Pediatric Infectious Diseases

PCOM Family Medicine Board Review Day
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The Golden “crusty” child
What is the diagnosis?
Impetigo

- **Facts:** Usually occurs in early childhood, more commonly affects ages 2 - 7, higher incidence in Summer

- Staph, strep, or combined infection w/ discrete thin walled vesicles that become pustular and then rupture releasing thin straw-colored, seropurulent discharge; forms stratified golden crusts when dry

- Mostly on exposed parts of the body, face and neck; spreads peripherally and clears centrally

- Methicillin-resistant *S aureus* (MRSA is an increasingly common cause of impetigo)

- Poststreptococcal glomerulonephritis is a rare complication with GABHS infection only
Impetigo

- Treatment: Oral antibiotics – semi-synthetic penicillin or first generation cephalosporin (unless MRSA is suspected) and topical antibiotic such as Bactroban or Altabax
- Soak crusts often
What’s the Diagnosis?

- Toxin-mediated cleavage of the skin at granular layer resulting in a split
- Risk factors: newborn, children less than six or less commonly, immunocompromised
- Complete re-epithelialization in 2 weeks
What’s the Diagnosis?

- **Key Clues:**
  
  - If affected, almost always in those less than six years of age
  
  - Initial lesion is usually superficial and crusty

  - Moves quickly, within 24 hours surrounding skin becomes painful and scarlet in color. Toxin enters circulation and spreads to other areas of skin

  - In older children, the face is typical beginning site

  - In infants primary infection often begins during first few days of life in diaper area or umbilical stump
Hint: positive Nikolsky Sign

- Positive when a blister occurs on normal appearing skin after application of lateral pressure w/ a finger
- Occurs in any superficial blistering process
What’s the diagnosis?
Staphylococcal Scalded Skin Syndrome

- Caused by the exfoliative toxins of some strains of *Staphylococcus aureus*.

- It is a syndrome of acute exfoliation of the skin typically following an erythematous cellulitis.

- Severity of staphylococcal scalded skin syndrome varies from a few blisters localized to the site of infection to a severe exfoliation affecting almost the entire body.

- A mild form of the illness involving desquamation of just the skin folds following impetigo has been described.

- The epidermis may peel easily, often in large sheets.

- Loss of protected skin barrier can lead to sepsis and fluid and electrolyte concerns.
# KEY POINTS

Staphylococcal Scalded Skin Syndrome (SSSS) versus Toxic Epidermal Necrolysis (TEN)

<table>
<thead>
<tr>
<th>Feature</th>
<th>SSSS</th>
<th>TEN</th>
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<tbody>
<tr>
<td>Patients affected</td>
<td>Infants, young children, immunocompromised adults</td>
<td>Older patients</td>
</tr>
<tr>
<td>Patient history</td>
<td>Recent staphylococcal infection</td>
<td>Drug use, renal failure</td>
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<tr>
<td>Level of epidermal cleavage (blister formation)*</td>
<td>Within the granular cell (outermost) layer of the epidermis</td>
<td>Between the epidermis and dermis or at the level of the basal cell</td>
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Treatment Approach

- Once SSSS diagnosed, treatment consists of supportive care and eradication of the primary infection.
- Fluid rehydration, topical wound care similar to the care for thermal burns, and parenteral antibiotics to cover *S aureus*.
- Consideration must be given for the sharply increasing rates of community-acquired *S aureus* infection (CA-MRSA).
- Prompt treatment with parenteral anti-staphylococcal antibiotics is essential.
- Most staphylococcal infections implicated in staphylococcal scalded skin syndrome have penicillinases and are resistant to penicillin. Nafcillin, oxacillin, or vancomycin is indicated.
Really itches and currently wrestling with other kids in waiting room!
Scabies

- Infestation of the skin by the mite Sarcoptes scabiei
- Intensely pruritic eruption especially after warm bath or shower and at night
- Characteristic distribution pattern (finger web space, linear lines)
- Hands, feet, inner wrists and axilla most affected
TRANSMISSION

- Person to Person - direct contact
- Parents to children
- Mother to infant, is routine
- Young adults, the mode of transmission is usually sexual contact
Pathophysiology

- Pruritus - result of a delayed type-IV hypersensitivity reaction to the mite, mite feces, and mite eggs
- Occurs 4 to 6 weeks after initial exposure
- Previously sensitized individuals can develop symptoms within hours of exposure
- Persistent scratching of skin = increased chance of secondary infection with impetigo
Treatment

- Permethrin cream 5%
  - Can be used in those age 2 months and older
  - Kills the scabies mite and eggs
  - Two (or more) applications at least 1 week apart may be needed

- Ivermectin – may help BUT
  - Not FDA approved for this use
  - Safety in children less than 15 Kg and in pregnant women not established
From Normal to OUCH!

A. Normal TM.
B. TM with mild bulging.
C. TM with moderate bulging.
D. TM with severe bulging.

Courtesy of Alejandro Hoberman, MD

Lieberthal A S et al. Pediatrics 2013;131:e964-e999
Acute Otitis Media

- Often arises as a complication of preceding viral respiratory infection
- Corresponds to the rhinovirus, RSV, and influenza season
- Acute suppurative infection of the middle ear cavity
- Prevalence is highest in those aged 2 years or younger, and it sharply declines in children older than 6 years
- The peak incidence is 6 – 18 months of life
Acute Otitis Media

- Common bacterial pathogens are:
  - S. pneumoniae
  - H. influenza
  - M. catarrhalis
  - Group A streptococcus

- Sterile effusions occur in approximately 30% of cases
When to suspect AOM?

Acute Otitis Media = THE BIG THREE

1. **Acute onset** of signs and symptoms (fever, pain, URI)
2. Presence of **middle ear effusion** (MEE)
3. Presence of **middle-ear inflammation**
# Criteria for Initial Antibacterial Agent Treatment or Observation in Children with AOM

<table>
<thead>
<tr>
<th>Age</th>
<th>Certain Diagnosis</th>
<th>Uncertain Diagnosis</th>
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<tbody>
<tr>
<td>&lt; 6 months</td>
<td>Antibacterial Tx</td>
<td>Antibacterial Tx</td>
</tr>
<tr>
<td>6 mo to 2 y</td>
<td>Antibacterial tx</td>
<td>Antibacterial Tx if <strong>Severe</strong> illness, observation option only if non-severe</td>
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<tr>
<td>≥ 2 y</td>
<td>Antibacterial therapy if <strong>Severe</strong> illness;</td>
<td>Antibacterial therapy if <strong>Severe</strong> illness;</td>
</tr>
<tr>
<td></td>
<td>Observation option if NOT severe illness</td>
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**Severe**: Moderate to Severe Otalgia OR Fever ≥ 39°C (102.2°F) in the previous 24 hours

**Observation Period**: 48-72, schedule follow-up if symptoms do not improve
**Acute Otitis Media**

- **Initial Antibiotic Treatment at AOM Diagnosis or After Observation**
  - *Amoxicillin (80-90 mg/kg/day) – first line therapy*
  - Cefdinir - 14 mg/kg/day (1 or 2 doses/day)
  - Cefuroxime - 30 mg/kg/day (in 2 divided doses)
  - Amoxicillin-clavulanate - 90 mg/kg/day (based on Amoxicillin component) with (6.4 mg/kg/day of clavulanate) – use if previous Amoxicillin within 30 days or if patient has OM+ conjunctivitis
  - Cefpodoxime (10 mg/kg/day in 2 divided doses)
  - Ceftriaxone (50 mg/kg/day IM or IV)

*Pediatrics 2013;131(3):e964-e999*
Acute Otitis Media

- Recurrent acute otitis media/treatment failure
  - *Amoxicillin-clavulanate - 90 mg/kg/day (based on Amoxicillin component) with (6.4 mg/kg/day of clavulanate) or
  - Ceftriaxone (50 mg/kg/day IM for 3 days) – maximum one gram/24 hours
  - Cefdinir 7 mg/kg q12h or 14 mg/kg q24h for 5-7d or
  - Cefpodoxime 10 mg/kg/day as a single dose or
  - Cefprozil 15 mg/kg q12h for 5-7d or
  - Cefuroxime 30 mg/kg/day divided q12h for 5-7d or

- Typanocentesis
- Consult specialist

*Pediatrics 2013;131(3):e964-e999
Say Aah!
Streptococcal Pharyngitis

Epidemiology

- Relatively uncommon before 2 to 3 years of age
- Increased incidence school-age children
- Decreased incidence in late adolescence and adulthood
- Occurs throughout the year in temperate climates
- Peaks during the winter and spring
- Easily spreads to siblings and classmates
- Exposure to confirmed case within preceding two weeks is risk factor
History Helps in Diagnosis

Positive Factors:

- Exposure to known carriers
- Fever, headache and abdominal pain in conjunction with a sore throat

Negative Factors:

- Involvement of other mucous membranes (ex, conjunctivitis, coryza) suggests a viral etiology
- Age less than 3
Pharyngitis

**Diagnosis**

- The challenge is to distinguish pharyngitis caused by group A beta-hemolytic streptococci (GABHS) from pharyngitis caused by other organisms.
- If symptoms suggestive of GABHS - Rapid streptococcal antigen tests
- If positive = antibiotic treatment, if negative – throat culture
- Throat culture is the diagnostic “gold standard”
Modified Centor Score

Estimates probability that pharyngitis is streptococcal in nature, and suggests management course.
Pharyngitis

Treatment

- Untreated most episodes of streptococcal pharyngitis resolve
- Antimicrobial therapy accelerates clinical recovery by 24-48 hours
- Major benefit of antimicrobial therapy is the prevention of acute rheumatic fever - to prevent this sequela, institute adequate antimicrobial therapy within 9 days of infection*
- Penicillin given orally three or four times daily for a full 10 days

*Pediatric Pharyngitis Harold K Simon, MD, MBA; Medscape May 26, 2015
I’m Thirsty!

Baby being fed oral rehydration.
Rotavirus

- **Etiology**
  - Invades the epithelium and damages villi of the upper small intestine
  - In severe cases involves the entire small bowel and colon
  - Vomiting may last 3 to 4 days, and diarrhea may last 7 to 10 days
  - Dehydration is common in younger children
  - Primary infection with rotavirus in infancy may cause moderate to severe disease but is less severe later in life
Rotavirus

**Epidemiology**
- Occurs in both developed and developing countries
- Peaks in the winter each year
- Highest rate of illness occurs in children 3-24 months of age
- Fecal oral route is the major mechanism of transmission
Rotavirus

- **Clinical Manifestation**
  - Fever (low grade)
  - Lethargy
  - Abdominal pain
  - Dehydration
  - Diarrhea is characterized by watery stools, with no blood or mucus
  - Stools may be odorless or foul-smelling
  - Vomiting may be present
  - Dehydration may be prominent
Rotavirus

Diagnosis
- UA for specific gravity as an indicator of hydration status
- Stool cultures

Treatment
- Most infectious causes of diarrhea in children are self-limited
- Correcting dehydration and electrolyte deficits
Rotavirus

**Prevention**
- Hand washing
- Diaper changing
- Water purification

**Vaccines**
- RotaTeq – (3-dose series between 6 - 32 weeks of age)
- Rotarix – (2-dose series between 6 – 24 weeks of age)
The Boy in Gym Class
Chickenpox (Varicella)

**Etiology**
- Varicella-zoster (VZV) is a type of herpes virus
- Humans are the only source of infection
Chickenpox

**Epidemiology**
- Person to person
- Occurs by direct contact with varicella or zoster and respiratory secretions
- Most common during late winter and early spring
- Most reported cases occur between the ages of 5 and 9 years
- Congenital varicella syndrome risk is about 2%, and is greatest in the first trimester
- Incubation 10 to 21 days after contact
- Cases most contagious 2 days before the rash appears, until 5 days after new lesions stop erupting
Chickenpox

- **Clinical Manifestation**
  - Rash has multiple stages
  - Starts on the trunk, followed by head, face, then extremities
  - The appearance of a typical rash that occurs in successive crops of macules, papules, and vesicles is distinctive
Chickenpox

**Treatment Approaches**
- Acyclovir is the drug of choice for children, used in those at high risk for complications.
- Acetaminophen may be used to control fever.
- NO ASPIRIN (concern for Reyes Syndrome).
- No ibuprofen (concern for 2nd-ary infection).
- Immunization-Prevention
  - Varicella
Forgot the Sunscreen?
Roseola

- **Etiology**
  - A common illness in preschool aged children characterized by fever lasting 3 to 7 days followed by rapid defervescence and the appearance of a blanching maculopapular rash lasting only 1 to 2 days
  - Major cause appears to be human herpesvirus 6 (HHV6)
  - Human herpesvirus 7 (HHV7) may also play a role
Roseola

- **Epidemiology**
  - Occurs throughout the year
  - Commonly affects children 3 months to 4 years
  - The peak age 7 to 13 months
  - 90% of cases occur in the first 2 years of life
  - Affects males and females equally
  - Incubation period is 5 to 15 days
Roseola

- Clinical Manifestation
  - Rash appears as fever disappears and lasts 1 to 2 days
  - Cough
  - Coryza
  - Children remain alert and are not ill appearing
  - Eyelid edema has been noted
  - Lymphadenopathy
Roseola

- **Diagnosis**
  - Clinical
  - History very important (telltale rash)
  - Can check blood test

- **Treatment**
  - Supportive care
What’s the Diagnosis?

Key Clue - Geographic Blisters
Hand Foot Mouth Disease (HFMD)

- Enterovirus family
- Coxsackie virus A16 infection – most common cause
Hand Foot Mouth

- More common Spring to Fall
- More common in infants children under 5 y/o
- Spread to other children through hand contamination and close contact
- 3-7 day incubation period
Hand Foot Mouth

- Exam shows ulcers or blisters in the pharynx, lips and or tongue
- Red rash may develop on hands and feet – may blister but not itch
- Fevers, loss of appetite, headache
- Supportive treatment. Control fever, good hydration
- Usually has a benign course
POTENTIAL CARDIAC CONCERN?

KEY CLUES

- Persistent fever – 5 days or more of 102-104F without a source
- Usually does not respond to acetaminophen or NSAID’s
- Oral mucous membrane changes
- “Strawberry tongue”
- Cervical adenopathy
Keyword hint - “Strawberry tongue”
KAWASAKI DISEASE
Kawasaki Syndrome
Mucocutaneous Lymph Node Syndrome

- More common in boys
- Most cases occur in children age 5 or younger
- More common in children of Asian and Pacific Island descent
- Affects mucus membranes, walls of blood vessels (inflammation), lymph nodes AND potentially, the heart
- Leading cause of acquired heart disease
Diagnosis

Requires the presence of **fever** lasting at least 5 days (without known source) combined with **4 out of 5 of the following:**

- Bilateral bulbar conjunctiva injection without exudate
- Oral mucous membrane changes including injected or fissured lips, injected pharynx, or strawberry tongue
- Peripheral extremity changes including erythema of palms or soles, edema of hands or feet and peri-ungual desquamation of fingers and toes
- Polymorphous rash
- Cervical lymphadenopathy at least one node greater than 1.5 cm
Kawasaki Disease

- Rarely occurs in adults

- Typically a self-limited condition, with fever and manifestations of acute inflammation lasting for an average of 11 days without therapy.

- PRESENCE OF CORONARY ARTERY ANEURYSMS IS A MAJOR CONCERN!
**Treatment** – aimed at early control of acute inflammation and monitoring for aneurysmal complications

- Intravenous Immunoglobulin IVIG
- **ASPIRIN**

Disease is self-limited and patients will ultimately recover however if left untreated increased risk of coronary aneurysm.

Screening and serial echocardiography (if needed)
Is It Just A Cough?
Pertussis

- Commonly known as “whooping cough”
- *Bordetella pertussis*
- Most often seen in pre-school and school aged children
- Be suspicious of a cough lasting more than two weeks
- Characterized by
  - a prolonged dry cough, with paroxysmal spasms, that may last weeks to months
  - Sleep disturbing cough
  - Cough may be followed by an inspiratory “whoop” in children
  - Post-tussive emesis
Pertussis

- **Reservoir:** Adolescents and adults with waning immunity are source for infant infections
- **Transmission:** Respiratory droplets
- **Communicability:** High
  - Attack rates of 80-100% in non-immunized household contacts & 20% in immunized household contacts
  - Most infectious during the first 2-3 weeks after cough onset

**Incubation Period:**
7–10 days w/ a range of 4 –21 days
Stages of Whooping Cough

Disease Progression:

Weeks

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<tr>
<th>Weeks</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
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</table>

Stage 1
Catarrhal Stage
May last 1 to 2 weeks

- Symptoms: runny nose, low-grade fever, mild, occasional cough - Highly contagious

Stage 2 - Paroxysmal Stage

Lasts from 1-6 weeks; may extend to 10 weeks

Symptoms: fits of numerous, rapid coughs followed by "whoop" sound; vomiting and exhaustion after coughing fits (called paroxysms)

Stage 3 - Convalescent Stage

Lasts about 2-3 weeks; susceptible to other respiratory infections for many

Recovery is gradual. Coughing lessens but fits of coughing may return.
Laboratory Diagnosis

Gold standard: 7-day bacterial culture of nasopharyngeal secretions—cultures positive by day 3

*Cultures in untreated pertussis remain positive for 3 weeks after illness onset (catarrhal phase when pertussis is usually not suspected). Therefore, small window of opportunity for culture-proven diagnosis*

Polymerase chain reaction (PCR) testing of nasopharyngeal swabs or aspirates.

- Rapid results within 1-2 days, sensitive, and specific
- PCR should be used in addition to culture, not as a replacement for culture
Treatment

**Antibiotics** – eradicates organism from secretions, decreases communicability, and, if given during the catarrhal stage, may modify clinical course:

- **Erythromycin**, 1-2g daily in 4 divided doses x 7-14 days OR 40-50 mg/kg/d (not to exceed 2 g/d) in 4 divided doses x 14 days.
- **Clarithromycin**, 500mg daily, 2 divided doses x 7 days OR 15-20 mg/kg/d PO in 2 divided doses, not to exceed 1 g/d for 5-7 days
- **Azithromycin**, 500mg on day 1, then 250 mg po x 4 days OR 10-12 mg/kg/day po x 5 days.

**Alternative for pts allergic to macrolides:**
- **Trimethoprim-sulfamethoxazole**, 160 mg trimethoprim, 800 mg sulfamethoxazole in 2 divided doses x 14 days OR trimethoprim 8 mg/kg/d and sulfamethoxazole 40 mg/kg/d in 2 divided doses.
What’s the diagnosis?

Barking cough
Possible steeple sign on lateral neck x-ray
Croup

- Croup = laryngeotracheobronchitis – edema around the larynx and trachea
- Major cause – Human Parainfluenza Viruses (HPIV) - type 1 more common* (other viruses such as adenovirus and RSV can cause croup)
- Occurs most often during the Fall and Early Winter *
- Commonly affects children between 6 months to three years of age
HPIV and Illness

- The incubation period from exposure to HPIV to onset of symptoms is generally 2 to 7 days.
- HPIV-1 and HPIV-2 are most often associated with croup (laryngotracheobronchitis).
- HPIV-1 more often causes croup in children.
- Symptoms caused by inflammation, edema and buildup of mucus in the larynx, trachea and bronchial tubes.
Symptom Pattern

- Often begins as a cold – potential low grade fever (but can elevate to 104°F)
- Characteristic symptom pattern - wake up in the middle of the night with a croupy cough and may have trouble breathing – symptoms often better during the day
- Distinctive cough – seal-like barking sound
- Hoarseness
- Inspiratory stridor
- Symptoms come back again at night, but are usually less intense each night
- Symptoms may become worse if child becomes anxious or agitated
- Cool or moist air, such as in a steamy bathroom or outside in the cool night air may offer some breathing relief
Croup

- X-ray may show "steeple" sign (from narrowed subglottic space)
- X-ray indicated only to evaluate when the diagnosis is unclear (pneumonia, foreign object, etc.)
Steroid Treatment Tips for Croup

- If administered within the first 4 – 24 hours of symptoms, a single dose of dexamethasone has been shown to be effective in reducing the overall severity of croup.

- Onset of action occurs within 6 hours after oral or intramuscular administration.

- The long half-life of dexamethasone (36-54 hrs) often allows for a single injection or dose to cover the usual symptom duration.

- Dexamethasone dosed at 0.15 mg/kg is as effective as 0.3 mg/kg or 0.6 mg/kg (with a maximum daily dose of 10 mg) in relieving the symptoms of mild-to-moderate croup.
Treatment summary for croup

- Cornerstones for the treatment of croup are corticosteroids and nebulized epinephrine*

- Steroids have proven beneficial in mild, moderate and severe croup

- The anti-inflammatory action of corticosteroids reduces laryngeal mucosal edema and decreases the need for nebulized epinephrine

- Nebulized epinephrine is typically reserved for patients in moderate to severe distress*

- Nebulized epinephrine is associated with a clinically and significant transient reduction of symptoms for 30 minutes post-treatment*
# Board Clues: Differential Diagnosis

## Croup
- Edema of the mucosa in the subglottic area of the larynx
- More prevalent during the wintertime
- More gradual onset than acute epiglottitis
- Commonly associated with low-grade fever
- Same symptoms of inspiratory stridor, suprasternal, intercostal and substernal retractions and hoarseness
- Differentiation in early illness is possible by additional observation of barking cough and absence of drooling and dysphagia in croup

## Epiglottitis
- No seasonal predilection
- Drooling and dysphagia with absence of coughing in epiglottitis.
- A preference to sit, and refusal to swallow
- Trouble speaking
- Leaning forward to breathe
- Taking rapid, shallow breaths
- Looks very ill
References


- Centers for Disease Control and Prevention · April 2015, May 2015


- National Center for Immunization and Respiratory Diseases (NCIRD) Division of Viral Diseases, July 7, 2015


- Croup: An Overview ROGER ZOOROB, MD, MPH; MOHAMAD SIDANI, MD, MS; and JOHN MURRAY, MD, PhD, Meharry Medical College, Nashville, Tennessee Am Fam Physician. 2011 May 1;83(9):1067-1073


BEST OF SUCCESS ON BOARDS