Updates in Therapeutics® 2015:
The Pharmacotherapy Preparatory Review & Recertification Course
Pediatrics
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The speaker, Kirsten Ohler, has no real or potential conflicts of interest to disclose related to the subject matter in this presentation.
Learning Objectives

- Describe the most common pathogens associated with neonatal and pediatric sepsis/meningitis.
- Describe current therapeutic options for the management of neonatal and pediatric sepsis/meningitis.
- Identify the drugs available for preventing and treating respiratory syncytial virus.
- Describe the most common causative organisms of otitis media and potential treatment options.
- Identify the recommended pediatric immunization schedule and barriers to routine immunization.
- Discuss the differences in anticonvulsant pharmacokinetics and adverse effects between children and adults.
- Describe the current drug therapy for treating patients with attention-deficit/hyperactivity disorder.
Case 1

Neonate born at 36 week’s gestational age develops respiratory distress, hypotension, and mottling at 5 hours of life. Witnessed seizure in the NICU. Mother is GBS positive; three doses of penicillin given before delivery.

Best empiric antibiotic regimen?

- a. Vancomycin
- b. Ampicillin + gentamicin
- c. Ampicillin + ceftriaxone
- d. Ceftazidime + gentamicin
## Sepsis/Meningitis - Pathogens

<table>
<thead>
<tr>
<th>Age</th>
<th>Organism</th>
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<tbody>
<tr>
<td>0 - 1 month</td>
<td>Group B β Streptococcus, E. coli, Listeria, viral, nosocomial</td>
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<tr>
<td>1 - 3 months</td>
<td>Neonatal pathogens, H. influenzae, N. meningitidis, Strep pneumoniae</td>
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<tr>
<td>3 mo - 12 yr</td>
<td>H. influenzae, N. meningitidis, Strep pneumoniae</td>
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<tr>
<td>&gt; 12 yr</td>
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Case 2

Culture results reveal gram negative rods in the cerebral spinal fluid.

Which recommendation regarding antibiotic prophylaxis is best?

- a. 5-month old stepsister is at high risk and should receive rifampin
- b. The patient should receive rifampin to eliminate nasal carriage
- c. Antibiotic prophylaxis is not indicated
- d. All close contacts should receive rifampin
Chemoprophylaxis

- Purpose: prevent the spread of *Haemophilus influenzae* and *Neisseria meningitidis*

- High risk groups: household contacts, nursery or child care center contacts, direct contact with patient’s secretions

- Drug of choice: rifampin
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b. The patient should receive rifampin to eliminate nasal carriage
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Case 3

6-year-old boy presents to the ED with fever, altered mental status & petechiae. No trauma. Tox screen negative. Elevated WBC with a left shift. Cultures are pending. NKDA

Best empiric antibiotic regimen?

a. Ampicillin + gentamicin
b. Cefuroxime
c. Ceftriaxone + vancomycin
d. Rifampin
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b. Cefuroxime
c. Ceftriaxone + vancomycin
d. Rifampin
Case 4

You are screening babies during the current RSV season for risk factors associated with the development of severe RSV infection.

Which is the best recommendation regarding the use of palivizumab for RSV prophylaxis?
Case 4

Palivizumab should be prescribed for:

a. An 18-month-old, 26 weeks’ gestation infant with a history of CLD, no $O_2$ or meds in past 8 mo

b. A 5-month-old, 28 weeks’ gestation infant, with a history of CLD, no $O_2$ or meds

c. A 41-day-old, 31 weeks’ gestation baby, without CLD, will attend day care

d. A 10-month-old, 37 weeks’ gestation baby with a surgically repaired congenital heart defect
Respiratory Syncytial Virus

- Risk Factors
  - premature birth
  - chronic lung disease (CLD)
  - cyanotic or complicated congenital heart disease
  - immunodeficiency
  - airway abnormalities
  - other: low socioeconomic status, passive smoking, day care, siblings
## Respiratory Syncytial Virus

### AAP guidelines for palivizumab use

<table>
<thead>
<tr>
<th>Gestational Age (weeks)</th>
<th>Age at Start of RSV Season (months)</th>
<th>Other Required Criteria</th>
<th>Maximal Doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 29 + 0 days</td>
<td>&lt; 12</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>&lt; 32 + 0 days</td>
<td>&lt; 12</td>
<td>Chronic lung disease requiring more than 21% oxygen for at least the first 28 days of life</td>
<td>5</td>
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<tr>
<td>&lt; 32 + 0 days</td>
<td>&lt; 24</td>
<td>Consider prophylaxis for a second RSV season if chronic lung disease requiring medical therapy within the 6 months preceding the start of RSV season</td>
<td>5</td>
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<tr>
<td>Any</td>
<td>&lt; 12</td>
<td>Hemodynamically significant acyanotic* congenital heart disease receiving medication for congestive heart failure AND will require cardiac surgery</td>
<td>5</td>
</tr>
<tr>
<td>Any</td>
<td>&lt; 12</td>
<td>Moderate to severe pulmonary hypertension</td>
<td>5</td>
</tr>
<tr>
<td>Any</td>
<td>&lt; 12</td>
<td>Congenital abnormalities of airway or neuromuscular disease</td>
<td>5</td>
</tr>
<tr>
<td>Any</td>
<td>&lt; 24</td>
<td>Profound immunocompromise</td>
<td>5</td>
</tr>
</tbody>
</table>
Case 4

Palivizumab should be prescribed for:

a. An 18-month-old, 26 weeks’ gestation infant with history of CLD, no O₂ or meds in past 8 mo

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Case 5

18-month-old with history of premature birth and CLD is admitted to the PICU with respiratory distress requiring intubation, fever, and a 3-day history of cold-like symptoms. A nasal swab is positive for respiratory syncytial virus.
Case 5

Which is the best intervention?

a. Palivizumab
b. Corticosteroids
c. Cefuroxime
d. Intravenous fluids and supportive care
Case 6

A 5-month-old infant, born at term, healthy is treated for her first case of otitis media with amoxicillin 45 mg/kg/day for 7 days. Follow-up exam shows fullness of middle ear, cloudy TM. Afebrile and eating well.

Best treatment recommendation?

a. No antibiotics are warranted at this time
b. High-dose (90 mg/kg/day) amoxicillin x 7 days
c. Decongestant & antihistamine daily
d. Azithromycin
Common pathogens

- viral
- *Streptococcus pneumoniae*
- nontypeable *Haemophilus influenzae*
- *Moraxella catarrhalis*
Otitis Media

Treatment Principles

- clinical resolution in a significant # of cases
- immediate antibiotics if bulging TM or otorrhea
- if > 2 years old, may delay antibiotics if NO bulging TM and no severe systemic symptoms
  - 6mo – 2yrs, may defer if mild symptoms and unilateral OM
- analgesics more beneficial than antibiotics for relieving otalgia within the first 24 hours
- antibiotics not needed for OM w/ effusion
- persistence of middle ear fluid is likely
Case 6

A 5-month-old infant, born at term, healthy is treated for her first case of otitis media with amoxicillin 45 mg/kg/day for 7 days. Follow-up exam shows fullness of middle ear, cloudy TM. Afebrile and eating well.

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- c. Decongestant & antihistamine daily
- d. Azithromycin
Case 7

4-year-old boy diagnosed with 4\textsuperscript{th} case of otitis media in 12 months. No evidence of hearing loss or delayed language skills.

Which of the following is the best intervention?

\begin{itemize}
  \item[a.] Long-term antibiotic prophylaxis
  \item[b.] Tympanostomy tubes
  \item[c.] High-dose amoxicillin and ensuring he is up-to-date on pneumococcal and influenza vaccines
  \item[d.] No antibiotic therapy is warranted
\end{itemize}
Case 8
1-year-old boy with history of Kawasaki disease treated 4 months ago with IVIG. At well-child check-up, due for MMR and varicella. Food allergies include peanuts, eggs, shellfish. Mother has several concerns regarding immunizations.

Best reason to defer administration of vaccines?

a. Association between MMR & autism
b. Allergic reaction to MMR if patient has egg allergy
c. Many concurrent vaccines can overload immune system
d. Decreased vaccine efficacy because of previous IVIG administration
Barriers to routine immunization

- contraindications
  - anaphylactic reaction to the vaccine
  - acute moderate – severe febrile illness
  - immunodeficiency, pregnancy, recent IVIG
  - encephalopathy w/in 7 days of previous DTaP

- misconceptions regarding contraindications
  - mild acute illness, current antibiotics, etc.
Immunizations

- Special populations
  - Preterm infants
    - immunize based on chronologic age
  - Immunocompromised children
    - no live vaccines
  - Patients receiving corticosteroids
    - recommendations depend on steroid dose / duration
  - Patients who recently received IVIG
    - affects live vaccines (ex. MMR, varicella)
    - recommendations depend on indication / dose of IVIG
  - HIV-infected patients
    - recommendations depend on degree of immunocompromise
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d. Decreased vaccine efficacy because of previous IVIG administration
Case 9

For which of the following patients would it be best to recommend deferring immunizations?

a. 12-month-old boy who recently completed a cycle chemotherapy for ALL
b. 6-month-old girl on amoxicillin for otitis media
c. 12-month-old, HIV-positive boy with CD4 >1000
d. 12-year-old girl completing a prednisone "burst" (1 mg/kg/day) for asthma exacerbation
<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Birth</th>
<th>1 mo</th>
<th>2 mos</th>
<th>4 mos</th>
<th>6 mos</th>
<th>9 mos</th>
<th>12 mos</th>
<th>15 mos</th>
<th>18 mos</th>
<th>19-23 mos</th>
<th>2-3 yrs</th>
<th>4-6 yrs</th>
<th>7-10 yrs</th>
<th>11-12 yrs</th>
<th>13-15 yrs</th>
<th>16-18 yrs</th>
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<td>Hepatitis B (HepB)</td>
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<td>2ª dose</td>
<td>3ª dose</td>
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<td>Rotavirus (RV) (RV1 (2-dose series); RV5 (3-dose series))</td>
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<td>2ª dose</td>
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<td>Diphtheria, tetanus, &amp; acellular pertussis (DTaP; &lt;7 yrs)</td>
<td>1ª dose</td>
<td>2ª dose</td>
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<td>Tetanus, diphtheria, &amp; acellular pertussis (Tdap; ≥7 yrs)</td>
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<td>Pneumococcal polysaccharide (PPSV23)</td>
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<td>2ª dose</td>
<td>3ª dose</td>
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<td>Influenza (IV; LAIV) 2 doses for some: See footnote 8</td>
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<tr>
<td>Human papillomavirus (HPV2: females only; HPV4: males and females)</td>
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<td>Meningococcal (Hib-MenCY ≥ 6 weeks; MenACWY-D ≥ 9 mos; MenACWY-CRM ≥ 2 mos)</td>
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See footnote 13
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    - recommendations depend on steroid dose / duration
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Case 10

14-year-old moderately obese girl complains of erythematous pruritic rash. She was started on oxcarbazepine three weeks ago for partial seizures. Sexually active ± contraception.

Which of the following is the best intervention?

- a. Change to carbamazepine
- b. Change to levetiracetam
- c. Change to valproic acid
- d. No change in therapy is necessary
# Pediatric Seizures

<table>
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<tr>
<th>Seizure type</th>
<th>Drugs of Choice</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partial</td>
<td>VPA, CBZ, PHT</td>
<td>PB, Gabapentin, Lamotrigine, Tiagabine, Topiramate, Oxcarbazepine, Zonisamide, Levetiracetam</td>
</tr>
<tr>
<td>Generalized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tonic-clonic</td>
<td>VPA, CBZ, PHT</td>
<td>Lamotrigine, Topiramate, Zonisamide, Levetiracetam</td>
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<tr>
<td>Myoclonic</td>
<td>VPA</td>
<td>Topiramate, Zonisamide, Levetiracetam</td>
</tr>
<tr>
<td>Absence</td>
<td>Ethosuximide, VPA</td>
<td>Lamotrigine, Zonisamide, Levetiracetam</td>
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<td>Lennox-Gastaut</td>
<td>VPA, Topiramate, Lamotrigine</td>
<td>Felbamate, Zonisamide</td>
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<tr>
<td>Infantile spasms</td>
<td>ACTH</td>
<td>Lamotrigine, tiagabine, topiramate, VPA, zonisamide</td>
</tr>
</tbody>
</table>
Pediatric Seizures

Rash
- Carbamazepine
- Oxcarbazepine
- Lamotrigine
- Phenytoin
- Phenobarbital
- Zonisamide

Menstrual irregularities
- Valproic acid

Weight gain
- Valproic acid
- Gabapentin

Weight loss
- Topiramate
- Zonisamide

Cognitive/CNS effects
- Phenobarbital
- Topiramate
- Levetiracetam
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Page 1-24; Answer 1-33 & 1-34
Case 11

9-year-old boy is newly diagnosed with ADHD symptoms at home and school.

Best recommendation for initial drug regimen?

a. Methylphenidate OROS (Concerta®) once daily
b. Methylphenidate IR (Ritalin®) twice daily given four hours apart
c. Guanfacine at bedtime
d. D-methylphenidate (Focalin®) twice daily given four hours apart
Drug Therapy for ADHD

- Stimulants
  - Methylphenidate-containing products
  - Amphetamine-containing products
- Non-stimulants
Drug Therapy for ADHD

- Methylphenidate-containing products
  - duration of effect
    - short = Ritalin and Focalin
    - intermediate = Metadate ER and Ritalin SR
    - long = Concerta, Metadate CD, Ritalin LA
  - side effects
    - insomnia, loss of appetite, headache, may exacerbate tics
Drug Therapy for ADHD

- Amphetamine-containing products
  - duration of effect
    - Adderall vs. Adderall XR

- side effects
  - insomnia, loss of appetite, nervousness, exacerbation of hypertension and tics
  - potential association with sudden cardiac death
Drug Therapy for ADHD

- Non-stimulant medications
  - Atomoxetine (Strattera)
    - potential association with severe liver injury
    - does not exacerbate tics
  - Clonidine
    - more effective for hyperactivity than inattention
    - lessens the severity of tics
    - sedation
  - Guanfacine
    - ↓ sedation and ↑ duration than clonidine
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c. Guanfacine at bedtime
d. D-methylphenidate (Focalin®) twice daily given four hours apart
Case 12

The patient is started on methylphenidate OROS (Concerta®); symptoms well-controlled, but complaining of insomnia.

Best modification to treatment regimen?

a. Administer Concerta later in day
b. Change to methylphenidate modified release (Metadate CD) once a day.
c. Change to methylphenidate patch
d. Change to atomoxetine at bedtime
Questions