

Drugs Acting on the Eye

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- Used for treating glaucoma, infections, inflammation, allergies, dry eye, and retinal disorders.
- Administered via **topical, systemic, or intraocular** routes.

Drug Classification

A. Pupil Size & Accommodation

➤ Mydriatics:

- *Sympathomimetics*: Phenylephrine
- *Anticholinergics*: Atropine, Tropicamide
- *Use*: Exams, surgery, uveitis

➤ Miotics:

- *Cholinergics*: Pilocarpine, Carbachol
- *Anticholinesterases*: Physostigmine
- *Use*: Glaucoma

B. Glaucoma Medications

➤ ↓ Aqueous Production:

- *Beta-blockers*: Timolol
- *Alpha-2 agonists*: Brimonidine
- *CAIs*: Dorzolamide

➤ ↑ Outflow:

- *Prostaglandins*: Latanoprost
- *Miotics*: Pilocarpine
- *Rho kinase inhibitors*: Netarsudil

➤ Combos:

- Timolol + Dorzolamide

C. Anti-Infectives

- **Antibiotics**: Ciprofloxacin, Tobramycin
- **Antivirals**: Acyclovir, Ganciclovir

- **Antifungals:** Natamycin, Amphotericin B

D. Anti-Inflammatories

- **Steroids:** Prednisolone
- **NSAIDs:** Ketorolac, Diclofenac

E. Others

- **Anesthetics:** Proparacaine
- **Anti-Allergics:** Olopatadine, Cromolyn
- **Lubricants:** CMC, PEG
- **Diagnostics:** Fluorescein, Rose Bengal
- **Anti-VEGF:** Ranibizumab (wet AMD)
- **Immunomodulators:** Cyclosporine, Lifitegrast
- **Hyperosmotics:** Mannitol (acute glaucoma)

Key Mechanisms (by Drug Class)

- **Beta-blockers:** Decrease aqueous humor production
- **Prostaglandins:** Increase uveoscleral outflow
- **Alpha-2 agonists:** Decrease aqueous production and increase outflow
- **Carbonic Anhydrase Inhibitors (CAIs):** Inhibit aqueous humor production
- **Miotics:** Increase trabecular outflow
- **Anticholinergics:** Cause mydriasis (pupil dilation) and cycloplegia (loss of accommodation)

Clinical Uses

- **Glaucoma:** IOP-lowering drugs
- **Eye exams/surgery:** Mydriatics, anesthetics, stains
- **Infections:** Antibiotics, antivirals, antifungals
- **Dry Eye:** Lubricants, cyclosporine
- **Allergies:** Antihistamines, stabilizers
- **Retinal disorders:** Anti-VEGF

Common Side Effects (by Drug Class)

- **Beta-blockers:** Bradycardia, dry eye
- **Prostaglandins:** Iris pigmentation, eyelash growth

- **Steroids:** Cataract formation, increased intraocular pressure (IOP)
- **Miotics:** Brow ache, blurred vision
- **Anticholinergics:** Photophobia, risk of angle-closure glaucoma

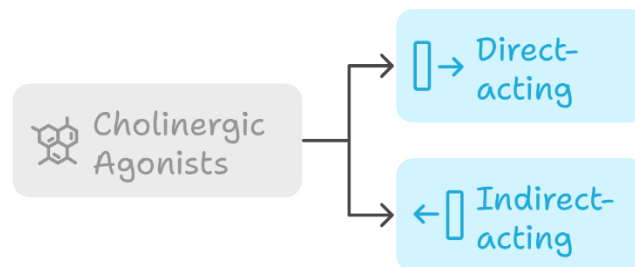
Miotics

Definition

- Miotics are drugs that cause **constriction of the pupil** (miosis) by stimulating the sphincter pupillae muscle of the iris.
- They act either by:
 - **Directly stimulating muscarinic receptors** (cholinergic agonists)
 - **Inhibiting acetylcholinesterase**, thereby increasing endogenous acetylcholine
- Miotics are commonly used in the **treatment of glaucoma**, particularly **angle-closure** or **narrow-angle glaucoma**, because they open up the trabecular meshwork to increase aqueous humor outflow.

Classification

Miotics are classified into:



1. Direct-acting cholinergic agonists (muscarinic agonists)

- Mimic acetylcholine at the muscarinic receptors

Examples:

- Pilocarpine
- Carbachol

2. Indirect-acting cholinergic agonists (anticholinesterases)

- Inhibit acetylcholinesterase → ↑ ACh availability

Examples:

- Physostigmine

- Echothiophate
- Demecarium

Pharmacological Actions

A. Ocular Effects

- **Pupillary constriction (miosis)** due to stimulation of M3 receptors in the iris sphincter muscle
- **Accommodation spasm** due to ciliary muscle contraction
- **Increased outflow** of aqueous humor → ↓ Intraocular pressure
- **Reduced intraocular pressure** in glaucoma
- Can cause **blurred vision** and **headache (brow ache)** due to ciliary muscle spasm

B. Systemic Effects (if absorbed)

(especially with indirect agents like echothiophate)

- Bradycardia
- Hypotension
- Increased salivation
- Diarrhea
- Muscle cramps

Dose

(Doses vary depending on the drug; here are some examples)

Drug	Formulation	Typical Dose
Pilocarpine	1%, 2%, 4% eye drops	1–2 drops 3–4 times/day
Carbachol	1% eye drops	1–2 drops up to 3 times/day
Physostigmine	0.25% eye drops	1 drop 2–4 times/day
Echothiophate	0.03%, 0.06% solution	1 drop once or twice/day

Indications

- **Primary open-angle glaucoma**
- **Acute angle-closure glaucoma** (as adjunct)
- Post-operative **intraocular hypertension**

- Diagnostic purposes: **Testing for Adie's pupil** (with dilute pilocarpine)
- **Counteracting mydriasis** induced by anticholinergic agents (e.g., after eye exams)

Contraindications

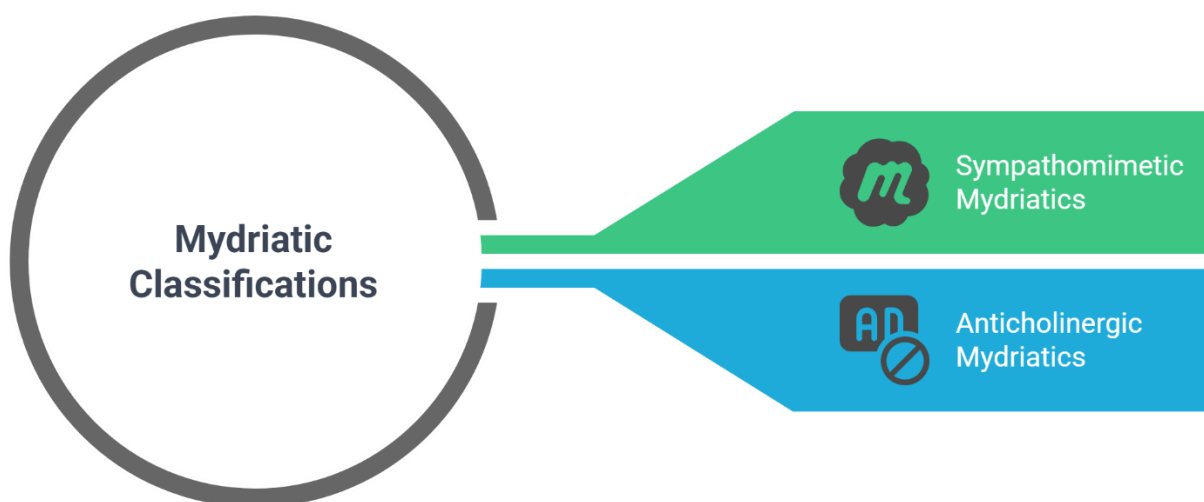
- **Uveitis** (may increase inflammation)
- **Iritis** (worsens symptoms)
- **Cataract** (may worsen vision due to miosis)
- **Retinal detachment** risk (in predisposed patients)
- **Young patients with clear lens** – can cause accommodation spasm
- Hypersensitivity to the drug

Mydriatics

Definition

- Mydriatics are drugs that **dilate the pupil** (mydriasis) by:
 - Stimulating the **dilator pupillae muscle** (adrenergic agonists)
 - Inhibiting the **sphincter pupillae muscle** (muscarinic antagonists)
- Mydriatics are used in **eye examinations, surgical procedures, and treatment of uveitis** to prevent synechiae.

Classification



A. Sympathomimetic Mydriatics

- Stimulate α_1 receptors $\rightarrow$ contraction of dilator pupillae muscle
- Do **not** cause cycloplegia



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