

SURGERY

Surgery

- I. Why surgery?
- II. Filtration surgery
- III. Antifibrotics in surgery
- IV. Angle configuration surgery
- V. Key points

Open-angle and secondary glaucomas

- Glaucoma filtration surgery
 - Penetrating
 - Non-penetrating
 - Glaucoma drainage device

Angle closure (\pm glaucoma)

- Surgery to modify the angle
 - Pupillary block relief
 - Iridectomy
 - Widening of the anterior chamber angle inlet
 - Lens extraction
 - Goniosynechialysis
- Glaucoma filtration surgery
 - Trabeculectomy
 - Glaucoma drainage device

Childhood glaucoma

- Surgery to modify the angle
 - Goniotomy and trabeculotomy (primary treatment)
- Glaucoma filtration surgery
 - Trabeculectomy, with or without trabeculotomy
 - Glaucoma drainage device

Surgery: why?

- Most powerful IOP-lowering procedure
- Resources for surgery are widely available
- Reasonably safe

Surgery: when?

- Failed medical and/or laser treatment
- Anticipated failure of medical/laser treatments
 - e.g. very high IOP
- Patient preference
- Other forms of therapy are inappropriate
 - Compliance
 - Side-effects
 - Socioeconomic problems

Surgery: how?

- Identify any risk factors for treatment failure and treat where applicable
 - Asian, African or Hispanic ethnicity
 - Previous surgery
 - Young age
 - Aphakia
 - Pseudophakia
 - Active ocular inflammation
 - Prolonged use of topical glaucoma medications
 - Tendency to form keloids
 - Neovascular glaucoma

Surgery: how?

- Select an appropriate surgical technique
- Techniques to enhance surgery
 - Antifibrotic agents
 - Intra-operative
 - Post-operative
 - Anti-inflammatory agents
 - Systemic corticosteroids
 - Other agents (e.g. NSAIDs)

Filtration surgery

Filtration surgery: what?

- Trabeculectomy
 - With or without antifibrotics
- Non-penetrating surgery
 - With or without implant
- Glaucoma drainage device

Trabeculectomy: principles

- Control pre-operative IOP to the greatest extent possible
- Control flow (avoid hypotony)
- Control wound healing response
- Achieve large drainage area

Trabeculectomy: how?

1. Anaesthesia
2. Traction suture
3. Conjunctival flap
4. Scleral flap
5. Internal ostium
6. Iridectomy
7. Flap closure
8. Conjunctival closure

Trabeculectomy: surgical pearls

- Conjunctival flap
 - Limbus- or fornix-based
- Scleral flap
 - Size, shape and thickness
- Sutures
 - Fixed, releasable or adjustable
- Reducing scarring
 - Antifibrotics

Surgical pearls: creating the conjunctival flap (1)

- Fornix- versus limbus-based flaps
 - Fornix-based flaps
 - Technically easier
 - Better exposure
 - Gentler tissue handling
 - Limbus-based flaps
 - Technically more difficult
 - Offer tighter wound closure

Surgical pearls: creating the conjunctival flap (2)

- Dissect carefully
- Use non-toothed forceps
- Keep the conjunctiva moist
- Do not let antifibrotic agents come into contact with the conjunctival edge
- Ensure water-tight conjunctival closure using sutures on a tapered needle

Surgical pearls: creating the scleral flap

- Size and shape varies
- The flap should be at least one-half of the scleral depth
- Use a uniform lamellar dissection
- Manipulate the flap gently

Surgical pearls: sclerostomy and iridectomy

- Sclerostomy
 - Ensure flap overlaps sclerostomy by ≥ 1 mm in all directions
- Iridectomy (unless sclerostomy is very anterior)
 - Create a broad peripheral iridectomy
 - Preferably wider than the sclerostomy
 - Full thickness

Surgical pearls: flap closure

- Scleral flap
 - Bury suture knots in the posterior sclera
 - Increase post-operative flow
 - Releasable/adjustable flap sutures
 - Laser suture lysis
- Conjunctival flap, fornix-based
 - Debride the corneal epithelium at the limbus to promote tighter adhesion
 - Examine the bleb for leaks

Post-operative management

- IOP measurement
- Examine the bleb at each visit
- Topical steroids for 6–12 weeks
- Topical antibiotics for 14 days or more
- Cycloplegics for 2–6 weeks
- Analgesics if needed
- Intensive individualised post-operative care is critical for success

Bleb assessment

- Bleb area
 - Central demarcated area
 - Maximal area
- Bleb height
- Vascularity
 - Bleb and non-bleb conjunctiva
- Presence of microcysts
- Seidel test for leakage

Antifibrotics in surgery: why?

- Scarring is the major cause of treatment failure following filtration surgery
- Antifibrotic agents inhibit scarring and increase the treatment success rate
 - Associated with an increased risk of bleb-related complications
 - Young, male patients with myopia are at increased risk of hypotony

Antifibrotics in surgery: when?

- High risk of failure following unaugmented filtration surgery
- Primary surgery, especially where a lower target IOP is required
- Needling of a failed filter

Antifibrotics in surgery: what?

- Commonly used:
 - 5-fluorouracil (5-FU)
 - Weaker
 - 50 mg/ml via sponge (3–5 minutes) and/or post-operative injection
 - Mitomycin C (MMC)
 - Stronger
 - 0.1–0.5 mg/ml via sponge (1–5 minutes)

Antifibrotics: application during surgery (1)

- Mode of application
 - Sponge placed under conjunctiva
 - Large subconjunctival pocket
 - Multiple sponges
 - Large surface area
 - More treatment for thicker areas of Tenon's capsule

Antifibrotics: application during surgery (2)

- Removal of residual drug during surgery
 - Copious irrigation of the treated area with:
 - balanced salt solution
 - normal saline solution
 - lactated Ringer's solution

Antifibrotics: post-operative injection of 5-FU

- 50 mg/ml for up to 4 weeks post-operatively
 - 30-gauge needle preferable
 - Given alongside or behind the bleb
 - Alternatively given 90–180° away
- Titrate the number of injections according to the appearance of the bleb
- Avoid spillage on the cornea
- Tamponade with a cotton bud
 - May be applied to the conjunctiva over the injection area for approximately 1 minute after the injection
- Amethocaine post-injection precipitates any 5-FU leaking into the tears

Bleb revision: why?

- Enhancement of outflow
- To prolong the life of the trabeculectomy
- Relatively simple
- Resources widely available

Bleb revision: when?

- Failing or encysting bleb
- Increasing IOP
- In combination with other surgery (e.g. cataract extraction)

Bleb revision: what?

- Simple techniques
 - Needle puncture of encysted bleb
- Advanced techniques
 - Extensive subconjunctival dissection
 - Lifting of the scleral flap with entry into the anterior chamber
- Antifibrotics strongly recommended

Bleb revision: how?

- Fine needle (25–27) gauge
- Bevel down
- Conjunctival entry away from the bleb
- Micro-puncture before sweeping
- Sweeping before entering the anterior chamber
- Stop when adequate flow is established
- Usually 5-FU (MMC is effective but potentially dangerous)
- Post-operative management as for trabeculectomy

Non-penetrating surgery: why?

- Advantages
 - Reduced intra- and post-operative complications, including hypotony
 - Visco canalostomy may re-establish physiological outflow routes
- Disadvantages
 - Less effective IOP reduction than trabeculectomy
 - Difficult technique
 - Fibrosis remains a problem

Non-penetrating surgery: what?

- Deep lamellar sclerectomy
- Visco canalostomy
 - Dilation of Schlemm's canal using viscoelastic injection
- With or without implant
- Not indicated in angle closure

Glaucoma drainage devices: why?

- Drainage devices allow aqueous to flow from the anterior chamber into a maintained episcleral space, from where it is absorbed into the surrounding blood vessels

Glaucoma drainage devices: when?

- When there is a very high risk of trabeculectomy failure even with antifibrotics
 - Previously failed trabeculectomy with antifibrotics
 - Multiple prior ocular surgeries with conjunctival scarring
 - Traumatic, inflammatory or chemically induced surface scarring
 - Intraocular membrane formation likely to occlude a non-implant drainage procedure

Glaucoma drainage devices: what?

- Valved implants
 - Ahmed*
 - Krupin
- Non-valved implants
 - Molteno*
 - Baerveldt*

* Commonly used devices

Glaucoma drainage devices: how?

- Principles of glaucoma drainage device surgery
 - Prime the tube with saline
 - Make sufficient space for the plate
 - Secure plate and tube
 - Tube coverings
 - Tight entry of tube into eye
 - Good position of tube in the eye
 - Control flow

Glaucoma drainage devices: how?

- To avoid immediate post-operative hypotony, the tube must be occluded either using a valve, or by suture
 - Venting slits may be needed to avoid high IOP until the suture is removed or dissolves
- A hypertensive phase is common and requires both medical control and antifibrotic therapy (usually 4–6 weeks)

Glaucoma drainage devices: complications

- Hypotony
- Failure to control IOP
- Corneal decompensation
- Peripheral anterior synechiae
- Pupillary distortion
- Cataract
- Ocular inflammation/ endophthalmitis
- Hyphaema
- Suprachoroidal effusion or haemorrhage
- Diplopia
- Erosion of the tube and/or plates

Angle configuration surgery

Angle configuration surgery: what?

- Iridectomy
- Goniosynechialysis
- Lens extraction
- Vitrectomy for aqueous misdirection

Peripheral iridectomy: what?

- Surgical removal of a section of the peripheral iris remains an effective alternative to laser iridotomy in difficult or refractory cases
- Largely replaced by laser iridotomy

Peripheral iridectomy: when?

- Failure to break an acute angle-closure attack
- Inability to achieve patent iridotomy
- Repeated iridotomy closure
- Patient who is uncooperative or has severe nystagmus

Goniosynechialysis: what?

- Lysis of peripheral anterior synechiae (PAS) in order to reopen the anterior chamber angle and improve aqueous outflow

Goniosynechialysis: when?

- Synechial angle-closure glaucoma uncontrolled by medical and laser therapy
 - Treat early to avoid permanent damage to the trabecular meshwork
- This procedure requires further study

Lens extraction: when?

- Cataract surgery is indicated for lens-induced glaucoma
 - Phacomorphic glaucoma (angle closure)
 - Phacolytic glaucoma (open angle)
 - Lens-particle glaucoma (open angle)
 - Occurs following trauma or surgery

Cataract and glaucoma surgery: what?

- Surgical treatment options
 - Cataract surgery alone
 - Cataract surgery after glaucoma surgery
 - Glaucoma surgery after cataract surgery
 - Combined cataract and glaucoma surgery

Cataract and glaucoma surgery: points to consider (1)



- Glaucoma surgery added to cataract surgery lowers IOP more than cataract surgery alone
- Glaucoma surgery alone is associated with an increased risk of post-operative cataract
- Weak evidence suggests glaucoma surgery alone lowers IOP more than combined cataract and glaucoma surgery

Cataract and glaucoma surgery: points to consider (2)

- Combined surgery is associated with similar complications as cataract and glaucoma surgery performed separately
- Insufficient evidence to determine if cataract surgery alters the function of pre-existing filtering blebs
- Insufficient evidence to conclude that either sequential or combined procedures give better results

Combined cataract and glaucoma surgery: when?

- Patients who require filtration surgery and have a cataract
- Patients with severe, but well-controlled, glaucoma who have a visually significant cataract

Combined cataract and glaucoma surgery: how?

- Same-site phacoemulsification and trabeculectomy

(1) Creation of scleral flap after intraocular lens implantation

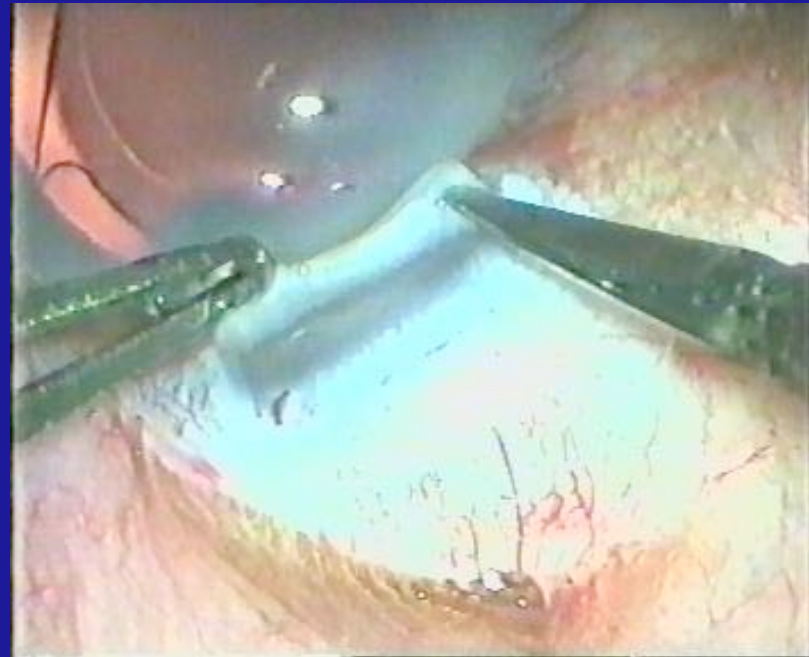


Photo courtesy of Murali Ariga

Combined cataract and glaucoma surgery: how?

- Same-site phacoemulsification and trabeculectomy

(2) Incision for trabeculectomy

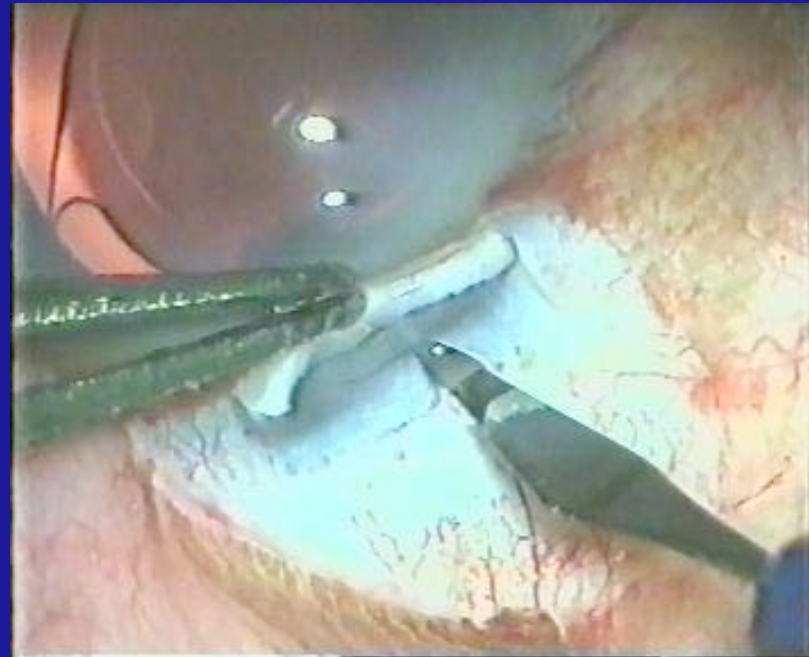


Photo courtesy of Murali Ariga

Combined cataract and glaucoma surgery: how?

- Same-site phacoemulsification and trabeculectomy
- (3) Punch used for trabeculectomy

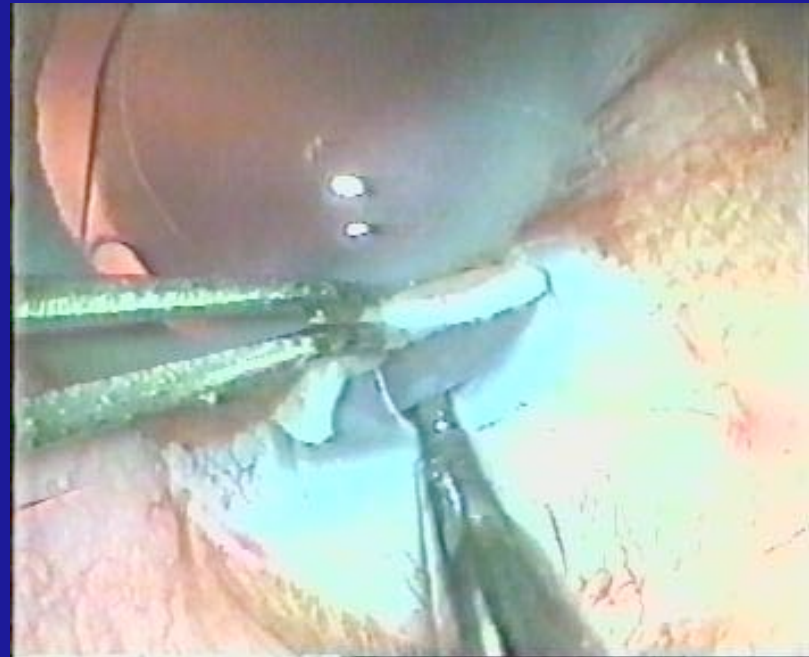


Photo courtesy of Murali Ariga

Combined cataract and glaucoma surgery: how?

- Same-site phacoemulsification and trabeculectomy

(4) Sclerostomy opening



Photo courtesy of Murali Ariga

Combined cataract and glaucoma surgery: how?

- Same-site phacoemulsification and trabeculectomy
(5) Iridectomy

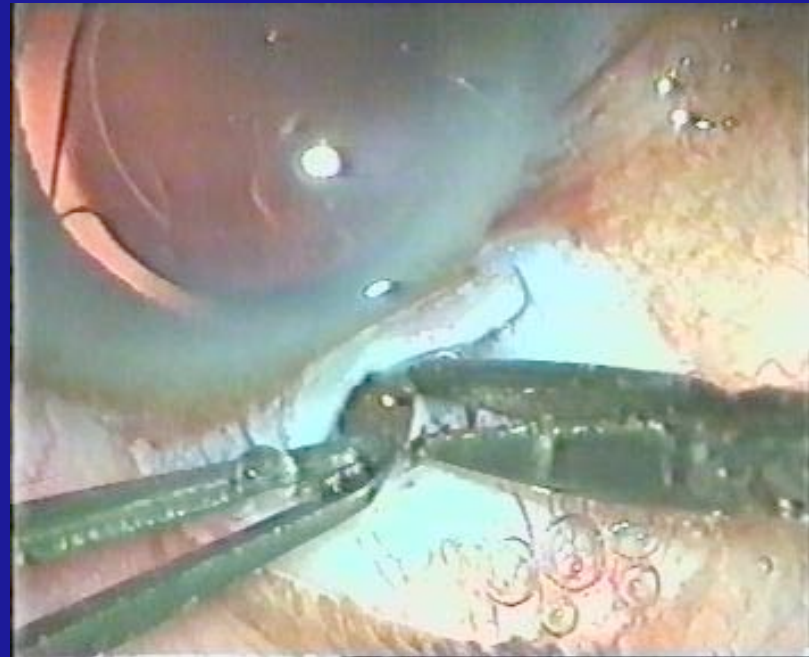


Photo courtesy of Murali Ariga

Combined cataract and glaucoma surgery: optimisation

Surgical management	Evidence grade
MMC (but not 5-FU) has a small benefit (2–4 mmHg) for ECCE–trabeculectomy	B
Two-site surgery provides slightly lower IOP (1–3 mmHg) than one-site surgery	C
IOP is lowered more (1–3 mmHg) by phacoemulsification than by ECCE in combined procedures	C
Two-staged versus combined procedures	I
Alternative glaucoma procedures versus trabeculectomy in combined procedures	I

Evidence grade: A, strong; B, moderate; C, weak; I, insufficient
ECCE, extracapsular cataract extraction

Key points

- Surgery is an effective option when other forms of therapy are inappropriate or ineffective
- Select an appropriate technique
- Antifibrotics inhibit scarring and increase the success rate