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Perioperative Care of the Eye Patient

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Objectives

• Understand the pharmacology of eye drops
• Learn the proper method of eye drop administration
• Know the indications for and complications of ocular anesthesia
• Learn how to properly patch an eye

Pharmacokinetics of the Eye

• Delivery systems: Drops, ointments
• Problems: small tear volume (7 ul)
• Quick turnover time
  – 1.2 ul min (16%/min)
• Lipid/water/lipid barrier
How to Overcome these problems?
- High concentrations
- Biphasic drugs when possible
  - Partition coefficient
  - Soluble in oil and water

Bioavailability: Penetration Into Ocular Tissues
- Concentration in ocular tissues
  - Tears
  - Cornea
  - Other intraocular structures
  - Vitreous
  What is concentration over time?

How do topical medications cause systemic side effects?
- Drainage into nasolacrimal duct and nose
  - Rich venous plexus; systemic absorption
  - High drug concentration in drops
Ophthalmic Preparations

- Diagnostic:
  - Dilating agents and proparacaine
- Antibiotics
- Glaucoma medications
- Anti-inflammatory drops: NSAID’s and steroid drops

Dilating drops (RED TOP)

Iris has sphincter and dilator muscle

- Sphincter: parasympathetic (stronger)
- Dilator: mostly sympathetic
- Dilation: paralyze sphincter or stimulate dilator muscle

Parasympatholytic agents:
Mydriacil, Cyclogyl, Homatropine, Atropine

- Primary difference is duration of action and muscarinic activity
  - Mydriacil peaks at 20 minutes, last for a few hours
  - Cyclogyl lasts about 1 day
  - Homatropine about 3 days
  - Scopolamine 3-5 days
  - Atropine up to 3 weeks

Side effects of Dilating agents (parasympatholytic)

- Ocular: Blurred vision from loss of accommodation and light sensitivity (dilation)
- Systemic: Similar to systemic atropine
  - Tachycardia, hallucinations, confusion, drowsiness, dermal flush, disorientation

More with atropine, much less with mydriacil
Dilating drops (continued)

- Neosynephrine
  - Sympathomimetic (fight or flight)
  - Blanches blood vessels
  - Directly stimulates dilator muscle
    - Onset 20-30min
    - Duration 4-6 hours
  - 2.5 and 10%
  - Don’t use 10%!! Blood pressure!!

When not to dilate

- Iris fixated intraocular lens
  - Rare to see today; surgery in early 1980’s
- History of narrow angle attack or glaucoma
  - Because lens-iris diaphragm drops posterior when relaxing ciliary body, usually OK to dilate if cycloplegia combined with neosynephrine.
  - Beware pseudoephedrine in narrow angle patient

Cataract Surgery

- Mixture of 3 agents in equal proportions
  - Mydriacil 1% (.35)
  - Cyclogyl 1% (.35)
  - Neosynephrine 10% (3.3%)
- Dilation is the single most important factor in predicting ocular surgical complications
Giving eye drops

- Wash your hands with soap and water. Rinse and dry your hands.
- Hold the dropper tip down all the time. This stops the drops from flowing back into the bulb where there may be bacteria that can get into the medicine.
- The eye drops must be kept clean. Avoid touching the dropper against the eye or anything else.

How to give drops

- Pull the lower lid down gently and place 1 drop in inferior fornix
- Wait 5 minutes between drops (ideally)
- About 1 minute for cataract surgery
- Administer another drop if 1st drop clearly misses

Don’t:

- Touch tip of bottle to eye or skin
- Do NOT place drops directly on cornea
  – Stings more
  – Risk of abrasion
- Don’t use more than 1 drop
Ophthalmic Anesthetic Agents

- Proparacaine, Tetracaine most common
  - Useful to check intraocular pressure
  - Relieve pain temporarily for diagnostic purposes
- DO NOT PRESCRIBE
  - Toxic if used chronically
  - Can cause loss of vision, loss of eye
  - ANESTHETIC ABUSE: most common among health care professionals

Anesthetic Drops for Cataract Surgery

- Given in OR prior to the prep
- Give X 3 (6 drops total)
  - Superior and inferior conjunctival fornices with patient in supine position
  - Cornea becomes numb with first drop
  - Conjunctiva more difficult to numb
- Finish with Xylocaine Gel to upper and lower conjunctival surface

Ocular Blocks

- Sub-tenons (parabulbar)
- Peribulbar
- Retrobulbar
**Anesthetic agents used**

- 2% Lidocaine (4cc)
- .75% Marcaine (4cc)
- 1 cc of Wydase (enzyme)

- Total volume mixed: 10 cc
  - Usual volume given much less and depends on technique chosen

**Highest to lowest risk**

- Retrobulbar
  - 3 cc on a “retrobulbar needle”
    - Tip specially designed not to lacerate blood vessels
  - Needle placed inferior to globe, outer 1/3 of orbital rim; once needle is past equator then directed toward orbital apex
  - Given retro, or behind the eye
    - Muscle cone
Retro: Advantages

- Relatively small volume
- Excellent anesthesia and motility block
- Still widely used

Retro: Risks

- Risks
  - Perforation (double!) of globe, hemorrhage, damage to ON, injection of muscle (diplopia)
  - BRAINSTEM ANESTHESIA
Peribulbar (moderate risk)

- Given outside of muscle cone
- Needle starts in same place; inferior lateral orbital rim
- Directed under and away from globe
- Larger volume used; diffuses into retro space

Peribulbar: Advantages

- Safety
- Not likely to hit optic nerve or cause brainstem anesthesia
- Good anesthesia

Peribulbar: Risks

- Perforation (smaller risk than retro)
- Still has risk of hemorrhage
  - Aspirin, Coumadin patients?
- Hit and miss akinesia
- Conjunctival chemosis
- Takes longer to take effect
Sub-Tenon’s

- Given after the prep
- Small incision made inferior nasal
- Dissection with blunt scissors past equator of globe
- Injection given with blunt cannula inferior nasal to globe

Sub-tenon’s: Advantages

- Safety; unlikely to perforate globe
- Relatively quick onset
- Smaller volumes than peribulbar

Sub-tenon’s disadvantages

- Chemosis
- Inconsistent akinesia
- Time for block to take effect
• No risk of perforation or retrobulbar hemorrhage
• Quick onset

Topical: Advantages

Topical: Disadvantages
• No akinesia
• No block of seventh nerve (squeezing)
The prep

- Carefully prep skin and lids/lashes with betadine
- 5% Betadine rinse to the ocular surface
  - Proven to be the most single effective step in preventing endophthalmitis (post-cataract infection)
  - CONTACT TIME IS IMPORTANT!!
    - 90 secs = minimum

Potential Targets for Antibiotics

- Cell Wall Synthesis: PCN, Cephalosporins
- Cell Wall Function: Bacitracin, Polymixin
- Bacterial Protein Synthesis: 30S and 50S Ribosomes
- DNA Synthesis: Sulfa, Fluoroquinolones

Advantages of Fluoroquinolones

- Good penetration
- Broad spectrum coverage against common ocular pathogens
- Low resistance
**Review of DNA Gyrase**

- Structurally unique bacterial enzyme
- Enzyme functions:
  - Topoisomerases break and re-link strands of DNA chains
    - responsible for DNA supercoiling
  - Super coiling condenses the DNA and enables it to be packaged inside the bacterium in an ordered, compact fashion
  - Necessary for fundamental bacterial cell processes including replication, transcription, recombination, and repair

**Effect of Fluoroquinolones on DNA Gyrase**

**Antibiotic prophylaxis for Cataract surgery**

- 4th generation fluoroquinolone
- Vigamox and Zymar
  - Moxifloxacin and Gatifloxacin
    - Broad spectrum
    - Good penetration
- Targets the usual suspects
  - Staph aureus and Strep species

**Antibiotic prophylaxis**

- Vigamox x 3 pre-op
  - Helps sterilize the conjunctival surface
  - Loads the cornea for delivery into the anterior chamber
- Collagen shield soaked in Vigamox and Dexamethasone at end of procedure
  - Delivers a high pulse of drug to the anterior chamber
  - Peaks at about 2 hours
**What do I do currently?**

- Preoperative Moxifloxacin X 3
  - Eliminate conjunctival flora
  - Corneal “loading”
- Prep: Include Povidone-Iodine 5%
  - Conjunctival surface
- Isolate lashes with plastic drapes
- For cataract surgery:
  - Apply Collagen shield pre-soaked in Ofloxacin for 10-15 minutes
  - Attempt to achieve high post-op aqueous level
  - Patch eye

**Enhancing Penetration: Collagen Shields**

- Act as a drug reservoir
  - Prolong contact time
- Absorption and drug delivery
  - Maximum drug absorbed: 10-15 minutes soaking time
  - Peak drug delivery: 30 minutes to 2 hours
- Factors affecting drug penetration
  - Solubility
  - Partition coefficient
  - Molecular weight
Advantages of Shields

• Painless delivery of drug
• Ease of administration
• No risk of perforation
• Enhance aqueous concentration of most water soluble antibiotics
• Potential for enhancing wound/epithelial healing

Disadvantages

• Enhance Toxicity of medication?
• Off label use of this device and antibiotic drop
• Must patch eye after surgery
• Conjunctival hyperemia
• Not proven to reduce the risk of endophthalmitis

Collagen Shield Penetration of Moxifloxacin

• 21 patients, 10 drops, 11 shields
• Drops: 4 times day before and X 3 day of surgery
• Moxifloxacin .5% (Vigamox) -soaked Shield applied and timed

Results

• Drops 866ug/ml +/- 280 SD
• Shield (17-97 minutes) 1548ug/ml +/- 886
• One result 10.3ug/ml (Shield on 97 minutes!)
  – No discernable toxicity noted
  – Without this outlier 672 ug/ml +/- 483

Neither result (with or without outlier) statistically different from drops
Data from RMLEI

- Retrospective review of last 4500 cases
  - 4 cases of endophthalmitis
  - 2 with Ofloxacin, 2 with Moxifloxacin soaked shields
    - 2 culture negative
    - 2 gm+
  - No loss of the eye or vision

Patching

- Tape lid shut
- 1 patch just beneath the brow
- Run tape from forehead to cheek
  - 4-5 six inch strips
  - Avoid taping the mouth
  - Place a shield over the tape

Glasses?
IFIS

- Smaller incision (2.2-2.4)
- Atropine dilation
- Healon GV for Capsulorhexis
- Malyugin Ring
  - Iris Hooks under incision (Diamond Shape)