Glaucoma: When angle is not wide open

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Disclosure

- Sanofi Speaker
- EyePromise - employee

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Risk factors Angle closure

- Race- Chinese Asians more common, inuits, higher prevalence compared to Caucasians
- Women- 70% cases; shallow chamber, smaller axial length compared to men
- Age-older individuals
- Hyperopia
- Smaller axial length
- Fellow eyes of an individual at risk
- First degree relatives of an angle closure patient

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Precipitating factors

- Factors that produce dilation
  - Dim illumination
  - Emotional stress
  - Drugs
- Factors that produce miosis (rare)

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Categories of angle closure

- primary angle closure suspect,
- Primary angle closure- 180 degrees or less of of TM visible, IOP normal, disc normal

Angle-closure glaucoma.

Primary angle closure glaucoma

Secondary angle closure glaucoma – Eg. Marfan's syndrome, uveitis, neovascular

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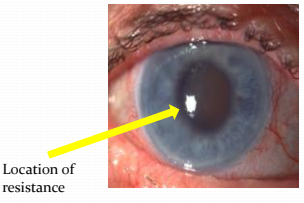
Pupillary block

- Most common form of Primary angle closure
- Initiating event- increased resistance of to flow of aqueous humor at pupil and anterior surface of lens
- Forward bending of iris
- Closure of angle



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Classification on clinical presentation

- Acute angle-closure/glaucoma
- Subacute angle-closure/glaucoma
- Chronic angle-closure/glaucoma
- Combined mechanism. glaucoma

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Acute angle-closure glaucoma

Symptoms

- Ocular pain
- Nausea and vomiting
- Blurred vision,
- Colored halos around lights
- Loss of vision

Signs

- Conjunctival and ciliary congestion,
- Corneal edema
- Shallow peripheral anterior chamber with cells and flare
- Intraocular pressure usually exceeds 40 mmHg

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Signs of a prior attack of angle closure

- iris atrophy,
- Posterior synechiae,
- glaukomflecken
- structural optic nerve damage- cupping or pale nerve

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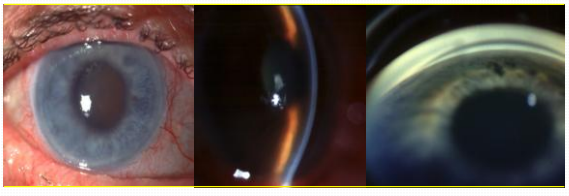
Acute congestive angle-closure glaucoma

Signs



- Severe corneal edema
- Dilated, unreactive, vertically oval pupil
- Ciliary injection
- Shallow anterior chamber
- Complete angle closure (Shaffer grade 0)

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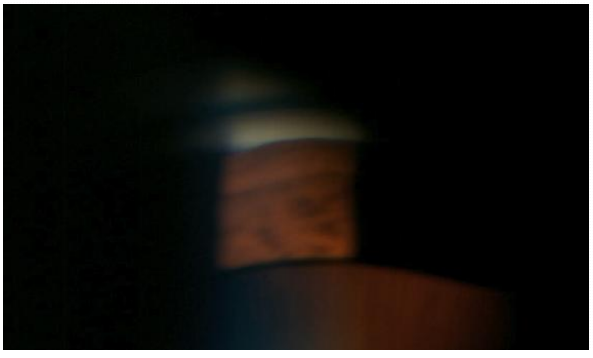
Angle without indentation



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Angle with indentation

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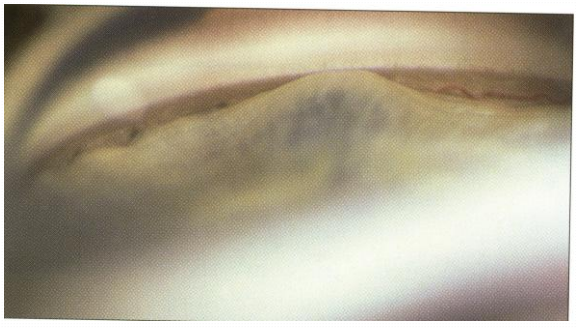
Peripheral anterior synechiae



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Iris Synechiae

- Iris is in contact to the peripheral cornea and the trabecular meshwork.
- During the first few hours of an acute attack synechiae have not yet formed
- Longer the iris is against the angle, the risk for anterior synechiae formation is higher and almost certain.
- Once this happens, the angle will no longer open with an iridectomy and trabecular outflow will be permanently affected.

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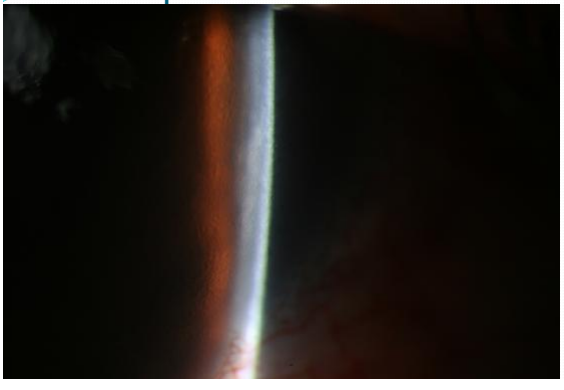
Corneal epithelial edema



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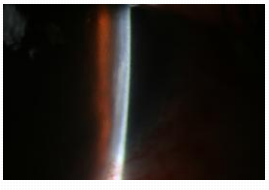
Corneal edema and halos

- Intraocular pressure is very high 50 mmHg or higher
- Aqueous that is forced into the corneal stroma, causing stretching of collagen lamellae and, eventually, epithelial edema.



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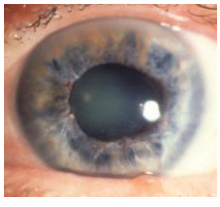
Mid-dilated unreactive pupils

- Paralysis and ischemia of the pupillary sphincter
  - caused by the increase in intraocular pressure
- Causing a fixed mid-dilated pupil



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Ciliary and conjunctival vessel congestion

- Venous congestion: This occurs when intraocular pressure exceeds that of episcleral veins.
- Iris blood vessels become dilated and also the veins in the conjunctiva, giving the patient a painful red eye

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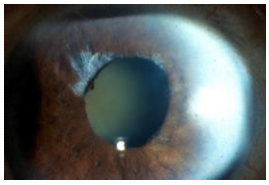
Iris atrophy



- The abrupt increase in intraocular pressure causes an interruption of the arterial supply to the iris, resulting in ischemia which causes damage to the iris, leaving behind patches of stromal atrophy

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Aqueous flare

- Mild flare due to break down of blood aqueous barrier so there is protein in anterior chamber

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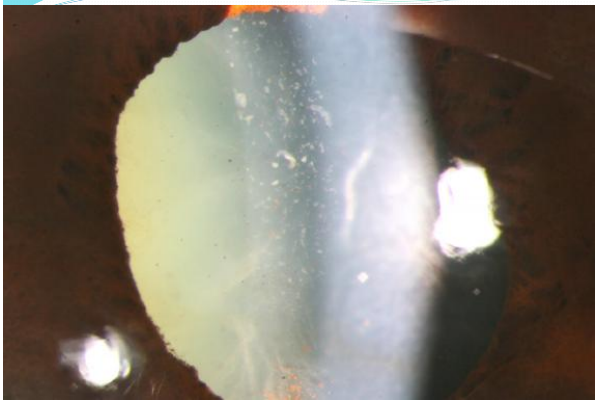
Glaucomflecken



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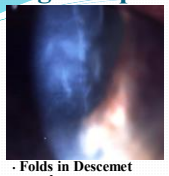
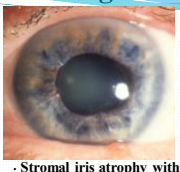
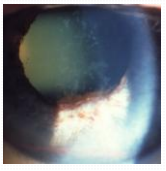
Signs of postcongestive angle-closure



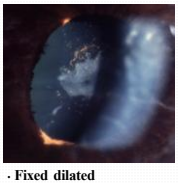
· Folds in Descemet membrane



· Stromal iris atrophy with spiral-like configuration



· Posterior synechiae
· Fine pigment on iris



· Fixed dilated pupil
· Glaukomflecken

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Autonomic Stimulation:

- Nausea and vomiting may accompany the acute angle-closure attack
- The oculocardiac reflex produces bradycardia (slow heart rate) and there is often profuse sweating.

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Sub-Acute Angle Closure

- Symptoms in subacute ACG may be similar to those in acute angle-closure glaucoma, but of intermittent or lower intensity, and may spontaneously disappear.

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Chronic angle-closure glaucoma

- Peripheral anterior synechiae (PAS)
- Increased intraocular pressure
- Patient asymptomatic until vision loss

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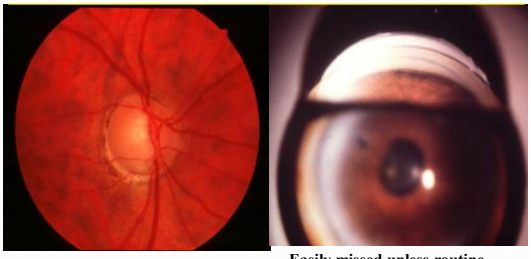
Chronic angle-closure glaucoma

Signs



- **Similar to POAG with cupping and field loss**
- **Easily missed unless routine gonioscopy performed**
- **Variable amount of angle closure**

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Combined mechanism glaucoma

- Open angle and angle closure mechanisms at work
- Diagnosis- IOP elevated post angle closure and successful iridotomy and open angle.

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Mechanisms of angle closure

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Pupillary block

- Eyes with shallow anterior chamber,
- more anterior position of the lens
- greater anterior surface curvature of lens , increases the area of contact of the posterior iris surface to the lens
- This causes a facilitating a pressure differential between the anterior and posterior chambers that causes forward bowing of the relaxed, peripheral iris.

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Anatomical

- Lens size and position.
- Eyes with a thicker and anteriorly positioned lens tend to have shallower anterior chambers
- Aging increases lens thickness

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Plateau Iris

- the anterior chamber depth appears to be normal,
- the iris plane remains flat,
- but the angle looks narrow or closed due to the shape of the peripheral iris

- Iris drops abruptly in the far periphery, making a narrow recess over the trabecular meshwork.
- The mechanisms that increase iridotrabecular contact are:
  - thicker iris,
  - anterior iris insertion
  - anterior position of the ciliary body.

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Plateau Iris caution

- Eyes with plateau iris configuration may have angle-closure when the pupil is dilated
  - iridotrabecular apposition

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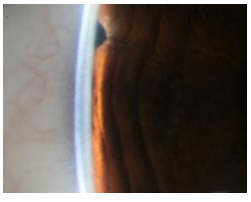
Plateau Iris with relative pupillary block

- Treatment is with peripheral iridotomy



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Plateau Iris Syndrome

- Whenever gonioscopy confirms angle-closure in the presence of a patent iridotomy.

- When performing indentation in these cases the iris can be pushed posteriorly, so it assumes a concave shape that follows the lens curvature, but the peripheral iris remains elevated due to the position of the ciliary processes.

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Treatment

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Treatment summary

Medical treatment	Laser treatment	Surgical treatment
Pilocarpine	Argon laser peripheral iridotomy	Anterior chamber paracentesis
Hyperosmotic agents (glycerin and mannitol)	Argon laser iridoplasty	Iridectomy
Carbonic anhydrase inhibitors	Argon laser iridotomy	Lens/cataract extraction
Alpha agonists	Nd:YAG iridotomy	Filtering surgeries
Prostaglandin analogs		Cyclodestructive surgeries
Beta blockers		

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Medical treatment- Goals

- Lower intraocular pressure
- Alleviate pain
- Clear cornea
- Prevent synechiae

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Intravenous medications

- Acetazolamide 500mg intravenous
- Intravenous Mannitol
- Best therapy however is not always available in clinics

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Treatment protocol-Acute angle closure- ABC procedure

- Alpha -2 agonist- Brimonidine
- Beta blocker- Timolol (caution in asthmatics) or Betaxolol
- Carbonic anhydrase inhibitor – Dorzolamide (Caution sulpha allergy contraindication)
- Each medication given every 15 minutes

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Oral medications

- Oral Carbonic anhydrase inhibitor
- Two tablets of 250 mg acetozolamide (Caution sulpha allergies contraindication)
- Works good when patient can retain medication - Vomiting common with angle closure glaucoma

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- Check intraocular pressure after 1 hour if lower
- Add Pilocarpine every 15 minutes for 45 minutes and repeat the procedure
- Seek ophthalmologist opinion-refer patient

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Take home medication

- Prednisolone acetate 1% q1-6 hours (approx every 3 hours)
- Acetazolamide 500 mg sequel BID
- Alpha agonist or beta blocker BID
- Pilocarpine 2% QID

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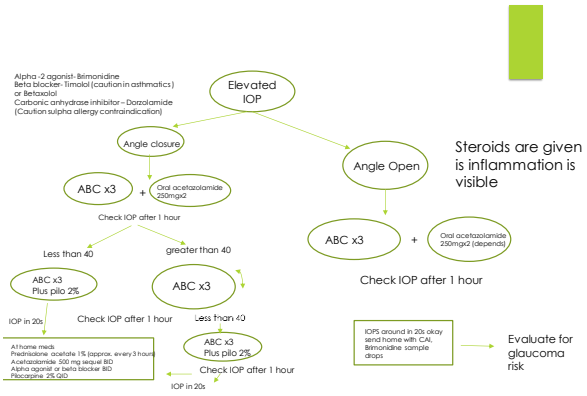

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Laser therapy

Procedure	Laser used	Indications
Iridotomy	Nd:YAG Argon Sequential argon-ND:YAG	Occludable angle Contralateral eye of an acute ACG Narrow or closed angle in more than 180 degrees with optic nerve damage and high IOP Acute ACG
Peripheral Iridoplasty	Argon	Plateau iris In preparation for laser trabeculoplasty After iridotomy if iris apposition is still present Before an iridotomy, in cases of thick, inflamed or rubeotic irises.

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ZAP trial

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Laser peripheral iridotomy for the prevention of angle closure: a single-centre, randomised controlled trial

Mingguang He, Yuzhen Jiang, Shengsong Huang, Dolly S Chang, Beatriz Munoz, Tin Aung, Paul J Foster*, David S Friedman*

Zhongshan Angle Closure Prevention (ZAP) Trial

www.thelancet.com Vol 393 April 20, 2019

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ZAP

- 11,991 screened
- 889 enrolled
- 889 eyes treated fellow eye 889 not treated
- Primary outcome Angle closure by 72 months
- Incidence of angle closure
  - 4.19 per 1000 treated
  - 7.97 per 1000 untreated
- Small but significant protective effect of treatment
- Widespread prophylactic laser for angle closure suspects not recommended

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Effectiveness of early lens extraction for the treatment of primary angle-closure glaucoma (EAGLE): a randomised controlled trial

Augusto Azuara-Blanco, Jennifer Burr, Craig Ramsay, David Cooper, Paul J Foster, David S Friedman, Graham Scotland, Mehdi Javanbakht, Claire Cochrane, John Norrie, for the EAGLE study group

www.thelancet.com Vol 388 October 1, 2016

EAGLE trial

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EAGLE trial

Hypothesis tested –

- clear lens extraction after primary angle closure glaucoma
- leads to **better quality of life, lowering of IOP and less need for glaucoma surgery** than standard care
- Standard care – Laser iridotomy and medications

Interpretation Clear-lens extraction showed greater efficacy and was more cost-effective than laser peripheral iridotomy, and should be considered as an option for first-line treatment.

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BMC Ophthalmology
https://doi.org/10.1186/s12886-026-05059-2
Article in Press

Longitudinal changes in vessel density and retinal nerve fiber layer thickness after acute primary angle closure

Qian Hao, Yuan Qin, Linwei Yan, Yue Wang, Ju Li & Fang Fan

21 individuals 1 eye APAC, fellow eye control
Followed up after cataract surgery and fellow eye LPI
1, day 1 week, 1 month 3 months, 6 months and 1 year

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- **What is known:**
  - The previous studies demonstrate that an initial increase in RNFL thickness after a single APAC episode, followed by a subsequent decrease.
  - The high IOP has a greater impact on the changes in vessel density parameters after an APAC episode.

What is new:

- The study demonstrates that the cpVD decreased significantly 1 day after the APAC episode was fully resolved, and remained stable during the follow-up.
- The study demonstrates that the cpVD was the more sensitive predictor than the RNFL thickness for the glaucomatous progression of APAC patients.

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