

NATIONAL ANTIBIOTIC GUIDELINES 2016

RESPIRATORY TRACT INFECTIONS

UPPER RESPIRATORY TRACT INFECTIONS (URTI)

PHARYNGITIS OR TONSILLITIS

Exudative or diffuse erythematous

- Associated cough, rhinorrhea, hoarseness and/or oral ulcers suggest a viral etiology
- The Rapid Strep Test may be used to diagnose Group A *Streptococcus* (GAS) pharyngitis.
- Complications of GAS pharyngitis include:
 - Acute rheumatic fever (ARF) – follows Group A *S. pyogenes* infection, and is rare after Group C/G infection. The rationale for therapy is to eradicate GAS and prevent ARF. Benzathine penicillin G decreases the rate of ARF from 2.8% to 0.2% in trials. For prevention, start treatment within 9 days of symptom onset.
 - Post-streptococcal glomerulonephritis in children < 7 years old
 - Pediatric autoimmune neuropsychiatric disorder associated with Group A *Streptococcus* infection, or PANDAS
 - Peritonsillar abscess and suppurative phlebitis are also potential complications.

Etiology	Preferred Regimen	Comments
Group A, C, G Streptococci <i>Fusobacterium</i> (in studies)	<p>FIRST LINE:</p> <p>Phenoxymethylpenicillin or Penicillin V P: 25-50 mg/kg/d div q6h PO x 10d A: 500 mg q12h or 250 mg q6h PO x 10d</p> <p>OR</p> <p>Benzathine Penicillin G P: 25,000 units/kg (max 1.2 million units) single dose IM OR <27 kg: 600,000 units single dose IM ≥27 kg: 1.2 million units single dose IM A: 1.2 million units single dose IM</p> <p>SECOND-LINE:</p> <p>Amoxicillin trihydrate P: 50 mg/kg/d (max 1g/d) 3 div q 8-12 hours PO x 10d A: 500 mg q12h PO x 10d</p>	<p>Penicillin V should be given on an empty stomach because its absorption is impaired by food. Take 1 hour before or 2 hours after a meal.</p> <p>In throat infections caused by Epstein Barr virus (infectious mononucleosis), amoxicillin or ampicillin produces a non-allergic maculopapular rash, which does not preclude the future use of penicillins.</p>

	<p>For penicillin allergy: The primary choice is a macrolide, such as erythromycin, clarithromycin or azithromycin.</p> <p>Erythromycin ethylsuccinate P: 40 mg/kg/d (max 1g/d) div q6h PO x 10d A: 400 mg q6-12h PO x 10d</p> <p>OR</p> <p>Clarithromycin P: 15 mg/kg/d div q12h PO x 10d A: 250 mg q12h PO x 10d</p> <p>OR</p> <p>Azithromycin P: 12 mg/kg qd for 5d A: 500 mg single dose and then 250 mg qd PO x 4d or 500 mg qd PO x 3d</p> <p>Alternative to the macrolides for severe penicillin allergy: Clindamycin P: 20-30 mg/kg/d div q8h PO x 10d (maximum dose 1.8g/day) A: 300-450 mg q6-8h PO x 10d</p>	<p>Cotrimoxazole, tetracyclines and fluoroquinolones are not effective.</p> <p>Resistance of <i>S. pyogenes</i> to macrolides has been reported.</p> <p>ALERT! Co-amoxiclav is not recommended.</p>
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Recurrent pharyngitis		
<ul style="list-style-type: none"> • True Group A Streptococci (GAS) infection is difficult to distinguish from GAS carriage with repeated viral pharyngitis. • Tonsillectomy is not recommended to decrease streptococcal infection. 		
Etiology	Preferred Regimen	Comments
Group A Streptococci	<p>FIRST LINE: Phenoxymethylpenicillin or Penicillin V P: 25-50 mg/kg/d div q6h PO x 10d A: 500 mg q12h or 250 mg q6h PO x 10d</p>	GAS are able to enter the epithelial cells, and internalization is associated with the presence of certain fibronectin-binding proteins. Because penicillin does not

	<p>OR</p> <p>Amoxicillin trihydrate P: 50 mg/kg/d (maximum of 1g/d) div q 8-12 hours PO x 10d A: 500 mg q12h PO x 10d</p> <p>SECOND LINE: Cefuroxime axetil P: 20 mg/kg/d div q12h PO x 10d A: 500mg-1g/d div q12h PO x 10d OR</p> <p>Co-amoxiclav P: <40 kg: 25-45 mg amoxicillin/kg/d div q8h PO x 10d >40 kg: 500 mg q8hrs (maximum of 2g/day) A: 500 mg amoxicillin q12h PO x 10d</p>	<p>effectively penetrate epithelial cells, this internalization may contribute to persistence despite antibiotic therapy.</p> <p>In cases of persistent pharyngitis, antibiotic options include cephalosporins, co-amoxiclav, macrolides including azalides (azithromycin), and clindamycin. However, there is varied expert opinion on which therapy is most appropriate.</p>
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Peritonsillar abscess (Quinsy)		
<ul style="list-style-type: none"> Sometimes a serious complication of exudative pharyngitis Surgical drainage is required in treatment. 		
Etiology	Preferred Regimen	Comments
<i>Fusobacterium necrophorum</i> (44%) Group A Streptococci (33%) Group C/G Streptococci (9%) <i>Streptococcus anginosus</i> group	FIRST LINE: Ampicillin + sulbactam P: 100 mg ampicillin/kg/d div q6h IV or IM A: 6-12 g ampicillin/d (max 4 g sulbactam/d) div q6h IV or IM Stepdown to: Co-amoxiclav P: 40 mg amoxicillin/kg/d div q8h PO x 10d A: 750 mg - 1.5 g amoxicillin/d div q8h PO x 10d	

<p>SECOND LINE: Ceftriaxone P: 50-75 mg/kg/d div. q12-24h IV A: 2 g q24h IV</p> <p>PLUS</p> <p>Metronidazole P: 30 mg/kg/d (max 4 g/d) div q6h IV/PO A: 500 mg q6-8h IV/PO</p> <p>For penicillin allergy: Clindamycin P: 40 mg/kg/d div q6-8h by IV A: 600-900 mg q6-8h IV</p>	<p>Fusobacterium is resistant to macrolides and are best avoided (not recommended).</p> <p>There are some reports of beta-lactamase production by oral anaerobes.</p>
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Deep Neck Abscess/ Retropharyngeal Abscess		
<ul style="list-style-type: none"> Surgical drainage is required in treatment. 		
Etiology	Preferred Regimen	Comments
Polymicrobial <i>Staphylococcus aureus</i> <i>Streptococcus sp.</i> <i>Bacteroides sp.</i>	<p>FIRST LINE: Ampicillin + sulbactam P: 100 mg ampicillin/kg/d div q6h IV or IM A: 6-12 g ampicillin (max 4 g/d) div q6h IV or IM</p> <p>Stepdown to: Co-amoxiclav P: 40 mg amoxicillin/kg/d div q8h PO A: 750 mg -1.5 g amoxicillin/d div q8h PO</p> <p>OR</p> <p>Cefuroxime Na P: 100-150 mg/kg/d div q8h IM or IV A: 750mg q8h IV</p> <p>Stepdown to: Cefuroxime axetil P: 20-30 mg/kg/d div q12 h PO</p>	<p>If methicillin-resistant <i>S. aureus</i> (MRSA) is suspected antibiotic therapy in preceding 90 day, current hospitalization for 5 days or more, high frequency of antibiotic resistance in the community or in the specific hospital unit, presence of risk factors for healthcare-associated pneumonia, immunosuppressive disease and/or therapy, recent or prolonged hospitalization, exposure to antibiotics, or stay in an intensive care unit), clindamycin or vancomycin is recommended.</p> <p>Community-acquired MRSA have been reported in children without identified risk factors. These cases have a predominance of superficial infections, including subcutaneous</p>

	<p>A: 500 mg PO bid</p> <p>PLUS</p> <p>Metronidazole P: 30 mg/kg/d (max 4g/d) div q6h IV x 7d (at least) A: 500 mg q8h IV for at least 7d</p> <p>Stepdown to: Metronidazole P: 30-50 mg/kg/day div q8h PO A: 500 mg q8h PO for at least 7d</p> <p>SECOND LINE: Ceftriaxone P: 50-75 mg/kg/d div q12-24h x 7d A: 2g IV q24h x 10-14d</p> <p>PLUS</p> <p>Metronidazole P: 30 mg/kg/d (max 4g/d) div q6h IV for at least 7d A: 500 mg q8h IV for at least 7d</p>	<p>abscesses, cellulitis, and recurrent skin infections.</p> <p>Stepdown should be guided by culture.</p>
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Membranous pharyngitis due to diphtheria

- Intensive surveillance and immediate notification to the Department of Health is necessary.
- Supportive treatment is critical in management. Antibiotics are not the mainstay of treatment.
- Ensure adequate airway. Perform cardiac assessment.
- Administer diphtheria toxoid before discharge.
- Culture contacts and treat accordingly.
- Observe standard droplet precautions (respiratory droplet isolation) for patients and carriers until 2 cultures from both the nose and throat collected 24 hours after completing antibiotics are negative for *Corynebacterium diphtheriae*.
- Persons recovering from diphtheria should begin or complete active immunization. Vaccine containing diphtheria toxoid is available in combination with tetanus and pertussis. It is given at a dose of 0.5 mL IM. Routine pediatric immunization should include 5 doses given on ages 6 weeks, 10 weeks, 14 weeks, 12 months (provided there is a minimum interval of 6 months from dose 3) and 4-6 years before school entry.
- Patients should be placed in isolation.
- Obtain nasal and pharyngeal cultures (special media.)

Etiology	Preferred Regimen	Comments
	FIRST LINE:	Antibiotics decrease toxin

<p><i>C. diphtheriae</i> (human to human)</p> <p><i>C. ulcerans</i> and <i>C. pseudotuberculosis</i> (animal to human, rare)</p>	<p>Penicillin G crystalline P: 100,000 to 150,000 U/kg/d div q6h IV or procaine penicillin 25,000 to 50,000 U/kg/d (maximum of 1.2 million U) div q12 IM A: 50,000 units/kg (max 1.2 million units) IV q12h</p> <p>Stepdown to: Phenoxymethylpenicillin P: 25-50 mg/kg/d div q6h PO x 14d A: 250 mg q6h PO x 14d</p> <p>SECOND LINE:</p> <p>Erythromycin P: 40-50 mg/kg/d (max 2g/d) div q6h IV A: 500 mg qid x 14d</p> <p>Stepdown to: Erythromycin ethylsuccinate P: 40-50 mg/kg/d (max 2g/d) div. q6h PO x 14d A: 500 mg q6h PO x 7-10d</p>	<p>production, decrease spread of organisms. Penicillin is superior to erythromycin.</p> <p>Eradication of the organism should be documented 24 hours after completing treatment by 2 consecutive negative cultures from pharyngeal specimens taken 24 hours apart. If follow-up cultures are positive, erythromycin should be given for an additional 10 days.</p> <p>Treatment of carrier state: Weight < 30 kg: benzathine penicillin G 600,000 U IM x 1 dose</p> <p>Weight >30 kg benzathine penicillin G 1.2 million U or oral erythromycin 40 to 50 mg/kg/day</p>
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<p>Vesicular, ulcerative pharyngitis (viral)</p> <ul style="list-style-type: none"> • More common in patients aged < 3 years • Associated signs and symptoms: <ul style="list-style-type: none"> - Consistently present: Hoarseness, cough, colds, conjunctivitis, ulcerative stomatitis. - Mild or possibly absent: Systemic findings, pharyngeal erythema, sore throat, difficulty swallowing, exudates, palatal petechiae - NO tender cervical lymph nodes 		
<p>Etiology</p> <p>Coxsackie A9, B1-5 Echo viruses (multiple types) Enterovirus 71 Herpes simplex virus (HSV) 1, 2</p>	<p>Preferred Regimen</p> <p>For HSV 1 and 2 in immunocompromised host:</p> <p>Aciclovir P:</p>	<p>Comments</p>

	<p>Infants and children < 12y: 10 mg/kg q8h x 7-14d as 1-3 h IV infusion</p> <p>≥ 12y: 5 mg/kg q8h x 7-14d as 1-3 h IV infusion</p> <p>A: 400mg PO 5x/d x 5d</p> <p>OR</p> <p>Valaciclovir P: 4g/d div 2 doses A: 500 mg bid x 7d</p> <p>Recurrent herpes labialis: Valaciclovir P: > 12 y 4g/d div q12 h x 1d A: 500 mg bid x 7d</p>	<p>For vesicular pharyngitis suspected to be caused by coxsackie A9, B1-5, echo viruses and enterovirus, antiviral therapy is not needed. Supportive therapy is recommended.</p> <p>For mild infections in immunocompetent host, supportive therapy is recommended.</p>
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Gonococcal pharyngitis		
Etiology	Preferred Regimen	Comments
<i>Neisseria gonorrhoea</i>	<p>FIRST LINE:</p> <p>Ceftriaxone P: <45 kg: 125 mg single dose IM ≥45 kg: 250 mg single dose IM</p> <p>A: 250 mg single dose IM</p>	Spectinomycin, cefixime, cefpodoxime and cefuroxime are not effective for pharyngeal gonococcal infections.

PARAPHARYNGEAL SPACE INFECTION; PERITONSILLAR ABSCESS

<ul style="list-style-type: none"> • May be due to poor dental hygiene, dental extractions, or foreign bodies (e.g., toothpicks, fish bones) • Closely monitor the airway; a third of patients require intubation. • Perform MRI or CT scan to identify the abscess. Perform surgical drainage. • Complications include infection of the carotid (with possible rupture) and jugular vein phlebitis. 		
Etiology	Preferred Regimen	Comments
Polymicrobial, including: <i>Streptococcus sp.</i>	FIRST LINE:	Clindamycin may be used in pediatric patients with penicillin allergy.

<p>Anaerobes (which outnumber aerobes 10:1)</p>	<p>P: Ampicillin + sulbactam Ampicillin 100 mg /kg/d div q6h IV or IM</p> <p>Stepdown to: Co-amoxiclav 40 mg/kg/d div q8h PO x 10d</p> <p>A: Clindamycin/Penicillin G PLUS Metronidazole</p> <ul style="list-style-type: none"> • Clindamycin 600-900 mg IV q8h • Penicillin G 24 million units/day by continuous infusion or q4-6h IV • Metronidazole 1 g loading dose THEN 0.5 g IV q6h or 1 g IV q12h. <p>SECOND LINE:</p> <p>P: Ceftriaxone 50-75 mg/kg/d div q12-24h IV PLUS Metronidazole 30 mg/kg/d (max 4 g/d) div q6h IV or PO</p> <p>A: Piperacillin + tazobactam 4.5 g IV q6h or 4-hr infusion of 3.375 g q8h OR Ampicillin + sulbactam 3 g IV q6h OR 2nd or 3rd Generation Cephalosporins, e.g., Ceftriaxone 1 g IV q24h PLUS Metronidazole 500 mg IV q8h for at least 7 d</p>	
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JUGULAR VEIN SUPPURATIVE PHLEBITIS (LEMIERRE'S SYNDROME)

<ul style="list-style-type: none"> • Pulmonary and systemic emboli are common. • Erosion into the carotid artery can occur. 		
Etiology	Preferred Regimen	Comments
<p><i>Fusobacterium necrophorum</i> in vast majority.</p> <p>Lemierre described <i>Fusobacterium</i> in 1936; other anaerobes and Gram (+) cocci are less common etiologies of suppurative phlebitis post-pharyngitis.</p>	<p>FIRST LINE:</p> <p>Piperacillin + tazobactam A: 4.5 g IV q8h</p> <p>OR</p> <p>Metronidazole PLUS Ceftriaxone</p>	<p>Avoid macrolides: fusobacterium resistance.</p> <p>Note: If not a complication of pharyngitis, and if there is an internal jugular line, treat empirically for methicillin-resistant <i>Staphylococcus</i></p>

	<p>A: Metronidazole 500 mg PO/IV q8h Ceftriaxone 2 g IV od</p> <p>SECOND LINE:</p> <p>Clindamycin A: 600-900 mg IV q8h</p>	<p><i>aureus</i> using vancomycin.</p>
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ACUTE EPIGLOTTITIS

- Requires urgent hospitalization. May present with life-threatening upper airway obstruction, especially in pediatrics.
- Have tracheostomy set “at bedside.”
- Use of steroids is controversial and not recommended.
- *Haemophilus influenzae* Type B immunization is recommended, given IM at a minimum age of 6 weeks with a minimum interval of 4 weeks in between doses.
 - If given between 6 weeks to 6 months: Primary series of 3 doses, 1-2 months apart. Booster dose at 12-15 months.
 - If given between 7-11 months: Primary series of 2 doses, 1-2 months apart. Booster dose at 18 months
 - If given between 12-59 months, give only 1 dose.

Etiology	Preferred Regimen	Comments
<p><i>Haemophilus influenzae</i> Type b <i>Streptococcus pneumoniae</i></p>	<p>FIRST LINE:</p> <p>Ceftriaxone P: 50-100 mg/kg/day div q12-24h IV x 7-10d A: 2g q24h IV infusion x 7-10d</p> <p>2nd line in pediatric patients: Ampicillin-sulbactam P: 100 mg/kg/day div q6h IV x 10d</p> <p>2nd line in adult patients: A: Levofloxacin 750 mg IV every 24 hours PLUS Clindamycin 600-900 mg q6-8h IV x 7-10 d</p>	<p>Levofloxacin is generally not recommended in patients < 18y. Avoid in patients with history of QT prolongation or with drugs that prolong QT interval. Tendon rupture can occur during or after therapy.</p>

RHINOSINUSITIS

Acute bacterial rhinosinusitis (ABRS)		
Etiology	Preferred Regimen	Comments
<p><i>Streptococcus pneumoniae</i> <i>Haemophilus influenzae</i> <i>Moraxella catarrhalis</i> <i>Staphylococcus aureus</i> <i>Anaerobic bacteria</i> <i>Some other streptococcal species</i></p>	<p>FIRST LINE: Co-amoxiclav for 10-14 days P: 1-3 mos: 30 mg/kg/d div q12h using 125 mg/5 mL</p> <p>≥3 mos: 20-40 mg/kg/d div q8h or 25-45 mg/kg/d div q12h For tid dosing, use the following formulations: 125/31.25 mg or 250/62.5 mg</p> <p>For bid dosing, use the following formulations: 200/28.5 mg or 400/57 mg or 600/42.9 mg (extra-strength)</p> <p>Alternative for ≥3 mo and <40 kg: 90 mg/kg/d div q12h using 600/42.9 mg</p> <p>A: 500 mg / 125 mg PO q8h x 5-7d</p> <p>SECOND LINE:</p> <p>P: Cefuroxime 30 mg/kg/d div q12 h minimum of 10d or A: Cefuroxime 500 mg bid x 5-7 d</p> <p>For patients with severe penicillin allergy (pediatric): <u>Type 1:</u> Clarithromycin 15 mg/kg/d div q12h <u>Type 2:</u> Cefuroxime 30 mg/kg/day div q12 h minimum of 10d</p> <p>For patients with severe penicillin allergy (adult): <u>Type 1:</u> Levofloxacin 500 mg qd PO x 5d or Doxycycline 100 mg q12h PO x 5-7 d <u>Type 2:</u> Cefuroxime 500 mg bid x 5-7 d</p>	<p>Antibiotics for bacterial sinusitis are recommended if: 1) with fever, pain, purulent nasal discharge; or 2) still symptomatic after 10 days with no antibiotic.</p> <p>The use of erythromycin and clindamycin as single-drug therapy for ABRS is controversial. On its own, erythromycin has poor coverage for Gram (-) bacteria and may not cover for <i>H. influenzae</i> and <i>M. catarrhalis</i> if used empirically. The same holds true for clindamycin; however, it makes up for this with the added coverage against anaerobic bacteria. These considerations should be taken into account when prescribing these antibiotics.</p> <p>Avoid trimethoprim-sulfamethoxazole because of increasing resistance.</p> <p>Levofloxacin is generally not recommended in patients < 18y. Avoid in patients with history of QT prolongation or with drugs that prolong QT interval. Tendon rupture can occur during or after therapy.</p>

Acute sinusitis (clinical failure after 3 days) in adults		
Etiology	Preferred Regimen	Comments
<i>Streptococcus pneumoniae</i> <i>Haemophilus influenzae</i> <i>Moraxella catarrhalis</i> <i>Staphylococcus aureus</i> <i>Anaerobic bacteria</i> <i>Some other streptococcal species;</i> consider diagnostic tap/aspirate	FIRST LINE OR MILD/MODERATE DISEASE: Cefuroxime axetil 500 mg q12h PO x 7-10d SECOND LINE OR SEVERE DISEASE: Levofloxacin 750 mg qd PO x 5 d	

Mucormycosis: diabetes mellitus with acute ketoacidosis; neutropenia; deferoxamine – adults only		
Early diagnosis is key to treatment success. Symptoms suggestive of fungal sinusitis (or lateral facial pain or numbness) should increase suspicion. Palatal ulcers and/or black eschars and unilateral blindness in immunocompromised or diabetic patients suggests mucor.		
<ul style="list-style-type: none"> • Rapidly fatal without treatment. • Diagnosis is by stain of tissue culture isolates, revealing wide ribbon-like, non-septated hyphae with variation in diameter and right-angle branching. • Diabetics are predisposed to mucormycosis due to microangiopathy and ketoacidosis. • Iron overload also predisposes to mucormycosis, as iron stimulates fungal growth. 		
Etiology	Preferred Regimen	Comments
<i>Rhizopus sp. (mucor),</i> <i>Aspergillus</i>	FIRST LINE: Amphotericin B 1-1.5 mg/kg/d OR Liposomal amphotericin B 5-10mg/kg/d SECOND LINE: Posaconazole 400 mg PO bid with meals. If NPO, 200 mg qid.	Amphotericin B lipid complex monotherapy has a 20% success rate vs 69% for other polyenes. Mucormycosis is (not in the PNDP and) is not included in the FDA-approved indications for posaconazole. Complete or partial response rates with posaconazole salvage protocols is from 60% to 80%. Resistant to Voriconazole: prolonged use of Voriconazole prophylaxis predisposes to mucormycosis infections.

		<p>Total duration of therapy is based on response. Continue therapy until 1) resolution of clinical signs and symptoms of infection, 2) resolution or stabilization of radiographic abnormalities; AND 3) resolution of underlying immunosuppression.</p> <p>Poconazole may be used for secondary prophylaxis for those on immunosuppressive therapy.</p>
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Acute sinusitis in adult hospitalized patients with nasotracheal or nasogastric intubation		
Etiology	Preferred Regimen	Comments
<p>Gram negative bacilli (<i>Pseudomonas</i>, <i>Acinetobacter</i>, <i>Escherichia coli</i> common) in 47% of cases</p> <p>Gram positive (<i>Staphylococcus aureus</i>) in 35%</p> <p>Polymicrobial in 80%</p> <p>Yeasts 18%</p>	<p>FIRST LINE:</p> <p>Meropenem A: 1 g IV q8h</p> <p>Add vancomycin if methicillin-resistant <i>S. aureus</i> is suspected.</p> <p>SECOND LINE:</p> <p>A: Ceftazidime 2 g IV q8h PLUS vancomycin (loading dose 25-30 mg/kg followed by 15 mg/kg q8h or q12h)</p> <p>OR</p> <p>Cefepime 2 g IV q12h PLUS vancomycin (loading dose 25-30 mg/kg followed by 15 mg/kg q8h or q12h)</p>	<p>After 7 days of nasotracheal or nasogastric tubes, 95% have x-ray "sinusitis" (fluid in sinuses), but on transnasal puncture only 38% culture positive. For patients requiring mechanical ventilation with nasotracheal tube for > 1 week, bacterial sinusitis occurs in < 10%. May need fluconazole if yeast on Gram stain of sinus aspirate.</p>

Chronic rhinosinusitis (CRS): Symptoms > 6 weeks		
Etiology	Preferred Regimen	Comments
<ul style="list-style-type: none"> Defined as drainage, blockage, facial pain or decreased sense of smell PLUS mucopurulence on endoscopy or CT scan changes. Serum IgE levels may be tested if allergy is suspected Perform CT scan of the maxillary bone if an odontogenic source is suspected. Culture and sensitivity testing is important. 		
<p>Multifactorial, e.g., damage to the ostiomeatal complex during acute bacterial disease; allergy with or without polyps; occult immunodeficiency; and/or</p>	<p>No persuasive evidence of benefit from antibiotics</p> <p>P & A: Otolaryngology consultation is recommended.</p>	<p>Treatment is usually with antibiotic therapy for 3 to 6 or up to 10 weeks with appropriately selected agents, but the efficacy of this approach is controversial. The benefit of antifungal agents for</p>

odontogenic disease (periodontitis in maxillary teeth)		<p>CRS is unproven and not currently recommended.</p> <p><u>Pediatric patients:</u></p> <ul style="list-style-type: none"> • Evaluate children for allergy. • Adjuvant therapy includes nasal saline washes (twice daily per nostril), antihistamines, anti-inflammatory agents, and topical (intranasal) corticosteroids. • Functional endoscopic sinus surgery can be considered for children with failed, extensive, prolonged, and adequate medical management.
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LARYNGITIS

Etiology	Preferred Regimen	Comments
Viral (90%)		Antibiotics are not indicated in viral laryngitis.
Diphtheria in developing countries (pedia)		See the recommendations for membranous pharyngitis due to diphtheria.

OTITIS

Otitis externa		
<ul style="list-style-type: none"> Usually secondary to chronic seborrhea. Control seborrhea with dandruff shampoo containing selenium sulphide OR ketoconazole shampoo plus medium-potency steroid solution (e.g., triamcinolone 0.1%) 		
Etiology	Preferred Regimen	Comments
Usually secondary to seborrhea(chronic)	<p>Ofloxacin ear drops</p> <p>P: < 1y: no recommendation 1-12y: 5 drops bid in the affected ear > 12y: 10 drops bid</p> <p>Duration of 7-10d or 3d after cessation of symptoms.</p> <p>A: 10 drops/day x 7d</p>	<p>None of the topical agents mentioned has been shown to have superior efficacy. Treatment choice should be based on factors such as patient allergy, risk of ototoxicity, bacterial resistance, availability, cost, and dosing schedule.</p> <p>Do not use neomycin drops if the tympanic membrane is punctured.</p> <p>For chronic otitis externa (symptoms 6 weeks to >3 months), treatment involves debridement and application of topical anti-inflammatory agents, i.e., corticosteroids.</p>

Fungal otitis externa / otomycosis		
Etiology	Preferred Regimen	Comments
<p><i>Aspergillus</i> <i>Candida spp.</i> <i>Actinomyces spp.</i> Phycomycetes</p>	<p>FIRST LINE:</p> <p>P: Topical aluminium sulphate-calcium acetate (Domeboro) or a drying powder such as boric acid given 3-4x a day x 7d</p> <p>OR</p> <p>Clotrimazole solution 1% (Lotrimin) 2-3 drops q8-12h up to 10-14d</p> <p>OR</p> <p>Gentian violet may be used and is well tolerated.</p> <p>A: Clotrimazole 1% solution 2-3 drops q8-12h up to 10-14d</p>	<p>Debridement and dry ear hygiene is crucial in otomycosis.</p> <p>Thorough cleaning with removal of the matted fungal debris is warranted.</p> <p>Assess for perforation of tympanic membrane, because antifungals are ototoxic.</p> <p>Clean the canal of detritus.</p> <p>Place a wick if edema prevents drug delivery.</p> <p>A 1:1 white vinegar + rubbing alcohol solution may be instilled in the external ear canal after swimming to restore proper acidic pH to the ear canal and to dry residual water.</p>

Necrotizing otitis externa		
<ul style="list-style-type: none"> • Very high erythrocyte sedimentation rates are typical. • Debridement is usually required. • Rule out osteomyelitis with a CT or MRI scan. If bone is involved, treat for 4-6 weeks. 		
Etiology	Preferred Regimen	Comments
<p><i>Pseudomonas aeruginosa</i> in >95% (<i>P. aeruginosa</i>, <i>Proteus mirabilis</i> in pediatric patients)</p>	<p>FIRST LINE:</p> <p>P: Ceftazidime 100-150 mg/kg/day div q8h IV</p> <p>A: Piperacillin-tazobactam 4.5 g q6h IV</p> <p>SECOND LINE:</p> <p>P: Piperacillin-tazobactam 300 mg/kg/day div q8h IV</p> <p>A: Piperacillin-tazobactam 4.5 g q6h IV +/- Gentamicin or Amikacin once daily dosing</p>	<p>Duration of therapy is prolonged for at least 6 weeks and until clinical and radiographical improvement has been achieved.</p> <p>Obtain cultures from the ear canal or from surgical debridement.</p> <p>Treatment from other etiologies should be guided by antibiotic susceptibility results.</p> <p>Do not use neomycin drops if the tympanic membrane is punctured.</p> <p>Give analgesics for severe pain.</p>
Acute diffuse otitis externa / swimmer's ear		
<ul style="list-style-type: none"> • May also be caused by occlusive devices (earphones); contact dermatitis; and psoriasis 		
Etiology	Preferred Regimen	Comments
<p><i>Staphylococcus. epidermidis</i> in 46% <i>S. aureus</i> in 11% <i>Pseudomonas sp.</i> in 11% Anaerobes in 2% <i>Candida</i> in 8%</p>	<p>Ofloxacin ear drops</p> <p>P: < 1y: no recommendation 1-12y: 5 drops twice a day in the affected ear > 12y: 10 drops twice a day</p> <p>Duration of 7-10d or 3d after cessation of symptoms.</p> <p>A: 10 drops 1-2x/day x 7d</p>	<p>Ointments should not be used in the ear. Do not use neomycin drops if the tympanic membrane is punctured.</p> <p>Perform surgical debridement.</p> <p>Avoid submerging head in water x 7-10 days</p> <p>A 1:1 white vinegar + rubbing alcohol solution may be instilled in the external ear canal after swimming to restore proper acidic pH to the ear canal and to dry residual water.</p> <p>For chronic otitis externa (symptoms 6 weeks to > 3</p>

		months), treatment involves debridement and application of topical anti-inflammatory agents, i.e., corticosteroids.
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Acute otitis media (AOM)		
<ul style="list-style-type: none"> Prevention includes immunization against invasive pneumococcal disease and <i>Haemophilus influenzae</i> Type B. <ul style="list-style-type: none"> Pneumococcal Conjugate Vaccine is given IM in children aged at least 6 weeks. Primary vaccination involves 3 doses with an interval of 4 weeks in between doses. Booster is given 6 months after the 3rd dose <i>H. influenzae</i> Type b Conjugate Vaccine is given IM in children aged at least 6 weeks. Primary vaccination involves 3 doses with an interval of 4 weeks in between doses. Booster is given at age 12-15 months, with an interval of 6 months after the 3rd dose 		
Etiology	Preferred Regimen	Comments
<p>Viruses cause up to 6% of middle ear infections.</p> <p>Bacterial pathogens account for 85% of middle ear infections: <i>Streptococcus pneumoniae</i> in 49% <i>H. influenzae</i> in 29% <i>Moraxella catarrhalis</i> in 28%</p> <p>In children aged 6 months to 3 years, there may be 2 episodes of AOM per year, and 63% are virus-positive.</p>	<p>No antibiotic use in the prior month</p> <p>FIRST LINE:</p> <p>Amoxicillin P: 80-90mg/kg/d div q12h <2y: 10 d 2-5y: 7 d >5y: 5-7d A: 1 g q8h x 10 d (high dose)</p> <p>SECOND LINE: P: <u>With anaphylaxis</u> Clarithromycin 15 mg/kg/day div q12h</p> <p><u>No anaphylaxis</u> Cefuroxime axetil 30 mg/kg/d div q12h <2y: 10 d 2-5y: 7 d >5y: 5-7d</p> <p>OR</p> <p>Ceftriaxone 50 mg/kg/d IM/IV x 3d</p> <p>A: <u>No penicillin allergy</u> Co-amoxiclav 875 mg / 125 mg tab q12h x 10 d</p>	<p>For patients above 2 years old with no fever and ear pain with a negative or questionable exam, consider analgesic treatment without antimicrobials. There may be favorable results in mostly afebrile patients with waiting for 48 hours before deciding to use antibiotics.</p> <p>For patients allergic to β-lactam drugs:</p> <ul style="list-style-type: none"> If history unclear or rash, may give effective oral cephalosporin If IgE-mediated allergy (e.g., anaphylaxis), avoid cephalosporins <p>Trimethoprim-sulfamethoxazole has a high failure rate if etiology is drug-resistant <i>S. pneumoniae</i> or <i>H. influenzae</i>.</p> <p>Up to 50% of <i>S. pneumoniae</i> are resistant to macrolides and 0%-5% are resistant to penicillins.</p> <p>Spontaneous resolution occurred in 90% of patients infected with <i>M. catarrhalis</i>, 50% with <i>H. influenzae</i>, and 10% with <i>S. pneumoniae</i> (overall 80% resolve within 2-14 days)</p> <p>For severe disease, appropriate duration of treatment is unclear, but 5 days may be inadequate.</p>

	<p><u>With penicillin allergy</u></p> <ul style="list-style-type: none"> • With anaphylaxis: Levofloxacin 750 mg q24h PO x 5d • No anaphylaxis: Cefuroxime axetil 500 mg – 1 g /d div q12h x 7d OR Ceftriaxone 2g qd x 3d 	
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Additional comments for pediatric patients:

- **Co-amoxiclav** and **ceftriaxone** may be used as a first-line agent if at the onset, the child presents with high fever $\geq 39^{\circ}\text{C}$ and/or severe otalgia.
- If infection is non-responsive to antimicrobial therapy, tympanocentesis or myringotomy may be necessary. Placement of tympanostomy tube is an option for some. Adenoidectomy at time of tympanostomy tubes decreases future hospitalization for AOM.
- Persistent middle ear effusion for 2-3 months after therapy is expected and does not require retreatment.
- Macrolide resistance of *S. pneumoniae* has been reported.
- Clindamycin is not effective against *H. influenzae* and *M. catarrhalis*.

Acute otitis media (clinical failure after 3 days)		
Etiology	Preferred Regimen	Comments
Drug-resistant <i>Streptococcus pneumoniae</i>	<p>FIRST LINE:</p> <p><u>P:</u> Co-amoxiclav 90 mg amoxicillin/kg/d div q12h</p> <p><2y: 10 d ≥ 2 y: 5-7days</p> <p>OR</p> <p>Cefuroxime 15 mg/kg/d div q12h 30 mg/kg/d div q12h <2y OR severe symptoms regardless of age: 10 d ≥ 2 y with mild or moderate disease: 5-7 d</p> <p>OR</p> <p>Ceftriaxone 50 mg/kg/ IM x 3d</p> <p><u>A:</u> Co-amoxiclav 1g tid PO x 5-7d</p>	<p>Clindamycin not active against <i>H. influenzae</i> or <i>M. Catarrhalis</i>. <i>S. pneumoniae</i> resistant to macrolides are usually also resistant to clindamycin.</p> <p>Definition of failure: no change in ear pain, fever, bulging tympanic membrane or otorrhea after 3 days of therapy. Tympanocentesis will allow culture.</p> <p>Amoxicillin-clavulanate high dose reported successful for penicillin-resistant <i>S. pneumoniae</i> acute otitis media.</p>

	<p>SECOND LINE:</p> <p>P: Ceftriaxone 15 mg/kg IM x 3d</p> <p>A: <u>Mild penicillin allergy:</u> Cefuroxime 15 mg/kg/d div q12h or Ceftriaxone 50 mg/kg IM x 3d <u>Severe penicillin allergy:</u> Levofloxacin 750 mg PO bid</p>	
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Chronic suppurative otitis media (CSOM)

- Aural toilet is an essential part of the treatment of CSOM in all patients.
- Surgery must be performed on all cases of CSOM with suppurative complications.

Etiology	Preferred Regimen	Comments
<p>Aerobic: <i>Pseudomonas aeruginosa</i> <i>Escherichia coli</i> <i>Staphylococcus aureus</i> <i>Streptococcus pyogenes</i> <i>Proteus mirabilis Klebsiella sp.</i></p> <p>Anaerobic: <i>Bacteroides</i> <i>Peptostreptococcus</i> <i>Propionibacterium</i></p>	<p>Daily ear cleansing and drying should be done. Give quinolone ear drops tid for 5 days.</p>	<p>Antibiotic treatment as in acute otitis media if there is acute exacerbation.</p> <p>Systemic antibiotics should not be routinely given to patients with CSOM either alone or in combination with topical antimicrobials.</p> <p>Do not use neomycin drops if the tympanic membrane is ruptured.</p>

Acute mastoiditis

- Usually a complication of acute otitis media. Obtain cultures.
- Diagnosis is by CT or MRI scan.
- Look for complication, such as osteomyelitis, suppurative lateral sinus thrombophlebitis, purulent meningitis, or brain abscess.
- Consult an otorhinolaryngologist (ENT) for possible mastoidectomy.

Etiology	Preferred Regimen	Comments
<p>1st episode: <i>Streptococcus pneumoniae</i> <i>S. pyogenes</i> <i>Staphylococcus aureus</i> <i>Haemophilus influenzae</i> <i>Moraxella catarrhalis</i> <i>Pseudomonas aeruginosa</i></p>	<p>FIRST LINE:</p> <p>P: Ceftriaxone 100 mg /kg/day div q12 h IV</p> <p>PLUS</p> <p>Oxacillin 150-200 mg/kg/day div q6h IV or Vancomycin 45-60 mg/kg/day div q6h IV</p>	

<p>If secondary to otitis media: <i>S. aureus</i> <i>P. aeruginosa</i> <i>S. pneumoniae</i></p>	<p>A: Obtain cultures, then empiric therapy for the first episode: Ceftriaxone 2 g IV qd</p> <p>OR</p> <p>Levofloxacin 750 mg IV qd</p> <p>SECOND LINE: A: Acute exacerbation of chronic otitis media: If <i>Pseudomonas</i> and <i>Staphylococcus spp.</i> are suspected, surgical debridement of the auditory canal, then:</p> <p>Vancomycin (dose to achieve serum trough levels of 15-20 mcg/mL)</p> <p>PLUS</p> <p>Piperacillin-tazobactam 3.375 g IV q6h</p> <p>If caused by a multidrug-resistant <i>Pseudomonas spp.</i>: Meropenem should be given. 1g q8h</p>	
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Chronic or recurrent mastoiditis		
Etiology	Preferred Regimen	Comments
<p><i>Streptococcus pneumoniae</i> <i>S. pyogenes</i> <i>Staphylococcus aureus</i> <i>Haemophilus influenzae</i> <i>Moraxella catarrhalis</i> <i>Pseudomonas aeruginosa</i> Fungi</p>	<p>P: Piperacillin-Tazobactam 300 mg/kg/d div q6h IV</p> <p>PLUS</p> <p>Gentamicin 7.5 mg/kg/d div q8 hr IV</p> <p><u>If intracranial extension is suspected:</u> Cefepime 150 mg/kg/d div q8h IV</p> <p>A: Culture ear drainage. May need surgical debridement. Topical fluoroquinolone ear drops. Consult with an otorhinolaryngologist (ENT) is recommended.</p>	<p>Surgical debridement, obtain cultures.</p> <p>Treatment on pediatric group depends on the patient's response.</p>