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Ocular Pharmacotherapy



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CHAPTER 4

Mydriatics and Cycloplegics

Pedro Arriola-Villalobos

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DEFINITION

Mydriatics are ophthalmic drops that achieve dilation of the pupil. Mydriasis can be achieved by two ways: paralyzing the sphincter muscle or causing stimulation of the dilator muscle of the iris. Cycloplegics paralyze the ciliary muscle, causing cycloplegia.

INDICATIONS

Diagnostic Purposes

- Mydriasis is needed to perform the funduscopic exploration, getting good visualization of lens, vitreous, optic head nerve, and retina.
- Mydriasis tests are also used in the diagnosis protocol of Horner syndrome.[1]
- Cycloplegia is necessary for obtaining an accurate refraction in young children,[2] strabismus, to distinguish true myopia from pseudomyopia, latent hyperopia, handicapped or mentally disabled individuals or suspicious of simulation. It may also be used in preoperative refractive surgery patients.[3] **Table 4.1** includes a suggested algorithm for cycloplegia in children.

Surgical Purposes

- Mydriasis and cycloplegia are performed in cataract and vitreoretinal surgery with the purpose of obtaining good visualization of lens and posterior pole. It can be achieved with drops[4] or intracameral mydriatics[5]
- Mydriasis must be used in some intraocular surgeries as Descemet's stripping automated endothelial keratoplasty (DSAEK) or Descemet's membrane endothelial keratoplasty (DMEK) to prevent pupillary block due to anterior chamber air bubble.[6]

Table 4.1 Choice of cycloplegic agent for infants and children

Patient age	Cycloplegic
0–3 months	Tropicamide 0.5% Cyclopentolate 0.2%
3 months–1 year	Cyclopentolate 0.5% Atropine 0.5% (darkly pigmented iris, esotropia) Scopolamine 0.25% (atropine indication but allergy)
1–5 years	Cyclopentolate 1% Atropine 0.5–1% (darkly pigmented iris, esotropia) Scopolamine 0.25% (atropine indication but allergy)
>5 years	Cyclopentolate 1%

Table 4.2 Mydriatic treatment algorithm in anterior uveitis

Cells	Mydriatic treatment
+/-	No treatment
1+	Tropicamide every 6–12 hours
2+	If pain: Homatropine 2% every 4–8 hours No pain: Tropicamide every 6–8 hours
3–4+	Mild-moderate pain: Homatropine 2% every 2–4 hours Severe pain or severe fibrinoid reaction: Atropine 1% every 12 hours

Therapeutic Purposes

- Mydriasis must be used in anterior uveitis to break or prevent the formation of posterior or anterior synechiae, iris bombe, pupillary block, or secondary angle closure.[7] We have suggested a mydriatic algorithm in anterior uveitis **(Table 4.2)**.[8]
- Mydriasis is included in the treatment algorithm of secondary angle closure with pupillary block and misdirection glaucoma.[9]
- Cycloplegia is used to treat the convergence spasm, getting symptomatic relief.[10]
- Cycloplegia is used to alleviate photophobia and other symptoms due to ciliary spasm in several conditions like anterior uveitis,[11] corneal diseases, or postsurgical status (photorefractive keratectomy).[12]
- Cycloplegia should be used to reduce the progression of myopia, unless there is no strong evidence supporting it.[13]
- Cycloplegia is also used in the treatment of amblyopia (pharmacologic occlusion therapy).[14]

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CONTRAINDICATIONS CAUTIONS

Mydriatics and cycloplegics must be used with extreme caution in patients with narrow anterior chamber or angle-closure glaucoma.

SIDE ADVERSE EFFECTS

Most of these drops share some infrequent ocular adverse events, like allergic blepharoconjunctivitis (mainly due to phenylephrine[15] and cyclopentolate[16]), blurred vision (mydriatics may affect higher order aberrations, especially spherical aberration),[17] photophobia[18] and transient keratitis, burning, or stinging. Cycloplegic drugs can precipitate an attack of acute angle closure glaucoma in predisposed patients.[19] A slight transient rise in intraocular pressure of little clinical significance may occur in glaucoma patients with open angles.

After a cycloplegic refraction, the loss of accommodation and mydriasis may last several hours to several days after the examination, depending on the drop instilled. Use of pilocarpine to reverse the cycloplegia or mydriasis produced by anticholinergic cycloplegic drugs, such as atropine and cyclopentolate is not effective.[20] Besides, the resultant miosis and ciliary spasm can cause significant discomfort. In conclusion, the use of miotics to counteract anticholinergic drops is not advised.

All these drugs, due to their mechanism of action, may have systemic side effects, mainly in cardiovascular and in central nervous systems. All cycloplegic drugs have potentially serious systemic side effects, especially in infants and children. Specific side effects will be discussed afterward in each drug description.

Proper techniques of drug instillation can greatly reduce the hazards of cycloplegics. Patients must be advised to use only one drop of each drug, and to apply digital pressure at the medial canthus 1 or 2 minutes after instillation. Physicians must try to prescribe the lowest dose necessary to produce adequate cycloplegia, above all in children.

MYDRIATICS

Purely, mydriatic drops are phenylephrine (Neosynephrine) and hydroxyamphetamine. They all are sympathomimetics, adrenergic agonists that stimulate the dilator muscle of the iris, causing mydriasis. They also stimulate the Müller muscle, leading to upper lid elevation.[21] Sympathetic stimulation also causes constriction of arterioles in conjunctiva. They have no effect on accommodation.

The mydriatic drug most commonly used is the phenylephrine, usually at 10%. Just one drop is enough for obtaining mydriasis, usually for funduscopic exploration or before surgery. Phenylephrine 1.5% is also used intracamerally

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to maintain pupil size and reduce iris billowing in intraoperative floppy iris syndrome.[22]

Several cardiovascular and central nervous system side effects have been reported after the use of topical phenylephrine, including arrhythmia, myocardial infarction, subarachnoid hemorrhage, syncope, headache, etc.[23]

Phenylephrine may cause systemic vasoconstriction, so it should be used with caution in patients with hypertension, cerebral aneurysm or under treatment with monoamine oxidase (MAO) inhibitors or tricyclic antidepressants (TCAs). Caution also in advanced arteriosclerotic changes, type 1 diabetes mellitus and hyperthyroidism. It is contraindicated in patients with ventricular tachycardia and idiopathic orthostatic hypotension.[24]

Phenylephrine may cause rebound miosis one day after the treatment in elderly people.

CYCLOPLEGICS

Cycloplegics are anticholinergic drugs, which block muscarinic receptors in the ciliary muscle, inhibiting its contraction and causing cycloplegia. They also block the sphincter pupillae causing mydriasis.

There are several cycloplegic drugs: atropine, cyclopentolate, homatropine, scopolamine and tropicamide. They all share mechanism of action but have different pharmacology **(Table 4.3)** and magnitude of cycloplegia.

Atropine

It is an alkaloid derived from *Atropa belladonna,* organic ester of tropic acid and tropine. It was the first antimuscarinic used in medicine. This is the most powerful mydriatic–cycloplegic drug, with cycloplegia considered gold standard (the got cycloplegia with other drugs graduates by percentage they get in relation to atropine) and excellent mydriasis (not superior, however, to phenylephrine).

There are several preparations, including drops 0.5%, 1%, and 2% and ointment 1%. The dosage for cycloplegia is one drop two or three times daily

Table 4.3 Mydriatics and cycloplegics pharmacology

Drug	Maximum effect		Duration of action	
	Cycloplegia	Mydriasis	Cycloplegia	Mydriasis
Atropine	36 hours	30 min	1–2 weeks	7–10 days
Homatropine	30–60 min	30–60 min	1–3 days	1–3 days
Scopolamine	60 min	20–30 min	5–7 days	3–7 days
Cyclopentolate	30–75 min	15–30 min	24 hours	24 hours
Tropicamide	20–35 min	30 min	10–40 min	4–6 hours
Phenylephrine	-	20–60 min	-	3–6 hours

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for 1 to 3 days before examination and in the morning of the examination.[25] Atropine is less effective in patients with darkly pigmented eyes.

Its use is limited by its long duration of action (**Table 4.3**), which determines the patient's vision, especially at near distance, an extended period after stopping the application. Furthermore, side effects with this drug are more frequent and severe than with other cycloplegics due to its high inhibition on muscarinic receptors in the body. However, it may be the first choice for accurate refraction in children, especially in those with darkly pigmented eyes with even poorest response to other cycloplegics. Some authors reserve the use of atropine in refraction for esotropic children < 5 years of age. Atropine is also the first choice for pharmacologic occlusion therapy in amblyopia and in severe anterior uveitis, even more with fibrinoid reaction within the anterior chamber or severe pain. Atropine must be avoided in Down's syndrome children due to a possible hyper-reactive response.

Systemic toxicity may exist from over dosage after multiple instillations or from an idiosyncratic response after the instillation of only one or two drops in each eye. Parents must be advised of the early signs of toxicity (fever, skin rash, rapid and irregular pulse, dry mouth and nose, and delirium) so that administration of atropine is not continued. Prompt treatment with physostigmine (or other anticholinesterase drugs) reverses both central and peripheral anticholinergic effects.

Atropine toxicity[26] includes tachycardia, hyperthermia, skin and other mucosae dryness, excitation, delirium, psychosis and in severe cases central nervous system depression with respiratory paralysis, which can even lead to death. Acute urine retention has also been reported.[27]

Cyclopentolate

Cyclopentolate is the most used cycloplegic due to its good safety profile and fine cycloplegia.

Available drops include 0.5%, 1%, and 2% concentration. The dosage for cycloplegia is one drop of 0.5% or 1% solution, followed in five to ten minutes by a second drop. The refraction must be performed 1 hour after the first drop. The 2% concentration should be avoided, especially in newborns and young infants, to prevent toxicity.

Systemic toxicity secondary to cyclopentolate is similar to that produced by atropine, with more tactile and visual hallucinations. Cyclopentolate toxicity, which is dose dependent, is more frequent in patients with Down's syndrome, mild iris pigmentation, seizures or cerebral disease,[28] and also with 2% concentration. Systemic toxicity includes central nervous system effects,[29] like confusion, drowsiness, incoherent speech, hyperexcitability, ataxia, hallucinations, and seizures.[30] Psychotic reactions have also been reported,[31] even a rare case of addiction.[32] The treatment of systemic cyclopentolate toxicity is the same as for atropine poisoning.[33]

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Homatropine

Homatropine is a semisynthetic alkaloid derived from atropine. It is seldom used for not possessing advantages over other cycloplegics (cycloplegic action is less complete than atropine[34] and last longer than that of cyclopentolate), although its half-life makes it useful in the treatment of moderate anterior uveitis.[8] Homatropine do not produce a satisfactory cycloplegia in children.

Available drops include 2% and 5% concentration. The dosage for cycloplegia is one drop of 2% solution, repeated in five to ten minutes by a second drop. The refraction must be performed 30–60 minutes after the first drop.

Homatropine must be used with extreme caution in infants and young children, as well as in Down's syndrome patients, because of increased susceptibility to systemic effects. Systemic side effects are similar to those from atropine,[35] although they appear less frequently by its smaller antimuscarinic activity.

Scopolamine

Scopolamine is a naturally occurring alkaloid extracted from *Hyoscyamus niger*, atropine-like, with more activity and toxicity and with a shorter half-life than atropine.[36] It may be an alternative to atropine in therapeutic purposes in case of allergy to atropine, but the higher frequency of undesirable effects in the central nervous system causes that is virtually unused.

Scopolamine is used at 0.25%. Dosage for cycloplegia is one drop in each eye twice daily for two days before refraction. This dosage does not cause usually side effects.[37] Systemic toxicity, which is similar to that with atropine, is also treated with physostigmine.

Tropicamide

This synthetic derivative of tropic acid has very mild and transient cycloplegic effect, so we should only consider it as a mydriatic drug. In fact, it is the most used drug to get mydriasis for funduscopic examination in the clinical setting.

Tropicamide is available at 0.5% and 1% solution. About 0.5% solution causes less discomfort and equal pupil dilation.[38] If used for cycloplegia, the dosage is one drop in each eye followed by other one in five minutes. Dapiprazole has been used to reverse the effects of tropicamide 1.0%.[39]

It is a very safe drug with very low incidence of systemic adverse effects. The drug may be used safely at any age as a mydriatic agent.

REFERENCES

1. Ramsay DA. Dilute solutions of phenylephrine and pilocarpine in the diagnosis of disordered autonomic innervation of the iris. Observations in normal subjects, and in the syndromes of Horner and Holmes-Adie. J Neurol Sci. 1986;73:125-34.

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2. Cowan EC, Archer D. Clinical evaluation of a new mydriatic-mydrilate. Br J Ophthalmol. 1962;46:730-6.
3. Hofmeister EM, Kaupp SE, Schallhorn SC. Comparison of tropicamide and cyclopentolate for cycloplegic refractions in myopic adult refractive surgery patients. J Cataract Refract Surg. 2005;31:694-700.
4. Tanner V, Casswell AG. A comparative study of the efficacy of 2.5% phenylephrine and 10% phenylephrine in pre-operative mydriasis for routine cataract surgery. Eye. 1996;10:95-8.
5. Lundberg B, Behndig A. Intracameral mydriatics in phacoemulsification cataract surgery. J Cataract Refract Surg. 2003;29:2366-71.
6. Terry MA, Shamie N, Chen ES, Hoar KL, Friend DJ. Endothelial keratoplasty a simplified technique to minimize graft dislocation, iatrogenic graft failure, and pupillary block. Ophthalmology. 2008;115:1179-86.
7. Vitale AT, Foster CS. Mydriatic and cycloplegic agents. In: Vitale AT, Foster CS (Eds). Diagnosis and Treatment of Uveitis. Philadelphia, PA: WB Saunders; 2001.pp.159-66.
8. Arriola Villalobos P, Díaz Valle D. Mydriatics and cycloplegics in uveítis. In: Díaz Valle D, Méndez Fernández R, Benítez del Castillo JM (Eds). Update on the Treatment of Uveitis. Madrid, Spain: Sociedad Española de Oftalmología; 2007.pp:61-64.
9. EGS. Terminology and Guidelines for Glaucoma, 3rd edn. Savona, Italy: DOGMA; 2009.pp.181-2.
10. Sarkies NJ, Sanders MD. Convergence spasm. Trans Ophthalmol Soc UK. 1985;104:782-6.
11. Nussenblatt RB. Philosophy, goals, and approaches to medical therapy. In: Nussenblatt RB, Whitcup SM (Eds). Uveitis. Fundamentals and Clinical Practice, 3rd edn. Philadelphia, PA: Mosby; 2004.pp.95-136.
12. Joshaghani M, Nazari H, Ghasemi Falavarjani K, et al. Effect of homatropine eyedrops on pain after photorefractive keratectomy: a pilot study. Saudi J Ophthalmol. 2013;27:83-5.
13. Walline JJ, Lindsley K, Vedula SS, et al. Interventions to slow progression of myopia in children. Cochrane Database Syst Rev. 20117;(12):CD004916.
14. Pediatric Eye Disease Investigator Group. The course of moderate amblyopia treated with atropine in children: experience of the amblyopia treatment study. Am J Ophthalmol. 2003;136:630-9.
15. Raison-Peyron N, Du Thanh A, Demoly P, Guillot B. Long-lasting allergic contact blepharoconjunctivitis to phenylephrine eyedrops. Allergy. 2009;64:657-8.
16. Jones LW, Hodes DT. Possible allergic reactions to cyclopentolate hydrochloride: case reports with literature review of uses and adverse reactions. Ophthalmic Physiol Opt. 1991;11:16-21.
17. Kim JH, Lim T, Kim MJ, Tchah H. Changes of higher-order aberrations with the use of various mydriatics. Ophthalmic Physiol Opt. 2009;29:602-5.
18. McDonald MB, Wyse TB, Borodkin MJ, Ocmand A, Shoelson B, Thompson H. Comparison of the effectiveness of 4 anti-inflammatory drops in relieving photophobia after pupil dilation. J Cataract Refract Surg. 1999;25:405-10.
19. Lavanya R, Baskaran M, Kumar RS, et al. Risk of acute angle closure and changes in intraocular pressure after pupillary dilation in Asian subjects with narrow angles. Ophthalmology. 2012;119:474-80.

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20. Nelson ME, Orton HP. Counteracting the effects of mydriatics. Does it benefit the patient? Arch Ophthalmol. 1987;105:486-9.
21. Esmaeli-Gutstein B, Hewlett BR, Pashby RC, Oestreicher J, Harvey JT. Distribution of adrenergic receptor subtypes in the retractor muscles of the upper eyelid. Ophthal Plast Reconstr Surg. 1999;15:92-9.
22. Lorente R, de Rojas V, Vázquez de Parga P, et al. Intracameral phenylephrine 1.5% for prophylaxis against intraoperative floppy iris syndrome: prospective, randomized fellow eye study. Ophthalmology. 2012;119:2053-8.
23. Brown GC, Brown MM, Spaeth GL. Systemic effects of topical phenylephrine. Arch Ophthalmol. 1986;104:336-7.
24. Robertson D. Contraindication to the use of ocular phenylephrine in idiopathic orthostatic hypotension. Am J Ophthalmol. 1979;87:819-22.
25. Stolovitch C, Loewenstein A, Nemmet P, Lazar M. Atropine cycloplegia: how many instillations does one need? J Pediatr Ophthalmol Strabismus. 1992;29:175-6.
26. Jiménez-Jiménez FJ, Alonso-Navarro H, Fernández-Díaz A, et al. Neurotoxic effects induced by the topical administration of cycloplegics. A case report and review of the literature. Rev Neurol. 2006;43:603-9.
27. Princelle A, Hue V, Pruvost I, et al. Systemic adverse effects of topical ocular instillation of atropine in two children. Arch Pediatr. 2013;20:391-4.
28. Fitzgerald DA, Hanson RM, West C, et al. Seizures associated with 1% cyclopentolate eyedrops. J Paediatr Child Health. 1990;26:106-7.
29. Derinoz O, Er A. Inability to walk, disequilibrium, incoherent speech, disorientation following the instillation of 1% cyclopentolate eyedrops: case report. Pediatr Emerg Care. 2012;28:59-60.
30. Demayo AP, Reidenberg MM. Grand mal seizure in a child 30 minutes after Cyclogyl (cyclopentolate hydrochloride) and 10% Neo-Synephrine (phenylephrine hydrochloride) eyedrops were instilled. Pediatrics. 2004;113:499-500.
31. Mirshahi A, Kohnen T. Acute psychotic reaction caused by topical cyclopentolate use for cycloplegic refraction before refractive surgery: case report and review of the literature. J Cataract Refract Surg. 2003;29:1026-30.
32. Darcin AE, Dilbaz N, Yilmaz S, Cetin MK. Cyclopentolate hydrochloride eyedrops addiction: a case report. J Addict Med. 2011;5:84-5.
33. Derinoz O, Emeksiz HC. Use of physostigmine for cyclopentolate overdose in an infant. Pediatrics. 2012;130:e703-5.
34. Shah BM, Sharma P, Menon V, Saxena R, Singh JP. Comparing homatropine and atropine in pediatric cycloplegic refractions. J AAPOS. 2011;15:245-50.
35. Reilly KM, Chan L, Mehta NJ, Salluzzo RF. Systemic toxicity from ocular homatropine. Acad Emerg Med. 1996;3:868-71.
36. Dean Foggitt KD. Mydriasis and cycloplegia. Br J Ophthalmol. 1963;47:253.
37. Lahdes K, Huupponen R, Kaila T, Salminen L, Iisalo E. Systemic absorption of ocular scopolamine in patients. Ocul Pharmacol. 1990;6:61-6.
38. Hassler-Hurst J, Wadham C, Rayman G. A double-blind study comparing 0.5% and 1% tropicamide for annual retinal screening in diabetic adolescents. Diabet Med. 2004;21:434-9.
39. Molinari JF, Johnson ME, Carter J. Dapiprazole clinical efficiency for counteracting tropicamide 1%. Optom Vis Sci. 1994;71:319-22.

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- Includes an interesting chapter on drugs of surgical use as cefuroxime for endophthalmitis prophylaxis, phenylephrine for the management of the intraoperative floppy iris syndrome, capsular staining for surgical management of white cataracts, retinal staining, etc.

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