

1. Antibacterial Agents

A. TOPICAL ANTIBIOTICS*

Drug	Trade	Preparation	Dose	Notes
bacitracin	N/A	Soln, 10,000 u/ml	Q 1 hr	Fortified°
besifloxacin	AK-Tracin	Oint, 500 u/gm	QD-QID	BC
cefazolin	Besivance	Suspension, 0.6%	TID-Q 1 hr	Fluoroquinolone-BC
chloramphenicol	Ancef	Soln, 5%	Q 1 hr	Fortified°
	Chloromycetin,	Soln, 0.5%	Q 3-6 hrs	BS, except BC against
	Chloroptic,			<i>H. influenzae</i> , <i>N. meningitidis</i> , <i>N. gonorrhea</i> ,
	Ocu-Chlor			<i>C. trachomatis</i> . Has been reported to be
				associated with aplastic anemia.
	Chloromycetin,	Oint, 1%	QHS-Q 3 hrs	
	Chloroptic,			
	Ocu-Chlor			
ciprofloxacin	Ciloxan	Soln, 0.3%	QID-Q 1/2 hr	Fluoroquinolone-BC; active against <i>P. Aeruginosa</i> and <i>Neisseria</i> species
erythromycin	AK-mycin, Ilotycin	Oint, 0.3%	QHS-QID	BS; active against <i>N. gonorrhea</i> &
		Oint, 0.5%	QD-QID	<i>C. trachomatis</i>
gatifloxacin	Zymar	Soln, 0.3%	QID-Q 1 hr	Fluoroquinolone-BC
gentamicin	Zymaxid	Soln, 0.5%	QD-Q 1 hr	
	Garamycin, Genoptic,	Soln, 0.3%	Q 1-6 hrs	Aminoglycoside-BC; active against
	Gentacidin, Gentak,			<i>P. Aeruginosa</i> and <i>N. gonorrhea</i>
	Ocu-mycin			
	Garamycin, Genoptic,	Oint, 0.3%	QD-TID	
	Gentacidin, Gentak,			
	Ocu-mycin			
	N/A	Soln, 1.5%	Q 1 hr	Fortified°

levofloxacin	Quixin Iquix	Soln, 0.5% Soln, 1.5%	QID-Q 1/2 hr Q 30½ hr- QID	Fluoroquinolone-BC; active against <i>P. Aeruginosa</i> and <i>Neisseria</i> species
metronidazole	MetroGel	Gel, 0.75%	BID	Periocular use for rosacea
moxifloxacin	Vigamox	Soln, 0.5%	TID-Q1 hr	Not for use in the eye
neomycin	only available in combination medications (see below)			Fluoroquinolone-BC; Self Preserved; pH 6.8
norfloxacin	Chibroxin	Soln, 0.3%	QID-Q 1 hr	Fluoroquinolone- BC
ofloxacin	Ocuflox	Soln, 0.3%	QID-Q 1 hr	Fluoroquinolone- BC; active against <i>P. Aeruginosa</i> and <i>Neisseria</i> species;
oxytetracycline/ polymyxin B	AK-tetra, Terramycin, Terak	Oint, 0.5%/10,000 u	QD-QID	BC
polymyxin B/ bacitracin	AK-poly-bac, Polysporin, Polytracin	Oint, 10,000 u per ml/500 u per ml	QD-QID	BC
polymyxin B/ neomycin	AK-trol, Statrol	Soln, 16,250 u per ml/ 0.35%	QID	BC
	AK-trol, Statrol	Oint, 10,000 u per ml/ 0.35%	QD-QID	
polymyxin B/ neomycin/ bacitracin	Neotal	Oint, 5,000 u per ml/ 0.5%/ 400 u per ml	QD- QID	BC
	AK-spore, Neosporin, Ocu-spor B	Oint, 10,000 u per ml/ 0.35%/ 400 u	QD-QID	

(continued)

A. TOPICAL ANTIBIOTICS* (continued)

Drug	Trade	Preparation	Dose	Notes
polymyxin B/ neomycin/ gramicidin	AK-Spore, Neosporin, Ocu-spor G, Polymycin	Soln, 10,000 u per ml/ 0.35%/0.025%	QID	BC, gramicidin makes cell membrane more permeable
polymyxin B/ trimethoprim sulfacetamide	Polytrim AK-sulf, Bleph-10, Ophthacet, Ocusulf, Sulf-10	Soln, 10,000 u per ml/ 0.1% Soln, 10%	QID QID-Q 1 hr	BC BS
sulfacetamide/ phenylephrine sulfisoxazole	AK-sulf Vasosulf	Oint, 10% Soln, 15%/0.125%	QD-QID QD-QID	BS; antibiotic with an alpha agonist
tetracycline	Gantrisin	Soln, 4%	QID-Q 1 hr	BS
tobramycin	Gantrisin Achromycin AKTOB, Defy, Tobrex	Oint, 4% Soln, 1% Soln, 0.3%	QD-QID QID-Q 1/2 hr QID-Q 1 hr	BS Aminoglycoside – BC active against <i>P. Aeruginosa</i> and <i>N. gonorrhea</i>
vancomycin	AKTOB, Defy, Tobrex	Oint, 0.3% Soln, 1.5% Soln, 5%	QD-TID Q 1 hr Q 1 hr	Fortified ^o BS, fortified ^o , not for Gram negative coverage; reserve use for PCN allergic patients and resistant organisms

*For antibiotic spectrum of topical agents, refer to Appendix 1
^oFortified medications not commercially available; refer to Appendix 2 for preparation instructions
 BC = bacteriocidal; BS = bacteriostatic; N/A = not available

B. ORAL ANTIBIOTICS

Drug	Trade	Dose	Notes
amoxicillin	Amoxil, Polymox	250–500 mg PO TID	Adult Dose
		25–50 mg/kg/day PO in 3 divided doses	Pediatric Dose
amoxicillin/clavulanate	Augmentin	250–500 mg PO TID or 875 mg PO BID	Adult Dose
		20–40 mg/kg/day PO in 3 divided doses	Pediatric Dose
azithromycin	Zithromax	500 mg PO day 1, then 250 mg QD × 4 days	Adult Dose
		20 mg/kg × 1 (pediatric dose)	
		1000 mg PO × 1 (adult dose)	
			Dose for <i>Chlamydia</i> conjunctivitis (Arch Ophthalmol 1998;116:1625–28 Ophthalmology 1998;105:658–61)
cephalexin	Keflex	5–12 mg/kg/day PO in one dose for 5 days	Pediatric Dose
		25–500 mg PO QID	Adult Dose
cefuroxime axetil	Ceftin	25–50 mg/kg/day PO in 4 divided doses	Pediatric Dose
		250–500 mg PO BID	Adult Dose
ciprofloxacin	Cipro	20–30 mg/kg/day PO divided BID	Pediatric Dose
		250–750 mg PO BID	Not for children or pregnancy Do not take with antacids must modify dosage in renal failure
			Extended release formula
clarithromycin	Cipro XE Biaxin	500 mg PO QD	Adult Dose
		250–500 mg PO BID	
		15 mg/kg/day PO divided BID	Pediatric Dose

(continued)

B. ORAL ANTIBIOTICS (continued)

Drug	Trade	Dose	Notes
doxycycline	Vibramycin	100 mg BID	Can be used for ocular rosacea Not for children or pregnancy
erythromycin	E-mycin	250–500 mg PO QID	Adult Dose
gatifloxacin	Avelox	30–50 mg/kg/day in 3–4 divided doses	Pediatric Dose
levofloxacin	Levaquin	400 mg PO QD	Not for children or pregnancy
		500 mg PO QD	Not for children or pregnancy; must modify dosage in renal failure
minocycline	Minocin	100–200 mg PO BID	Not for children or pregnancy
moxifloxacin	Tequin	400 mg PO QD	Not for children or pregnancy
ofloxacin	generic	200–400 mg PO BID	Not for children or pregnancy; must modify dosage in renal failure
tetracycline	Achromycin	250–500 mg PO QID	Can be used for ocular rosacea Not for children or pregnancy
			Do not take with food, milk products, or antacids

C. ANTIBIOTICS FOR SUBCONJUNCTIVAL/INTRAVITREAL INJECTION

	Subconjunctival Injection [•]	Intravitreal Injection ^{••}	Notes
(1) Aminoglycosides^v			
amikacin	25 mg	0.2–0.4 mg	
gentamicin	10–20 mg	0.2–0.4 mg	
kanamycin	30 mg	N/A	
neomycin	125–250 mg	N/A	rarely used
tobramycin	10–20 mg	0.1–0.4 mg	
(2) Penicillins			
ampicillin	50–150 mg	0.5 mg	
carbenicillin	100 mg	0.25–2.0 mg	rarely used
methicillin	50–100 mg	1.0–2.0 mg	
penicillin G	0.5–1.0 million units	N/A	
ticarcillin	100 mg	N/A	
(3) Cephalosporins			
cefazolin	100 mg	2.0–2.25 mg	1st Generation, rarely used
ceftazidime	200 mg	2.25 mg	3rd Generation

(continued)

	Subconjunctival Injection*	Intravitreal Injection**	Notes
(4) Others			
bacitracin	5,000 units	N/A	
chloramphenicol	N/A	1.0 mg	rarely used
clindamycin	15–50 mg	1.0 mg	
erythromycin	100 mg	0.5 mg	almost never used
polymyxin B sulfate	100,000 units	N/A	almost never used
vancomycin	25 mg	1.0 mg	

*subconjunctival dose should be in a volume of 0.5 ml

**intravitreal dose should be in a volume of 0.1 ml

†all intravitreal injections of aminoglycosides have potential for macular necrosis

N/A = not available

D. REGIMENS FOR SPECIFIC ORGANISMS

(1) **Syphilis** (caused by *Treponema Pallidum*) (*Expert Opin Pharmacother* 2005;6:2271)

Note: Both patient and sexual partners must be evaluated for other sexually transmitted diseases, including HIV.

(a) *Early (Primary, secondary, or latent infection less than one year)*

Drug	Dose
penicillin G benzathine	2.4 million U IM once (may repeat 7 days later in patients with AIDS)
OR	
one of the following for penicillin-allergic patients:	
doxycycline	100 mg PO BID × 14 days
azithromycin	2 Gm PO × 1
erythromycin	500 mg PO Q 6 hrs × 14 days

(b) *Late (Includes isolated anterior uveitis; latent infection more than one year's duration; cardiovascular; gumma)*

Drug	Dose
penicillin G benzathine or doxycycline	2.4 million U IM weekly \times 3 weeks 100 mg PO BID \times 4 weeks

(c) *Neurosyphilis (Includes posterior uveitic involvement)*

Note: PCN allergic patients may need to be desensitized

Drug	Dose
penicillin G	2–4 million U IV Q 4 hrs \times 10–14 days followed by penicillin G benzathine 2.4 MU IM Q week \times 3

(d) *Congenital*

Drug	Dose
penicillin G	50,000 U/kg IM or IV Q 8–12 hrs \times 10–14 days

(2) **Gonococcal Conjunctivitis/Keratitis** (caused by *Neisseria gonorrhea*) (*The Medical Letter*, 37:119, 1995)

- Notes:**
- 1) Patient's sexual partners must be treated. Both patient and sexual partners must be evaluated for other manifestations of gonorrhea and for other sexually transmitted diseases, including HIV and syphilis
 - 2) Patients must also be treated for concurrent chlamydial infection, which may be present.
 - 3) In penicillin/cephalosporin-allergic patients, consider ciprofloxacin 500 mg PO for one dose; an infectious disease consult may be needed.

4) All patients should receive warm saline irrigation of fornices

5) Also administer topical antibiotics:

- bacitracin or erythromycin ointment QID [may use ciprofloxacin, ofloxacin, gatifloxacin, or moxifloxacin soln Q 2 hrs (adults only)] for conjunctivitis only
- gatifloxacin, moxifloxacin, besifloxacin, ofloxacin, ciprofloxacin or gentamicin or tobramycin soln Q 1 hr for **corneal** involvement

Drug	Trade	Dose	Notes
ceftriaxone	Rocephin	1 gram IM \times 1 dose 25–50 mg/kg IV QD \times 7 days 125 mg IM \times 1 dose	for adult GC conjunctivitis for child with GC conjunctivitis ^A for Neonatal Gonococcal conjunctivitis ; do not use with hyperbilirubinemic neonates
cefotaxime	Claforan	1–2 gram IV QD \times 3–5 days 50 mg/kg IV or IM Q 8–12 hrs \times 7 days	for adult GC corneal ulcer for Neonatal Gonococcal conjunctivitis

(3) Chlamydial Inclusion Conjunctivitis (caused by *C. Trachomatis* Subtypes D-K) Trachoma (caused by *C. Trachomatis* Subtypes A, B, C)

Notes:

- 1) Duration of treatment is 3 weeks for inclusion conjunctivitis and 3–6 weeks for trachoma^Φ. Oral azithromycin may be given as a single dose.
- 2) Diagnosis of inclusion conjunctivitis requires that patient's sexual partners be treated. Both patient and sexual partners must be evaluated for other sexually transmitted diseases, including HIV.
- 3) Select one ointment **and** one oral agent

Drug	Trade	Dose	Notes
erythromycin	AK-mycin, Ilotycin	Oint, 0.5% BID-TID \times 3–6 weeks	recommended for Neonatal Chlamydial Conjunctivitis
oxytetracycline/ polymyxin B sulfacetamide	AK-tetra, Terramycin, Terak AK-sulf, Bleph-10, Cetamide, Sulamyd Sodium	Oint, 0.5%/10,000 u BID-TID \times 3–6 weeks Oint, 10% BID-ID \times 3–6 weeks	Not for children or pregnancy
PLUS azithromycin	Zithromax	20 mg/kg \times 1 (pediatric dose) 1000 mg PO \times 1 (adult dose)	Effective as a single dose (Arch Ophthalmol 1998;116:1625–28 Ophthalmology 1998;105:658–61)
clarithromycin	Biaxin	250–500 mg PO BID for 3–6 weeks	Adult Dose
doxycycline	Vibramycin	15 mg/kg/day PO divided BID for 3–6 weeks	Pediatric Dose
erythromycin	E-mycin	100 mg PO BID \times 3–6 weeks 250–500 mg PO QID \times 3–6 weeks 50 mg/kg/day PO divided QID for 3–6 weeks	Not for children or pregnancy Adult Dose Pediatric Dose, recommended for 14 days in Neonatal Chlamydial
ofloxacin	Floxin	300 mg PO BID for 3–6 weeks	Conjunctivitis
tetracycline	Achromycin	250–500 mg PO QID \times 3–6 weeks	Not for children or pregnancy Not for children or pregnancy

(4) Lyme Disease^r (*Borrelia burgdorferi*): if patient has ocular involvement beyond follicular conjunctivitis occurring within the first month of infection, must be considered to have CNS involvement.

(a) Stage 1 (erythema migrans):

Early (limited to follicular conjunctivitis as above) select **one** agent and treat for 14 to 21 days (except azithromycin)

Drug	Trade	Dose	Notes
amoxicillin	Amoxil	500 mg PO TID	Preferred first line agent
azithromycin	Zithromax	20–40 mg/kg/day PO in 3 divided doses 500 mg PO QD \times 1 day, then 250 mg PO QD \times 4 days	Pediatric Dose
cefuroxime	Ceftin	500 mg PO BID	Adult Dose
clarithromycin	Biaxin	20–30 mg/kg/day PO divided BID 250–500 mg PO BID	Pediatric Dose (max 1 g QD) Adult Dose
doxycycline	Vibramycin	15 mg/kg/day PO divided BID 100 mg PO BID	Pediatric Dose Preferred first line agent
erythromycin	E-mycin	250 mg PO QID 30–50 mg/kg/day in 3–4 divided doses	Not for children or pregnancy Adult Dose
tetracycline	Achromycin	250 mg PO QID	Pediatric Dose Not for children or pregnancy

(b) *Stage 2*

Develops in days to months with dissemination of organism to skin, heart, joints and CNS. Ocular involvement consists of granulomatous anterior uveitis, retinal vasculitis, choroiditis. Select **one** agent – patient needs systemic work-up to rule out arthritis, which must be treated with ceftriaxone or doxycycline

Drug	Trade	Dose	Notes
cefotaxime	Claforan	3 Gm IV Q 12 hrs \times 21–28 days	Preferred first line agent Pediatric Dose (max 2 g/day) Preferred first line agent Not for children or pregnancy,
ceftriaxone	Rocephin	2.0 Gm IV QD \times 21–28 days	
doxycycline	Vibramycin	50–75 mg/kg/day divided Q 12 hrs	
		100 mg PO BID	
penicillin G		2–4 MU IV Q 4 hrs \times 21–28 days	

(c) *Stage 3*

Develops weeks to years following initial infection and is typically characterized by development of arthritis. Ocular involvement includes episcleritis, stromal keratitis, orbital myositis.

Drug	Trade	Dose	Notes
ceftriaxone	Rocephin	2.0 gm IV QD \times 14–28 days	Preferred first line agent Pediatric Dose (max 2 g/day)
or		50–75 mg/kg/day divided Q 12 hrs	
doxycycline	Vibramycin	100 mg PO BID \times 30 days	Not for children or pregnancy

Drug	Trade	Dose	Notes
rifampin	Rifadin	300 mg PO BID \times 4 weeks	LFTs should be monitored
and doxycycline	Vibramycin	100 mg PO BID \times 4 weeks	Not for children or pregnancy

^Δ*Wills Eye Manual: Office and Emergency Room Diagnosis and Treatment of Eye Disease.*

^ΦCurrent Ocular Therapy 4, Fraunfelder, F., Roy, FH. 1995. Saunders Co. p. 62–63. [Current Ocular Therapy 6. Roy, FH, Fraunfelder, FW, Fraunfelder FT, Saunders Elsevier, 2008, p. 86–89.]

[†]Sanford Guide to Antimicrobial Therapy. Sanford, JP., Gilbert, DN., Sande, MA. 1995. p. 38–39.

E. REGIMENS FOR SPECIFIC CLINICAL ENTITIES

(1) Blepharitis

Notes:

- 1) Treated with combination of warm compresses, lid hygiene (using warm wash cloth with baby shampoo to scrub lashes), and artificial tears 4–8 \times /day depending on the severity of dry eye symptoms. Commercial lid scrub products also available, see below
- 2) May supplement with either erythromycin or bacitracin ointment at bedtime.
- 3) Additionally, may use a combination antibiotic/steroid (e.g. Vasocidin, Blephamide) QID. However, we recommend short duration of treatment and extreme care to monitor for side effects of topical steroids.
- 4) Cyclosporine 0.05% drops BID can be effective for posterior blepharitis, but often takes weeks-months to have a significant effect.
- 5) For severe posterior blepharitis or ocular rosacea, may supplement with an oral agent (see section on **rosacea, ocular**).

Drug	Trade	Dose	Notes
azithromycin	Azasite	bid \times 2 days then qhs to eyes or lids	Off-label use
cocamidopropyl hydroxysultaine	OcuSoft Lid Scrub	scrub lids QD-QID	cocamidopropyl hydroxysultaine is a mild surfactant; preserved with quaternium-15
cocoamidopropylamide oxide	Lid Wipes	scrub lids QD-QID	
cyclosporine	Restasis	oil emulsion, 0.05% BID	Off-label use, may take weeks to months to have a significant effect
	Novartis Eye Scrub OcuClenz	scrub lids QD-QID	

(2) Rosacea, Ocular

Select **one** agent, in addition to warm compresses, lid hygiene, and artificial tears. For oral agents, treat for 2–6 weeks, then decrease dosing frequency by half (e.g. BID \rightarrow QD) and continue for several months. After several months, the dose can be cut in half again in many patients.

Drug	Trade	Dose	Notes
azithromycin	Azasite	bid \times 2 days then qhs to eyes or lids	Off-label use
doxycycline	Vibramycin	100 mg PO BID	Not for children or pregnancy
erythromycin	E-mycin	250 mg PO QID	If unable to take doxycycline or tetracycline
metronidazole	MetroGel	Gel, 0.75%, apply BID	Periocular use for rosacea
tetracycline	Achromycin	250 mg PO QID	Not for use in the eye
cyclosporin	Restasis	oil emulsion, 0.05% BID	Not for children or pregnancy
			Off-label use, may take weeks to months to have a significant effect

(3) **Stye/Hordeolum**

- Notes:**
- 1) Warm compress with massage over the affected area for 10–15 minutes four times per day.
 - 2) Medications are not indicated unless **preseptal cellulitis** occurs (see subject index)
 - 3) For **chalazion**, see Chapter X: Miscellaneous Conditions

(3.5) **Chalazion/Hordeolum**

- Notes:**
- 1) Warm compress with massage over the affected area four times per day.
 - 2) If the lesion does not disappear after 3–4 weeks, then can consider surgical removal (incision and curettage) or steroid injection. Steroid injection can lead to permanent depigmentation of the skin at the injection site. If steroid injection is elected, can use 0.2–1.0 ml of a 40 mg/ml solution of triamcinolone (Kenalog).

(4) **Pediculosis** (*Phthirus pubis*, lice, “crabs”)

- Notes:**
- 1) Use anti-lice lotion and shampoo for non-ocular areas: e.g. piperonyl butoxide/permethrins (e.g. Rid), permethrin (e.g. Elimite) or Lindane Shampoo.
 - 2) Additionally, lice and nits (eggs) may be removed from lids/lashes with fine forceps at the slit lamp.
 - 3) All sexual partners need to be examined; instruct the patient to wash and machine dry linens and sheets.
 - 4) Physostigmine interferes with the organism’s respiratory function, but has significant ocular side effects and is rarely used.

Drug	Trade	Dosage	Notes
Any bland ophthalmic ointment (bacitracin, erythromycin) to eyelids TID for 10 days (smothers lice and nits)			
OR			
physostigmine	Eserine	Oint, 0.25%	2 applications to lids 1 week apart; has significant ocular side effects; rarely used.

(5) Conjunctivitis

(a) Viral:

Anti-bacterial medications are not indicated in most viral conjunctivitis unless significant corneal epithelial damage has occurred to prevent secondary bacterial infections. For symptomatic improvement, consider artificial tears, ocular decongestant/antihistamine (i.e. naphazoline/pheniramine), topical nonsteroidals, and cool compresses.

(b) Bacterial:

If clinically suspect bacterial conjunctivitis, Gram stain and culture appropriately and start on a broad spectrum topical agent (e.g. azithromycin $1-2 \times$ day, polymyxin/trimethoprim, ciprofloxacin, ofloxacin, levofloxacin $4-8 \times$ /day or gatifloxacin, moxifloxacin, besifloxacin $3-6 \times$ /day). Certain etiologies (i.e. *Neisseria gonorrhoea*) are relative emergencies and should be managed according to specific regimens.

(c) Neonatal:

Most commonly caused by *Chlamydia trachomatis*, *Strep. viridans*, *Staph. aureus*, *Haemophilus influenzae*, group B *Streptococcus*, *Moraxella catarrhalis*, or *Neisseria gonorrhoea*. Treatment is guided by gram stain (which should be performed immediately to identify *N. gonorrhoea*) and culture results. *N. gonorrhoea* and *C. trachomatis* have specific regimens as described (see Neonatal Gonococcal Conjunctivitis and Neonatal Chlamydial Conjunctivitis in subject index). If not gonococcal or chlamydial, may use erythromycin or bacitracin ointment Q 4-6 hrs. as only initial treatment. In the United States, neonatal conjunctivitis is most commonly chlamydial.

(6) Canaliculitis

Notes:

- 1) Etiologies include *Actinomyces Israelii* (most common), viruses, chlamydia, fungi, and other bacteria.
- 2) Surgical removal of offending agent is the most important aspect of treatment. Evaluate drainage system for obstruction, attempt to remove concretions, and obtain smears and cultures of any material expressed.

- 3) Consider irrigation of canaliculus with penicillin G solution 100,000 units/ml, repeat as necessary; irrigation should be performed in upright position so drainage is out nose rather than nasopharynx.
- 4) Consider tetracycline 250 mg PO QID (not for use in children or pregnancy) or Bactrim DS 1 tab PO BID, for bacterial etiologies.
- 5) If fungus is recovered, irrigate with nystatin 1:20,000 units/ml in addition to topical nystatin drops TID.
- 6) If herpes is found, treat with trifluridine 1% drops 5×/day for several weeks.
- 7) Warm compresses QID.
- 8) Canaliculotomy may be necessary to prevent recurrent infections due to the tendency for diverticuli formation that may harbor concretions and additional organisms

(7) Dacryocystitis

Notes:

- 1) All patients receive topical polymyxin/trimethoprim (Polytrim) QID in addition to systemic antibiotics
- 2) All patients receive warm compresses QID
- 3) May require surgical incision & drainage if abscess is present
- 4) May require surgical reconstruction of nasolacrimal drainage system (e.g. DCR) 1–4 weeks after acute inflammation is resolved
- 5) Fungal etiologies usually have a more subacute or chronic presentation; aspergillus is most common fungal cause (see **Aspergillosis**)
- 6) Pediatric consultation is recommended in children
- 7) Recent studies suggest an increase in methicillin-resistant *Staphylococcus aureus* and gram negative pathogens as causative agents in dacryocystitis. Many affected patients harbor multiple organisms. This should be taken consider if clinical response to first-line agents is not as expected.

(a) *Afebrile, mild case, systemically well, reliable patient/parent*

Select **one** agent with daily follow-up

Drug	Trade	Dose	Notes
amoxicillin/clavulanate	Augmentin	500 mg PO TID or 875 mg PO BID	Adult Dose
		20–40 mg/kg/day PO in 3 divided doses	Pediatric Dose
cefaclor	Ceclor	250 mg PO TID	Adult Dose
		20–40 mg/kg/day PO in 3 divided doses	Pediatric Dose
cephalexin	Keflex	500 mg PO QID	Adult Dose
		25–50 mg/kg/day PO in 4 divided doses	Pediatric Dose

(b) *Febrile, moderate-severe case, acutely ill, unreliable parent*

Hospitalize and select **one** agent

Drug	Trade	Dose	Notes
cefazolin	Ancef	1 Gm IV Q 8 hrs	Adult Dose
		25–50 mg/kg/day IV in 3 divided doses	Pediatric Dose
cefuroxime	Zinacef	1.5 Gm IV Q 8 hrs	Adult Dose
		75–100 mg/kg/day IV in 3 divided doses	Pediatric Dose

(8) Dacryoadenitis—Bacterial

Notes: 1) Other causes of lacrimal gland masses include inflammatory, neoplastic, and viral causes. Please refer to the Wills Eye Manual: Office and Emergency Room Diagnosis and Treatment of Eye Disease for complete discussion on evaluation of non-bacterial treatment.

- 2) CT scan of orbit and brain to rule out abscess formation which may require surgical incision & drainage
- 3) Pediatric consultation is recommended in children

(a) *Mild*

Select **one** agent with daily follow-up

Drug	Trade	Dose	Notes
amoxicillin/clavulanate	Augmentin	250–500 mg PO TID or 875 mg PO BID	Adult Dose
		20–40 mg/kg/day in 3 divided doses	Pediatric Dose
cephalexin	Keflex	250–500 mg PO QID	Adult Dose
		25–50 mg/kg/day in 4 divided doses	Pediatric Dose

(b) *Moderate to Severe*

Hospitalize and select **one** agent

Drug	Trade	Dose	Notes
ticarcillin/clavulanate	Timentin	3.1 Gm IV Q 4–6 hrs	Adult Dose
		200 mg/kg/day in 4 divided doses	Pediatric Dose above age 12
cefazolin	Ancef	1 Gm IV Q 8 hrs	Adult Dose
		50–100 mg/kg/day IV in 3 divided doses	Pediatric Dose over one month of age (max adult dose 4–6 g/day)

(9) Preseptal Cellulitis

(a) *Mild case, patient > 5 years of age, afebrile, systemically well, reliable patient/parent*

Select **one** agent with daily follow-up and treat for 10 days

Drug	Trade	Dose	Notes
amoxicillin/ clavulanate	Augmentin	250–500 mg PO TID or 875 PO BID	Adult Dose
cefaclor	Ceclor	20–40 mg/kg/day PO in 3 divided doses 250–500 mg PO TID	Pediatric Dose Adult Dose
cephalexin	Keflex	20–40 mg/kg/day PO in 3 divided doses 250–500 mg PO QID	Pediatric Dose Adult Dose
clarithromycin	Biaxin	25–50 mg/kg/day in 4 divided doses 250–500 mg PO BID	Pediatric Dose Adult Dose
erythromycin	E-mycin	15 mg/kg/day PO divided BID 250–500 mg PO QID 30–50 mg/kg/day PO in 3–4 divided doses	Pediatric Dose Adult Dose Not very good against Staphylococcus or Streptococcus
trimethoprim/ sulfamethoxazole	Bactrim	1 double strength tablet PO BID 8–12 mg/kg/day TMX & 40–60 mg/kg/day SMX PO in 2 divided doses	Adult Dose Pediatric Dose

(b) *Moderate-Severe Preseptal Cellulitis or Child <5 years of age*

Hospitalize and give **BOTH** agents

Drug	Trade	Dose	Notes
ceftriaxone	Rocephin	1–2 Gm IV Q 12 hrs 100 mg/kg/day IV in 2 divided doses	Adult Dose Pediatric Dose
AND			
vancomycin	Vancocin	0.5–1 GM IV Q 12 hrs 40 mg/kg/day IV in 3–4 divided doses 15 mg/kg load, maintenance dose 10 mg/kg BID-TID	Adult Dose ^Y Pediatric Dose ^Y Neonatal Dose ^Y

Notes:

- 1) Patient may be switched to oral therapy after significant improvement has occurred; total duration of systemic therapy should be for 10–14 days.
- 2) Children under 5 years must receive complete physical examination to rule out concurrent otitis media, sinusitis, and bacteremia. Pediatric consultation is recommended.
- 3) Widespread introduction of the Hemophilus influenza type B vaccine have reduced the frequency of preseptal cellulitis caused by this agent

^YFollow peak and trough levels; dosage must be adjusted in renal failure

(10) Orbital Cellulitis–Bacterial

(a) Children:

Give **BOTH** agents; pediatric consultation is recommended.

Drug	Trade	Dose	Notes
ceftriaxone AND vancomycin	Rocephin Vancocin	100 mg/kg/day IV in 2 divided doses 40 mg/kg/day IV in 3–4 divided doses 15 mg/kg load, maintenance dose 10 mg/kg BID-TID	Pediatric Dose ^Y Neonatal Dose

(b) Adults:

Give either ampicillin/sulbactam alone or ceftriaxone plus vancomycin

Drug	Trade	Dose	Notes
ampicillin/sulbactam	Unasyn	1.5 Gm–3.0 Gm IV Q 6 hrs × 7 days	
ceftriaxone	Rocephin	1–2 Gm IV Q 12 hrs × 7 days ^Y	Continue oral antibiotics on discharge
vancomycin	Vancocin	1 Gm IV Q 12 hrs × 7 days	Continue oral antibiotics on discharge

Notes:

- 1) If highly suspect adults with anaerobic infections consider adding metronidazole 15 mg/kg IV load, then 7.5 mg/kg IV Q 6 hrs, or clindamycin 600 mg IV Q 8 hrs. (Ampicillin/sulbactam alone has adequate anaerobic coverage)

^YFollow peak and trough levels; dosage must be adjusted in renal failure

- 2) If adult patient is allergic to penicillin/cephalosporin, may use vancomycin plus gentamicin 2.0 mg/kg IV loading dose, then 1 mg/kg IV Q 8 hrs or clindamycin 600 mg IV Q 8 hrs plus gentamicin
- 3) Case reports have documented the appearance of methicillin-resistant *Staphylococcus aureus* as a causative agent in non-hospitalized adults and children.
- 4) Recent studies suggest that anaerobic bacteria may play a larger role in orbital cellulitis than previously thought. Consideration should be given to adding intravenous metronidazole (Flagyl; 7.5 mg/kg three times daily, max dose 400 mg), especially if the clinical exam does not improve with standard antibiotic therapy.
- 5) If no improvement, suspect abscess or resistant organism
- 6) Initial work-up should include orbital/sinus CT with contrast.
- 7) Children tend to do better on IV antibiotics than adults because they are less likely to have polymicrobial infections.
- 8) Adults often have a mix of anaerobes in addition to the usual infections agents, which may limit response to systemic antibiotics alone. Consider urgent surgical drainage for adults with subperiosteal abscesses.
- 9) Consider ENT evaluation for all patients with suspected sinus etiology.

(11) Prophylaxis of post-traumatic endophthalmitis following open globe injuries (including full thickness corneal laceration)

Notes:

- 1) On presentation shield eye without contact to globe and keep patient NPO.
- 2) Treatment is prompt surgical exploration and repair.
- 3) Admit and give systemic antibiotics for 36 hours – give **two** (i.e. vancomycin plus ceftazidime or vancomycin plus levofloxacin):

Drug	Trade	Dose	Notes
vancomycin	Vancocin	1 Gm IV Q 12 hrs 40 mg/kg/day IV in 2–4 divided doses 15 mg/kg load, maintenance dose 10 mg/kg BID-TID	Adult Dose ^Y Pediatric Dose ^Y Neonatal Dose ^Y
PLUS ceftazidime	Fortaz	1 Gm IV Q 8 hrs 25–50 mg/kg IV Q 8 hrs (max 6 g/day)	Adult Dose Pediatric Dose
OR levofloxacin	Levaquin	500 mg IV or po Q 24 hrs	Not approved for use in children Modify dose in renal failure
If vancomycin allergy consider: clindamycin	Cleocin	10–15 mg/kg IV or IM Q 6–12 hours	true allergy to vancomycin is uncommon

- 4) CT scan to rule out intraocular and/or intraorbital foreign body
- 5) Vancomycin should be infused slowly (over 1–2 hours) to prevent “red man” syndrome
- 5) If no endophthalmitis develops after 48–72 hours of IV therapy, may discontinue. If high risk for endophthalmitis (delayed presentation or intraocular foreign body, consider oral levoquin (500 mg daily for 1 week)
- 6) If tetanus immunization not up to date, give tetanus toxoid 0.5 ml IM.
- 7) If endophthalmitis does develop, see **endophthalmitis – traumatic**

Note: oral levofloxacin and moxifloxacin achieve good aqueous and vitreous penetration (**Ophthalmology** 1999;106:2286–2290; Am J Ophthalmol 2007;143:338–40) and can be used for completion of the antibiotic course in outpatient setting.

^YFollow peak and trough levels; dosage must be adjusted in renal failure

(12) Blebitis (most commonly associated with *Streptococcus* species and *Haemophilus influenzae*)

26

(a) *Suspected bleb infection but NO anterior chamber or vitreal involvement*

Notes:

- 1) Consider culturing bleb for diagnostic purposes
- 2) Select antibiotic regimen (use gatifloxacin or moxifloxacin alone or both fortified tobramycin and vancomycin)

Name	Trade	Preparation	Dose	Notes
gatifloxacin	Zymar	Soln, 0.3%	Q 1 hr	mild case
moxifloxacin	Vigamox	Soln, 0.5%	Q 1 hr	mild case
OR				
tobramycin (fortified) ^o	Tobrex	Soln, 1.5%	Q 1 hr	moderate-severe case
and				
vancomycin (fortified) ^o	Vancocin	Soln, 5%	Q 1 hr	moderate-severe case

- 3) In adults, consider oral ciprofloxacin 250–500 mg PO BID for 10 days; may also consider oral fourth generation fluoroquinolone as well.
- 4) Re-evaluate after 12–24 hrs and if there is improvement consider adding steroid to prevent loss of bleb.
prednisolone acetate Pred Forte, Econopred plus Susp, 1% QID

(b) *Suspected bleb infection with anterior chamber but NO vitreal involvement*

Notes:

- 1) Consider culturing bleb and/or performing anterior chamber tap for diagnostic purposes.
- 2) Begin antibiotics immediately; use both drops alternating every half hour; consider admission to hospital.
- 3) In adults, consider oral ciprofloxacin 250–500 mg PO BID for 10 days; may also consider oral fourth generation fluoroquinolone as well.

Name	Trade	Preparation	Dose	Notes
tobramycin (fortified) ^o and	Tobrex	Soln, 1.5%	Q 1 hr	
cefazolin (fortified) ^o or	Ancef	Soln, 5%	Q 1 hr	
vancomycin (fortified) ^o	Vancocin	Soln, 5%	Q 1 hr	should be reserved for PCN allergic patients or resistant organisms

Note: 4) Re-evaluate after 12–24 hrs; if there is improvement, consider adding steroid to prevent loss of bleb.
prednisolone acetate Pred Forte, Econopred Plus Susp, 1% Q 2 hr

(c) with anterior chamber and vitreal involvement – see endophthalmitis (see below)

(13) Endophthalmitis

(a) Postoperative-Acute (less than one week)

Most common organism encountered is *Staph. epidermidis*, others include *Staph. aureus*, *Streptococcus* species, *Serratia marcescens*, *Proteus* species, and *Pseudomonas* species

- Notes:**
- 1) Intravitreal antibiotics are the treatment of choice, combined with topical antibiotics; the benefit of subconjunctival antibiotics is unclear and is not frequently used.
 - 2) Immediate pars plana vitrectomy is beneficial if visual acuity on presentation is light perception or worse (Arch Ophthalmol. 1995;113:1479–1496).
 - 3) Often combined with topical, subconjunctival, and/or intravitreal steroids since fungi are unlikely in the early post-operative setting. Use topical prednisolone acetate 1% Q 1 hr and subconjunctival triamcinolone 40 mg at the time of vitrectomy. Intravitreal dexamethasone 0.4 mg at time of surgery is at surgeon's discretion. Some have shown that concomitant use of intravitreal steroids may yield a worse visual prognosis (Ophthalmology 2000;107:486–489).
 - 4) Topical atropine 1% TID is also given for cycloplegia.

(1) *Topical*: combination of fortified aminoglycoside with either fortified cefazolin or vancomycin

Drug	Dose
fortified cefazolin [◊] OR fortified vancomycin [◊] PLUS fortified gentamicin [◊] OR fortified tobramycin [◊]	Q 1 hr (alternate drops every 30 minutes) Q 1 hr (alternate drops every 30 minutes)

(2) *Intravitreal*: can be re-injected if the vitreous is not clearing

Note: Cefazidime is alternative agent for Gram-negative coverage in bacterial endophthalmitis (Surv Ophthalmol. 41:395–401, 1997)

Drug	Dose
amikacin	0.2–0.4 mg in 0.1 ml
OR	
cefazidime	2.25 mg in 0.1 ml
PLUS	
vancomycin	1.0 mg in 0.1 ml (clindamycin 1 mg in 0.1 ml may be used in place of vancomycin)

(3) *Subconjunctival*

Drug	Dose
cefazidime AND vancomycin	100 mg in 0.5 ml 25–50 mg in 0.5 ml

(b) *Postoperative—Delayed (longer than one week)*

Notes:

- 1) Begin treatment as with Postoperative-Acute except do **NOT** use steroids if fungal etiology is suspected.
- 2) Immediate pars plana vitrectomy is beneficial if visual acuity on presentation is light perception or worse up to six weeks following surgery (Arch Ophthalmol. 1995;113:1479–1496). Benefit beyond six weeks is not known.
- 3) If *Propionibacterium acnes* infection is suspected [usually from 2 months to several years following cataract surgery with granulomatous keratic precipitates, anterior uveitis, vitritis, and white plaques in capsular bag (often with retained lens material)], intravitreal vancomycin combined with local debridement/removal of intracapsular plaques may be sufficient.
- 4) If mild *Staph epidermidis* is isolated, intraocular vancomycin alone may be sufficient.
- 5) If fungus is suspected (usually begins approximately 3 months after surgery – *Candida* is most commonly encountered organism), consider amphotericin B 5–10 µg at time of vitrectomy. Amphotericin B has been reported to have retinal toxicity in animal studies. Therefore, if air-fluid exchange is performed for concurrent retinal detachment, the dose of amphotericin should be reduced by a third to one half.
- 6) If fungus is identified on Gram stain, Giemsa, or Calcofluor white, then use combination of topical and systemic antifungal medications. Natamycin 5% Q 1 hr is a good topical option. The antibiotic of choice for broad-spectrum systemic coverage has traditionally been Amphotericin B administered intravenously. Fluconazole 400–800 mg PO QD is also commonly used if the strain is sensitive. For fluconazole-resistant fungi, Voriconazole administered orally or intravenously at 200 mg twice daily can be used (Am J Ophthalmol 2005;139:135–140).

(c) *Traumatic*

Notes:

- 1) Begin treatment as with Postoperative-Acute except do **NOT** use steroids and therapeutic benefit of pars plana vitrectomy (PPV) is unknown for this type of endophthalmitis. However PPV offers the benefit of reducing infectious load and providing sufficient material for diagnostic culture and pathology.

- 2) Intravitreal amikacin 0.4 mg in 0.1 ml or ceftazidime 2.25 in 0.1 ml along with intravitreal vancomycin 1.0 mg in 0.1 ml should be given. May repeat Q 2–3 days. (clindamycin 1 mg in 0.1 ml may be used instead of vancomycin).
- 3) If wound or sclera is involved, consider addition of oral ciprofloxacin 250–750 mg BID.
- 4) Consider obtaining CT scan to rule out intraocular foreign body.
- 5) If tetanus immunization not up to date, give tetanus toxoid 0.5 ml IM.
- 6) Steroids should **NOT** be used until fungal organisms are ruled out. If no fungi are isolated, may use prednisolone acetate 1% Q 4 hrs and subconjunctival dexamethasone 4 mg. Prednisone 40–80 mg PO QD is at the discretion of the surgeon. If fungus is isolated, specific anti-fungal regimens may be used.
- 7) Incidence of post-traumatic endophthalmitis higher in rural settings; most common agents are *Staph. epidermidis*, *Bacillus* species, *Streptococcus* species, *Staph. aureus*, and various fungi.

(d) *Endogenous—therapy is variable and treatment depends on suspected source*

Notes:

- 1) Thorough physical examination must be performed to locate potential source of infection and consultation with an infectious disease specialist is desirable.
- 2) Broad spectrum IV antibiotics are used according to the suspected source of septic infection and blood culture results. IV drug users should receive aminoglycosides and clindamycin to eliminate possible *Bacillus cereus*, and vancomycin should be considered for *Staph. aureus* coverage. Other common associated pathogens include *Streptococcus* species and *Staph. aureus* with endocarditis, and *Candida* with indwelling catheters, hyperalimentation, and IV drug users.
- 3) Intravitreal antibiotics offer higher intraocular concentrations.
- 4) Vitrectomy offers the benefit of reducing infective load and providing sufficient material for diagnostic culture and pathology.
- 5) For fungal etiologies (see subject index for specific organisms), the decision to perform vitrectomy should be made when there is an inadequate response to systemic medications or advanced vitreous opacification on presentation.

^Y Follow peak and trough levels; dosage must be adjusted in renal failure

◦ Fortified medications not commercially available; refer to Appendix 2 for preparation instructions

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2011, XI, 138 p., Softcover

ISBN: 978-1-4419-7620-8