Co-existing glaucoma and cataract

Options:
- Combined or sequential surgery?
- Phacoemulsification or trabeculectomy alone?
- Cataract surgery first or cataract surgery first?

Scope

- What are the options?
- How is it done?
- What to look out for and how to get out of trouble?

Coexisting Cataract and Glaucoma

What are the options?

Options for Glaucoma Surgery

"Traditional" Filtering surgery
- Trabeculectomy
- Enhanced filtering surgery
- Drainage devices

Phacoemulsification

Phacoemulsification alone leads to reduction of IOP
- Angle closure glaucoma
- More postoperative complications
- More intraocular inflammation

Phacoemulsification >6 months average trabeculectomy

- More postoperative complications
- More intraocular inflammation
- More hypotony

Phacoemulsification alone

Phacoemulsification after trabeculectomy

Leads to induced trabeculectomy failure
- Especially effective 3 months after trabeculectomy
- Risk of IOP elevation in 3-6 months
- Increase in IOP of 2-5 mmHg in first 12 months after Phacoemulsification
- Change in topography
- More adverse events

Phacoemulsification vs Trabeculectomy

Phacoemulsification vs Consecutive Trabeculectomy-Phacoemulsification

- Phacoemulsification +6 months after trabeculectomy
- Similar success rate.

Phacoemulsification vs Consecutive Trabeculectomy-Phacoemulsification

- Phacoemulsification +6 months after trabeculectomy
- Better success rate.

Phacoemulsification Alone

- More postoperative complications
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- More hypotony

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Phacoemulsification vs Consecutive Trabeculectomy-Phacoemulsification

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Cons

- More complications in phaco trabeculectomy
- Higher the pre-op IOP, greater the IOP lowering
- ~1.5 mmHg

Combined or sequential surgery?

Opinions

• "Traditional" Filtering surgery
• Enhanced filtering surgery
• Drainage devices

Opinions for Glaucoma Surgery

"Traditional" Filtering surgery
- Trabeculectomy
- Enhanced filtering surgery
- Drainage devices

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Single, or Combined?

- Minimally Invasive Glaucoma Surgery
  - MIGS
  - Latest technologies
  - Less invasive procedure
  - Less conjunctival scarring
  - Remove bypass site of greatest aqueous outflow resistance
  - Subconjunctival 10K

Minimally Invasive Glaucoma Surgery

- Ideal MIGS
  - Ab internal approach
  - Minimal trauma/destruction of target tissue
  - Rapid post-op recovery
  - Safe
  - Effective long-term IOP reduction
  - Does not prevent/complicate subsequent conventional glaucoma surgery

Conventional Glaucoma Surgery

- Establish a direct communication between the AC and subconjunctival space
- Complications related to:
  - Late leaks, infection, scarring, dysesthesia
  - Pain & tube exposure, migration, infection, corneal decompensation

Novel IOP-lowering Procedures

- Drain aqueous into subconjunctival space
- Enhance uveoscleral outflow
- Improve trabecular resistance
- Safe
- Rapid post-op recovery
- Minimal trauma/destruction of target

Goniosynechialysis

- In angle closure
- Breaking of PAS, opening TM

Microbypass Trabecular iStent

- Heparin coated titanium
- Ab internal implantation
- Bypass trabecular resistance
- Improves TM outflow facility
- Requires visualization of TM


Saheb H et al. J Glaucoma 2014


Teekhasaenee et al. Ophthalmology 1999

Maeda et al. J Glaucoma 2014


Minimally Invasive Glaucoma Surgery

Enhance Conventional Outflow

Enhance Juxtacanalicular TM Outflow

Ideal MIGS

Drain Aqueous into Subconjunctival Space

Decrease Aqueous Production

ECP

Cypass

Trabectome

Hydrus

iStent

GSL

iStent + Phaco

Enhance OUflow

Goniosynechialysis

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iStent + Phaco

Enhance OUflow
21.1 ± 5.3
2.2 ± 1.4

More iStents = Lower IOP

- Operative
- 2-3 iStents implanted at end of phacofragmentation
- 30 days, 30%, 6 months follow-up
- Post-op IOP < pre-op IOP (p < 0.05)
- Median IOP at 6 months: 15.5 (p < 0.05)
- Glaucoma medications reduced by 5.7 (p < 0.05)
- 5% group needed significantly less medication

Post-op IOP less than pre-op IOP (p < 0.001)
Mean IOP at 1 year 14.3 mmHg

Trabectome

- Device delivers up to 480 µm of Schlemm’s canal
- Cross-dressing for anterior chambers
- Using Trabectome you can perform intracanalicular Schlemm’s canal visualization
- Animal studies
- New technology, safer technology
- No need for efferent valve
- No need for postoperative medications
- No technique 

- Phase 1: Early IOP spike in Phaco-trabectome
- Phase 2: Late IOP spike in Phaco-trabectome

Post-op complications
- Only IOP spikes in phase 1
- Not associated with postoperative medications
- Not the result of any postoperative medications

Phaco-trabectome vs Phaco-trabeculectomy

- Prephaco trabeculectomy in 35 trabeculectomy pts
- 6 months follow-up

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<tr>
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Trabectome + Phaco

- Excimer Laser Trabeculotomy (ELT)
- Make a small incision in TM and open up Schlemm’s canal
- Provide a direct pathway for aqueous into collector channel
- Phaco-trabeculectomy anterior chamber incision
- No postoperative medications
- A small pressure of 90° through a transverse approach

Trabectome

- Hydrus Schlemm’s Canal Scaffold
- Intracanalicular scaffold
- Bioded low energy, nonthermal
- Suture lines can be placed into Schlemm’s canal
- Can be molded to shape
- Can be crossed by laser fibers
- Inserted through TM
- Spans 3 clock hours to target multiple collector channels
- Scalloped, open design
- Flexi-vascular: flexible, biocompatible

Intracanalicular scaffold

- Pfeiffer et al. AGS 2012
- Ahuja 3 stent group needed significantly less medication
- MedicaHons reduced from 2.7 to 0.7 (p < 0.001)

Retrospective, single-center (Mayo), case series
Randomised controlled multi-center trial
- iStent + Phaco
- iStent + Phaco
- Hydrus

- More iStents = Lower IOP
- Target IOP achieved in 77% post-op vs 43% pre-op
- IOP reduction 2
- Post-op IOP 15.9 ± 3.5
- Pre-op IOP 0.2 ± 0.7

- 2Jea SY et al. J Glaucoma 2012
- 2Tetz et al. ESCR 2011

- Post-op complication
- Stent malposition
- Decrease 6.7 (27%)
- 12 (44%)
- Compared to 34% with two trabecular micro-bypasses

- Adverse events
- Need for post-op IOP medication lesser in iStent group
- 89 %
- Multicenter trial
- Phaco-trabeculectomy
- Trabectome + Phaco
- Phaco-trabeculectomy vs Phaco-trabectome

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- Ahuja 3 stent group needed significantly less medication
- MedicaHons reduced from 2.7 to 0.7 (p < 0.001)
### ELT Results

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- **Pre-op** to **Post-op**: 20% improvement

### ELT

- ELT vs. 180° SLT
- No significant difference in complete/qualified success
- Post-op: 18.9 ± 8.1 to 1.4 ± 1.4 (P<.001)

### CyPass Suprachoroidal Microstent

- Polyamide material
- Size of a grain of rice
- Drain aqueous into suprachoroidal space

### CyPass alone for OAG

- Multicenter clinical trial
- EOS eyes, OAG, 12 months follow-up

### CyPass + Phaco

- Multicenter clinical trial
- EOS eyes, OAG, 12 months follow-up

### CyPass + Phaco

- Multicenter clinical trial
- EOS eyes, OAG, 12 months follow-up

### AqueSys

- Polyamide material
- Size of a grain of rice
- Drain aqueous into suprachoroidal space

### AqueSys Data

- None available on PubMed

### Cases

- 225 eyes, OAG, 12 months follow-up
- None available on PubMed

### Complications

- Pre-op well-controlled IOP (n=41)
- Pre-op uncontrolled IOP (n=57)

### Drainage

- Drain aqueous into subconjunctival space

- Tube implanted into pigmented trabecular meshwork with one end in anterior chamber and the other in the subconjunctival space

- Drainage channel diameter 250 microns external diameter with internal lumen

- Size of a grain of rice

### IOP Reduction:

- Pre-op mean IOP 21.1 ± 5.9 to Post-op 18.9 ± 8.1 (P<.001)

### Macula Edema

- BRVO
- Persistent inflammation
- Transient hyphaema
- Transient early hypotony (13.8%)
- IOP unchanged, meds reduced by 30%
- 37% reduction in IOP, meds reduced by >50%
- No significant difference in complete/qualified success
ECP
• Pulsed, continuous-wave diode laser
• Delivered with fiber optic cable
• Fiber optic cable houses the laser probe and endoscopic camera
• Laser applied to ciliary processes
• Under direct endoscopic visualization

ECP + Phaco

MIGS Results
• MIGS better than phaco alone in reducing IOP
• No RCTs, mostly case series
• IOP reduction inferior to trabeculectomy
• Small number of subjects
• Short duration of follow-up
• Lack of publications

Efficacy
• Adriamycin® Effective Glaucoma Surgery?
• Not suitable for patients with low target IOP

Should We Adopt MIGS?
• Depends on outcome of trials
  – Safety
  – Efficacy
  – Long term results
• Ease of performing surgery
• Cost of procedure, implant & consumables

Phaco Alone in PACG – Potential problems
• Very shallow anterior chamber
• Iridodialysis
• Bulky lens
• Zonular weakness
• Posterior synechiae especially after acute attack

Solutions
• Long corneal tunnel
• Break posterior synechiae before starting capsulorhexis
• Release viscoelastic before hydrodissection
• Increase bottle height during phaco
• Gentle nucleus manipulation
• May require capsular tension ring

Phaco/IOI/Trab/ MMC
• Surgical videos
  • Divert conjunctival flap and scleral flap
  • Place MMC sponges under conjunctival flap
  • Perform phaco
  • Perform sclerostomy and iridectomy
  • Closure of scleral and conjunctival flaps

Surgical Options
Phacemulsification alone or with
1. Filtration surgery– trabeculectomy/MMC
2. Goniosynechiolysis
3. Endoscopic cyclophotocoagulation
4. Minimally invasive Glaucoma surgery (MIGS)
5. Ahmed
6. Neovue
7. iStent
8. Trabectome

Gonioysis
Phaco/IOI/Trab/ MMC

Angle Closure
Phaco/IOI/Tраб/ MMC
Phaco/IOI/Tраб/ MMC


Goniosynechiolysis in PACG

- Surgical video
- Complete phaco/IOL, inflate AC with viscoelastic
- Visualize angle structures with gonio lens
- Insert spunkt into AC to reach iris
- Gently break iris with spatula
- Additional corneal incisions to reach all quadrants

Endoscopic cyclophotocoagulation

- Surgical video
- Complete phaco/IOL, inflate AC with viscoelastic
- Visualize angle structures with gonio lens
- Insert implanting needle into AC
- Enter PTM, aiming to exit sclera 2-3mm behind limbus
- Deploy implant

AqueSys

- Surgical video
- Complete phaco/IOL, inflate AC with viscoelastic
- Visualize angle structures with gonio lens
- Implant inserted into target zone

Hydrus

- Surgical video
- Complete phaco/IOL, inflate AC with viscoelastic
- Visualize angle structures with gonio lens
- Implant inserted into target zone

iStent

- Surgical video
- Complete phaco/IOL, inflates AC with viscoelastic
- Visualize angle structures with gonio lens
- Implant inserted through TM
- May need 2 or more implants spaced apart

Trabectome

- Surgical video
- Complete phaco/IOL, inflate AC with viscoelastic
- Visualize angle structures with gonio lens
- Insert probe into AC
- Advance probe towards ciliary processes till they whiten and shrink, then withdraw
- Pay attention to endoscope view & Microscope view

Complications: When can these occur?

- Intraoperative
- Early postoperative
- Late postoperative

Complications of Glaucoma Surgery: What to expect and how to manage them

Jocelyn CHUA
Consultant
Glaucoma Service
Singapore National Eye Centre
Intraoperative complications

- Corneal dehiscence - Excessive handling of conjunctiva
- Intracameral hemorrhage - Risk on scleral flap
- Scleral tear - Risk on scleral flap
- Suprachoroidal bleed - Immediate wound closure
- Bleb wound leak - Bandage contact lens

Management of intraoperative complications

- Corneal dehiscence - Excessive handling of conjunctiva
- Intracameral hemorrhage - Risk on scleral flap
- Scleral tear - Risk on scleral flap
- Suprachoroidal bleed - Immediate wound closure
- Bleb wound leak - Bandage contact lens

Early postoperative complications

- Hyphema - Avoid incision of iris root during iridectomy
- Retained anh-­‐metabolite sponge - Need to account for number of sponges (medication)
- Hyphema - Avoid damage to iris root during iridectomy
- Underfiltration - Avoid having height flap sutures; iridectomy performed
- Overfiltration - Avoid having loose flap sutures

Management of early postoperative complications

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Late postoperative complications

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Management of late postoperative complications

- Hyphema - Avoid incision of iris root during iridectomy
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- Hyphema - Avoid damage to iris root during iridectomy
- Underfiltration - Avoid having height flap sutures; iridectomy performed
- Overfiltration - Avoid having loose flap sutures

Advantages

- Concomitant opening
- Use of lateral scleral flap
- Risk of anterior erosion lower than tubecular flap
- Use of MMC
- Glaucoma surgery

Pre-­‐requisite for success

- Correct identification of angle structures - posterior trabecular meshwork
- Van to see glaucoma well
- Familiarity with instruments, residents
- Patient selection / glaucoma medications
Early postoperative complications
- Underfiltration with raised IOP - Topical glaucoma meds
- Hyphema - Often treated conservatively
- Dislocated implant - May need removal of implant

Late postoperative complications
- Underfiltration with raised IOP - Topical glaucoma meds

I-Stent: Success of IOP control
- 6 weeks - 60% final IOP reduction
- 6-24 months - 50% failure rate with 50% requiring additional surgery. 40% fail at 1 year
- 6-24 months - 85% mean IOP reduction, 90% failure rate

Trabecome: Success of IOP control
- 12 months - 60% final IOP reduction
- 6-24 months - 70% failure rate with 60% requiring additional surgery.
- 6-24 months - 85% mean IOP reduction, 90% failure rate

Intraoperative complications
- Trauma related
  - Scalp / conjunctival laceration
- Endoscopy
  - Laser damage to intraocular structures

Early postoperative complications
- Goniotomy - Cataract surgery performed as well as disease severity

Type and severity of complications depend on the type of glaucoma surgery performed as well as disease severity

Early postoperative complications
- Increased AC inflammation
  - Increase topical steroid doses
- Hyphema
  -虹膜前房出血
- Dislocated implant
  - May need removal of implant

Late postoperative complications
- Scleral / conjunctival burn

IOP:
- 6-24 months - 70% failure rate with 60% requiring additional surgery
- 6-24 months - 85% mean IOP reduction, 90% failure rate

Hyphema
- Hyphema

Posterior vitreous detachment / Retinal detachment
- Retina disease
- Cataract surgery

Arriola
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Subjects:
Mild-moderate primary open angle glaucoma
- Aver 3 years – 16% final IOP reduction;
- 42% medical free
- At 15/24 months – 67% medical free; medical use not
- At 1 year – 30% final IOP reduction;
- 75% medical free
- At 6 mths – 66% medical free

Ahuja

Underfiltration with raised IOP - Topical glaucoma
Dislodged implant - May need removal of implant
- Hyphema - Ovner treated conservatively

Minckler
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Trans
Am
Ophthalmol
Soc
2008;106:149-60.

Maeda
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Glaucoma

Francis
BA
et
al.
J
Cataract
Refract
Surg
2008;34:1096-103.

Phthisis bulbi / vision loss

Raised IOP - Topical glaucoma meds

Underfiltration with raised IOP - Topical glaucoma
Dislodged implant - May need removal of implant
- Hyphema - Ovner treated conservatively

Minckler
D
et
al.
Trans
Am
Ophthalmol
Soc
2006;104:40-50.

Makrasky

Overfiltration with raised IOP - Topical glaucoma
Dislodged implant - May need removal of implant
- Hyphema - Ovner treated conservatively

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Phthisis bulbi / vision loss