MODULE 2:
Management approach

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 2

- **Chair:** Prof. Tina Wong (Singapore)
- Prof. Chungkwon Yoo (South Korea)
- Assoc Prof. Do Tan (Vietnam)
- Prof. Norlina Ramli (Malaysia)
- Dr. Rainier Covar (Philippines)

APGS Expert Review – Module 2

- Prof. Catherine Liu (Taiwan)
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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 2: Management approach**

Module 2 focuses on the management approach for glaucoma. It distils key recommendations into actionable strategies across the spectrum of glaucoma subtypes, with a focus on real-world application and decision-making support for:

- Ocular hypertension
- Primary open-angle glaucoma
- Normal-tension glaucoma
- Primary angle-closure glaucoma
- Acute angle closure
- Neovascular glaucoma
- Uveitic glaucoma

Meet the expert faculty:

The diagnostic workup 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:

Prof. Chungkwon Yoo | **Dr. Rainier Covar** | **Prof. Norlina Ramli** | **Assoc. Prof. Do Tan**

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

Ocular hypertension

Definition: Untreated IOP >21 mmHg with normal VF, optic disc, and RNFL. Open angle, no secondary causes of elevated IOP (including trauma, steroid use, or uveitis)

Diagnostic workup[1]

1. **Good history taking and slit-lamp examination**
2. **IOP measurement with GAT**
3. **CCT measurement**
4. **Examination of the ONH and RNFL**
5. **Dark room gonioscopy**
6. **Reliable VF and OCT examinations**

Prof. Chungkwon Yoo

Common pitfalls in the diagnosis of OHT:

1. Overestimation of IOP with non-contact tonometry → ***Confirmation with GAT is essential***
2. IOP elevation due to steroid use may occur → ***Careful history taking is needed***
3. ***IOP can be underestimated after corneal refractive surgery, which can mask true OHT***

Dr. Rainier Covar

Accurate IOP measurement is essential for diagnosis; patients should avoid straining, breath-holding, eyelid squeezing, or tight neckwear, as these may artificially elevate readings.

Risk factors for POAG:[2,3]

- **Older age**
- **Higher IOP**
- **Higher PSD in the VF**
- **Smaller CCT**
- **Larger vertical CDR**

CCT: central corneal thickness; CDR: cup-to-disc ratio; GAT: Goldmann applanation tonometry; IOP: intraocular pressure; OCT: optical coherence tomography; ONH: optic nerve head; OHT: ocular hypertension; POAG: primary open-angle glaucoma; PSD: pattern standard deviation; RNFL: retinal nerve fiber layer; VF: visual field.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Gordon M, et al. *Arch Ophthalmol* 2002;120:714–20; **3.** European Glaucoma Prevention Study Group. *Ophthalmology* 2007;114:3–9.

Management of ocular hypertension

Prof. Chungkwon Yoo

Something to consider: Several population-based studies have shown that IOP and/or CCT is relatively lower in some Asian populations compared with white cohorts, including in China, Japan, and Korea.[12–15]

The decision to initiate treatment should be made after a thorough discussion between the patient and ophthalmologist that weighs the risks and benefits of both options[1]

OCT is helpful for detecting early structural changes[2–4]

First-line treatment can be either **SLT or topical IOP-lowering drops[5]**

In patients with low- to moderate-risk, **treatment may be safely stopped with careful monitoring[6]**

Repeat assessments are important[7–11]

Initiation of treatment should be considered when the **risk of POAG conversion is likely to be high[1]**

CCT: central corneal thickness; IOP: intraocular pressure; OCT: optical coherence tomography; POAG: primary open-angle glaucoma; SLT: selective laser trabeculoplasty.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Sehi M, et al. *Am J Ophthalmol* 2013;155:73–82.e1; **3.** Yu M, et al. *Ophthalmology* 2016;123:1201–10; **4.** Lalezary M, et al. *Am J Ophthalmol* 2006;142:576–82; **5.** Gazzard G, et al. *Lancet* 2019;393:1505–16; **6.** Chan P, et al. *Br J Ophthalmol* 2015;99:1245–50; **7.** Bhorade A, et al. *Ophthalmology* 2009;116:717–24; **8.** Correnti A, et al. *Ophthalmology* 2003;110:1499–505; **9.** Gardiner S, et al. *Ophthalmology* 2013;120:724–30; **10.** Song C, et al. *J Glaucoma* 2014;23:1–4; **11.** Chan P, et al. *Br J Ophthalmol* 2019;103:361–8; **12.** Hwang Y, et al. *Invest Ophthalmol Vis Sci* 2012;53:6851–5; **13.** Fukuchi T, et al. *Ophthalmology* 2006;113:2103–8; **14.** Wang D, et al. *PLoS One* 2013;8:e66741; **15.** Brandt JD, et al. *Arch Ophthalmol* 2001;119:1771–8.

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Diagnosis of primary open-angle glaucoma

Clinical examination includes history taking, physical examination, and diagnostic evaluation[1,2]

Risk factors for POAG:[3–16]

- IOP
- Older age
- Family history
- Disc hemorrhage
- Larger cup-to-disc ratio
- Beta-zone parapapillary atrophy
- Thinner central cornea
- Decreased corneal hysteresis
- Lower ocular perfusion pressure
- High myopia

GCIPL: ganglion cell–inner plexiform layer; ICL: implantable collamer lens; IOP: intraocular pressure; LASIK: laser-assisted in situ keratomileusis; OCT: optical coherence tomography; ONH: optic nerve head; POAG: primary open-angle glaucoma; RAPD: relative afferent pupillary defect; RGC: retinal ganglion cell; RNFL: retinal nerve fiber layer; SAP: standard automated perimetry; SMILE: small incision lenticule extraction; VF: visual field.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Gupta N, Weinreb RN. *Curr Opin Ophthalmol* 1997;8:38–41; **3.** Zhou K, et al. *Zhonghua Yan Ke Za Zhi* 2019;55:777–84; **4.** Nouri-Mahdavi K, et al. *Ophthalmology* 2004;111:1627–35; **5.** Stewart WC, et al. *Am J Ophthalmol* 2000;130:274–9; **6.** Gaasterland DE, et al. *Am J Ophthalmol* 2000;130:429–40; **7.** Seol BR, et al. *PLoS One* 2019;14:e0222166; **8.** Jasty U, et al. *Br J Ophthalmol* 2020;104:1488–91; **9.** Salowe RJ, et al. *BMJ Open Ophthalmol* 2023;8:e001120; **10.** Teng CC, et al. *Ophthalmology* 2011;118:2409–13; **11.** Ha A, et al. *Br J Ophthalmol* 2021;105:361–6; **12.** Wei Y, et al. *Front Bioeng Biotechnol* 2023;11:1174419; **13.** Ng S, et al. *Br J Ophthalmol* 2018;102:802–7; **14.** Jiménez-Santos MA, et al. *Graefes Arch Clin Exp Ophthalmol* 2021;259:2743–51; **15.** Leske MC, et al. *Arch Ophthalmol* 2003;121:48–56; **16.** Rossi GCM, et al. *Eur J Ophthalmol* 2011;21:410–4.

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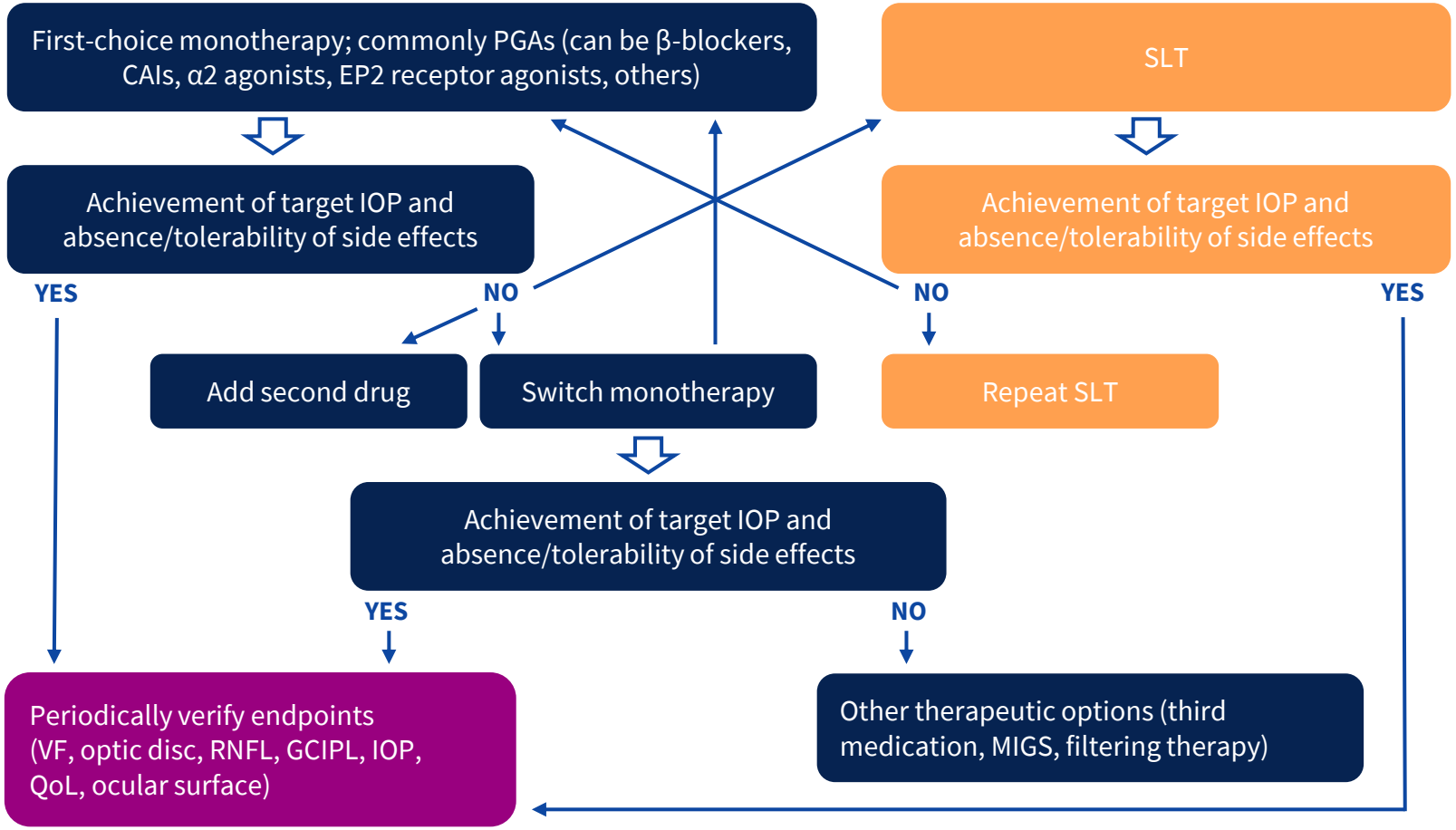
Management of primary open-angle glaucoma

Treatment algorithm:[1]



Follow-up schedule:[2]

Target IOP achieved	Progression of damage	Duration of control (months)	Approx. follow-up interval (months)
Yes	No	<6	6
Yes	No	>6	12
Yes	Yes	NA	1–2
No	Yes	NA	1–2
No	No	NA	3–6

CAI: carbonic anhydrase inhibitor; GCIPL: ganglion cell–inner plexiform layer; IOP: intraocular pressure; MIGS: minimally invasive glaucoma surgery; PGA: prostaglandin analogue; QoL: quality of life; RNFL: retinal nerve fiber layer; SLT: selective laser trabeculoplasty; VF: visual field.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** American Academy of Ophthalmology (AAO). Glaucoma Summary Benchmarks – 2024. Available at: https://www.aao.org/education/summary-benchmark-detail/glaucoma-summary-benchmarks-2020. Last accessed July 2025.

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Diagnosis of normal-tension glaucoma

Diagnostic workup[1–5]

- Rule out other optic neuropathies
- Take a comprehensive systemic history
- Core assessments
- Flame-shaped disc hemorrhages, deep and focal notching, and peripapillary atrophy may be observed more frequently in NTG than in high-tension POAG
- VF defects may be similar to POAG but are often deeper, more localized, and closer to fixation

Prof. Chungkwon Yoo

Common pitfalls in the diagnosis of OHT:

1. Single IOP reading can lead to misdiagnosis → ***Consider diurnal and long-term IOP fluctuation***
2. Intermittent angle-closure glaucoma may be mistaken for NTG → ***Ensure gonioscopy is performed***
3. ***Old retinal vein occlusions can resemble NTG***

Assoc. Prof. Do Tan

NTG should be considered a diagnosis of exclusion, made only after ruling out other possible causes such as prior steroid-induced glaucoma or POAG with IOP fluctuation.

NTG accounts for 47–92% of POAG cases in Asia, and is often undiagnosed due to normal IOP[6]

GAT: Goldmann applanation tonometry; GON: glaucomatous optic neuropathy; IOP: intraocular pressure; NTG: normal-tension glaucoma; OCT: optical coherence tomography; POAG: primary open-angle glaucoma; RNFL: retinal nerve fiber layer; VF: visual field.

1. Lee B, et al. *J Glaucoma* 1998;7:366–71; **2.** Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **3.** Killer HE, Pircher A. *Eye (Lond)* 2018;32:924–30; **4.** Collaborative Normal-Tension Glaucoma Study Group. *Am J Ophthalmol* 1998;126:487–97; **5.** Gramer E, et al. *Klin Monbl Augenheilkd* 1986;189:190–8; **6.** Salvetat M, et al. *Pharmaceuticals (Basel)* 2023;16:1172.

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Risk factors for normal-tension glaucoma

IOP-dependent risk factors:[1–12]

- Higher IOP
- IOP asymmetry
- Elevated nocturnal IOP
- Wider diurnal IOP fluctuation
- Thin CCT

IOP-independent risk factors:[13–20]

- Ocular vascular abnormalities
- Cardiovascular dysregulation
- Hematologic abnormalities
- Genetic predispositions
- Systemic abnormal vasoregulation
- Other systemic factors

CCT: central corneal thickness; IOP: intraocular pressure.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Gramer E, et al. *Klin Monbl Augenheilkd* 1985;186:262–7; **3.** Cartwright MJ, et al. *Arch Ophthalmol* 1988;106:898–900; **4.** Crichton A, et al. *Ophthalmology* 1989;96:1312–4; **5.** Greenfield DS, et al. *Ophthalmology* 2007;114:460–5; **6.** Mitchell P, et al. *Ophthalmology* 1996;103:1661–9; **7.** Bhartiya S, et al. *Rom J Ophthalmol* 2019;63:315–20; **8.** Jeoung JW, et al. *Ophthalmology* 2008;115:2132–40; **9.** Shields M. *Curr Opin Ophthalmol* 2008;19:85–8; **10.** Weinreb RN, Liu JH. *Arch Ophthalmol* 2006;124:269–70; **11.** Shetgar AC, et al. *J Clin Diagn Res* 2013;7:1063–7; **12.** Ventura AC, et al. *Br J Ophthalmol* 2001;85:792–5; **13.** Higashide T, et al. *Ophthalmol Glaucoma* 2020;3:S2589–4196(20)30220–9; **14.** Anderson DR, et al. *Curr Opin Ophthalmol* 2003;14:86–90; **15.** James CB, et al. *Br J Ophthalmol* 1991;75:466–70; **16.** Hashimoto M, et al. *Am J Ophthalmol* 2000;130:670–2; **17.** Rader J, et al. *Am J Ophthalmol* 1994;117:72–80; **18.** Kondo Y, et al. *Am J Ophthalmol* 2000;130:454–60; **19.** Sung KR, et al. *Invest Ophthalmol Vis Sci* 2009;50:5266–74; **20.** Sung KR, et al. *Invest Ophthalmol Vis Sci* 2011;52:737–43.

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Treatment of normal-tension glaucoma

In addition to IOP-lowering therapy, factors affecting ONH perfusion (such as systemic or nocturnal hypotension, anaemia, cardiac arrhythmias) should be assessed in NTG.

A **30% reduction in baseline IOP** significantly reduced the risk of progression of NTG (12% vs 35% in observation group over 5 years)[1]

Medical therapy

- **PGAs** tend to have a greater IOP-lowering effect[2]
- **Dorzolamide–timolol FDCs** are safe and effective[3,4]
- **Brimonidine** may improve retinal vascular autoregulation[5–7]

Laser and surgery

- Approach is similar to POAG[8]
- In CNTGS, a 30% IOP reduction achieved in:[9,10]
  - **57% with topical medication and/or laser trabeculoplasty**
  - The remaining 43% required filtering surgery

CNTGS: Collaborative Normal Tension Glaucoma Study; FDC: fixed-dose combination IOP: intraocular pressure; PGA: prostaglandin analog.

1. Gramer E, et al. *Klinische Monatsblatter fur Augenheilkunde* 1986;189:190–8; **2.** Kanski JJ, Bowling B. Clinical ophthalmology: a systematic approach. Elsevier Health Sciences; 2011; **3.** Kim TW, et al. *J Glaucoma* 2014;23:329–32; **4.** Gramer E, et al. *Klinische Monatsblatter fur Augenheilkunde* 1987;191:184–98; **5.** Feke GT, et al. *Am J Ophthalmol* 2014;158:105–12; **6.** Krupin T, et al. *Am J Ophthalmol* 2011;151:67–81; **7.** Sena DF, Lindsley K. *Cochrane Database Syst Rev* 2017;1:CD006539; **8.** Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **9.** Schulzer M. *Ophthalmology* 1992;99:1468–70; **10.** Lee JW, et al. *J Glaucoma* 2015;24:77–80.

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EP2 receptor agonists for the management of normal-tension glaucoma

The only known modifiable risk factor that can alter the progression of NTG is IOP reduction.[4]

Eybelis®, an EP2 receptor agonist, consistently demonstrates IOP lowering in patients with NTG:[1–3]

	Inoue K, et al. *Clin Ophthalmol* 2020[1]	Lee S, et al. *J Glaucoma* 2023[2]	Inoue K, et al. *Jpn J Ophthalmol* 2024[3]
Study description	Retrospective evaluation of the **short-term** efficacy of Eybelis in patients with NTG	Retrospective analysis of medical records of patients with NTG treated with Eybelis for **≥6 months**	Retrospective evaluation of the **3-year** efficacy of Eybelis in patients with NTG
Treatment regimen	**Eybelis ophthalmic solution (0.002%)**	**Eybelis ophthalmic solution (0.002%)**	**Eybelis ophthalmic solution (0.002%)**
Participants	54 eyes	62 eyes	100 eyes
Outcomes	IOP at baseline, 1–2 months after, and 3–4 months after Eybelis	IOP, refraction, keratometry, CCT, endothelial cell count, CV, corneal erosion, and central retinal thickness at 1, 3, and 6 months after Eybelis	IOP at baseline and 6, 9, 12, 18, 24, 30, and 36 months after Eybelis
Duration of follow-up	4 months	6 months	36 months
Key efficacy results	**There was a significant decrease in IOP at 4 months following treatment with Eybelis in patients with NTG (P<0.0001)**	**Treatment with Eybelis elicited significant and stable IOP reductions after 6 months in patients with NTG with low IOP (P<0.001). Patients who switched to Eybelis showed reductions in PAPS symptoms**	**Within 3 years of treatment with Eybelis, IOP significantly decreased (P<0.0001) from baseline, and visual fields were maintained in patients with NTG**
Key safety results	AEs occurred in four patients (7.4%), including conjunctival hyperemia in three patients and eye pain in one patient	Transient myopic and corneal endothelial cell changes, development of corneal thickening, and corneal erosion should be considered when using Eybelis	AEs occurred in 11 patients (11.0%), including conjunctival hyperemia in six patients
Conclusion	After administration of Eybelis, IOP in patients with NTG was significantly decreased.	Eybelis elicited significant and stable IOP reductions in patients with NTG and low IOP.	Eybelis can be used as the first-line treatment for patients with NTG.

Eybelis contraindications include patients with aphakic eyes or intraocular lens inserted eyes, and concomitant use with tafluprost.

AE: adverse event; CCT: central corneal thickness; CV: coefficient of variation of endothelial cell area; IOP: intraocular pressure; NTG: normal-tension glaucoma; PAPS: prostaglandin-associated periorbitopathy syndrome.

1. Inoue K, et al. *Clin Ophthalmol* 2020;14:2943–9; **2.** Lee S, et al. *J Glaucoma* 2023;32:245–51; **3.** Inoue K, et al. *Jpn J Ophthalmol* 2024;68:206–10; **4.** Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

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ROCK inhibitors for the management of normal-tension glaucoma

The only known modifiable risk factor that can alter the progression of NTG is IOP reduction.[4]

ROCK inhibitors have demonstrated IOP-lowering in patients with NTG:[1–3]

	Tanihara H, et al. *BMC Ophthalmol* 2020[2]	Tanihara H, et al. *Adv Ther* 2022[3]	Effect of netarsudil vs brimonidine in NTG patients on latanoprost (NCT06449352)
Study description	Prospective, open-label, observational study of patients with glaucoma or OHT who started ripasudil during routine care	**ROCK-J:** Prospective, open-label, observational study of patients who were naïve to ripasudil with glaucoma or OHT who initiated ripasudil in Japan	Phase IV, randomized, multicenter, investigator-masked prospective study of the addition of netarsudil vs brimonidine in patients with NTG currently on latanoprost
Treatment regimen	**Ripasudil ophthalmic solution (0.4%)**	**Ripasudil ophthalmic solution (0.4%)**	**Netarsudil 0.02% vs brimonidine 0.1%**
Participants	Total study population: 3359 patients **Subset of patients with NTG: 1229 patients**	Total study population: 3374 patients **Subset of patients with NTG: 1237 patients**	Estimated enrollment: 100 patients
Outcomes	IOP at baseline, 3 months, and 6 months after ripasudil	Least-squares mean change in IOP from baseline to 24 months after ripasudil	Visual acuity and IOP
Duration of follow-up	12 months	24 months	*Currently recruiting*
Key efficacy results	**There was a significant reduction in IOP at 12 months after treatment with ripasudil in patients with NTG (P<0.001)**	**There was a significant reduction in IOP at 24 months after treatment with ripasudil in patients with NTG (P<0.001)**	*Currently recruiting*
Key safety results	ADRs occurred in 626 patients (18.6%); the most common were conjunctival hyperemia and blepharitis*	ADRs occurred in 853 (25.3%) of patients; the most common were blepharitis (8.6%), conjunctival hyperemia (8.5%), and conjunctivitis (6.3%)†	*Currently recruiting*
Conclusion	Ripasudil was safe and effective in patients with glaucoma or OHT during routine care.	Ripasudil was safe and effective, with no new safety signals identified and significant IOP reductions at 24 months.	*Currently recruiting*

Ripasudil is contraindicated in patients with history of hypersensitivity to any of the components of ripasudil. Netarsudil has no listed contraindications.

*Safety results are reported for the total study population; 3323 patients were included in the safety analysis set.[2] †Safety results are reported for the total study population.[3]

ADR: adverse drug reaction; IOP: intraocular pressure; NTG: normal-tension glaucoma; OHT: ocular hypertension; ROCK: Rho-kinase.

1. Tanihara H, et al. *BMC Ophthalmol* 2020;20:275; **2.** Tanihara H, et al. *Adv Ther* 2022;39:1659–77; **3.** ClinicalTrials.gov. NCT06449352. Available at: https://clinicaltrials.gov/study/NCT06449352. Last accessed August 2025; **4.** Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

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Management of PACS and PAC

Prof. Norlina Ramli

Top tips for patients after LPI or phacoemulsification:
1. Gonioscopy should be repeated after 1 week
2. IOP and VF parameters should be rechecked after 1 to 3 months

PACS

LPI[1–3]

Not recommended routinely

- ZAP and ANA-LIS trials show very low risk of progression and no glaucoma/vision loss
- Consider LPI only if risk factors are present

PAC

LPI[1,4–7]

Recommended if IOP <30 mmHg, limited PAS, and pupillary block present

- Location (11, 12 or 1 o'clock or temporal) does not affect dysphotopsia
- In the absence of crypt or thick iris, sequential argon then YAG LPI can be done
- No need to stop anticoagulants if INR <3
- Residual ITC common (20–80%) – no further intervention needed for ITC alone
- If angle still closed and IOP high post-LPI → consider medical treatment

Phacoemulsification[1,4–7]

Preferred if IOP >30 mmHg and lens mechanism predominates

- LPI may be considered if pupil block predominates
- No added benefit from adjunctive GSL; IOP-lowering similar with or without GSL

Assoc. Prof. Do Tan

The role of GSL in the management of PACS and PAC remains debatable

GSL: goniosynechialysis; IOP: intraocular pressure; INR: international normalized ratio; ITC: irido-trabecular contact; LPI: laser peripheral iridotomy; PAC: primary angle closure; PACS: primary angle-closure suspect; VF: visual field; YAG: yttrium aluminium garnet.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** He M, et al. *Lancet* 2019;393:1609–18; **3.** Baskaran M, et al. *Ophthalmology* 2022;129:147–58; **4.** Srinivasan K, et al. *Ophthalmology* 2018;125:345–51; **5.** Golan S, et al. *JAMA Ophthalmol* 2013;131:626–9; **6.** Narayanaswamy A, et al. *Ophthalmology* 2016;123:514–21; **7.** Narayanaswamy A, et al. *JAMA Ophthalmol* 2015;133:206–12.

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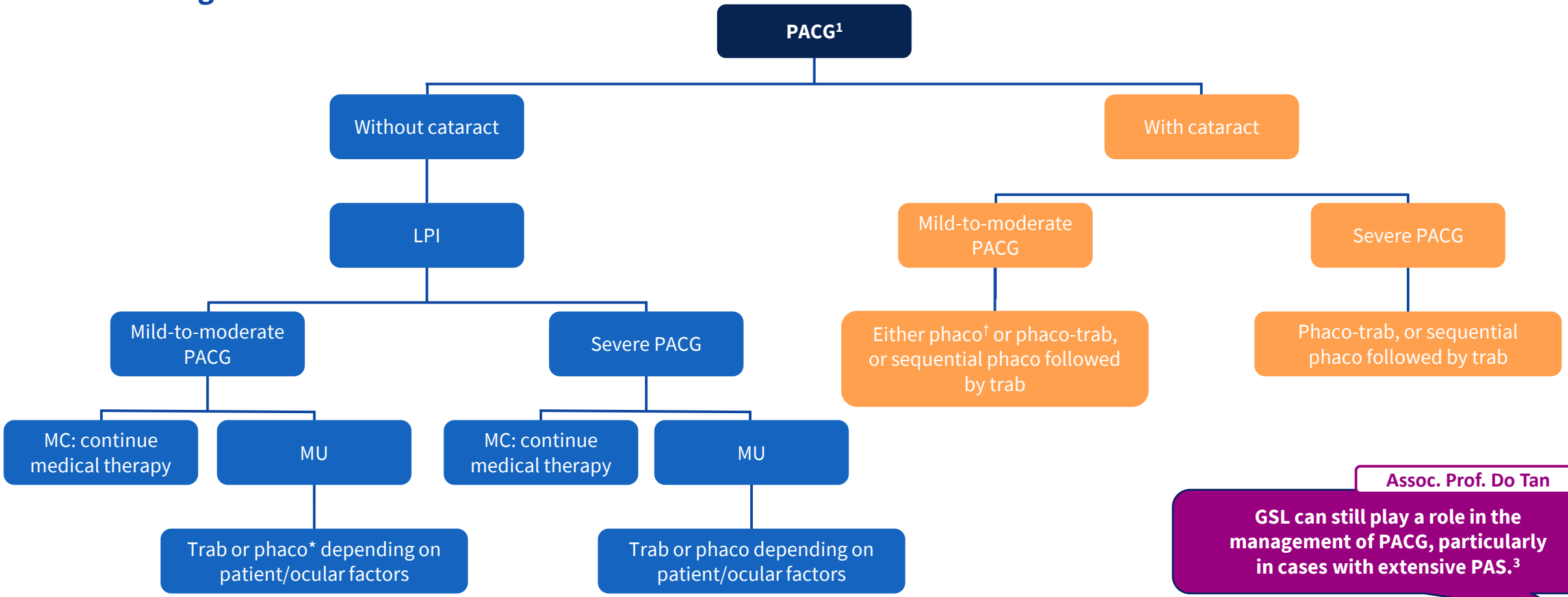
Management of PACG

Dr. Rainier Covar

"Several drug classes can precipitate acute angle-closure glaucoma, including adrenergic, cholinergic/anticholinergic, antidepressant, and sulfa-based agents. Clinicians should remain mindful of these medications."[2]

Treatment algorithm:[1]



Assoc. Prof. Do Tan

GSL can still play a role in the management of PACG, particularly in cases with extensive PAS.[3]

*Risks of clear lens extraction to be explained to the patient. †Need for subsequent trabeculectomy to be explained to the patient.
CAI: carbonic anhydrase inhibitor; IOP: intraocular pressure; LPI: laser peripheral iridotomy; MC: medically controlled; MU: medically uncontrolled; OAG: open-angle glaucoma; PACG: primary angle-closure glaucoma; PAS: peripheral anterior synechiae; PGA: prostaglandin analogue; phaco: phacoemulsification with intraocular lens implantation; phaco-trab: phacoemulsification with intraocular lens implantation and trabeculectomy with mitomycin C; trab: trabeculectomy with mitomycin C.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Ah-kee E, et al. *Qatar Med J* 2015;2015:6; **3.** Li J, et al. *BMC Ophthalmol* 2025;25:627.

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Diagnostic workup of acute angle closure

1. Early stage AAC

- Slit-lamp examination
- GAT
- Anterior segment OCT*
- Ultrasound biomicroscopy*
- Gonioscopy

2. Follow-up

- ONH and RNFL imaging
- VF examination

Prof. Chungkwon Yoo and Dr. Rainier Covar

Expert insights into AAC:

- OCT and RNFL assessment during an acute ACG attack can be misleading, as disc swelling may mask underlying damage; reassess 1–3 months later
- Differentiating between primary and lens-induced ACG can be aided by gonioscopy of the contralateral eye
- Drug-induced or secondary ACG is systemic and may affect both eyes, in contrast to primary ACG, which usually occurs unilaterally
- Weight-loss medications can precipitate secondary ACG

*Recommended but not essential; ; these may be placed further down the treatment algorithm to workup non-resolving AAC.
AAC: acute angle closure; ACG: angle closure glaucoma; GAT: Goldmann applanation tonometry; IOP: intraocular pressure; OCT: optical coherence tomography; ONH: optic nerve head; RNFL: retinal nerve fiber layer.
Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

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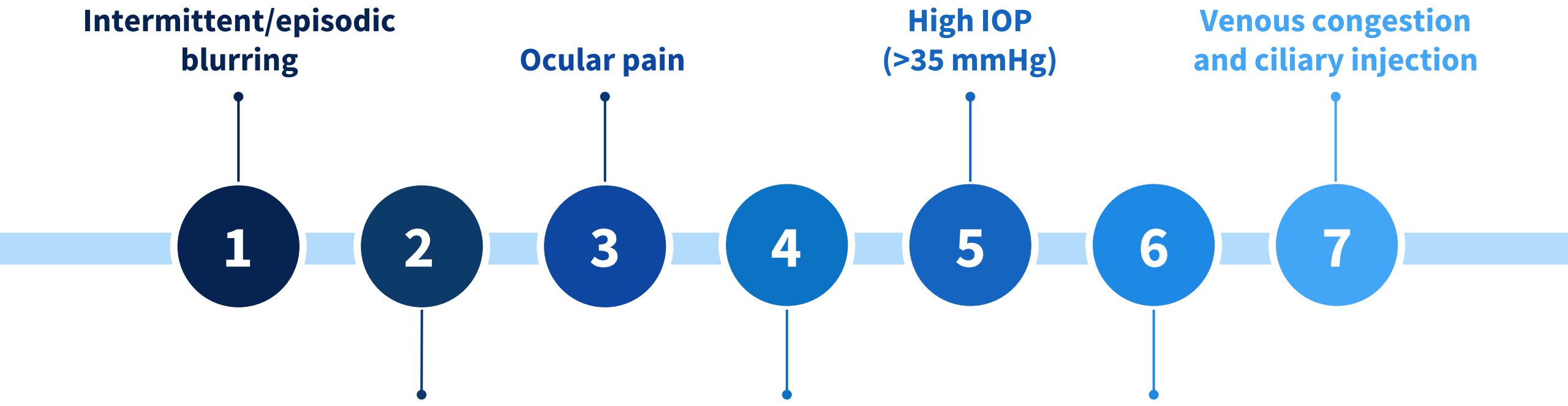
Signs and symptoms of acute angle closure

Assoc. Prof. Do Tan

Gonioscopy, and even Van Herick estimation, are valuable tools for identifying acute angle-closure.



IOP: intraocular pressure.

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

Risk factors for acute angle closure

Risk factors for AAC[1]

- **Older age**
- **Family history**
- **Female**
- **Hypermetropia**
- **South and East Asian ethnicity**
- **Thick peripheral iris**
- **More anterior iris insertion**
- **More prominent and anterior lens vault**

Pharmacological agents[1–5]

Several classes may precipitate AAC:

- Topical
- Antibacterial
- CNS
- Respiratory
- Cardiac
- Hematologic
- Anti-inflammatory
- Gastrointestinal

AAC: acute angle closure; CNS: central nervous system.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Ritch R. *J Glaucoma* 1996;5:225–7; **3.** Wolfs RC, et al. *Invest Ophthalmol Vis Sci* 1997;38:2683–7; **4.** Friedman DS, et al. *Ophthalmol Glaucoma* 2022;5:581–6; **5.** Corridan P, et al. *Br J Ophthalmol* 1990;74:309–10.

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Management of acute angle closure

Assoc. Prof. Do Tan

In the management of acute angle closure, systemic therapy should be initiated first, followed by pilocarpine.

Medical procedures

Decrease AH production

Topical therapy
β-blockers/α2 agonists

Systemic therapy IV
Acetazolamide/mannitol (repeat if necessary)

Re-open the angle

Pharmacological
Pilocarpine 2%

Reduce inflammation

Topical steroids

Dr. Rainier Covar

Urgent medical, laser, or surgical treatment is required for acute angle closure glaucoma. Rapid elevation of IOP can lead to severe optic nerve damage; therefore, prompt intervention is essential to prevent irreversible vision loss.

Laser/surgical procedures

Whenever possible, consider LPI as the first treatment option

Break pupillary block

- **Iris procedures**
  - Persistently cloudy cornea → Surgical iridectomy / Iridoplasty / Cyclophotocoagulation
  - Try topical glycerin 10%
  - Clear cornea → LPI / Surgical iridectomy
  - **Consider clear cornea paracentesis**
- **Remember prophylactic LPI in the other eye**

AAC: acute angle closure; AH: aqueous humor; IV: intravenous; LPI: laser peripheral iridotomy.
Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024.

Diagnosis of neovascular glaucoma

Dr. Rainier Covar

NVG can often be mistaken for ACG before the rubeosis becomes visible. Patients may present with increased IOP, PAS, and beduwing before the iris vessels become visible.

Diagnostic workup[1–5]

1. **Identifying the underlying etiology**
2. **Detailed anterior and posterior segment examination**
3. **Formulating a management plan after evaluating the cause, stage, systemic, and ocular conditions at presentation**
4. **Consult with medicine specialist to control hypertension, anemia or kidney disease, if applicable**

Risk factors for NVG

Systemic and ocular ischemic associations:[1–6]
DM, CRVO, BRVO, ocular ischemic syndrome, and central retinal arterial occlusion

Ocular risk factors:[1,7–12]
Tumors, retinal detachment, uveitis, trauma, and radiation

ACG: angle closure glaucoma BRVO: branch retinal vein occlusion; CRVO: central retinal vein occlusion; DM: diabetes mellitus; IOP: intraocular pressure; NVG: neovascular glaucoma; PAS: peripheral anterior synechiae.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Senthil S, et al. *Indian J Ophthalmol* 2021;69:525–34; **3.** Hayreh SS. *Prog Retin Eye Res* 2007;26:470–85; **4.** Hayreh SS, et al. *Ophthalmology* 1983;90:488–506; **5.** Si Z, et al. Neovascular Glaucoma in Ocular Ischemic Syndrome. In: Qiu, M (eds.). *Neovascular Glaucoma*. Springer, Cham;2022; **6.** Luo J, et al. *J Ophthalmol* 2018;2018:2606147; **7.** Allaire GS, et al. *Can J Ophthalmol* 1997;32:338–41; **8.** Terasaki H, et al. *Graefes Arch Clin Exp Ophthalmol* 2001;239:876–81; **9.** De Potter P. *Curr Opin Ophthalmol* 2002;13:331–6; **10.** Matsui N, et al. *Nippon Ganka Gakkai Zasshi* 2005;109:434–9; **11.** Kim DI, et al. *Korean J Ophthalmol* 2023;37:224–9; **12.** Nishimura JK, et al. *Am J Ophthalmol* 1998;126:130–2.

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Stages of neovascular glaucoma

NVI/NVA is present, while angles are open and IOP is normal. Fluorescein angiography will show leakage from vessels at the pupillary margin and CNP areas in the retina

Pre-rubeotic/rubeotic glaucoma

1

Presence of NVI/NVA along with the fibrovascular membrane blocking the TM, causing a rise in IOP

OAG

2

Contracture of the fibrovascular membrane pulls the iris over the TM, forming PAS and leading to zipper angle closure. As the progression to this stage is very rapid, close monitoring is required

ACG

3

Prof. Chungkwon Yoo

Expert insights into NVG:

- Triaging open vs closed angles is vital, as eyes with extensive PAS and uncontrolled IOP may require early glaucoma surgery
- High IOP can lead to falsely elevated RNFL measurements, so clinicians may defer surgery
- Subtle NVI may appear only as a few fine tufts at the pupillary margin and can easily be overlooked unless carefully examined under high magnification at the slit lamp

Prof. Norlina Ramli

Open angles in NVG:

- If the view permits, gonioscopy is crucial to assess the angle. Open angles suggest interventions such as anti-VEGF may still be effective, while 360° angle closure indicates that surgical management is more appropriate

ACG: angle closure glaucoma; CNP: capillary non-perfusion; IOP: intraocular pressure; NVA: neovascularization of the Angle; NVG: neovascular glaucoma; NVI: neovascularization of the iris; OAG: open-angle glaucoma; OCT: optical coherence tomography; PAS: peripheral anterior synechiae; RNFL: retinal nerve fiber layer; TM: trabecular meshwork; VEGF: vascular endothelial growth factor.

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

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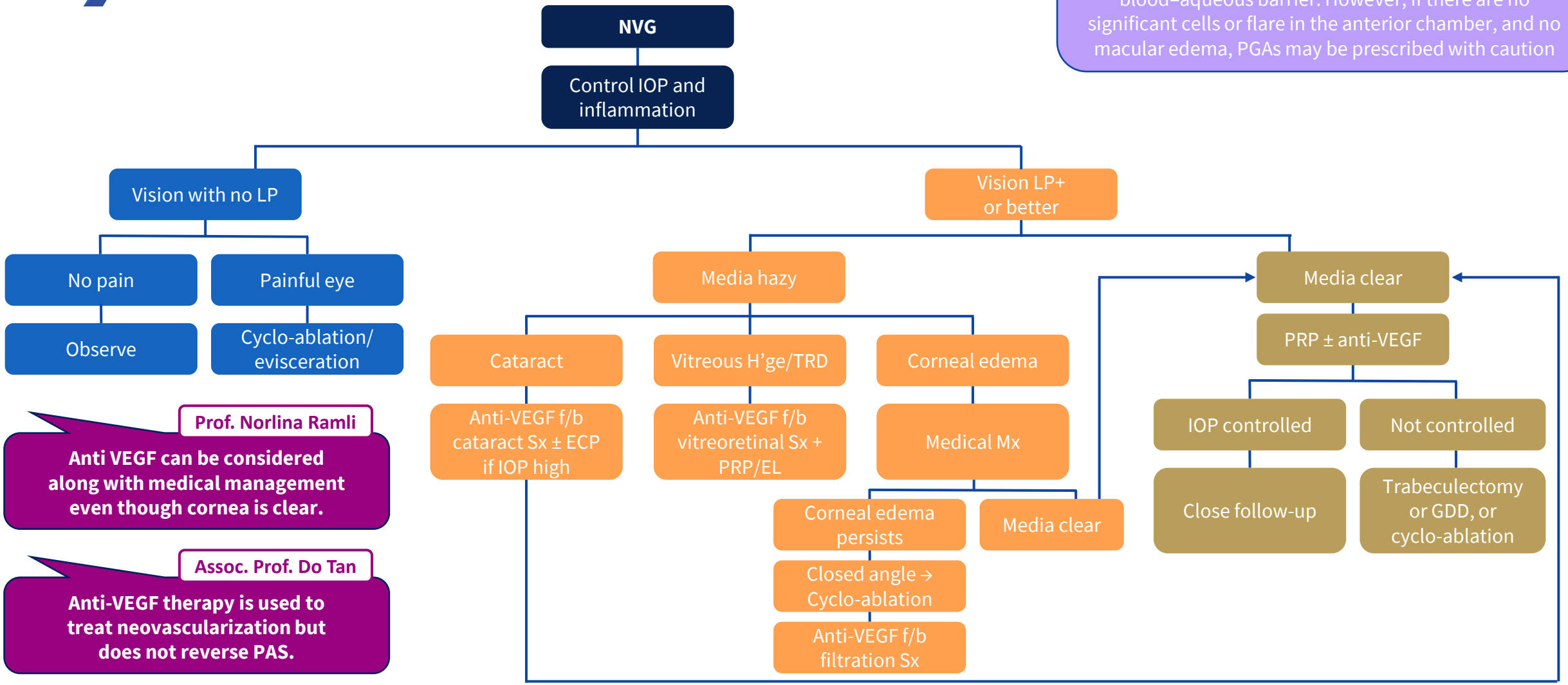
Management of neovascular glaucoma

Can PGAs be used in NVG?

PGAs and cholinergic drugs, such as pilocarpine, may increase inflammation by further compromising the blood–aqueous barrier. However, if there are no significant cells or flare in the anterior chamber, and no macular edema, PGAs may be prescribed with caution



Prof. Norlina Ramli

Anti VEGF can be considered along with medical management even though cornea is clear.

Assoc. Prof. Do Tan

Anti-VEGF therapy is used to treat neovascularization but does not reverse PAS.

ECP: endoscopic cyclophotocoagulation; EL: endolaser; f/b: followed by; GDD: glaucoma drainage device; H'ge: hemorrhage; IOP: intraocular pressure; LP: light perception; Mx: management; NVG: neovascular glaucoma; PAS: peripheral anterior synechiae; PGA: prostaglandin analogue; PRP: panretinal photocoagulation; Sx: surgery; TRD: tractional retinal detachment;
VEGF: vascular endothelial growth factor.

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

Management of uveitic glaucoma

Assoc. Prof. Do Tan

In the management of uveitic glaucoma, consider and address viral causes such as PSS, which may require antiviral therapy in addition to IOP control.

Treatment should target both the uveitis and the elevated IOP

Addressing uveitis:

Aggressive management of the underlying inflammation is paramount in managing uveitic glaucoma, with several treatment options available:

1. **Corticosteroids**
2. **NSAIDs**
3. **Systemic immunosuppressive therapy**
4. **Cycloplegic agents**

Should we prescribe systemic steroids to patients with uveitis prior to surgery to improve outcomes?

Preoperative topical or oral steroid treatment (0.5 to 1 mg/kg/day of oral prednisolone) may be prescribed to patients prior to filtration surgery to decrease inflammatory intraocular conjunctival cells

GON: glaucomatous optic neuropathy; IOP: intraocular pressure; NSAID: non-steroidal anti-inflammatory drug; PSS: Posner–Schlossman syndrome.

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Management of uveitic glaucoma

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Treatment should target both the uveitis and the elevated IOP

Addressing elevated IOP with medical therapy:[1,2]

Medication class[1]	Therapeutic use	Remarks/contraindications
Non-selective β-blockers	First line	Except metipranolol due to anterior granulomatous uveitis
Topical and systemic CAIs	First line. Positive effect in preventing and treating CME coexistent with uveitic glaucoma	Avoid in patients with compromised corneal endothelium and corneal endothelial injury
α2 adrenergic agonists	Second line	May reactivate anterior uveitis
PGAs	Used in cases of quiescent uveitis without previous complicated intraocular surgery or pre-existing CME	Avoid in herpetic keratitis or keratouveitis
Rho-kinase inhibitors	Can be used safely as an option if the eye is a responder	None
Hyperosmotics	Rapid onset of action and useful for marked IOP elevation	None
Tissue plasminogen activator	In eyes with acute fibrinous anterior uveitis and impending pupillary block with or without PAS at a dose of 6.25–1.25 µg	None

CAI: carbonic anhydrase inhibitor; CME: cystoid macular oedema; GDD: glaucoma drainage device; IOP: intraocular pressure; MIGS: minimally invasive glaucoma surgery; PAS: peripheral anterior synechiae; PGA: prostaglandin analogue; PSS: Posner–Schlossman syndrome; SLT: selective laser trabeculoplasty; TM: trabecular meshwork.

1. Asia-Pacific Glaucoma Society (APGS). Asia-Pacific Glaucoma Guidelines. 4th ed. May 2024; **2.** Skolnick CA, et al. *Am J Ophthalmol* 2000;129:363–6.

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Management of uveitic glaucoma

Treatment should target both the uveitis and the elevated IOP

Addressing elevated IOP with laser therapy and surgery:

Laser therapy

- Laser trabeculoplasty may cause an acute flare-up of uveitis, leading to a significant rise in IOP
- SLT can be considered for steroid-induced glaucoma with quiescent uveitis
- LPI may be beneficial in cases with pupillary block
- LPI may re-occlude in the setting of uncontrolled post-laser inflammation
- In the case of iris bombe/thick iris; sequential argon YAG LPI is preferred

Surgery

- In refractory cases surgical intervention may be necessary, although uveitis is a known risk factor for surgical failure
- GDD surgery is an effective intervention in cases with significant postoperative inflammation and in cases with risk for trabeculectomy failure

CAI: carbonic anhydrase inhibitor; CME: cystoid macular oedema; GDD: glaucoma drainage device; IOP: intraocular pressure; LPI: laser peripheral iridotomy; MIGS: minimally invasive glaucoma surgery; PAS: peripheral anterior synechiae; PGA: prostaglandin analogue; SLT: selective laser trabeculoplasty; TM: trabecular meshwork; YAG: yttrium aluminium garnet.

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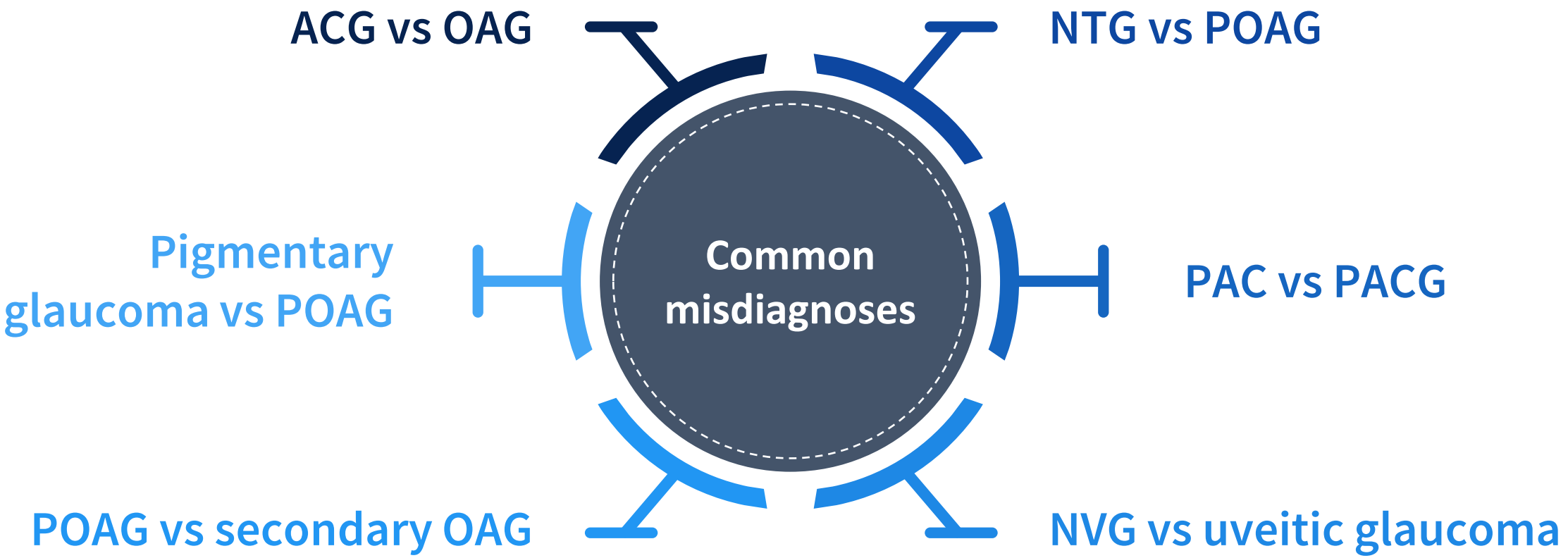
Expert advice on avoiding misdiagnoses in glaucoma



ACG: angle closure glaucoma; NTG: normal-tension glaucoma; OAG: open-angle glaucoma; PAC: primary angle closure; PACG: primary angle closure glaucoma; POAG: primary open-angle glaucoma; PXG: pseudoexfoliation glaucoma.

1. ACG (plateau iris) vs OAG

ACG:

Particular care should be taken in ACG with a plateau iris configuration, where the central anterior chamber may appear deep enough, masking the underlying narrow angle.

Assessment:

Compare peripheral angle closure depth to corneal thickness: if ¼ or less, suspect PAC spectrum.

ACG: angle closure glaucoma; OAG: open-angle glaucoma; PAC: primary angle closure.

2. NTG vs POAG

NTG and POAG share similar clinical features, except for the difference in IOP.

NTG is associated with:

- Abnormal blood flow, such as vasospasm and vascular dysregulation
- Optic nerve sensitivity causing damage at low IOP
- Thinner corneas that can cause IOP readings to appear falsely low

Assessment:

- IOP measurements should include:
  - Measurements taken at different times of day
  - 24-hour IOP (if available)
  - Water drinking test

IOP: intraocular pressure; NTG: normal-tension glaucoma; POAG: primary open-angle glaucoma.

3. NVG vs uveitic glaucoma

Both may present with:

- **Rubeosis**
- **Bedewing**
- **IOP**
- **Can lead to diagnostic error**

Uveitic glaucoma may also be seen with:

- Keratic precipitates
- Small pupils
- Iris bombei in later stages
- Koeppe nodules at iris margin
- Busacca nodules in iris stroma

IOP: intraocular pressure; NTG: normal-tension glaucoma; NVG: neovascular glaucoma; OAG: open-angle glaucoma; POAG: primary open-angle glaucoma.

4. PAC vs PACG

- **PAC is a condition where there is physical blockage in the drainage angle of the eye (≥180 degrees iridotrabecular contact) causing an increase in IOP readings.**
- **Once there is evidence of optic nerve damage based on OCT or VF, it is classified as PACG.**

PAC may present as:

- Shallow anterior chamber
- Mid dilated pupil
- PAS
- Asymptomatic
- No evidence of optic nerve damage based on VF tests

Assessment:

- Exclude the presence of PAS by indentation gonioscopy
- Optic nerve damage by OCT or VF tests

IOP: intraocular pressure; NTG: normal-tension glaucoma; OCT: optical coherence tomography; PAC: primary angle closure; PACS: primary angle-closure suspect; PAS: peripheral anterior synechiae; VF: visual field.

5. POAG vs secondary OAG

Both show open angles with optic damage, but POAG has no attributable underlying cause.

Secondary OAG:

Develops as a result of another disease, injury, or a medical condition/medication that blocks or damages the TM.

Assessment:

- Meticulous examination should be performed to rule out pseudoexfoliation, pigmentary, neovascular, traumatic, uveitic, steroid-induced, lens-induced, and post-surgery glaucoma
  - **PXG:** Look for white material accumulation at the anterior capsule, pupillary margin, or in the angle. Presence of PXG is often missed without examination under pupil dilation. Irregular pupil shape may indicate the underlying pathology

NVI: neovascularization of the iris; OAG: open-angle glaucoma; PAS: peripheral anterior synechiae; POAG: primary open-angle glaucoma; PXG: pseudoexfoliation glaucoma.

6. Pigmentary glaucoma vs POAG

Pigmentary glaucoma is a secondary glaucoma caused by pigment dispersion from the iris. It may have specific signs like transillumination defects and Krukenberg spindles on the cornea.

Pigmentary glaucoma:

The classic triad of Krukenberg spindle, transillumination defects, and heavy TM pigmentation may be unreliable when diagnosing pigmentary glaucoma in Asian patients due to thick iris anatomy.

Assessment:

- Alternative diagnostic signs include:
  - **Iris concavity:** Backward bowing of the iris
  - **Sampaolesi line:** Pigmentation anterior to the TM is a reliable sign
- Look for accumulation of white material at the anterior capsule, pupillary margin, or in the angle

POAG: primary open-angle glaucoma; TM: trabecular meshwork .

Summary

1. In OHT and POAG, management is risk-based with monitoring and stepwise IOP-lowering treatment
2. In NTG, other causes must be excluded and IOP lowered despite normal baseline pressures
3. In PACD, treatment depends on stage and mechanism, with LPI or phacoemulsification as appropriate
4. In AAC, urgent IOP reduction and inflammation control are required, followed by definitive LPI, cataract surgery, or filtration surgery
5. In NVG and uveitic glaucoma, both the underlying cause and IOP/inflammation must be addressed, including intravitreal anti-VEGF therapy, with laser or surgery reserved for refractory cases

AAC: acute angle closure; IOP: intraocular pressure; LPI: laser peripheral iridotomy; NTG: normal-tension glaucoma; NVG: neovascular glaucoma; OHT: ocular hypertension; PACD: primary angle-closure disease; POAG: primary open-angle glaucoma.

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