


Glaucoma: Closed-angle versus Open-angle



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Objectives

- Differentiate between closed-angle glaucoma and open-angle glaucoma.
- Identify treatment options for closed-angle glaucoma or open-angle glaucoma.
- Identify medications to avoid in closed-angle glaucoma or open-angle glaucoma.

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Glaucoma Overview


- A group of eye conditions which cause optic nerve damage, leading to progressive, irreversible loss of vision
- Leading cause of irreversible blindness worldwide
 - US - second leading cause of blindness overall
- Open-angle glaucoma (OAG) is the most common form of glaucoma throughout the world accounting for about two-thirds of cases
- Once believed that glaucoma is caused by elevated intraocular pressure (IOP)



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Risk Factors

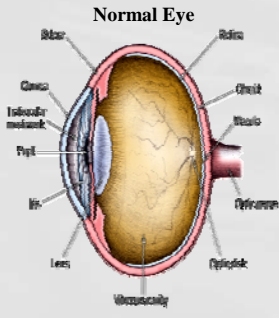
- Elevated intraocular pressure (IOP)
- Family history of glaucoma
- Ethnic background
- Age
- Prolonged corticosteroid use
- Previous eye injury
- Medical conditions



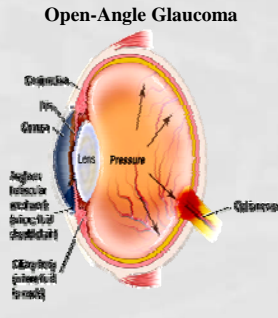
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Open-angle Glaucoma (OAG)

Normal Eye



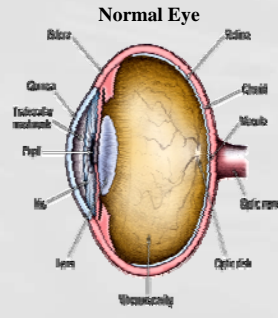
Open-Angle Glaucoma



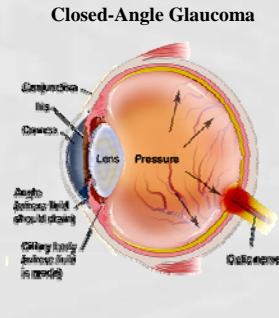
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Closed-angle Glaucoma (CAG)

Normal Eye



Closed-Angle Glaucoma



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Open-angle vs Closed-angle Glaucoma

Open-angle glaucoma

- Drainage canals in the eyes become clogged gradually
- Painless and causes no early symptoms
 - Blind spots or patches of vision loss
 - Central vision generally lost last
 - Tunnel vision
 - Complete blindness

Closed-angle glaucoma

- The normal drainage canals within the eye are physically blocked
- Acute
 - Abrupt onset of severe eye pain, redness, sudden loss of vision and headache
- Chronic
 - May cause vision damage without symptoms

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Drugs Used to Treat Glaucoma

- Decrease aqueous humour production
 - α -adrenoreceptor agonists
 - β -adrenoreceptor antagonists
 - Carbonic anhydrase inhibitors
- Increase aqueous humour outflow
 - α -adrenoreceptor agonists
 - Acetylcholine receptor agonists (cholinergics)
 - Prostaglandin analogues

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Alpha-adrenoreceptor Agonists

- **Mechanism of Action (MOA):** Decrease aqueous humor production and increase aqueous humor outflow
 - Brimonidine (Alphagan P[®])
 - Highly selective α_2 -adrenoceptor agonist
 - Apraclonidine (Iopidine[®])
 - Dipivefrin (Propine[®])
 - Epinephrine
- **Side effects:** Increase in blood pressure and heart rate

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Beta-adrenoreceptor Antagonists

- **MOA:** Decrease aqueous humour production
 - Betaxolol (Betoptic S[®])
 - Carteolol (Ocupress[®])
 - Levobunolol (Betagan[®])
 - Metipranolol (Optipranolol[®])
 - Timolol (Timoptic[®], Timoptic-XE)
- **Side effects:** Decreased heart rate, weakened myocardial contractility and bronchospasm

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Carbonic Anhydrase Inhibitors

- **MOA:** Decrease aqueous humour production
 - IV/ PO
 - Acetazolamide
 - Extended release oral capsule (Diamox Sequels[®])
 - PO
 - Methazolamide (Galuctabs[®])
 - Eye drops
 - Brinzolamide (Azopt[®])
 - Dorzolamide (Trusopt[®])
- **Side effects:** Altered taste, loss of appetite, electrolyte abnormalities, numbness or tingling and weight loss

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Acetylcholine Receptor Agonists

- **MOA:** Increase aqueous humour outflow
 - Carbachol (Miostat[®])
 - Echothiophate iodide (Phospholine iodide[®])
 - Physostigmine
 - Pilocarpine (Ocuser Pilo[®])
- **Side effects:** Eyes' inability to adapt to darkness, pupil constriction and blurred vision

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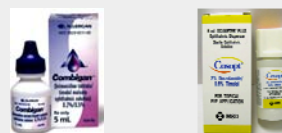
Prostaglandin Analogues

- **MOA:** Increase aqueous humour outflow
 - Popular choice for the first-line treatment of glaucoma
 - Bimatoprost (Lumigan®)
 - Latanoprost (Xalatan®)
 - Travoprost (Travatan®, Travatan Z®)
- **Side effects:** Change in iris color, periorbital hyperpigmentation, trichiasis, and hypertrichosis

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Combination Therapy

- Brimonidine tartrate/Timolol maleate (Combigan®)
 - Decrease aqueous humour production
- Dorzolamide HCl/Timolol maleate (Cosopt®)
 - Decrease aqueous humour production



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Pilocarpine for CAG

- Chronic angle-closure glaucoma (CAG)
 - Portions of the anterior chamber angle are closed permanently
- Treatment
 - Pilocarpine
 - Dose: 1 or 2 drops three to four times per day
 - Individuals with heavily pigmented irides may require higher strengths
 - Patients may be maintained on pilocarpine as long as IOP is controlled and no deterioration in visual fields occurs

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Surgical Treatment: OAG

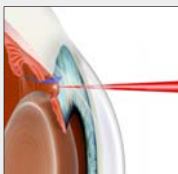
- Laser trabeculoplasty
 - Uses a laser to open up the drainage angle of the eye
- Trabeculectomy
 - Part of the eye's trabecular meshwork and adjacent structures are removed
- May be helpful in the treatment of open-angle glaucoma that continues to get worse in spite of medication therapy



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Surgical Treatment: CAG

- Laser iridotomy
 - Laser spots are applied to make a small hole through the iris
 - Aqueous humour flows freely between the anterior chamber and the posterior chamber
 - Procedure of choice in angle-closure glaucoma
- Chronic angle closure glaucoma
 - Eye drops usually still required



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Treatment Options: CAG

- Incisional iridectomy
 - A small section of peripheral iris is removed through a limbal incision
 - Very effective and safe surgical procedure for glaucoma treatment
 - Some disadvantages:
 - Operating room procedure
 - Costlier than laser iridotomy
 - Longer postoperative recovery time



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Treatment Options: CAG

- Acute angle-closure attack
 - Dilation of the eye results in a pathologic iris-lens apposition
 - Medical emergency
 - Goal: To reduce intraocular pressure
 - Treatment includes:
 - Acetazolamide
 - Topical β -adrenoreceptor antagonist
 - Topical steroid
 - Laser peripheral iridotomy

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Lifestyle Modifications

- The following factors have been found to affect intraocular pressure:
 - Caffeine intake
 - A single cup of coffee can elevate IOP by 1 to 4 millimeters of mercury for at least 90 minutes
 - Alcohol
 - Dose-dependent decrease in IOP after ingestion
 - Regular alcohol consumption is associated with increased IOP
 - No studies have shown alcohol use to be a risk factor for the development of glaucoma
 - Exercise
 - Lowers IOP in the immediate post-exercise period
 - Exercise and physical fitness may slow glaucoma progression


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Use with Caution in OAG

- Corticosteroids
 - May produce elevation of intraocular pressure (IOP)
 - Steroid-induced IOP elevation typically occurs within a few weeks of beginning steroid therapy
 - More likely from topically applied drops (including topically applied creams to the periorbital area) or intravitreal injection
 - In most cases, the IOP lowers spontaneously to the baseline within a few weeks to months upon stopping the steroid

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Agents that Cause Mydriasis

- | | | |
|---|--|---|
| <ul style="list-style-type: none"> • Anticholinergic agents <ul style="list-style-type: none"> • Ipratropium bromide • Atropine • Scopolamine • Anti-histaminics • Anti-spasmodics |  | <ul style="list-style-type: none"> • Adrenergic agents <ul style="list-style-type: none"> • Nebulized β_2-adrenergic agents • Amphetamines • Antidepressants <ul style="list-style-type: none"> • Imipramine • Monoamine oxidase inhibitors • Phenylephrine |
|---|--|---|

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Pharmacist's Role

- January is National Glaucoma Awareness Month!
- Examinations
- Compliance
- Side-effects
- Expiration date
- How to instill eye drops



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Self Assessment Questions



- **True or False**
 - Closed-angle glaucoma is the most common type of glaucoma.
 - Timolol eye drops may be used to treat both closed-angle and open-angle glaucoma.
 - Anticholinergics are contraindicated in patients with closed-angle glaucoma.

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