Managing Angle Closure Disease
Where People Go Wrong and Why

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Declaration of Competing Interests

- I am supported by an NIHR HTA grant to investigate Cost Effectiveness and Health Related Quality of Life in SLT.

- In the last 5 years I have been in receipt of research funding, honoraria, travel or related support from:
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- Neither I, nor my family, have a financial interest in any ophthalmic product.
Angle Closure Disease

- What is it?
- Is it important?
- Who gets it?
- How do we detect it?
- What’s done about it?
- What should I look out for?
POAG is a \textit{diagnosis of exclusion}
1st Mistake:

If you don’t look – you don’t see.
- so gonioscopy for everyone
What then *is* ‘angle-closure’?

Defining feature: contact between iris and corneoscleral coat (primary aetiology) = ITC
Lights On & Lights Off
The Posterior Location of the Dilator Muscle Induces Anterior Iris Bowing during Dilation, Even in the Absence of Pupillary Block

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2nd Mistake:

It’s not just about pupil block.
- so gonio’ *after* PI and look for other mechanisms
Traditional (out-of-date) classification of angle-closure

- Acute ACG: severe symptoms
- Intermittent ACG: remitting symptoms
- Chronic ACG: high IOP, no symptoms
- Latent ACG: angle-closure inducible
Classification of angle-closure

- Newer scheme: endorsed by ISGEO, AAO, SEAGIG, AIGS
  - Abandons symptomatic classification

- Describes:
  - Natural history staging: *end-organ damage*
    i.e. addresses tissue damage affecting visual function
  - Mechanism causing closure
Natural history of angle-closure disease

Angle-closure *Suspects (PACS)*

- 10 - 40% per decade?

Angle-closure (*PAC*)

- 28% in 5 years?

Angle-closure *Glaucoma (PACG)*

*Foster, Buhrmann, Quigley, Johnson*  *BJO 2002*
3rd Mistake:

Diagnostic muddles...
- language dictates how we think: take care with classification!
Classification by mechanism

- Ritch’s System
  - Pupil block
  - Anterior, non-pupil-block (incl. plateau) $25 - 40\%$
  - Lens induced
  - Causes behind the lens
- Mixed mechanism disease: common $\text{upto 50}\%$?
- Sub-classification
  - B-type
  - S-type
Mechanisms of Closure

- Ritch’s 4 “levels of block”
  - Pupil block vs Non-pupil block
    - peripheral iris crowding; prominent last iris roll; plateau-type etc: 24-33%
  - Direct ‘large lens’ effects
  - Mixed mechanisms
European Prevalence of PACG (%) by age group

Overall 40 years +

70+ years old

60-69 years old

50-59 years old

40-49 years old

Mean (95% CI)

0.4 (0.3 - 0.5)

0.94 (0.63 - 1.35)

0.20 (0.06 - 0.42)

0.60 (0.27 - 1.00)

0.02 (0.00 - 0.08)
PACG Prevalence in European Populations

- **Absolute numbers:**
  - UK = 130,000
  - Europe = 1.6 million
  - US = 581,000

- **Increase over 10 years:**
  - 19% UK
  - 9% Europe
  - 18% US
Who needs an iridotomy? Who needs screening?
4th Mistake:

Angle closure is not ‘rare’!
“Why me?”
Natural history of angle-closure

Narrow Angle

Synechial Angle-closure

Appositional* TM Damage†

Glaucoma

*Thomas BJO 2003 †Sihota Indian J Ophth 2001
Natural history of primary angle-closure

Risk Factors for Angle-closure

Angle-closure: ITC

Trabecular Meshwork Dysfunction

Glaucoma
Natural history of primary angle-closure

Risk Factors for Angle-closure

Angle-closure: ITC

Trabecular Meshwork Dysfunction

Glaucoma

Iris volume? Choroid?

Apposition* Synechiae†

IOP

*Thomas BJO 2003 †Sihota Indian J Ophth 2001
Risk factors for PACG

Demographic

- Age +++
- Race ++
- Gender +
- Family history ?

Ocular

- Anterior lens position
- Thicker lens
- Shallow anterior chamber centrally
- Decreased radius of corneal curvature
- *Lens vault etc*
- *Iris anatomy/physiology*
- ?Choroid physiology
Detecting Angle Closure in 2013
1st Mistake (again):

If you don’t look – you don’t see.
- so gonioscopy for *almost* everyone
Chamber Width an independent risk factor
Lens Vault

Left spur x,y: 99, 165
Right spur x,y: 536, 159

Lens Vault
Anterior Chamber Area
Iris Factors

(adjusted for age, gender, ACD, AL and pupil size)

IRIS CURVATURE
(OR 2.5, 95% CI=1.3-5.1)

IRIS THICKNESS
(OR 2.7, 95% CI=1.6-4.8)

IRIS AREA
(OR 2.6, 95% CI=1.6-4.1)

NARROW ANGLES
Does iris *physiology* predict angle closure?
Iris Cross-sectional Area Decreases With Pupil Dilation and its Dynamic Behavior is a Risk Factor in Angle Closure

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- Iris x-sectional area reduced on physiological pupil dilatation
- Rapid, reversible change
- Less change seen in PACG
- Histology suggests extra-vascular changes
  - BVs only 10% of cross-sectional area
Raw – unadjusted figure
“De-warped” – adjusted figure
Pigment in the angle
Peripheral anterior synechiae
5th Mistake:

Over-reliance on Imaging...
- Lest we forget! ...gonioscopy for all.
Risk Factors & Imaging summary

- Anatomy differs, but predicts poorly
- Does iris physiology differ?
- Challenges for standardisation of assessment conditions
- Perhaps it’s not just thick lenses in small eyes after all...
Principles of *Treatment* in Angle Closure Disease
Principles of Managing PAC(G)

Remove risk of Acute Angle Closure
Preserve remaining Trabecular Meshwork Function
Treat any raised IOP

Restore non-pathological anatomical relationships:
Resolve Irido-Trabecular Contact (ITC)

Relieve Pupil Block
+/- Treat non-pupil block mechanisms of closure
Relieve Pupil Block

Iridotomy / Iridectomy

Lens Extraction

Post – Phaco’
Iridotomy

Pre-iridotomy

Pupil block
Pressure differential
Convex / Bombé
Angle closure : ITC

Post-iridotomy

Pupil block relieved
Flat iris plane
↑ iris-lens contact
Angle opens
Lens Extraction

Phakic

Pupil block
Bombé
Large Lens Volume
Angle closure: ITC

Post – Phaco’

Pupil block relieved
Flat iris plane
Angle open
Relieve Pupil Block
? Treat non-pupil block mechanisms of closure

- Iridoplasty
- Lens Extraction

Post - iridoplasty
Post – Phaco’
6th Mistake:

Forgetting the mechanism and treating only the pressure...
- Treat the angle *and* the nerve.
Clinical Scenarios

Symptomatic Acute Angle Closure, AAC & Asymptomatic Chronic Angle Closure, PAC(G)

Treatment Options

Iridotomy
Iridoplasty
Lens Extraction +/- synechiolysis

Plus whatever else required to control IOP: medical +/- trabeculectomy
There is no good evidence from good quality randomised trials or non-randomised studies of the effectiveness of lens extraction for chronic primary angle-closure glaucoma.

“There is still insufficient evidence about other interventions.”
Acute PAC & Early Lens Extraction

- **‘ACLIPS’**: RCT early phaco vs. LPI (Singapore)
  - 3 year follow-up
  - better IOP control, fewer med’s
  - 0% vs. 40% required trabeculectomy

- **Hong Kong RCT**: early phaco vs. LPI (Lam)
  - After attack broken; 18 month follow-up
  - 3% vs. 46% with IOP rise
  - Hazard Ratio for IOP rise 14.9 (95% CI 1.9 – 114.2)
Lens Extraction – selected evidence

- ‘Chronic PACG’ ~ 40% patients on fewer meds
  - Yang CH & Hung PT JCRS 1997
- ECCE vs. Trab’ ~ identical IOP control
  - Gunning & Greve JCRS 1998
- Mixed Group PACG ~ 6mmHg drop IOP 1 yr
  - Hayashi et al Ophthalmology 2000
Risks vs Benefits
Effectiveness, in Angle-Closure Glaucoma, of Lens Extraction

Is early lens extraction in PAC(G) (vs standard care)
- clinically effective?
- safe?
- cost-effective?
‘Chronic’ Angle Closure: time to remove a lens?

Consider:

- pre or post laser PI?
- IOP controlled or uncontrolled?
- any post-PI closure? (24-33%)
- severity of glaucoma?
- previous acute angle closure? when?
- race
- surgical risk
- refractive benefits
- extent of PAS?
Risks vs Benefits

**Treat:**
- Lens Opacity
- Pupil block and Non-pupil block
- IOP
- Hyperopia

**Prevent:**
- TM damage
- PAS
- IOP rise
- ?GON

**PACS**

**PAC**

**Mild PACG**

**Mod. PACG**

**Severe PACG**

**Surgical risk:**
- Small eyes
- IOP spikes & GON
- Prior AAC
- Aqueous Mis-direction
- Nanophthalmos

**+/− loss of accommodation**

**Laser risk?**
- Race
- PAS
Lens management suggestions in Angle Closure

- Any visually significant cataract in any angle closure

- Consider ‘Near-Clear’ lens extractions in:
  - PACG
    - post-LPI irido-trabecular contact (i.e. closure) or
    - raised IOP (on or off Rx)
  - PAC
    - presbyopic post-LPI closure, with residual raised IOP, esp. hyperopes
  - PACS
    - presbyopic post-LPI closure plus failed iridoplasty or hyperopia with residual raised IOP
Monitoring & Follow up for PAC Disease:

- **PACS**
  - Angle open? Discharge to annual IOP check
  - Angle closed? Needs annual IOP & gonioscopy

- **PAC**
  - Angle open & IOP normal? Discharge to annual IOP
  - Angle closed or IOP raised: IOP, VF, disc & gonio’

- **PACG**
  - As per severity of GON but shorter follow-up if an ‘unstable’ or at risk angle.
Summary

- Classify on mechanism & GON
- Rates higher than we thought
- PACG blindness > POAG
- Non-pupil block mechanisms are important
- Treat both mechanism & IOP
- Consider early lens-extraction

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