MEDICAL TREATMENT

Medical Treatment

I. Optimising medical treatment
II. Medical treatment algorithm
III. Drug classes
IV. Initiation of treatment
V. Angle closure glaucoma
VI. Pregnancy and paediatric glaucoma
VII. Contraindications, interactions and side effects
VIII. Key points

Medical Treatment of glaucoma

- Rationale for medical treatment
  - Effective for the majority of patients
  - Generally acceptable therapeutic index
  - Widely available
  - Requires good compliance (adherence and persistence) to the prescribed medication. The choice depends on the mechanism of glaucoma, comorbidities such as dry eye disease, as well as other risk factors

Optimising Medical Treatment

- Choose the Most Appropriate Medication
  - Greatest chance of reaching target IOP
  - Best safety and tolerability profiles
  - Minimal inconvenience
  - Affordable
  - Maximal likelihood of adherence
  - Start with monotherapy wherever possible
- Start ‘low and slow’
  - Minimise concentration
  - Minimal frequency

Optimising Medical Treatment

- one-eyed therapeutic trial*
  - Start treatment in the worse eye
  - Check IOP after 2–4 weeks
  - Assess side effects
  - If treatment is acceptable and effective, treat both eyes

Optimising Medical Treatment

Inadequate initial treatment

- If the response is inadequate to achieve the target pressure, switch before adding:
  - Switch to a different class of medication (switching within the PGA class may be useful, but adherence and regression to the mean need to be considered)
  - If a drug fails to reduce IOP from baseline or produces significant side effects, one should switch to a second drug

Optimising Medical Treatment

Inadequate initial treatment

- Use more than one agent only if each has demonstrated efficacy (≥ 50% efficacy) but is insufficient to reach target pressure:
  - Apply this principle also to the fixed combinations
  - Do not combine two drugs with the same pharmacological action
  - Do not use two fixed combinations containing overlapping categories.
  - In rare cases where a very large IOP reduction is needed it may be necessary to start with more than one active agent

Optimising medical treatment:

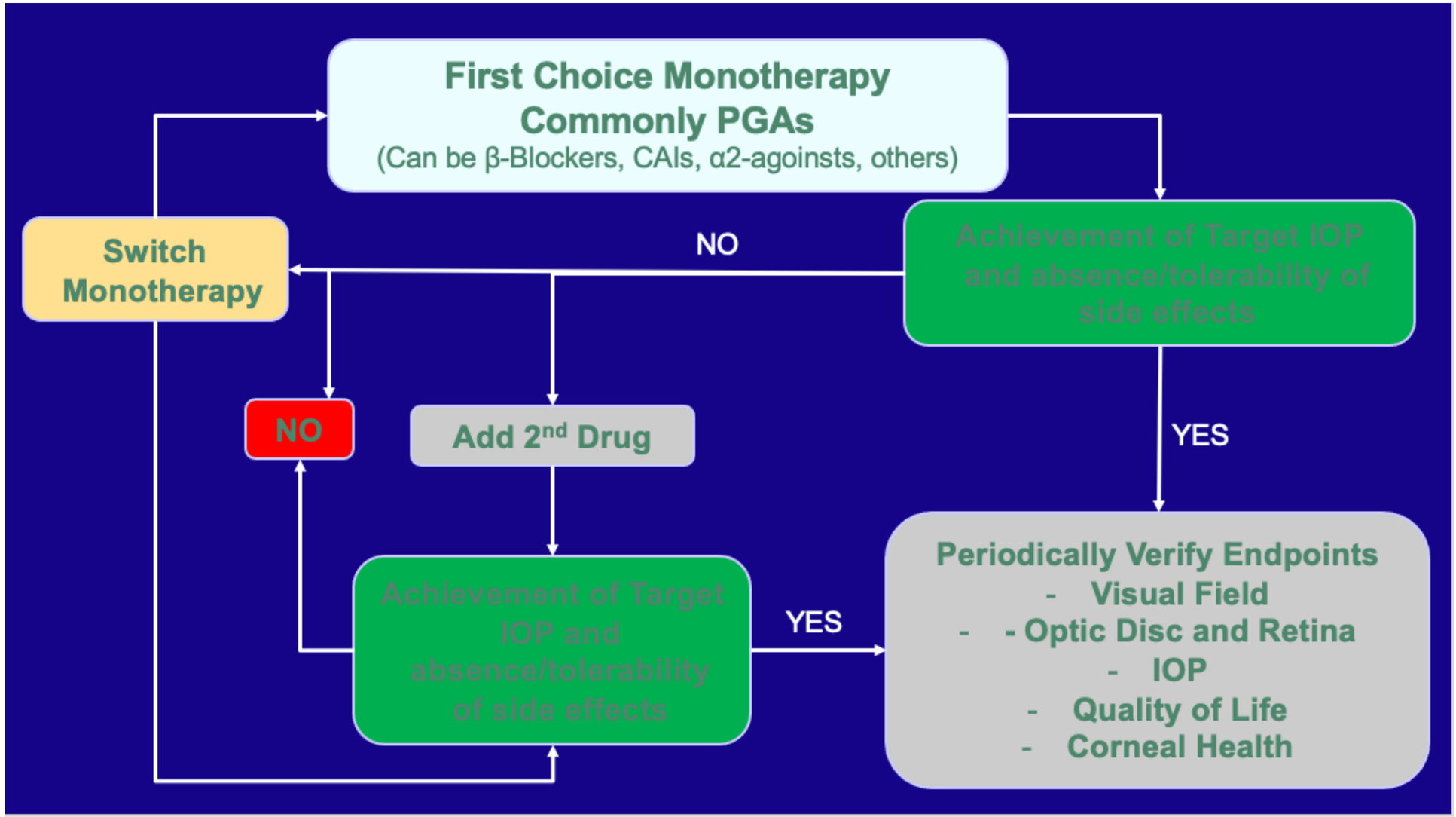
Maximise the likelihood adherence

- Establish a therapeutic alliance with the patient and their family – they need to view the doctor as an ally against the disease
- Patient and family education
- Least complex regimen
- Least disruption of lifestyle
- Reminder systems (such as cellphone based alarms) significantly improve adherence

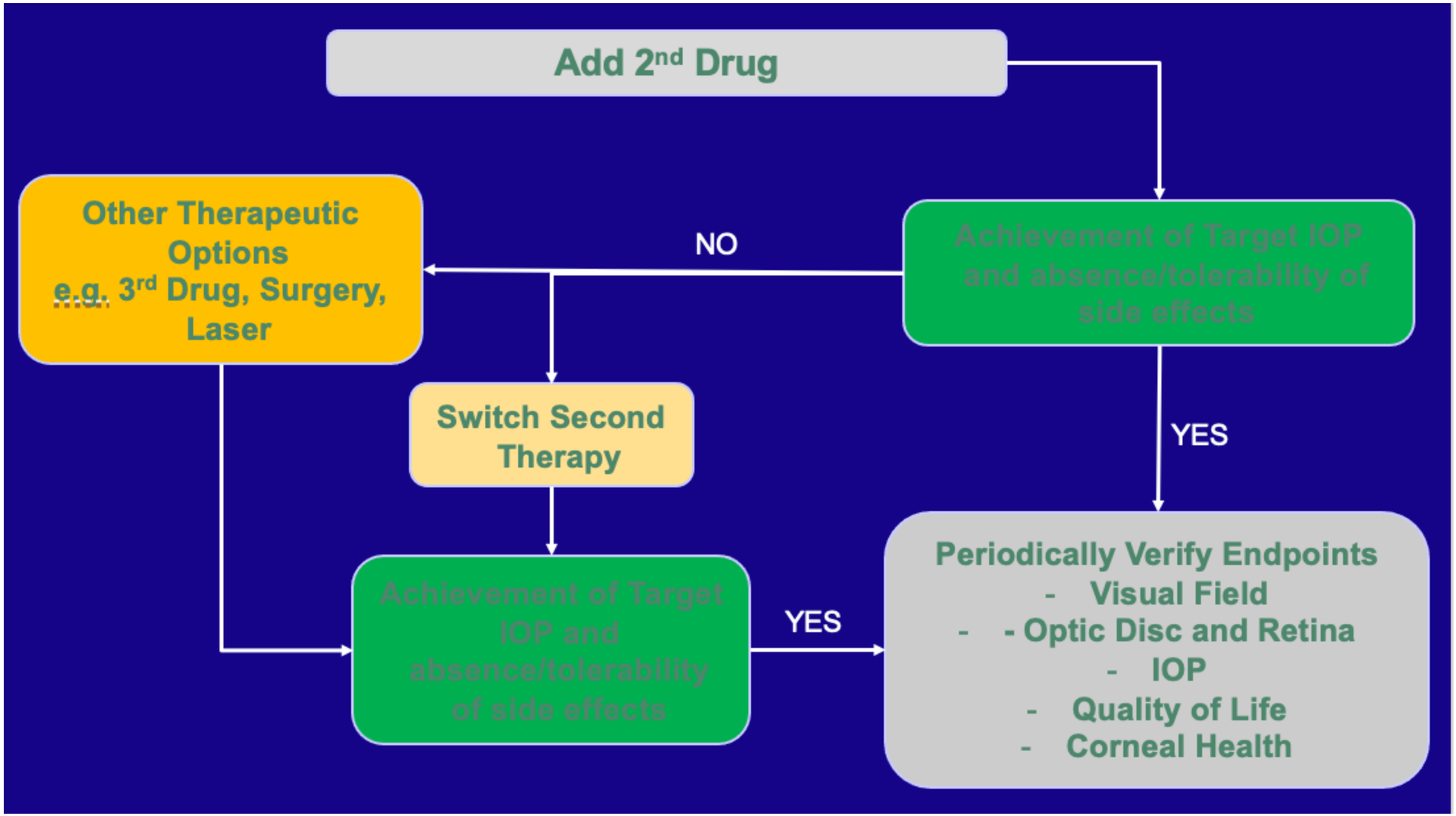
Optimising medical treatment: drop instillation

- Teach the technique of drop instillation
  - –Demonstrate the ‘double DOT’ technique
    - **D**igital **O**cclusion **T**echnique – punctal occlusion for at least 2–3 minutes
    - **D**on’t **O**pen **T**echnique – eyelid closure for at least 2–3 minutes
  - –Ensure the patient can perform the technique
  - –If two or more drops are instilled, wait at least 5 minutes between drops
  - –Instilling drops at the same time each day may improve adherence
  - –Provide educational material
  - –Efficacy of additional medications diminishes as number of drugs increases

Medical Treatment Algorithm (1)



Medical Treatment Algorithm (1)



Mechanism of action:

reduction of aqueous inflow[1,2]

α_2-Adrenergic agonists
- Brimonidine, apraclonidine

Adrenergic agents
- Epinephrine, phenylephrine, dipivefrin

β-blockers

–Non-selective
- Timolol
  levobunolol, carteolol

–β_1-selective
- Betaxolol

Carbonic anhydrase inhibitors (CAIs)

–Systemic
- Acetazolamide, methazolamide, dichlorphenamide

–Topical
- Dorzolamide, brinzolamide

Rho-kinase inhibitors
- Netarsudil, ripasudil

Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Mechanism of action:

increase in aqueous outflow

α_2-Adrenergic agonists
–Increase uveoscleral outflow
- Brimonidine, apraclonidine

Adrenergic agents
–Increase uveoscleral outflow
- Epinephrine, phenylephrine, dipivefrin

Cholinergics
–Increase trabecular outflow
- Pilocarpine, carbachol, echothiophate

Prostaglandin analogues (PGAs)
–Increase outflow (mainly uveoscleral, perhaps trabecular as well)
- Latanoprost, travoprost, bimatoprost, tafluprost, unoprostone

Rho-kinase inhibitors
–Increase trabecular and uveoscleral outflow
- Netarsudil, ripasudil

Nitric-oxide donating prostaglandin analogues
–Increase trabecular and uveoscleral outflow
- Latanoprostene bunod

Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

IOP Reduction by Glaucoma Medications

Class	IOP Reduction
Prostaglandin analogues	25-35%
β-blockers	20-25%
α1-Blockers	15-20%
α2-Adrenergic agonists	18-25%
α1β-blockers	20%
Carbonic anhydrase inhibitors topical	20%
Carbonic anhydrase inhibitors systemic	30-40%
Parasympathomimetic agents	20-25%
Rho-kinase inhibitors	20%
Nitric-oxide donating prostaglandin analogues	32-34%

1. APGS. Asia Pacific Glaucoma Guidelines. 2016.
2. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
3. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Proprietary fixed combinations

- Advantages include convenience, reduced preservative instillation and possible improved adherence[1,2]
- Combinations include:[1]
  - Brinzolamide and timolol
  - brimonidine and timolol
  - Dorzolamide and timolol
  - Brimonidine and brinzolamide
  - Travoprost and timolol
  - Bimatoprost and timolol
  - Latanoprost and timolol
  - Taflotan and timolol
  - Rhokinase inhibitor and latanoprost

1. APGS. Asia Pacific Glaucoma Guidelines. 2016.
2. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
3. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

IOP Reduction by Propietary Fixed Combinations

Class	IOP Reduction
β-blockers + Prostaglandin analogues	25-35%
β-blockers + CAI	25-30%
β-blockers + Pilocarpine	25-30%
β-blockers + α2-Adrenergic agonists	25-35%
CAI + α2-Adrenergic agonists	20%

APGS. Asia Pacific Glaucoma Guidelines. 2016.

Efficacy, safety and dosing frequency of various drug classes

Drug class	Daily dosage	Efficacy	Side Effects	
			Local	Systemic
α_2-Agonists†	2–3×	++ to +++	++	+ to ++
β-Blockers†	1– 2×	+++	+	+ to +++
CAIs				
Topical	2–3×	++	++	0 to ++
Systemic	2–4×	++++	0	++ to ++++
Cholinergics	3–4×	+++	++++	0 to ++
Hyperosmotic agents	Stat dose(s)	+++++	0	++ to +++++
Prostaglandin analogues*	1×	++++	+ to ++	0
Proprietary fixed combinations	2×	+++ to ++++	++	+ to +++
β-Blocker + CAI	1×	++++ to +++++	+ to ++	+ to +++
β-Blocker + PGA	2×	++++	++++	+ to +++
β-Blocker + pilocarpine	2×	+++ to ++++	+ to ++	+ to +++
β-Blocker + α_2-agonists†				

* Excludes unoprostone; † Important: see notes.

APGS. *Asia Pacific Glaucoma Guidelines*. 2016.

Which drug first?

- Prostaglandin analogues are widely used as first-line therapy
- β-Blockers and α_2-agonists may be appropriate, especially in countries where cost is an issue

APGS. *Asia Pacific Glaucoma Guidelines*. 2016.

Switching within class: PGAs

- Switching to another PGA may be useful if target IOP is not achieved[1]
  - Need to consider adherence and regression to the mean
- Some studies of bimatoprost and latanoprost showed a mean 1 mmHg difference favouring bimatoprost[2,3]
  - In clinical practice, the difference for any individual patient may be much greater, or even reversed

1.; APGS. *Asia Pacific Glaucoma Guidelines*. 2016
2. Gandolfi S *et al. Adv Ther* 2001; 18: 110–21;
3. Noecker RS *et al. Am J Ophthalmol* 2003; 135: 55–63.

Efficacy in clinical experience

- Points to remember
  - –Data from large clinical trials are reported as aggregate data
  - –Means are calculated across a large population
  - –Such calculations do not indicate the response of individual patients to IOP-lowering medications

Preservatives[1,2]

- Ocular surface changes may occur following chronic exposure to detergent preservatives in multi-dose topical medications
  - Particularly benzalkonium chloride (BAK)
- Newer preservatives may help
  - Oxidising preservatives (e.g. sodium perborate and stabilised oxychloro complex)
  - Ionic buffered preservatives
- Alternative approaches include unit–dose packages and ophthalmic depot preparations
- Direct comparisons are lacking

1. World Glaucoma Association. 7th Consensus Meeting: Medical Treatment of Glaucoma, 2010;
2. Freeman DF, Kahook MY. *Expert Rev Ophthalmol* 2009; 4: 59–64.

Neuroprotection

- Neuroprotective strategies aim to prevent the occurrence or progression of optic neuropathy by mechanisms other than IOP lowering[1]
- There is currently little evidence for neuroprotection as an isolated strategy[1,2]
- Improved clinical tools to assess the optic nerve may be needed[1]

1. World Glaucoma Association. 7th Consensus Meeting: Medical Treatment of Glaucoma, 2010;

Blood flow and Blood Pressure

- Low ocular perfusion pressure has been linked to glaucoma development and progression
- There is currently no standard method to measure ocular blood flow, and the clinical value of such methods has not been determined
- Vascular risk factors should be taken into account in glaucoma management
- Hypertension or hypotension should be treated

European Glaucoma Society. *Terminology and Guidelines for Glaucoma*. 2008.

Non-pharmaceutical and alternative approaches

- Non-pharmaceutical therapies
  - There is a paucity of clinical trial information examining neuroprotective effects
  - Bio-availability has not been well studied
  - Clinical studies of efficacy and safety are needed
- Exercise reduces IOP, but the extent, duration and clinical significance are unclear
- Acupuncture reportedly lowers IOP and increases ocular blood flow, but results are inconsistent

World Glaucoma Association. 7th Consensus Meeting: Medical Treatment of Glaucoma, 2010.

Initiation of Treatment

Goals of intervention

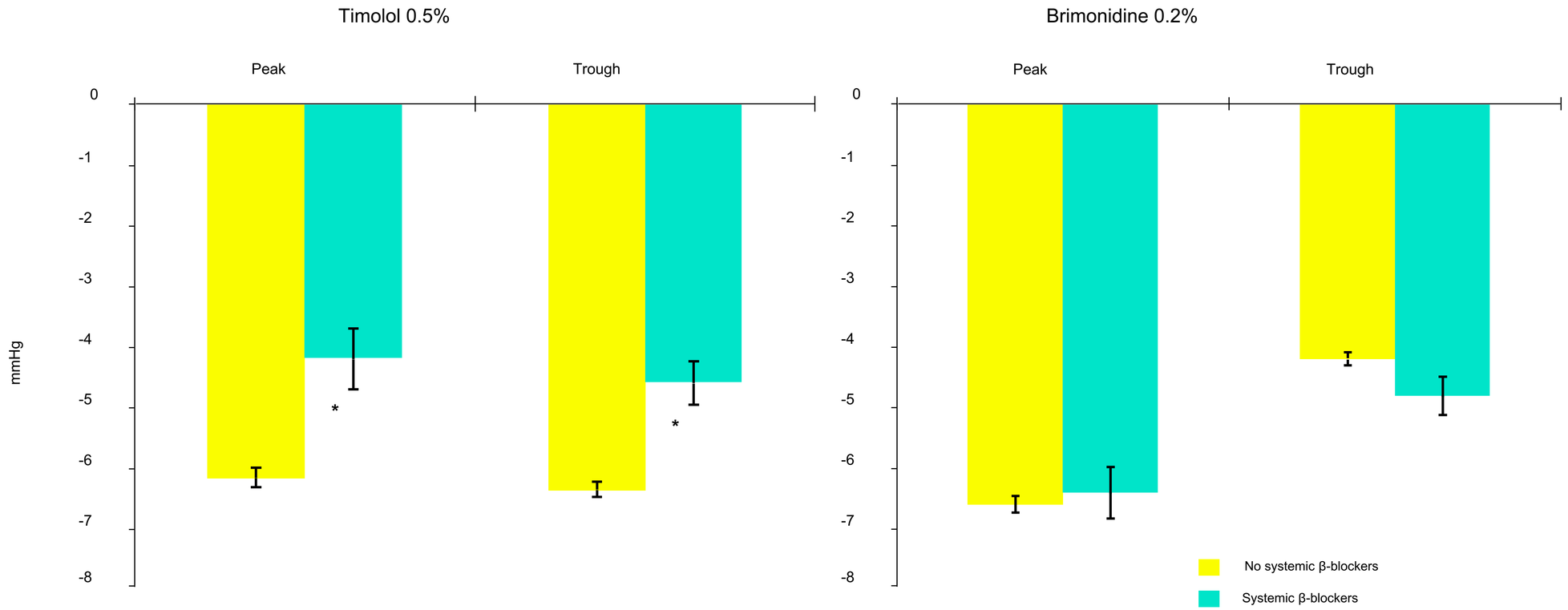
- Goal of Intervention Is Risk Factor Reduction
  - IOP
  - Angle control; elimination of angle closure
  - Treatment of predisposing disease/factors (diabetes mellitus, uveitis, steroids)

Table 1.8 How to identify risk of progression and lifetime visual disability[79,80]

Factors associated with high risk of progression within 5-years	Disease stage	Factors associated with High risk for lifetime visual disability
Demonstrated progression over a short time Higher IOP Pigment dispersion and Pseudoexfoliation glaucoma Secondary glaucoma Recurrent disc haemorrhages	**I. Open angle glaucoma**	Advanced disease at time of presentation Bilateral visual field disability Visual field loss threatening fixation Younger age at diagnosis
Demonstrated progression over a short time Higher IOP Greater extent of PAS	**I. Primary angle closure glaucoma**	Advanced disease at time of presentation Bilateral visual field disability Visual field loss threatening fixation Younger age at diagnosis
High IOP and PAS	**Primary angle closure**	Younger age
OHTS risk factors[78] -Low CCT -High IOP -suspiscious discs -Older age African origin Recurrent optic disc haemorrhages Pseudoexfoliation syndrome	**III. Ocular hypertensives**	Young age Multiple risk factors for progression Fellow eye of established GON (excluding unilateral secondary glaucoma)

APGS. *Asia Pacific Glaucoma Guidelines*. 2016.

Interaction between systemic medication and topical glaucoma therapy



*In the timolol group, patients concurrently on systemic β-blockers had a smaller mean IOP reduction than those on timolol alone ($p < 0.05$).

Schuman JS. *Ophthalmology* 2000; 107: 1171–77.

Angle-Closure Glaucoma

Angle closure glaucoma in Asia

- PACG causes ~3 times more blindness than POAG
- PACG is more common in Southeast Asia than in Western populations
  - –Southeast Asian prevalence 0.5–2.2%
  - –Caucasian and African prevalence 0.4–0.7%, typically in ages > 40 years
- Acute angle closure is more common in China than in India

APGS. *Asia Pacific Glaucoma Guidelines*. 2016.

Angle closure glaucoma: medical therapy

- Medical therapy for ACG is an adjunct to laser or surgical treatment[1,2]
  - –Before laser therapy in primary AC suspects
  - –Immediate medical therapy to break an acute AC attack
  - –Long-term medical treatment after laser therapy for chronic PACG

1. See JL *et al. Indian J Ophthalmol* 2011; 59 (Suppl): S82–7;
2. Sit AJ. Angle-closure glaucoma: medical therapy. In Giaconi JA, Law SK, Caprioli J (eds), *Pearls of Glaucoma Management*. Berlin: Springer-Verlag, 2010.

Acute angle closure

- Immediate medical therapy:[1,2]
  - Systemic or topical CAI
  - Topical β-blocker
  - α_2-Agonist
  - Hyperosmotic agent if needed
- Once IOP is reduced:[1,2]
  - Pilocarpine or carbachol: use with care
  - Other miotics are contraindicated

1. See JL *et al. Indian J Ophthalmol* 2011; 59 (Suppl): S82–7;
2. Sit AJ. Angle-closure glaucoma: medical therapy. In Giaconi JA, Law SK, Caprioli J (eds), *Pearls of Glaucoma Management*. Berlin: Springer-Verlag, 2010.

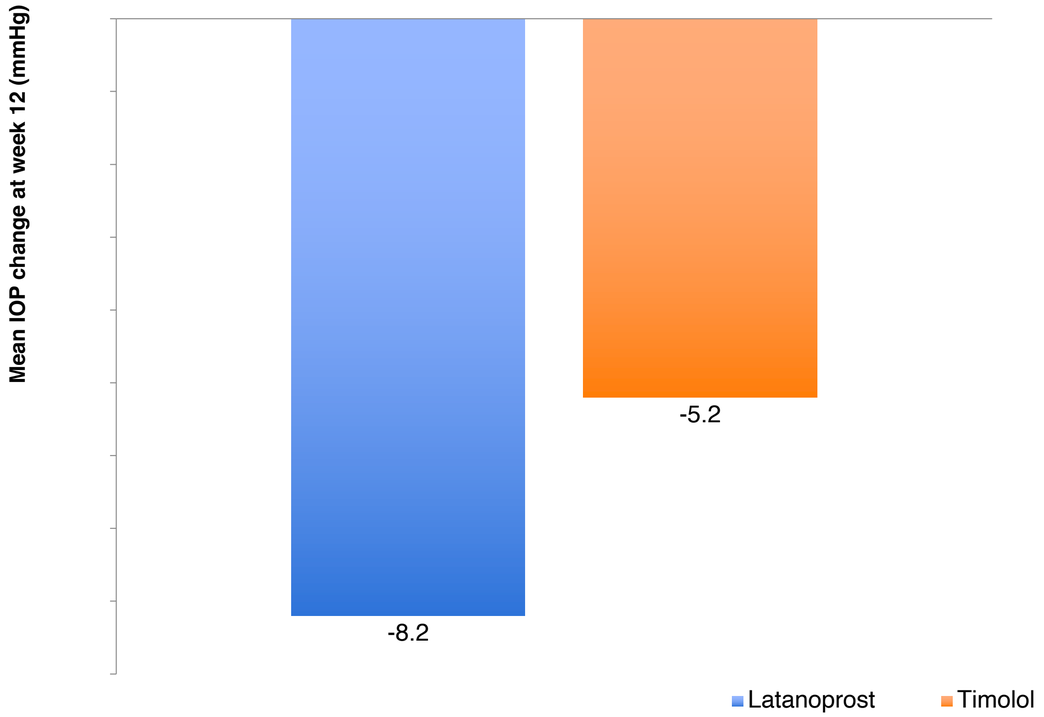
Chronic angle closure

- If IOP control remains suboptimal after laser treatment, long-term medical therapy may be needed
  - Topical β-blocker
  - α_2-Agonist
  - CAI
  - Prostaglandin analogue

See JL *et al. Indian J Ophthalmol* 2011; 59 (Suppl): S82–7.

Chronic ACG:

Latanoprost versus timolol

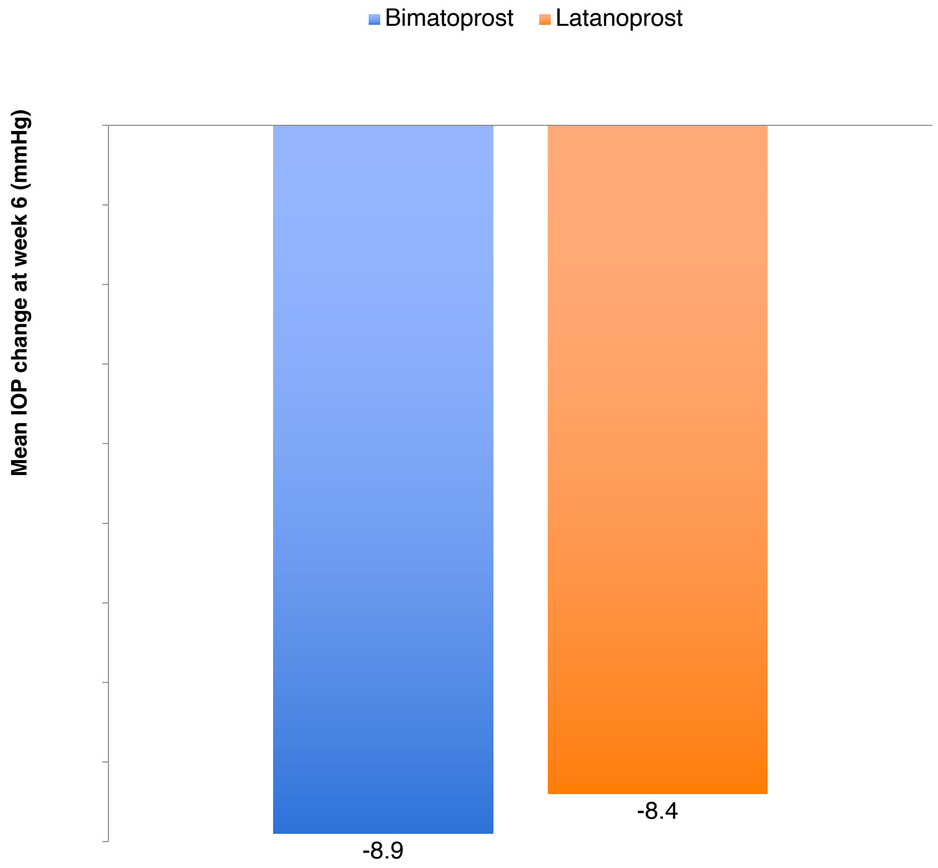


- Randomised, double-masked trial in Asia
- Mean IOP reduction after 12 weeks:
  - –Latanoprost 30%
  - –Timolol 20%

Chew PT; EXACT Study Group. *Ophthalmology* 2004; 111: 427–34.

Chronic ACG:

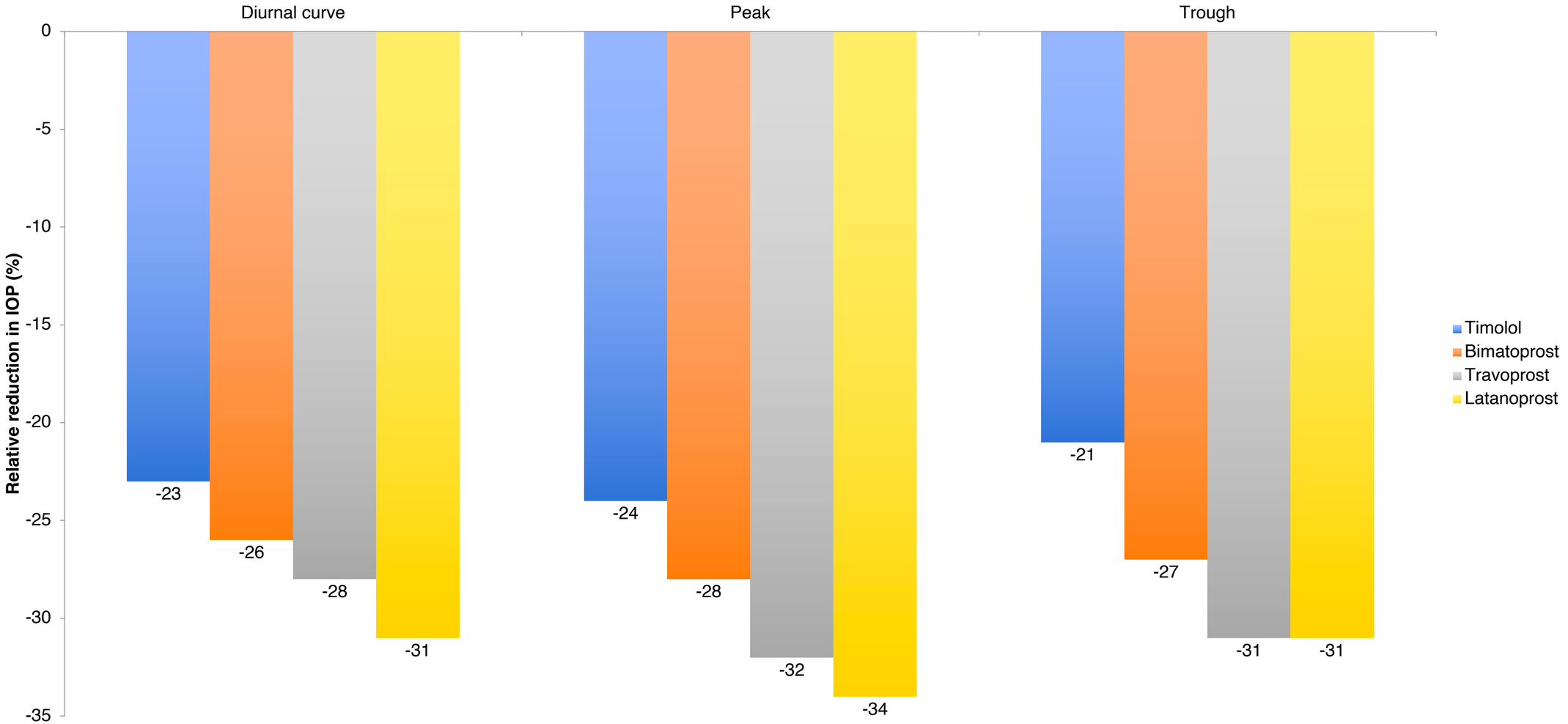
Latanoprost versus timolol



- Randomised, cross-over trial in Singapore
- Bimatoprost and latanoprost had comparable efficacy
- Ocular hyperaemia was more common with bimatoprost

Chronic ACG:

PGA meta-analysis



Cheng JW *et al*. *J Glaucoma* 2009; 18: 652–7.

Pregnancy and Paediatric Glaucoma

Treatment in pregnancy

- IOP often falls during pregnancy
- Where possible, consider discontinuation or dose reduction
- Be proactive – discuss treatment options with women of childbearing age prior to pregnancy
- Collaborate closely with the obstetrician

1. Mathew S. *Management of Glaucoma in Pregnancy*. J Glaucoma. 2019.
2. Kumari R, et al. Management of glaucoma in pregnancy – balancing safety with efficacy. Ther Adv Ophthalmol. 2021

Glaucoma medications and pregnancy

- Beta-blockers
  - –FDA pregnancy category C
  - –Conflicting conclusions from previous researches
  - –Monitor the foetus regularly for arrhythmia and bradycardia
- Sympathomimetics
  - –FDA pregnancy category B
  - –Consider discnotinuing in the 3rd trimester as it causes hypotension, apnea, CNS depression in infants
- CAI
  - –FDA pregnancy category C
  - –Mixed results in human studies
- Prostaglandin Analogues
  - –FDA pregnancy category C
  - –May trigger contractions

1. Mathew S. *Management of Glaucoma in Pregnancy*. J Glaucoma. 2019.
2. Kumari R, et al. Management of glaucoma in pregnancy – balancing safety with efficacy. Ther Adv Ophthalmol. 2021

Glaucoma medications and pregnancy

- Parasympathomimetics
  - –FDA pregnancy category C
  - –Documented cases of meningsm in newborn
  - –Avoid use in pregnancy
- Rho-kinase Inhibitors
  - –Not yet classified in FDA pregnancy category
  - –Lack of data in human studies
  - –Avoid use in pregnancy, especially in the 1st trimester
- Nitric-oxide donating prostaglandin analogues
  - –Not yet classified in FDA pregnancy category
  - –Lack of data in human studies
  - –May trigger contractions

1. Mathew S. *Management of Glaucoma in Pregnancy*. J Glaucoma. 2019.
2. Kumari R, et al. Management of glaucoma in pregnancy – balancing safety with efficacy. Ther Adv Ophthalmol. 2021

Glaucoma medications and lactation

- Beta-blockers
  - –Controversy over concentrations in breast milk
  - –Can cause apnea and bradycardia
- Sympathomimetics
  - –May cause CNS depression, hypotension, and apnea
  - –Avoid use during lactation period
- CAI
  - –Approved by the American Academy of Pediatrics but with close monitoring
- Prostaglandin Analogues
  - –Excreted in breast milk in animal studies, but there is a lack of data in human studies

1. Mathew S. *Management of Glaucoma in Pregnancy*. J Glaucoma. 2019.
2. Kumari R, et al. Management of glaucoma in pregnancy – balancing safety with efficacy. Ther Adv Ophthalmol. 2021

Glaucoma medications and lactation

- Parasympathomimetics
  - –Reports of hyperthermia, seizures, and restlessness in neonates
  - –Avoid use during lactation period
- Rho-kinase Inhibitors
  - –Unknown concentration in breast milk
- Nitric-oxide donating prostaglandin analogues
  - –Unknown concentration in breast milk

1. Mathew S. *Management of Glaucoma in Pregnancy*. J Glaucoma. 2019.
2. Kumari R, et al. Management of glaucoma in pregnancy – balancing safety with efficacy. Ther Adv Ophthalmol. 2021

Paediatric glaucoma

- Children with glaucoma should be referred to a specialist centre
- Surgery is usually required
- The safety of glaucoma medications in young children has not been established
- Systemic side effects may occur
  - –Small volume of distribution
  - –Reduced metabolism

Glaucoma medications in children

- β-blockers
  - –Use with caution and at lower concentrations
  - –Severe cardiorespiratory adverse effects may occur (e.g. apnoea attack)
- PGAs
  - –May be effective in older children or juvenile OAG. Side effects are uncommon.
- Adrenergic agonists
  - –Must be avoided in neonates, infants and children aged < 7 years
- Topical steroids
  - –Use with caution and at lower concentrations. Ocular hypertensive response is a common side effect.

APGS. *Asia Pacific Glaucoma Guidelines*. 2016.

Contraindications, interactions and side effects

Contraindications, interactions and side effects:

Adrenergic agonists

- Contraindications
  - –MAOI therapy
  - –Age < 2 years
  - –Caution for children < 7 years
- Drug interactions
  - –CNS depressants
    - Alcohol, barbiturates, opiates, sedatives, anaesthetics
  - –Tricyclic antidepressants
- Local side effects
  - –Ocular allergy, burning, stinging, blurring, itching, foreign-body sensation, hyperaemia, blepharoconjunctivitis
- Systemic side effects
  - –CNS depression, oral dryness, headache, fatigue, drowsiness, bradycardia, hypotension, hypothermia, apnoea

MAOI, monoamine oxidase inhibitor.

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Non-selective β-blockers

- Contraindications
  - –Absolutely contraindicated in bronchial asthma, chronic obstructive pulmonary disease (COPD), bradycardia, heart block
  - –Use cautiously in cardiac failure
  - –Punctate epithelial keratopathy
- Interactions
  - –Systemic β-blockers, calcium channel blockers
- Local side effects
  - –Burning, stinging, photophobia, itching, tearing, decreased corneal sensitivity, hyperaemia
- Systemic side effects
  - –Bronchospasm, hypotension, bradycardia, heart block, mask hypoglycaemia, adversely affects lipid profile (except carteolol), loss of libido, fatigue, aggravation of myasthenia gravis, depression, memory impairment, reduced exercise tolerance, increased falls, hair loss

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Selective β-blockers

- Contraindications
  - –Relatively contraindicated in bronchial asthma, COPD, bradycardia, heart block, cardiac failure
- Interactions
  - –As for non-selective β-blockers, with wider safety margin
- Local side effects
  - –As for non-selective β-blockers, with wider safety margin
- Systemic side effects
  - –As for non-selective β-blockers, with wider safety margin

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Topical CAIs[1,2]

- Contraindications
  - –Relatively contraindicated in compromised corneal endothelium and sulphonamide allergy
- Interactions
  - –None reported, but potential to be similar to systemic CAIs
- Local side effects
  - –Burning, stinging, itching, tearing, punctate epithelial keratopathy, blepharoconjunctivitis, corneal endothelial cell decompensation, blurred vision
- Systemic side effects
  - –Bitter taste, headache

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Systemic CAIs

- Contraindications
  - –Sulphonamide allergy, kidney stones and failure, respiratory/metabolic acidosis, hyperkalaemia
- Interactions
  - –Steroids, diuretics, digoxin
- Systemic side effects
  - –Fatigue/lethargy, anorexia/weight loss, GI upset, paraesthesia, taste disturbance, Stevens–Johnson syndrome, blood dyscrasias, kidney stones and failure, hypokalaemia, acute leucopenia, agranulocytosis, aplastic anaemia, neutropenia, pancytopenia, thrombocytopenia

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Cholinergics

- Contraindications
  - –Uveitic, neovascular and lens-induced glaucomas
  - –Post-drainage surgery
  - –Aqueous misdirection syndrome
  - –Phospholine iodide in phakic patients
- Interactions
  - –Many for phospholine iodide
- Local side effects
  - –Cataract, brow-ache, dim vision, blurring, myopic shift, retinal detachment, aggravation of pupillary block
- Systemic side effects
  - –Headache, salivation, lacrimation, urinary frequency, diarrhoea, abdominal cramps, diaphoresis, tremor, bronchospasm, pulmonary oedema, hypotension, bradycardia, nausea, vomiting

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Hyperosmotic agents

- Contraindications
  - –Heart failure, pulmonary oedema, kidney failure
  - –Use caution in hypertension
- Interactions
  - –N/A
- Local side effects
  - –N/A
- Systemic side effects
  - –Headaches, unpleasant taste, heart failure, pulmonary oedema, diuresis, death

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Prostaglandins (PGAs)

- Contraindications
  - –Herpes simplex keratitis, active or quiescent
  - –Relatively contraindicated in cataract surgery complicated by posterior capsular rupture and vitreous loss
  - –Relatively contraindicated in active inflammatory ocular conditions and cystoid macular oedema
- Interactions
  - –Chronic pilocarpine use may reduce efficacy
- Local side effects
  - –Blurred vision, burning, stinging, conjunctival hyperaemia, foreign-body sensation, itching, irreversible increase in pigmentation of the iris/periorbital skin, longer, darker/thicker lashes, punctate epithelial keratopathy, cystoid macular oedema, reactivation of herpetic infection, facial rash
- Systemic side effects
  - –Unlikely, but possible

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Rho-kinase Inhibitors

- Contraindications
  - N/A
- Interactions
  - N/A
- Local side effects
  - Conjunctival hyperaemia, microhemorrhages, cornea verticillate, blurred vision, eyelid erythema, instillation-site pain, increased lacrimation, reduced visual acuity
- Systemic side effects
  - Not reported

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Nitric-oxide donating prostaglandin analogues

- Contraindications
  - N/A
- Interactions
  - N/A
- Local side effects
  - Conjunctival hyperaemia, growth of eyelashes, eye irritation, eye pain, increase in iris pigmentation
- Systemic side effects
  - Not reported

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Contraindications, interactions and side effects:

Proprietary fixed combinations

- Contraindications, interactions, side effects
  - –Generally as for the individual components
  - –Some differences favour the combination
    - Ocular allergy reduced for Combigan versus brimonidine alone
    - Conjunctival injection reduced for Xalacom, DuoTrav and Ganfort versus monotherapy with latanoprost, travoprost and bimatoprost, respectively

1. AAO. Basic and clinical science course 2019-2020. Section 10 Glaucoma. 2019.
2. Cvenkel B, Kolko M. Current medical therapy and future Trends in the management of glaucoma treatment. Journal of Ophthalmolomolgy. 2020.

Key Points

- Prostaglandin analogues provide superior IOP-lowering efficacy
- A one-eyed trial can be used to determine the patient's response to therapy where appropriate
- Use monotherapy where possible
- Maximise adherence
- Special condition: Angle closure, pregnancy and pediatric

Additional Points

- Tachyphylaxis
- Reverse therapeutic trials?
- Treatments for secondary glaucoma
- Neuroprotection – when is it relevant?
- Alternative therapies?
- Future treatments?
  - Protective autoimmunity

Prescription Medications

- Always refer to the appropriate Prescribing Information before prescribing any agents mentioned in this presentation
- Education to the patients should include the type of drugs given, the target of medications, possible side effects, and when to stop medications
- Please note that this presentation may discuss ‘off-label’ use of some medications