Commonly Prescribed Systemic and Ocular Pediatric Medications

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Course Description

• Course Objectives Systemic and Ocular Medication
• Become familiar with the thirty most prescribed medications for patients under eighteen
• Review indications, adverse effects, and side effects, both ocular and systemic, of these agents
• Review systemic medications used for ocular conditions
• Calculate dosage using mg per kg for pediatric medications.
• Review topical ophthalmic agents for recommended dosage, age recommendations and possible contraindications

Course Objectives

• Medications are frequently used in the pediatric population to manage chronic and acute conditions. This course will provide information about commonly prescribed systemic and ocular medications. Indications, therapeutic dosing recommendations, adverse effects and ocular side effects will be reviewed.

Common pediatric conditions

• Asthma
• Attention-deficit hyperactivity disorder (ADHD)
• Infections
• Pain/Fever
• Allergies
• Gastrointestinal (GI) complaints

Conditions of Interest

• Hyperlipidemia
• Psychosis
• Autism
• Depression
Factors Unique to Pediatric Pharmacology

- Babies
- Undeveloped metabolic and excretory processes:
  - Conjugation reactions are not developed until one year of age. Hence many drugs cannot be used in neonates, newborns and infants up to one year of age.
  - Excretory processes are not at adult levels until one year of age.

Factors unique to Pediatric Pharmacology

- Children one to twelve years of age
- Metabolism
  - Is generally faster than normal adult levels until age 2, then slowly declines until puberty, and finally drops to adult levels.
  - This may mean increased dosage or dosing frequency for drugs eliminated by hepatic metabolism.

Drug Dosing in Children

- Doses are often extrapolated from adult doses based on body surface area (Approximation)
- Future dosing should be done based on clinical outcome to maximize therapeutic benefit and minimize adverse effects.

Top Thirty Drugs Prescribed in Pediatric Medicine

1. Amoxicillin
2. Azithromycin
3. Albuterol
4. Amoxicillin/clavulanate
5. Cefdinir
6. Cephalexin
7. Fluticasone
8. Prednisolone sodium phosphate
9. Ibuprofen
10. Montelukast
11. Trimethoprim/sulfamethoxazole
12. Codeine phosphate/acetaminophen
13. Hydrocodone bitartrate/acetaminophen
14. Mupirocin
15. Nystatin
16. Methylprednisolone
17. Dextromethorphan/phenylephrine/chlorpheniramin
18. Mometasone
19. Triamcinolone
20. Prednisone
21. Sodium Fluoroide
22. Multivitamins with fluoride
23. Amphetamine/dextroamphetamine
24. Hydrocortisone
Top Thirty Drugs Prescribed in Pediatric Medicine

- 25. Budesonide
- 26. Ciprofloxacin/dexamethasone
- 27. Promethazine
- 28. Prednisolone
- 29. Antipyrine/benzocaine
- 30. Lisdexamfetamine

Drugs by Classification

- Infection:
  - Amoxicillin
  - Azithromycin
  - Amoxicillin/clavulanate
  - Cefdinir
  - Cephalexin
  - Trimethoprim/sulfamethoxazole
  - Mupirocin
  - Mupirocin
  - Nystatin
  - Ciprofloxacin/dexamethasone

Drugs by Classification: Asthma Allergy

- Asthma/Allergy
- Albuterol
- Fluticasone
- Prednisolone sodium phosphate
- Montelukast
- Mometasone
- Triamcinolone
- Prednisone
- Hydrocortisone
- Prednisolone

Drugs by Classification: Pain/Fever

- Pain/Fever
- Ibuprofen
- Codeine phosphate/acetaminophen
- Hydrocodone bitartrate/acetaminophen
- Promethazine (Phenergan for nausea and vomiting)
- Antipyrine/benzocaine (A/Botic drops) for pain relief of ear infection

Drugs by Classification: Behavior Management

- Behavior Management
- Methylphenidate (Ritalin, Concerta, Daytrana)
- Amphetamine/dextroamphetamine (Adderall, Adderal XR)
- Lisdexamfetamine (Vyvanse)

Optometric Considerations

- Oral Antibiotics may be used to manage pre-septal cellulitis and internal hordeola
- Top picks are:
  - Amoxicillin
  - Cephalexin
  - Azithromycin
Calculating pediatric dosage

- Demonstrate how to calculate mg/kg for desired therapeutic effect.
- Online calculators search weight based divided dosage calculator or do the math

Example of calculations

- Example: A doctor orders Acyclovir for a 30 pound 2 year old.
- Acyclovir comes in formulation 200 mg/5ml
- Desired dosage is 20-40 mg/kg/day
- First convert weight in pounds to kilograms:
  - 30 pounds divided by 2.2 kilograms/pound = 13.63 kg
- 13.6 kg * 20/mg/kg = 272.72 (minimum desired dosage)
- 13.6 kg * 40/mg/kg = 544 (maximum desired dosage)
- Order 200 mg bid for a total daily dosage of 400 mg which falls within the dosage range.

Pediatric side effects of systemic antibiotics

- Diarrhea
- Nausea
- Drug resistance

Pediatric side effects of systemic antibiotics

- Diarrhea
- Nausea
- Drug resistance

Pediatric side effects of Asthma/Anti allergy meds.

- Dry eyes
- Pharmacologically dilated pupil
- Tiredness or Hyperactivity

Pediatric side effects of Pain meds

- Listless, Tired, fatigued
- Hyperactive

Pediatric side effects of Pain meds

- Listless, Tired, fatigued
- Hyperactive

Pediatric side effects of Behavior Meds

- Dry eye
- Pupil dilation
- Accommodative dysfunction
- Nystagmus
Commonly used Ocular pediatric medications
Angela Howell, OD, FAAO, FCVD

Common pediatric ocular conditions requiring medication
Conjunctivitis
Allergic
Bacterial
Viral
Keratitis
Pre-septal cellulitis
Glaucoma

Chart of medication age approved dosage

- Anti allergy drops
- Anti allergy ointment
- Anti allergy orals

Anti-Allergy Drops-Mast Cell Stabilizers

- Medication
  - Cromolyn Sodium 4%(Crolom) 4+ qid to 6 times daily
  - Lodoxamide 0.1%(Alomide) 2+ bid to qid

Anti-Allergy Drops-Antihistamines

- Medication
  - Ketotifen 0.025%(Zatidor, Alaway)-OTC 3+ bid
  - Olopatadine 0.1%(Patanol) 2+ bid
  - Olopatadine 0.2%(Pataday) 2+ qd
  - Epinastine 0.05%(Elestat) 2+ bid
  - Azelastine 0.05%(Optivar) 3+ bid
  - Beopotastine 1.5%(Bepreve) 2+ bid
  - Alcaftadine 0.25%(Lastacaft) 2+ qd
  - Emeprastine 0.05%(Emadine) 3+ up to qid

Anti-Allergy Orals

- Medication
  - Diphenhydramine Citrate-OTC 6-12 19 to 38 mg orally q4-6h
  - 12+ 38 to 76 mg orally q4-6h
  - Diphenhydramine HCl 2-6 6.25 mg orally q4-6h
  - Maximum dosage not to exceed 37.5 mg daily
  - Diphenhydramine HCl 6-12 12.5 to 25 mg orally q4-6h
  - Maximum dosage not to exceed 150 mg/day
### Anti-Allergy Orals

<table>
<thead>
<tr>
<th>Medication</th>
<th>Age</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loratadine (Claritin)-OTC</td>
<td>2+</td>
<td>5mg,10mg day ages 6+</td>
</tr>
<tr>
<td>Cetirizine (Zyrtec)-OTC</td>
<td>6+</td>
<td>10mg day ages 6+</td>
</tr>
<tr>
<td>Fexofenadine(Allegra)-OTC</td>
<td>6+</td>
<td>60mg bid, 180mg qd 12+</td>
</tr>
<tr>
<td>Desoloratadine( Clarinex)-OTC</td>
<td>2+</td>
<td>5mg qd ages 12+</td>
</tr>
</tbody>
</table>

### Steroid Drops

<table>
<thead>
<tr>
<th>Medication</th>
<th>Age</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lotoprednol 0.2% (Alrex)</td>
<td></td>
<td>qid</td>
</tr>
<tr>
<td>Lotoprednol 0.5% (Loemox)</td>
<td></td>
<td>qid</td>
</tr>
<tr>
<td>Fluromethalone 0.1% (FML, Flarex)</td>
<td>2+</td>
<td>bid to qid</td>
</tr>
<tr>
<td>Fluromethalone 0.25% (FML Forte)</td>
<td>2+</td>
<td>bid to qid</td>
</tr>
<tr>
<td>Prednisolone acetate 1%</td>
<td></td>
<td>up to q1h</td>
</tr>
<tr>
<td>Difluprednate 0.05% (Durezol)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Anti Infectives

- Antibiotic ointment
- Antibiotic eye drops
- Antifungal eye drops
- Steroid-Antibiotic Drops/Ointments
- Oral antibiotics
- Antivirals Topical
- Antivirals Oral

### Antibiotic Ointments

<table>
<thead>
<tr>
<th>Medication</th>
<th>Age</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erythromycin 0.5% (Ilotycin)</td>
<td>2+months</td>
<td>qid</td>
</tr>
<tr>
<td>Tobramycin 0.3% (Tobrex)</td>
<td>2+months</td>
<td>bid to qid</td>
</tr>
<tr>
<td>Ciprofloxan 0.3% (Ciloxan)</td>
<td>2+years</td>
<td>tid x days then bid</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Medication</th>
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<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymixin B &amp; Trimethoprim (Polytrim)</td>
<td>2+months</td>
<td>q3h</td>
</tr>
<tr>
<td>Tobramycin (Tobrex)</td>
<td>2+months</td>
<td></td>
</tr>
<tr>
<td>Ciprofloxan 0.3%(Ciloxan)</td>
<td>1+years</td>
<td>q2hx2 days then qid x 5 days</td>
</tr>
<tr>
<td>Ofloxacin 0.3%(Ocuflox)</td>
<td>same</td>
<td></td>
</tr>
<tr>
<td>Gatifloxacin 0.3%(Zymar)</td>
<td>same</td>
<td></td>
</tr>
<tr>
<td>Gatifloxacin 0.5%(Zymaxid)</td>
<td>1+years</td>
<td>q2hx1 day then qidx6 days</td>
</tr>
</tbody>
</table>

### Antibiotic Drops

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<thead>
<tr>
<th>Medication</th>
<th>Age</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levofloxacin 0.5%(Quizin)</td>
<td>1+year</td>
<td>q2hx2days then qid x 5 days</td>
</tr>
<tr>
<td>Levofloxacin 1.5% (Iquix)</td>
<td>6+</td>
<td>q2hx2days then qid x 5 days</td>
</tr>
<tr>
<td>Moxifloxacin 0.3%(Vigamox)</td>
<td>1+</td>
<td>tid x 7 days</td>
</tr>
<tr>
<td>Moxifloxacin 0.5%(Moxeza)</td>
<td>4+months</td>
<td>bid x 7 days</td>
</tr>
<tr>
<td>Besifloxacin 0.6%(Besivance)</td>
<td>1+</td>
<td>tid x 7 days</td>
</tr>
<tr>
<td>Azithromycin 1%(AzaSite)</td>
<td>1+</td>
<td>bidx2days then qd x 5 days</td>
</tr>
</tbody>
</table>
Antifungal Eye Drops

- Natamycin 5% q1h x 1day taper 14-21 days

Steroid-Antibiotic Drops/Ointments

<table>
<thead>
<tr>
<th>Medication</th>
<th>Age</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Dexamethasone 0.1% &amp; Tobramycin 0.3%</td>
<td>2+</td>
<td></td>
</tr>
<tr>
<td>(Tobradex)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dexamethasone 0.1% &amp; Tobramycin 0.5%</td>
<td>2+</td>
<td></td>
</tr>
<tr>
<td>Tobradex ST</td>
<td></td>
<td>2+</td>
</tr>
<tr>
<td>Loteprednol 0.5% &amp; Tobramycin 0.3%</td>
<td>2+</td>
<td></td>
</tr>
<tr>
<td>(Zylet) drops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dexamethasone, Neomycin, Polymixin B</td>
<td>2+</td>
<td></td>
</tr>
<tr>
<td>(Mastrol)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Oral Antibiotics

- Amoxicillin, Clavulanate (Augmentin)
  - 20-40 mg/kg/day q 8h
  - Formulations 125/200/250/400 mg/5ml

- Erythromycin Ethylsuccinate (EES) formulations 200/400 mg/5ml
  - Dosage 30-50 mg/kg/q 6h

- Amoxicillin: Formulations 125/200/250/400 mg/5ml
  - 25-45 mg/kg/day q 12 h OR
  - 20-40 mg/kg/day q 8 h

- Cephalixin (Keflex) formulations 125/250/500 mg/5ml
  - Dosage 25-50 mg/kg/day q 12 hours

- Cefaclor (Ceclor) formulations 125/187/250/375 mg/5ml
  - Dosage 20-40 mg/kg/day q 8 or 12 h

- Cefdinir (Omnicef) formulations 125/250 mg/5ml
  - Dosage 7mg/kg/day q 12 h

- Erythromycin Ethylsuccinate (EES) formulations 200/400 mg/5ml
  - Dosage 30-50 mg/kg/q 6 h

- Amoxicillin: Formulations 125/200/250/400 mg/5ml
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Antivirals Topical

- Trifluothymadine 1% (Viroptic) 2qh up to 9 times per day

- Ganciclovir 0.15% (Zirgan) 5x/day until heals

- then tid For seven days
Antivirals Oral

- Acyclovir formulation 200/mg/5ml
- 2+ 20-40 mg/kg/day
- OR
- 1.5-3 years 200 mg tid
- 3-5 years 300 mg tid
- 6+ years 400 mg tid

Anti-Glaucoma Drops: Beta Blockers

- Timolol maleate 0.25, 0.5% Timoptic/XE
- Timolol 0.5% Istralol
- Betaxolol 0.25% (Betoptic S)
- Pregnancy category C
- No safety for pediatrics established

Anti-Glaucoma Drops Adrenergic agonist

- Apraclonidine 0.5%, 1% (Iopidine)
- Embryocidal in animal studies, not advised for pregnant women
- No safety for pediatrics is established
- Bimodine 0.2% (Alphagan) Ages 2 and up

Anti-Glaucoma Drops Adrenergic agonist

In a well-controlled clinical study conducted in pediatric glaucoma patients (ages 2 to 7 years) the most commonly observed adverse reactions with brimonidine tartrate ophthalmic solution 0.2% dosed three times daily were somnolence (50-83% in patients ages 2 to 6 years) and decreased alertness. In pediatric patients 7 years of age (>20 kg), somnolence appears to occur less frequently (25%). Approximately 16% of patients on brimonidine tartrate ophthalmic solution discontinued from the study due to somnolence.

Antiglaucoma drops Carbonic Anhydrase Inhibitors

- Brinzolamide 1% (Azopt)
- Dorzolamide 25% (Trusopt)
- Pregnancy category C

Anti-glaucoma drops Prostaglandin Analogs

- Brimatoprost (Lumigan) Ages 16+
- Travaprost (Travatan) Ages 16+
- Tafluprost (Zioptin) Ages 18+
- Lantanoprost 0.005% (Xalatan) No safety documented for pediatrics

- Changes in iris and eyelid pigmentation are a concern for younger patients
Anti-glaucoma Drops Combination

- Brimodine 0.2% and Timolol 0.5% (Combigan) indicated for ages 2+
- Brinzolamide 1% and Brimodine 0.2% (Simbrinza) ages 2+
- Dorzolamide 2% and Timolol 0.25% (Cosopt) ages 2+

Later combination eye drops were required to be tested on children even though the individual drugs have "no safety for pediatrics" on their package insert.

Anti-glaucoma drops

- Management of pediatric conditions may indicate using medications that do not have safety for pediatrics documented
- For example:
  - A fungal ulcer with Natamyain
  - A raging uveitis with Pred Forte or Durazol

Conclusion

- Managing pediatric patients requires comfort with systemic medication management and ocular medication management. Managing the desired results and potential side effects of medications will result in optimal outcomes.