



OCCULAR HYPERTENSION

- Drugs which are used to treat ocular hypertension include:
 - **Autonomic drugs: these in turn include:**
 - ✓ Cholinergic drugs:
 - ❖ Pilocarpine (direct).
 - ❖ Physostigmine (indirect).
 - ✓ Anticholinergic drugs:
 - ❖ Atropine.
 - ❖ Homatropine.
 - ❖ Cyclopentolate.
 - ✓ Adrenergic drugs:
 - ❖ Epinephrine (direct).
 - ❖ Ephedrine (indirect).
 - ❖ Difiveprine (prodrug).
 - ✓ Antiadrenergic drugs:
 - ❖ Timolol.
 - ❖ Corteolol.
 - ❖ Betaxolol.
 - **Prostaglandin analogs: these include the following drugs:**
 - ✓ Latanoprost (topical).
 - ✓ Bimatoprost (topical).
 - ✓ Travoprost (topical).
 - **Carbonic anhydrase inhibitors (diuretics):**
 - ✓ Dorzolamide (topical).
 - ✓ Acetazolamide (systemic).
 - ✓ Mannitol (systemic).
- Remember that aqueous humor is produced from ciliary body. Then, it enters the anterior chamber of the eye to be drained through canal of Schlemm.
- Autonomic receptors in the eye:
 - **Radial muscles of the iris:** they have α_1 -adrenergic receptors which result in dilation of the pupil when they are contracted (mydriasis).
 - **Circular muscles of the iris (constrictor papillae):** they have M_3 -muscarinic receptors which result in constriction of the pupil when they are contracted (miosis).
 - **Ciliary muscles:** they have 2 types of receptors:
 - ✓ B_2 -adrenergic receptors which result in relaxation of ciliary muscle → therefore, lens becomes flatter to accommodate with far vision.
 - ✓ M_3 -muscarinic receptors which result in widening of the drainage angle.
- What are the effects of cholinergic and anticholinergic drugs on the eye?
 - **Cholinergic drugs: they cause the following effects:**
 - ✓ Contraction of constrictor papillae muscle: leading to constriction of the pupil (miosis).
 - ✓ Contraction of ciliary muscle: resulting in:
 - ❖ *Accommodation of the eye for near vision* (due to relaxation of suspensory ligaments → lens becomes more biconvex).
 - ❖ *Decrease in intraocular pressure (IOP)* due to widening of the drainage angle.
 - **Anticholinergic drugs: they cause the opposite effects on the eye:**
 - ✓ Blocking the action of acetylcholine on constrictor papillae muscle: leading to dilation of the pupil (mydriasis) and loss of light reflex (photophobia).
 - ✓ Relaxation of ciliary muscle: resulting in:
 - ❖ *Loss of accommodation reflex* (cycloplegia) especially for near vision.

- ❖ *Increased intraocular pressure (IOP)* due to narrowing of the drainage angle.



<u>Effects</u>	<u>Cholinergics</u>	<u>Anticholinergics</u>
Papillary size	Miosis	Mydriasis
Light reflex	Present: notice if there is maximum constriction of the pupil with use of these drugs, further constriction in response to light reflex is not possible (because the pupil is already pinpoint)	Absent (photophobia)
Accommodation	For near vision	Lost
Formation of aqueous humor	-	-
Drainage of aqueous humor	Increased	Decreased
Intraocular pressure	Decreased	Increased

- What are the effects of adrenergic and antiadrenergic drugs on the eye?

- **Adrenergic drugs: they cause the following effects:**
 - ✓ Contraction of radial muscles of the iris: leading to dilation of the pupil (mydriasis).
 - ✓ Increased drainage of aqueous humor thus lowering intraocular pressure (IOP) but notice that adrenergic drugs are rarely used for lowering (IOP) in the eye.
- **Antiadrenergic drugs: they decrease intraocular pressure** via decreasing the formation of aqueous humor (not by increasing the drainage as cholinergic and adrenergic drugs do).

<u>Effects</u>	<u>Adrenergics</u>	<u>Antiadrenergics</u>
Papillary size	Mydriasis	-
Light reflex	Present	-
Accommodation	-	-
Formation of aqueous humor	-	Decreased
Drainage of aqueous humor	Increased	-
Intraocular pressure	Decreased	Decreased

- What are the effects of diuretics and prostaglandin analogs on the eye?

- **Diuretics:** they decrease intraocular pressure via decreasing the formation of aqueous humor (same as antiadrenergic drugs).
- **Prostaglandins:** they decrease intraocular pressure via increasing the drainage of aqueous humor (same as cholinergic and adrenergic drugs).
- **Glaucoma (المياه الزرقاء):** it usually occurs when pressure in your eye increases. This can happen when eye fluid isn't circulating normally in the anterior chamber of the eye. Normally, this fluid, called aqueous humor, flows out of the eye through a mesh-like channel. If this channel becomes blocked, fluid builds up, causing glaucoma.
- **Fixed dose drug combinations for glaucoma:**
 - ✓ Timolol (0.5%) + latanoprost (0.005%)
(Antiadrenergic + Prostaglandin)
 - ✓ Timolol (0.5%) + travoprost (0.004%)
(Antiadrenergic + Prostaglandin)
 - ✓ Timolol (0.5%) + Dorzolamide (2%)
(Antiadrenergic + Diuretic)
 - ✓ Timolol (0.5%) + brimonidine (0.2%)
(Antiadrenergic + Adrenergic)



- **Acute glaucoma:** it is an emergency condition which has to be managed with aggressive use of osmotic diuretics and carbonic anhydrase inhibitors otherwise permanent damage to the eye will occur.
- **Drug-induced glaucoma:**
 - ✓ Topical anticholinergics (atropine, homatropine, cyclopentylate): because they decrease the drainage of aqueous humor.
 - ✓ Drugs with anticholinergic side effects:
 - ❖ *Tricyclic antidepressants.*
 - ❖ *Phenothiazines (antipsychotics).*
 - ❖ *Anti-histamines (H₁ blockers-sedative type).*
 - ✓ Corticosteroids:
 - ❖ More common with topical steroids (especially dexamethasone) than with systemic steroids.
 - ❖ Probably due to decreased outflow of aqueous humor.

ADMINISTRATION OF DRUGS INTO THE EYE

- Topical preparations:
 - Eye drops.
 - Ointment (not washed with tears).
 - Local injection (uncomfortable for the patient).
 - Ocular implants-sustained release.
- Application technique-related issues:
 - **Nasolacrimal duct:** you have to compress the medial aspect of the eye when you put the eye drop so it doesn't drain into the nasal cavity.
 - **Blinking:** it helps in distribution of the drug.
 - **Dilution overflow.**
- There might be systemic absorption of drugs topically applied to the eye.

ANTI-INFLAMMATORY DRUGS OF THE EYE

- Corticosteroids:
 - **Used for:** anterior segment inflammation (including post-surgical).
 - **Available forms (all are topical):** eye drop, ointment and subconjunctival injection.
 - **Risks associated with the use of topical corticosteroids:**
 - ✓ Steroid glaucoma (as mentioned earlier and it happens especially in susceptible individuals).
 - ✓ Steroid cataract (especially after prolonged use). Cataract is clouding of the lens in the eye leading to decreased vision.
 - ✓ Thinning of cornea and sclera.
 - ✓ Undiagnosed red eye:
 - ❖ Corneal ulceration.
 - ❖ Masking of bacterial and fungal infections.
- Other anti-inflammatory drugs:
 - **Topical antihistamines:**
 - ✓ Examples include: anatazoline, azelastine, ketotifen, lodoxamide and olopatidine.
 - ✓ These are used for allergic conjunctivitis. Notice that they can also be combined with sympathomimetic vasoconstrictors to relieve congestion.



- **Mast-cell stabilizers:**
 - ✓ Examples include: nedocromil and sodium cromoglycate.
 - ✓ These are mainly used for seasonal allergic conjunctivitis.
- **NSAIDs:**
 - ✓ Examples include: flurbiprofen, diclofenac sodium and ketorolac trometamol.
 - ✓ These are used for:
 - ❖ Inflammatory conditions of the eye (including surgery).
 - ❖ Preventing intra-operative miosis during cataract surgery.
- **Leukotriene antagonists.**

TEAR DEFICIENCY

- Sodium chloride solution is used for dry eyes, tear deficiency and lubrication.

OCULAR DIAGNOSTICS

- Examples include: fluorescein sodium and rose bengal.
- They are used to locate the damaged area (combined with a local anesthetic to reduce stinging الشعور بالأسع).