OPHTHALMIC PHARMACOLOGY

Anti-inflammatory & Anti-infectives

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TERMINOLOGY[1,4]

- Antigen – substance, usually foreign bodies or bacterial protein, stimulates the immune response by production of antibodies.
- Immune response – function of the body to produce cells and chemicals to protect itself from foreign substances.
- Antibodies – proteins, or immunoglobulins, produced in response to specific antigen (foreign substance).
- Lymphocyte – white blood cell produced during immune response; may be B-cell (Humoral -memory) or T-cell (Cell-mediated,killers).
- Mast cell – white blood cells that produce inflammatory mediators.
- Inflammation – Protective response by body to localize involved area of injury and infection.

ALLERGIC RESPONSE[1]

1. Antigen introduced (pollen, etc.)
2. Antigen binds to antibody
3. Antigen/antibody binds to mast cell
4. Mast cell degranulates, releases inflammatory mediators (ex. Histamines)
5. Inflammatory mediator connects to receptor.
6. Inflammatory response: swelling, itching, redness, and tearing

CLASSIC SIGNS OF INFLAMMATION

- RUBOR – redness
- CALOR – heat
- TUMOR – swelling
- DOLOR – pain

- Redness is produced as a result of vasodilation of blood vessels and more blood being pumped to the injured area.
- Swelling, heat, and pain are from immune mediators released and recruitment of inflammatory cells.

WHITE BLOOD CELLS (WBC)

- Different WBCs are produced during inflammation and allergic responses.

- Neutrophil – first line of defense during inflammation
- Lymphocyte – produced during chronic inflammation (B-cell)
- Monocyte – or macrophage; major phagocytes
- Eosinophils – produced during allergic inflammation
- Basophils – mast cells, result of the presence of histamines.

- Acronym: Never Let Monkeys Eat Bananas

CORTICOSTEROIDS

- Considered the “workhorses” of ophthalmic care in decreasing ocular inflammation. [1]
- Related to and mimic substances produced by the body to reduce inflammation.
- Do NOT eliminate the stimulant causing inflammation
- Steroid names routinely end in -one

NSAIDS

- Non-Steroidal Anti-Inflammatory Drugs
- Considered “aspirin-like”
- Inhibit synthesis of prostaglandins and cyclo-oxygenase (enzyme)

ACTIONS 2

- Reduce capillary permeability
- Inhibit degranulation of mast cells
- Decrease synthesis of prostaglandins and leukotrienes
- Inhibit cell-mediated immune response (T-cells)

TYPES OF CORTICOSTEROIDS

- Prednisolone – Pred Forte ™, Econopred Plus ™, and AK-Pred ™
- Fluorometholone – FML ™, Flarex ™
- Dexamethasone – Decadron™, Maxidex™
- Rimexolone – Vexol™
- Lotepredenol - Lotemax™

- Steroids have varying strengths and are prescribed to a patient accordingly. The strength and dosage will depend on degree of lesion and therapeutic response.

- Steroids should be discontinued in a step-down pattern. A sudden stop in these medications can lead to a relapse.

NSAIDS

- Aspirin – Bayer™, Bufferin™
- Diclofenac – Voltaren™
- Ibuprofen – Advil™,Motrin™
- Ketorolac – Acular™
- Flurbiprofen – Ocufen™

CONTRAINDICATIONS[2]

- Steroids are generally not used during an active infection due to the suppression of the immune response.
- Steroids should not be used in patients with Herpes Simplex Virus (HSV), Herpes Zoster Virus (HZV), or fungal keratitis.
- Adverse reactions: elevated intraocular pressures (steroid responder), and posterior subcapsular cataract (PSC)

ANTI-INFECTIVES

- Infections occur when the body's defense system is overcome by bacteria, parasites, viruses, or fungi. [1]
- The defense system consists of physical barriers (skin, membranes, and secretions), and the immune system.
- 3 families of anti-infectives: antibiotics, antiviral, and antifungal.
- Antibiotics are either bacteriostatic (inhibit growth) or bactericidal (kill bacteria)[3]

BACTERIA & MICROORGANISMS

Gram +ve:

- *Staphylococcus*
- *Streptococcus*

Gram –ve:

- *Pseudomonas*
- *Neiserria*

BACTERIOCIDAL AGENTS

- Penicillin – Ampicillin™
- Bacitracin™
- Ofloxacin – Ocuflox™
- Ciprofloxacin – Ciloxan™
- Tobramycin – Tobrex™

BACTERIOSTATIC AGENTS

- Erythromycin
- Sulfonamides

ANTIVIRAL

- Interfere with DNA synthesis inhibiting reproduction of viruses in cells.

- Vidarabine – Vira-A™
- Trifluridine – Viroptic™
- Acyclovir – Zovirax™
- Gancyclovir - Cytovene™

ANTIFUNGAL

- Natamycin – Natacyn™
- Only approved topical anti-fungal medication approved for ophthalmic use.
- Effective on infections caused by *Aspergillus*, *Fusarium*, *Candida*, and *Penicillum*.

COMBINATION ANTIBIOTICS

- Many times, antibiotics are combined with steroids.
- These allow simultaneous effects on bacteria and decrease of inflammation.
- Tobramycin/Dexamethasone – Tobradex™
- Gentamycin/Prednisolone Acetate – Pred-G™

REFERENCES

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3. Stein, HA et al., *The Ophthalmic Assistant: A guide for Ophthalmic Medical Personnel,* 2000, 7th Ed.
4. Cassin, B, Solomon S: *Dictionary of eye terminology,* Gainesville, FL, 1990, Triad