ANTIBIOTIC THERAPY IN PEDIATRIC DENTISTRY

A. GENERAL INDICATIONS FOR ANTIBIOTIC USE IN CHILDREN

1) Cellulitis
2) Acute Dental Infection
3) Dental Abscess
4) Orofacial and Dentoalveolar Trauma
5) The Non-Healing Wound
6) Antibiotic Prophylaxis

B. IS AN ANTIBIOTIC NECESSARY?

**ANTIBIOTIC THERAPY INDICATED**
- Trismus, fever and/or chills
- Cellulitis not localized and advancing
- Weakness, dizziness, rapid respirations

**ANTIBIOTIC THERAPY NOT INDICATED**
- Uncomplicated procedural edema, alveolar osteitis, pericoronitis
- Pain secondary to pulpitis or trauma
- Nonvital tooth draining sinus tract

C. PATIENT-SPECIFIC CRITERIA

1. HOST DEFENSES AND ANTIMICROBIAL MECHANISM OF ACTION

**BACTERIOSTATIC AGENTS**
- Tetracyclines
- Sulfas
- Macrolides
- Clindamycin*

**BACTERICIDAL AGENTS**
- Penicillins
- Cephalosporins
- Metronidazole
- Vancomycin
- Fluoroquinolones
- Aminoglycosides

2. THE COMPROMISED HOST

a) DISEASE
- Poorly controlled diabetes
- Malnutrition secondary to alcoholism or disease
- Neoplastic disease and radiation therapy

b) DRUG THERAPY
- Immunosuppressives:
  - Glucocorticoids (B & T)
  - Azathioprine (B & T) and Cyclosporine (T)
- Cytotoxic agents:
  - Methotrexate

3. OTHER HOST FACTORS

a) ALLERGY - history must be taken frequently, allergenicity greatest in childhood
b) AGE - achlorhydria, other meds, compliance based on taste for children
c) PREGNANCY
  - FDA pregnancy classifications: A, B, C, X
d) RENAL FAILURE
  - Contraindicated: tetracycline HCl
  - Dosage reduction: amoxicillin, ampicillin, cephalaxin, ciprofloxacin, vancomycin
  - No dosage change: erythromycin, clindamycin, doxycycline, dicloxacillin, metronidazole, cefaclor
e) SITE OF INFECTION - must be able to obtain MIC at site of infection

D. COMMON ORAL PATHOGENS

**AEROBIC GRAM POSITIVE COCCI**
- Alpha-hemolytic strep 43%
- Staph epidermis 14%
- Strep (non-specific) 10%
- Beta-hemolytic strep 7%
- Staph aureus 6%

**ANAEROBIC SPECIES**
- Gram + cocci
- Peptococcus* 38%
- Peptostrept* 29%
- Gram - rods
- Fusobacterium 25%
- Eubacterium 14%
- Bacteroides 92%
E. DENTAL DRUG REFERENCE
- drugs listed by generic, indexed by brand, non-comparative, incomplete
- authored by Gage, published by Mosby

F. DRUG INFORMATION COMPUTER SOFTWARE
1. DRUG FACTS ELECTRONIC VERSION BY DRUG FACTS & COMPARISONS
   - provides drug information monographs and performs drug interaction searches
   - cost $300 for individual, phone: 1-800-223-0554, demo diskette available.
2. ASK-RX
   - by Camdat, for comprehensive, full-text information using USP DI database
   - updated yearly in May. Clipboard allows for entry of individual patient data and Rx
   - $195 subscription fee/year. Phone: 1-800-875-8355

III. PATIENT MANAGEMENT REFERENCES FOR PEDIATRIC DENTISTRY

A. DENTAL MANAGEMENT OF THE MEDICALLY COMPROMISED PATIENT
   - authors: James Little/Donald Falace

B. MEDICAL EMERGENCIES IN THE DENTAL OFFICE
   - author: Stanley F. Malamed

C. SEDATION: A GUIDE TO PATIENT MANAGEMENT
   - author: Stanley F. Malamed

D. CURRENT PEDIATRIC DIAGNOSIS AND TREATMENT
   - edited by Hay, Groothius, Hayward and Levin

E. PEDIATRIC DENTISTRY: INFANCY THROUGH ADOLESCENCE
   - edited by Pinkham, Casamassimo, Fields, McTigue and Nowak

F. THE HARRIET LANE HANDBOOK; A MANUAL FOR PEDIATRIC HOUSE OFFICERS
   - edited by Johnson

G. PEDIATRIC DOSAGE HANDBOOK
   - authors Taketomo, Hodding, Kraus
   - APhA 1995 ed. available 6/1/95, price $29.50

H. POCKET BOOK OF PEDIATRIC ANTIMICROBIAL THERAPY
   - authored by Nelson

I. SWEETENER CONTENT OF COMMON PEDIATRIC ORAL LIQUID MEDICATIONS
   - authors Hill, Flatz, Frost

J. THE PAIN DRUGS HANDBOOK
   - authored by Omoigui
1. The typical odontogenic infection is composed of a mix of aerobic and anaerobic species.
2. The timeline of infection may show: AEROBES—MIXED—ANAEROBES.
3. Obtain cultures & sensitivities for: antibiotic failures, recalcitrant infections, suspected osteomyelitis, impaired host defenses, post-op wound infections, etc.

E. ANTIBIOTIC THERAPY GUIDELINES

Antimicrobial prescribing in the U.S.:
- 80% empirical therapy
- 10% prophylactic coverage
- 10% definitive therapy - after C & S

- Target causative organism - empirical or lab
- Patient drug and medical history - ALLERGIES?
- Patient counseling - adverse effects, compliance, cost
- Positive response expected in 48 hours
- Continue therapy 3 days after symptoms resolve
- Combination therapy: 3 possible effects - indifferent (additive) - synergism - antagonism
  Cidal + Cidal or Static + Static

F. ORAL PENICILLINS

<table>
<thead>
<tr>
<th>Classification</th>
<th>Oral Penicillin Use in Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PEDS DOSEAGE</td>
</tr>
<tr>
<td></td>
<td>mg/kg/day</td>
</tr>
<tr>
<td>Natural</td>
<td>500-1000u</td>
</tr>
<tr>
<td>Penicillin VK</td>
<td>25-50</td>
</tr>
<tr>
<td>Penicillinase-Resistant</td>
<td>12-25</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>50-100</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>20-40</td>
</tr>
<tr>
<td>Amox/potassium</td>
<td>40</td>
</tr>
<tr>
<td>clavulanate(Augmentin)</td>
<td>50-100</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>250-1000</td>
</tr>
<tr>
<td>Dicloxacillin</td>
<td>50-100</td>
</tr>
<tr>
<td>Nafcillin</td>
<td>50-100</td>
</tr>
</tbody>
</table>

1. INDIVIDUAL AGENTS

Amoxicillin advantages over ampicillin
- 2-4 fold better absorption
- spectrum of activity
- may be taken with food
- TID administration

2. ADVERSE EFFECTS

Hypersensitivity
- 3 - 10% of population is allergic to penicillins (more frequently with IV/IM than PO route)
- IgE Mediated acute reaction - PCN binds to protein and acts as a hapten to which Ab develop
- True anaphylactic reactions to penicillin are 1/7,000 to 1/25,000 instances of PCN use
  * mortality occurs once in every 50,000 - 60,000 treatment courses
  * sx. begin 10-20 min. after ingestion, antihistamines are of little effect
- Cross-reactivity to cephalosporins occurs in 3-5% of patients
  * Cephalosporins are contraindicated with pt history of severe or immediate penicillin reaction (urticaria, angioedema, anaphylaxis)
### G. ORAL CEPHALOSPORINS

<table>
<thead>
<tr>
<th>Classification</th>
<th>Oral Cephalospors Useful in Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PED DOSE: mg/kg/day OK with food? Usual adult regimen activity against oral pathogens</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First Generation</strong></td>
<td></td>
</tr>
<tr>
<td>Cephalexin (Keflex,g)</td>
<td>25-50</td>
</tr>
<tr>
<td>Cefadroxil (Duricef, Ultracert,g)</td>
<td>30</td>
</tr>
<tr>
<td>Cephradine (Anapar, Velosef,g)</td>
<td>25-50</td>
</tr>
<tr>
<td><strong>Second Generation</strong></td>
<td></td>
</tr>
<tr>
<td>Cefaclor (Cefclor)</td>
<td>40</td>
</tr>
<tr>
<td>Cefuroxime (Cefxin)</td>
<td>30-40</td>
</tr>
<tr>
<td>Cefprozil (Cefzil)</td>
<td>30</td>
</tr>
<tr>
<td>Cefpodoxime (Vantin)</td>
<td>10</td>
</tr>
<tr>
<td>Loracarbef (Lorbid)</td>
<td>15-30</td>
</tr>
<tr>
<td><strong>Third Generation</strong></td>
<td></td>
</tr>
<tr>
<td>Cefixime (Suprax)</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>400mg/day</td>
</tr>
</tbody>
</table>

**1. INDIVIDUAL AGENTS**

*1st generation:* best gram + coverage of all cephalosporins
*2nd generation:* best anaerobe coverage - Cefin suspension now available
*3rd generation:* no anaerobic advantage over first generation
*4th generation:* ? some gram +, value in dentistry remains to be seen

**2. ADVERSE EFFECTS**

- Hypersensitivity
- Oral candidiasis

**3. DRUG INTERACTIONS**

- Bacteriostatic antibiotics
- Anticoagulants
- Antacids, H₂ blockers

**H. ORAL MACROLIDES**

<table>
<thead>
<tr>
<th>Oral Macrolides Useful in Dentistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug</td>
</tr>
<tr>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Erythromycin Base</td>
</tr>
<tr>
<td>Abbott Filetab</td>
</tr>
<tr>
<td>Boots E-Mycin (ECI)</td>
</tr>
<tr>
<td>Abbott Ery-Tab (ECI)</td>
</tr>
<tr>
<td>Abbott PCE (PC)</td>
</tr>
<tr>
<td>P-D ERY (EC)</td>
</tr>
<tr>
<td>Erythromycin Phthalidinate</td>
</tr>
<tr>
<td>Abbott E.E.S., generic</td>
</tr>
<tr>
<td>Erythromycin Acegrate</td>
</tr>
<tr>
<td>Abbott Erythrocin</td>
</tr>
<tr>
<td>Azithromycin (Zithromax)</td>
</tr>
<tr>
<td>(not for &lt; 15 years)</td>
</tr>
<tr>
<td>Clarithromycin (Biasin)</td>
</tr>
</tbody>
</table>
4. Predisposing factors/risk factors include:
   recent hospitalization, recent broad-spectrum antibiotic use, history of colitis, advanced age, recent instrumentation of lower bowel

   d) Signs and Symptoms of AAC
   profuse, watery diarrhea 1-20 times/day, bloody diarrhea in 5-10% of cases, foul smelling, abdominal cramping, nausea, fever and leukocytosis
   * may occur up to 10 weeks after discontinuation of the antimicrobial agent

   c). Drug interactions:
   Succinylcholine  Erythromycin  Kaolin-Pectin

2. METRONIDAZOLE

   a). Adverse effects:
   Taste disturbances
   Peripheral neuropathy
   GI irritation (no oral suspension available)

   b). Drug interactions
   Anticoagulants  Disulfiram  Ethanol (IV diazepam, IV SMZ/TMP)
   Lithium  Phenytoin

   c) Characteristics of Metronidazole

   ADVANTAGES: - bactericidal
                - good bone penetration
                - great efficacy against oral anaerobes
                - inexpensive, can be given with penicillin VK

   DISADVANTAGES: - no oral suspension available
                   - no efficacy against gram positive bacteria (Strep species)
                   - significant gastrointestinal adverse effects
                   - significant drug interactions - including ethanol

3. TETRACYCLINES

   a). Adverse effects
   1) Esophageal ulceration - take with 8 oz of liquid
   2) Tooth staining - worst with tetracycline, best with doxycycline
      - avoid below ages 8-10
   3) Toxicity - outdated tetracycline (epimerization to renally toxic form)

   b). Drug interactions

   ALL TETRACYCLINES  DOXYCYCLINE  TETRACYCLINE
   Antacids, bismuth  Phenobarbital  Food (milk, dairy)
   Iron salts  Phenytoin  Cholestipol
   Oral contraceptives

   c). Periodontal infections
   Advantages in periodontal infections:
   - high concentration in GCF
   - good activity against A.A
   - binds to root surfaces
   - anticollagenase activity
1. INDIVIDUAL AGENTS

Clarithromycin (Biaxin) advantages over erythromycin base:
- PEDIATRIC DOSE: 15mg/kg/day
- 3% GI irritation as opposed to 30% for older agents, BID dosing, suspension available
- better activity against S. pyogenes than erythromycin, cefaclor or doxycycline
- better anaerobe coverage than erythromycin
- pregnancy C classification by FDA

Azithromycin (Zithromax): 2-4 fold less active than erythromycin against most strains of strep.
- pregnancy B classification by FDA

Erythromycin Base: ped dose 30-50mg/kg/day - not to exceed 2 grams/day
Erythromycin Ethylsuccinate: ped dose 40mg/kg/day - not to exceed 3.2 grams/day

2. ADVERSE EFFECTS

Cholestatic jaundice,
Gastrointestinal disturbances

3. DRUG INTERACTIONS

<table>
<thead>
<tr>
<th>Drug</th>
<th>Carbamazepine</th>
<th>Ergotamine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfentanil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anticoagulants</td>
<td>Cyclosporine</td>
<td>Terfenadine</td>
</tr>
<tr>
<td>Bromocriptine</td>
<td>Disopyramide</td>
<td>Theophylline</td>
</tr>
</tbody>
</table>

I. FLUOROQUINOLONES

- Not for use in pediatric patients (<18 years old) due to potential for arthropathy
- Sometimes used to manage chronic pseudomonal infections in cystic fibrosis patients

J. MISCELLANEOUS AGENTS

<table>
<thead>
<tr>
<th>Drug</th>
<th>OR with food?</th>
<th>Usual adult regimen</th>
<th>activity against oral pathogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clindamycin (Cleocin,g)</td>
<td>yes</td>
<td>150-300mg q6h</td>
<td>+</td>
</tr>
<tr>
<td>Metronidazole (Flagyl,g)</td>
<td>yes</td>
<td>250-500mg q8h</td>
<td>+</td>
</tr>
<tr>
<td>Tetracyclines (avoid if 4-10yr)</td>
<td>no</td>
<td>250-500mg q6h</td>
<td>+</td>
</tr>
<tr>
<td>Tetracycline HCL(Sumycin,g)</td>
<td>yes</td>
<td>100mg q12-24h</td>
<td>+</td>
</tr>
<tr>
<td>Minocycline (Minocin,g)</td>
<td>yes</td>
<td>100mg q12h</td>
<td>+</td>
</tr>
</tbody>
</table>

1. CLINDAMYCIN

a) Adverse effects:

Gastrointestinal disturbances
Antibiotic-associated colitis (AAC) - previously known as pseudomembranous colitis

b) Clostridia Difficile Induced Colitis (CDIC):

- caused by overgrowth of Clostridia difficile - toxin
- potential adverse effect of all antimicrobial agents - especially ones that affect obligate anaerobes

c) Four requirements for CDIC:

1. Presence of Clostridia difficile in GI tract
2. Altered gastrointestinal flora
3. Presence of Toxin A and B
   - must have toxin receptors in gut - children lack receptors