



## **Missed Hints in Glaucoma**



**HASSAN EISA SWIFY  
FRCS ED.(OPHTHALMOLOGY)  
AIR FORCE HOSPITAL**

## Disclaimer

- I have no financial interest to declare in this presentation

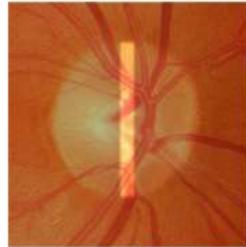
## Examination of Optic Nerve Head (ONH) & Nerve Fiber Layer (NFL)

- **When :**  
on each visit
- **How :** SL Biomicroscopy  
Lens , narrow beam  
Neutral density filter  
proper posture  
Focus then change to higher  
Magnification gives better  
stereopsis

### Structural loss precedes functional loss



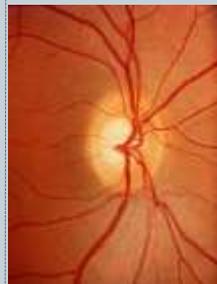
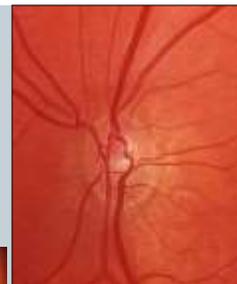
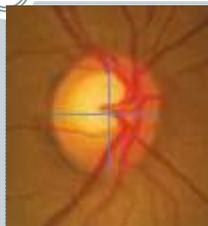
## Disc Size



lens	+60D Volk-Nikon	+78D Volk	+90D Volk-Nikon	Superfield NC Volk
correction factor	0.94-1.03	1.13	1.36-1.59	1.50

## Normal (Typical ) ONH

- Wide range of size & cup
- Vertical disc diameter 1.7 to 1.8 mm (1.5 to 2.2)
- Vertically oval with horizontal cup
- ISNT rule IN 83%
- Rim colour :yellow orange or pinkish colour
- Central retinal vessels slightly nasal to center



## ONH Examination

To define the borders of the optic disk look for the thin white band encircling the disk. This is the inner side of the peripapillary scleral ring and is more easily detected on the temporal side and when viewing the disk stereoscopically.

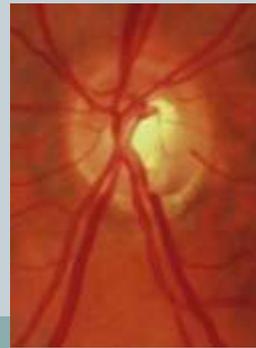
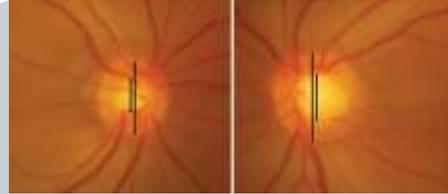
### Identification of the rim :

Colour & contour

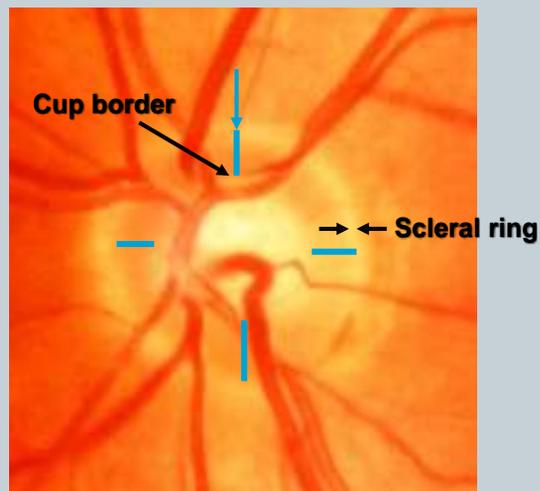
Vessels :

change in colour

Change in direction



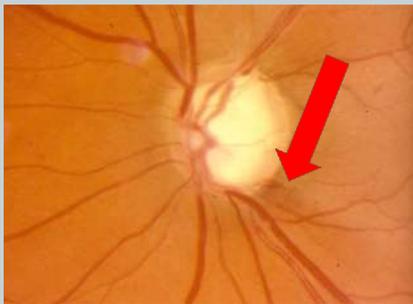
**Rim width** = distance between the scleral ring and the location where the vessel is bent (cup border)



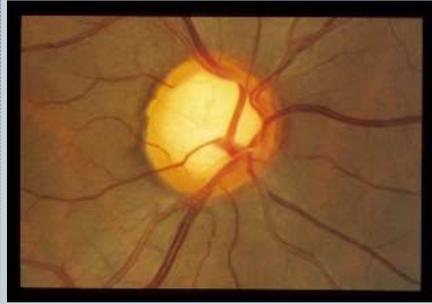
## Optic nerve head Changes in Glaucoma

- Large cup to - disc- ratio (for disc size)  
NB :5% of normal eyes have C/D ratio larger than 0.6)
- Asymmetry of CDR (only if disc are same size )
- Cup becomes more vertically oval (depending on what was the baseline cup shape )
- Violation of ISNT rule ( may not apply in atypically –shaped discs )
- Progressive optic nerve cupping = loss of rim tissue  
Vertical cupping  
Notching
- Disc hemorrhage

## C/D Ratio

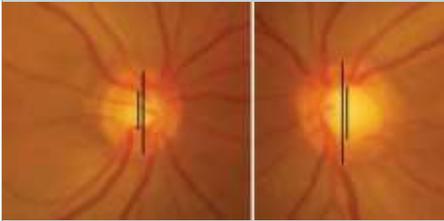


Glaucomatous optic nerve with optic disc hemorrhage inferiorly, with associated nerve fibre layer defect.



**Large physiological cup in a large disc**

## Asymmetry in CD ratio



Asymmetry in disk size leading to asymmetry in CD ratio.  
Left disk is larger



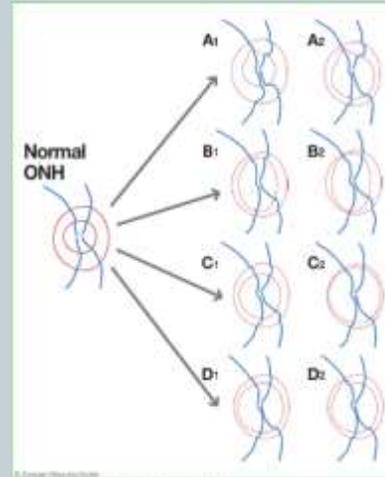
## Asymmetry of Cupping

- Asymmetry of C/D ratio greater than 0.1 was found in less than 7% of population. (But discs should be same size)



## Neuroretinal Rim

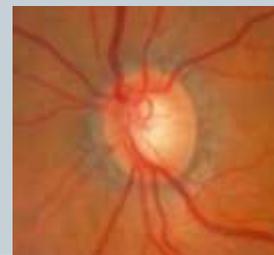
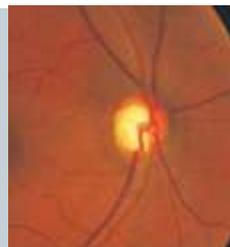
- Glaucoma is characterized by progressive narrowing of the neuroretinal rim. The pattern of rim loss varies :
  - diffuse narrowing,
  - localized notching, or
  - both in combination.
 Narrowing of the rim, while occurring in all disc sectors, is more common and greatest at the inferior and superior poles



## Vessels at the optic disc

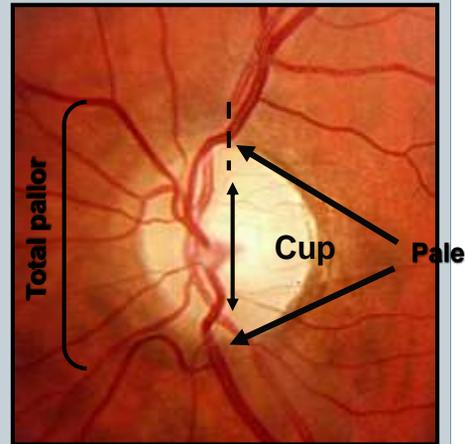
Narrowing of the neuroretinal tissue will change the position of the vessels at the optic disc with bending, **bayoneting** or beading of circumferential vessels. Those positional changes are particularly important to observe when looking for progression, in comparison to a baseline photo.

**Saucerization** : diffuse shallow cup extending to the disc margin with retention of central pale disc



## Non-Glaucomatous Optic Neuropathy

- In a glaucomatous disc, the pallor usually does not extend onto the rim.
- An eye with diffuse pallor is typically not a glaucomatous eye, despite the presence of cupping. In this case, you should suspect a non-glaucomatous optic neuropathy.



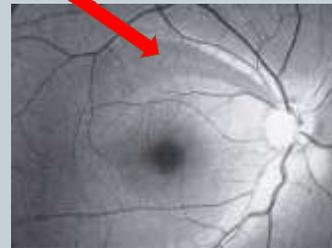
**Pallor > Cup**

## **5 Reasons to Obtain Neurologic Radiographs from Glaucoma Patients**

- 1. Pallor greater than cupping :**
- 2. VF Defects that Respect the Vertical Midline**
- 3. Younger Age (<50 Years) :** non glaucomatous optic neuropathy more common in patients less than 50
- 4. Poor Visual Acuity :** suggest non glaucomatous optic neuropathy 77% specificity
- 5. Patients Progressing at Normal IOP:** When previously well-controlled glaucoma patients begin progressing at acceptable IOPs, it is important to rule out a concurrent process.

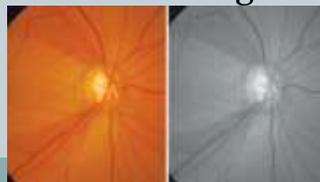
## NFL examination

- Green light (red free)
- wide, short slit, bright beam
- The green wave length are more highly absorbed by the RPE and choroid therefore the reflected light allows more contrast and easier viewing in NFL.
- Texture ( Striations)
- Medium size B.V.
- Any abrupt change to darker region
- prevalence of RNFL defects is < 3% in the normal population, their presence is likely to be pathological



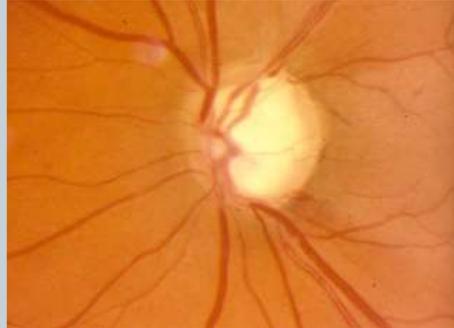
## Nerve fiber layer (NFL)

- **A generalized thinning** : of the NFL can be appreciated by comparison with the other half of the same fundus and with the other fundus; as well, generalized thinning can be detected by a greater prominence of the BVs, with sharper well demarcated transition between vessel edge and retinal tissue.
- **Localized NFL defects**: are easier to appreciate and can appear as the earliest sign of glaucomatous damage



## Optic Nerve Head Changes in Glaucoma

- **Vessel changes variable importance as indicators of glaucoma**
- **Peripapillary atrophy**
- **Slit like laminar dots are more significant than laminar dots**
- **Photography is very useful**
- **Multiple signs = more significant**
- **MULTIPLE SIGNS ALL IN THE SAME AREA**



Glaucomatous optic nerve with optic disc hemorrhage inferiorly, with associated nerve fibre layer defect.

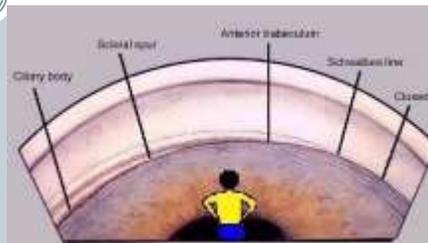
## Gonioscopy

Contact lenses are used to overcome the problem of total internal reflection.

### **Two basic types :**

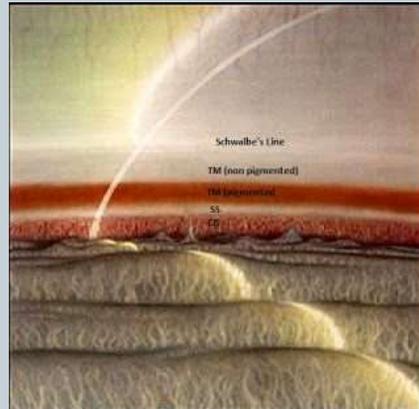
**Direct lens :** Direct lenses are used for surgical procedures such as goniotomy , goniosynechialysis &EUA. The Hoskins-Barkan and Swan-Jacobs lenses are most commonly used.

**Indirect lens:** using a mirror to look @ the angle useful & more convenient in clinic



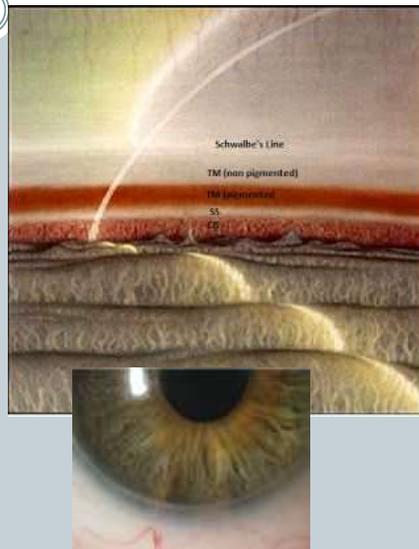
## Gonioscopy

- **Schwalbe's Line**
- **Trabecular Meshwork**
- **Scleral Spur**
- **Ciliary Muscle Band**
- **Iris Root and Iris**



## Schwalbe's Line

- The edge of Descemet's membrane.
- It is an important landmark to identify because normal vessels and tissue will not cross it. Neovascularization or PAS may pass Schwalbe's line anteriorly.
- if prominent called a **"posterior embryotoxon"** and can be found in normal individuals.
- identifying Schwalbe's line is the corneal light wedge using narrow beam

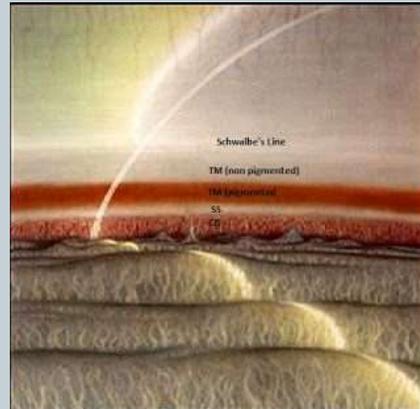


## Trabecular Meshwork

- The trabecular meshwork is a very important landmark
- The amount of pigmentation may vary from person to person, and even from quadrant to quadrant

### Schlemm's Canal

- Schlemm's canal drains the aqueous humor after passing through the trabecular meshwork. It is only visible when there is blood in the canal.



### Scleral Spur

- The scleral spur is made up of a ridge of collagen tissue. This is noted by its white color.
- Identifying this structure helps to differentiate open angles from closed angles. It is possible for the scleral spur to be covered by small sharp-ended iris processes that reach up to the trabecular meshwork. They do not cross the trabecular meshwork and have no pathologic consequence.

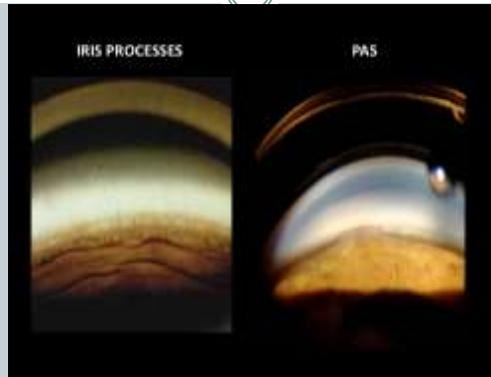
### Ciliary Muscle Band

- The anterior ciliary body band can be seen in eyes with deeper angles. It represents the longitudinal fibers of the ciliary muscle. This is the site of nonconventional or suprachoroidal outflow and is also a landmark for newer surgical procedures.

### Iris Root and Iris

- The insertion of the iris is an important part of the classification of angle anatomy. The configuration of the peripheral iris is also important to note when studying angle structures. Pathology that exists in this part of the angle includes ITC or apposition and PAS, which should be noted.

## Iris Processes & Peripheral Anterior Synechiae



. **Iris processes** are fine, lacy projections of peripheral **iris** tissue extending to the scleral spur or trabecular meshwork. They are a benign finding and are often seen in otherwise normal eyes.

## Gonioscopy

- **Blood vessels:** found in normal iridocorneal angles. They have a radial or circumferential orientation, have few anastomoses and do not run across the scleral spur.
- **Pathological vessels** are usually thinner, have a disordered orientation and may run across the scleral spur to form a neovascular membrane. Abnormal vessels are also seen in Fuchs' heterochromic iridocyclitis and chronic anterior uveitis.



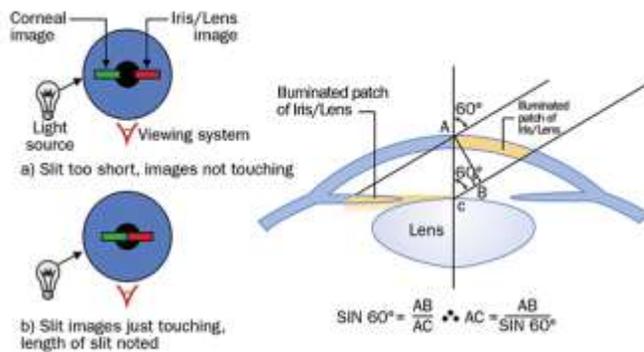
## Van Herick's technique

- A narrow slit beam is angled at 60° onto the limbus to estimate the depth of the peripheral anterior chamber.



Grade	Cornea:Peripheral AC ratio	Risk of angle closure Angle (°)
4	1:1 or higher	Very unlikely or impossible 35-40
3	1:1/2	Unlikely or improbable 20-35
2	1:1/4	Possible 20
1	1:<1/4	Likely or probably 10
0	No anterior chamber slit visible	Closed 0

## Central AC Depth Measurement Smith's Technique



# Glaucoma management



Non penetrating Glaucoma surgery



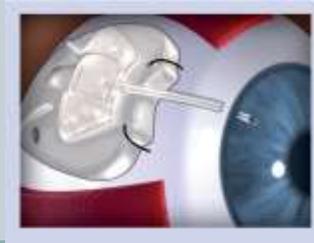
MIGS



ALT  
SLT  
MPLT

Yag PI

Gonioplasty



Cyclodiode photocoagulation

# Neovascular Glaucoma???



## Neovascular Glaucoma

### Medical: not a solution

drops to decrease aq productin , avoid PGA & never use pilocarpine  
Steroids , Cycloplegics

Anti – VEGF : adjunctive ,temporary 4 to 6 weeks

Panretinal photocoagulation : ASAP , mainstay of therapy

Trabeculectomy & GDD : comparable results ?( TVT study)

Cyclodiode photocoagulation :

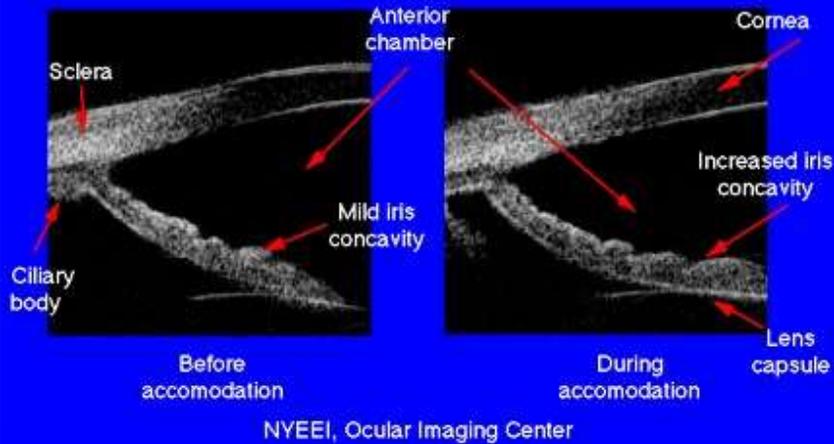
## Pigment Dispersion Syndrome

- Young myopic patients  
During blinking or accomodation the iris bows backwards (**reverse pupillary block**) & vigrouse exercise Pigments from posterior surface of the iris becomes dispersed throughout the anterior segment & may damage TM & lead to ++IOP (**PG**)



## PDS & PG

### Reverse Pupillary Block in Pigment Dispersion Syndrome



## PDS & PG

### Transillumination defect :

Dark room ,Coaxial, short beam  
,highest illumination

### Krukenberg spindle :

Focus S L broad beam on  
corneal endothelium  
Neither sensitive nor specific  
to PDS

Pigment dispersion may  
disappear

2ry causes : IOL ,angle  
recession, Iris cyst



EyeRounds.org

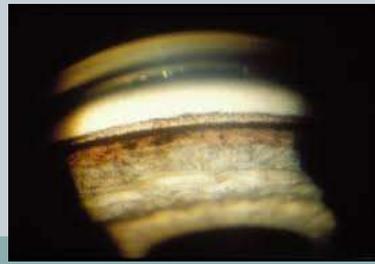
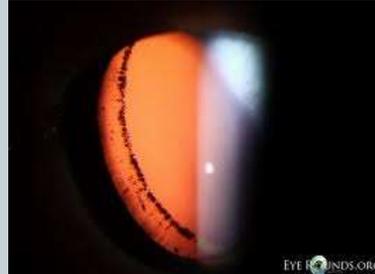
## Pigment Dispersion Syndrome

### **Scheie stripe or Zentemeyer line:**

dilate pupil ask patient to look in extreme gaze & focus on PC  
Pigments may deposit on Hyalo – capsular ligament & filtration bleb

### **Pigment reversal**

NB :Pigmentary glaucoma may burn out  
smaller pupil & lens thicker



## Laser PI

- Laser PI may reduce pigment shedding (relief of reverse pupillary block).
- This may help prevent glaucoma in individuals at higher risk but have not yet developed uncontrolled IOP .
- LTP effective but IOP spikes may occur post op



## Plateau Iris

- Type of narrow angle more commonly seen in younger adults that can lead to chronic angle closure glaucoma
- The iris configuration is planar and the depth of the anterior chamber (ACD) is normal the iris root is often short and inserted anteriorly on the ciliary face, causing a shallow and narrow angle there is a relative pupil block mechanism.



## Plateau Iris

- A “double hump sign” on indentation gonioscopy is characteristically seen
- The peripheral “hump” on the iris is caused by the ciliary body propping up the iris root, whereas central “hump” represents the central third of the iris resting over the surface of the lens



## Plateau Iris

- Yag PI
- Argon Laser Peripheral Iridoplasty (Gonioplasty)
- Pilocarpin
- Goniosynecholysis
- Cataract surgery & trab



## THANK YOU FOR YOUR TIME

- **Visit:**

**Adel Abdelshafik website & youtube Channel**

**IOWA Glaucoma curriculum**

**Gonioscopy .org**

**optic-disc.org**