MODULE 4:
Laser and surgical treatment

EAGLE ALLIANCE

Acknowledgement

Our sincere thanks to the **EAGLE Faculty** for developing the modules, and to the **APGS Review Experts** for their contributions throughout the review and approval process. Their guidance and dedication have been essential in ensuring the accuracy, clarity, and relevance of these educational resources.

EAGLE Alliance Faculty – Module 4

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- Dr. Seng Kheong Fang (Malaysia)
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Introduction to the **EAGLE Alliance Initiative**

Welcome to the EAGLE Alliance initiative:

The EAGLE Alliance has been developed to strengthen clinical capacity in glaucoma management among general ophthalmologists across Asia. Through expert-led modules aligned with the APGG (4th edition), we aim to provide practical, guideline-based learning that supports everyday clinical practice.

How to use each module:

Each module follows the flow of one section of the APGG, concluding with a summary to reinforce key learning points

Look out for:

Expert tips and tricks – practical insights from the faculty

Tips and tricks from the experts

FAQs from the APGG – answers to common clinical questions

FAQs from the APGG

APGG: Asia-Pacific Glaucoma Guidelines.

Asia–Pacific Glaucoma Society (APGS). Asia–Pacific Glaucoma Guidelines. 4th ed. May 2024.

Introduction to **Module 4: Laser and surgical treatment**

Module 4 focuses on laser and surgical treatment for glaucoma, outlining the indications, techniques, and postoperative considerations for available laser and surgical interventions:

Laser treatment

- Laser trabeculoplasty
- Laser peripheral iridotomy
- Peripheral iridoplasty
- Cyclophotocoagulation
- Micropulse laser
- Laser suture lysis

Surgical treatment

- Trabeculectomy
- Glaucoma drainage devices
- Minimally invasive glaucoma surgery
- Non-penetrating glaucoma surgery
- Phaco-goniosynechialysis

Meet the expert faculty:

The laser and surgical treatment module was developed with guidance and insights from the following faculty members from the EAGLE Alliance, whose expertise helped shape the content for use in daily practice:

Assoc. Prof. Visanee Tantisevi | **Assoc. Prof. Shamira Perera** | **Assoc. Prof. Virna Dwi O. Asrory**

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Asia–Pacific Glaucoma Society (APGS). Asia–Pacific Glaucoma Guidelines. 4th ed. May 2024.

Laser treatment

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Laser trabeculoplasty

ALT and SLT are the most commonly used lasers for trabeculoplasty.

Laser trabeculoplasty is a relatively effective and non-invasive procedure that increases TM outflow and allows bypassing of non-adherence to medical therapy[1]

Indications

1. **Medical therapy failure**
2. **Adjunct to medical therapy**
3. **Primary treatment, if appropriate**

ALT and SLT have similar efficacy:[1,2]

- Effective in 80–85% of treated eyes with a mean IOP reduction of 20–25% (6–9 mmHg)
- Effect wears off over time for both ALT and SLT

Variables	SLT	ALT
Number of spots	30–50	50
Exposure time (nanoseconds)	3	100,000,000
Fluence (mJ/mm^2)	6	40,000
Power	0.4–1.4 mJ	300–600 mW
Laser requirements	Ultrashort pulse duration; low laser energy	

ALT: argon laser trabeculoplasty; IOP: intraocular pressure; SLT: selective laser trabeculoplasty; TM: trabecular meshwork.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Bovell AM, et al. *Can J Ophthalmol* 2011;46:408–13.

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Selective laser trabeculoplasty

Pre-laser treatment[1]

- **Pre-laser treatment with topical α2 agonist (or similar) helps reduce post-treatment IOP spikes**

Post-laser management[1,2]

- **Give α2 agonist, recheck IOP at 1 hour**
  - **If high IOP:** additional treatment, recheck the next day
  - **If normal IOP:** follow-up at 1 week, 4 weeks, and 3 months
- **Post-laser NSAIDs are an option, but not compulsory**
- **Resume glaucoma eye drops immediately**

Complications[3,4]

- **Temporary blurred vision**
- **IOP spikes with possible VF loss**
- **Transient iritis**
- **Chronic increase in IOP**
- **Corneo-refractive changes**
- **Suprachoroidal effusion**

Repeat SLT treatment

Initial SLT may not be long-lasting and can be repeated, especially in eyes that have shown a prolonged response to previous treatment[1,2]

SLT is considered relatively safe to repeat twice[5]

IOP: intraocular pressure; SLT: selective laser trabeculoplasty; VF: visual field.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Jorizzo PA, et al. *Am J Ophthalmol* 1988;106:682–5; **3.** Kennedy CJ, et al. *Aust N Z J Ophthalmol* 1996;24:279–82; **4.** Zhou Y, Aref A. *Ophthalmol Ther* 2017 Mar 3;6:19–32; **5.** Lai J. *Invest Ophthalmol Vis Sci* 2005;46:119.

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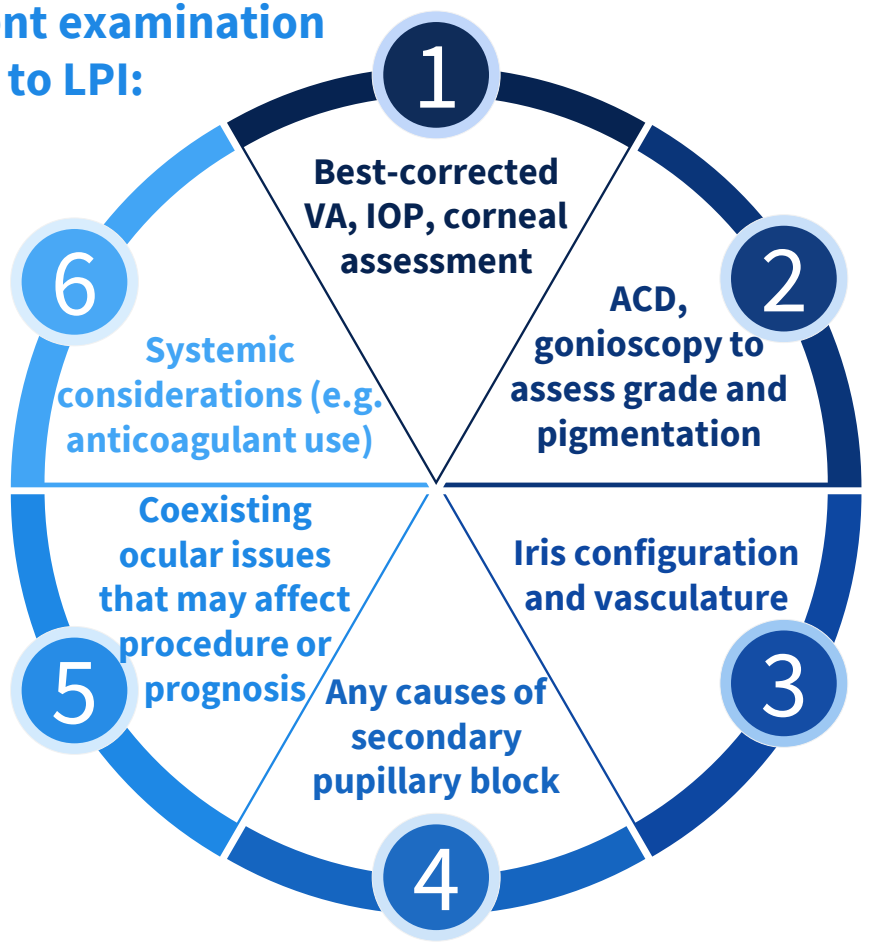
Laser peripheral iridotomy

LPI relieves pupillary block via a full-thickness hole created in the peripheral iris

Indications

1. Laser treatment to connect the anterior and posterior chambers to relieve pupillary block
2. PAC and PACG: significant pupillary block
3. PACS (absolute): PAC in the fellow eye
4. PACS (relative): need for repeated dilated examinations; poor access to regular ophthalmic care; family history of PACG
5. Secondary angle closure with pupillary block

Patient examination prior to LPI:



ACD: anterior chamber depth; IOP: intraocular pressure; LPI: laser peripheral iridotomy; PAC: primary angle closure; PACG: primary angle closure glaucoma; PACS: primary angle closure suspect; PAS: peripheral anterior synechiae; VA: visual acuity.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Steps in laser peripheral iridotomy management

Pre-laser:[1]

- Instill 2% or 4% pilocarpine
- Consider 1% apraclonidine or 0.15%–0.2% brimonidine, and/or a beta blocker, and/or oral CAI, and/or steroid drops for inflammation
- Topical anaesthesia: Three applications of proparacaine in 5-minute intervals
- Topical glycerine if the cornea is oedematous
- Lenses: Abraham (+66 diopters), Wise (+103 diopters), or CGI©LASAG CH lens (procedure).

- LPI site is usually chosen in the superior quadrants of the iris, well covered by the upper eyelid, in a thin looking area or a small iris crypt
- A temporally placed iridotomy may lead to reduced visual symptoms
- Care should be taken to perform iridotomies peripherally and the laser should not be placed at the junction of eyelid margin to avoid diplopia
- Patients should be warned of the low risk of visual symptoms, which can occur regardless of the site of the iridotomy

Laser:[1]

Nd:YAG	Argon	"Sequential" laser: argon followed by Nd:YAG	Sequential LPI is useful in eyes with thick irides as well as in patients receiving systemic anticoagulation or antiplatelet medication to reduce the risk of hyphaema

CAI: carbonic anhydrase inhibitor; LPI: laser peripheral iridotomy; Nd:YAG: neodymium yttrium aluminum garnet.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Parameters of different laser types[1*]

	Spot size (µm)	Exposure time (s)	Power (mW)
Continuous-wave argon laser			
Preparatory stretch burns	200–500	0.2–0.5	200–600
Penetration laser burns	50	0.05–0.1	700–1000
Parameters according to iris color			
Pale blue or hazel irises			
1. Obtain a gas bubble	50	0.5	1500
2. Penetration through the gas bubble	50	0.05	1000
Thick dark brown irises (chipping technique)[2] Choose/modify parameters depending on individual response	50	0.05–0.1	600–1000
Sequential laser-argon laser followed by Nd:YAG laser (particularly for darker irises)			
Preparatory burns with argon laser (chipping technique)[3] Depending on iris pigmentation (darker irises require lower power)	50	0.02–0.05	500–1000*
Nd:YAG laser			
Once penetration has occurred, reduce power to continue enlarging the iridotomy horizontally[3†] as lens damage and zonule weakness are possible above 2 mJ per pulse once the iris has been penetrated	–	1–3 pulses per burst	1.5–3 mJ (minimum energy)

*Further details on pre-operative preparation and post-operative treatment can be found in the APGG, 4th edition[1]; † iridotomy size is typically ~2mm to ensure long-term patency.

CPC: cyclophotocoagulation; IOP: intraocular pressure; Nd:YAG: neodymium yttrium aluminum garnet.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** de Silva DJ, et al. *Br J Ophthalmol* 2007;91:222–5; **3.** Fleck BW. *Br J Ophthalmol* 1990;74:583–8.

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Peripheral iridoplasty

Peripheral iridoplasty is a non-invasive laser treatment to flatten the peripheral iris, widen the anterior chamber angle inlet, and re-open appositionally closed segments of the drainage angle[1]

Indications

1. Acute angle closure[2–8]
2. Where the angle remains occludable following LPI[9,10]
3. Secondary forms of acute angle closure[11–13]
4. To facilitate access to the TM for laser trabeculoplasty[2]
5. As an adjunct to GSL[14,15]
6. Plateau iris syndrome

Pre-laser:[1]

- Instill 2% or 4% pilocarpine
- Use treatment to reduce post-laser IOP spikes/inflammation
- Topical anesthesia: three instillations of proparacaine in 5-minute intervals

Post-laser:[1]

- If no preventive treatment, check IOP at 1 hour and 24–48 hours
- Topical corticosteroids 4–6 times per day for ≥7 days
- Repeat gonioscopy to assess angle and other closure mechanisms

GSL: goniosynechialysis; LPI: laser peripheral iridotomy; PAS: peripheral anterior synechiae; TM: trabecular meshwork.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Lam DS, et al. *Ophthalmology* 1998;105:2231–6; **3.** Lai JS, et al. *Eye (Lond)* 1999;13 (Pt 1):26–30; **4.** Tham CC, et al. *Ophthalmology* 1999;106:1042–3; **5.** Lai JS, et al. *J Glaucoma* 2001;10:89–94; **6.** Lai JS, et al. *J Glaucoma* 2002;11:484–7; **7.** Lam DS, et al. *Ophthalmology* 2002;109:1591–6; **8.** Lai JS, et al. *Eye (Lond)* 2006;20:309–14; **9.** Yeung BY, et al. *Clin Exp Ophthalmol* 2005;33:478–82; **10.** Ritch R, et al. *Ophthalmology* 2004;111:104–8; **11.** Tham CC, et al. *Eye (Lond)* 2005;19:778–83; **12.** Yip PP, et al. *Ophthalmic Surg Lasers Imaging* 2005;36:286–91; **13.** Thyagarajan S. *Eye (Lond)* 2006;20:1323; author reply 1323–4; **14.** Lai JS, et al. *J Glaucoma* 2000;9:388–91; **15.** Lai JS, et al. *J Glaucoma* 2001;10:309–15.

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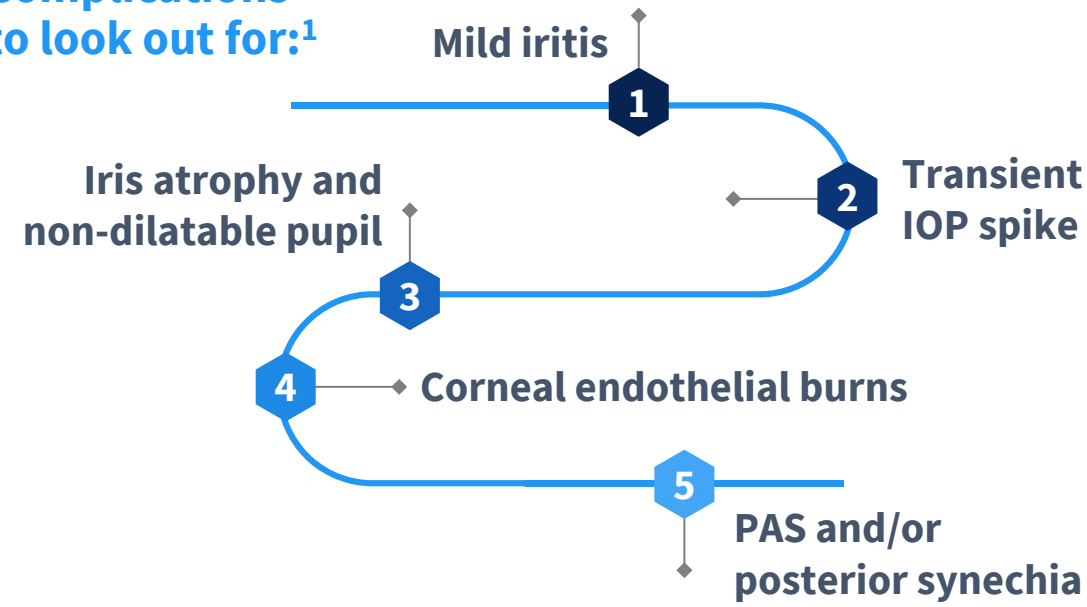
Peripheral iridoplasty

Peripheral iridoplasty is a non-invasive laser treatment to flatten the peripheral iris, widen the anterior chamber angle inlet, and re-open appositionally closed segments of the drainage angle[1]

Variables	Laser parameter[1,2]
Power	150–240 mW depending on the reaction
Spot size	500 µm; both small-spot and large-spot patterns can be used
Exposure time	0.5 second
Number of spots	10–40 applications over 360°, leaving at least 1- to 2-spot diameters between spots; 180° treatment may also be effective[2]

Complications to look out for:[1]



GSL: goniosynechialysis; LPI: laser peripheral iridotomy; PAS: peripheral anterior synechiae; TM: trabecular meshwork.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; 2. Vera V, et al. *Am J Ophthalmol* 2014;157:929–35.

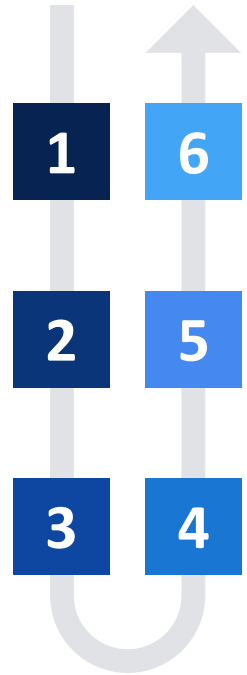
Cyclophotocoagulation[1*]

CPC, or cyclodiode, is an effective modality for reducing aqueous inflow by coagulative destruction of the ciliary epithelium[1]

Indications[1]

1. Painful blind eyes or poor vision
2. Sighted eyes where the benefits and risks of CPC outweigh those for surgery
3. Failed multiple filtering surgeries
4. Primary procedure to alleviate pain in secondary glaucoma with poor visual potential
5. When incisional surgery is not appropriate

Postoperative management:[1]



1. Analgesia
2. Check IOP after 24–48 hours
3. Continue any current treatment
4. Topical corticosteroids 4–6 times/day for ≥14 days
5. Cycloplegia 2–4 times/day for 7–14 days
6. Taper IOP-lowering treatment as indicated

*Further details on pre-operative preparation can be found in the APGG, 4th edition[1]
CPC: cyclophotocoagulation.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

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Cyclophotocoagulation

CPC, or cyclodiode, is an effective modality for reducing aqueous inflow by coagulative destruction of the ciliary epithelium[1]

Variables	Laser parameter[1]
Wavelength	810 nm
Exposure time	2.0–4.0 seconds
Power	1000–2500 mW
Number of burns	20-40 over 180°–360° (depending on IOP lowering required)
Location	Anterior edge of footplate, alternating 0.0–1.0 mm from the limbus to cover the full width of the ciliary body. Avoid the 3 and 9 o'clock positions due to the long ciliary nerves and vessels

Complications to look out for:

- Pain
- Persistent inflammation
- Loss of visual acuity[2,3]
- Hypotony[4]
- Phthisis[5]
- Scleral thinning or rupture[6–8]
- Pupillary distortion[9]
- Macular edema
- Retinal detachment[10]
- Aqueous misdirection syndrome[5]
- Sympathetic ophthalmia[11]

The laser tip should be placed over the ciliary body, i.e., the dark band posterior to the perilimbal halo seen with transillumination[1]

CPC: cyclophotocoagulation.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Schuman J, et al. *Ophthalmol* 1992;99:1089–94; **3.** Shields M, Shields S. *Trans Am Ophthalmol Soc* 1994;92:271-283; **4.** Maus M, Katz L. *Ophthalmology* 1990;97:69-72; **5.** Trope G, Ma S. *Ophthalmology* 1990;97:73-75; **6.** Bhola R, et al. *Eye (Lond)* 2001;15:453-457; **7.** Fiore P, et al. *Ophthalmic Surg* 1989;20:215-16; **8.** Kwong Y, et al. *Eye (Lond)* 2006;20:1316-17; **9.** Lai J, et al. *Eye (Lond)* 2002;16:674-75; **10.** Geyer O, et al. *Ann Ophthalmol* 1993;25:170-72; **11.** Lam S, et al. *Ophthalmology* 1992;99:1818-22.

Micropulse laser

Micropulse laser is another modality for CPC, but with the potential advantage of a more homogeneous distribution of energy resulting in less energy use and a lower rate of complications. It can be titrated if further IOP-lowering is required and repeated if there is loss of IOP-lowering efficacy

Pre-laser

1

- Slit-lamp to select site; stop anticoagulants if possible
- Anesthetic block (± sedation) over topical anesthesia alone

Laser

2

- Use coupling gel; probe sweeps across hemisphere
- Avoid 3 and 9 o'clock positions

Post-laser

3

- Less pain than cyclodiode
- Continue any current glaucoma treatment
- Optimal IOP lowering seen at 1 month
- Adjust drops based on response
- Follow-up: 1 week, then 1 month
- Topical steroids/NSAIDs used for 1–4 weeks

CPC: cyclophotocoagulation; IOP: intraocular pressure; NASID: nonsteroidal anti-inflammatory drug.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Laser suture lysis

Laser suture lysis is an effective, non-invasive postoperative laser treatment for IOP titration after filtering surgery

Indication: commonly within 7–28 days of glaucoma filtering surgery

Key steps in management:

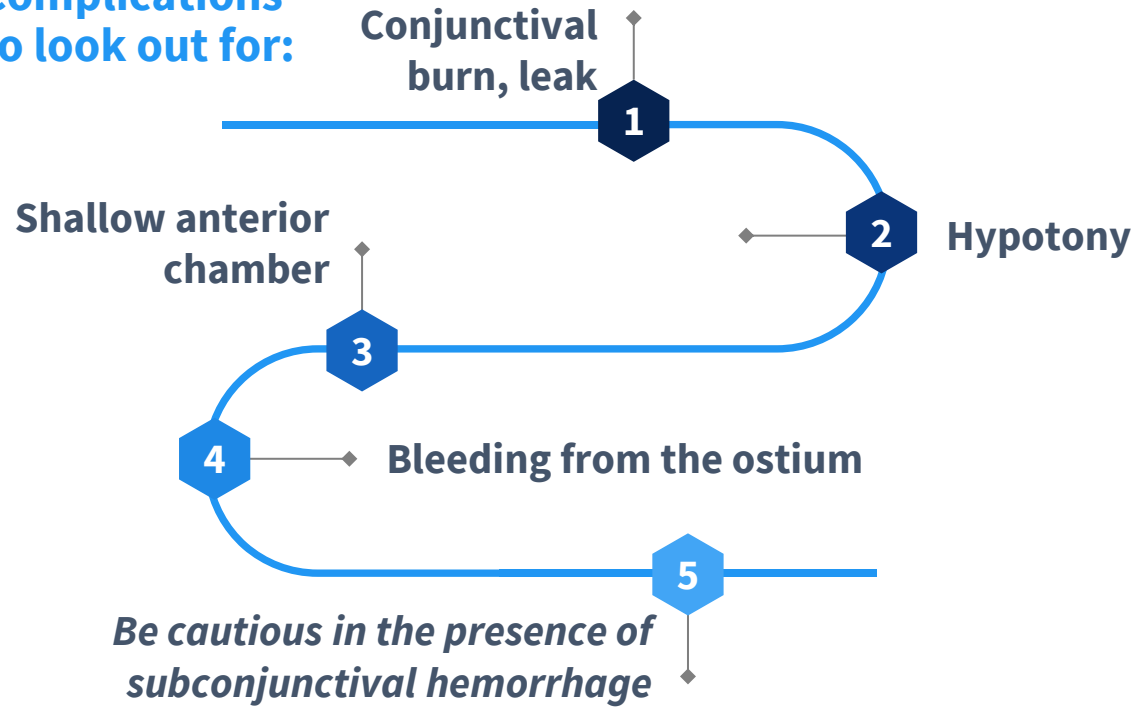
Pre-laser: topical anesthesia

Laser types: argon, diode, Nd:YAG

Lenses: Ritch, Hoskins, Mandelkorn, Zeiss, glass rod

Technique: cut one suture per session; adjust if blood present

Complications to look out for:



IOP: intraocular pressure; NASID: nonsteroidal anti-inflammatory drug; Nd:YAG: neodymium yttrium aluminum garnet.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Laser power by type

A useful tip to reduce laser power for laser iridotomy is to choose a small iris crypt or thin iris area that is located peripherally as possible.

Laser type	Power
Laser trabeculoplasty	**300–1200 mW,** depending on the tissue reaction
SLT	**0.4–1.4 mJ**
ALT	**300–600 mW**
LPI	**Set at 1.5–3 mJ,** depending on thickness of the iris

Continuous-wave argon laser	• *Preparatory stretch burns*: **200–600 mW**
	• *Penetration laser burns*: **700–1000 mW**
	• *Pale blue or hazel irises*:
	  ○ *Obtain a gas bubble*: **1500 mW**
	  ○ *Penetrate through the gas bubble*: **1000 mW**
	• *Thick dark brown irises*: **600–1000 mW**

Sequential laser–argon laser followed by ND:YAG laser	**500–1000 mW,** depending on iris pigmentation
Peripheral iridoplasty	**150–240 mW,** depending on the reaction
Cyclophotocoagulation	**1000–2500 mW**
Micropulse laser	**1600–2500 mW**
Laser suture lysis	**300–800 mW**
Laser goniopuncture	**3–6 mJ,** starting at 3 mJ

ALT: argon laser trabeculoplasty; LPI: laser peripheral iridotomy; Nd:YAG: neodymium yttrium aluminum garnet; SLT: selective laser trabeculoplasty.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Surgical treatment

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Trabeculectomy

Trabeculectomy is the most performed glaucoma filtering surgery and is conventionally considered the gold standard of penetrating surgery to create a subconjunctival bleb without the need for an implant[1]

Indications[1]

1. Glaucoma status (e.g. moderate to severe) requiring a low target IOP that is unlikely to be achieved with medication or laser
2. Where other therapies are inappropriate (e.g. poor adherence, side effects, socioeconomic problems)
3. Failed medical and/or laser treatment

Preoperative assessment[1,2]

1. Evaluate visual acuity and estimate the predicted visual outcome
2. Evaluate the conjunctival health of the selected location for the filtering bleb, as well as its mobility and adhesion
3. Identify risk factors for treatment failure

IOP: intraocular pressure.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; 2. Allingham RR. Shields' Textbook of Glaucoma: Lippincott Williams & Wilkins; 2005.

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Trabeculectomy: surgical technique

1. Anesthesia: topical, sub-Tenon's, or peribulbar

2. Corneal traction suture: 8-0 suture to rotate globe and expose conjunctiva

3. Conjunctival flap: fornix- or limbus-based (similar success)

4. Undermine conjunctiva: blunt scissors to avoid tear

5. Antimetabolite application: sponge or injection to reduce bleb failure

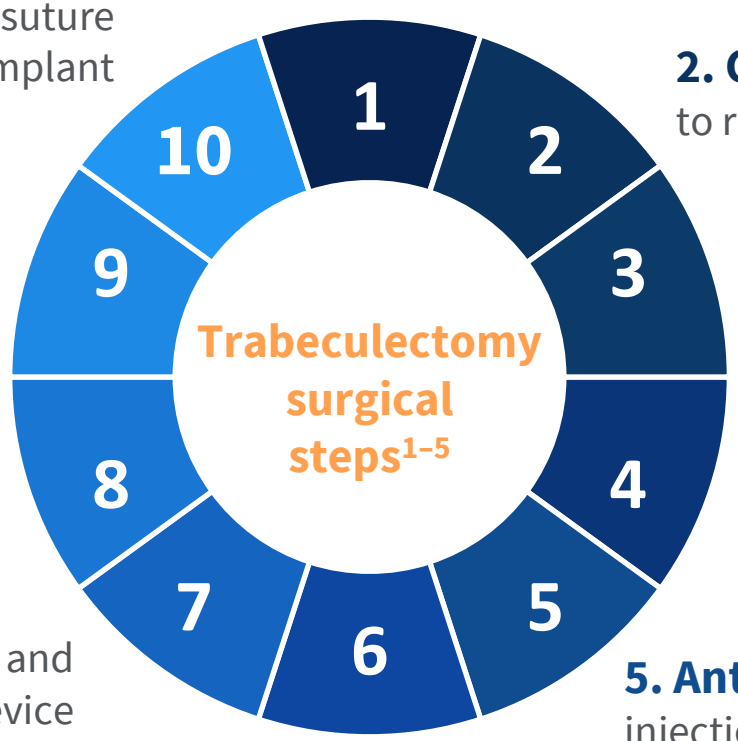
6. Scleral flap: triangular, semicircular, or trapezoidal

7. Fistulizing technique: blade and punch, or micro-drainage device

8. Scleral flap suturing: 10-0 nylon (fixed or releasable), titrate filtration, reduce hypotony

9. Closure: meticulous Tenon's and conjunctiva closure to prevent leaks

10. Postsurgery modulation: anti-inflammatories (NSAIDs, steroids), laser suture lysis/releasable sutures, optional collagen matrix implant



NASID: nonsteroidal anti-inflammatory drug.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Al-Haddad CE, et al. *Am J Ophthalmol* 2017;174:33–41; **3.** Clemente P. *Klin Monbl Augenheilkd* 1980;177:455–8; **4.** Dellaporta A. *Trans Sect Ophthalmol Am Acad Ophthalmol Otolaryngol* 1975;79:OP362–71; **5.** He M, et al. *PLoS One* 2014;9:e85782.

Postoperative management of trabeculectomy

The first 12 postoperative weeks are critical for trabeculectomy outcomes, and intensive individualized care must be provided

1st or 2nd postoperative day

Examine the patient and then as clinically indicated.

Intensive topical steroids.

2–6 weeks

Consider cycloplegics, especially for those at risk of ciliary block.

Intensive topical steroids.

First 8–12 weeks

Prescribe intensive topical steroids (starting at 2–3 hourly and gradually tapering off depending on clinical findings)

Prescribe topical antibiotics until the topical steroid frequency is reduced to 2–3 times daily

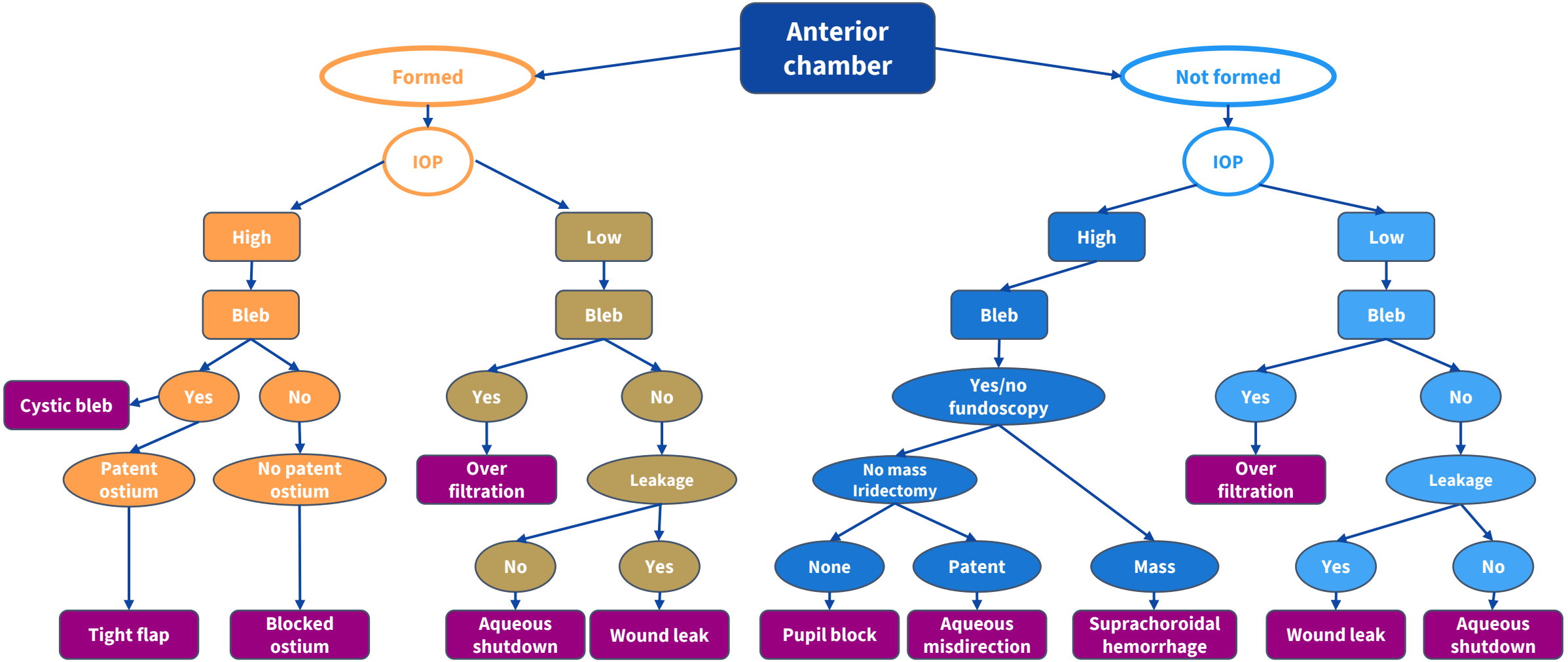
Up to 4–5 months postoperatively

Steroids may need to be continued for patients at persistent risk of scar formation

From 1–4 weeks consider laser suture lysis

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Post-trabeculectomy complications



IOP: intraocular pressure.

Oktariana V. Oral presentation, presented at Sumatera Ophthalmologist Meeting, March 2–4 2023, Bukittinggi, West Sumatera, Indonesia.

Use of adjunctive agents in glaucoma surgery

Antimetabolite agents (MMC and 5-FU) have been shown to inhibit scarring, which is a major cause of failure following filtration surgery[1]

Indications[2]

Adjunctive agents are the current gold standard intraoperative treatment for bleb-forming surgeries, including in:

- **Repeat surgery**
- **Neovascular glaucoma**
- **Uveitic glaucoma**
- **Aphakic glaucoma**
- **Younger patients**
- **Populations of African descent**

Antimetabolites

MMC: used widely in filtering surgery[2]

5-FU: used less with filtering surgery due to reduced efficacy compared with MMC. More commonly used postoperatively, combined with needling[2]

Antimetabolites can result in complications; caution and monitoring are mandatory. They are contraindicated in pregnancy and lactation[3]

5-FU: 5-fluorouracil; MMC: mitomycin C.

1. Khaw PT. *J Glaucoma* 2001;10(5 Suppl 1):S81–4; **2.** Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **3.** Lin ZJ, et al. *J Ocul Pharmacol Ther* 2012;28:166–73.

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Glaucoma drainage devices: Valved versus non-valved

GDDs are implants consisting of a tube connected to a reservoir plate that diverts aqueous from the anterior chamber to a reservoir placed in the equator, where fluid is absorbed by surrounding vessels to lower IOP

Valved

May have a lower rate of immediate hypotony, but postoperative hypotony can occur via peritubular leak

Non-valved

Greater IOP reduction and lower rates of re-operation, but associated with a greater risk of postoperative hypotony compared with valved

- **Previous failed trabeculectomy with antimetabolites**
- **Insufficient conjunctiva due to scarring**
- **Complicated and refractory glaucoma**

GDD: glaucoma drainage device; IOP: intraocular pressure.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Glaucoma drainage devices: Valved versus non-valved

GDDs are implants consisting of a tube connected to a reservoir plate that diverts aqueous from the anterior chamber to a reservoir placed in the equator, where fluid is absorbed by surrounding vessels to lower IOP

Valved

- Ahmed Glaucoma Valve (New World Medical, Rancho Cucamonga, CA, USA).
- The possibility of developing an encysted bleb is much higher with the Ahmed implant and the hypertensive phase is more significant.

Non-valved

- Baerveldt Glaucoma Implant (Johnson and Johnson Vision, Irvine, CA, USA).
- Aravind Aqueous Drainage Implant (Aurolab, Madurai, India).
- Ahmed ClearPath (New World Medical, Rancho Cucamonga, CA, USA).
- Paul Glaucoma Implant (Advanced Ophthalmic Innovations, Singapore).

Indications

- Previous failed trabeculectomy with antimetabolites
- Insufficient conjunctiva due to scarring
- Complicated and refractory glaucoma

GDD: glaucoma drainage device; IOP: intraocular pressure.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Glaucoma drainage devices: Surgical technique

1. Anesthesia: deep sub-Tenon's, peribulbar , or retrobulbar

2. Corneal traction suture: expose upper conjunctiva and inter-rectus sclera

3. Subconjunctival space: created with or without radial relaxing incision

4. Plate insertion: irrigation through the tube prior to insertion (**valved**); aqueous flow restriction (**non-valved**)

5. Scleral tunnel and tube placement: create tunnel into AC or sulcus and trim tube length appropriately

- **Anterior chamber:** bevel up on iris surface
- **Sulcus:** bevel down to avoid iris suction
- **Needle size:** 25 or 23 gauge

6. Suturing and closure: patch graft (corneal/scleral/other) to prevent erosion; close conjunctiva with 10-0 nylon or 8-0 Vicryl

AC: anterior chamber; GDD: glaucoma drainage device.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Minimally invasive glaucoma surgery

MIGS initially referred to ab-interno devices and procedures usually targeting Schlemm's canal. However, the term has broadened to include ab-externo bleb-forming procedures with little or no scleral dissection

Class of MIGS	Clinical examples	Key details
TM MIGS	**Stents** **Ab-interno dilating ± excision** **Tissue excision MIGS**	**Indicated in stable and well-controlled mild-to-moderate OAG and OHT, and patients on one to three ocular hypotensive medications**
Subconjunctival MIGS devices	**PRESERFLO MicroShunt** **Xen Gel Stent**	**Although similar to trabeculectomy, PRESERFLO results in less tissue manipulation at the time of surgery. The Xen decreases IOP by creating a permanent drainage shunt from the AC to the subconjunctival space through a scleral channel**
Suprachoroidal MIGS devices	**MINIject glaucoma drainage device**	**A supraciliary, minimally invasive, soft, flexible silicone implant that drains into the suprachoroidal space**

MIGS: minimally invasive glaucoma surgery; OAG: open-angle glaucoma; OHT: ocular hypertension; TM: trabecular meshwork.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

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Minimally invasive glaucoma surgery

TM MIGS

STENT PROCEDURES

- **Ab-interno dilating ± excision**
  - iTrack Advance Microcatheter (Ellex, Adelaide, Australia)
  - OMNI Surgical System (Menlo Park, CA, USA)

- **Tissue excision MIGS**
  - Kahook Dual Blade (New World Medical, Rancho Cucamonga, CA, USA)
  - Tanito Microhook (Inami, Tokyo, Japan)
  - Trabectome (NeoMedix Corporation, Tustin, CA USA)
  - Gonioscopy-assisted transluminal trabeculotomy

Subconjunctival MIGS devices

PRESERFLO MICROSHUNT

- A stent made of SIBS (poly[styrene-block-isobutylene-block-styrene]) material
- Dimensions: 8.5 mm in length, with a 1 mm fin (external diameter: 350 µm; internal lumen: 70 µm)
- Keep ocular pressure high with reinflation to ensure immediate flow through the PRESERFLO upon insertion

XEN GEL STENT

- Made of porcine collagen-derived gelatine
- Dimensions: 6 mm hydrophilic flexible tube with a 45 µm lumen
- Decreases intraocular pressure by creating a permanent drainage shunt from the anterior chamber to the subconjunctival space through a scleral channel

Suprachoroidal MIGS devices

MINIject GLAUCOMA DRAINAGE DEVICE

- Supraciliary, minimally invasive, soft, flexible silicone implant that drains into the suprachoroidal space
- Dimensions: 1.1×0.6×5 mm in length
- Can be inserted ab-interno into the suprachoroidal space as a stand-alone procedure

MIGS: minimally invasive glaucoma surgery; OAG: open-angle glaucoma; OHT: ocular hypertension; TM: trabecular meshwork.

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Non-penetrating glaucoma surgery

NPGS is a form of drainage surgery where Schlemm's canal is de-roofed underneath a scleral flap and deep corneoscleral lamellae are removed to create an intrascleral lake

Indications

- **Failed medical and/or laser treatment, where there is still a need for a lower target IOP in eyes with an open and normal angle**
- **In higher-risk patients, it may reduce the hypotony risks of trabeculectomy**

Key points for NPGS

Reduces IOP less effectively than penetrating surgery, but has lower complication rates

Requires a steep learning curve

The deep sclerectomy may be performed manually or assisted with CO_2 laser

IOP: intraocular pressure; NPGS: non-penetrating glaucoma surgery.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Tam DY, et al. *J Glaucoma* 2013;22:620–5.

Phaco-goniosynechialysis

GSL involves separation of the PAS with a spatula, micro forceps, or needle under gonioscopic guidance, and is often used with phacoemulsification (i.e. phaco-GSL) to open the angle

Tips

- Proficiency with gonioscopy is imperative
- Miotics may help, and some surgeons perform argon laser iridoplasty to maintain the angle opening
- Diamox is useful postoperatively to prevent IOP spikes

Contra-indications

- Traumatic, malignant, uveitic, or neovascular glaucoma
- Discernible congenital anomalies of the anterior chamber angle
- Cases where PAS is known to be longstanding are less likely to be successful

When to use

- Phaco-GSL is a good option to treat PACG with concomitant cataract due to its bleb-less nature
- Capacity for lowering IOP seems superior to that of phacoemulsification alone
- Phaco-GSL is an option when lens extraction is performed after an acute angle-closure attack

GSL: goniosynechialysis; IOP: intraocular pressure; PACG: primary angle-closure glaucoma; PAS: peripheral anterior synechiae.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed.

Identifying patients who may benefit from alternatives to eye drops

Who might benefit from first-line laser?

- OHT or early POAG with presumed intolerance to eye drops
- Younger age
- Active lifestyle (lots of outdoors activities, frequent travellers)
- Easily lost to follow-up
- Any age group reporting frequent forgetfulness

Who might benefit from surgery?

- Patients with moderate to advanced glaucoma who cannot tolerate eye drops
- A discussion is needed to determine the appropriate surgical approach: MIGS, MIBS, trabeculectomy, or GDD

Surgical choice is guided by the target IOP intended to be achieved with the procedure.

GDD: glaucoma drainage device; MIBS: minimally invasive bleb-forming surgery; MIGS: minimally invasive glaucoma surgery; OHT: ocular hypertension; POAG: primary open angle glaucoma.
Based on the experience of Assoc. Prof. Visanee Tantisevi and Prof. Tina Wong.

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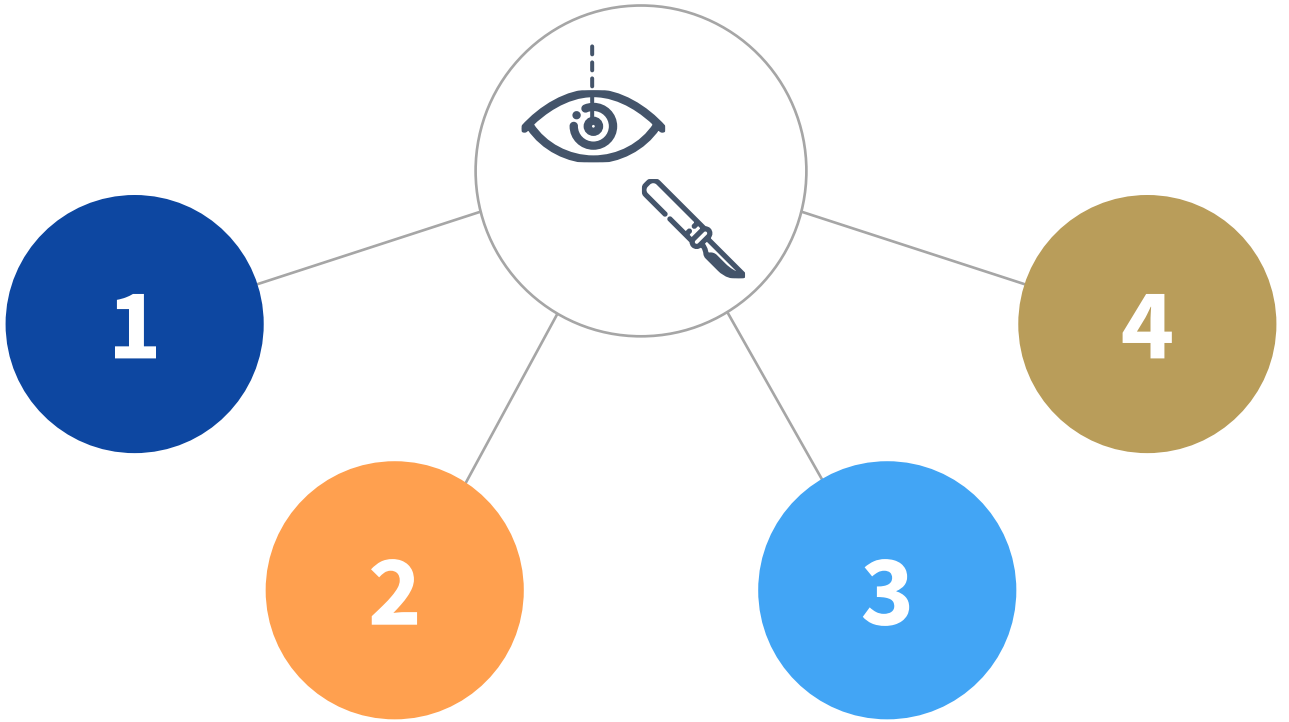
Identifying patients who may benefit from alternatives to eye drops



1 Non-compliance and/or non-adherence with medical treatment

2 Adequate IOP control cannot be achieved with medical treatment

3 Congenital glaucoma, where surgery is the first-line treatment

4 Patients who live in areas with limited access to glaucoma medications

Based on the experience of Assoc. Prof. Virna Dwi O. Asrory.

Summary: When to use different laser treatments

OAG

- **Outflow enhancement:** laser trabeculoplasty
- **Inflow reduction:** CPC (usually for end-stage disease)

Angle closure (± glaucoma)

- **Pupillary block relief:** laser peripheral iridotomy
- **Modification of iris contour:** laser peripheral iridoplasty
- **Inflow reduction:** CPC (usually for end-stage disease)

Post-filtering surgery

- **Outflow enhancement:** argon laser suture lysis

CPC: cyclophotocoagulation; OAG: open-angle glaucoma.
Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed.

Summary: Surgical approaches for glaucoma

1. **Trabeculectomy is the most performed glaucoma filtering surgery and is conventionally considered the gold standard of penetrating surgery to create a subconjunctival bleb without the need for an implant**
2. **GDDs are implants consisting of a tube connected to a reservoir plate that diverts aqueous from the anterior chamber to a subconjunctival bleb, where fluid is absorbed by surrounding vessels to lower IOP**
3. **MIGS initially referred to ab-interno devices and procedures usually targeting Schlemm's canal. However, the term has broadened to include ab-externo bleb-forming procedures with little or no scleral dissection**
4. **NPGS is a form of drainage surgery where Schlemm's canal is de-roofed underneath a scleral flap and deep corneoscleral lamellae are removed to create an intrascleral lake**
5. **GSL involves separation of the PAS with a spatula, micro forceps, or needle under gonioscopic guidance and is often used with phacoemulsification to open the angle**

GDD: glaucoma drainage device; GSL: goniosynechialysis; IOP: intraocular pressure; MIGS: minimally invasive glaucoma surgery; NPGS: non-penetrating glaucoma surgery; PAS: peripheral anterior synechiae.

Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed.

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