Ocular Anatomy and Physiology

Tissues and structures of the eye

- Anterior chamber angle and aqueous flow
  - Trabecular Meshwork
  - Iris
  - Cornea
  - Schlemm’s Canal

- Macular area and optic disc
  - Macula
  - Fovea
  - Optic Disc
  - Arteries/Veins
History Taking

Practical tips¹

Be consistent and systematic:

1. Determine the primary reason for the eye exam.
2. Identify any secondary issues related to the eyes.
3. Inquire about the patient’s general health and family medical and ocular history.
4. Note any existing medical conditions the patient may have and current medications.
5. Inquire about past ocular disorders, treatments, and/or operations and current status.
6. If the patient wears contact lenses and/or eyeglasses, record how old the contacts or eyeglasses are and the approximate date of the patient’s last eye exam.
7. Be sure to get the details of any presenting or past ocular problems.
8. Be succinct, systematic, and thorough.

Summary of key questions¹

<table>
<thead>
<tr>
<th>Area</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chief complaint</strong></td>
<td>• What are your symptoms?</td>
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<tr>
<td></td>
<td>• When did the problem start and under what conditions?</td>
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<td></td>
<td>• Was the onset fast or slow?</td>
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<td></td>
<td>• Does it affect one or both eyes?</td>
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<td></td>
<td>• Have you taken any medications for the symptoms?</td>
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<tr>
<td></td>
<td>• Is the problem getting worse?</td>
</tr>
<tr>
<td><strong>Medical and ocular history</strong></td>
<td>• How is your health generally (now and in the past)?</td>
</tr>
<tr>
<td></td>
<td>• Are you taking any prescription or over-the-counter medications for any health condition, such as high blood pressure, a cardiac condition, diabetes, or arthritis?</td>
</tr>
<tr>
<td></td>
<td>• Have you ever required treatment for any serious disease?</td>
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<tr>
<td></td>
<td>• Do you wear, or have you ever worn, eyeglasses or contact lenses?</td>
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<tr>
<td></td>
<td>• Have you ever had eye surgery?</td>
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<tr>
<td></td>
<td>• Have you ever been treated for a serious eye condition, such as glaucoma, corneal ulcer, or cataracts?</td>
</tr>
<tr>
<td></td>
<td>• Are you taking any prescription or over-the-counter medications for your eyes, including eyedrops?</td>
</tr>
<tr>
<td></td>
<td>• When was your last eye exam?</td>
</tr>
<tr>
<td><strong>Family medical and ocular history</strong></td>
<td>• Does anyone in your family have any significant eye or other health problems?</td>
</tr>
<tr>
<td></td>
<td>– Mention myopia, strabismus, and glaucoma</td>
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<tr>
<td><strong>Allergies</strong></td>
<td>• Do you have any allergies to</td>
</tr>
<tr>
<td></td>
<td>– Drugs (topical or systemic)?</td>
</tr>
<tr>
<td></td>
<td>– Inhalants (eg, pollen, dust)?</td>
</tr>
<tr>
<td></td>
<td>– Contactants (eg, cosmetics, wool)?</td>
</tr>
<tr>
<td></td>
<td>– Food?</td>
</tr>
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<td></td>
<td>– Injectants (eg, tetanus antiserum)?</td>
</tr>
</tbody>
</table>
**Definitions**

**General ophthalmic terms**

- **Anterior chamber (AC):** The area in the front of the eye between the cornea and the iris that is filled with aqueous humor

- **Anterior chamber angle (or filtration angle):** The angle where the cornea meets the iris. This is also the site of the trabecular meshwork, through which the aqueous humor flows out of the eye

- **Aqueous humor:** The transparent, watery fluid found in the anterior and posterior chambers, located within the front part of the eye

- **Ciliary body:** Tissues that supply fluid to nourish the eye; located around the lens of the eye

- **Cornea:** The transparent part of the outer eye that covers the iris, pupil, and anterior chamber. Part of the eye’s protective covering and focusing system

- **Cup-to-disc (C/D) ratio:** The optic nerve’s appearance is often described in terms of cup-to-disc ratio. The ratio is an image that an eye care professional can view by looking through a dilated pupil to the optic nerve (ophthalmoscopy). Cup-to-disc ratios of greater than 0.33 or asymmetric (uneven) ratios are considered suspicious for glaucoma

- **Dilation:** A process in which eyedrops are applied, temporarily enlarging the pupil. This allows the eye care specialist to better view the inside of the eye

- **Disc hemorrhage:** Small hemorrhages that appear on the surface of the optic nerve. They often indicate that glaucoma damage has progressed or will soon progress

- **Intraocular pressure (IOP):** Fluid pressure within the eye. The most significant risk factor for glaucoma is elevated IOP. Normal IOP usually ranges from 13 to 20 mm Hg

- **Iris:** The colored ring of tissue suspended behind the cornea and immediately in front of the lens. Expands and contracts to adjust the size of the pupil, allowing the correct amount of light to enter the eye

- **Legal blindness:** In the United States, legal blindness is defined by either: (1) visual acuity of 20/200 or worse in the better eye with corrective lenses (20/200 means that a person must be 20 feet from an eye chart to see what a person with normal vision can see at 200 feet), or (2) visual field restricted to ≤ 20˚ diameter (tunnel vision) in the better eye

- **Lens:** The transparent, double-convex structure suspended between the eye’s aqueous and vitreous humors. Located behind the iris, it helps bring rays of light to focus on the retina
**Ocular hypertension (OHT):** The condition in which a person has elevated eye pressure but no detectable optic nerve or visual field damage. The term is used to distinguish people with elevated eye pressure from those with glaucomatous injury to the optic nerve. While not all people with ocular hypertension develop glaucoma, there is an increased risk of glaucoma among those with ocular hypertension.

**Optic nerve:** The bundle of nerve fibers that carry visual messages from the retina to the brain.

**Peripheral vision:** The outer areas of vision along the top, sides, and bottom. Sometimes referred to as side vision, these areas are usually the first affected by glaucoma.

**Pupil:** The black circular opening in the center of the iris. It adjusts size to regulate the amount of light entering the eye.

**Retina:** The sensory part of the eye that delivers light and images through the optic nerve to the brain.

**Schlemm’s canal:** A circular canal situated at the junction of the sclera and the cornea through which the aqueous humor drains.

**Solution:** A type of medication formulation in which the drug particles are dissolved in a fluid.

**Suspension:** A type of medication formulation in which the drug particles are mixed with a fluid but remain undissolved.

**Trabecular meshwork (TM):** Located at the anterior chamber angle, this is the drainage network where aqueous humor flows out of the eye.

**Visual field (VF):** The entire area that can be seen when the eye is looking forward, including side vision.

**Vitreous humor:** The transparent, colorless mass of gel that fills the posterior chamber behind the lens and in front of the retina.
Definitions

Glaucoma: terms and types

- **Congenital glaucoma:** A rare form of glaucoma that is present at birth or in early childhood. This condition may be inherited and is usually the result of abnormal or incomplete development of the eyes’ drainage canals.

- **Glaucoma (the “sneak thief of sight”):** An eye disease that affects the optic nerve and typically causes gradual visual field loss over time; commonly characterized by elevated IOP. Often there are no symptoms until significant visual field loss has occurred. In patients with glaucoma, the side or peripheral vision will gradually fail even though items right in front are still clearly seen. They may not even notice the narrowing of their peripheral vision because it can be very gradual. That’s why glaucoma is sometimes called the “sneak thief of sight”.

- **Glaucoma suspect:** A person who might have glaucoma but it’s too early to tell. This term includes patients with ocular hypertension (persons with elevated intraocular pressure but no detectable optic nerve or visual field damage) and patients with large cup-to-disc ratios and normal visual fields who may or may not have early normal-tension glaucoma.

- **Low-tension glaucoma (LTG):** See normal-tension glaucoma.

- **Normal-tension glaucoma (NTG):** Also known as low-tension glaucoma, this condition is characterized by progressive optic nerve damage and visual field loss with normal intraocular pressure. Poor blood flow to the optic nerve or other factors that lead to cell death may play a role.

- **Pigmentary dispersion glaucoma:** A type of open-angle glaucoma caused by pigment granules gradually breaking free from the iris and ciliary epithelium; depositing back on the corneal surface, lens, and zonules; and obstructing the trabecular meshwork.

- **Primary angle-closure glaucoma (PACG):** In this form of glaucoma, the anterior chamber is smaller than normal, which limits the flow of the aqueous fluid and causes fluid pressure to build up behind the iris. The building pressure continues to narrow the angle further. When the angle is completely blocked, an acute glaucoma attack results.

- **Primary open-angle glaucoma (POAG):** Associated with elevated intraocular pressure, this is the most common type of glaucoma. Even though the trabecular meshwork appears normal, the aqueous fluid does not flow correctly and intraocular pressure builds. Left untreated, POAG can lead to visual field loss and optic nerve damage.

- **Pseudoexfoliation:** Also known as exfoliation syndrome, this condition is characterized by small deposits within the eye that clog the trabecular meshwork. Aqueous humor flow becomes blocked and intraocular pressure increases, which can cause open-angle or angle-closure glaucoma.
• **Secondary glaucoma (or trauma-related glaucoma):** Acute or chronic glaucoma can be caused by a blow to the eye, chemical burn, or penetrating injury. In these cases, there is usually a mechanical disruption or physical change that impacts the eye’s drainage system.

**Common tests for glaucoma**

• **Gonioscopy:** This test is performed to determine whether open-angle or angle-closure glaucoma is present. It involves placing a mirrored contact lens on the eye that enables the doctor to look sideways into the eye to see whether the angle where the iris meets the cornea is open or closed.

• **Ophthalmoscopy:** This test is performed to look at the inside of the eye, particularly the optic nerve. In a darkened room, a device with a small light at the end of it is held up to the eye. The eye is lit up and magnified so that the shape and color of the optic nerve can be seen.

• **Optic nerve computer imaging:** Over time these imaging techniques can detect loss of optic nerve fibers.
  
  — **Scanning laser polarimetry (GDx):** The GDx can measure the thickness of the nerve fiber layer by directing a laser beam into the eye and measuring the rate at which the light is reflected off the retinal tissues.
  
  — **Confocal laser ophthalmoscopy (or Heidelberg retinal tomography II [HRT II]):** In this diagnostic test, a laser scan of the retinal surface and optic nerve are taken and converted into a topographic (3-D) image of the optic nerve including a contour outline of the optic cup. Retinal nerve fiber layer thickness is also measured.

  — **Optical coherence tomography (OCT):** This technology delivers a contour map of the optic nerve and optic cup, and also measures retinal nerve fiber layer thickness.

• **Perimetry:** Also known as the visual field test, this diagnostic maps the complete field of vision to assess any vision loss.

• **Tonometry:** The use of a device to measure intraocular pressure.
  
  — **Air puff:** This test involves an instrument that directs a puff of air at the eye. It is the only tonometry test that does not directly touch the surface of the eye.
  
  — **Applanation:** In this test, after the patient’s eye has been treated with anesthetic drops and a fluorescein stain, the tonometer is placed on the cornea and a tiny amount of pressure is applied.
Definitions

Glaucoma treatment terms

- **Adjunctive therapy:** Also known as *add-on* or *second-line therapy*. Used to describe an additional drug that is administered in conjunction with primary drug therapy in order to further reduce intraocular pressure.
- **Compliance:** Taking prescribed medication as directed.
- **Efficacy:** The capacity or effectiveness of a specific therapy to produce a beneficial result under ideal conditions.
- **Monotherapy:** The use of a single drug to lower intraocular pressure.
- **Conjunctival hyperemia:** Commonly known as *red eye*. The mucous membrane that lines the inner surface of the eyelids and the forefront of the eye is known as the conjunctiva. Hyperemia refers to the redness that results from an increase in blood flow to the area due to vasodilation.
- **Persistence:** The long-term equivalent of compliance. Refilling prescriptions as recommended and continuing drug therapy over time. Typically used in the context of chronic conditions, such as glaucoma.

Glaucoma surgical terms

- **5-Fluorouracil (5-FU):** A medication designed to stop the body’s healing process that is sometimes used around a bleb to prevent it from healing or scarring.
- **Bleb:** Bubbles in eye tissue that can form over the new drainage openings created during surgery.
- **Incisional iridectomy:** In incisional (surgical) iridectomy, the ophthalmologist creates a hole in the iris by making surgical incisions. Performed instead of a laser procedure if the cornea is extremely cloudy or if the patient cannot cooperate.
- **Laser surgery:** In these procedures, a tiny, powerful beam of energy is used to correct eye conditions.
  - **Argon laser trabeculoplasty (ALT):** In this procedure the laser is aimed at the drainage channels of the eye in an attempt to open those channels so fluid can leave the eye more efficiently.
  - **Laser peripheral iridotomy (LPI):** This procedure involves creating a new drainage hole in the iris. The iris falls away from the outflow channel and fluid can then drain out of the eye.
  - **Selective laser trabeculoplasty (SLT):** This type of laser surgery uses a combination of low-level frequencies to selectively treat specific trabecular cells, while sparing others—leaving the trabecular meshwork intact.
  - **YAG laser cyclophotocoagulation (YAG CP):** Typically reserved for people who have severe glaucoma and are not responding to standard glaucoma surgery, this laser procedure is used to partially destroy the tissues that make the fluid in the eye.
- **Microsurgery:** Using a microscope and a tiny tool, a very small opening is made in the sclera so that intraocular fluid can drain out of the inside of the eye.
- **Trabeculectomy:** Removal of part of the trabecular meshwork to increase outflow of aqueous from the eye; type of filtering procedure used in the treatment of glaucoma.
## Common Abbreviations and Symbols

### General Ophthalmology
- **AACG**: acute angle-closure glaucoma
- **AC**: anterior chamber
- **ACG**: angle-closure glaucoma
- **ALT**: argon laser trabeculoplasty
- **ARMD or AMD**: age-related macular degeneration
- **BRAO**: branch retinal artery occlusion
- **BRVO**: branch retinal vein occlusion
- **CAI**: carbonic anhydrase inhibitor
- **cc**: with correction
- **CC**: chief complaint
- **CCT**: computed coronal tomography
- **C/D**: cup-to-disc ratio
- **C&F**: cell and flare
- **CME**: cystoid macular edema
- **COAG**: chronic open-angle glaucoma
- **conj**: conjunctive, conjunctival
- **CRAO**: central retinal artery occlusion
- **CRVO**: central retinal vein occlusion
- **CT**: computed tomography
- **D**: diopter, distance, distance vision
- **DMV**: optic disc, macula, retinal vessels
- **EOM**: extraocular muscles
- **ET**: esotropia at distance
- **FA, f/a**: fluorescein angiogram/angiography
- **5-FU**: 5-fluorouracil
- **FB**: foreign body
- **GPC**: giant papillary conjunctivitis
- **GVF**: Goldmann visual field
- **HRT II**: Heidelberg retinal tomography II
- **HVF**: Humphrey® visual field
- **HZ**: herpes zoster
- **IOL**: intraocular lens
- **IOP**: intraocular pressure
- **J1, J2, etc**: Jaeger notation/size of type for near vision
- **LASIK**: laser-assisted in situ keratomileusis
- **LLL**: left lower eyelid
- **LP**: light perception, lumbar puncture
- **LPI**: laser peripheral iridotomy
- **LTG**: low-tension glaucoma
- **LTP**: laser trabeculoplasty
- **LUL**: left upper eyelid
- **M**: macula, manifest refraction
- **MG**: Marcus-Gunn pupil, myasthenia gravis
- **NFL**: nerve fiber layer
- **NI**: no improvement, not improvable
- **ni**: normal
- **NLP**: no light perception
- **NPDR**: nonproliferative diabetic retinopathy
- **NSAID**: nonsteroidal anti-inflammatory drug
- **NTG**: normal-tension glaucoma
- **NVD**: neovascularization of the disc
- **NVE**: neovascularization elsewhere
- **NVG**: neovascular glaucoma
- **OAG**: open-angle glaucoma
- **OCT**: optical coherence tomography
• OD: right eye (oculus dexter), optic disc, overdose
• OHT: ocular hypertension
• OS: left eye (oculus sinister)
• OU: both eyes (oculus uterque)
• PACG: primary angle-closure glaucoma
• PERRLA: pupils equal, round, reactive to light and accommodation
• PGA: prostaglandin analog
• PH: past history, pinhole (visual acuity)
• PI: peripheral iridectomy/iridotomy
• POAG: primary open-angle glaucoma
• PSC: posterior subcapsular cataract
• R: retinoscopy, refraction, right
• RD: retinal detachment
• RLL: right lower eyelid
• RUL: right upper eyelid
• SLT: selective laser trabeculoplasty
• SPK: superficial punctate keratitis
• TA, Tapp: tension by applanation (tonometry)
• TBUT: tear breakup time
• TM: trabecular meshwork
• VA: visual acuity, vision
• VF: visual field
• Vit: vitreous
• YAG: yttrium aluminum garnet laser
• YAG CP: yttrium aluminum garnet cyclophotocoagulation
• YLT: YAG laser trabeculotomy

Prescription writing
• <: less than
• >: more than
• ad lib: as much as wanted
• BID: twice a day
• gt, gtt: drop
• h: hour
• hs: bedtime
• M: mix
• non rep: do not repeat
• OD: right eye
• OS: left eye
• OU: both eyes
• prn: as needed
• q: every
• QD: every day
• q4h: every 4 hours
• QID: four times a day
• Rx: prescribe
• Sol: solution
• TID: three times a day
• Ung: ointment
# Common Glaucoma Medications

## Alpha-agonist

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Generic Name</th>
<th>Dosing</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALPHAGAN&lt;sup&gt;®&lt;/sup&gt; P 0.1%&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Brimonidine tartrate ophthalmic solution 0.1%</td>
<td>1 drop in the affected eye(s) 3 times daily, approximately 8 hours apart</td>
<td>Allergan, Inc.</td>
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</table>

## Beta-blockers

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Generic Name</th>
<th>Dosing</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timolol maleate, USP&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Timolol maleate ophthalmic solution 0.25% and 0.5%</td>
<td>May vary by manufacturer — check product labeling</td>
<td>Multiple manufacturers</td>
</tr>
<tr>
<td>Timoptic-XE&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Timolol maleate ophthalmic gel forming solution 0.25% and 0.5%</td>
<td>1 drop in the affected eye(s) once daily</td>
<td>Merck &amp; Co., Inc.</td>
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</tbody>
</table>

## Carbonic anhydrase inhibitors (CAIs)

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<thead>
<tr>
<th>Brand Name</th>
<th>Generic Name</th>
<th>Dosing</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azopt&lt;sup&gt;4&lt;/sup&gt;</td>
<td>Brinzolamide ophthalmic suspension 1%</td>
<td>1 drop in the affected eye(s) 3 times daily</td>
<td>Alcon Laboratories, Inc.</td>
</tr>
<tr>
<td>Trusopt&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Dorzolamide hydrochloride ophthalmic solution 2%</td>
<td>1 drop in the affected eye(s) 3 times daily</td>
<td>Merck &amp; Co., Inc.</td>
</tr>
</tbody>
</table>
### Prostaglandin analogs (PGAs)

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Generic Name</th>
<th>Dosing</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUMIGAN®</td>
<td>Bimatoprost ophthalmic solution 0.03%</td>
<td>1 drop in the affected eye(s) once daily in the evening</td>
<td>Allergan, Inc.</td>
</tr>
<tr>
<td>Travatan®, Travatan Z®</td>
<td>Travoprost ophthalmic solution 0.004%</td>
<td>1 drop in the affected eye(s) once daily in the evening</td>
<td>Alcon Laboratories, Inc.</td>
</tr>
<tr>
<td>Xalatan®</td>
<td>Latanoprost ophthalmic solution 0.005%</td>
<td>1 drop in the affected eye(s) once daily in the evening</td>
<td>Pfizer Inc.</td>
</tr>
</tbody>
</table>

### Alpha-agonist + beta-blocker combined

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Generic Name</th>
<th>Dosing</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMBIGAN®</td>
<td>Brimonidine tartrate/timolol maleate ophthalmic solution 0.2%/0.5%</td>
<td>1 drop in the affected eye(s) twice daily, approximately 12 hours apart</td>
<td>Allergan, Inc.</td>
</tr>
</tbody>
</table>

### Beta-blocker + CAI combined

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Generic Name</th>
<th>Dosing</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorzolamide hydrochloride-timolol maleate®</td>
<td>Dorzolamide hydrochloride-timolol maleate ophthalmic solution</td>
<td>1 drop in the affected eye(s) 2 times daily</td>
<td>Multiple manufacturers</td>
</tr>
</tbody>
</table>
The Visual Field

Visual field perimetry is a critical component of glaucoma diagnosis and management

- A number of testing options exist—selection is often based on patient type
- The role of the technician is very important in perimetry

Tips for getting the best test results

1. Take your time explaining the test to ensure that your patient understands how it will work.

2. Communicate that the test requires complete concentration and reiterate where the patient should fixate his/her eyes.

3. Make sure the patient is still/sitting correctly.

4. Make adjustments as needed so that the patient’s head fits snugly into the headrest.

5. Select the correct refractive lens and place it in front of the patient’s eyes.

6. Next, center the patient’s pupil on the refractive lens.

7. Check that the patch completely covers the patient’s other eye so the patient can’t see around it.

8. If the upper eyelid is significantly droopy and interfering, consider gently taping it up for a better assessment.

9. If the pupil diameter is 2 mm or less, dilation may be necessary (please obtain authorization from the ophthalmologist or optometrist before dilating any patient).

10. Prompt the patient to respond more or less as needed during the test.

Tips for reading visual field reports

1. Double-check that the test is for the right patient: confirm the patient’s date of birth, the refraction, the pupil size, and the eye tested.

2. Identify and exclude possible artifacts.
   a. The deeper the defect, the more likely that it signifies a real change instead of an artifact; also, worsening glaucomatous scotomas generally progress by widening and deepening.

3. Use the gray scale to get an idea of the overall results.

4. In Humphrey® perimeter printouts, use the total deviation plot to compare the patient’s visual field with age-matched controls.

5. Use the pattern standard deviation plot to determine global changes in the visual field—it will show the characteristic patterns for glaucomatous visual field loss.

6. Too many false positives may be an indication of an unreliable test.

7. Too many false negatives indicate that the field should be rescheduled.

8. Fixation loss > 20% may artificially minimize a glaucomatous scotoma on the visual field.

9. Unusually high fixation loss (80%-90%) indicates that the perimeter may have missed the patient’s blind spot.

Example of a Visual Field Interpretation Report

Patient name: _________________________________

Visual field

☐ Automated  ☐ Goldmann  ☐ Right Eye
☐ Left Eye  ☐ Both Eyes

Technician comments

Date performed: ______________
Performed by: _________________________________
Reliability: _________________________________
Patient understanding and cooperation: ___________

Physician interpretation

Test results: _________________________________
_____________________________________________
_____________________________________________

Implications: _________________________________
_____________________________________________
Impact on treatment/prognosis: __________________
_____________________________________________

______________________________________________

MD ___________________________  Date __________
How to Talk to Patients About LUMIGAN®

Your doctor has selected LUMIGAN® eyedrop therapy because it is effective and proven to lower IOP. Please take LUMIGAN® ophthalmic solution once daily at or near bedtime. It is important to use your glaucoma eyedrops every day, as directed by your doctor.

One of the most common side effects of LUMIGAN® is temporary eye redness, known as hyperemia. Eye redness can occur immediately after use but usually only lasts a few weeks. Your eyes may get red but typically won’t hurt or itch.

- Your doctor recognizes that the benefits of LUMIGAN® far outweigh this issue
- Call the office if your eyes hurt or itch while using LUMIGAN® ophthalmic solution
- Do not stop taking LUMIGAN® without speaking to the office

Excellent managed care coverage

- Low co-pays are an excellent reason to recommend LUMIGAN® ophthalmic solution

Supplied in convenient bottles

- If patients use LUMIGAN® in both eyes
  - 2.5-mL bottle lasts more than a month (approximately 55 days¹)
  - 5.0-mL bottle lasts approximately 95 days¹
  - 7.5-mL bottle lasts approximately 130 days¹

Patient Web site and rebate coupon

Instruct patients to go to www.lumigan.com if they would like additional information about LUMIGAN® or for a rebate coupon.

Indication: LUMIGAN® (bimatoprost ophthalmic solution) 0.03% is indicated for the reduction of elevated intraocular pressure (IOP) in patients with open-angle glaucoma or ocular hypertension.

Important Safety Information

Contraindications: LUMIGAN® (bimatoprost ophthalmic solution) 0.03% is contraindicated in patients with hypersensitivity to bimatoprost or any other ingredient in this product.

Warnings: LUMIGAN® (bimatoprost ophthalmic solution) 0.03% has been reported to cause changes to pigmented tissues. The most frequently reported changes have been increased pigmentation of the iris, periorbital tissue (eyelid) and eyelashes, and growth of eyelashes. Pigmentation is expected to increase as long as LUMIGAN® 0.03% is administered. After discontinuation of LUMIGAN® 0.03%, pigmentation of the iris is likely to be permanent, while pigmentation of the periorbital tissue and eyelash changes have been reported to be reversible in some patients. Patients who receive treatment should be informed of the possibility of increased pigmentation. The effects of increased pigmentation beyond 5 years are not known.

Adverse reactions: The most frequently reported adverse events occurring in approximately 15% to 45% of patients, in descending order of incidence, were conjunctival hyperemia, growth of eyelashes, and ocular pruritus.

Please see accompanying full prescribing information.
How to Talk to Patients About COMBIGAN®

Your doctor has prescribed COMBIGAN® ophthalmic solution as adjunctive therapy to lower your IOP for these important reasons:

- COMBIGAN® offers convenient twice-daily dosing that may help you follow your therapy—which is essential for protecting your eyes from glaucomatous vision loss
  - COMBIGAN® should be taken once in the morning and once in the evening
- COMBIGAN® combines 2 effective medications in 1 bottle, leaving you with 1 co-pay instead of 2, when refilling your prescription
- COMBIGAN® is generally well tolerated by patients, as shown in large clinical studies
- COMBIGAN® ophthalmic solution has a lower allergy rate than brimonidine (a component of COMBIGAN®) administered alone
- Call your eye care professional if you experience shortness of breath, visual changes, irregular heartbeat, or fatigue/drowsiness

If you take other eyedrops besides COMBIGAN® ophthalmic solution, they should be administered at least 5 minutes apart.

Convenient bottle sizes

Your doctor may prescribe either of 2 convenient bottle sizes for you:

- 5-mL bottle
- 10-mL bottle

How much does COMBIGAN® cost?

The cost of COMBIGAN® will be determined by your health plan. Rebate offers may be available, so be sure and ask your doctor, or visit www.Combigan.com for special cost-saving offers.

Indication: COMBIGAN® is an alpha-adrenergic receptor agonist with a beta-adrenergic receptor inhibitor indicated for the reduction of elevated IOP in patients with glaucoma or ocular hypertension who require adjunctive or replacement therapy due to inadequately controlled IOP; the IOP-lowering of COMBIGAN® dosed twice a day was slightly less than that seen with the concomitant administration of timolol maleate ophthalmic solution 0.5% dosed twice a day and brimonidine tartrate ophthalmic solution 0.2% dosed three times per day.

IMPORTANT SAFETY INFORMATION

Contraindications: COMBIGAN® ophthalmic solution is contraindicated in patients with bronchial asthma, a history of bronchial asthma, severe chronic obstructive pulmonary disease; in patients with sinus bradycardia, second or third degree atrioventricular block, overt cardiac failure, cardiogenic shock; and in patients with hypersensitivity to any component of this product.

Warnings and Precautions: Severe respiratory reactions including death due to bronchospasm in patients with asthma have been reported following systemic or ophthalmic administration of timolol maleate. Sympathetic stimulation may be essential in individuals with diminished myocardial contractility, and its inhibition by beta-adrenergic receptor blockade may precipitate more severe cardiac failure. In patients without a history of cardiac failure, continued depression of the myocardium with beta-blocking agents over a period of time can, in some cases, lead to cardiac failure.

Please see additional Important Safety Information on next page.
How to Talk to Patients About ALPHAGAN® P 0.1%

Some of the reasons the doctor may have selected ALPHAGAN® P 0.1% ophthalmic solution as adjunctive therapy are:

- ALPHAGAN® P 0.1% is the most advanced formulation of ALPHAGAN®, with reduced drug exposure and the same effectiveness as original ALPHAGAN®.
- ALPHAGAN® P 0.1% offers proven efficacy to lower IOP when added to a PGA.
- ALPHAGAN® P 0.1% is preserved with gentle-to-the-eyes PURITE®.
- ALPHAGAN® P 0.1% is supplied in 5-mL, 10-mL, and 15-mL sizes.

When talking to patients about ALPHAGAN® P 0.1%, be sure to inform them that many glaucoma patients require more than one eyedrop. Let them know it is very important to take all of their medications as prescribed by their doctors. Compliance is key to lowering IOP, which reduces the risk of vision loss with glaucoma.

Instruct patients to go to www.AlphaganP.com if they would like further information on ALPHAGAN® P 0.1% and rebates.
Indication: ALPHAGAN® P 0.1% ophthalmic solution is indicated for the lowering of IOP in patients with open-angle glaucoma or ocular hypertension.

Important Safety Information

Contraindication: ALPHAGAN® P 0.1% is contraindicated in patients receiving monoamine oxidase (MAO) inhibitor therapy.

Precautions: Although ALPHAGAN® P 0.1% had minimal effect on the blood pressure of patients in clinical studies, caution should be exercised in treating patients with severe cardiovascular disease. ALPHAGAN® P 0.1% should be used with caution in patients with depression, cerebral or coronary insufficiency, Raynaud's phenomenon, orthostatic hypotension, or thromboangiitis obliterans.

Adverse reactions: Adverse events occurring in approximately 10% to 20% of the subjects included: allergic conjunctivitis, conjunctival hyperemia, and eye pruritus. Adverse events occurring in approximately 5% to 9% included: burning sensation, conjunctival folliculosis, hypertension, ocular allergic reaction, oral dryness, and visual disturbance.

Please see accompanying full prescribing information.
Treatment Guidelines for Glaucoma Patients

American Academy of Ophthalmology (AAO): recommended initial target pressures

2005 AAO Preferred Practice Pattern
Primary Open-Angle Glaucoma

Glaucoma patients and suspects (when treatment is needed)

- Current guidelines for the treatment of glaucoma and glaucoma suspects recommend reducing IOP by at least 20% from baseline
- Guidelines acknowledge that greater IOP lowering is required to reduce the risk of disease progression in patients at high risk of disease progression

---

Interpreting a Prescription

Physician name and information

DEA Reg. No. A012345678  Lic. No. 012345
Ophthalmology Medical Center
Dr. John Doe
170 Example Blvd
Santa Monica, CA
(323) 123-4567

Patient name, address and date of prescription

Name: Jami Rogers
Address: 123 Sample Street, Anywhere Town, CA 90000
Date: September 9, 2008

Rx

Symbol for prescription

LUMIGAN®
Sig: 1 gtt OU QD
M: 5 mL

Indication to pharmacist what directions to put on the label for the medicine, headed by the symbol Sig or S (for label). Specify how many drops to use, which eye, and frequency of use

Dispense as written

Notation to specify dispense as written or substitution permitted

Repeat: x2

Signature: John Doe, MD

Indication to pharmacist the number of refills allowed

Physician signature
Formularies and “preferred” drugs
A list of drugs covered by a Medicare drug plan is called a formulary. Formularies categorize drugs into tiers based on cost and other considerations. Preferred (2nd-tier) glaucoma drugs usually have a lower overall price as well as lower co-pays for patients.

Prescribing nonpreferred glaucoma drugs, while they may be covered by a formulary, costs more and causes patients to reach the Donut Hole faster. It pays to check with the formulary to help your patients save money.

Co-pays
This is the amount patients pay for prescriptions after they have paid their deductible. In many plans, co-pays are determined by the tier of the drug prescribed. Preferred 2nd-tier drugs usually have lower co-pays, which means less out-of-pocket expenses for patients.

Different drug brands within the same class may have different co-pays based on their formulary status. Co-pays are another important consideration when selecting a glaucoma treatment.
Common CPT®
Ophthalmology Codes¹

Ophthalmology exams
92002  Ophthalmology exam; intermediate, new patient
92004  comprehensive, new patient
92012  intermediate, established patient
92014  comprehensive, established patient

Ophthalmology services
92015  Determine refractive state
92018  Ophthalmological exam under general anesthesia
92020*  Gonioscopy
92060  Sensor-motor exam
92065  Orthoptic/pleoptic training
92070  Fit contact lens
92081  Visual field exam; limited
92082  intermediate
92083  extended
92100*  Serial tonometry
92120  Tonography with interpretation and report
92135  Scan computer ophthalmic diagnostic imaging, unilateral
92136  Ophthalmic biometry
92140  Provocative tests glaucoma
92225  Extended ophthalmoscopy; initial
92226  Extended ophthalmoscopy; subsequent
92230  Fluorescein angioscopy
92235  Fluorescein angiography
92240  Indocyanine-green angiography
92250  Fundus photography
92260  Ophthalmodynamometry
92275  Electroretinography
92283  Color vision exam
92284  Dark adaptation exam
92285  Ext ocular photography
92286  Special anterior segment photography
92310  Prescribe contact lens; non-aphakia
92325  Modification of contact lens
92340  Fit spectacles; monofocal
92341  Fit spectacles; bifocal
92370  Repair and refit spectacles

*Separate procedure.
### Common ICD-9-CM Glaucoma Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>365.02</td>
<td>Anatomical narrow-angle borderline glaucoma</td>
</tr>
<tr>
<td>365.04</td>
<td>Ocular hypertension</td>
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<tr>
<td>365.10</td>
<td>Open-angle glaucoma unspec</td>
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<td>365.11</td>
<td>Primary open-angle glaucoma</td>
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<td>365.12</td>
<td>Low-tension open-angle glaucoma</td>
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<td>365.13</td>
<td>Pigmentary open-angle glaucoma</td>
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<td>365.62</td>
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### Common ICD-9-CM Ophthalmology Codes

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<td>250.52</td>
<td>Diabetes mellitus with ophthalmic manifestations type ii uncontrolled</td>
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<td>333.81</td>
<td>Blepharospasm</td>
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<td>351.00</td>
<td>Bell's palsy</td>
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<td>361.00</td>
<td>Retinal detach with retinal defect unspec</td>
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<td>361.06</td>
<td>Old retinal detach partial</td>
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<tr>
<td>361.07</td>
<td>Old retinal detach total or subtotal</td>
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<td>361.30</td>
<td>Retinal defect unspec</td>
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<td>361.31</td>
<td>Round hole retina w/o detach</td>
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<td>361.32</td>
<td>Horseshoe tear retina w/o detach</td>
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<td>Proliferative diabetic retinopathy</td>
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<td>362.54</td>
<td>Macular cyst hole or pseudohole retina</td>
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<tr>
<td>362.56</td>
<td>Macular puckering retina</td>
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<td>362.57</td>
<td>Drusen (degenerative) retina</td>
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<td>362.83</td>
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<td>Hyphema iris &amp; ciliary body</td>
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<td>375.15</td>
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<td>379.00</td>
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<td>379.91</td>
<td>Pain in or around eye</td>
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<tr>
<td>V45.61</td>
<td>Cataract extraction status</td>
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</tbody>
</table>
Explaining Glaucoma to Patients

Education: the key to better compliance

Providing your patients with a basic understanding of their condition during the first visit is of the utmost importance. Compliance can be increased when patients have:

- A complete understanding of the severity of the disease—blindness can be permanent
- An appreciation for the use of medication to treat the disease
- Instructions on how to take medication
- Knowledge of the long-term benefits of medication vs the short-term side effects, such as hyperemia

Answers to patients’ FAQ

What is glaucoma?

Glaucoma is a serious eye disease and a leading cause of preventable blindness among adults in the United States. It is characterized by unusually high pressure inside the eye. This intraocular pressure (IOP) can damage the optic nerve and lead to permanent vision loss. While glaucoma is a lifelong condition, lowering IOP with daily treatment can prevent further vision loss.\(^1\)
What are the types of glaucoma?
The 2 main types of glaucoma are primary open-angle glaucoma (POAG) and primary angle-closure glaucoma (PACG). Both are marked by an increase of IOP, or pressure inside the eye. When optic nerve damage is present, despite a normal IOP, this is called normal-tension glaucoma (NTG).

When another disease causes or contributes to increased IOP, resulting in optic nerve damage and vision loss, it is called secondary glaucoma.2

Who gets glaucoma?
Glaucoma affects about 4 million Americans today, but only about half know they have it.2 People who are aged 40 or older, are African American, have diabetes, or have immediate family members with glaucoma are at higher risk of developing glaucoma.3

How does glaucoma affect my eyes?
Your eyes naturally contain fluid, which keeps them nourished and healthy. Normally, this fluid flows and drains freely. In people with glaucoma, the fluid does not drain properly, which causes increased IOP. If IOP remains high for too long, it can permanently damage the optic nerve and impair your vision.

Does glaucoma have any early warning signs?
Unfortunately, glaucoma does not have any early warning signs. You can’t feel increased IOP, and it takes a while for you to notice that it has affected your vision. At that point, permanent damage has already occurred. Only your doctor can detect glaucoma before vision loss occurs. That’s why it’s so important to keep your annual eye appointment.

Is there a cure for glaucoma?
Although there is no cure for glaucoma, reducing IOP is the best way to manage glaucoma and help prevent vision loss. It is important to lower your IOP because significant damage to your optic nerve may occur before you notice any difference in your vision. That’s why early detection and ongoing treatment are so vital. Studies show that IOP-lowering medications can help delay or prevent the development of glaucoma and its associated vision loss.4-6

How is glaucoma treated?
Reducing IOP by taking medication or through surgery is the best way to manage glaucoma and reduce the risk for progressive visual field loss. Clinical studies have shown that by lowering IOP—and keeping it low—patients may lower their risk for visual field loss.4-6

How long must I take my medication?
Glaucoma requires lifelong treatment. If you have been diagnosed with glaucoma, it is important to continue therapy even if you feel fine or experience eye redness. Remembering to take your eyedrops is easier if you make it part of your daily routine. Committing to taking your medication exactly as prescribed is the best way to manage glaucoma and prevent or delay any further vision loss.
Patient Tips for Easy Eyedrop Administration

Simple instructions you can provide to patients

1. Wash your hands. Tilt your head back and look at the ceiling.

2. Using your index finger, gently pull down your lower eyelid to form a pocket.

3. Gently squeeze 1 drop into the pocket. Do not let the bottle tip touch your eye, your fingers, or anything else.

4. Gently close your eyes and lightly press on the inside corners of your eyes.

5. Then carefully blot away any excess liquid that may be on your skin.

Tips

1. If you wear contacts, remove them before instilling your eyedrops. Wait 15 minutes after using eyedrops before putting your contacts back in.

2. If you use more than 1 type of eyedrop, always wait 5 to 10 minutes between administration of each medication.

3. Sometimes eyedrops can cause a few moments of blurry vision—be sure to wait until it clears before doing activities such as driving.
<table>
<thead>
<tr>
<th>Online Glaucoma Resources</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td><strong>For in-depth information about glaucoma and its treatment</strong></td>
<td></td>
</tr>
<tr>
<td>• American Glaucoma Society (AGS): <a href="http://www.glaucomaweb.org">www.glaucomaweb.org</a></td>
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<td>• Glaucoma Research Foundation: <a href="http://www.glaucoma.org">www.glaucoma.org</a></td>
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<td>• Glaucoma Service Foundation to Prevent Blindness: <a href="http://www.willsglaucoma.org">www.willsglaucoma.org</a></td>
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<td>• International Glaucoma Association (IGA): <a href="http://www.glaucoma-association.com">www.glaucoma-association.com</a></td>
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<td>• Joint Commission on Allied Health Personnel in Ophthalmology (JCAHPO): <a href="http://www.jcahpo.org">www.jcahpo.org</a></td>
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<td>• The Glaucoma Foundation (TGF): <a href="http://www.glaucomafoundation.org">www.glaucomafoundation.org</a></td>
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<td>• ALPHAGAN® P (brimonidine tartrate ophthalmic solution) 0.1%: <a href="http://www.AlphaganP.com">www.AlphaganP.com</a></td>
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<tr>
<td>• COMBIGAN® (brimonidine tartrate/timolol maleate ophthalmic solution) 0.2%/0.5%: <a href="http://www.Combigan.com">www.Combigan.com</a></td>
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<tr>
<td>• LUMIGAN® (bimatoprost ophthalmic solution) 0.03%: <a href="http://www.lumigan.com">www.lumigan.com</a></td>
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How to Talk to Patients About LUMIGAN® (bimatoprost ophthalmic solution) 0.03% 30

References

History Taking

Definitions

Common Abbreviations

Common Glaucoma Medications
1. ALPHAGAN® P Prescribing Information.
2. Timolol Ophthalmic Prescribing Information.
3. Timoptic-XE® Prescribing Information.
4. Azopt® Prescribing Information.
5. Trusopt® Prescribing Information.
6. LUMIGAN® 0.03% Prescribing Information.
7. Travatan® Prescribing Information.
8. Travatan® Z Prescribing Information.
9. Xalatan® Prescribing Information.
10. COMBIGAN® Prescribing Information.
11. Dorzolamide Hydrochloride-Timolol Maleate Prescribing Information.

The Visual Field

How to Talk to Patients About LUMIGAN®

How to Talk to Patients About COMBIGAN®
1. Shorwood MB, Craven ER, Chou C, et al. for COMBIGAN® Study Groups I and II. Twice-daily 0.2% brimonidine-0.5% timolol fixed-combination therapy vs monotherapy with timolol or brimonidine in patients with glaucoma or ocular hypertension: a 12-month randomized trial. Arch Ophthalmol. 2006;124(12):1230-1236.

How to Talk to Patients About ALPHAGAN® P
1. ALPHAGAN® P Prescribing Information.
2. Day DG, Hollander DA. Brimonidine PURTE® 0.1% versus brinzolamide 1% as adjunctive therapy to latanoprost in patients with glaucoma or ocular hypertension. Curr Med Res Opin. 2008;24(3):1430-1442.

Treatment Guidelines for Glaucoma Patients

Interpreting a Prescription

Medicare Part D: Prescription Drug Coverage

Common Billing Codes

Explaining Glaucoma to Patients