MICHIGAN MEDICINE
UNIVERSITY OF MICHIGAN

# TREATMENT OF OCULAR INFECTIONS IN HOSPITALIZED ADULTS

| Clinical Setting | Empiric Therapy | Duration | Comments |
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| **Periorbital Cellulitis**<br><br>Severe infection warranting hospital admission, or failing outpatient oral antibiotics<br><br>*Staphylococcus aureus*<br><br>*Streptococcus pneumonia*<br><br>*Streptococcus milleri group*<br><br>*Streptococcus pyogenes*<br><br>*Haemophilus influenzae*<br><br>*Oral anaerobes* | 1st line:<br>**Vancomycin** (see nomogram, AUC goal 400-600)*<br>+ **Ampicillin-sulbactam** 3 g IV q6h*<br><br>PCN allergy without anaphylaxis, angioedema, or urticaria:<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Ceftriaxone** 2 g IV q24h<br><br>Severe PCN or cephalosporin allergy (anaphylaxis, angioedema, hives):<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Aztreonam** 2 g IV q8h*<br><br>Recommend the addition of anaerobic coverage with **metronidazole** 500 mg PO q8h if dental infection presumed to be initial source in the setting of PCN allergy and regimen without ampicillin-sulbactam. | Transition to oral antibiotics can be considered if significant improvement within 24-48 hours.<br><br>Antibiotic duration for severe periorbital cellulitis is typically about 10 days, but should be guided by clinical resolution. | • Appropriately tailor therapy based on culture results, if obtained.<br><br>• For culture negative or not obtained, transition to oral therapy when patient is afebrile with clinical improvement and hemodynamically stable for 48 hours:<br>  • 1st line:<br>  **Amoxicillin-clavulanate** 875 mg BID*<br>  + **TMP-SMX** 2 DS tabs PO BID*<br>  • PCN allergic, without anaphylaxis, angioedema, or urticaria:<br>  **Cefpodoxime** 400 mg PO BID*<br>  + **TMP-SMX** 2 DS tabs PO BID*<br>  • Severe PCN allergic patients who do not tolerate cephalosporins:<br>  **Clindamycin** 450 mg PO TID<br>  + **TMP-SMX** 2 DS tabs PO BID*<br><br>For sulfa allergy, **doxycycline** 200 mg PO x1, then 100 mg PO BID can be substituted for TMP-SMX |

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| **Orbital cellulitis**<br><br>*Staphylococcus aureus*<br><br>*Streptococcus pneumonia*<br><br>*Streptococcus milleri group*<br><br>*Streptococcus pyogenes*<br><br>*Haemophilus influenzae*<br><br>*Oral anaerobes* | 1st line:<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Ampicillin-sulbactam** 3 g IV q6h*<br><br>PCN allergy without anaphylaxis, angioedema, or urticaria:<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Ceftriaxone** 2 g IV q24h<br><br>Severe PCN or cephalosporin allergy (anaphylaxis, angioedema, hives):<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Aztreonam** 2 g IV q8h*<br><br>Recommend the addition of anaerobic coverage with **metronidazole** 500 mg PO q8h if dental infection presumed to be initial source in the setting of PCN allergy and regimen without ampicillin-sulbactam. | Uncomplicated Orbital cellulitis (without abscess or bony destruction):<br>If rapid and dramatic improvement (Afebrile, normal WBC, normal vitals, exam improved with significant decrease in swelling, redness, and pain), transition to oral antibiotics can be considered after 24-48 hours.<br><br>Antibiotic duration is typically at least 2 weeks, and should be guided by clinical resolution.<br><br>Complicated Orbital cellulitis (with abscess or significant bony destruction):<br>If abscess is drained, antibiotic duration is typically 2-3 weeks, and should be guided by clinical resolution.<br><br>If significant ethmoid bony destruction, would recommend at least 4 weeks of therapy, guided by clinical resolution. | **Ophthalmology and ID consult is strongly recommended.**<br><br>• Appropriately tailor therapy based on abscess culture results, if obtained.<br><br>• For culture negative or not obtained, or no bone involvement presumed, transition to oral therapy when patient is afebrile with clinical improvement and hemodynamically stable for 48 hours:<br>• 1st line:<br>**Amoxicillin-clavulanate** 875 mg BID*<br>+ **TMP-SMX** 2 DS tabs PO BID*<br>• PCN allergic, without anaphylaxis, angioedema, or urticaria:<br>**Cefpodoxime** 400 mg PO BID*<br>+ **TMP-SMX** 2 DS tabs PO BID*<br>• Severe PCN allergic patients who do not tolerate cephalosporins:<br>**Clindamycin** 450 mg PO TID<br>+ **TMP-SMX** 2 DS tabs PO BID*<br><br>For sulfa allergy, **doxycycline** 200 mg PO x1, then 100 mg PO BID can be substituted for TMP-SMX |

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| **Orbital cellulitis with INTRACRANIAL EXTENSION**<br><br>*Staphylococcus aureus*<br><br>*Streptococcus pneumonia*<br><br>*Streptococcus milleri group*<br><br>*Streptococcus pyogenes*<br><br>*Haemophilus influenzae*<br><br>*Oral anaerobes* | 1st line:<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Ceftriaxone** 2 g IV q12h*<br>+ **Metronidazole** 500 mg IV q8h<br><br>PCN allergy without anaphylaxis, angioedema, or urticaria:<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Ceftriaxone** 2 g IV q12h<br>+ **Metronidazole** 500 mg IV q8h<br><br>Severe PCN or cephalosporin allergy (anaphylaxis, angioedema, hives):<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Aztreonam** 2 g IV q6h*<br>+ **Metronidazole** 500 mg IV q8h | Duration depends on source control and clinical improvement, typically 6-8 weeks. | **Ophthalmology Consult is required, and ID consult is strongly recommended.**<br>• Appropriately tailor therapy based on abscess culture results, if obtained. |
| **Endophthalmitis prophylaxis in patients with penetrating trauma to the globe of the eye (open globe)**<br><br>*Staphylococcus* spp<br><br>*Streptococcus* spp<br><br>*Bacillus cereus* | 1st line:<br>**Moxifloxacin** 400 mg IV/PO q24h | To 48 hours post repair. | • Endophthalmitis prophylaxis is warranted in patients with penetrating trauma to the globe of the eye.<br>• Prophylaxis regimen should be the same whether prophylaxis is initiated pre- or post- repair.<br>• The major difference in spectrum between levofloxacin and moxifloxacin is a lack of activity against *Pseudomonas* with moxifloxacin. While moxifloxacin is more potent in vitro against *Staphylococcus* and *Streptococcus*, the clinical relevance is unclear. |

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| **Bacterial Endophthalmitis**<br><br>Post-surgical<br>• *S. epidermidis* (60-70%)<br>• *S. aureus,* streptococci, and enterococci (5%–10%)<br>• Gram-negative species (~5%)<br>• *P. acnes* (delayed disease)<br><br>Post-traumatic<br>• Staphylococci, streptococci, *B cereus*<br><br>Endogenous<br>• Endocarditis is the source in 40% of cases<br>• Staphylococci, gram-negative bacilli, streptococci | ***Ophthalmology and Infectious Diseases consultation is strongly recommended***<br><br>Treatment for *endogenous* endophthalmitis usually consists of a combination of intravitreal and systemic antibiotics. Systemic antibiotics should be targeted towards the infecting pathogen, by the direction of the Infectious Diseases consult service. Systemic antibiotics with adequate intravitreal penetration are recommended (see comments).<br><br>*Post-surgical* and *post-traumatic* endophthalmitis is usually treated with intravitreal antibiotics alone. If systemic antibiotics are deemed necessary, the below empiric regimens are recommended (in combination with intravitreal antibiotics). Definitive treatment should be based on results of culture, as available.<br><br>Intravitreal antibiotics:<br>1. **vancomycin** 1 mg/0.1 mL (0.1 mL) intravitreal<br>2. **ceftazidime** 2.25 mg/0.1 mL (0.1 mL) intravitreal<br>3. **amikacin** 0.4 mg/0.1 ml (0.1 mL); instead of ceftazidime if PCN allergy<br><br>1st line:<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Cefepime** 2 g IV q8h*<br><br>PCN allergy without anaphylaxis, angioedema, or urticaria:<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Cefepime** 2 g IV q8h*<br><br>Severe PCN or cephalosporin allergy (anaphylaxis, angioedema, hives):<br>**Vancomycin** IV (see nomogram, AUC goal 400-600)*<br>+ **Levofloxacin** 750 mg IV/PO q24h* | Post-surgical and post-traumatic infection:<br>Minimum 7-10 days; dependent on resolution of findings<br><br>Endogenous infection:<br>Should be based on duration required to treat endogenous source | • A general rule is that agents that readily penetrate the central nervous system also penetrate the vitreous. Intravenous administration of beta-lactams is necessary to achieve therapeutic levels. 3rd and 4th generation cephalosporins are preferred over 1st generation agents. Levofloxacin, moxifloxacin and linezolid also rapidly achieve therapeutic levels. The difficulty in reliably (rapidly) achieving therapeutic concentrations with systemic antibiotics necessitates early intravitreal therapy in ALL patients.<br>• If intravitreal therapy is not able to be administered, this should be communicated to Infectious Diseases so that the need for a brief course of antibiotics which do rapidly penetrate the vitreous (linezolid, quinolones) may be considered prior to transitioning to the listed empiric/definitive regimens. |

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| ***Candida* Endophthalmitis** | ***Ophthalmology and Infectious Diseases consultation is strongly recommended***<br><br>Intravitreal antifungal therapy:<br>**Voriconazole** 100 micrograms/0.1 mL (0.1 mL)<br>OR<br>**Amphotericin B** 5 micrograms/0.1 mL (0.1 mL)<br><br>Empiric systemic antifungal therapy, *Candida* suspected/confirmed:<br>Note: Therapy may include **Micafungin** in addition to the below. See comment.<br><br>**Fluconazole** 800 mg IV/PO daily*<br><br>Empiric systemic therapy, *Candida* species confirmed, susceptibilities pending:<br>*Candida albicans*<br>*Candida dubliniensis*<br>*Candida parapsilosis*<br>*Candida tropicalis*<br>*Candida lusitaniae*<br>*C. glabrata*<br>**Fluconazole** 800 mg IV/PO daily*<br><br>*C. krusei*:<br>**Voriconazole** 6 mg/kg PO/IV q12h x2 doses, then 4 mg/kg PO/IV q12h<br><br>Definitive systemic therapy:<br>*Candida albicans*<br>*Candida dubliniensis*<br>*Candida parapsilosis*<br>*Candida tropicalis*<br>*Candida lusitaniae*<br>Fluconazole 800 mg IV/PO daily* if susceptible<br><br>*C. krusei*:<br>**Voriconazole** 6 mg/kg PO/IV q12h x2 doses, then 4 mg/kg PO/IV q12h if susceptible | *Candida*:<br>Typically, 4-6 weeks.<br><br>Duration is dependent on resolution of eye lesions based on serial examination | • **Treatment consists of a combination of intravitreal and systemic antifungal therapy**<br>• **Micafungin is not recommended for the treatment of endophthalmitis due to poor vitreous penetration, thus fluconazole/voriconazole should be added, as appropriate per the treatment algorithm, if micafungin is being used for the treatment of candidiasis/candidemia. See candidemia guidelines.**<br>• Antimicrobial Dosing guidelines<br>• Weight-based dosing recommendations for adult obese patients<br>• Therapeutic drug monitoring is recommended for voriconazole. Please see Recommendations for Therapeutic Drug Monitoring of Antifungal Agents<br>• Numerous significant drug interactions occur with azole antifungals. A comprehensive review of the patient profile should be undertaken when these agents are initiated and discontinued.<br>• **For scenarios outside those listed (i.e., *C. albicans* resistant to fluconazole or concern for *Aspergillus* or other non-*Candida* fungi), please consult Infectious Diseases** |

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| | *C. glabrata*:<br>**Fluconazole** 800 mg IV/PO daily* if fluconazole MIC ≤4<br>OR<br>**Voriconazole** 6 mg/kg PO/IV q12h x2 doses, then 3-4 mg/kg PO/IV q12h only if fluconazole MIC >4 and voriconazole MIC is ≤0.125<br><br>*Fluconazole and Voriconazole resistant isolates, including C. glabrata isolates with elevated MICs as defined above:*<br>**Liposomal amphotericin B** (3 - 5 mg/kg IV daily)<br>+ **Flucytosine** (25 mg/kg PO QID)* IF SUSCEPTIBLE | | |

*Dose may need to be adjusted for renal dysfunction. See renal dosing guidelines.

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