# OCULAR THERAPEUTICS

# Drug Delivery in Eyes

| Topical | Periocular | Intraocular | Systemic |
|---|---|---|---|
| drop | Subconj. | Intracameral | oral |
| ointment | Subtenon | Intravitreal | intravenous |
| gel | Peribulbar | | Intramuscular |
| Soft contact lens | Retrobulbar | | |

# TOPICAL

**Drop (Gutta)**- simplest and more convenient
mainly for day time use

1 drop=50 microlitre

Conjuctival sac capacity=7-13 micro liter

so, even 1 drop is more than enough

**Method**

hold the skin below the lower eye lid

↓

pull it forward slightly

↓

INSTALL 1 drop

- **measures to increase drop absorption**:
  - -wait 5-10 minutes between drops
  - -compress lacrimal sac
  - -keep lids closed for 5 minutes after instillation

# Ointments

- Increase the contact time of ocular medication to ocular surface finds better effect
- It has the disadvantage of vision blurring
- The drug has to be high lipid soluble with some water solubility to have the maximum effect as ointment

# Peri-ocular injections

- They reach behind iris-lens diaphragm better than topical application
- E.g. subconjunctival, subtenon, peribulbar, or retrobulbar
- This route bypass the conjunctival and corneal epithelium which is good for drugs with low lipid solubility (e.g. penicillins)
- Also steroid and local anesthetics can be applied this way

# Periocular

**Subconjunctival -** To achieve higher concentration
Drugs which can't penetrate cornea due to large size
Penetrate via sclera

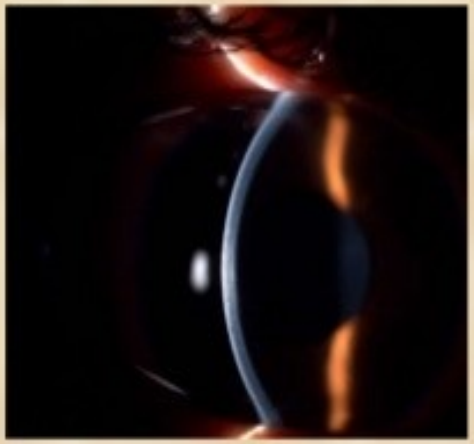
**Subtenon**— ant. Subtenon– disease ant to the Lens
Post Subtenon– disease posterior to the lens

**Retrobulbar**-Optic neuritis
Papillitis
Posterior uveitis
Anesthesia

**Peribulbar**-- anesthesia

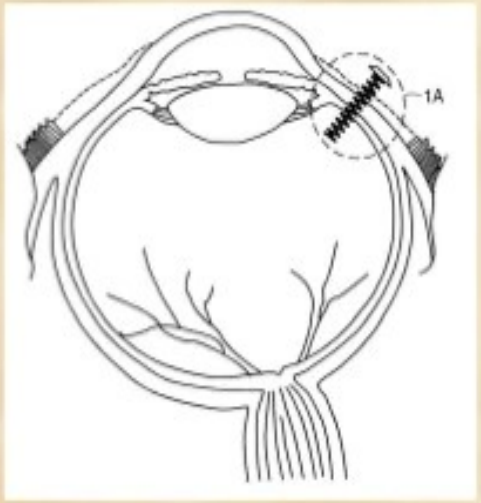
# Intraocular injections

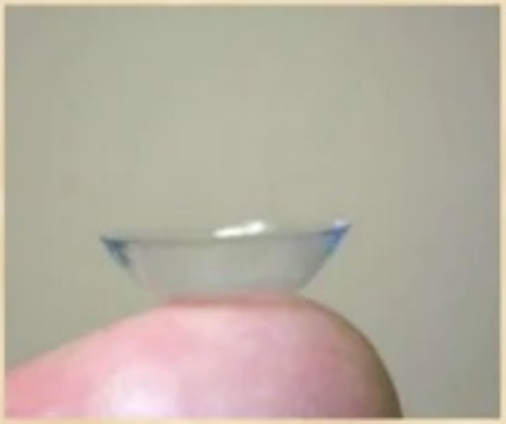
- Intracameral or intravitreal
- E.g.
  - Intracameral acetylcholine (miochol) during cataract surgery
  - Intravitreal antibiotics in cases of endophthalmitis
  - Intravitreal steroid in macular edema
  - Intravitreal Anti-VEGF for DR



# Sustained-release devices

- These are devices that deliver an adequate supply of medication at a steady-state level
- E.g.
  - Ocusert delivering pilocarpine
  - Timoptic XE delivering timolol
  - Ganciclovir sustained-release intraocular device
  - Collagen shields



# ANTIBIOTICS

- 4th generation fluroquinolones
- Broad spectrum antibiotics
- Aminoglycosides.
- Penicillin groups.

# ANTIFUNGAL

**INDICATIONS**

Fungal corneal ulcer
Fungal retinitis/ Endophthalmitis

**Commonly used drugs are**

- **Polyenes**
  - damage cell membrane of susceptible fungi
  - e.g. amphotericin B, natamycin, nystatin
  - side effect: nephrotoxicity
- **Imidazoles**
  - increase fungal cell membrane permeability
  - e.g. miconazole, ketoconazole,fluconazile
- **Flucytocine**
  - act by inhibiting DNA synthesis

## Imidazoles :-

MOA - Block fungal cytochrome P-450 enzyme in ergosterol
[increase permeability tru membrane]

Clotrimazole :- [1 % topical]

Miconazole :- [ 1 % drops,2 % oint, 5-10 mg sub conj ]

Ketoconazole :- [200-800 mg oral daily , 0.5 mg intravitreal]
Uses :- candida,fungal , endoophthalmitis
Side effect:- liver toxicity

## Triazoles :-

Fluconazole - [100-200 mg oral]
[0.2% topical]
[0.1 mg intravitreal]
Uses :- Candida,cryptococcus

# Antivirals

- Acyclovir

3% oinment 5 times-10-14 days

800mg oral 5 times 10-14 days

intravenous for Herpes zoster retinitis

Others

- Idoxuridine
- Vidarabine
- Cytarabine
- Triflurothymidine
- Gancyclovir

**INDICATIONS**

HZ keratitis

Viral uveitis

# Antiviral Agents for Ophthalmic Use…

| GENERIC NAME | ROUTE OF ADMINISTRATION | OCULAR TOXICITY | INDICATIONS FOR USE |
|---|---|---|---|
| Foscarnet | Intravenous<br>Intravitreal | ----- | Cytomegalovirus Retinitis |
| Ganciclovir | Intravenous, Oral<br>Intravitreal implant | ----- | Cytomegalovirus Retinitis |
| Valganciclovir | Oral | ------- | Cytomegalovirus Retinitis |
| Cidofovir | Intravenous | ------ | Cytomegalovirus Retinitis |

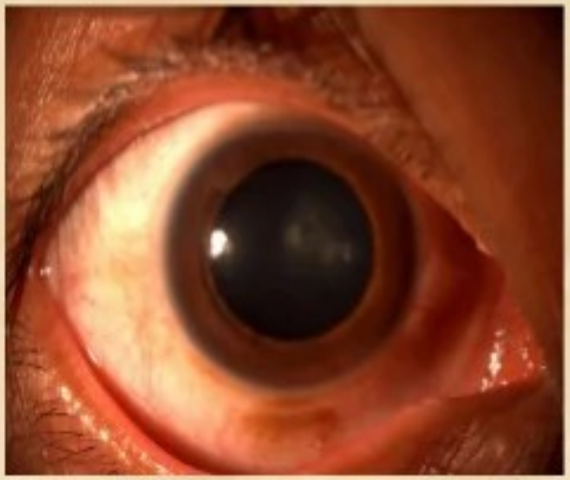
# Mydriatics and cycloplegics

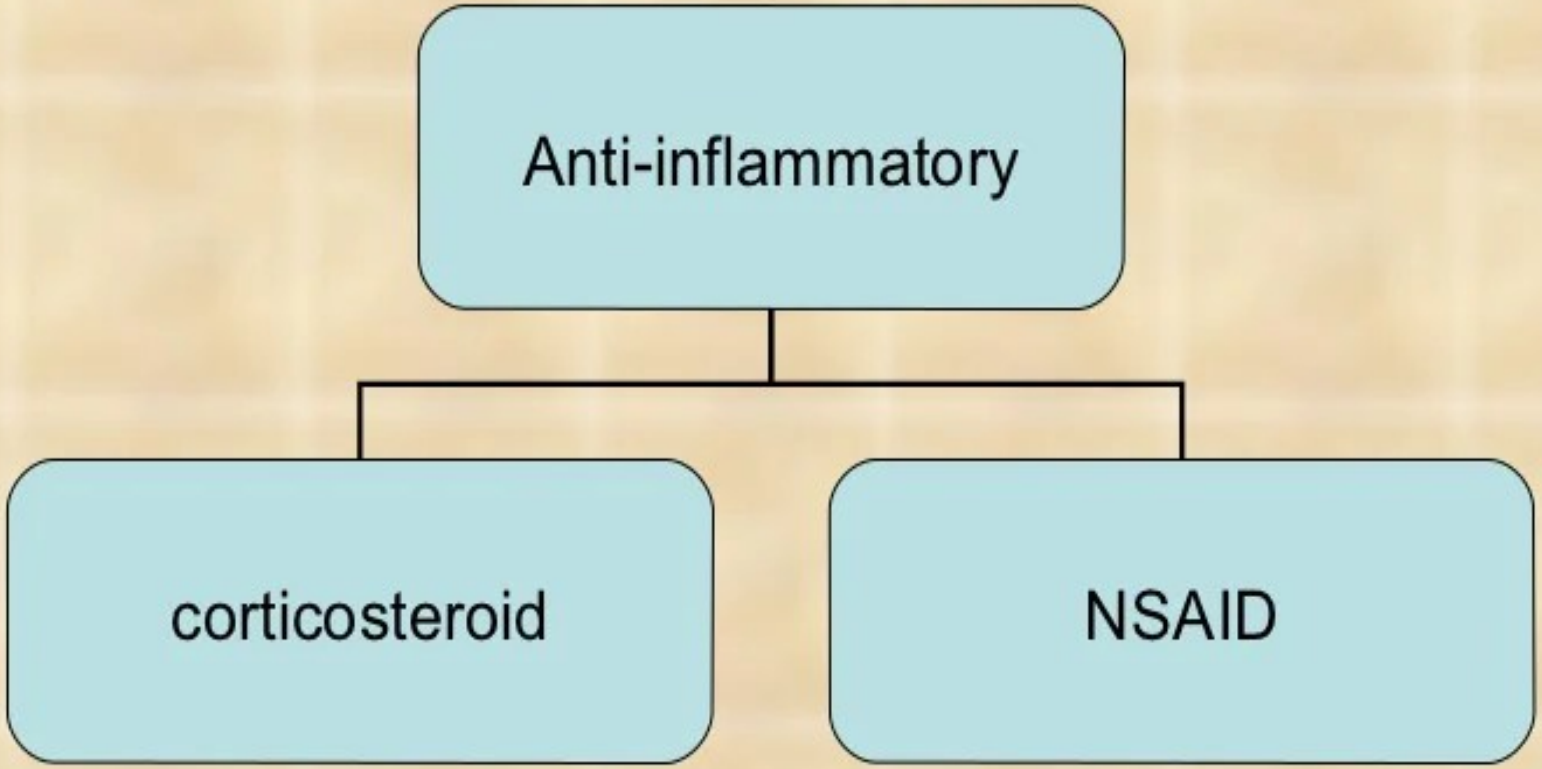
- Dilate the pupil, ciliary muscle paralysis
- **CLASSIFICATION**

Short acting- Tropicamide (4-6 hours)
Intermediate- homatropine ( 24 hours)
Long acting- atropine (2 weeks)

**Indications**

corneal ulcer
uveitis
cycloplegic refraction




Anti-inflammatory
corticosteroid
NSAID

# Indications

**Topical**

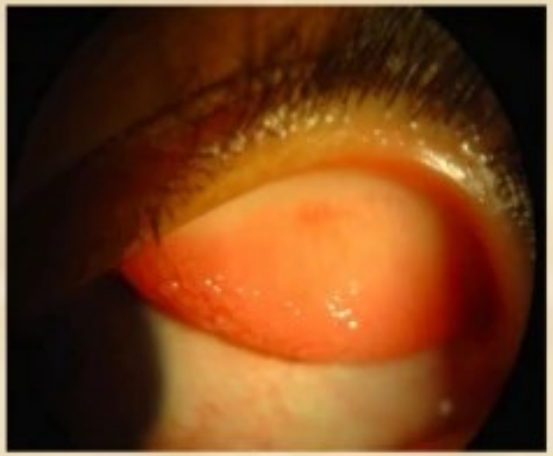
allergic conjunctivitis,
scleritis,
uveitis,
allergic keratitis
after intraocular and extra ocular surgeries

**Systemic (pathology behind the LENS)**

Posterior uveitis
Optic neuritis
corneal graft rejection

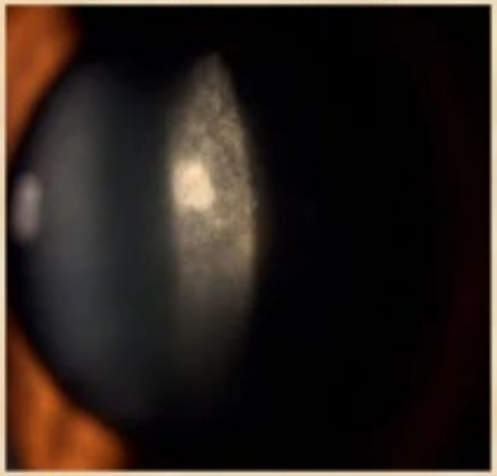
**NEVER GIVE STEROID IF YOU ARE SUSPECTING ACTIVE INFECTION**

# ALLERGIC CONJUNCTIVITIS

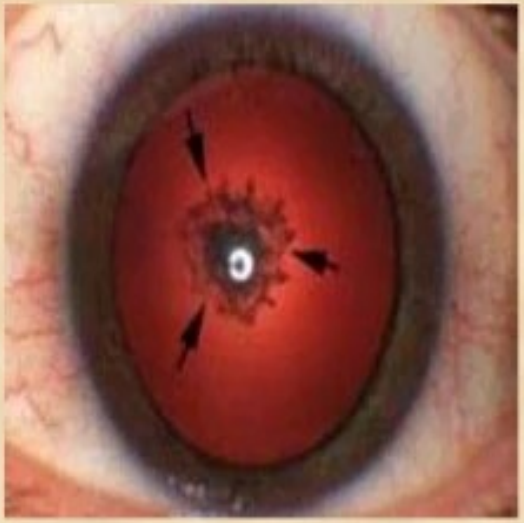


SCLERITIS

- **Side effects**



- **OCULAR**
  glaucoma
  cataract
  activation of infection
  delayed wound healing



# NSAIDS

- **Topical use**
  - flurbiprofen
  - indomethacine
  - ketorolac


**Indications**

episcleritis and scleritis

uveitis

CME

PRE operatively to maintain dilation of the pupil

# Ocular Lubricants

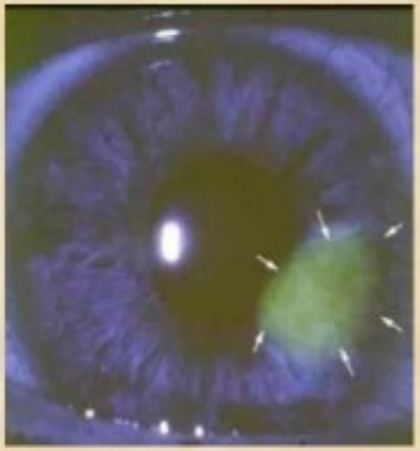
- **Indication**
  - ocular irritations in various diseases
  - Dry eyes

**Commonly available commercial tear substitutes**

REFRESH TEARS
TEAR PLUS
MOISOL
OCCUWET
DUDROP

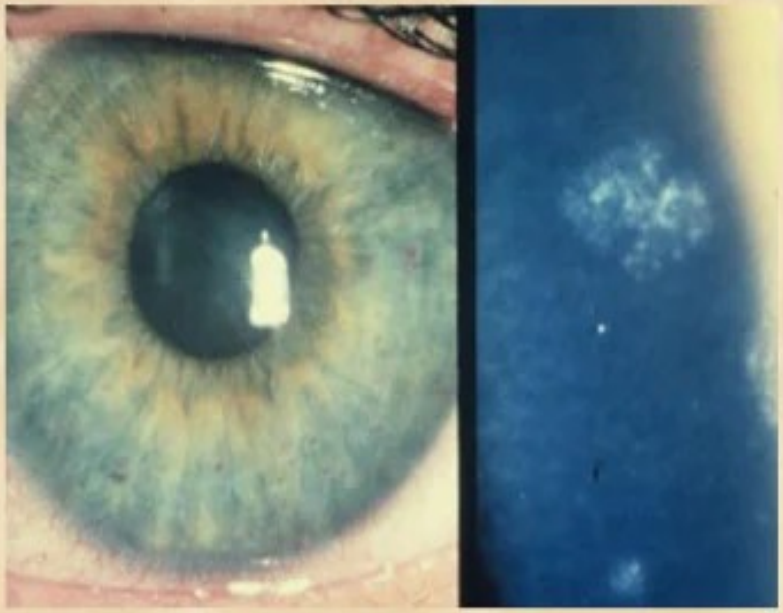
# Ocular diagnostic drugs

- Fluorescein dye
  - Available as drops or strips
  - Uses stain corneal abrasions, applanation tonometry, detecting wound leak, NLD obstruction, fluorescein angiography
  - Caution:
    - stains soft contact lens
    - Fluorescein drops can be contaminated by Pseudomonas sp.



# Ocular diagnostic drugs

- Rose bengal stain
  - Stains devitalized epithelium
  - Uses: severe dry eye, herpetic keratitis



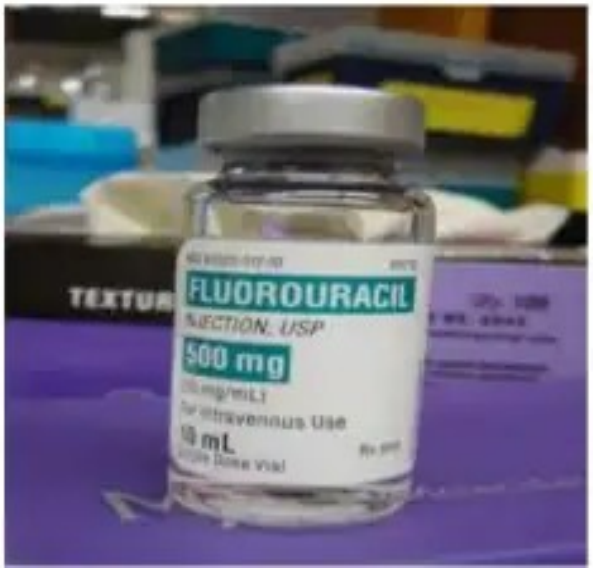
# Local anesthetics

- topical
  - E.g. propacaine, tetracaine
  - Uses: applanation tonometry, goniscopy, removal of corneal foreign bodies, removal of sutures, examination of patients who cannot open eyes because of pain
  - Adverse effects: toxic to corneal epithelium, allergic reaction rarely

# Immunosuppressive & Antimitotic Agents

Agents commonly used –

1. 5-fluorouracil
2. Mitomycin C



# Therapeutic Uses

1. In Glaucoma surgery, to improve success of filtration surgery by limiting postoperative wound-healing process.

2. In corneal surgery, topical mitomycin – To reduce risk of scarring after excision of pterygium

3. Conjunctival papilloma & conjunctival tumours – Interferon alpha- 2b

4. Uveitis & uveitic cystoid macular edema – Intraocular Methotrexate

# Immunomodulatory Agent

## Topical Cyclosporine

- Approved for the treatment of chronic dry eye associated with inflammation

-Decreases inflammatory markers in lacrimal gland & increases tear production

# Agents Used to treat Retinal Neovascularization & Macular Degeneration

1. Verteporfin
2. Pegaptanib
3. Bevacizumab
4. Ranibizumab

# Bevacizumab

- Monoclonal antibody against Vascular Endothelial Growth Factor (VEGF)

- Inhibits vascular proliferation & tumor growth
- Intravitreal injection weekly/monthly

- **Off label Uses of Bevacizumab**

1. Proliferative Diabetic Retinopathy
2. Macular edema
3. Retinopathy of Prematurity
4. ARMD

# BIOLOGICAL AGENTS:

1. Povidone iodine
2. Viscoelastic substances
3. Ophthalmic Glue
4. Anterior Segment Gases
5. Vitreous Substitutes

| Sr. No. | Drugs & Biological Agents | Use in Ophthalmic Surgery |
|---|---|---|
| 1 | Povidone iodine (5% solution) | To prepare periocular skin & to irrigate cornea, conjunctiva & palpebral fornices |
| 2 | Viscoelastic substances(chondroitin sulphate, hudroxypropylmethylcellulose ) | Maintain spaces & protects surfaces during anterior segment surgery |
| 3 | Ophthalmic Glue-<br>a) Cyanoacrylate tissue adhesive<br>b) Fibrinogen Glue | Corneal ulcerations & Perforations<br><br>To secure conjunctiva & corneal grafts. |
| 4 | Anterior Segment Gases<br>a) Sulfur Hexafluoride (SF6)<br>b) Perfluoropropane | Reattachment of descemet's membrane to stroma of Cornea |
| 5 | Vitreous Substitutes | Reattachment of retina following Vitrectomy. |


Thank You