Fever and Infectious Diseases in Children

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Learning Objectives

1. Identify an approach to evaluate and manage infants/children with fever
2. Describe bacterial and viral illnesses of the respiratory tree with a focus on epidemiology, diagnosis, and treatment
3. List the characteristic features and describe the clinical courses of common exanthems

Fever

• An abnormal condition of the body characterized by an undue rise in temperature, quickening of the pulse, and disturbance of various body functions
• “Fever is fantastic” Dale Newton ECU
• Fever (> 100.4°F or 38°C)—rectal most accurate
  – Usually does not indicate serious illness
  – Can cause discomfort and seizures
  – Does not cause brain damage
  – Does help fight infection (“Fever is nature’s engine which she brings into the field to remove her enemy” Thomas Sydenham 1624-1689)

1. 3-week-old infant brought to ED for fever of 102°F. Child does not appear ill, but has not been feeding well. What should you do?

A. Sepsis work up and send home if negative
B. Admit and do sepsis work up
C. Observe in ED and send home if fever resolves with acetaminophen
D. Admit and observe until fever breaks

Fever in First Month

• Admit for temperature > 100.4°F
• CBC with differential
• Urinalysis and urine culture
• Blood culture
• Lumbar puncture for CSF studies and culture
• Bugs: Group B strep, E.coli, Listeria
• IV antibiotics: amp/gent or amp/cefotaxime acyclovir
  – No ceftriaxone less than 2 months (kernicterus risk)
Fever of Unknown Source

- It is recommended in all infants 60 days of age or less with fever of unknown source that the following 5 laboratory tests be performed: CBC with differential, blood culture, urinalysis/urine culture, C-reactive protein and lumbar puncture (level C)
- National Guideline Clearinghouse
- Consider CXR if respiratory symptoms present or rectal temp > 102º F and WBC > 20,000
- Stool culture if diarrhea present

Fever in Child 1-3 Months of Age Who Appears Toxic

- What is toxic?
  - Cyanosis
  - Decreased activity
  - Inability to interact with surroundings
  - Irritability
  - Lethargy
  - Poor tone
  - Signs of poor perfusion
  - Tachycardia
  - Weak eye contact
  - Inadequate feeding
- Treat the same as a child < 29 days

Outpatient Management of Fever in Child 1-3 Months Old

- If non-toxic and low risk, may be managed outpatient if:
  - WBC <15,000 and <1,500 bands, negative gram stain
  - CSF <8 WBC and negative gram stain
  - Blood culture
  - Urine culture (urethral catheterization)
  - Ceftriaxone 50 mg/kg (max 1 g) IM
  - Meets low-risk criteria
  - Term infant without chronic disease or hospitalizations
  - Reliable caretakers
  - Transportation and telephone available
  - Willingness to return in 24 hr

Febrile Seizures

- 3-4% of children
- 9-20 mo most common age
- 30-40% will have a recurrence
- Family history or underlying neurological condition
- Not associated with brain damage
- No evaluation other than work up of fever is indicated for first febrile seizure

2. 3 y/o girl presents with 4 day history of fever without other symptoms. Throat and lung exams are normal, but she appears quite ill. What should be your next step?

A. Order an abdominal sonogram
B. Order UA with cultures
C. Admit for IV fluids
D. Reassure mother that it is viral and see her back the next day
UTI
• Most common serious bacterial infection in children (look for it when there are no signs)
• First 8-12 weeks of life some caused by hematogenous spread. After that, caused by ascending infection through urethra
• 70-90% E. coli
• Newborns: males and premature infants more likely to have UTI
• Ages 1-5: girls 10-20 times more likely
• Urine culture needed: catheter or suprapubic tap

Treatment of UTI
• < 2 months of age: admit for IV antibiotics
• > 2 months and nontoxic
  – TMP-SMX, cephalosporin
  – Treat 7-10 days
• Follow up VCUG and usually renal ultrasound
  – Boys at any age with first UTI
  – Girls < 3 with first UTI
  – Children any age with febrile UTI

3. 4 y/o male seen in your office for sore throat. No fever, rash, or adenopathy. Tonsils are erythematous without exudates. Mother insists on antibiotics. What do you do?

A. Treat with amoxicillin
B. Treat with penicillin
C. Do rapid strep screen and if negative do strep culture prior to treating
D. Explain to mother that it is probably viral and that antibiotics are not indicated

Pharyngitis
• Viral: most common
• Group A β-hemolytic streptococcus: 15%
  – Mod to severe tonsillar swelling with exudate
  – Mod to severe anterior cervical adenopathy
  – Absence of moderate to severe cough
  – Fever
  – Scarlatiniform rash
  – Treatment with penicillin (erythromycin or clindamycin if pen allergic) prevents rheumatic fever but not glomerulonephritis
  – Suppurative complications: peritonsillar abscess & retropharyngeal abscess

Epiglottitis
• Rare since Hemophilus influenza vaccine
• Can visualize swollen, cherry red epiglottis
• X-ray shows “thumb print” sign
• Airway management
• Antibiotic treatment
  • Ceftriaxone (50 mg/kg/d IV)
  • Cefotaxime (150 mg/kg/d divided q8h IV)
  • Cefuroxime (100-150 mg/kg/d divided q8h IV)
• Steroids and racemic epinephrine are not used

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Peritonsillar Abscess & Retropharyngeal Abscess

- **Symptoms**
  - Severe throat or neck pain
  - Painful swallowing
  - High fever
  - Poor oral intake (dehydration)
- **Physical**
  - Cervical adenopathy
  - Uvular deviation
  - Muffled voice with trismus
- Elevated WBC with a left shift
- Treatment: surgical drainage, IV antibiotics

4. A 2 y/o child is brought to the ED. She has a barking cough and some stridor that worsened tonight, and a temperature of 101°F. What is the treatment?

- A. Nebulized epinephrine and dexamethasone
- B. Albuterol via maximist
- C. Humidified oxygen
- D. Inhaled steroids

Croup (Laryngeotracheobronchitis)

- Viral illness causing edema of upper airways
- **Etiology**
  - Parainfluenza viruses 1, 2, 3, cause 75%
  - Adenovirus
  - Respiratory syncytial virus (RSV)
  - Mycoplasma pneumoniae
- **Symptoms:** URI symptoms, “barky” cough, hoarseness, tachypnea, mild stridor—worse at night
- X-rays show subglottic narrowing (“steeple” sign) in 40-50%

Treatment of Croup

- Cool, moist air widely used: no evidence
- Dexamethasone 0.6 mg/kg IM (or oral) reduces hospitalization rates and shortens ED stay
  - Single dose (multiple dose may lead to bacterial or fungal infections)
  - Indicated for croup of any severity
- Nebulized epinephrine for immediate relief: followed by admission or at least 3-hr observation and/or corticosteroids
- Beta-agonist bronchodilators not effective

Pneumonia

- **Etiology of childhood pneumonia**
  - S. pneumoniae, 28%
  - Mycoplasma pneumoniae, 22%
  - Chlamydia, 14%
  - Haemophilus influenzae, 6%
  - Moraxella catarrhalis, 3%
- Pneumovax/Prevnar reduces pneumonia
- High risk: sickle cell, splenectomy, Native American, immunocompromised, renal disease
Pneumonia Pearls

- Viruses are the most common cause of pneumonia in children (few months to 5 years old)
- RSV is most common virus in age group <5 y/o
- Strep pneumoniae is the most common etiologic agent for bacterial pneumonia in children of all age groups
  - Ceftriaxone or Cefuroxime inpatient; Amoxicillin outpatient
- Think also of Mycoplasma in children >5
  - Macrolides
- Staph aureus and necrotizing pneumonias can follow influenza and chicken pox

5. 9-month-old child is admitted in Jan. for cough, wheezing, ↓ feeding, and fever of 38°C. CXR shows mild peribronchial cuffing. Which treatment is indicated?

A. Amoxicillin/clavulanate (Augmentin)
B. Systemic corticosteroids
C. Supplemental oxygen and fluids
D. Nebulized ipratropium (Atrovent)

Respiratory Syncytial Virus (RSV)

- Most common cause of bronchiolitis and pneumonia in infants under 1 year
- Rhinorrhea, pharyngitis, cough, wheezing, rhonchi, rales, CXR often normal, fever and WBC inconsistent
- Diagnosis: antigen detection assays
- Treatment is supportive (oxygen, acetaminophen, fluids)/inhaled bronchodilator albuterol or epinephrine only if effective
- No evidence for steroids, antibiotics, or ribavirin

For bronchopulmonary dysplasia, vaccine given up to 24 months
- Prematurity
  - <28 weeks, vaccine given up to 12 months
  - 29-32 weeks, vaccine given up to 6 months

Pertussis

- Symptoms
  - URI symptoms
  - Paroxysms of coughing with “whoops” on inspiration 2-4 weeks
  - Coughing to the point of vomiting
  - Dyspnea
  - Seizures 20-25%
- Pertussis and bronchiolitis may present with apnea under 3 mo of age
- No specific physical findings, but high WBC
- Pneumonia most frequent
Treatment of Pertussis

- Admission for most children < 3 mo
- Supportive: hydration, pulmonary toilet, oxygen
- Antibiotics: erythromycin, clarithromycin, azithromycin, TMP-SMX for 14 days
- Treat patient and all household contacts
- Adults should get Tdap as single booster dose

Impetigo

- Caused by group A β-hemolytic Streptococcus or Staphylococcus aureus
- "Honey-colored crusts"
- Treatment recommended because of contagiousness
- Mupirocin cream is treatment of choice (amoxicillin does not cover Staph)

MRSA

- Consider even in neonates
- Erythematous, warm, tender, pustular &/or oozing
- Culture and treat by sensitivity
  - Trimethoprim/sulfamethoxazole
  - Clindamycin
  - Tetracyclines
- If ill, admit and start IV vancomycin

Fifth Disease

- Common disease, rarely clinically significant
- Caused by Parvovirus B 19
- Rash is immune-mediated and occurs after acute infection, so children with rash may attend school or day care
- Phase I: facial flushing (slapped cheeks)
- Phase II: macular rash
- Phase III: reticular rash
- Arthritis rarely in adolescents
- Pregnant women: rare complication fetal hydrops and fetal demise; women develop arthritis

6. A 2 y/o boy has very red cheeks and a fine rash but does not appear ill. He had a fever a couple of days ago. When can he return to day care?

A. Today
B. Tomorrow
C. 5 days
D. After the rash is gone
Guess the Exanthem

Human Herpesvirus (HHV)-6. Presents with high fever, followed by transient rash.

Roseola Infantum (Exanthem Subitum)
• “Sudden Rash” Herpes virus HHV 6 or HHV 7
• Usually mild and sporadic
• Children 6 months to 4 years
• Natural course
  – Days 1-2: Anorexia/vomiting, occipital adenopathy
  – Days 2-3: High fever (103-106º F), possible seizures
  – Day 4: Rash begins as fever abates
  – Pink almond-shaped macules on trunk/neck
  – Confluent then fade in hours to 2 days

Roseola
• Pink, blanchable, discrete maculopapular rash mainly on trunk; resolves in 1-2 days
• Nearly 100% of children have antibodies to HHV-6 by 3 years of age

This Is?

Henoch-Schönlein Purpura
• Usually follows URI with low-grade fever, fatigue, arthralgias, colicky abdominal pain, arthritis
• Rash: pink maculopapules progressing to nonthrombocytopenic palpable purpura on buttocks and legs
• Hematuria and proteinuria
• ↑ESR, ↑WBCs, ↑platelets, ↓RBCs
• Can treat with prednisone in severe cases (renal complications)

Guess the Exanthem
• Lesions on hands and feet
• Late summer and early fall
Hand, Foot and Mouth
(Coxsackie A)
• Usually in children < 5 years
• Late summer, early fall
• Oral-oral, oral-fecal spread
• Incubation period 4-6 days
• Prodrome of fever, sore throat, and anorexia 1-2 days before the rash
• Small vesicles, erythematous base
• Hands (nail borders), feet (heel margins), buttocks
• Spontaneous resolution in a few days
• Can try acyclovir

7. A 7 y/o male has 7 days of spiking high fevers, diffuse erythematous rash. His tongue and lips are red, dry, and cracked and he has large cervical lymph nodes. What next?
A. Admit and treat with IV antibiotics
B. Admit and treat with a single injection of immune globulin and high-dose aspirin
C. Send home with frequent sips of rehydration solution
D. Admit and treat with aspirin 40 mg/kg/d

Kawasaki Disease
• Diffuse vasculitis of unknown etiology
• Leading cause of acquired cardiac disease in children in U.S.
• Diagnostic criteria:
  – Fever > 5 days duration
  – Bilateral conjunctival injection
  – Oropharyngeal erythema, strawberry tongue, fissuring and crusting of the lips
  – Induration of hands and feet, erythema of palms and soles; desquamation of fingertips and toes
  – Erythematous rash (scorbutiform or morbilliform)
  – Enlarged lymph node mass (> 1.5 cm)
  – May also be irritable and have perineal rash

Kawasaki
• Laboratory abnormalities
  – WBC > 20,000/mm3
  – ↑ neutrophils, ESR and CRP
  – Thrombocytosis (600,000 to 1.8 million)
  – Sterile pyuria
  – Aseptic meningitis
• Treatment
  – Within the 1st seven days if possible
  – Aspirin, high-dose (80 mg/kg/d) until inflammatory markers normalize
  – Single dose of gamma-immune globulin (IVIG at 2 mg/kg)
  – Aspirin at 3-5 mg/kg/d for 4-6 months
  – Steroids if no response to 2 doses of IVIG

Sequelae of Kawasaki Disease
• Development of giant aneurysms (> 6 mm)
  – Can lead to coronary thrombosis or stenosis
  – Treat with warfarin and aspirin; INR 2.0-2.5
• Long-term effects
  – Persistent vascular changes
  – Altered lipid metabolism
  – Thickened coronary artery walls
  – Abnormal reactivity with less flow during reactive hyperemia
Meningococcal Meningitis

• Neisseria meningitidis: gram negative diplococcus. Serogroups B, C, and Y account for 90% of invasive disease in US
• Clinical manifestations of meningococcemia or meningitis
  – Abrupt onset: fever, chills, malaise, prostration
  – Rash: maculopapular, macular, petechial
  – Waterhouse-Friderichsen syndrome: purpura, DIC, shock, coma, death

Meningococcal Meningitis

• Sporadic, usually type B in infants (no vaccine available yet)
• Rifampin is used for exposure prophylaxis (family/close contacts)
• Treatment:
  – Ceftriaxone (80-100 mg/kg/dose) bid on day 1
  – Cefotaxime (50-75 mg/kg q 6h)
  – Ceftazidime (75 mg/kg/dose q 8h)
  – No evidence that vancomycin increases survival
  – Dexamethasone 0.6 mg/kg/d q 6 h for 4 days

Do Not Miss This One

Rash typically begins on day 3-5 of the illness, first appearing peripherally (hands, wrists, feet, ankles). Palm and sole involvement occurs in 50%-70% of individuals. However, the classic triad of fever, rash, and tick exposure only occurs in 20% at the time of presentation.

Rocky Mountain Spotted Fever

• Rickettsia rickettsii, gram negative bacteria
• Most common fatal tick-borne disease in the US
• The American dog tick is the vector—found in tall grass
• Symptoms: sudden onset of fever, muscle pain, nausea, vomiting, then rash, abdominal and joint pain, hypotension, headache
• Lesions: begin as blanching, macules and papules which become nonblanching, petechial and hemorrhagic.
• Usually starts on the legs, palms, and soles, spares the face
• Severe cases can form ecchymoses
• Untreated cases can progress to systemic and pulmonary hemorrhage, CNS manifestations, hematologic penias.

RMSF Management

• Indirect immunofluorescence titers > 1:64 are diagnostic
• Direct immunofluorescence on skin bx
• Tests: ↓Na (56%), ↓Plt (50%), ↓Hct (20%), ↑LFT
• Nonspecific ECG changes
• LP for suspected meningitis
• Elevated serum creatinine associated with increased risk for fatality
• Antibiotics have reduced mortality from 30% to 40%
• Doxycycline 100 mg bid if >45 lbs. (4 mg/kg/day if < 45 pounds)
• www.emedicine.com/EMERG/topic510.htm

References

• Subcommittee on Diagnosis and Management of Bronchiolitis. Diagnosis and management of bronchiolitis. Pediatrics 2006;118(4):1774.
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## Answers

1. B  
2. B  
3. D  
4. A  
5. C  
6. A  
7. B