- Advanced changes
  - Marked cupping (0.7-0.9)
  - Thinning of NRR
  - Bayonetting sign
  - Lamellar dot sign
  - Pulsations of retinal arterioles

Glaucomatous optic atrophy

- Visual field changes
  - Isopter contraction
  - Baring of blind spot
  - Wing shaped paracentral scotoma
  - Seidel's scotoma
  - Arcuate or Bjerrum's scotoma
  - Ring or double arcuate scotoma
  - Roenne's central nasal step
  - Tubular vision


Eye: Right
Single Field Analysis
Name: anita
ID: gl5441
Eye: Left
DOB: 24-08-1954
Central 30-2 Threshold Test
Fixation Monitor: Gaze/Blindspot
Fixation Target: Central
Fixation Losses: 0/18
False POS Errors: 1 %
False NEG Errors: 4 %
Test Duration: 07:33
Fovea: 38 dB
Stimulus: III, White
Background: 31.5 ASB
Strategy: SITA-Standard
Pupil Diameter: 2.8 mm
Visual Acuity:
RX: +0.75 DS
DC X
Date: 12-03-2001
Time: 10:21 AM
Age: 46
GHT
Outside normal limits
MD -2.43 dB P < 5%
PSD 2.93 dB P < 5%
Total Deviation
Pattern Deviation
:: < 5%
∅ < 2%
▒ < 1%
■ < 0.5%
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HFA II 750-6627-Rev. A10.2/12

Single Field Analysis

Eye: Right

Name: singh sarwan

ID: 644111

DOB: 11-06-1923

Central 10-2 Threshold Test

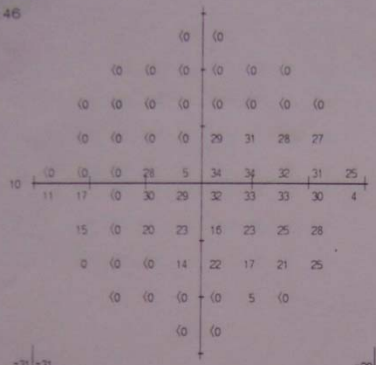
Fixation Monitor: Gaze/Blindspot
Fixation Target: Central
Fixation Losses: 0/18
False POS Errors: 1 %
False NEG Errors: 7 %
Test Duration: 07:46

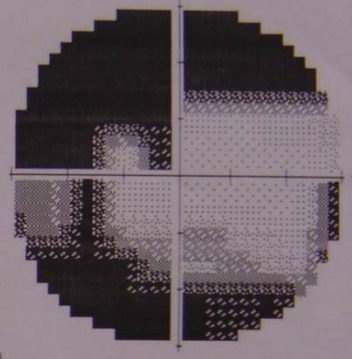
Fovea: 34 dB

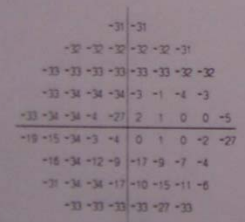
Stimulus: III, White
Background: 31.5 ASB
Strategy: SITA-Standard

Pupil Diameter: 3.4 mm
Visual Acuity: 20/20
RX: +4.50 DS +0.50 DC X 180

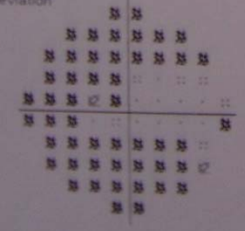
Date: 27-01-20
Time: 11:29 AM
Age: 81

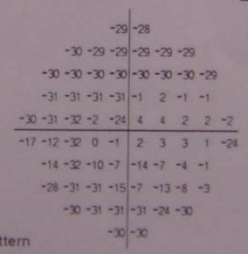




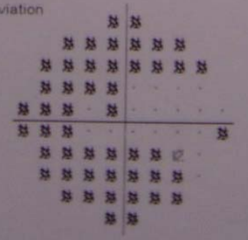


Total Deviation





Pattern Deviation



MD -20.73 dB P < 1%
PSD 13.87 dB P < 1%

:: < 5%
∅ < 2%
■ < 1%

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Single Field Analysis

Eye: Right

Name: saini gurnam singh | ID: 170440 | DOB: 09-04-1946

Central 30-2 Threshold Test

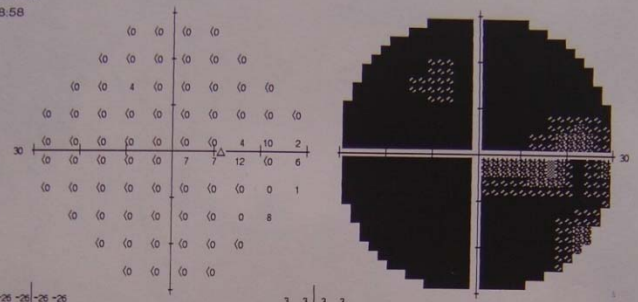
Fixation Monitor: Gaze/Blindspot
Fixation Target: Central
Fixation Losses: 4/15 xx
False POS Errors: 4 %
False NEG Errors: N/A
Test Duration: 08:58

Stimulus: III, White
Background: 31.5 ASB
Strategy: SITA-Standard

Pupil Diameter: 6.8 mm
Visual Acuity: 20/100
RX: +3.00 DS DC X

Date: 18-07-2002
Time: 9:39 AM
Age: 56

Fovea: <0 dB



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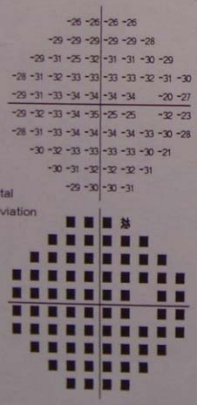
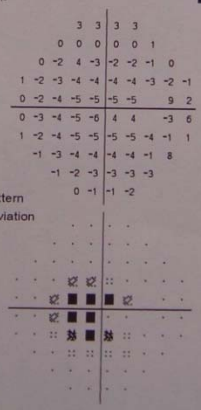


Pattern Deviation



:: < 5%
▨ < 2%
▩ < 1%
■ < 0.5%

*** Low Test Reliability ***
GHT
Outside normal limits

MD -31.21 dB P < 0.5%
PSD 3.66 dB P < 2%

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- Gonioscopy

  Normal open angle

Grading of glaucomatous damage

Mild damage : early visual field defects
MD <-6dB mild cupping

Moderate damage : definite arcuate scotoma MD <-12dB moderate thinning of NRR

Severe damage : extensive VF loss
MD >-12dB
Marked cupping

End-stage disease : small residual field
Minimal residual NRR

Treatment

- Baseline evaluation
- Achive target pressure
- Monitoring optic nerve and visual field

THERAPUTIC CHOICE

Medical therapy

Argon or diode laser trabeculoplasty

Filteration surgery

Single drug therapy

- Prostaglandin analogues
  - Latanoprost (0.005%)
  - Bimatoprost (0.03%)
  - Travoprost (0.004%)

Topical beta blockers

- Timolol maleate (0.25,0.5%)
- Betaxolol (0.5%) Carteolol (1%,2%)
- Levobunolol (0.5%) Metipranolol (0.1%)

- Alpha-2 agonist
  - Brimonidine (Alphagan 0.2%)
  - Apraclonidine (0.5%, 1%)

Miotics
- Pilocarpine (1%,2%,3%,4%)

Topical carbonic anhydrase inhibitors
- Dorzolamide (2%)
- Brinzolamide (1%)

Combined topical drugs

- Xalacom
- Travocom
- Cosopt
- Timpilo
- Combigan

Systemic carbonic anhydrase inhibiters

- Acetazolamide 250-1000mg
- Methazolamide 50-100mg

- Hyperosmotic agents

  Glycerol (50%)

  Mannitol (20%)

  Isosorbide


a
b
c
d

Argon or diode laser trabeculoplasty

- Indications
  - Avoidance of polypharmacy
  - Avoidance of surgery
  - Non compliant patient

Trabeculectomy

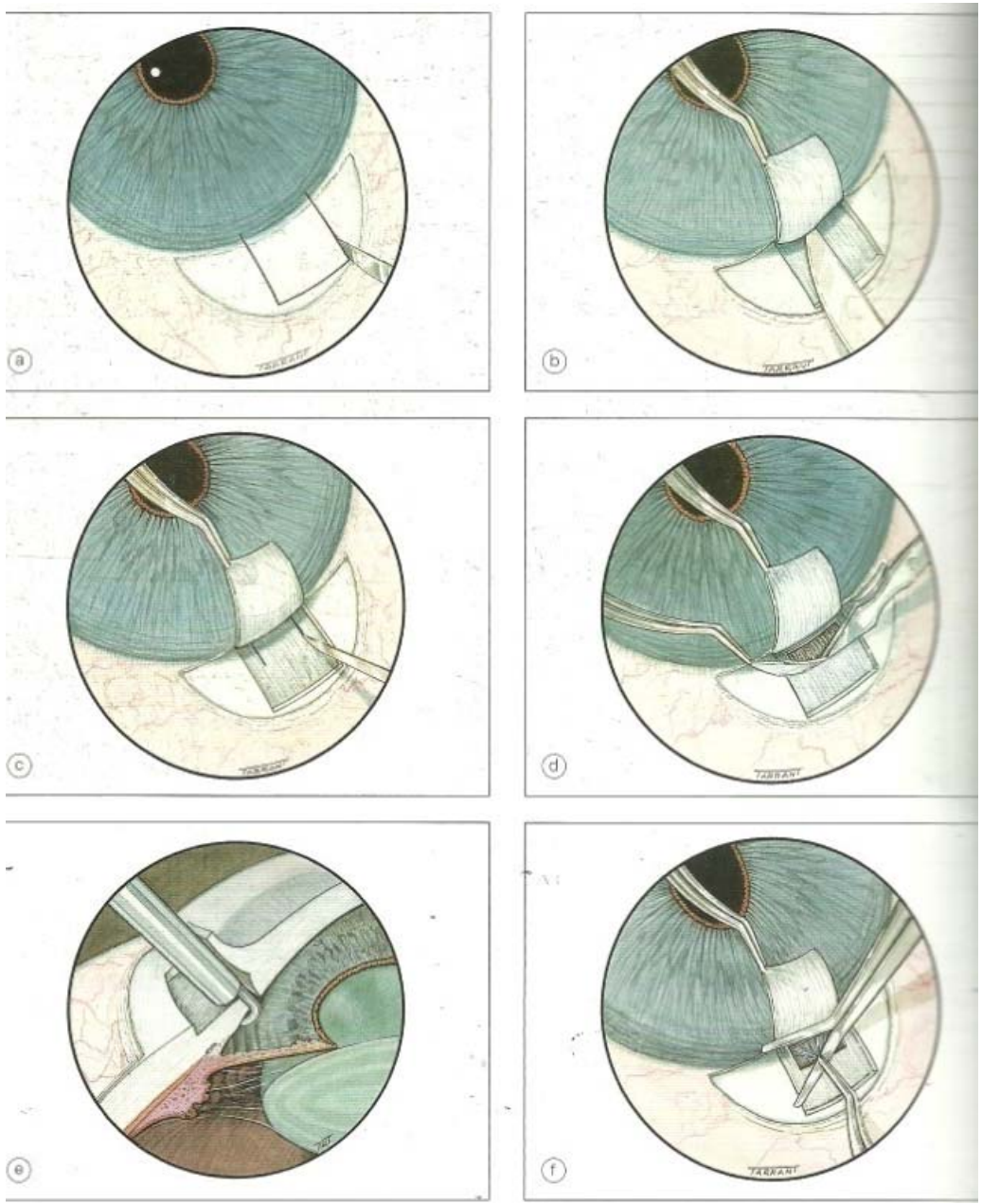
- Indications

  Failed medical therapy

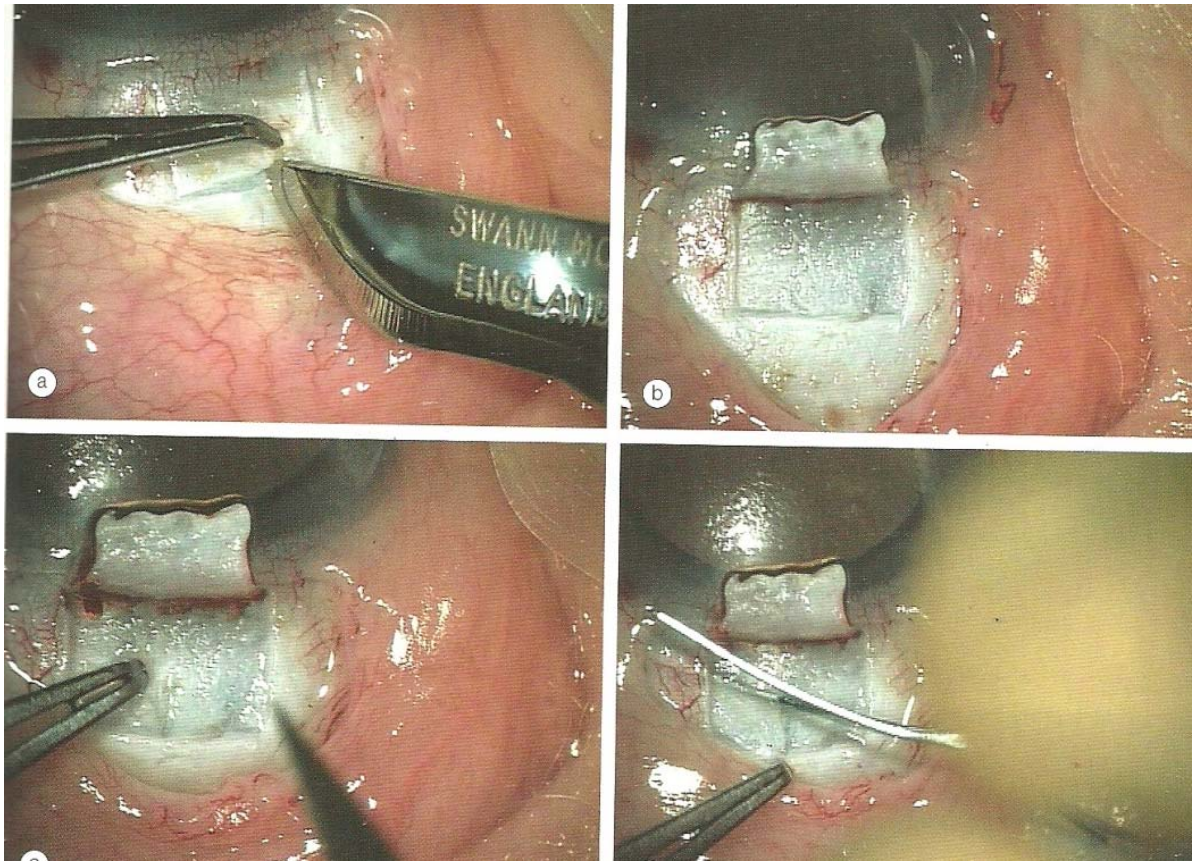
  Failed laser trabeculoplasty

  Advanced disease

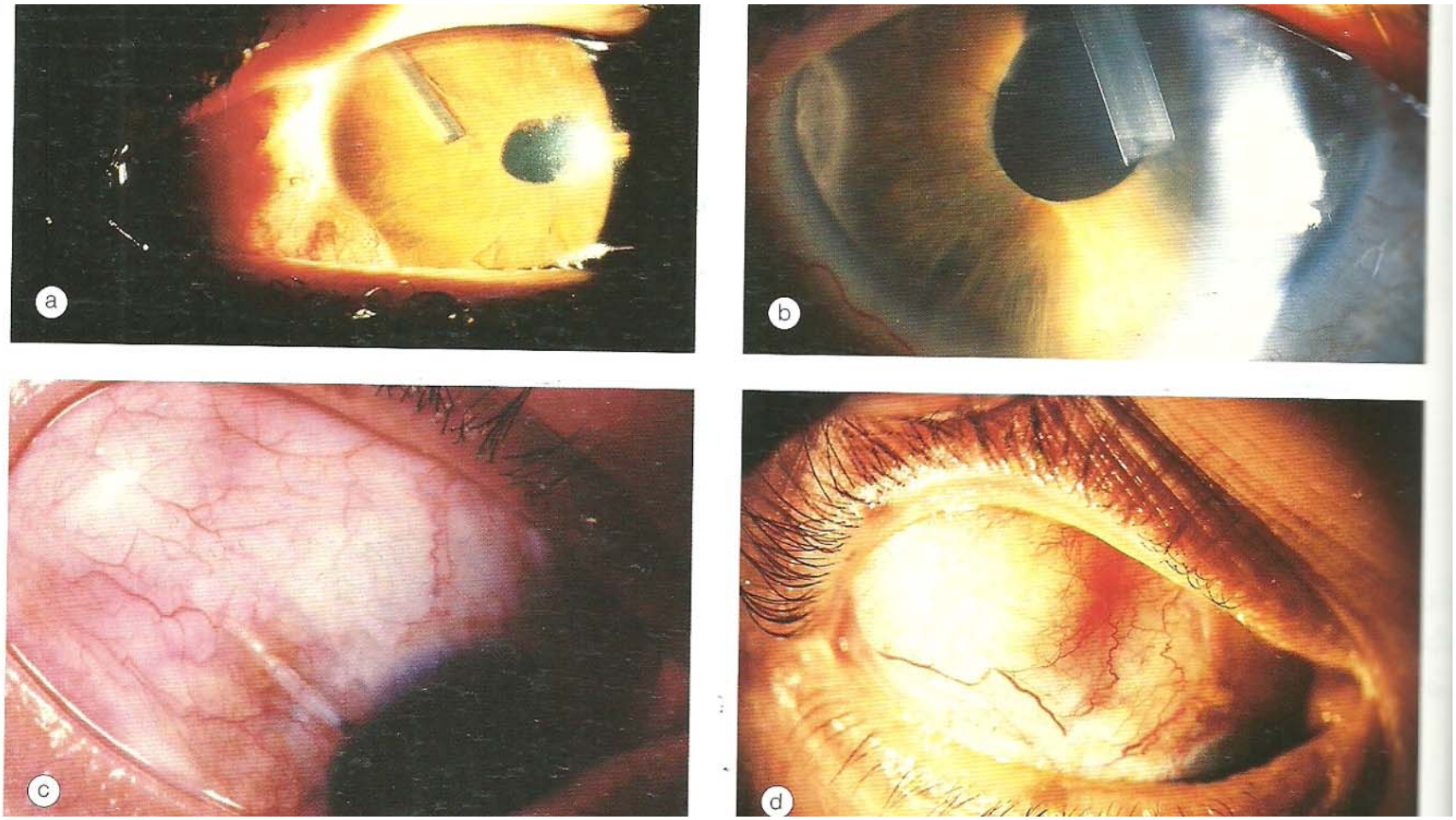
  Unsuitability for laser therapy

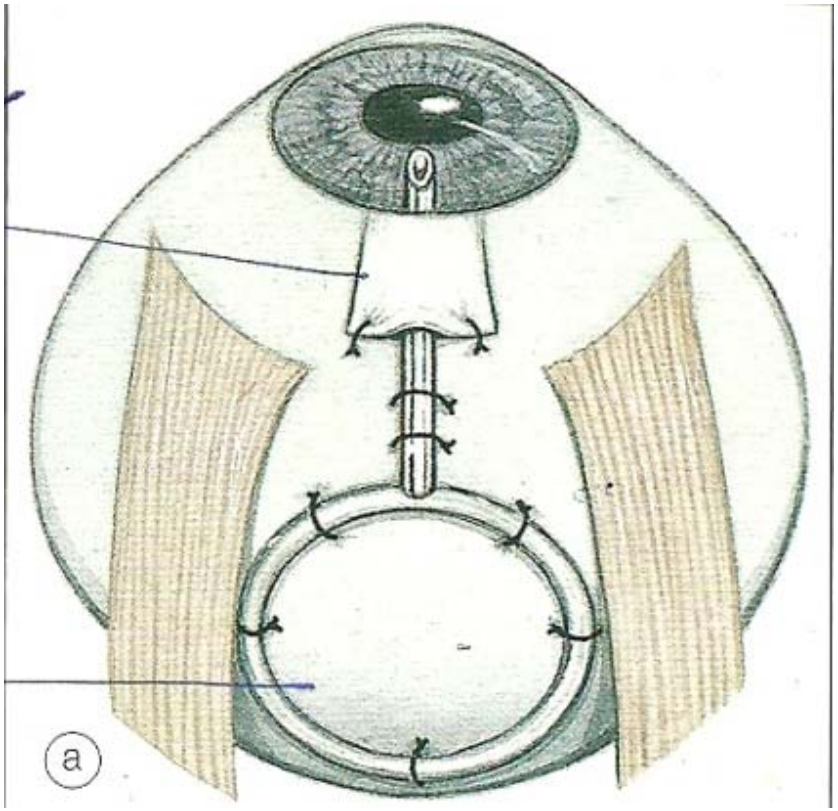

a
b
c
d
e
f

Trabeculotomy

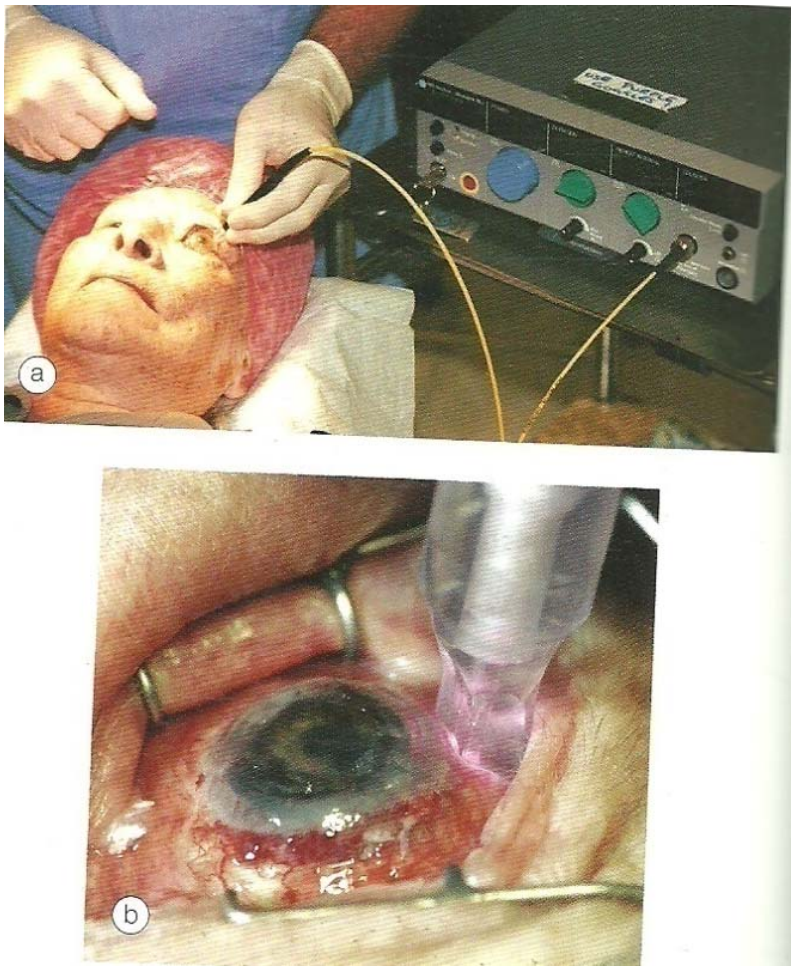


Drainage devices(Tube shunts)

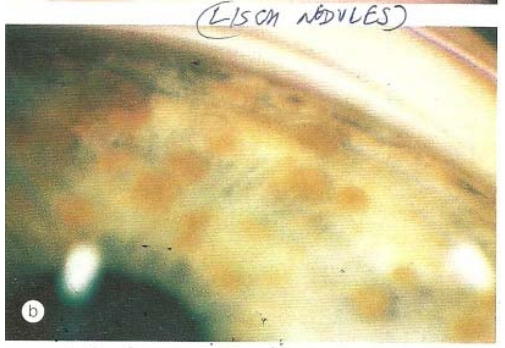


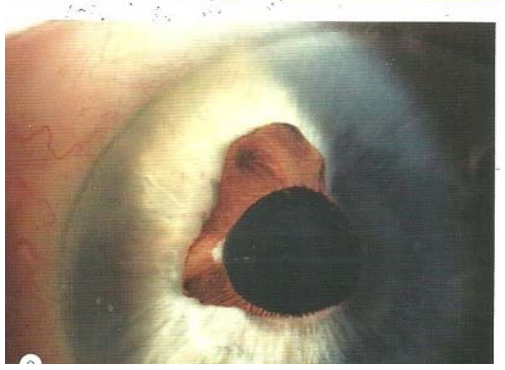

a

Diode Laser Cyclophotocoagulation

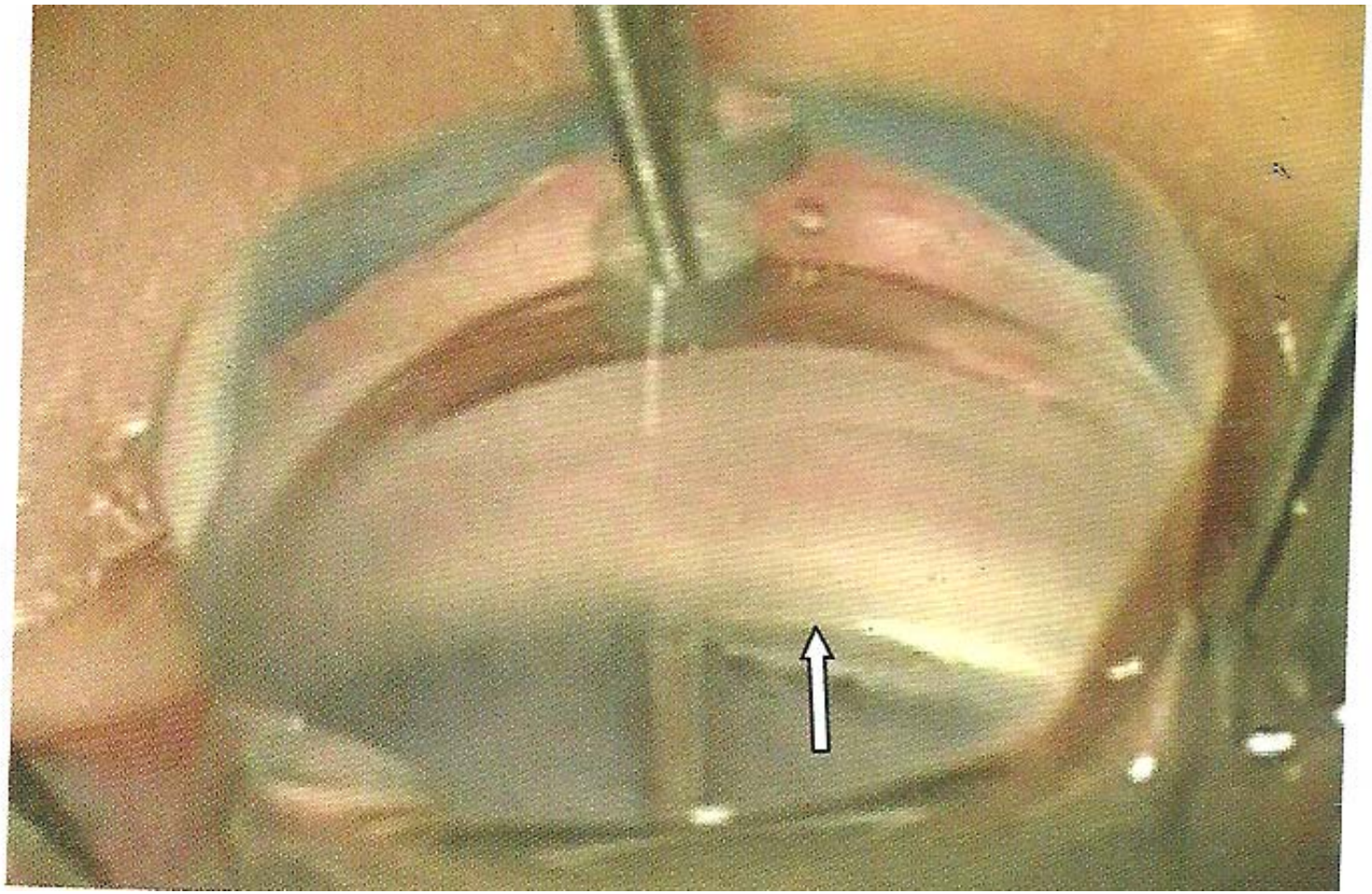


SWS; NF





Direct gonioscopy



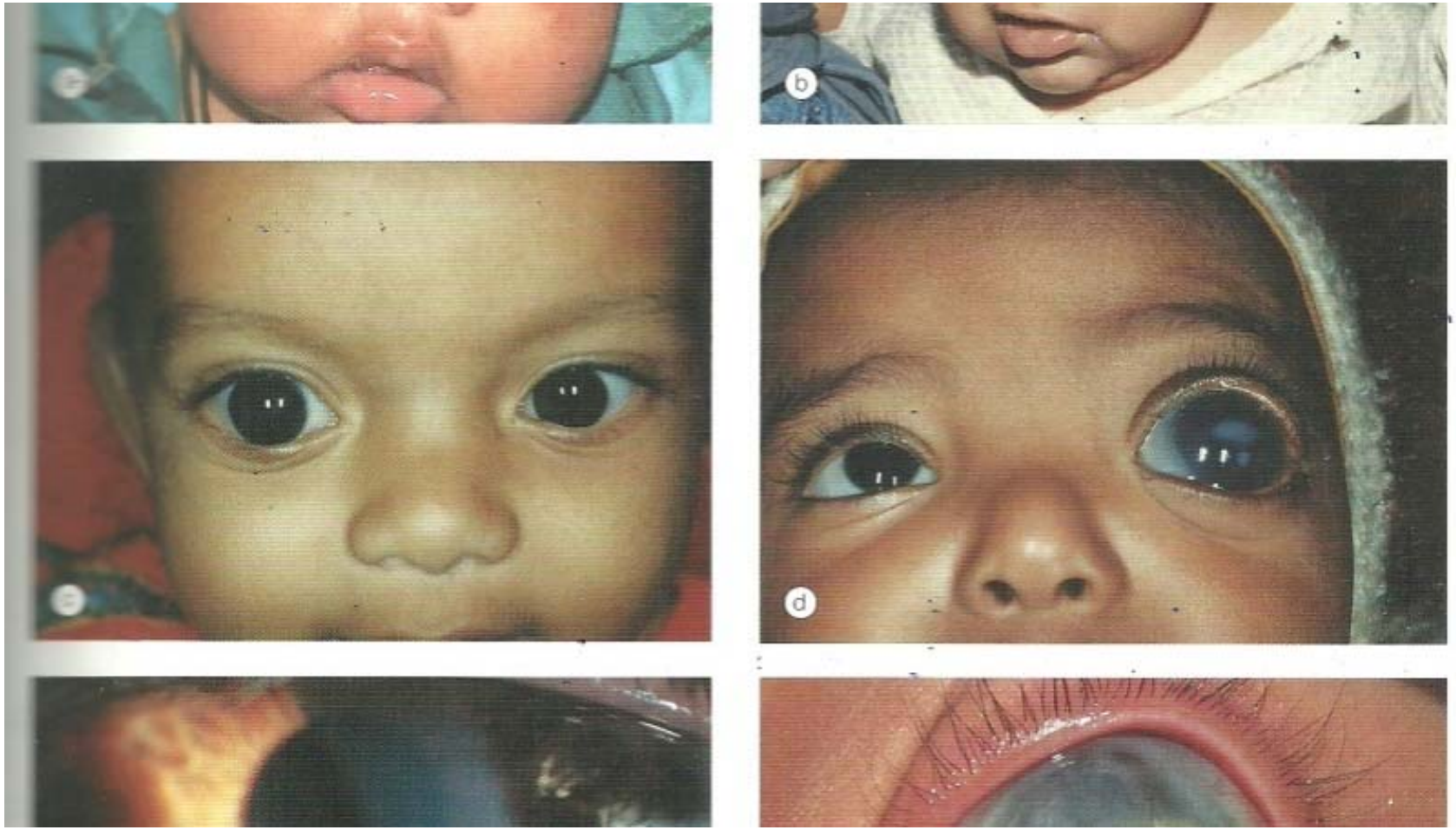
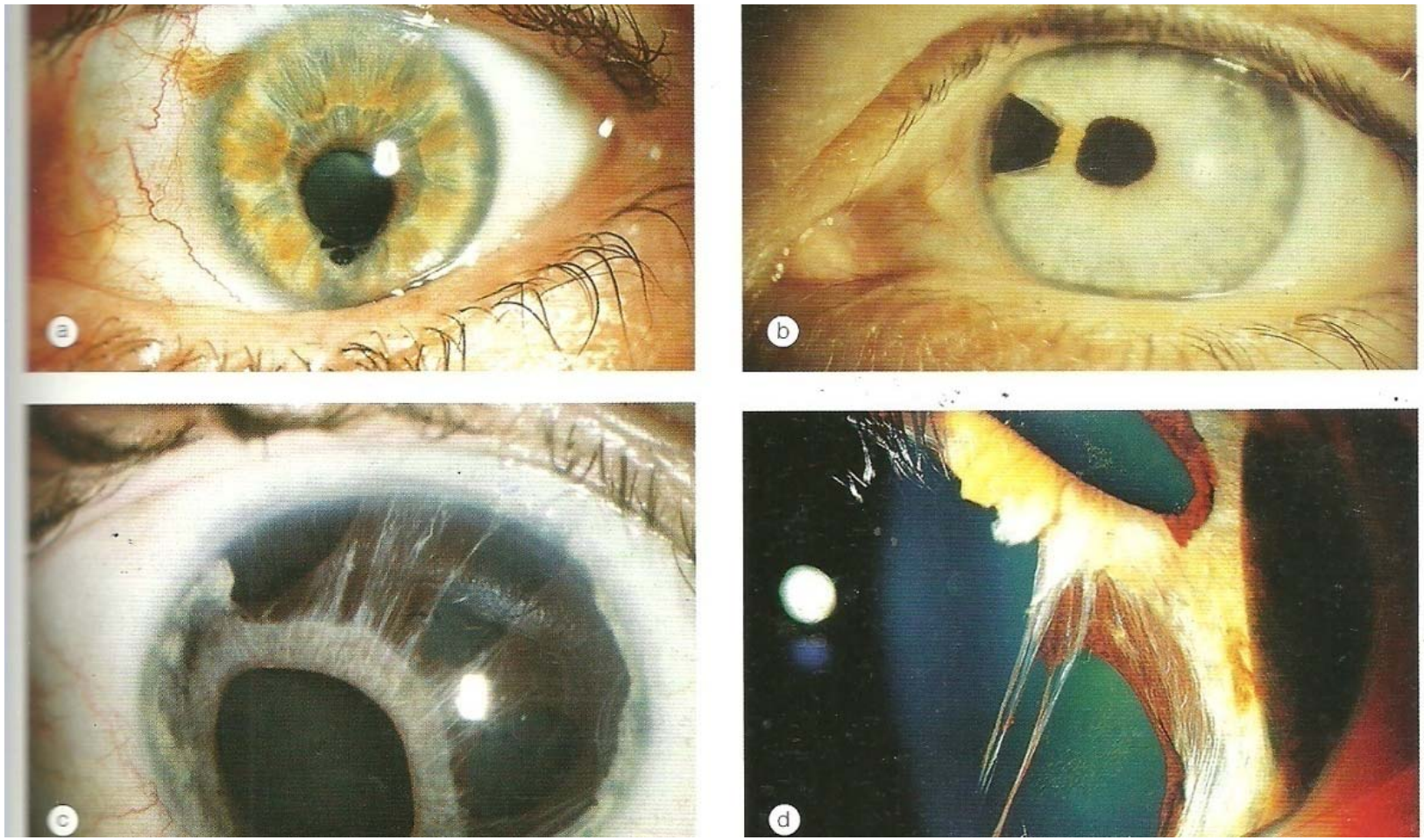
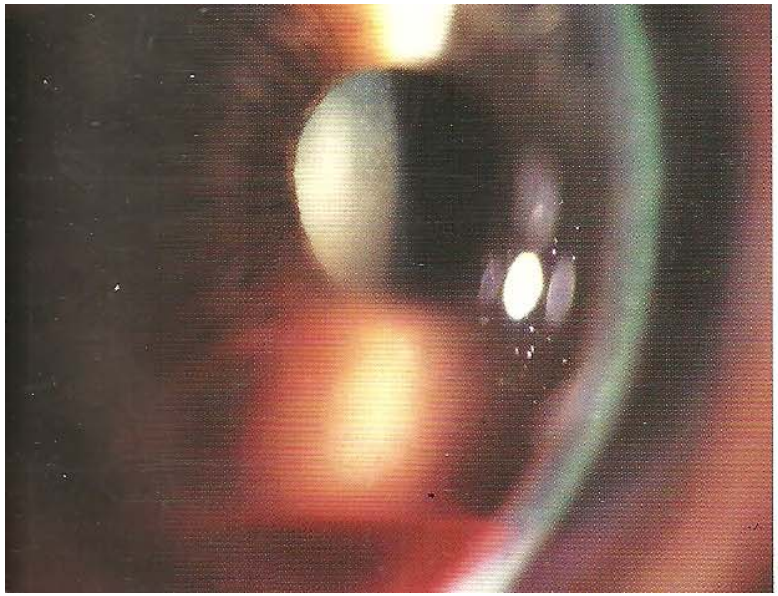

a
b
c
d

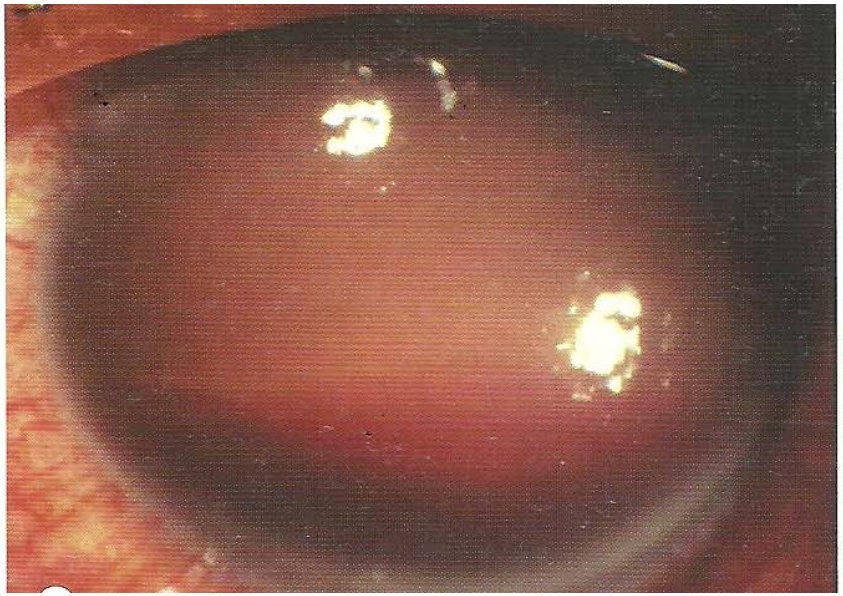
Fig. 13.41
Glaucoma in intraocular tumours. **(a)** Angle invasion by a solid iris melanoma; **(b)** melanoma cells infiltrating the trabeculum; **(c)** melanomalytic glaucoma; **(d)** angle closure by a large ciliary body melanoma (Courtesy of R Curtis – figs a and c; J Harry – fig. b)

AR Anomaly

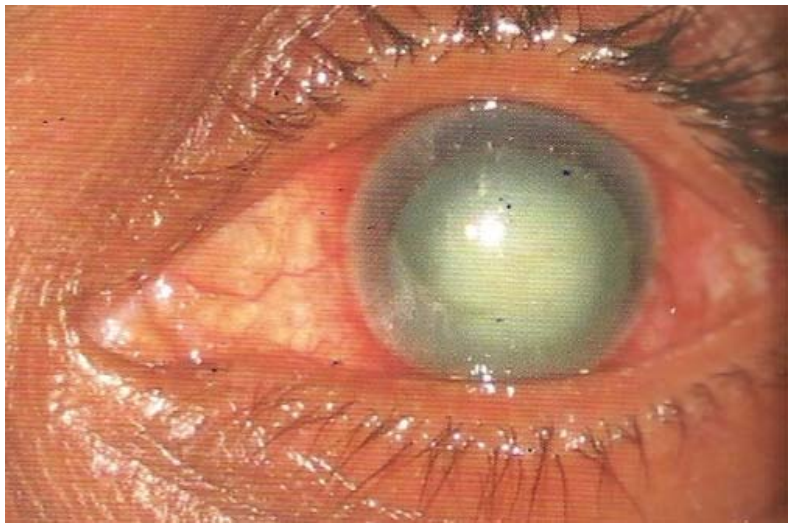


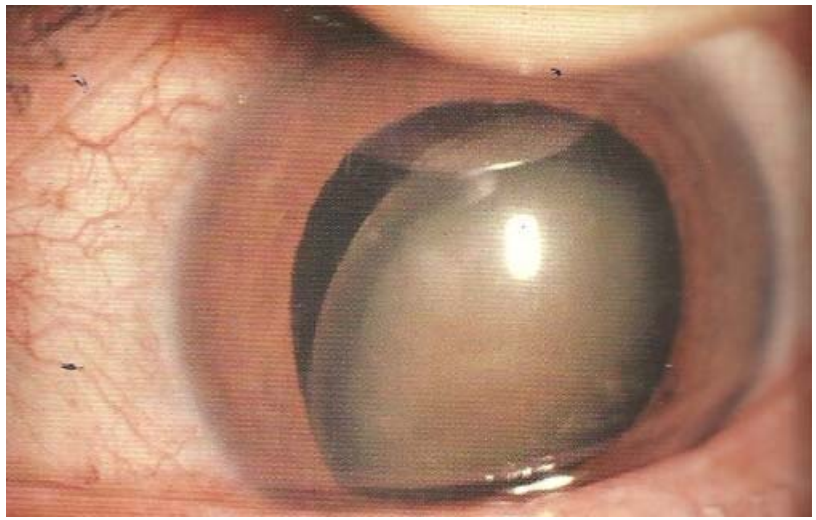
Traumatic Glaucoma: Hyphaema

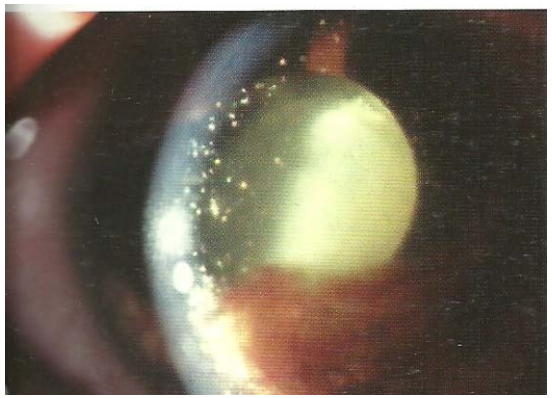




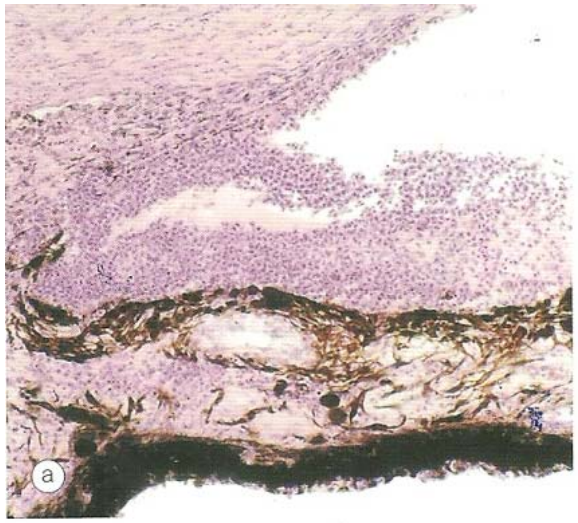
Lens Induced Glaucoma

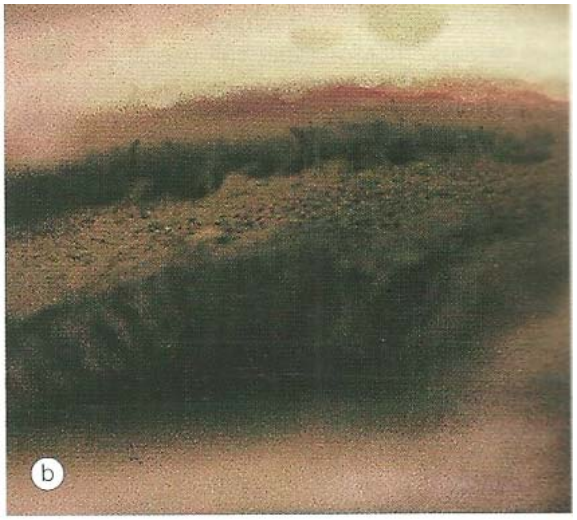


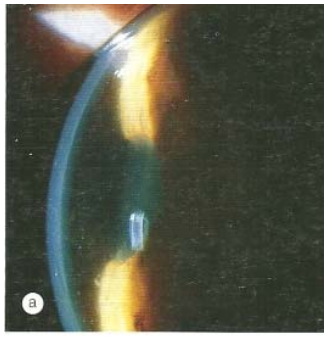


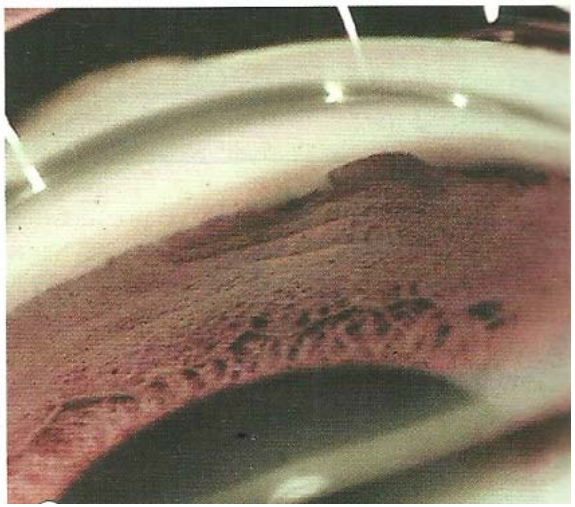


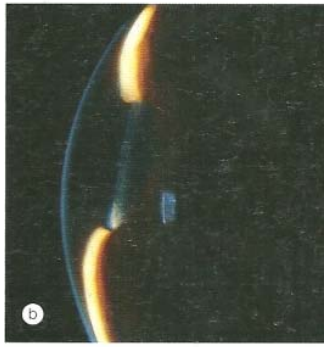
SACG



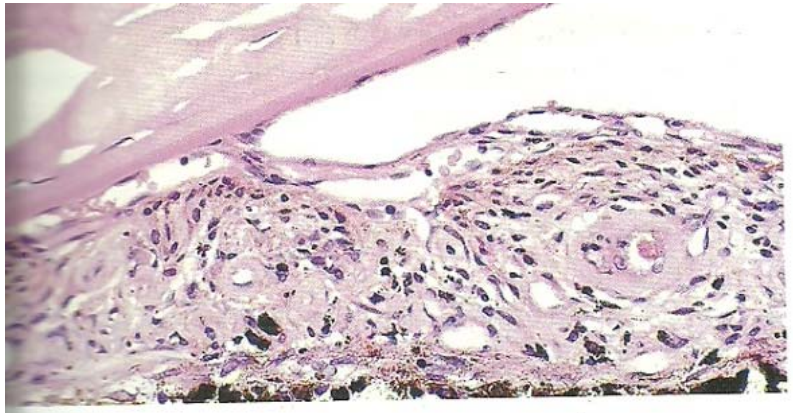


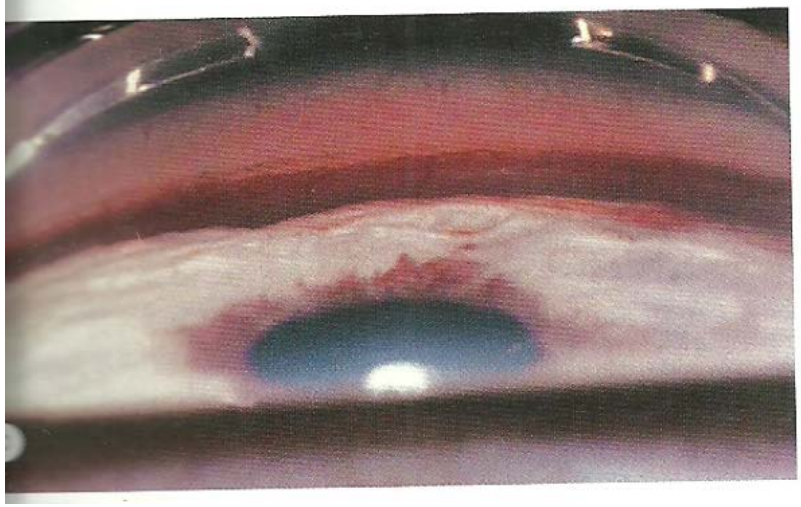




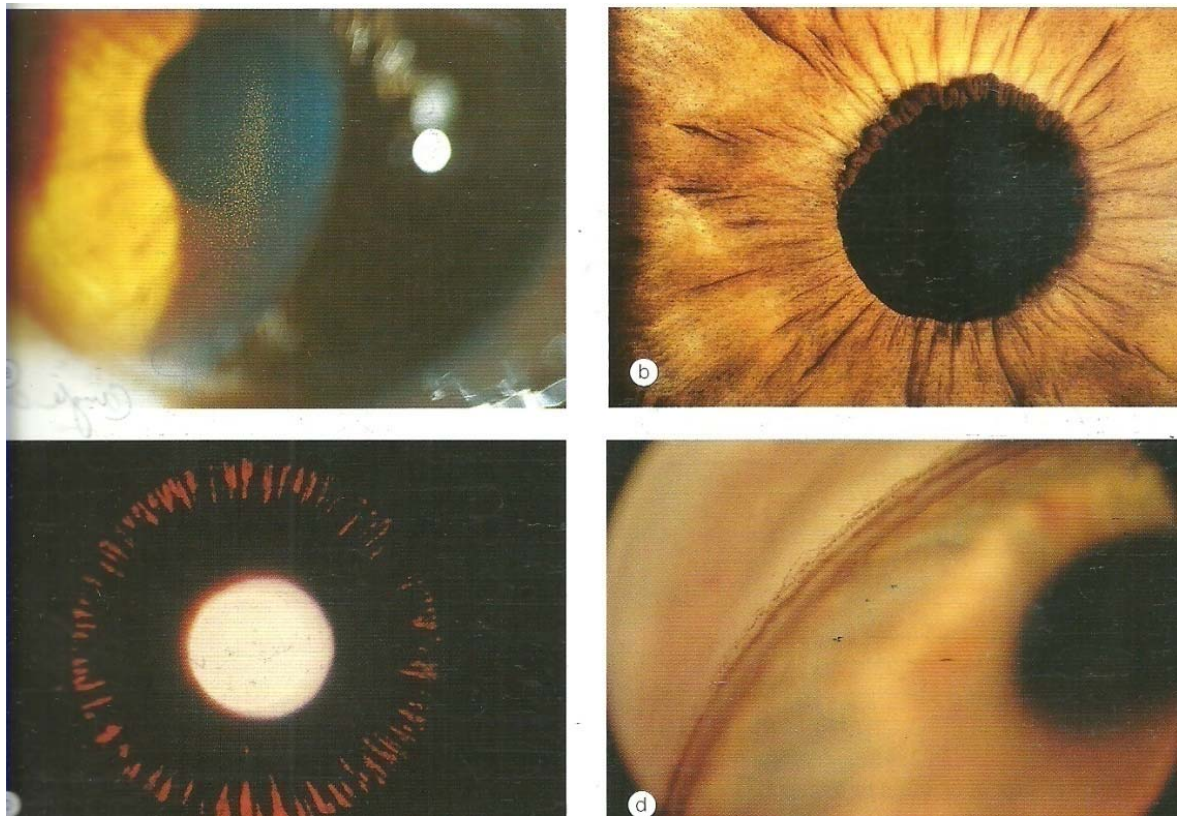


Neovascularisation

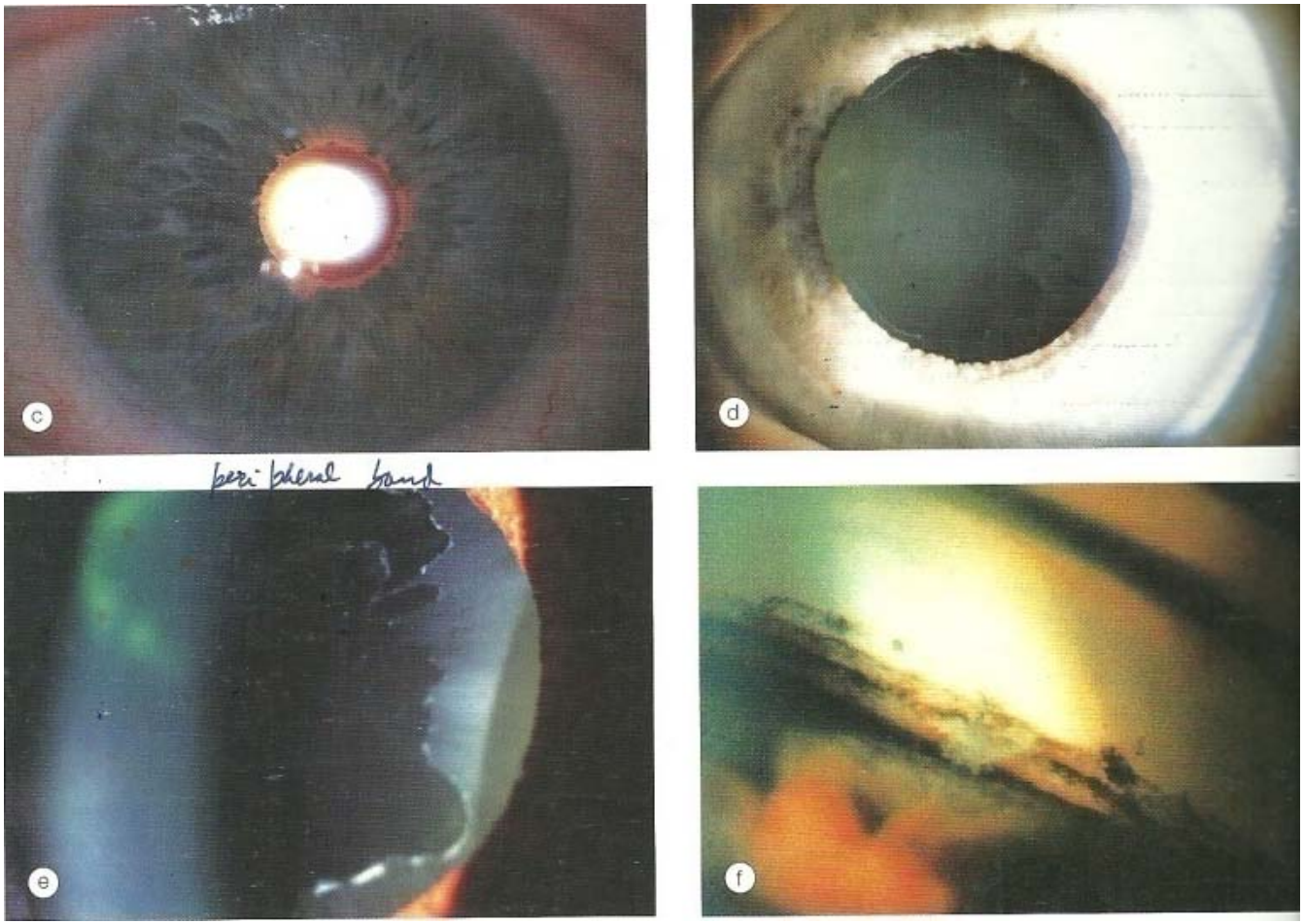




Pigment Dispersion



Pseudoexfoliation



Angle Closure Glaucoma