

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

DR. Kanwal Sajid Abbasi
MCPS, FCPS, FRCS (Glasgow)
Senior registrar ophthalmology
BBH

OCULAR PHARMACOLOGY

Overview

- drug classifications
- delivery methods
- Preparations: eye drops, ointments, injections

Eye drops

- most ocular medications are delivered topically - maximizes anterior segment concentrations and minimizes systemic toxicity
- drug gradient from tear reservoir to corneal and conjunctival epithelium forces passive absorption

Eye drops

- Factors affecting absorption:
 - drug concentration (limited by tonicity) and solubility (aqueous solution v's suspension)
 - viscosity (increased residence time)

Eye drops

- lipid solubility: lipid rich epithelial cell membrane v's water rich stroma
- pH and ionic charge - most eye drops are weak bases existing in both charged and uncharged forms enhancing absorption

Eye drops

- Surfactants - preservatives used are surface-active agents that alter cell membranes in the cornea as well as bacteria, increasing drug permeability and preventing bacterial contamination

Eye drops

- Reflex tearing: ocular irritation and secondary tearing wash out of the drug reservoir in the tears and reduce contact time with cornea. This occurs when drops are not isotonic, have non-physiological pH or contain irritants

Eye ointments

- increases contact time of drug with ocular surface
- mixture of petrolatum and mineral oil
- water-soluble drugs are insolvent in the ointment and are present as microcrystals. The surface microcrystals dissolve in the tears, the rest are trapped until the ointment melts

Eye ointments

- only drugs with high lipid solubility and some water solubility will get into both tears and corneal epithelium eg. chloramphenicol and tetracycline both achieve higher aqueous levels as ointment rather than drops

Peri-ocular injections

- subconjunctival, subTenon's and retrobulbar
- allow drugs to bypass the conjunctival/corneal epithelial barrier and reach therapeutic levels in the posterior segment
- eg anaesthetic agents, steroids, botulinum toxin

Intraocular injections

- allow instant drug delivery at therapeutic concentrations to target site
- intracameral eg. antibiotics, viscoelastics, miochol
- intravitreal eg. triamcinolone, avastin

Systemic

- ❑ drug getting into eye from systemic circulation limited by tight junctions in vascular endothelium of retinal vessels, and non-pigmented epithelium of ciliary body
- ❑ drugs with higher lipid solubility pass through blood-ocular barrier more readily

Systemic

- extent of drug bound to plasma proteins also effects access of drug into eye - only unbound form can pass blood-ocular barrier
 - bolus administration exceeds the capacity of a drug to bind to plasma proteins and so leads to higher intraocular drug levels than with slow IV drip

Sustained release devices

- devices available for steroid, gancyclovir delivery within vitreous cavity

CLASSIFICATION

USES:

- THERAPEUTIC
- DIAGNOSTIC

CLASSIFICATION

ROUTE

- TOPICAL
- SUBCONJUNCTIVAL
- SUBTENON
- INTRAVITREAL
- INTRALESIONAL
- SYSTEMIC

THERAPEUTIC

- ANTIBIOTICS
- ANTIVIRAL
- ANTIFUNGAL
- ANTI-INFLAMMATORY
- STEROIDS
- NSAIDS
- ANTIALLERGICS
- ANTIPARASITIC

- ANTIGLAUCOMA
- MYDRIATICS, CYCLOPLEGICS
- ARTIFICIAL TEARS
- ANTIOXIDANTS (Lutein, xanthin, copper, zinc, beta carotene)
- ANTI-VEGF
- ANTIMETABOLITES
- RIBOFLAVIN
- BOTULINUM TOXIN (BOTOX)

DIAGNOSTIC

- PROPARACAINE
- FLOURESCIEN
- ROSE BENGAL

ANTIBIOTICS

Route:

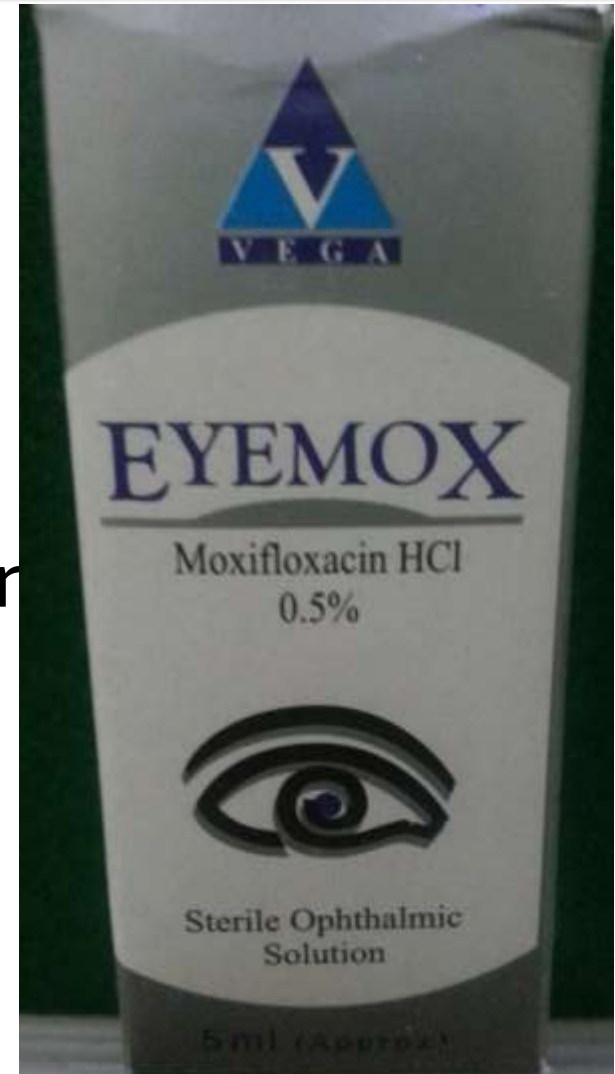
Topical

- CIPROFLOXACIN 0.3%
- MOXIFLOXACIN 0.5%
- TOBRAMYCIN 0.3%

MOA: act on DNA/RNA of bacter

Periocular

- Ceftazidime
- Vancomycin
- Cefuroxime



ANTIBIOTICS

Routes:

Intravitreal

- Ceftazidime
- Vancomycin
- Amikacin

Systemic

- Penicillins
- Cephalosporins
- Fluoroquinolones

MOA: cell wall inhibitors

ANTIBIOTICS

Uses:

- Bacterial Conjunctivitis
- Bacterial Corneal Ulcers
- Endophthalmitis
- Bacterial Uveitis (Syphylitic, Tuberculous)
- Bacterial Blephritis, Internal Hordeolum, External Hordeolum
- Dacryocystitis

ANTIVIRALS

Route:

Topical

- Acyclovir (ointment)

Intravitreal

Systemic:

- Acyclovir
- Ganciclovir
- Famciclovir
- Foscarnet
- HAART (Highly active antiretroviral therapy)

ANTIVIRALS

Uses:

- Herpes Simplex Keratitis
- Herpes Zoster Ophthalmicus
 - Epithelial Keratitis
 - Disciform Keratitis
 - Necrotizing Stromal Keratitis
- Viral Posterior Uveitis (CMV, HZV, HIV; Necrotizing Retinitis, Vitritis, Choroiditis)
- Viral Conjunctivitis

ANTIFUNGAL

Route:

Topical:

Natamycin 5%

Amphotericin B 0.15%

Econazole 1%

Systemic:

Voriconazole

Itraconazole

Fluconazole

ANTIFUNGAL

Uses:

- Fungal Keratitis (Ulcer)
- Fungal Endophthalmitis
- Fungal Retinitis & Choroiditis

ANTI-INFLAMMATORY

STEROIDS:

MOA: get translocated into nucleus, increase anti-inflammatory transcription of genes.

Route:

Topical:

- Dexamethasone
- Prednisolone
- Fluorometholone

Periocular (Subconjunctival, Subtenon)

- Triamcinolone
- Dexamethasone
- Methylprednisolone

ANTI-INFLAMMATORY

STEROIDS



ANTI-INFLAMMATORY

STEROIDS:

Route:

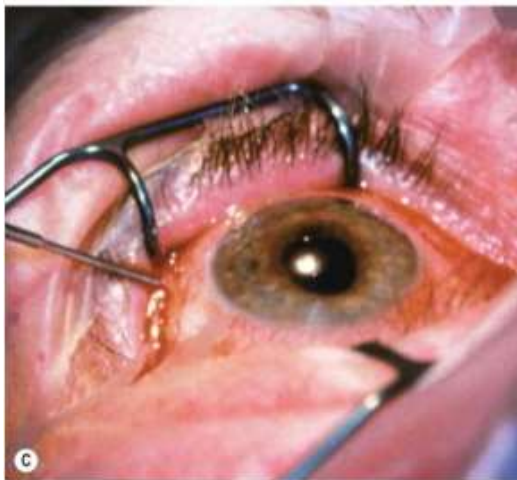
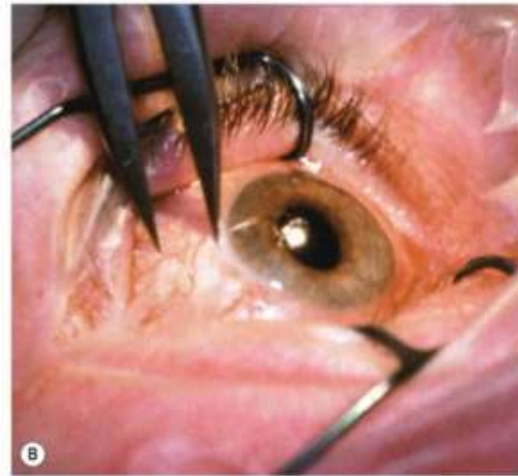
Intravitreal:

- Triamcinolone
- Dexamethasone

Intralesional:

- Triamcinolone

ANTI-INFLAMMATORY



ANTI-INFLAMMATORY

- Subtenon Injection



ANTI-INFLAMMATORY

Steroids:

Uses:

- Mooren's Ulcer
- Conjunctivitis (Bacterial, Viral, Allergic, VKC)
- Blephritis
- Uveitis
- Endophthalmitis
- Panophthalmitis
- Idiopathic Orbital Inflammatory Disease

ANTI-INFLAMMATORY

Steroids:

Uses:

- Optic Neuritis
- Chalazion
- Scleritis
- Episcleritis

ANTI-INFLAMMATORY

STEROIDS:

Route:

Systemic:

- Tab. Prednisolone
- Inj. Dexamethasone
- Inj. Methylprednisolone

ANTI-INFLAMMATORY

NSAID's:

Route:

Topical:

- Diclofenac Sodium
- Flurbiprofen
- Nepafenac

Systemic:

- Diclofenac

ANTI-INFLAMMATORY

Uses:

- Keratitis
- Conjunctivitis
- Uveitis
- Scleritis
- Episcleritis
- Dacryocystitis

ANTI-ALLERGICS

Routes:

Topical:

Antihistamines & Mast Cells Stabilizers

- Olopatadine
- Sodium Cromoglycate
- Ketotifen
- Tetrahydrozoline

ANTI-ALLERGICS

Uses:

- Allergic Conjunctivitis
- VKC
- Atopic Conjunctivitis

ANTIPARASITIC

Routes:

Topical

- Polyhexamethylene biguanide 0.2%
- Chlorhexidine Digluconate 0.02%
- Propamidine

Oral:

- Albendazole
- Ivermectin

- Uses:
- Acanthamoeba Keratitis
- Parasitic Uveitis
- Parasitic Endophthalmitis

ANTIGLAUCOMA

BETA BLOCKERS:

Mechanism of Action:

- Decrease IOP by decreasing aqueous secretion

Side Effects:

- Allergy, Bradycardia, hypotension, bronchoconstriction

Contraindication:

- Astma, COPD, heart blocks, CCF

BETA BLOCKERS:

- Timolol
- Betaxalol (Betoptic-S)
- Levobunolol (Betagan)



ALPHA-2 AGONISTS:

Mechanism of Action:

Decreased Aqueous production and increased uveoscleral Outflow

Preparations:

Brimonidine (Alphagan 0.2%)

Apraclonidine (Iopidine 1%) after Laser

PROSTAGLANDIN ANALOGUES:

Mechanism of Action:

- Act on prostaglandin receptor located in different ocular tissues and so regulate IOP and blood flow



PROSTAGLANDIN ANALOGUES:

Preparations:

- Latanoprost 0.005%, Travoprost 0.004% (F2 Alpha Analogues)
- Bimatoprost 0.03%
- Tefluprost 0.0015%

Side Effects:

- Eyelash thickening, lengthening, hyperpigmentation, and Iris and periobital skin hyperpigmentation
- Cystoid Macular Oedema

CARBONIC ANHYDRASE INHIBITORS:

MOA: Dec IOP by dec secretion of aqueous

Topical:

- Dorzolamide
- Brinzolamide

Systemic:

- Acetazolamide

MIOTICS:

- Pilocarpine 0.5%, 1%, 2%, 4%
- Carbachol 3%

MOA:

- In POAG → contraction of ciliary muscles → increase trabecular outflow
- In PACG → sphincter pupillae contraction → miosis → pulls iris away from trabeculum

Combined Preparations:

- Cosopt (Timolol, Dorzolamide)
- Xalacomb (Timolol, Latanoprost)
- Timpilo (Timolol, Pilocarpine)
- Combigan (Timolol, Brimonidine)
- Duotrav (Timolol, Travoprost)

SYSTEMIC CARBONIC ANHYDRASE INHIBITORS:

- Acetazolamide
- Dichlorphenamide
- Methazolamide

Side Effects:

- Paresthesias
- Malaise complex
- GI Disturbances
- Renal Stone formation
- Blood Dyscrasias
- Hypokalemia
- Stevens Johnson Syndrome

OSMOTIC AGENTS:

- Mannitol (1g/kg body wt, IV)
- Glycerol (2ml/kg body wt, orally)
- Isosorbide (2ml/kg body wt, orally)

Uses:

- When a temporary drop in IOP is required, (Acute angle closure, before intraocular surgery with raised IOP)



500 mL

MANNITOL

10% w/v Solution for Intravenous Infusion

Sterile, Non-pyrogenic, Single-dose Container

INDICATIONS:

Indicated to treat edema with adequate renal function to excrete the fluid. Indicated in patients with acute renal failure and in low fluid retention patients and hypotensive patients. It is also used for the short term management of glaucoma, especially to reduce intraocular pressure prior to ocular surgery and to control the duration of local anesthesia in dental surgery.

USAGE:

As directed by the physician. For intravenous administration.



Mfg. Lic. No.: G-4MVI
D.R. No.: XY37160

Batch No.: 72421019

Mfg. Date: 10/1-2012

Exp. Date: 01/1-2015

FORMULATION:

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

MANNITOL

10% w/v Solution for Intravenous Infusion

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

100 mg

MYDRIATICS & CYCLOPLEGICS

Topical

- Cyclopentolate 1%
- Tropicamide 1%
- Atropine 1%

Subconjunctival (Mydricine)

- Atropine, Adrenaline, Lignocaine



MOA:

- to prevent posterior synechie formation,
- To break PS
- To relieve the sphincter spasm

Uses:

- Uveitis
- Corneal Ulcer

ANTIOXIDANTS

- Lutein, xanthin, copper, zinc, beta carotene)

Uses:

- Retinal diseases e.g. Age-related Macular degeneration, Retinitis Pigmentosa and other hereditary fundus dystrophies

ANTI-VEGF

- Avastin, Bevacizumab
- Intravitreal
- Proliferative Retinopathies due to ischememic Retina(PDR, NVG, Post CRVO)

RIBOFLAVIN DROPS:

- Used in keratoplasty treatment CXL (corneal cross-linkages)

BOTULINUM TOXIN (BOTOX)

- Hemifacial Spasms
- Squint
- Cosmetic

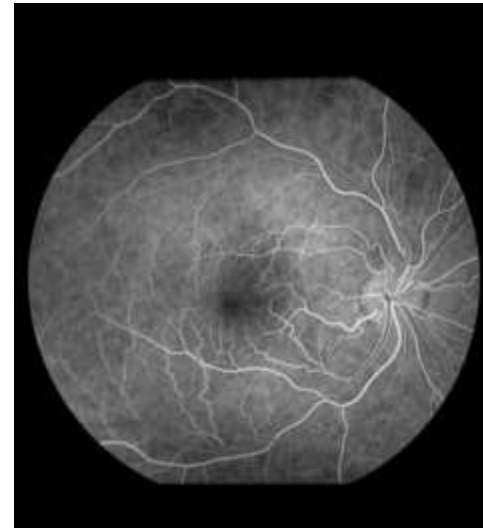
- **Artificial tears:**
- Dry eye, corneal ulcers
- Drops. Gels
- Hyperomellose, viscotears, polyvinyl alcohol.
- Acetylcystein
- **Antimetabolites**
- 5-fluorouracil, mitomycin c
- Glaucoma surgery(trab), pterygium excision.
- MOA: inhibit DNA synthesis and replication.

DIAGNOSTIC

- PROPARACAINE
- FLOURESCIEN
- ROSE BENGAL

Fundus Fluorescein Angiography

- Diabetic Retinopathy
- Macular Oedema
- Macular Hole
- AMD



FLUORESCIN AND ROSE BENGAL STRIPS

- Corneal Ulcers
- Filamentary Keratitis (Dry Eye)



Proparacaine

- Local anesthetic
- To remove foreign bodies
- Suture Removal



MYDRIATICS & CYCLOPLEGICS

Topical

- Cyclopentolate 1%
- Tropicamide 1%
- Atropine 1%

Uses:

- Fundoscopy
- Cycloplegic Refraction in Children
- Squint

Any Questions??

THANKYOU