Glaucoma
Glaucoma: The Essentials

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‘I will have symptoms of pain or decreased vision if I have glaucoma’

True or False?

FALSE
1. Glaucoma is a silent disease
There is a cure for glaucoma.

True or False?

False
2. Glaucoma is a chronic disease
Most people with glaucoma go blind.

True or False?

False
3. If diagnosed early, treated and monitored blindness is RARE.
Lost eyesight from glaucoma can be restored.

True or False?

False
4. Visual field loss secondary to glaucoma is IRREVERSIBLE!

Dora Maar, Pablo Picasso’s weeping woman
Treatment for glaucoma is usually lifelong

True or False?

TRUE
5. Treatment is life-long, but majority avoid surgery.
What is glaucoma?
Aqueous humour production and circulation

**Production:**
- Continually produced by ciliary processes of ciliary body

**Circulation:**
- Flows through lens zonules (suspensory ligaments)
- Past lens
- Through the pupillary aperture
- Enters anterior chamber

**Drainage:**
- Drainage angle
- Filtration through trabecular meshwork
- Into canal of Schlemm
- Canal of Schlemm drains into extra-ocular veins
Glaucoma

Glaucoma is an optic neuropathy with a specific pattern of axonal loss which may be associated with elevated intraocular pressure and a typical pattern of visual field loss.
Glaucoma

• A disease of the optic nerves
• Two principal types
  o Open angle glaucoma
  o Closed angle glaucoma
Glaucoma

Open Angle
- Primary – presumed angle predisposition
- Secondary – cells, inflammation

Closed Angle
- Primary – narrow anterior chamber angle
- Secondary – tumours, synechiae

Other:
- Congenital

Secondary forms:
- Pigmentary
- Pseudoexfoliation
- Traumatic
- Neovascular
- Uveitic
- Irido corneal endothelial syndrome
- Phacomorphic
Four Key Components in Glaucoma Assessment

1. Intraocular Pressure
2. Angle Assessment
3. Optic Nerve
4. Visual Fields
Open Angle Glaucoma

- It affects 2-3% of people over 60
- 2nd leading cause of blindness in N.Z.
- In N.Z. 95% of glaucoma of this type
- There are significant racial variations
- Risk factors: FHx, myopia,
Primary open-angle glaucoma

- Commonest form

- **Risk factors:**
  - Ocular hypertension (↑ IOP)
  - ↑ age
  - Genetics/family history
  - Myopia
  - Vascular/haematological disease

- **Clinical features:**
  - Asymptomatic until advanced
  - Visual field defects:
    - Peripheral fields loss
    - Arctuate scotoma
Measuring the eye pressure
IOP Assessment

• “Normal IOP” is 21 mmHg or less
• 95 % of normals fall within this range
• Ocular hypertension > glaucoma
• 25-30 % of glaucoma in N.Z. is normal pressure glaucoma
• Proportion varies markedly with race
Gonioscopy
Glaucoma: the common feature –

Characteristic damage to the optic disc, the beginning of the optic nerve, at the back of the eye known as disc “cupping”
Optic nerve

Telephone Cable
Worsening of Disease
Advanced Glaucoma in the Right Eye

Right Eye

Left Eye
A Normal optic nerve head and visual field

B Glaucomatous optic nerve head and associated inferior visual field loss

C Extensive neural tissue loss in severe glaucoma and associated severe visual field loss

Optic nerve head cupping progression

0.3 c/d  0.6 c/d  0.95 c/d
How does glaucoma cause damage?
Normal visual field

Abnormal visual field
Glaucoma steals the peripheral vision

Normal vision

Moderate glaucoma

Severe glaucoma
Peripheral Visual Field Loss
Glaucoma Risk Factors

- Age
- Family history
- Elevated eye pressure
- Myopia (short sightedness)
- African Descent
- Steroid medication
- High blood pressure
- Migraine sufferers
For example:

Pigment dispersion
Observing the optic disc
Testing the visual field
How do we treat glaucoma?
Myth: Eye Drops do not have side effects outside the eye
Side-effects of Glaucoma Treatment
"I stopped taking the medicine because I prefer the original disease to the side effects."
Prostaglandin Analogues

↑ uveoscleral outflow
Side Effects

1. Eyelash Growth
2. Change in Eye colour
Eye before and After 20 months of treatment showing darkening of the eyelashes.
Beta Blockers

- Asthma
- Lower Blood Pressure
- Slower Pulse
- Dizziness
- Depression
- Vivid Dreams
- Impotence
- Hair Loss

↓ aqueous humour production
Alpha Agonists
Alphagan

- Allergies
- Fatigue
- Somnolence
- High Blood Pressure
- Dry Mouth
- Altered Taste

↑ uveoscleral outflow
↓ aqueous humour production
Neuroprotective [brimonidine]
Carbonic Anhydrase Inhibitors

- Drugs Available: Trusopt and Azopt
- Local Side Effects:
  - Stinging/burning
  - Conj hyperemia
  - Crusty Eyelashes
- Systemic Side Effects
  - Bitter taste

↓ aqueous humour production
## Summary of topical medications

<table>
<thead>
<tr>
<th>Drug class</th>
<th>Mechanism of action</th>
<th>Examples</th>
<th>Adverse effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostaglandin analogues</td>
<td>↑ uveoscleral outflow</td>
<td>Latanoprost Travoprost Bimatoprost</td>
<td>Eyelash growth (trichomegaly) Iris pigmentation Peri-ocular skin pigmentation Conjunctival injection ('red eye')</td>
</tr>
<tr>
<td>Beta blockers</td>
<td>↓ aqueous humour production</td>
<td>Timolol</td>
<td>Bronchospasm (asthma contraindication) Bradycardia Hypotension Fatigue Major depressive disorder Erectile dysfunction</td>
</tr>
<tr>
<td>Carbonic anhydrase inhibitors</td>
<td>↓ aqueous humour production</td>
<td>Dorzolamide Brinzolamide</td>
<td>Paraesthesia Malaise complex (fatigue, depression, anorexia, weight loss, libido loss) Gastrointestinal complex (gastric irritation, abdominal cramps, diarrhoea) Renal calculi</td>
</tr>
<tr>
<td>Alpha-2 agonists</td>
<td>↑ uveoscleral outflow ↓ aqueous humour production Neuroprotective [brimonidine]</td>
<td>Brimonidine Apraclonidine</td>
<td>Allergic conjunctivitis Xerostomia (dry mouth) Drowsiness and fatigue</td>
</tr>
</tbody>
</table>
Diamox and Sulphur allergy?

• “Sulfur” or “Sulphur” allergy is a misleading term

• Sulphonamide diuretics don’t contain the arylamide group which is responsible for hypersensitivity reactions (Aust Presc. 2008:31:8-10)

• Diamox should not be contraindicated in patients who have had reactions to sulphonamide antibiotics
"In the computer model the only side effect was a dry mouth."
Medications to reduce IOP - must get into the eye to work!
Most common treatment is eye drops

Need to confirm patient is using correct technique for getting drops in the eye
Laser Treatment for Glaucoma

- Non-invasive
- Works by improving the natural drainage of fluid out of the eye
- Painless
- Takes 2-3 minutes
• **Surgical:**
  - Trabeculectomy
  - Drainage shunts
  - Stents
  - Laser therapy: Argon laser trabeculoplasty
  - Cyclodiode laser therapy
New Microstents: iStent
What is angle closure glaucoma?

- Angle closure crisis is painful with significant morbidity
- It is generally ACUTE compared to Open angle which is CHRONIC
Acute angle closure

• **Symptoms and signs**
  - sudden onset painful red eye
  - pain may -> vomiting
  - may see *rainbow halos* round lights
  - _decreased visual acuity_ due to corneal oedema
  - _semidilated oval pupil_
  - _stony hard eyeball_

• **This is an emergency!**
  They will shortly go irreversibly blind.
Pupil block

- Increase in physiological pupil block
- Dilatation of pupil renders peripheral iris more flaccid
- Increased pressure in posterior chamber causes iris bombé
- Angle obstructed by peripheral iris and rise in IOP
  *(intra-ocular pressure)*
78 year old woman

- Acute red eye
- Painful eye
- Blurred vision
- Nausea and vomiting
- Other symptoms
  - Halo around lights
At Risk

1. Age over 60
2. Females greater than males (4:1)
3. Hyperopia
4. Asian ethnicity
5. Family history of angle closure with first degree relatives
Aims of early management in acute angle closure

• Eliminate severe pain and nausea
• Lower IOP and clear the cornea which allows for definitive management
• Prevent permanent visual loss
Treatment of acute angle closure glaucoma

**Drops**
Stat: pilocarpine, timolol
(and any other pressure lowering Drop you can find)

**IV/Oral**
Oral acetozolamide 500mg-1mg
IV acetozolamide
IV mannitol

**Laser**
Corneal indentation aims to break the attack by:

• Forcing aqueous into the peripheral anterior chamber opening the angle.
• If the angle can be forced open, the IOP will fall rapidly (within minutes)
• Definitive management can follow
Preferred instruments
Technique

- Topical anaesthetic
- Pressure in cycles
  - 30 seconds on / off
- IOP response in 3-4 cycles
- Inferior cornea
- End points
  - Iris contour → convex
  - Pupil margin movement
Case 1: 69 year old male

- PC: Acute onset severe pain and nausea 3-4 hours following pupil
- IOP 72mm Hg OD, 14mmHg OS
- Oral Diamox, Pilocarpine, Timolol and Brimonidine

- Minimal decrease in IOP after 45 min.
- IOP OD 11mmHg after corneal indentation
- Definitive Rx with laser iridotomies (OD same day, OS next day)
Infantile Glaucoma

- Hazy corneas
- Tearing/watering
- Photophobia
- Buphthalmos
“IS THERE ANYTHING I CAN DO?”
Lifestyle and Glaucoma
Effect of yoga on IOP

• 10 subjects

• IOP measured sitting and immediately after headstand position

• IOP 14 +/- 2mmHg increased to 32 +/-4 mmHg.
Asanas with Props

The ancient yogis used logs of wood, stones, and ropes to help them practice asanas effectively. Extending this principle, Yogacharya Iyengar invented props which allow asanas to be held easily and for a longer duration, without strain.

Yogacharya Iyengar in Setubandha Sarvangasana

This version of the posture requires considerable strength in the neck, shoulders, and back, requiring years of practice to achieve. It should not be attempted without supervision.
Australian yoga
Other variables influencing IOP

- Head position at night
  - Flat-head sleeping position increase nocturnal IOP by 20-30%
Wind instrument and IOP

• Does playing a wind instrument affect glaucoma?

Yes.. 😞
Role of Diet: inconclusive evidence

- Omega-3 Fatty Acids
- Green collards
- Carrots
Gingko Biloba

- 3 potential effects of gingko extract: flavonoids and terpenoids
  - improvement in blood flow
  - protect against oxidative cell damage/free radicals
    - Glaucoma patients decrease mitochondrial function
    - Gingko improve
  - Anti-inflammatory effect

Flammer et al, Molecular Vision 2012
Cannabis?
Purpose: Association between physical activity levels and VF loss

Design: Longitudinal, observational study.

Participants: 141 OAG /suspect

Methods: Accelerometers for 1 week to define average steps per day, minutes of moderate-to-vigorous activity, and minutes of non-sedentary activity.

Main Outcome Measures: Point-wise changes in VF sensitivity associated with physical activity measures.

Conclusions:
- Increased walking,
- greater time spent doing moderate-to-vigorous physical activity,
- More time spent in non-sedentary activity were associated with slower rates of VF loss
- Additional 5000 daily steps or 2.6 hours of non-sedentary physical activity decreasing the average rate of VF loss by approximately 10%.
Swimming

1. IOP increased while wearing goggles by 4.5 mm Hg.

2. A smaller goggle face area was consistently associated with greater IOP elevation.

It is not harmful to use your eyes—no evidence. Computer use causes any damage.
Stress and IOP

• No strong evidence.

• Psychosocial stress questionnaire

• Positive correlation in female between stress score and IOP.

*Journal of Physiological Anthropology*
Conclusions

✓ Glaucoma is the leading cause of preventable blindness

✓ Silent disease requires regular eye assessments

✓ Treatment involves eye drops

✓ New treatments include laser procedures and microstents
Conclusions

✓ Lifestyle effects still being investigated

✓ Glaucoma patients should be cautious with yoga positions

✓ Cannabis lowers pressure but not recommended
The End

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