Infectious Diseases in Pediatrics

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Recommended immunization schedule for persons aged 0 through 6 years—United States, 2012.

Recommended immunization schedule for persons aged 7 through 18 years—United States, 2012.

Measles cases reported in U.S. 2001-2011
Pneumococcal Vaccine 2012

- Pneumococcal Conjugate Vaccine (PCV13)
  - All children 2-59 months
  - A PCV series begun with PCV7 should be completed with PCV13
  - A single dose of PCV13 at 14-59 months of age for all children who received PCV7 series

Pneumococcal vaccine 2012

- For children with asplenia, HIV, or other immunocompromising conditions:
  - One supplemental dose of PCV13 at 6-18 years of age
  - Pneumococcal polysaccharide vaccine:
    - 2 years old
    - 7 years old

Influenza Vaccine 2012

- Administer annually to children/adolescents 6 months through 18 years of age. (trivalent inactivated vaccine)
  - Live attenuated vaccine for children over 2 years of age except:
    - children with asthma
    - children 2-4 yo with wheezing in past year
    - underlying conditions predisposing to complications from influenza

Influenza hospitalizations per 10,000 by age group for 3 seasons
Influenza

- 6 yo with cough and high fever

“Cocooning” children at high risk from influenza

- Immunize adults who live with or care for:
  - Children less than 5 years old
  - Infants less than 6 months old
  - Children and adolescents with diabetes, asthma, morbid obesity, immunosuppression, neurologic disorders

Meningococcal Vaccine 2012

- Administer at 11-12 years of age
- Administer a booster dose at 16 years of age (16-18 years of age if 1st dose at 13-15 years)
- Administer to children 2-10 years of age with special conditions; (eg, persistent complement deficiencies, asplenia)

U.S. rates of meningococcal disease by age

Source: Pediatr Infect Dis 2007; Lippincott Williams & Wilkins
Pertussis in California

- 9,120 cases of pertussis reported in California in 2010.
  - Highest incidence since 1958
  - 804 cases hospitalized
  - 10 deaths
    - 9 infants < 2 months of age (none vaccinated)
    - 1 infant, 2 months of age, 1 vaccination

Rates of infection by age

- < 6 months: 435 cases/100,000
- 6 months – 6 years: 61 cases/100,000
- 7-9 years: 67 cases/100,000
- 10-11 years: 49 cases/100,000

Pertussis Vaccine 2012

- Tdap vaccine
  - 7-10 years yo; single dose of Tdap if incompletely immunized
  - 11-18 yo; a single dose for those who have completed the recommended childhood series

General vaccine recommendations

- All vaccines can be administered at the same visit as all other vaccines.
- If not given at the same visit, live parenteral vaccines or live intranasal influenza vaccine should be separated by at least 4 weeks.
General vaccine recommendations

- Increasing the interval between doses of a multidose vaccine does not diminish the effectiveness of the vaccine.
- Decreasing the interval may interfere with antibody response

General vaccine recommendations

- Live vaccine should not be administered to severely immunosuppressed patients.
- Inactivated vaccines are safe for immunosuppressed patients.

Common Vaccine Questions

- Can you give live virus vaccine to children taking corticosteroids?
  - No: if taking >2 mg/kg/day or >20 mg/day of prednisone for greater than 14 days.
  - Yes: if taking lower daily doses, on alternate day dosage, on systemic steroids for less than 14 days, on inhaled or topical steroids

Common Vaccine Questions

- How long should children wait to get vaccinated after receiving immunoglobulins?
  - Depends on the immunoglobulin
Common Vaccine Questions

What are contraindications to further immunization with pertussis vaccine?
- Anaphylactic reaction to the vaccine
- Encephalopathy developing within 7 days of the vaccine

Invalid contraindications to vaccination
- Mild illness
- Antimicrobial therapy
- Pregnant or immunosuppressed person in the home
- Breastfeeding
- Premature birth
- Tuberculin skin test

Common Vaccine Questions

What are precautions to further vaccinations with pertussis vaccine?
- Fever >40.5 within hours of a previous dose
- Persistent inconsolable crying for >3 hours
- Collapse or shock-like state
- Seizure within 3 days of previous vaccine

Tuberculosis

U.S., 2007
- 13,000 new cases
- 820 in children< 15yo
- 60% of all cases in California, Florida, Georgia, Illinois, New Jersey, New York, Texas
### Risk of Progression from TB Infection to Disease

<table>
<thead>
<tr>
<th>Age at Primary Infection</th>
<th>No Disease (%)</th>
<th>Pulmonary Disease (%)</th>
<th>Miliary or CNS (%)</th>
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</thead>
<tbody>
<tr>
<td>&lt; 1yo</td>
<td>50</td>
<td>30-40</td>
<td>10-20</td>
</tr>
<tr>
<td>1-2yo</td>
<td>75-80</td>
<td>10-20</td>
<td>2.5</td>
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<tr>
<td>2-5yo</td>
<td>95</td>
<td>5</td>
<td>&lt;0.5</td>
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<tr>
<td>5-10</td>
<td>98</td>
<td>2</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>&gt;10</td>
<td>85-90</td>
<td>10-20</td>
<td>&lt;0.5</td>
</tr>
</tbody>
</table>

### Clinical Manifestations of Disease
- Lung - 80% of all cases
- Extrapulmonary
  - Lymphadenopathy 67%
  - Meningitis 13%
  - Pleural 6%
  - Miliary 5%
  - Skeletal 4%

### Tuberculosis

**Reaction of tuberculin skin test considered positive**

- **Reaction Size**
  - ≥5mm
  - Risk Factors
    - HIV infection
    - Abnormal CXR c/w TB
    - Contact with infectious case

- **Reaction Size**
  - 10mm
  - Risk Factors
    - Age < 4yo
    - Birth or residence in high prevalence country
    - Residence in correctional facility
    - Certain medical conditions (diabetes, renal failure)
    - Any child with close contact of adult with above risk factors
Tuberculosis

Reaction Size of Tuberculin Skin Test
Considered Positive

<table>
<thead>
<tr>
<th>Reaction Size</th>
<th>Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 15 mm</td>
<td>no risk factors</td>
</tr>
</tbody>
</table>

Tuberculosis

TST in children who have received BCG
- Prior BCG may not explain a positive TST
- BCG administered in parts of the world with high rates of TB
- Use of whole blood interferon-gamma release assays to discriminate infection from BCG effect

Tuberculosis

Treatment
- TB exposure
  - > 4yo, immunocompetent
    - TST, repeat in 2-3 months
  - < 4yo, immunocompromised
    - TST; if negative, treat 2-3 months with INH, repeat TST
    - Remember TST’s may be unreliable in infants

Tuberculosis

Treatment of TB infection (neg CXR)
- INH for 9 months
- If source case has isolate resistant to INH but sensitive to rifampin, can treat with rifampin
Tuberculosis

- Tuberculosis Disease
  - Multidrug treatment via directly observed therapy.

Tuberculin Testing

- Immediate TSTs
  - Contacts of confirmed or suspicious cases
  - Children with clinical findings of disease
  - Children immigrating from or with recent travel to endemic countries and/or significant contact with indigenous persons from such countries.

- Annual TST's
  - Children infected with HIV or living in household with HIV infected persons
  - Incarcerated adolescents

Tuberculin Testing

- TST testing every 2-3 years
  - Children exposed to following persons:
    - HIV infected
    - Homeless
    - Residents of nursing homes
    - Institutionalized or incarcerated adolescents or adults
    - Users of illicit drugs
    - Migrant farm workers
Tuberculin Testing

- TST at 4-6 years and 11-16 years
  - Children whose parents immigrated from endemic countries
  - Children without specific risk factors who reside in high prevalence areas

Pulmonary tuberculosis

- 16 year old female with history of worsening cough and weight loss for one month
Pharyngitis in Children

**Etiology**
- Most cases are benign self-limited viral infections:
  - Adenovirus (pharyngoconjunctival fever)
  - Rhinovirus
  - Coxsackievirus A, Echovirus (herpangina; hand, foot, mouth disease)
  - Parainfluenza
  - Influenza
  - EBV
  - Herpes simplex, type 1 (gingivostomatitis)

- Grp A Streptococcus accounts for 15%-30% of all cases
- Uncommon causes – Grp C and G beta hemolytic streptococcus, N gonorrhea, tularemia
- Mycoplasma infections of the upper respiratory tract are also associated with pharyngitis

**Features suggestive of GAS pharyngitis**
- Sudden onset
- Scarlet fever rash
- Fever, headache, abdominal pain
- Sore throat in absence of viral symptoms
- Tonsillar erythema, exudate
- Palatal petechiae
- Cervical lymphadenitis
- Age 5-15 years

**Features suggestive of viral infection**
- Conjunctivitis
- Coryza
- Cough
- Hoarseness
- Myalgia
- Diarrhea
- Characteristic enanths and exanths
Pharyngitis in Children

- Throat Cultures
  - Laboratory confirmation of infection recommended as clinical identification not reliable
  - Throat culture remains the gold standard
  - Rapid antigen tests are highly specific, but have variable sensitivity (negative antigen tests should be followed up with culture)
  - Neither culture nor RAT’s discriminate between GAS infection and carrier state
  - Antistreptococcal antibody titers have no value in diagnosis of acute GAS pharyngitis

Who NOT to do throat cultures on:
- Children <3 years old
- Children with coryza, conjunctivitis, cough, hoarseness, anterior stomatitis, discreet ulcerations
- Post-treatment

GAS Pharyngitis – Why Treat?

- Suppurative sequelae
  - Peritonsillar abscess, retropharyngeal abscess, cervical adenitis, otitis media
- Nonsuppurative sequelae
  - Acute rheumatic fever (pharyngeal infection only, treatment within 9 days of onset of infection)
  - Post-streptococcal glomerulonephritis (after pharyngeal or skin infection, not prevented by treatment of primary infection)
  - Poststreptococcal reactive arthritis (symmetrical large joint involvement, hands)

GAS Pharyngitis - Treatment

- Penicillin V
  - 250 mg BID for children for 10 days
  - 500 mg BID for teens for 10 days
- Benzathine penicillin G
  - 600,000 units IM for kids <60 lbs
  - 1.2 million units for everyone >60 lbs
GAS Pharyngitis - Treatment

- Amoxicillin
  - Single daily dose, 50 mg/kg/d for 10 days
- Macrolides
  - Erythromycin, azithromycin, clarithromycin
- First generation cephalosporin
  - Keflex 20-50 mg/kg/d

Streptococcal Pharyngitis

- Palatal petechiae

Streptococcal Scarlet Fever

- Typical facial rash with erythema of cheeks and perioral pallor

Streptococcal Scarlet Fever

- Sandpaper exanthem of scarlet fever
Streptococcal Scarlet Fever
- Pastia’s Lines

Streptococcal Infecions
- Perianal streptococcal cellulitis
  - Diagnosis confirmed by culture of rectal swab
  - Treat like strep pharyngitis

Otitis Media
- Otitis Media with Effusion (OME)
- Acute Otitis Media (AOM)
- Chronic Suppurative Otitis Media (CSOM)
Acute Otitis Media

- Elements of the definition of AOM are all of the following:
  - Recent, usually abrupt, onset of signs and symptoms
  - Presence of MEE that is indicated by any of the following:
    - Bulging of the TM, decreased TM mobility, air fluid level behind the TM, otorrhea
    - Signs or symptoms of middle-ear inflammation
      - Distinct otalgia; distinct erythema of the TM

Otitis Media

- Otitis Media with Effusion
  - Presence of middle ear effusion without signs or symptoms of infection
- Chronic Suppurative Otitis Media
  - Purulent otorrhea associated with perforation of the TM that persists > 6 weeks

Otitis Media

- Leading cause of physician visits among children
- Peak incidence rates occur at 6-18 months
- Onset of AOM in the first few months of life often associated with recurrent middle ear disease.

Acute Otitis Media

- Eustachian tube dysfunction
  - Acute Viral URI, GERD, allergic rhinitis
- Shorter eustachian tubes in younger children
Acute Otitis Media

- Bacteriology
  - S. pneumoniae
  - H. flu (non-typeable)- “otitis-conjunctivitis syndrome”
  - M. catarrhalis (beta-lactamase positive, more frequent in infants)
  - Grp A Strep (usually in children > 5yo)

Acute Otitis Media

- Severe illness
  - Moderate to severe otalgia or temperature greater than 39 C

- Nonsevere illness
  - Mild otalgia and temperature less than 39 C

Otitis Media

- Opacification of the tympanic membrane with loss of normal landmarks

Acute Otitis Media

- Treatment Recommendations
  - Infants younger than 6 months should receive antibiotics
  - Children 6 months – 2 years old: should receive antibiotics if diagnosis is certain. If diagnosis uncertain and illness nonsevere, observation for 48-72 hours can be considered
Acute Otitis Media

Children 2 years and older:
- Should receive antibiotics if diagnosis certain and disease severe
- Observation is an option when diagnosis uncertain or if diagnosis is certain and disease nonsevere

Antibiotic Treatment
- Amoxicillin 80-90 mg/kg/d
  - Treat all children < 6 years of age or those with severe disease for 10 days
  - Children 6 years and older with nonsevere disease, intact TM’s, and no AOM within the previous month can be treated for 5-7 days

Alternative first line therapy for penicillin allergic patients
- For severe disease
  - Ceftriaxone, 1-3 days
- For nonsevere disease
  - Non-type 1 allergy: cefdinir, cefpodoxime, cefuroxime
  - Type 1 allergy: azithromycin, clarithromycin
Acute Otitis Media

- Antibiotic options for treatment failure after 48-72 hours initial therapy
  - Nonsevere disease – augmentin
    - If has non-type 1 penicillin allergy, ceftriaxone for 3 days
    - For type 1 penicillin allergy, clindamycin for 10 days

- Antibiotic treatment for clinical failure after 48-72 hours initial therapy
  - Severe disease: Ceftriaxone for 3 days
    - If penicillin allergic, clindamycin (consider tympanocentesis)

Otitis Media with Effusion

- Following an episode of AOM, residual OME is common; 75% resolve in 3 months.
  - After diagnosis of AOM:
    - Follow-up visit at 48-72 hours if not clinically improved
    - 2 week recheck not necessary if clinically better
    - Follow-up at 3 months to check for OME.

Acute Sinusitis in Children

- Children average 6-8 viral upper respiratory tract infections / year
- 5-10% of URI’s in early childhood are complicated by acute bacterial sinusitis
Sinusitis in Children

- Development of Sinuses in Children
  - Ethmoid and maxillary sinuses present at birth
  - Frontal sinuses begin to develop at 2 years old but not fully developed until 6 years of age
  - Sphenoid sinus developed by 6 years of age

Sinusitis

- Diseases predisposing patients to sinusitis
  - Viral rhinitis
  - Allergic rhinitis
  - Ciliary dysmotility
    - Kartagener’s Syndrome
  - Cystic Fibrosis
  - Asthma

Acute Sinusitis

- Clinical diagnosis
  - Uncomplicated viral URI usually symptomatic for 10 days. Fever, if present, usually early in the disease

Acute Sinusitis

- Persistent symptoms
  - Nasal discharge, cough or both > 10 days
- Severe symptoms
  - High fever and purulent nasal discharge for > 3 days
- Worsening symptoms
  - Resolving URI; worsening on day 6 or 7 with new fever and worsening nasal discharge and/or cough
Sinusitis

- **Diagnosis**
  - Sinus x-rays not necessary to make diagnosis
  - CT scan for:
    - Complicated sinus disease (orbital or CNS complications)
    - Recurrent sinusitis
    - Protracted or nonresponsive

Sinusitis in Children

- **Bacterial etiology of acute sinusitis**
  - Strep pneumoniae - 30-40%
  - H. influenza - 20%
  - M. catarrhalis - 20%
  - 35-50% H flu, 55-100% M catarrhalis are beta-lactamase producing

Sinusitis in Children

- **Outpatient Treatment (10-14 days)**
  - Amoxicillin - 90 mg/kg/d
  - Augmentin - 90/6.4 mg/kg/d
  - Cefdinir, Cefuroxime, Cefprozil, Cefpodoxime
  - Azithromycin

Acute Sinusitis

- **Inpatient Treatment**
  - Cefotaxime 200mg/kg/d
  - Ceftriaxone 50 mg/kg/d
Acute Sinusitis

- Major Complications:
  - Orbital
    - Subperiosteal abscess, Orbital Cellulitis, Orbital abscess
  - Intracranial
    - Epidural empyema; Subdural empyema, Cavernous Sinus Thrombosis, Meningitis, Brain Abscess
  - Osteitis
    - Frontal (Pott's Puffy Tumor)

Sinusitis

- Orbital cellulitis secondary to extension of ethmoid sinusitis

17 yo boy being treated for presumed sinusitis; worsening headache and appearance of mass over forehead

Bronchiolitis

- Definition: child younger than 2 yo with “rhinitis, tachypnea, wheezing, cough, crackles, use of accessory muscles, and/or nasal flaring” (AAP, AAFP 2006)
- Leading cause of hospitalization for infants in U.S.
Bronchiolitis

- Pathophysiology
  - Acute edema and necrosis of epithelial cells lining small airways.
  - Increased mucus production
  - Bronchospasm

Bronchiolitis

- Etiology
  - Respiratory Syncytial Virus (most common)
  - Rhinovirus
  - Human metapneumovirus
  - Influenza
  - Adenovirus
  - Parainfluenza

Bronchiolitis

- 2 month old infant; cough, tachypnea, wheezing, rales
- Admission for hypoxia, dehydration
- RVP positive for human metapneumovirus

Bronchiolitis

- Risk factors for severe disease
  - History of prematurity (< 37 weeks)
  - Young age of infant (6-12 weeks)
  - Underlying conditions
    - Congenital heart disease
    - Chronic lung disease (eg, BPD, cystic fibrosis)
    - Immunocompromise
Bronchiolitis

- Treatment
  - Hydration
  - Hypertonic saline
  - Bronchodilators
    - If helpful
  - Corticosteroids
    - Not for routine use
  - Antibiotics
    - For specific indications of coexisting bacterial infection
  - Supplemental oxygen
    - For O2 saturations consistently < 90%

Pneumonia in Children

- Hospitalization rates for empyema increased in children in spite of pneumococcal conjugate vaccine

Etiology of community acquired pneumonia

- S. pneumoniae is most common bacterial cause of pneumonia in children.
- Viruses account for 14-35% of cases
- Viruses more commonly identified in children <5yo
- In children > 5yo Mycoplasma pneumoniae and Chlamydia pneumoniae are more common

Infants and Children < 5yo

- Viruses are the most common cause of CAP
  - RSV
  - Influenza A & B
  - Parainfluenza
  - Adenovirus
  - Human metapneumovirus
  - Rhinovirus
Pneumonia in Children

- Infants < 1 yo
  - Pertussis
    - Coughing paroxysms, lymphocytosis
  - Afebrile pneumonia of infancy
    - Chlamydia trachomatis
      - 2 weeks – 4 months of age
      - Staccato cough, rales
      - Bilateral interstitial infiltrates
      - Elevated Chlamydia IgM

Pneumonia in Children

- 2 month old infant with 2 weeks of cough, tachypnea
- History of neonatal conjunctivitis
- Bilateral rales
- Elevated Chlamydia IgM

Pneumonia in Children

- Infants and Children < 5yo
  - S. pneumoniae most common bacterial pathogen
  - H. influenza now rare cause of pneumonia
  - S. aureus and Strep pyogenes becoming more frequent causes of CAP; particularly in association with influenza and chicken pox, respectively.

Pneumonia in Children

- Children > 5 yo
  - S. pneumoniae most common bacterial cause of pneumonia
  - M. pneumoniae and C. pneumonia are more common in children > 5yo
Pneumonia in Children

Clinical Assessment
- History
  - Age
  - Season of year
  - Immunization Status
  - Tb exposure

Clinical assessment
- Physical Exam
  - Nasal flaring, oxygen saturation, tachypnea, retractions
  - Criteria for tachypnea:

<table>
<thead>
<tr>
<th>Age</th>
<th>Normal RR</th>
<th>Tachypnea</th>
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<tr>
<td>2-12 mos</td>
<td>25-40</td>
<td>50</td>
</tr>
<tr>
<td>1-5 years</td>
<td>20-30</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 5 yrs</td>
<td>15-25</td>
<td>20</td>
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</table>

Chest x-rays?
- Clinical findings are ambiguous
- Suspected pleural effusion
- Pneumonia unresponsive to antibiotics
- Children < 5yo with high fever and elevated WBC without obvious source

Lab Assessment
- CBC with diff when deciding whether to treat with antibiotics
  - In setting of CXR finding of focal consolidation WBC > 15,000 and fever > 39C associated with bacterial etiology.
- Blood culture, ESR, CRP need not routinely be obtained
Pneumonia in Children

**Hospital Admission Criteria**
- Infants < 4 mos with fever and pneumonia
- O2 saturation < 91%
- Dehydration, unable to hydrate orally
- Moderate to severe respiratory distress
- Has failed outpatient therapy
- Unable to assure compliance with outpatient therapy

Pneumonia in Children

**Infants and Children < 5yo**
- Outpatient treatment
  - High dose amoxicillin (80-90 mg/kg/d) for 7-10 days when bacterial cause likely
  - If allergic to penicillin, macrolide or cephalosporin
  - Consider initial dose of ceftriaxone before initiating oral antibiotic

Pneumonia in Children

**Children > 5 yo**
- Outpatient treatment
  - Macrolide antibiotic for 7-10 days (azithromycin for 5 days)
  - More severe pneumonia: macrolide plus beta lactam antibiotic (high dose amoxicillin or ceftriaxone)

Pneumonia in Children

**Inpatient therapy:**
- Third generation cephalosporin-ceftriaxone
- Macrolide for suspected mycoplasma, chlamydia, or pertussis
- Toxic child, complex pneumonia-vancomycin/clindamycin, ceftriaxone, macrolide
Pneumonia in Children

- 8 year old boy with 1 week history of abdominal pain, fever, vomiting

Mycoplasma pneumoniae

- 8 yo female with 10 day history of fever and cough

Pneumonia in Children

- 8 year old boy; WBC 28,000, right upper lobe consolidation, worsening respiratory distress

Pneumonia in Children

- 2 yo boy with three day history of persistent cough
**UTIs in Infants and Children**

- Prevalence of UTIs in children; highest in the first year of life
  - Febrile Infants < 3 months of age without source of infection - 7-9% (regardless of sex)
  - Girls 1-2 years of age 8.1%
  - Boys 1-2 years of age 1.2% (<0.5% >2yo)

**Urinary Tract Infections in Children**

- Neonatal UTIs
  - Often associated with bacteremia (21-33%)
  - As compared to:
    - 1-3 month olds – 18%
    - 4-8 month olds – 6%

**Urinary tract Infections in Children**

- Neonatal circumcision decreases risk of UTI 90% in first year of life.
  - Risk of UTI in first year of life of male infant
    - 1/1000 if circumcised
    - 1/100 if uncircumcised

**Urinary Tract Infections**

- Microbiology:
  - E Coli (75-90%)
  - Proteus (males)
  - Staph saprophyticus (sexually active teens)
  - Enterococcus
  - Klebsiella
  - Enterobacter, pseudomonas
Urinary Tract Infections

- Distinguishing lower tract from upper tract disease:
  - Fever, CVA tenderness
  - CBC, sed rate, CRP
  - Radioisotope scan

UTI Guidelines 2-24 months 2012

- Diagnosis:
  - In a febrile infant who clinically appears ill urine should be obtained by catheterization for urinalysis and culture prior to treating with antibiotics.
  - The diagnosis of a UTI cannot be established reliably by culture of urine collected in a bag.

Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 months

Pediatrics volume 128, number 3, September 2011

If an infant with a fever without an apparent source is not ill appearing than assess the likelihood of a UTI

- If infant has low likelihood of a UTI, clinical follow-up without testing for UTI is sufficient
- If infant not at low risk, obtain culture by catheterization for U/A and culture.
UTI Guidelines 2-24 months: risk factors for infections.

- Individual Risk Factors: Girls
  - White race
  - Age < 12 months
  - Temperature > 39C
  - Fever > 2 days
  - Absence of another source of infection
    • 2 factors 2% probability of UTI

- Individual Risk factors: Boys
  - Nonblack race
  - Temperature > 39C
  - Fever for > 24 hours
  - Absence of another source of infection
    • 3 factors 2% probability of UTI; uncircumcised 2%

UTI Guidelines 2-24 months 2012

- Diagnosis of UTI:
  - Clinicians should require both urinalysis results that suggest infection (pyuria and/or bacteriuria) and presence of at least 50,000 CFU’s per ml of a uropathogen cultures from urine obtained by catheterization.

- Management:
  - When initiating treatment base choice of antibiotic on local sensitivity patterns and adjust choice according to sensitivity testing.
  - Choose 7-14 days as duration of antimicrobial therapy.

- Febrile infants with UTI’s should undergo renal and bladder ultrasonography. (RBUS)
  - Recommended in the first 2 days of treatment.
  - In this population, RBUS will yield 15-20% abnormal results and 1-2 % will have results that will lead to additional evaluation, referral, or surgery.
UTI Guidelines 2-14 months 2012

- VCUG should not be performed routinely after the first febrile UTI.
- VCUG is indicated if RBUS reveals hydronephrosis, scarring, or other findings suggestive of high grade VUR or obstruction.
- Perform a VCUG if there is a recurrence of a febrile UTI.

UTI Guidelines 2-24 months 2012

- After confirmation of a UTI, parents should be instructed to seek medical attention within 48 hours for a febrile illness to ensure recurrent infections be detected and promptly treated.

UTI’s in children

- Inpatient treatment:
  - Infants less than 3 months old
  - > 3 months old:
    - Dehydration; inability to take fluids po
    - Ill appearing
    - Co-existing chronic disease (eg, sickle cell, diabetes, CF, urinary tract anomalies)

UTIs in Children

- Inpatient therapy for children who are toxic, dehydrated, or unable to take po fluids
  - Ceftriaxone 75 mg/kg/d
  - Cefotaxime 150 mg/kg/d divided q6h
  - Ceftazidime 100-150 mg/kg/d divided q8h
  - Gentamicin 7.5 mg/kg/d divided q8h
UTIs in Children

- **Outpatient treatment**
  - Empiric antibiotic therapy is directed against E Coli
    - Cephalexin 50-100 mg/kg/d in 4 doses
    - TMP-SMX 6-12 mg/kg trimethoprim and 30-60 mg/kg sulfamethoxazole per day
    - Cefpodoxime (vantin) 10 mg/kg/d in 2 doses
    - Amoxicillin-clavulanate 20-40 mg/kg/d
    - Cefuroxime axetil 20-30 mg/kg/d in 2 doses

Bacterial Meningitis in Infants and Children

- **The Bugs**
  - 0-3 months: Grp B Strep, Listeria, E Coli
  - 1-3 months: the above and S pneumoniae, N meningitidis, H influenzae
  - 3-36 months: Strep pneumoniae, N meningitidis, H influenzae, M tuberculosis

Meningitis in Infants and Children

- **Viral meningitis**
  - Enterovirus (coxsackie, echo)
  - Mumps
  - HSV
  - VZV
  - EBV
  - Adenovirus

Meningitis in Infants and Children

- **Treatment**
  - < 30 days; ampicillin and gentamicin or cefotaxime
  - > 30 days; vancomycin and ceftriaxone or cefotaxime
  - Dexamethasone
    - Decreased neurologic and audiologic sequelae in children with H Flu B meningitis
  - Prophylaxis of contacts
Meningitis in Infants and Children

- Duration of Antibiotic Treatment
  - Grp B Strep- 10 -14 days
  - E Coli- 21 days or 14 days beyond first negative CSF culture (whichever is longer)
  - Listeria- at least 21 days
  - Meningococcus- 7 days
  - Strep pneumoniae- 14 days
  - H influenza- 10 days

Pneumococcal Meningitis

- 6 month old infant with pneumococcal meningitis
- MRI showing multiple brain emboli.

Kawasaki’s Disease

- An acute multisystem vasculitis of unknown etiology
- A leading cause of acquired heart disease in children

Kawasaki’s Disease

- Peak age of occurrence between 18 months and 2 years
- 80% of patients less than 5 years old
- Incidence is highest in Asians
Kawasaki’s Disease

Diagnostic Criteria:
- Fever for 5 or more days
- Bilateral nonexudative bulbar conjunctivitis
- Polymorphous exanthem with perineal accentuation
- Red cracked lips, strawberry tongue, pharyngeal erythema
- Erythema and induration of hands and feet
- Cervical adenopathy present in 50% of cases

Associated findings
- Urethritis with sterile pyuria
- Hepatic dysfunction
- Arthritis, arthralgia
- Aseptic meningitis
- Pericardial effusion
- Myocarditis with CHF
- Gallbladder hydrops

Differential Diagnosis
- Measles
- Scarlet fever
- Steven’s-Johnson syndrome
- Staphylococcal scalded skin
- Toxic shock syndrome
- JRA

Coronary artery dilatation or aneurysms will develop in 15-25% of untreated patients

Risk factors for coronary artery aneurysms
- Male
- < 1 year old
- Long duration of fever (> 10 days)
- Elevated sedimentation rate
- Elevated band count
- Hgb < 10, thrombocytopenia, hypoalbuminemia
Kawasaki’s Disease

- Treatment/Management
  - IVIG
  - Aspirin
  - Echocardiography
  - Immunizations

Dry, cracked lips

Bulbar, nonexudative conjunctivitis

Erythema and tender induration of hand
Common Pediatric Viral Infections

- Erythema infectiosum
  - Parvovirus B19
  - Low grade fever
  - Parvovirus affects red blood cell precursors
  - Decrease in reticulocyte count

Common Viral Infections

- Coxsackie virus infection
  - Hand-foot-mouth syndrome
  - Summer and Fall
  - Lesions on hands and feet are usually vesicular
  - May be associated with aseptic meningitis

Common Viral Infections

- Coxsackie virus
  - herpangina

Common Viral Infections

- Roseola
  - Human Herpesvirus 6
  - High fever for 1-5 days
  - Rash follows fever
  - Post-Occipital adenopathy
  - Common cause of febrile seizures
Scabies in Babies
- Predilection for axilla

Scabies
- 3 month old infant with typical lesions of scabies including papules and burrows

Scabies
- Commonly associated with nodular lesions
- May involve the face
- Caused by the mite, Sarcoptes scabiei
- Elimite