D.PHARM • SECOND YEAR

Pharmacology

CHAPTER 3

Drugs Acting on the Eye



ENGLISH CHAPTER NOTES

DIPLOMA IN PHARMACY

DRUGS ACTING ON THE EYE OVERVIEW

Ocular drugs treat glaucoma, infection, inflammation, allergy, dry eye and retinal disease. They may be given by topical, systemic or intraocular routes.

1. PUPIL SIZE AND ACCOMMODATION

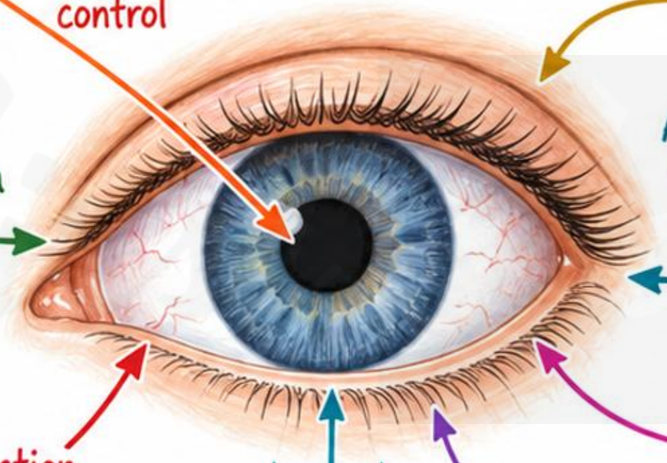
- **Mydriatics:** phenylephrine; atropine or tropicamide.
- **Miotics:** pilocarpine, carbachol or physostigmine.

2. GLAUCOMA

- **Reduce aqueous production:** timolol, brimonidine, dorzolamide.
- **Increase aqueous outflow:** latanoprost, pilocarpine, netarsudil.
- **Combination example:** timolol + dorzolamide.

3. ANTI-INFECTIVES

- **antibiotics:** ciprofloxacin, tobramycin
- **antivirals:** acyclovir, ganciclovir
- **antifungals:** natamycin, amphotericin B



Routes of administration

- Topical
- Systemic
- Intraocular

4. ANTI-INFLAMMATORY DRUGS

- **steroid:** prednisolone
- **NSAIDs:** ketorolac, diclofenac

5. OTHER IMPORTANT GROUPS

- **local anaesthetic:** proparacaine
- **antiallergics:** olopatadine, cromolyn
- **lubricants:** carboxymethylcellulose, CMC, and polyethylene glycol, PEG
- **diagnostic stains:** fluorescein, Rose Bengal
- **anti-VEGF:** ranibizumab for wet age-related macular degeneration, AMD
- **immunomodulators:** cyclosporine, lifitegrast
- **hyperosmotic agent:** mannitol in selected acute glaucoma care.

OCULAR DRUG MECHANISMS AND CLINICAL USES

Key mechanisms

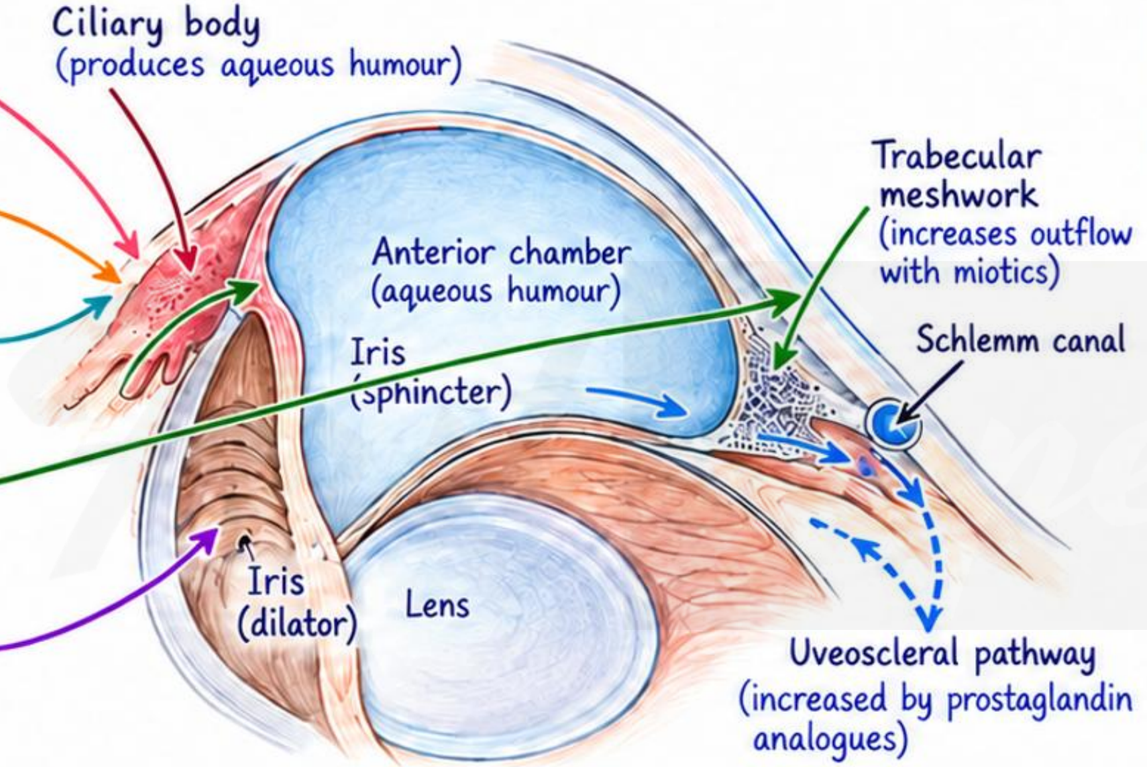
Alpha2 agonists
- reduce aqueous production and also increase outflow.

Beta blockers
- reduce aqueous-humour production.

Carbonic anhydrase inhibitors, CAIs
- reduce aqueous formation.

Miotics
- contract the ciliary muscle and increase trabecular outflow.

Anticholinergics
- cause mydriasis and cycloplegia.



Clinical uses

- **glaucoma:** drugs that lower intraocular pressure, IOP
- **eye examination or surgery:** mydriatics, local anaesthetics and stains
- **infection:** antibiotics, antivirals or antifungals
- **inflammation:** corticosteroids or ocular NSAIDs when indicated
- **dry eye:** lubricants; selected cyclosporine or lifitegrast
- **allergy:** antihistamines and mast-cell stabilizers
- **retinal disorders:** anti-VEGF agents

Important adverse effects

- **ocular beta blockers:** bradycardia, bronchospasm risk and dry eye
- **prostaglandin analogues:** iris darkening, eyelash growth and conjunctival redness
- **ocular corticosteroids:** cataract and increased IOP with prolonged or unsuitable use
- **miotics:** brow ache and blurred vision
- **anticholinergics:** photophobia and risk of precipitating angle closure in a susceptible eye

Key safety point

Rx

Eye drops can produce systemic effects after absorption. Use the correct medicine, concentration and technique, and follow professional instructions.

MIOTICS CLASSIFICATION AND MECHANISM

Miotics constrict the pupil, producing miosis. They stimulate cholinergic activity at the iris sphincter and ciliary muscle.

A. DIRECT-ACTING MUSCARINIC AGONISTS

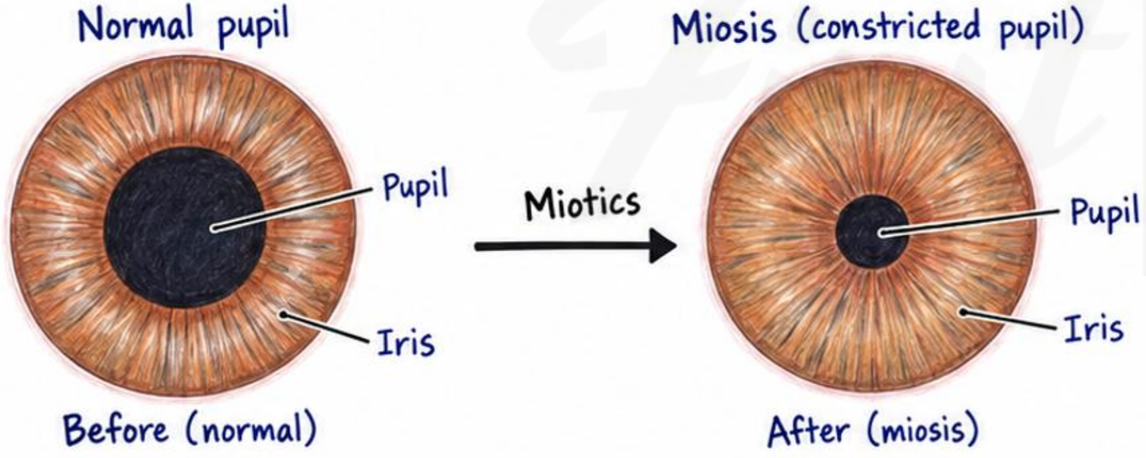
Directly stimulate muscarinic receptors.

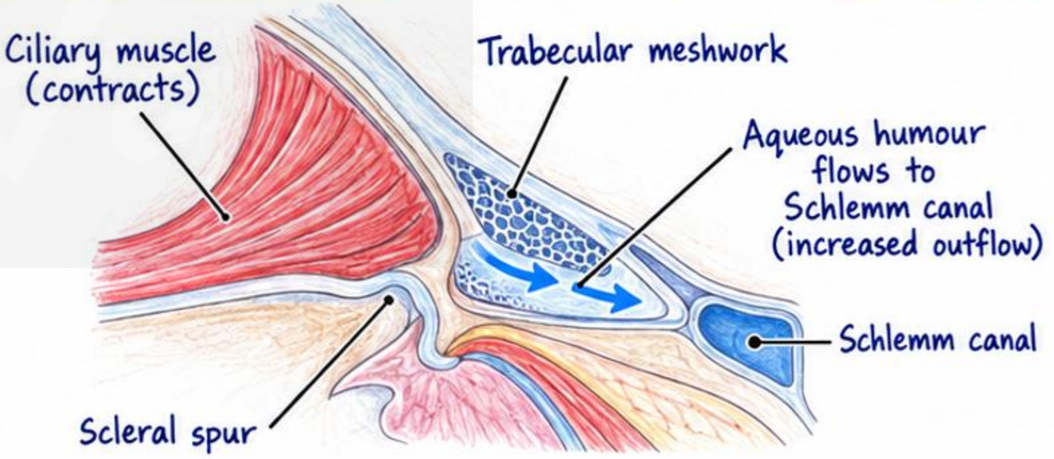
- pilocarpine
- carbachol

B. INDIRECT-ACTING AGONISTS: ANTICHOLINESTERASES

Inhibit acetylcholinesterase → more endogenous ACh at muscarinic receptors.

- physostigmine
- echothiophate
- demecarium





OCULAR MECHANISM

1. M_3 receptor stimulation contracts the iris sphincter → miosis.
2. Ciliary-muscle contraction pulls on the scleral spur.
3. Trabecular meshwork opens → conventional aqueous outflow through Schlemm canal increases.
4. IOP falls.

OTHER OCULAR ACTION

Ciliary-muscle contraction can cause accommodation spasm, brow ache, headache and blurred distance vision.

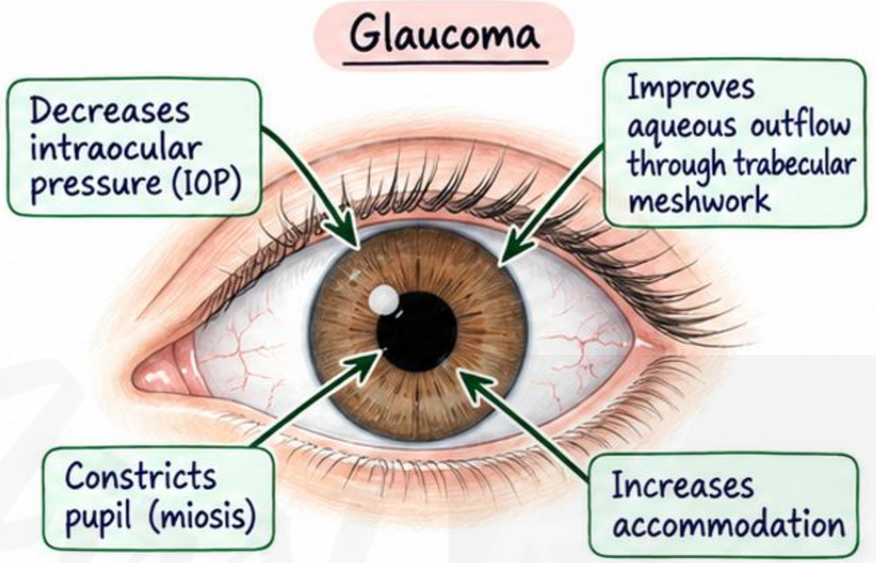
SYSTEMIC EFFECTS IF ABSORBED

Bradycardia, hypotension, salivation, diarrhoea and muscle cramps; risk is greater with potent or long-acting indirect agents.

MIOTICS USES, DOSES AND PRECAUTIONS

Important uses

- primary open-angle glaucoma in selected patients
- acute angle-closure glaucoma as an adjunct after initial IOP reduction and specialist assessment
- selected postoperative intraocular hypertension
- dilute pilocarpine testing for Adie pupil
- selected reversal of anticholinergic mydriasis



Effect of miotics in glaucoma

Contraindications or major cautions

- uveitis or iritis: miosis and ciliary spasm may worsen inflammation or pain
- predisposition to retinal detachment
- cataract or other media opacity: miosis may worsen vision
- young patients with clear lenses: marked accommodation spasm
- hypersensitivity

Dose examples

pilocarpine 1%, 2% or 4% eye drops	1–2 drops, 3–4 times daily
carbachol 1% eye drops	1–2 drops, up to 3 times daily
physostigmine 0.25% eye drops	1 drop, 2–4 times daily
echothiophate 0.03% or 0.06% solution	1 drop once or twice daily

Dose and duration depend on diagnosis, product and specialist advice.

Acute angle-closure point

Acute angle closure is an ophthalmic emergency. Pilocarpine may be ineffective while IOP is extremely high and is generally used only after pressure begins to fall under an emergency protocol.

Very high IOP (acute angle closure) → Initial IOP reduction and specialist assessment → Then pilocarpine may be useful

Stop and seek help

Severe eye pain, sudden visual loss, marked wheeze, faintness or pronounced bradycardia needs urgent assessment.



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