Common Infections and Other Causes of Fever in School-Age Children
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Disclosures
- I am employee of GSK and Adjunct Faculty at Duke
- The responsibilities of my GSK employment have no relation to the content of my presentation
- I will not include any reference to branded products of GSK.

Objectives
- At the end of this session, the participant should be able to:
  - Understand common infections that occur in school-age children
  - Understand the treatment of the common infections in school-age children
  - Understand other illnesses that present with fever that are not infectious
What is fever?
- When human body temperature goes above the normal range
- Normal daily temperature variation
  - Highest in early evening and lowest in early morning due to diurnal cortisol levels
- One of body’s mechanism to fight infection
- Defined as temp ≥100.4 F

Evaluation of Fever
- History
  - Pattern, Timing
  - Associated signs/symptoms
    - Sign: objective
    - Symptom: subjective
  - Pets, Travel, Family History, Immunizations
- Physical
  - HEENT, lymphadenopathy, Lungs, HSM, rashes, arthritis/arthralgias
- Labs

Common sources of Fever
- Infectious
  - Bacterial, viral, fungal
  - Atypical
  - Zoonotic
- Non-infectious
  - Oncologic
  - Inflammatory: Rheumatologic
  - Drug-induced
  - Immunizations
  - Fever syndromes
## Infectious Causes

### SITES:
- Pharyngitis
- Otitis/Sinusitis
- Cellulitis
- Pneumonia
- Gastroenteritis
- UTI
- Septic arthritis
- Osteomyelitis

### SOURCE:
- Bacterial
- Viral
  - Respiratory viruses
  - GI viruses
  - EBV, CMV
- Fungal
- Tick-borne
- Arthropod

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### Pharyngitis

- **Bacterial:**
  - Group A Strep
  - *Arcanobacterium haemolyticum*
  - Gonorrhea
- **Viral:**
  - Coxsackie, Adenovirus, CMV, EBV

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### S. Pyogenes (Group A Strep)

- Gram-positive cocci
- Can colonize the posterior pharynx
- Grouping based on M protein on cell wall (Lancefield group)
- Treatment: PCN or Amox
Very small red bumps, starting on neck and groin. Lasts 5-6 days

http://www.atu.edu/faculty/chamberlain/scarletfever.htm

Strawberry tongue – white, then red

http://www.atu.edu/faculty/chamberlain/scarletfever.htm

Desquamation

Circumoral pallor

Pastia’s lines

http://www.atu.edu/faculty/chamberlain/scarletfever.htm
**Otitis Media**
- Acute vs. chronic
- Common pathogens:
  - S. pneumoniae, Hemophilus, Moraxella
  - MRSA on the rise
  - Viral
- Treatment: Amox or Cephalosporin, (unless MRSA)
- Duration: 7-10 days

**Sinusitis**
- Acute vs. chronic
- Pathogens same as for ear infections
  - S. pneumoniae, Hemophilus, Moraxella
  - MRSA on the rise
- Treatment: Amox/Clav or Cephalosporin (unless MRSA)
- Duration: 21 days

**MRSA**
- S. aureus: gram-positive cocci
- 1950s: PCN resistance (beta-lactamases)
- 1959: methicillin introduced
- 1960: MRSA identified (mec A)
- Can cause otitis, sinusitis, boils, cellulitis, osteomyelitis, pneumonia, bacteremia, meningitis
- Treatment: based on susceptibility
  - Local epidemiology is important
Pneumonia

- **Bacterial:**
  - *S. pneumonia, Mycoplasma, S. pyogenes, MRSA*

- **Viral:**
  - Influenza, Adenovirus, RSV

- **Fungal:**
  - Rare unless immunocompromised

- **Mycobacterial:**
  - *TB*

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Influenza virus

- RNA virus, segmented genome
- Orthomyxoviridae family
- 3 types (A,B,C)
- 16 H, 9 N
- Incubation Period 1-3 d
- Treatment: anti-viral within 48 h
RSV
- Enveloped RNA paramyxovirus
- Humans only source of infection
- Persist on surfaces for hours
- Symptomatic treatment

GI infections
- Bacterial:
  - *Salmonella, Shigella, Campylobacter*
  - *E. coli* O157:H7, *Yersinia*
  - *C. difficile* (h/o abx use?)
- Hosts of viruses that can cause acute gastroenteritis
  - Norovirus, Enteroviruses, Rotavirus
- Parasites:
  - *Cryptosporidium, Giardia*

Rotavirus
- Segmentated, dsRNA virus
- 7 distinct antigenic groups (A through G)
- Group A major cause of diarrhea
- Incubation period 1-3 days
- Symptomatic treatment
Fever and Skin Rashes

Case Study

- 7 year-old girl presents with a rash in June.
- She has been febrile (up to about 102°F) for about 2 days and rash was noticed one day prior to arrival.
- The rash started on her trunk but has spread to cover her body, including face.
- The rash is pruritic.

The lesions are fluid filled and at different healing stages.
Varicella

- Incubation period 10 – 21 days
- Low-grade fever
- Variable constitutional symptoms (malaise, anorexia, headache – more in older children)
- Rash: Start on scalp, face, or trunk
  - Erythematous macule → papule → vesicle → pustule → crusting
  - Comes in crops
Varicella (2)

- Caused by Varicella Zoster Virus (VZV)
- Dx: clinical; confirmed by skin PCR or viral culture
- Rx: self-resolving; acyclovir for immunocompromised and optional for immunocompetent.
- Complications: secondary skin infections, pneumonia, encephalitis.

Case Study

- A 9 y/o boy is brought to your clinic with a 3 day h/o low grade fever, malaise, sore throat, and anorexia.
- On exam, you find mildly painful, shallow, yellow ulcers surrounded by red halos on the buccal mucosa.
- Erythematous macules are seen on the palmar aspect of the hands.
Hand Foot Mouth Disease
- Coxsackie virus
- 90% have oral lesions
- Incubation 2-6 days
- Highly contagious
- Peak in summer through early fall
- Rx: supportive

Enteroviruses
- Incubation period 3 – 5 days
- Wide range of clinical manifestations – most common is nonspecific febrile illness
  - Respiratory
  - Neurologic
  - Eye
  - Skin
  - GI/GU
  - Heart
- Often bi-phasic illness
- Can cause outbreaks (EV-D68)

Case Study
- 15 yo presents with fever, sore throat, fatigue, headache
- On exam, swollen tonsils, enlarged cervical lymph nodes, enlarged spleen
- Initially seen early on in illness and empirically treated with antibiotics for Strep
- Now with rash
Infectious Mononucleosis

- Caused by Epstein-Barr virus (EBV)
- Virus transmitted via saliva
- Incubation period 4-6 weeks
- Symptoms can last for weeks to months
  - May be asymptomatic to severe symptoms
- Complications:
  - Splenic rupture
  - Hepatitis
  - Meningitis/encephalitis/cerebellitis
  - Myocarditis
  - Anemia, thrombocytopenia

Case summary

- Fifteen year-old boy presents with a rash.
- Episode started as a febrile illness with cough, coryza, conjunctivitis and photophobia for a few days before the onset of rash.
- The rash now involves his entire body, including palms and soles.
- He denies sexual activity.
Measles Figure 5. Measles (rubella).
Measles (Rubeola)

- Incubation period 8 – 12 days
- Prodrome 2 – 4 days
  - Malaise, coryza, conjunctivitis, cough
  - Fever – gradually rises to about 103°F
- Rash
  - Enanthem (Koplik spots): “bluish white specks on bright red mucosal surface”
  - Exanthem: Starts behind ears, hairline
    Erythematous, macular

Measles Cases and Outbreaks
January 1 to July 24, 2015

183 Cases
5 Outbreaks
representing 6% of reported cases this year

U.S. Measles Cases by Year

*Provisional data as of August 2015, National Center for Immunization and Respiratory Diseases*
Fifth Disease

- Incubation period 4 – 14 days (but up to 21 days)
- Often asymptomatic
- Mild systemic symptoms (15% - 30% have fever)
- Classic “slapped cheek rash”
- Symmetric, macular, lace-like rash on trunk, moving peripherally

Fifth Disease (cont.)

- Arthralgia/arthritia in fewer than 10 %
  - Knees in children
  - Knees, fingers, other joints in adults (symmetric polyarthropathy)
- Acquisition in pregnancy can lead to fetal hydrops, IUGR, pleural and/or pericardial effusions, death
Fifth Disease

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Useful for a trivia bowl

<table>
<thead>
<tr>
<th>Number</th>
<th>AKA</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Disease</td>
<td>Rubella (Measles, Hard measles, 14-day measles, Red Measles)</td>
</tr>
<tr>
<td>Second Disease</td>
<td>Scarlet fever</td>
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<tr>
<td>Third Disease</td>
<td>Rubella (German measles, 3 day measles)</td>
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<tr>
<td>Fourth Disease</td>
<td>Dukes' Disease, Filatow-Dukes' Disease, Staphylococcal Scalded Skin Disease</td>
</tr>
<tr>
<td>Fifth Disease</td>
<td>Erythema Infectiosum; Parvovirus B19</td>
</tr>
<tr>
<td>Sixth Disease</td>
<td>Roseola, Exanthem subitum, 3-day fever</td>
</tr>
</tbody>
</table>

Case Study

- 8 yo child presents with fever and rash
- Other symptoms include abdominal pain, headache, myalgias
- Rash involves palms and soles
- Lives in NC, rural environment
- Labs show low platelets and low sodium
Rocky Mountain Spotted Fever

- More cases in NC than the Rocky Mountain states!
- Low-threshold for treating any child who has rash and fever (treat early!)
- Most effective if treated before 5th day
- Serology to state lab for diagnosis
- Treatment with doxycycline
Some Causes of Rash on Palms and Soles

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rash on Palms and Soles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endocarditis</td>
<td></td>
</tr>
<tr>
<td>Meningococcemia</td>
<td></td>
</tr>
<tr>
<td>Enterovirus</td>
<td></td>
</tr>
<tr>
<td>Rocky Mountain Spotted Fever</td>
<td></td>
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<tr>
<td>Gonorrhea, disseminated</td>
<td></td>
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<tr>
<td>Smallpox</td>
<td></td>
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<tr>
<td>HIV, Acute</td>
<td></td>
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<tr>
<td>Syphilis</td>
<td></td>
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<tr>
<td>Kawasaki</td>
<td></td>
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<tr>
<td>Toxic Shock</td>
<td></td>
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<tr>
<td>Measles</td>
<td></td>
</tr>
<tr>
<td>Varicella</td>
<td></td>
</tr>
</tbody>
</table>

Non-infectious sources of Fever

- **Oncologic**
- **Inflammatory**
  - Rheumatoid arthritis, inflammatory bowel disease
- **Drug-induced**
  - Antibiotics, PPIs
- **Immunizations**
  - May also be associated with rash (MMR)
- **Fever syndromes**
  - PFAPA, Familial Mediterranean Fever, TRAPS

PFAPA (1)

- Periodic Fever, Aphthous Stomatitis, Pharyngitis, Adenopathy
- Recurrent bouts of fever associated with:
  - Sore throat (65-100%)
  - Swollen cervical lymph nodes (61-100%)
  - Mouth ulcers (40-75%)
- May also have other symptoms such as malaise and headache

PFAPA (2)
- Typical cycle every 28 days
- Rapid onset-off-set
- Well in between episodes
- No other source of fever
- Labs often normal
  - May have elevated WBC, platelets or ESR
- Treatment:
  - Prednisone 2 mg/kg/dose x 1
  - Must give at start of fever


Case Study
- A 5 y/o girl presents with a 6 day history of fever, rash, “pink eye”, cervical lymphadenopathy, and irritability.
- On exam you notice cracked lips and swollen hands.

Kawasaki Disease
- Fever for 5 days PLUS 4 of
  1. erythema of the lips or oral cavity or cracking of the lips
  2. rash on the trunk
  3. swelling or erythema of the hands or feet
  4. red eyes (conjunctival injection); nonpurulent
  5. swollen lymph node in the neck of at least 1.5 cm
- Treat with IVIG, low-dose aspirin
Controlling infections in schools

- Handwashing!!!
- Environmental hygiene
- Immunizations
- Exclusions
- Antibiotic therapy
- Antibiotic prophylaxis

Red Book, 2015, p. 152

<table>
<thead>
<tr>
<th>Infection</th>
<th>Management of Case</th>
<th>Management of Contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis A</td>
<td>Exclude 1 week after onset of illness</td>
<td>Administer Hep A Vac or IgG to unimmunized classroom children of index case</td>
</tr>
<tr>
<td>Impetigo</td>
<td>Exclude until 24h of abx</td>
<td>None</td>
</tr>
<tr>
<td>Measles</td>
<td>Exclude 4 days after beginning of rash</td>
<td>Immunize exposed unimmunized within 72 hours or exclude</td>
</tr>
<tr>
<td>Pertussis</td>
<td>Exclude until 5 d of abx, or 21 days if not treated</td>
<td>Chemoprophylaxis for household contacts</td>
</tr>
<tr>
<td>Strep pharyngitis</td>
<td>Exclude until 24 h of abx</td>
<td>Test symptomatic contacts</td>
</tr>
<tr>
<td>Varicella</td>
<td>Exclude until all lesions are crusted</td>
<td>Vaccinate unimmunized within 3-5 days</td>
</tr>
<tr>
<td>S. Aureus skin infection</td>
<td>Exclude if lesions are draining</td>
<td>Hand hygiene</td>
</tr>
</tbody>
</table>
Summary

- Fever is body’s reaction to infection or inflammation
- Not everything that causes fever is an infection!
- Fever does not equal contagiousness
  - You can have a fever and not be contagious
  - You can be contagious and not have a fever