Advanced Pediatric Bacterial Infections
Basic Dermatology Curriculum

Content for this module was developed by the Society for Pediatric Dermatology.

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Module Instructions

- The following module contains a number of blue, underlined terms which are hyperlinked to the dermatology glossary, an illustrated interactive guide to clinical dermatology and dermatopathology.
- We encourage the learner to read all the hyperlinked information.
- Learner should complete this module after completion of “Bacterial skin infections” “Atopic dermatitis” and “Blisters” modules.
Goals and Objectives

- Develop a clinical approach to the evaluation and initial management of select pediatric bacterial infections

- By completing this module, the learner will be able to:
  - Summarize the clinical manifestations of pediatric streptococcal and staphylococcal skin infections
  - Identify and treat infectious complications in pediatric patients with eczema
Case 1: History

- **HPI:** John is a 10 week old baby with fragile blisters for 2 days. Lesions are present in the folds of the neck, arms, legs and groin. He also has some perioral crusting. He is more irritable than baseline.
- **ROS:** +rhinorrhea
- **PMH:** Healthy, full term male born via uncomplicated vaginal delivery with unremarkable prenatal and postnatal course. Immunizations are up to date.
- **Medications:** none
- **SH:** in daycare, no contacts with rash
- **Vital signs:** Tm 38.5, HR/RR/BP within normal range.
Case 1: Skin Exam
Case 1: Question 1

Based on John’s findings, what is the most likely infectious diagnosis?

a. Bullous impetigo
b. Erythrasma
c. Intertrigo
d. Meningococcemia
e. Staph Scalded Skin Syndrome
Case 1: Question 1

Answer e

Based on John’s findings, what is the most likely infectious diagnosis?

a. Bullous impetigo (more localized blisters and erosions)

b. Erythrasma (scaling and redness but no erosions or blisters, not acute, no fever)

c. Intertrigo (redness, occasionally erosions but no blisters, no fever)

d. Meningococcemia (purpura in a critically ill child)

e. Staph Scalded Skin Syndrome
Case 1, Question 2

The most likely causative organism is?

a. Group A streptococcus
b. Group B streptococcus
c. Neisseria meningitidis
d. Staphylococcus epidermidis
e. Staphylococcus aureus
Case 1, Question 2

Answer: e

The most likely causative organism is?

a. *Group A streptococcus* (impetigo, cellulitis, necrotising fasciitis, scarlet fever, toxic shock syndrome)

b. *Group B streptococcus* (less common cause of cutaneous infections)

c. *Neisseria meningitidis* (meningococcemia, purpura fulminans)

d. *Staphylococcus epidermidis* (skin colonizer, opportunistic infections)

e. *Staphylococcus aureus*
Staphylococcal Scalded Skin Syndrome (SSSS)

- Blistering skin infection caused by toxins produced by some strains of *S. aureus*
- Usually presents in infants and children under 5 years of age
- Starts with tender, sunburn-like erythema followed by blisters filled with clear fluid that rupture leaving erosions and superficial desquamation
- Fever, malaise and/or pain may be associated
Staphylococcal Scalded Skin Syndrome (SSSS)

- Typical sites of involvement:
  - Skin around the eyes
  - Nose
  - Mouth
  - Umbilicus
  - Perineum
  - Flexural creases

- Although areas around mucous membranes are usually involved, the actual mucous membranes are spared

- Nikolsky sign is positive (when you press the edge of an intact blister, the blister gets larger)
Case 1, Question 3

How would you make the diagnosis of SSSS?

a. Clinically
b. Culture the fluid from a blister
c. Direct immunofluorescence test
d. Obtain a CBC
Case 1, Question 3

Answer: a

How would you make the diagnosis of SSSS?

a. Clinically
b. Culture the fluid from a blister (toxin mediated process, blisters are sterile)
c. Direct immunofluorescence test (not antibody mediated, DIF is negative)
d. Obtain a CBC (WBC may be elevated, not diagnostic)
You treat the patient with appropriate antibiotics and he is starting to get better. The pain is resolving and he is not getting new blisters. The parents ask if he will have scars. You answer:

a. Yes
b. No
Case 1, Question 4

Answer: b

You treat the patient with appropriate antibiotics and he is starting to get better. The pain is resolving and he is not getting new blisters. The parents ask if he will have scars. You answer:

a. Yes
b. No
Staphylococcal Scalded Skin Syndrome (SSSS)

- Caused by an exfoliative toxin produced by *Staphylococcus aureus*
  - The toxin spreads via the blood stream so blisters themselves are usually sterile
  - The exfoliative toxin attacks desmoglein 1 (Dsg-1)
  - There is no scarring because this is a very superficial process

- Diagnosis is usually clinical based on history and exam
  - *S. aureus* can sometimes be isolated from a pus-filled area on the skin, conjunctiva, nose or nasopharynx
  - A biopsy can also confirm the diagnosis (shows a superficial blister with acantholysis)
Case 1: Treatment

**Staphylococcal Scalded Skin Syndrome (SSSS)**
Treatment includes antibiotics and supportive care

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Supportive Care</th>
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<tbody>
<tr>
<td>• Anti-staphylococcal</td>
<td></td>
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<tr>
<td>– Penicillinase-resistant penicillin</td>
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<tr>
<td>– 1&lt;sup&gt;st&lt;/sup&gt; and 2&lt;sup&gt;nd&lt;/sup&gt; generation cephalosporins</td>
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<tr>
<td>– Clindamycin</td>
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<tr>
<td>– Consider coverage for MRSA</td>
<td></td>
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<tr>
<td>• Pain management</td>
<td></td>
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<tr>
<td>• Wound care</td>
<td></td>
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<td>• Fluid/electrolyte management</td>
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</table>
Case 2: History

- HPI: Angelo is a 5-year-old male who presents with fever, anorexia and rash x 2 days

- PMH:
  - Otherwise healthy
  - Immunizations are up to date

- SH: 2 older siblings
Case 2: Skin Exam
Case 2: Skin Exam
In addition to this appearance of the tongue, you also appreciate a tonsilar exudate when you examine the oropharynx.
What is your diagnosis?

a. Fifth’s Disease
b. Hand Foot and Mouth Disease
c. Measles
d. Mumps
e. Scarlet Fever
Case 2, Question 1

Answer: e

What is your diagnosis?

a. Fifth’s Disease (slapped cheek in first stage, then lacy and reticulated exanthem on trunk and extremities)

b. Hand Foot and Mouth Disease (vesicular lesions on palms, soles and mouth)

c. Measles (prodrome with fever, cough, coryza and conjunctivitis; exanthem is maculopapular)

d. Mumps (parotid gland swelling and pain, rash is not a typical manifestation)

e. Scarlet Fever
Case 2, Question 2

In addition to the tonsillar exudate, the oral examination may also reveal this finding:

a. Koplik spots
b. Forschheimer spots
c. Strawberry tongue
d. Ulceration on the buccal mucosa
e. Ulceration of the palate
Case 2, Question 2

Answer: c

In addition to the tonsillar exudate, the oral examination may also reveal this finding:
a. Koplik spots (associated with measles)
b. Forschheimer spots (associated with rubella)
c. Strawberry tongue (associated with scarlet fever, but also seen in other diseases such as Kawasaki’s disease and toxic shock syndrome)
d. Ulceration on the buccal mucosa (nonspecific)
e. Ulceration of the palate (nonspecific)
Case 2

Scarlet Fever

• Exanthem caused by group A beta-hemolytic streptococcal infection, most commonly of the oropharynx

• Patients typically present with:
  – Fever
  – Throat pain
  – Headache
  – Cervical lymphadenopathy
  – Rash and mucosal findings
### Case 2

#### Scarlet Fever

<table>
<thead>
<tr>
<th>Skin findings</th>
<th>Mucosal findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sandpaper-like exanthem</td>
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<tr>
<td>– Rough, fine, erythematous papules on the trunk and extremities</td>
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<tr>
<td>• Pastia’s lines</td>
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<tr>
<td>– Accentuation of the rash in the folds of the extremities</td>
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<tr>
<td>• Oropharynx:</td>
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<tr>
<td>– Tonsillar exudate</td>
<td></td>
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<tr>
<td>– Tongue has bright red, strawberry appearance</td>
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Case 2, Question 3

Which of the following is your initial treatment recommendation?

a. Supportive care alone
b. Penicillin
c. Linezolid
d. Admission to burn unit
Case 2, Question 3

Answer: b

Which of the following is your initial treatment recommendation?

a. Supportive care alone (treatment is recommended to prevent acute rheumatic fever)

b. Penicillin

c. Linezolid (not first line, used as second line or complicated infections)

d. Admission to burn unit (rash does not require burn unit care)
Case 2: Treatment

• Treatment with antibiotics is necessary to prevent complications, primarily acute rheumatic fever

• Penicillin, amoxicillin, ampicillin, macrolides and 1st generation cephalosporins may be used

• Desquamation of the distal extremities may occur and last for weeks (independent of treatment)
Case 2: Exam

3 weeks after treatment Angelo’s feet begin to peel.
Case 2, Question 4

Which of the following conditions manifests palmoplantar desquamation?

a. Herpetic whitlow
b. Kawasaki disease
c. Candidal paronychia
d. Varicella
e. Acropustulosis of infancy
Case 2, Question 4

Answer: b

Which of the following conditions manifests palmoplantar desquamation?

a. Herpetic whitlow (painful vesicles or bullae on the pulp of distal phalanx)

b. Kawasaki disease

c. Candidal paronychia (redness, swelling of nail fold with nail dystrophy)

d. Varicella (small vesicles with surrounding erythema in different stages of development)

e. Acropustulosis of infancy (recurrent, pruritic vesicles and pustules on palms and soles)
Differential Diagnosis of Palmoplantar Desquamation

- **Infectious**
  - Viral
  - Streptococcal
- **Primary dermatologic disease**
  - Atopic dermatitis
  - Psoriasis
  - Ichthyosis

- **Burn**
- **Nutritional deficiency**
- **Kawasaki’s disease**
- **Environmental agents**
  - Arsenic
  - Mercury
- **Drugs**
- **Idiopathic**
Case 3

- HPI: a 4 year old boy presents to your office for recurrent redness and crusting around the anal area. He complains of discomfort.
- PMHx: constipation
- Medications: none
- Allergies: none
- Social history: attends daycare, potty trained, wears pull-ups at night
- Family history: none
Case 3: Skin Examination
Case 3, Question 1

What is your leading diagnosis?

a. Atopic dermatitis
b. Candidal diaper dermatitis
c. Irritant contact dermatitis
d. Perianal streptococcal infection
e. Perianal warts (condyloma)
Case 3, Question 1

Answer d

What is your leading diagnosis?

a. Atopic dermatitis (usually spares the diaper area)
b. Candidal diaper dermatitis (no satellite papules, pustules or erosions)
c. Irritant contact dermatitis (no history of diaper wipes or encopresis)
d. Perianal streptococcal infection
e. Perianal warts (condyloma) (no verrucous papules noted)
### Differential Diagnosis Perianal Eruption

- Contact dermatitis: Irritant or Allergic
- Candidal intertrigo
- Psoriasis
- Seborrheic dermatitis
- Lichen sclerosus
- Pinworm infection
- Cutaneous inflammatory bowel disease
- Sexual Abuse
Perianal Streptococcal Dermatitis

- Most commonly caused by Group A Strep
  - However, *Staphylococcus aureus* or enteric bacteria can also be causes of perianal bacterial dermatitis
- May be an infectious trigger for a guttate psoriasis flare
Perianal Streptococcal Dermatitis

- Well-demarcated pink to erythematous patch
- Occasional drainage, fissuring
- Tenderness, itching or discomfort
  - May have changes in bowel pattern including constipation or pain with defecation
  - May have associated vulvovaginitis or balanitis
Perianal Streptococcal Dermatitis: Treatment

- Obtain bacterial culture when possible

- Oral antibiotic coverage for group A strep
  - Consider coverage for *S. aureus* when etiology is uncertain

  - Consider adjunctive measure to reduce colonization such as topical antibiotic ointment or dilute bleach baths
Case 4: History

- **HPI:** A 3 year old boy presents for evaluation of new onset rash of 2 days duration on leg. Denies change in topical products or new exposures.
- **PMHx:** atopic dermatitis
- **Allergies:** NKDA
- **Medications:** topical steroid as needed, multivitamin
- **Social history:** Attends daycare
- **Family history:** No family history of blistering skin rashes or recurrent skin infections
Case 4: Skin exam
Case 4, Question 1

What is your leading diagnosis?

a. Bacterial folliculitis
b. Eczema herpeticum
c. Impetigo
d. Irritant dermatitis
e. Scabies
Answer: c

What is your leading diagnosis?

a. Bacterial folliculitis (follicular based pustules and red papules)
b. Eczema herpeticum (monomorphous punched out papules and vesicles)
c. Impetigo
d. Irritant dermatitis (scaly, erythematous plaques without honey-colored crusting)
e. Scabies (burrows, scaly papules and plaques; legs is not a typical site of involvement)
Case 4, Question 2

Which of the following might be empiric treatment for this infection?

a. IV ampicillin
b. Oral acyclovir
c. Oral amoxicillin
d. Oral trimethoprim-sulfamethoxazole
e. Topical mupirocin
Case 4, Question 2

Answer: e

Which of the following might be empiric treatment for this infection?

a. IV ampicillin (no *S. aureus* coverage)
b. Oral acyclovir (no bacterial coverage)
c. Oral amoxicillin (no *S. aureus* coverage)
d. Oral trimethoprim-sulfamethoxazole (no Group A strep coverage)
e. Topical mupirocin
Case 5

- HPI: a 10 year old boy presents with a 3 day history of blisters on bilateral lower extremities. Blisters rupture easily after scratching.
- PMHx: healthy, immunizations up to date
- Allergies: NKDA
- Medications: multivitamin
- Social Hx: attends school, participates in wrestling
- Family history: no family history of blistering skin rashes
Case 5: Skin Examination
Case 5

What is your leading diagnosis?

a. Bullous impetigo
b. Herpes zoster
c. Bullous tinea
d. Herpes simplex
e. Varicella
Case 5

Answer: a

What is your leading diagnosis?

a. Bullous impetigo

b. Herpes zoster (painful papulo-vesicles in dermatomal distribution, typically unilateral)

c. Bullous tinea (vesicles and bullae with surrounding erythema, most common on feet)

d. Herpes simplex (small clustered painful vesicles)

e. Varicella (small vesicles with surrounding erythema in different stages of development)
Impetigo

- Superficial bacterial skin infection most common in children aged 2 to 5 years

- Causative agents:
  - *Staphylococcus aureus* (most common)
  - Group A β-hemolytic streptococcus

- Presents with crusted papules, pustules or vesicles that easily rupture developing honey-colored crusting
Bullous Impetigo

- Presents with flaccid bullae that rupture easily leaving a rim of scale, later developing an overlying honey-colored crust, bullae are toxin mediated
- Common locations include the face, extremities and diaper area in young children
- Bullae and erosions are superficial and heal without scarring
• Management:
  – Topical antibiotics for uncomplicated limited infections
    • Consider mupirocin
    • Consider adjunctive use of dilute bleach baths
  – Oral antibiotics often indicated for more extensive or recurrent episodes of bullous impetigo
Case 6: History

- HPI: A 9 month old male presents for acute worsening of his eczema on face and neck. Mother notes onset of blisters which developed “overnight,” many opened due to scratching and rubbing.
- PMH: former term infant, no significant illnesses
- Medication: Vitamin D
- Allergies: none
- Family history: atopic dermatitis in mother, asthma in father
- Social history: lives at home with parents, attends daycare
Case 5: Physical Exam

- Tm 38.5, HR 140, RR 34, BP 85/60
- Child is awake and alert but uncomfortable and scratching his face and eyes
Case 6, Question 1

This complication is likely caused by?

a. Enterovirus  
b. Group A Streptococcus  
c. Molluscum virus  
d. Herpes simplex virus  
e. Staphylococcus aureus
This complication is likely caused by?

a. Enterovirus (hand-foot-mouth disease and herpangina most common presentation)
b. Group A Streptococcus (honey-colored crusting)
c. Molluscum virus (skin colored umbilicated papules)
d. Herpes simplex virus
e. Staphylococcus aureus (honey-colored crusting or flaccid bullae)
Which of the following is the primary treatment intervention?

a. Cephalexin  
b. Acyclovir  
c. Doxycycline  
d. Intravenous fluids  
e. Wet wraps with topical steroids
Case 6, Question 2

Answer: b

Which of the following is the primary treatment intervention?

a. Cephalexin (no viral coverage)
b. Acyclovir
c. Doxycycline (no viral coverage)
d. Intravenous fluids (may be used as supportive therapy)
e. Wet wraps with topical steroids (may worsen viral infection)
Eczema Herpeticum

- Cutaneous superinfection with herpes simplex virus (HSV)

- Patients at risk
  - Eczema or atopic dermatitis
  - Other skin disorders (ichthyosis, Darier disease, etc)

- Can progress rapidly to diffuse cutaneous disease with associated systemic symptoms
Eczema Herpeticum

- Starts with clusters of itchy or painful monomorphous vesicles and papulo-vesicles

- Vesicles then rupture to form small “punched out” erosions

- It can occur on normal skin or skin affected by eczema or other skin problems

- Most common on the face, neck and trunk
Eczema Herpeticum: Management

• Systemic therapy with acyclovir is recommended

• Superimposed bacterial infection is common
  – Consider obtaining culture and starting empiric antibiotics

• Hospitalization may be required

• Ophthalmology evaluation recommended in cases with periorbital or nasal tip involvement
Impetigo

- Note the honey-colored crusting

Eczema Herpeticum

- Monomorphic, punched-out papules, vesicles and erosions
- Periocular involvement concerning for associated herpetic keratitis, urgent ophthalmology evaluation recommended
Superinfected eczema herpeticum

- Not uncommonly patients with eczema herpeticum develop a bacterial superinfection
- Monomorphous, punched-out papules, vesicles and erosions with overlying yellowish and honey-colored crusting
Infection Prevention

• Patients at greater risk of infectious complications:
  – Underlying immunodeficiency
  – Chronic skin diseases like eczema

• Dilute bleach baths are helpful in preventing infections
  – Mix ¼ cup of bleach per half-filled bathtub and soak for approximately 10 minutes at least twice per week.

• Intermittent intranasal mupirocin ointment is also another effective intervention for patients at risk
  – Resistance to mupirocin is developing
Take Home Points

- Many skin infections that present in children will be due to *S. aureus* and Group A streptococcus
- SSSS requires prompt diagnosis and treatment with parenteral antibiotics and supportive care
- Impetigo is a superficial bacterial infection most commonly caused by *Staphylococcus aureus*
Take Home Points

• Group A streptococcus may cause scarlet fever, perianal dermatitis and impetigo

• Strawberry tongue can be seen in scarlet fever, Kawasaki disease and toxic shock syndrome

• Palmoplantar desquamation can be seen in scarlet fever; in the appropriate clinical context additional diagnoses should be considered
Take Home Points

• Patients with impaired skin barrier including atopic dermatitis are at risk of infectious complications including impetigo and eczema herpeticum

• Antimicrobial therapy should be tailored to cover bacterial infections with consideration of regional variability in isolate resistance patterns
Acknowledgements

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- Primary authors: Marla Jahnke MD, Christine Lauren MD
- Peer reviewers: Esteban Fernandez Faith, MD, Sheilagh Maguiness
- Last revised: 1/31/16
References