

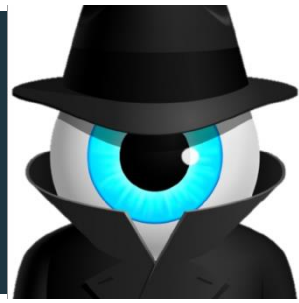
# OPHTHALMIC MEDICATIONS

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PGY1 Pharmacy Resident  
September 7, 2017

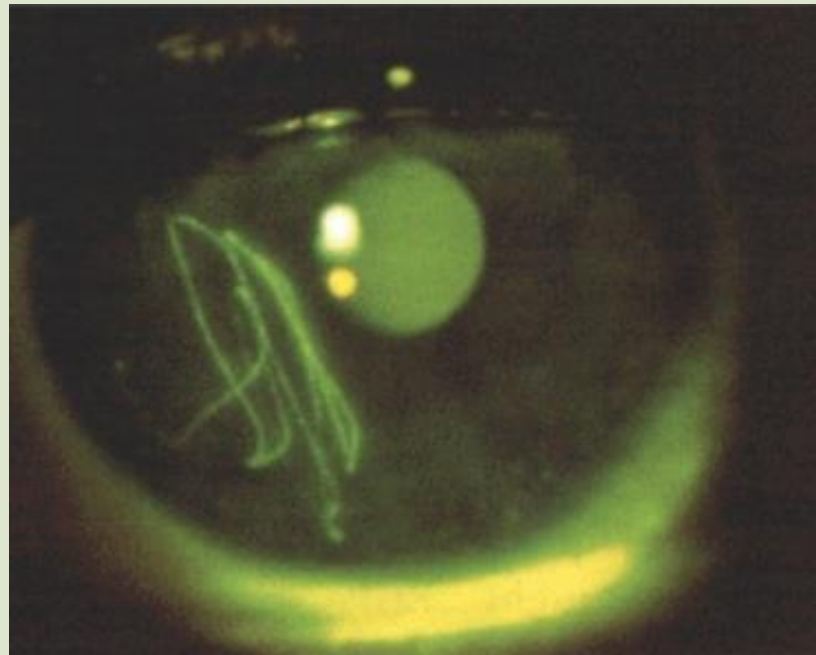
# AMERICAN ACADEMY OF OPHTHALMOLOGY

Class	Color
Adrenergic agonist combinations	Light Green
Adrenergic agonists	Purple
Anti-infectives	Tan
Anti-inflammatory, non-steroidal	Gray
Anti-inflammatory, steroids	Pink
Anti-inflammatory, immunomodulators	Olive Green
Beta-blocker combinations	Dark Blue
Beta-blockers	Yellow
Carbonic anhydrase inhibitors	Orange
Cytotoxic	Black
Miotics	Dark Green
Mydriatics and cycloplegics	Red
Prostaglandin analogues	Turquoise

# CASE #1



- TR is a 76 YOM with no significant PMH who presents to the ER with a two-day history of 8/10 eye pain after “something hit me in the eye while chopping wood.” Examination with Wood’s lamp showed the following:



# DIAGNOSTIC MEDICATIONS

	*Fluorescein strips	*Fluorescein + benoxinate solution
Brand	Ful-Glo, Bio Glo, Fluor-I-Strips	Flurox
Administration	Moisten strip with sterile water and touch tip to eye	Instill 1 – 2 gtts into each eye before procedure, max 6 gtts
Notes	<ul style="list-style-type: none"> <li>• Instruct patient to blink several times after application</li> <li>• Used for removal of foreign bodies, sutures, or tonometry</li> </ul>	



# DIAGNOSTIC MEDICATIONS



## ■ Mydriatics

Drug	Dose	Onset	Duration	Side Effects
Cyclopentolate 0.5%, 1%, 2%	1 – 2 gtts, may repeat in 5 – 10 minutes	15 – 60 minutes	Up to 24 hours	↑ IOP, accommodation disturbance
Tropicamide 0.5%	1 – 2 gtts 15 – 20 minutes before exam	20 – 40 minutes	~6 hours	Blurred vision, photophobia, stinging, superficial keratitis
Homatropine 2%, 5%	1 – 2 gtts, may repeat in 5 – 10 minutes	Within minutes	Few hours	Blurred vision, ↑ IOP, photophobia, ocular exudate
Atropine 1%	1 gtt 40 min before max dilation wanted, up to BID	Within minutes	Up to days	Blurred vision, eyelid edema, ↓ lacrimation, eye pain and stinging

# OCULAR ANESTHETICS



	<b>Tetracaine 0.5%</b>	<b>*Proparacaine 0.5%</b>
<b>Uses</b>	Short-term anesthesia, minor or prolonged surgical procedures	Short corneal and conjunctival procedures, tonometry, gonioscopy, suture removal
<b>Dose</b>	1 – 2 gtts into affected eye	1 – 2 gtts into affected eye
<b>Onset</b>	Within 30 seconds	Within 20 seconds
<b>Duration</b>	10 – 20 minutes	10 – 20 minutes
<b>Side Effects</b>	Red eyes, lacrimation, photophobia, burning or stinging	Eye redness, burning or stinging, contact dermatitis, hypersensitivity reaction, conjunctival hemorrhage, corneal erosion, vision loss
<b>Length of Tx</b>	Do not use for more than ~24-48 hours	
<b>Price</b>	\$	\$

# OCULAR ANESTHETICS

## A comparison of proparacaine and tetracaine eye anesthetics.

Bartfield JM<sup>1</sup>, Holmes TJ, Raccio-Robak N.

<b>Design</b>	<ul style="list-style-type: none"><li>• Prospective, randomized, double-blind</li></ul>
<b>Population</b>	<ul style="list-style-type: none"><li>• 23 healthy volunteers</li></ul>
<b>Intervention</b>	<ul style="list-style-type: none"><li>• 1 gtt proparacaine in one eye, 1 gtt tetracaine in other eye</li></ul>
<b>Results</b>	<ul style="list-style-type: none"><li>• 20 patients reported better outcomes with proparacaine</li><li>• 2 patients reported similar outcomes with both agents</li><li>• 1 patient reported better outcomes with tetracaine</li></ul>
<b>Conclusion</b>	<ul style="list-style-type: none"><li>• Proparacaine eye drops are preferable to tetracaine eye drops because they cause less pain and last longer</li></ul>

# OCULAR ANESTHETICS

**Topical tetracaine used for 24 hours is safe and rated highly effective by patients for the treatment of pain caused by corneal abrasions: a double-blind, randomized clinical trial.**

Waldman N<sup>1</sup>, Denale IK, Herblison P.

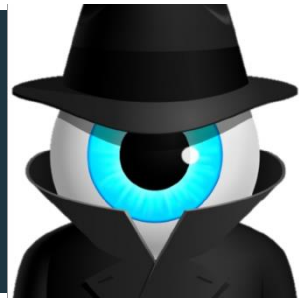
<b>Design</b>	<ul style="list-style-type: none"><li>• Prospective, double-blind, randomized trial</li></ul>
<b>Population</b>	<ul style="list-style-type: none"><li>• 116 patients with uncomplicated corneal abrasions</li></ul>
<b>Intervention</b>	<ul style="list-style-type: none"><li>• Tetracaine 1% vs. saline eye drops</li><li>• Applied every 30 minutes ATC while awake</li></ul>
<b>Results</b>	<ul style="list-style-type: none"><li>• No significant difference in corneal healing or persistent symptoms at 48 hours</li></ul>
<b>Conclusion</b>	<ul style="list-style-type: none"><li>• Though no significant difference in pain ratings, patients perceived topical tetracaine to be more effective than placebo</li><li>• Topical tetracaine is safe to use for 24 hours ATC</li></ul>



# DILUTED PROPARACAINE

Study	Shahinian, et al. (1997)	Ball, et al. (2010)
Design	Prospective, randomized, double-blind in patients with pain after PRK (n = 48 eyes)	Prospective, randomized, double-blind in patients with acute corneal injuries (n = 33)
Intervention	0.05% proparacaine vs. placebo	0.05% proparacaine vs. placebo
Primary Outcome	Analgesic effect of topical 0.05% proparacaine after PRK	Mean difference in pain scores before/after drug administration
Results	Average change in pain score was greater in proparacaine group (p < 0.002)	Pain reduction was better in the proparacaine group (p = 0.007)
Conclusion	Proparacaine is more effective for pain than placebo	Treatment with dilute topical anesthetics may be safe and effective if used for <b>1 – 2 days</b>

## CASE #2



- HP is a 11 YOM who presents to the ED with complaints of itching and redness of his right eye. He states there was “gunk in it” when he woke up this morning.




# ACUTE BACTERIAL CONJUNCTIVITIS

- Typical organisms:
  - *Staphylococcus aureus* (children and adults)
  - *Streptococcus pneumoniae*
  - *Haemophilus influenzae* (infants and toddlers)
  - *Moraxella catarrhalis*
  - *Neisseria gonorrhoeae* (neonates)
  
- Other organisms:
  - *Escherichia coli*
  - *Pseudomonas* spp. (contact wearers)

# BACTERIAL CONJUNCTIVITIS TREATMENT

- Choice of antibiotic should be based on:
  - Patient allergies
  - Patient preference (drops, ointments, etc.)
  - Cost-effectiveness
  - Local resistance patterns
  
- If infection does not improve within 1 week of treatment, refer to ophthalmologist

# POLYMYXIN COMBINATIONS

	Polymyxin B + trimethoprim	Polymyxin B + bacitracin	Polymyxin B + neomycin + gramicidin
Brand	Polytrim	Polysporin	Neosporin Ophthalmic
Dose	<u>Solution</u> : 1 gtt q3-4h, max 6 gtts/day	<u>Ointment</u> : ½ inch ribbon 2 – 3x/day	<u>Solution</u> : 1 – 2 gtts q4h
Duration	7 – 10 days		
Side effects	Eye irritation, burning, itching, inflammation, contact dermatitis		
Price	\$	\$	\$
Typical organisms	 <p><i>S. aureus</i>  <i>S. pneumoniae</i>  <i>Neisseria spp.</i>  <i>H. Influenzae</i></p>		



■ Drug of choice in most patients!

# AMINOGLYCOSIDES

	*Gentamicin 0.3%	*Tobramycin 0.3%
Brand	Gentak	Tobrex
Dose	<ul style="list-style-type: none"> <li>*<u>Ointment</u>: ½ inch 2 – 3x/day</li> <li>*<u>Solution</u>: 1 – 2 gtt 4x/day</li> </ul>	<ul style="list-style-type: none"> <li>*<u>Ointment</u>: ½ inch 2 – 3x/day</li> <li>*<u>Solution</u>: 1 – 2 gtt q4h</li> </ul>
Duration	Until symptoms resolve	
Side effects	May delay corneal healing, redness, irritation, superinfection	Conjunctival erythema, eyelid swelling, eyelid pruritus
Price	<u>Ointment</u> : \$\$ <u>Solution</u> : \$	<u>Ointment</u> : \$\$ <u>Solution</u> : \$
Typical organisms	<p><i>S. aureus</i>  <i>S. pneumoniae</i>  <i>Haemophilus spp.</i>  <i>Pseudomonas spp.</i></p>	



# MACROLIDES

	*Erythromycin 5 mg/g	Azithromycin 1%
Brand	Generic	AzaSite
Dose	<u>Ointment</u> : apply 1 cm ribbon to affected eye up to 6x/day	<u>Solution</u> : 1 gtt BID x 2 days, then 1 gtt daily x 5 days
Duration	5 – 7 days	7 days
Side effects	Blurred vision after application, irritation, redness	Eye irritation
Price	\$	\$\$\$

Typical organisms



*S. aureus*  
*S. pneumoniae*  
*Haemophilus spp.*  
*Neisseria gonorrhoeae*  
 Atypical bacteria





# FLUOROQUINOLONES



	*Ciprofloxacin 0.3%	*Moxifloxacin 0.5%	Ofloxacin 0.3%
Brand	Ciloxan	Moxeza, Vigamox	Ocuflox
Dose	<ul style="list-style-type: none"> <li>*<u>Solution</u>: 1 – 2 gtt q2h WA x 2 days, then q4h x 5 days</li> <li>*<u>Ointment</u>: 1/2 ribbon TID x 2 days, then BID x 5 days</li> </ul>	<ul style="list-style-type: none"> <li><u>Solution</u>: 1 gtt TID</li> </ul>	<ul style="list-style-type: none"> <li><u>Solution</u>: 1 – 2 gtt q2 – 4h for 2 days then 1 – 2 gtt 4x/day for 5 days</li> </ul>
Duration	5 – 7 days	7 days	7 days
Side effects	Eye deposits, burning, itching, discomfort	Blurred vision, eye irritation, conjunctivitis	Blurred vision, eye irritation, conjunctivitis
Price	<u>Solution</u> : \$\$ <u>Ointment</u> : \$\$\$	\$\$\$	\$\$
Typical organisms	<i>H. influenzae</i> <i>Pseudomonas spp.</i>	<i>S. pneumoniae</i> <i>H. influenzae</i>	



# ANTIBIOTIC/STEROID COMBINATIONS

## ■ How do I choose?

<b>Antibiotic ONLY</b>	<ul style="list-style-type: none"><li>• Mucopurulent discharge <b>OR</b></li><li>• Evidence or high risk for corneal infection</li></ul>
<b>Steroid ONLY</b>	<ul style="list-style-type: none"><li>• Red eye <b>AND</b></li><li>• Intact corneal epithelium</li></ul>
<b>Combination</b>	<ul style="list-style-type: none"><li>• Considerable red eye <b>AND</b></li><li>• Mild - moderate epithelial compromise</li></ul>

# COMBINATION ANTIMICROBIALS/CORTICOSTEROIDS

Brand Name	Antibiotic	Steroid	Typical Dose
Blephamide	Sodium sulfacetamide 10%	Prednisolone acetate 0.2%	<ul style="list-style-type: none"> <li>• 2 gtts q4h</li> <li>• ½ inch 3-4x/day</li> </ul>
Cortisporin	Neomycin 0.35%/polymyxin B 10k/mL	Hydrocortisone 1%	<ul style="list-style-type: none"> <li>• 1 – 2 gtts 2-4x/day</li> </ul>
Neo-Polycin HC	Neomycin 0.35%/polymyxin B 10k/bacitracin 400 units/g	Hydrocortisone 1%	<ul style="list-style-type: none"> <li>• ½ inch ribbon q3-4h</li> </ul>
Maxitrol	Neomycin 0.35%/polymyxin B 10k/mL	Dexamethasone 0.1%	<ul style="list-style-type: none"> <li>• 1 – 2 gtts 4-6x/day</li> <li>• ½ inch 3-4x/day</li> </ul>
Poly-Pred	Neomycin 0.35%/polymyxin B 10k/mL	Prednisolone acetate 1%	<ul style="list-style-type: none"> <li>• 1 – 2 gtts q3-4h</li> </ul>
Pred-G	Gentamicin 0.3%	Prednisolone acetate 1%	<ul style="list-style-type: none"> <li>• 1 gtt 2-4x/day</li> <li>• ½ inch 1-3x/day</li> </ul>
TobraDex	Tobramycin 0.3%	Dexamethasone 0.1%	<ul style="list-style-type: none"> <li>• 1 – 2 gtts q4-6h</li> <li>• ½ 3-4x/day</li> </ul>
Zylet	Tobramycin 0.3%	Loteprednol 0.5%	<ul style="list-style-type: none"> <li>• 1 – 2 gtts q4-6h</li> </ul>

# RESISTANCE PATTERNS

**Ocular TRUST: nationwide antimicrobial susceptibility patterns in ocular isolates.**

Asbell PA<sup>1</sup>, Colby KA, Deng S, McDonnell P, Meisler DM, Raizman MB, Sheppard JD Jr, Sahm DF.

- TRUST (2008): Tracking Resistance in U.S. Today
- Annually evaluates in vitro antibiotic susceptibilities (%)

	MSSA	MRSA	<i>S. pneumoniae</i>	<i>H. influenzae</i>
Polymyxin	0	0	0	100
Trimethoprim	97.6	93.9	77.6	81.3
Azithromycin	54.7	6.1	77.6	100
Tobramycin	92.7	36.4	2	100
Ciprofloxacin	79.9	15.2	89.8	100
Moxifloxacin	81.1	15.2	100	100

# RESISTANCE PATTERNS

## Antibiotic Resistance Among Ocular Pathogens in the United States: Five-Year Results From the Antibiotic Resistance Monitoring in Ocular Microorganisms (ARMOR) Surveillance Study.

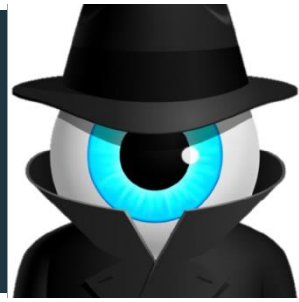
Asbell PA<sup>1</sup>, Sanfilippo CM<sup>2</sup>, Pillar CM<sup>3</sup>, DeCory HH<sup>2</sup>, Sahm DF<sup>4</sup>, Morris TW<sup>5</sup>.

- ARMOR (2013)
- Extended data collection of TRUST plus *Pseudomonas*

	MSSA	MRSA	<i>S. pneumoniae</i>	<i>H. influenzae</i>	<u><i>Pseudomonas</i></u>
Azithromycin	57.2	6.7	65.2	100	NE
Tobramycin	95.9	55.7	NE	100	96.9
Ciprofloxacin	85.8	22.7	NE	100	92.3
Moxifloxacin	88	26	99.7	100	NE

NE: not evaluated

# CASE #3



- RW is a 37 YOM who presents to the ED with a three-day history of bilateral redness of the sclera. He claims his eyes have been “tearing up” for a few days.
- PMH: recent cold



# ACUTE VIRAL CONJUNCTIVITIS

- **SUPPORTIVE TREATMENT**
  - Cold compresses
  - Artificial tears
  - Ocular antihistamines (if significant itching)
  - Ocular NSAIDs (if significant pain)
- **Topical steroids should be avoided**
  - May prolong viral replication and viral shedding
- **Do not use antibiotics for viral conjunctivitis**

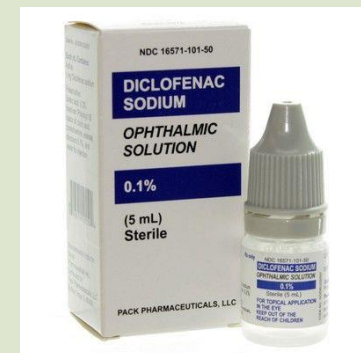
# OPHTHALMIC ANTIHISTAMINES

	Ketotifen fumarate 0.025%	Azelastine 0.05%	*Olopatadine 0.1%, 0.2%,
Brand	Alaway, Zaditor	Generic	Patanol, Pataday
Dose	<ul style="list-style-type: none"> <li>1 gtt BID</li> </ul>	<ul style="list-style-type: none"> <li>1 gtt BID</li> </ul>	<ul style="list-style-type: none"> <li><u>Patanol</u>: 1 gtt BID</li> <li><u>Pataday</u>: 1 gtt daily</li> </ul>
Duration	Until symptoms resolve		
Side effects	Headache, rhinitis, conjunctival injection	Headache, eye burning/stinging	Headache, nausea, conjunctivitis, irritation
Price	\$	\$\$	\$\$



# OPHTHALMIC NSAIDS

	*Ketorolac 0.4%, 0.5%	*Diclofenac 0.1%
Brand	Acular, Acuvail	Generic
Dose	1 gtt 4x/day	1 – 2 gtt 4x/day
Duration	Until symptoms resolve, do not use longer than <b>14 days</b>	
Side effects	Burning sensation, headache, blurred vision, hypersensitivity	Burning sensation, lacrimation, keratitis, increased IOP
Price	\$\$\$	\$\$
Notes	Usually used post-op	

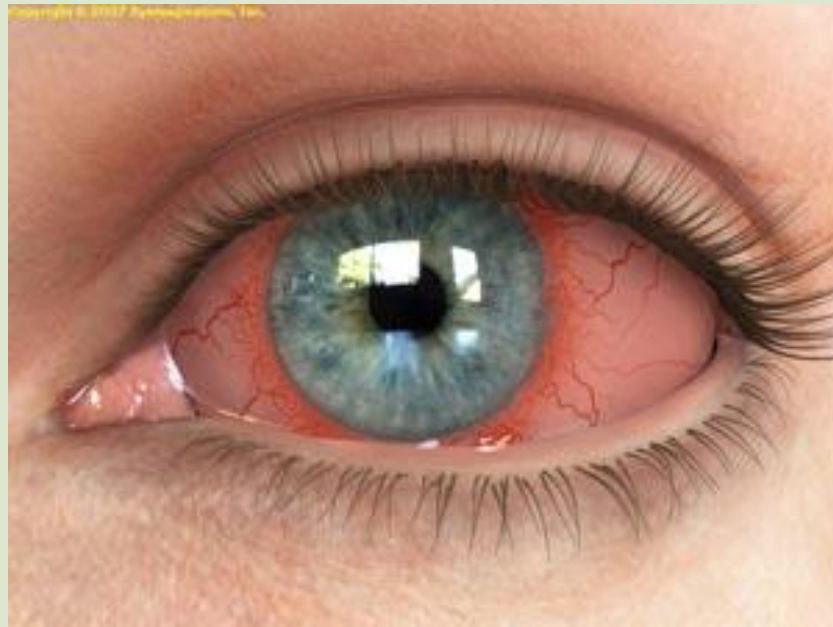




# CASE #4



- BL is a 36 YOF with a PMH of lupus who presents to your ED complaining of joint pain and blurred vision. Of note, she was seen in the ED 2 weeks ago where she was treated for gonorrhea and chlamydia infections.



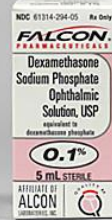
# NON-INFECTIOUS UVEITIS TREATMENT

- **Goals of treatment:**
  - Eliminate inflammation
  - Alleviate pain
  - Prevent further tissue damage
  - Restore loss of vision
  
- **Treatment options depend on type of uveitis**

<b>Anterior Uveitis</b>	<ul style="list-style-type: none"><li>• Ocular steroids</li><li>• Mydriatics</li></ul>
<b>Intermediate Uveitis</b>	<ul style="list-style-type: none"><li>• Eye injections</li><li>• Oral steroids or immunosuppressive drugs</li><li>• Surgically-implanted drug-releasing capsule</li></ul>
<b>Posterior Uveitis</b>	
<b>Pan-Uveitis</b>	



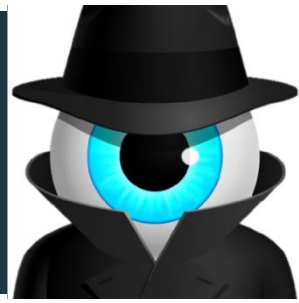
# OCULAR STEROIDS



Generic	Brand	Dose	Side Effects
Prednisolone 0.125%, 1%	Pred Forte	<ul style="list-style-type: none"> <li><u>Suspension</u>: 1 – 2 gtts 2-4x/day</li> <li><u>Solution</u>: 1 – 2 gtts q1-2h</li> </ul>	Blurred vision, burning eyes, photophobia, delayed healing, increased risk of infection, cataracts, increased IOP, glaucoma
Dexamethasone 0.05%	Maxidex	<ul style="list-style-type: none"> <li><u>Solution</u>: 1 – 2 gtts q1h during day and q2h during night</li> <li><u>Suspension</u>: 1 – 2 gtts 4-6x/day</li> </ul>	
Fluorometholone 0.1%, 0.25%	FML	<ul style="list-style-type: none"> <li><u>Ointment</u>: ½ inch 1-3x/day</li> <li><u>Suspension</u>: 1-2 gtt 2-4x/day</li> </ul>	
Difluprednate 0.05%, 0.1%	Durezol	<ul style="list-style-type: none"> <li><u>Solution</u>: 1 gtt 4x/day x 14 days, then taper as indicated</li> </ul>	
Loteprednol 0.2%. 0.5%	Alrex, Lotemax	<ul style="list-style-type: none"> <li><u>Suspension</u>: 1 – 2 gtts 4x/day</li> </ul>	

Begin taper once inflammation is completely controlled

# CASE #5



- HG is a 56 YOF who presents to the ED with acute onset of severe pain and blurred vision in her left eye. Left pupil is 4 cm, nonreactive. IOP elevated at 37 mmHg.



# ACUTE ANGLE-CLOSURE GLAUCOMA

- Emergent treatment is necessary to avoid optic nerve damage and irreversible vision loss!
- General goals of drug treatment
  - Lower IOP
    - To decrease optic nerve compression
  - Constrict pupil
    - To widen anterior chamber angles and reestablish aqueous humor outflow

# ACUTE ANGLE-CLOSURE GLAUCOMA

	Beta-Blockers
Examples	<ul style="list-style-type: none"> <li>• Timolol 0.25%, 0.5%</li> <li>• Betaxolol 0.5%</li> </ul>
Dose	1 – 2 gtts BID
Effect	↓ humor production or ↑ outflow of aqueous humor
Reduction in IOP	20 – 30 mmHg within 1 hour
Side effects	Burning and/or stinging of eyes, blurred vision, diplopia, eye pain, eye pruritis, blepharitis, foreign body sensation, keratitis
Price	\$



# ACUTE ANGLE-CLOSURE GLAUCOMA

	Alpha-2 Agonists
Examples	<ul style="list-style-type: none"><li>• Apraclonidine 0.5% (Iopidine)</li><li>• Brimonidine 0.2% (Alphagan)</li></ul>
Dose	1 – 2 gtt TID
Effect	Causes ↓ of aqueous humor formation and ↑ uveoscleral outflow
Reduction in IOP	About 25% within 2 hours
Side effects	Eye discomfort, eye pruritus, ocular hyperemia
Price	\$\$\$



# ACUTE ANGLE-CLOSURE GLAUCOMA

	Miotics
Examples	• Pilocarpine 2%
Dose	1 gtt up to 3x in 30 minutes
Effect	Directly stimulates M3 ACh receptors to cause miosis and ↓ resistance to aqueous humor outflow
Reduction in IOP	25 – 40%
Side Effects	Burning, lacrimation, conjunctival vascular congestion, myopia, retinal detachment, HA
Price	\$\$\$
Notes	Do not use if IOP > 40 mmHg





# ACUTE ANGLE-CLOSURE GLAUCOMA

	Carbonic Anhydrase Inhibitors	
Examples	<ul style="list-style-type: none"> <li>Acetazolamide</li> </ul>	<ul style="list-style-type: none"> <li>Dorzolamide 2% (Trusopt)</li> <li>Brinzolamide 1% (Azopt)</li> </ul>
Dosing	250 – 500 mg IV/PO	1 gtt TID
Effect	↓ production of aqueous humor	
Reduction in IOP	~10 mmHg	
Side Effects	Flushing, rash, urticaria, SJS/TEN, anaphylaxis	Burning and/or stinging, redness, eye irritation/discomfort, blurred vision, conjunctivitis, lacrimation
Price	<u>IV</u> : \$\$ <u>PO</u> : \$	<u>Dorzolamide</u> : \$\$\$ <u>Brinzolamide</u> : \$\$\$
Notes	<b>AVOID in sulfa allergy</b>	



# TREATMENT SUMMARY

<b>Diagnostics</b>	<ul style="list-style-type: none"><li>• Fluorescein</li><li>• Mydriatics (cyclopentolate, tropicamide, homatropine, atropine)</li></ul>
<b>Corneal Abrasions</b>	<ul style="list-style-type: none"><li>• Topical anesthetics (proparacaine, tetracaine)</li></ul>
<b>Bacterial Conjunctivitis</b>	<ul style="list-style-type: none"><li>• Polymyxin-B combination products (drug of choice)</li><li>• Aminoglycosides (gentamycin, tobramycin)</li><li>• Macrolides (erythromycin, azithromycin)</li><li>• Fluoroquinolones (ciprofloxacin, moxifloxacin, ofloxacin)</li></ul>
<b>Viral Conjunctivitis</b>	<ul style="list-style-type: none"><li>• Topical antihistamines (ketotifen, azelastine, olopatadine)</li><li>• Ophthalmic NSAIDs (ketorolac, diclofenac)</li></ul>
<b>Non-Infectious Uveitis</b>	<ul style="list-style-type: none"><li>• Topical steroids</li><li>• Mydriatics</li></ul>
<b>Acute Angle-Closure Glaucoma</b>	<ul style="list-style-type: none"><li>• Beta-blockers (timolol, betaxolol)</li><li>• Alpha-2 agonists (apraclonidine, brimonidine)</li><li>• Miotics (pilocarpine)</li><li>• Carbonic anhydrase inhibitors (acetazolamide, dorzolamide)</li></ul>



# OPHTHALMIC MEDICATIONS

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September 7, 2017

