4 Common eye medications

The clinician should have an understanding of all the commonly used ocular medications. In prescribing eye medications or in seeing patients that are on ocular medications, a knowledge of the mechanisms of action and potential side effects may be valuable. It is well known that certain eye medications have been associated with systemic problems that include myocardial infarction, CNS symptoms, and kidney stones. In addition, specific eye medications can result in ocular complications that include glaucoma, cataracts, ptosis, and keratitis.

MYDRIATIC AND CYCLOPLEGIC AGENTS
Mydriatic drugs dilate the pupil. Cycloplegic agents, in addition to dilating the pupil, act on the ciliary body musculature to inhibit accommodation.

Mydriatic agent

Phenylephrine
- Synthetic sympathomimetic amine primarily used as a mydriatic
- Strength: 0.12, 0.125, 0.2, 2.5, and 10%

Actions
- Mydriasis—produced by stimulation of alpha receptors in the iris dilator muscle; alpha stimulation is overcome by bright light that stimulates a parasympathetic response and results in pupillary constriction
- Decrease ptosis—useful in mild ptosis secondary to Homer’s syndrome; the drug stimulates Miller’s muscle of the lid and results in a decrease in ptosis

Side effects
- Systemic
  - Hypertension
  - Myocardial infarction

Fifteen cases of acute myocardial infarction were documented (Fraunfelder, 1978) after 10% phenylephrine was instilled. Therefore this drug should be used with great caution in patients with cardiac disease or vascular-occlusive problems.

<table>
<thead>
<tr>
<th></th>
<th>(maximum effect in minutes)</th>
<th>(maximum effect in hours)</th>
<th>Full recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine</td>
<td>40</td>
<td>2-6</td>
<td>10-14</td>
</tr>
<tr>
<td>Scopolamine</td>
<td>30</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Homatropine</td>
<td>30</td>
<td>1</td>
<td>1-3</td>
</tr>
<tr>
<td>Cyclogyl</td>
<td>25</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Tropicamide</td>
<td>20</td>
<td>0.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>


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Ocular

- Angle-closure glaucoma
- Pseudoiritis
Liberation of iris pigment granules that mimic aqueous cells. There is no flare that helps to differentiate this from a true iritis.
- Allergy

Mydriatic and cycloplegic agents

Mydriatic and cycloplegic agents (Table 4-1) prevent the acetylcholine effect by reacting with postsynaptic receptors. These drugs paralyze the iris sphincter muscle, which leads to pupillary dilation by the unopposed action of the sympathetic dilator muscle. In addition, these agents will act on the ciliary musculature to inhibit the accommodative effect of the lens, that is, cycloplegia.

Indications

- Dilation of the pupil for funduscopy—short-acting agents are used, such as cyclogyl or tropicamide
- Treatment of iritis—relief of pain by paralyzing the ciliary body; these agents are also used to prevent synechiae, for example, iris-lens adhesions, by dilating the pupil
- Cycloplegic refraction—used in an ophthalmic examination to inhibit accommodation so that the refractive error for glasses or contact lenses can be determined

Side effects

Ocular

- Elevated intraocular pressure—Dilation of the pupil can occasionally precipitate angle-closure glaucoma in a patient with narrow angles
- Impaired accommodation—this may result in a decrease in vision at near and/or distance

Systemic (dry or bone/red as a beet/mod as a hotter)

- Dry mouth—salivary secretion and gastric secretion impaired
- Flushing—sweating impaired
- Urinary retention
- Tachycardia—caused by vagus block
- CNS symptoms—restlessness, delirium
TOPICAL ANESTHETICS
Topical anesthetics play an important role in ophthalmology. They anesthetize the eye so that intraocular pressure can be checked and minor surgery can be undertaken (for example, removal of a corneal foreign body).

Mechanism of action
- Block action potential of neurons by stabilizing cell membranes
- Cell membranes are stabilized primarily by decreasing sodium conductance (that is, sodium movement into the cell) and to a lesser extent by decreasing potassium conductance out of the cell

Proparacaine (Ophthaine)
- Produces rapid corneal anesthesia when used as a 0.5% solution
- Tonometry can be performed within 20 seconds
- Anesthesia lasts between 10 and 20 minutes
- Burns less than tetracaine

Tetracaine
- Onset and duration of action similar to that of proparacaine
- Major drawback is that it burns significantly

Cocaine
- First drug used as a topical anesthetic; introduced in 1884
- Rapid onset of action; lasts 10 to 20 minutes
- Also acts to dilate the pupil

Indications
- Aid in removal of foreign body
- To make patient more comfortable in traumatic or infected cases so as to allow an adequate examination
- Checking intraocular pressure

Side effects
- Corneal toxicity (more common with cocaine)
- Delayed corneal epithelial healing

Comment
Do not allow patients to use a topical anesthetic outside the office. The anesthetic will impair epithelial healing and prevent resolution of a corneal epithelial defect (for example, abrasion).

ANTIMICROBIALS
The clinician should understand the commonly used topical antibiotic preparations for the eye. Below are the mechanism of action, spectrum of activity, and adverse reactions of the most commonly used ophthalmic antibiotics.
• Maximum pressure effect 2 hours after instillation; not related to pupil size
• Iris pigment is a specific binding site for pilocarpine, thus in heavily pigmented eyes the miosis and effect on IOP is reduced
• Also available in a sustained release form; pilocarpine embedded in hydrophilic polymers inserted in the cul-de-sac; one problem is the burst phenomenon, in which there is a large initial release of pilocarpine after insertion, which causes severe miosis and ciliary body spasm; another problem with these devices is the number of patients who have difficulty retaining the device in their cul-de-sac; advantage: maximum duration of pressure control

**Action**

• Contraction of iris sphincter (miosis)—may be undesirable, especially in patients with cataracts
• Contraction of ciliary muscle (accommodation)—produces miosis; may be disabling in individuals under 50 years of age
• Decreases intraocular pressure as a result of improvement in outflow—contraction of the longitudinal fibers of the ciliary body musculature, which pulls the scleral spur posteriorly, which widens the pores of the trabecular meshwork or opens a collapsed canal of Schlemm

**Side effects**

**Ocufor**

• Accommodative spasm and pain
• Allergic or toxic reaction
• Pseudodecrease in visual field

**Systemic (parasympathetic effects)**

• Vomiting
• Diarrhea
• Sweating
• Lacrimation

**Carbachol (Isoptocarbachol)**

• Strengths 0.75% to 3.0%; frequency: three times daily
• Structurally: combination of portions of physostigmine and acetylcholine molecules; *direct effect* (like pilocarpine) plus *indirect effect* (displacing acetylcholine from the parasympathetic nerve terminals)
• More prolonged action than pilocarpine, and is a more powerful miotic; however, carbachol causes more severe headaches and accommodative spasms of the eye than pilocarpine
• Usually prescribed for patients who are allergic to pilocarpine or whose condition cannot be adequately controlled by pilocarpine
• No systemic effects—unlike pilocarpine