Antibiotic Prescribing in ENT Conditions
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Antibiotic Prescribing in ENT Conditions
- No financial relationships to disclose
- Discuss responsible antibiotic use in ENT conditions
- Review Antibiotic agents by classification, discuss routes of administration, pharmacokinetics, pharmacotherapeutics adverse reactions and drug interactions.
- Discuss common ENT infections and appropriate antibiotic selection.

Antibiotic Use in the United States
- One fourth of all Americans seek medical care due to infectious diseases
- Over 150 million courses of antibiotics are prescribed each year
- Five most common symptoms include: cough, sore throat, fever, nasal congestion, and earache
- ENT clinicians must be current in understanding responsibilities in prescribing antibiotics for ENT infections

Empiric versus Culture Directed
- Identify infecting microorganism by obtaining a culture
- Culture and sensitivity may take 48-72 hours may begin treatment with a broad spectrum antibiotic switch to culture directed therapy as appropriate
- The location of infection is considered for therapy to be effective, adequate concentration of agent to infection site for the appropriate time period.

Increasing Antibiotic Resistance
- Indiscriminate use of anti-bacterial agents has serious consequences
- Unnecessary exposure of organisms to anti-bacterial agents encourages the emergence of resistive strains.
- New resistant strains of bacteria have greater consequences
- In spite of mounting data clinicians in the US continue to prescribe antibiotics 40-50% of the in acute respiratory infections

Responsible Prescribing
- Anti-infective agents should be reserved for patients with infections caused by susceptible organisms.
- Agents should be prescribed in high enough doses for appropriate periods of time
- New anti-infective agents should be reserved for severely ill patients with serious infections that do not respond to conventional treatment agents.
For the scope of this discussion we will focus on antibacterial agents.

### Penicillins

**Natural Penicillins**

- Penicillin G
- Penicillin G Procaine
- Penicillin G Sodium
- Penicillin V

**Penicillinase Resistant Penicillins**

- Dicloxacillin Sodium
- Clavulanic Acid
- Nafcinil Sodium

**Amoxicillin**

- Amoxicillin, Ampicillin, Amodacillin, Clavulanate Potassium

**Extended-spectrum Penicillins**

- Cefadroxil, Cefazolin Sodium
- Cephalexin Hydrochloride Monohydrate
- Cefaclor, Cefotetan, Loracarbef, Cefuroxime Axetil
- Cefuroxime Sodium

**Cephalosporins**

**First Generation**

- Cefadroxil, Cefuroxime Axetil
- Cefadroxil, Cefnir

**Second Generation**

- Cefaclor, Cefmenoxime
- Cefmenoxime, Ceftizoxime, Ceftriaxone Sodium

**Third Generation**

- Cefotaxime Sodium
- Ceftepime Hydrochloride

**Fourth Generation**

- Cefpodoxime Proxetil
- Cefquinome, Cefprozil

### Erythromycins

- Erythromycin Estolate
- Erythromycin Ethylsuccinate
- Clarithromycin

**Route of Administration**

- Oral, IM, IV

**Adverse Reactions**

- Confusion, Seizures, Nausea, Vomiting, Diarrhea

**Drug Interactions**

- Alcohol Intolerance with 24 Hours of Erythromycin 
- 72 Hours of Azithromycin

### Macrolides

- Erythromycin
- Clarithromycin

**Route of Administration**

- Oral, IM, IV

**Adverse Reactions**

- Diarrhea, Nausea, Vomiting, Abdominal Cramps

**Drug Interactions**

- Azithromycin
- Biaxin XL
**Macrolides**

<table>
<thead>
<tr>
<th>Routes of Administration</th>
<th>Pharmacotherapeutics</th>
<th>Adverse Reactions</th>
<th>Drug Interactions</th>
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</thead>
<tbody>
<tr>
<td>Oral, IV</td>
<td>erythromycin,螺旋霉素</td>
<td>GI distress, nausea, vomiting, rash, fever, eosinophilia, anaphylaxis</td>
<td>Inc. theophylline levels + toxicity; Clarithromycin may increase carbamazepine DDI with H2 antagonists, antacids, and proton pump inhibitors in duodenal ulcer disease</td>
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**Fluoroquinolones**

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</thead>
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<tr>
<td>Oral, topical, IV Oral</td>
<td>Ciprofloxacin</td>
<td>Dizziness, nausea, vomiting, abdominal pain, ruptured tendons, tendonitis, fever, chills, blurred vision, tinnitus, phototoxicity</td>
<td>Decreased abs when admin with aluminum/mg containing antacids; cipro, norfloxacin, &amp; ofloxacin may increase xanthine abs; cipro or norfloxacin may decrease excretion of probenecid Use Moxifloxacin with caution with drugs that prolong QT interval ie antiarrhythmics</td>
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**Clindamycin**

- Derivative of Lincomycin
- High potential of toxicity
- Drug of choice with no therapeutic alternative

**Tetracyclines**

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<tr>
<th>Intermediate Acting Compounds</th>
<th>Long Acting Compounds</th>
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<tr>
<td>Demeclocycline hydrochloride</td>
<td>Doxycycline hydrochloride</td>
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<tr>
<td>Tetracycline hydrochloride</td>
<td>Minocycline hydrochloride</td>
</tr>
</tbody>
</table>
### Tetracyclines

**Routes of Administration** | **Pharmacotherapeutics** | **Adverse Reactions** | **Drug Interactions**
--- | --- | --- | ---
Oral | Give 1 hour before or 2 hours after meals for maximum absorption. Do not give tetracycline with food, milk or other dairy products. Give water with oral admin to promote passage to stomach. | Broad spectrum gram + and gram-negative and anaerobic bacteria, sprochetes, mycoplasma, rickettsiae, chlamydia, gonoreha, some protozoa. Used to treat acne due to decrease of fatty acid content of sebum. | Superinfections, nausea, vomiting, abd distress and diarrhea, photosensitivity, hepatic toxicity, renal toxicity, decolorization of permanent tooth enamel in fetuses and children, may impair fetal skeletal development in pregnancy. Reduce effectiveness of oral contraceptives; reduced absorption with aluminum, calcium and magnesium antacids. Reduced absorption with iron salts, bismuth subsalicylate, and zinc Increased metabolism and decreased antibiotic action with barbituates, cabamazine and phenytoin.

### Sulfonamides

**Trimethoprim and Sulfamethoxazole**

| Pneumocystis carinii pneumonia, acute otitis media due to H. influenza and acute pneumonaei Acute exacerbations of bronchitis | Bacteriostatic, inhibit folic acid production, to treat URI's, broad spectrum gram + and gram neg., Nocardia asteroides and Toxoplasma gondii, trim, is comb of sulf and folate antag, active against H influenza and s pneumonia. | Reduce absorption with iron salts, bismuth subsalicylate, and zinc Increased metabolism and decreased antibiotic action with barbituates, cabamazine and phenytoin.

### Aminoglycosides

- Amikacin sulfate
- Gentamicin sulfate
- Kanamycin sulfate
- Neomycin sulfate
- Netilmicin sulfate
- Paromomycin sulfate
- Streptomycin sulfate
- Tobramycin sulfate

**Routes of Administration** | **Pharmacotherapeutics** | **Adverse reactions** | **Drug interaction**
--- | --- | --- | ---
Typically parenteral, topical, orally for pre-op bowel prep | Otoxicity, Neurotoxicity, Nausea, vomiting, diarrhea | Cautions with neuromuscular blockers increase muscular relaxation and respiratory. Increased risk of renal toxicity with cyclosporine, amphotericin B and aminoglycosides.
**Vancomycin**

- Used to treat methicillin-resistant S. Aureus
- 85% of drug is excreted in urine unchanged
- Metabolism unknown

**Carbapenems**

- Imipenem-cilastatin sodium-broader spectrum coverage used for serious nosocomial infections particularly gram negative and gram positive.
- Meropenem
- Ertapenem
- Doripenem

**Otologic Infections**

- Acute Otitis Media
- Acute Bullous Myringitis
- Chronic Otitis Media
- Mastoiditis
- Acute Otitis Externa
- Chronic Otitis Externa
- Necrotizing Malignant Otitis Externa

**Otitis media - microbiology**

- Streptococcus pneumoniae – 25%
- Hemophilus influenzae – 20-25%
- Moraxella catarrhalis 10%
- Occasional Streptococcus pyogenes/aureus/viral

**Drug choices:**

1st line Amoxicillin/Amox/Clav (Augmentin)
- Cefdinir (omnicef), cefuroxime (ceftin), Ceftriaxone(rocephin)
- If pen allergic: erythromycin, clindamycin, sulfonamide, levofloxacin
**Mastoiditis - microbiology**
- Predominant pathogens: Strep pneumoniae, group A beta-hemolytic streptococci, Staph aureus, hemophilus, proteus and bacteriodes species also reported.
- Primary treatment choice: Vancomycin IV plus Ceftriaxone IV
- Alternate Levofloxacin IV, Avelox IV, or Clindamycin rifampin or ceftriaxone IV or Ampicillin/sulbactam (Unasyn) IV

**Suppurative Otitis Media - microbiology**
- Mix of aerobic and anaerobic pathogens: Pseudomonas aeruginosa, Staph aureus and epidermidis, proteus species, klebsiella, rare E coli, prevotella, porphyromonas. With cholesteatoma, typical anaerobic streptococci, and Bacteriodes fragilis.
- Primary treatment choice: Floxin otic, cipro HC alternatives cortisporin, boric acid powder

**Otitis Externa - microbiology**
- Predominantly Staph aureus occasionally other Staph/ Strep species.
- Primary treatment choices: Cephalexin
- Alternate choice Clindamycin, dicloxacillin

**Rhinologic Infections**
- Acute Rhino-sinusitis
- Acute orbital cellulitis
- Chronic Sinusitis
- Chronic Rhinitis Nasopharyngitis

**Acute Rhinosinusitis - microbiology**
- Hemophilus influenzae – 38%
- Streptococcus pneumoniae -37%
- Other hemophilus species - 8%
- Strep pyogenes – 6%
- Moraxella catarrhalis – 5%
- Viruses are also predominate cause
- First line treatment Amoxicillin/ Augmentin
- Alternate erythromycin plus Bactrim or doxycycline.

**Amoxicillin for Acute Rhinosinusitis**
- A randomized controlled trial 166 adults.
- Among patients blinded with antibiotic treatment versus placebo/ supportive medications did not show reduced symptoms at day 3 of treatment
- Outcomes assessed by telephone triage @ days 3, 7, 10, and 28.
- More improvements were noted in the amoxicillin treated group at day 7.
**Chronic Sinusitis - microbiology**

- Staphylococcus aureus more prevalent
- Fungi- more in chronic but role may be over estimated.
- Pseudomonas predominant in cystic fibrosis with polyposis and in chronic sinusitis with polyposis
- Otherwise same pathogens as acute
  - Streptococcus pneumoniae
  - Hemophilus influenzae
  - Moraxella catarrhalis

**Treatment choices for Chronic Sinusitis**

- First line treatment Augmentin – Alternate Metronidazole plus Cefuroxime or levofloxacin or ciprofloxacin
- If staph: Clindamycin or Augmentin plus metronidazole
- If pseudomonas ciprofloxin,floxin,levofloxacin plus metronidazole or IV Ceftazidime (Fortaz), Aminoglycoside.

**Oropharyngeal Infections**

- Pharyngitis acute
- Adenoiditis
- Tonsillitis
- Stomatitis/mucositis
- Vincent’s Angina
- Hand, foot and mouth disease
- Laryngitis-acute
- Laryngitis Chronic
- Epiglottitis
- Tracheobronchitis

**Chronic Rhinitis/Nasopharyngitis microbiology – nonsymptomatic carrier**

- Hemophilus influenzae prevalent inhabitant of adenoids in children.
- Drug of choice if adenoidectomy not an option rifampin (Rifadin)
- Staph aureus may be cultured from one third of normal healthy individuals.
- Drug of choice: mupirocin ointment, rifampin plus first generation cephalosporin or clindamycin.

**Tonsillitis – microbiology**

- Group A beta-hemolytic streptococcus most important pathogen.
- Other agents; Staph aureus, Moraxella catarrhalis, Hemophilus influenza.
- Throat cultures show wide variability- surface may not predict the core
- Drugs of choice: Augmentin, cephalaxin with metronidazole. Alternate Clindamycin, cefuroxime

**Peritonsillar Abscess - microbiology**

- Streptococcus alpha and beta hemolytic species
- Strep viridans
- Neisseria species
- Various anaerobes and gram negative bacteria
- Drug of choice: Clindamycin with alternate Augmentin, Unasyn, or cefuroxime plus metronidazole.
**Pharyngitis - Microbiology**

- **Bacterial - 30%**
  - Strep Group A Beta hemolytic
  - Group C Beta Hemolytic
  - Mycoplasma pneumoniae
  - Chlamydia

- **Viral – 40%**

- **Other 30%**

  Acute onset, rapid progression, extreme pain, drooling rule out acute epiglottitis.

**Stomatitis-Mucositis**

- Auto-immune/allergic condition with ulcerations that become invaded by normal flora

- Primary Nystatin or clotrimazole with alternant fluconazole (diflucan) or itraconazole (sporonox).

- Topical treatment – magic mouthwash
  - Diphenhydramine 100ml
  - Dexamethasone 0.5mg/5cc 20ml
  - Nystatin suspension 60ml
  - Tetracycline (from capsule) 1500mg

  One teaspoon 6X/day swish and swallow.

**Vincent’s Angina - “trench mouth”**

**Acute Necrotizing Ulcerative Gingivostomatitis**

- Spirochetes; Treponema vincenti, fusiforms, and anaerobes.

- Treatment Drug of choice: Clindamycin.

  Alternant: Ampicillin/sulbactam (Unasyn) IV, amoxicillin/clav, cefoxitin, or cefotetan IV or penicillin IV plus metronidazole.

**Hand, Foot and Mouth Disease**

- Type A Coxsackie virus

- Maculopapular lesions hands, soles of feet, cheeks, palate, tongue, tonsillar arches, and buccal mucosa.

- Spontaneous recovery after several day duration.

- Supportive therapy

**Epiptelitis – Supraglottic group**

- Predominantly Hemophilus influenzae type b

- In adults Strep pyogenes; rare Streptococcus pneumoniae, Staphylococcus aureus.

- Uvulitis- same pathology

- Primary drug of choice: Ceftriaxone Rocephin IV

  Alternant: Cefuroxime (Zinacef) Ampicillin/sulbactam (Unasyn) Levofloxacin or moxifloxacin IV

**Laryngitis**

- Acute typically viral

- After several days may have secondary bacterial infection; Moraxella catarrhalis 50%, Hemophilus influenzae 15%, other pneumococcus, streptococcus, staphylococcus, mycoplasma, pertussis.

- Initial supportive care – viral. Alternant Azithromycin, Doxycycline, Levofloxacin or moxifloxacin
Tracheobronchitis

- Acute typically viral should not continue greater than 2 weeks. M. catarrhalis, Mycoplasma pneumoniae, or Legionella.
- Pertussis possible.
- Primary drug of choice initial supportive Erythromycin, Azithromycin, or Clarithromycin with or without sulfonamide (TMP/SMX).
- Doxycycline or Levofloxacin or moxifloxacin

Laryngotracheobronchitis - subglottic group

- Predominately viral Influenza A. Possible superinfection with Staph aureus, Streptococcus pyogenes, Hemophilus influenzae.
- Primary drug of choice: Cefuroxime (Zincacef) or Ceftriaxone (Rocephin) or cefotaxime
- Alternant: Ampicillin/sulbactam (Unasyn) of Levofloxacin or moxifloxacin.

Head and Neck Infections

- Thyroiditis
- Necrotizing cellulitis/fasciitis
- Parotitis and sialadenitis
- Dacryocystitis
- Skin infections
- Folliculitis/ Furunculosis
- Odontogenic infections
- Lyme disease
- Cervical lymphadenitis

Thyroiditis/Necrotizing Cellulitis/Fasciitis - microbiology

- Staph aureus, Strept pyogenes, pneumoniae, streptococcal species, E. coli, klebsiella various aerobes and anaerobes.
- Rare mycobacteria, actinomycetes, salmonella, treponema.
- Drug Choices: Clindamycin IV may add Gentamycin, ceftazidime, imipenem, or meropenem
- Alternant: Ampicillin/sulbactam (Unasyn) IV plus metronidazole, and or gentamycin.

Parotitis and Sialadenitis

- Most common viral mumps
- Least common cytomegalovirus
- Coxsackie and Epstein–Barr virus
- Bacterial infections typically coagulase positive Staph aureus; less common S. pneumoniae, E. coli, Hemophilus influenzae oral anaerobes.
- Drug of choice Augmentin oral or Unasyn IV
- Alternatives: Clindamycin po or IV; cephalaxin or cefazolin with or without metronidazole, cefoxime, or vancomycin + metronidazole.

Dacryocystitis - microbiology

- S. pneumoniae and Hemophilus influenzae predominate in children
- Staph epidermidis, Staph aureus and Strept pyogenes more likely in adults
- Drugs of choice: Augmentin po or Unasyn IV
- Alternates Cefuroxime, or respiratory quinolones in adults.
Skin Infections - Impetigo
- Predominantly Strep pyogenes, Staph aureus
- Drug of choice: Mupirocin ointment plus 1st generation cephalosporin cephalaxin
- Alternant: Mupirocin plus amox/clav or dicloxacillin, cefuroxime, clindamycin, or levofloxacin.

Skin Infections: Folliculitis/Furunculosis/Carbuncles
- Staph aureus, Pseudomonas aeruginosa
- Drug of choice: Mupirocin ointment plus 1st generation cephalosporin cephalaxin
- Alternant: Mupirocin plus amox/clav or dicloxacillin, cefuroxime, clindamycin, or levofloxacin.
- If pseudomonas ciprofloxacin.

Skin Infections - Erysipelas
- Strep pyogenes, strep pneumoniae, Hemophilus influenzae, Staph aureus
- Primary drug of choice: amox/clav (Augmentin) or Ampicillin/sublactam (Unasyn)
- Alternate: cefuroxime Ceftin oral of Zinacef IV
- Levofloxacin or moxifloxacin or Vancomycin IV plus ceftriaxone IV

Cellulitis
- Adults: Strep pyogenes, or rare Staph aureus
- Children: Hemophilus influenzae, Strep pneumoniae
- Primary drug of choice: amox/clav (Augmentin) or Ampicillin/sublactam (Unasyn)
- Alternate: cefuroxime Ceftin oral of Zinacef IV
- Levofloxacin or moxifloxacin or Vancomycin IV plus ceftriaxone IV

Odontogenic Infections
- Anaerobes predominate over aerobes. Streptococcus, peptostreptococcus, bacteroides, porphyromonas, prevotella, fusobacterium, actinomyces, veillonella, as well as anaerobic spirochetes. Beta lactam production by fusobacterium and prevotella is common.
- Primary drug of choice. Clindamycin IV Alternant; Ampicillin/sublactam (Unasyn) IV or Amox/clav , Cefoxitin IV or cefotetan IV or penicillin plus metronidazole.

Lyme Disease
- Tick borne spirochete Borrelia burgdorferi.
- Primary Doxycycline 100mg BID 21-28 days
- Alternant: Amoxicillin 500mg qid 21-28days
- Erythromycin 250 mg qid 21-28 days
- Cefuroxime 500 mg bid 21-28 days
- Clarithromycin 500mg bid 21-28 days
- With neurological symptoms Ceftriaxone IV 2 GM/ day 21-28 days
Lymphadenitis - microbiology
Acute suppurative
- Represent entire spectrum of head and neck infections along with systemic infections
- Strep pyogenes impetigo / tonsillopharyngitis
- Staph aureus - skin infections- these two account for 50-80% of cases
- Peptococcus, Peptostreptococcus, Fusobacterium bacteroides - odontogenic infections
- Corynebacterium diptheria

Subacute/Chronic Lymphadenitis
- Viruses: Parainfluenza, Adenoviruses, Enteroviruses, Herpes simplex, human herpes, Epstein-Barr, Cytomegalovirus
- Bartonella (cat scratch Fever) 1st line Doxycycline or macrolide
- Toxoplasmosis
- Chronic Suppurative - Atypical Mycobacterium tuberculosis

Patient Teaching / Antibiotic Prescribing
- Take medication as prescribed, take entire course, and follow food instructions
- Report any unusual reactions.
- If taking hormonal contraception, use additional form contraception during drug therapy.
- Do not discontinue upon symptom relief.
- Do not start a previous prescription or take someone’s medication.
- Follow expiration dates.
- Store medication properly.