Pediatric Cutaneous Fungal Infections

Basic Dermatology Curriculum
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.
Goals and Objectives

- The purpose of this module is to help medical students develop a clinical approach to the evaluation and initial management of pediatric patients presenting with cutaneous fungal infections.

- By completing this module, the learner will be able to:
  - Identify and describe the morphologies of pediatric superficial fungal infections
  - Describe how to perform a KOH examination and interpret the results
  - Recommend an initial treatment plan for a child with tinea capitis and for a child with diaper candidiasis
  - Determine when to refer a pediatric patient with a cutaneous fungal infection to a dermatologist
Pediatric Superficial Fungal Infections

- Superficial fungal infections are limited to the epidermis, as opposed to systemic fungal infections.
- Dermatophytes (which include *Trichophyton* spp., *Microsporum* spp., and *Epidermophyton* spp.) infect keratinized tissues: the stratum corneum (outermost epidermal layer), the nail or the hair.
- The term tinea is used for dermatophytoses and is modified according to the anatomic site of infection, e.g., tinea pedis (dermatophytosis of the foot).
The most common cutaneous fungal infections in children differ from those in adults

- Diaper rash (e.g. diaper candidiasis) is the most common dermatologic condition in infants, diagnosed in approximately 1 million pediatric outpatient visits annually
- Tinea capitis is the most common dermatologic disorder in school-aged children in the US, where the vast majority of cases are caused by the dermatophyte *Trichophyton tonsurans*
Case One

Billy Smith
Case One: History

- **HPI:** Billy Smith is an 8-year-old healthy boy who presents to your clinic with his mother. His mother tells you that Billy has been losing his hair in patches over the last several weeks.
- **PMH:** all vaccinations up to date, no chronic illnesses or prior hospitalizations
- **Medications:** none
- **Allergies:** no known allergies
- **Family history:** noncontributory
- **Social history:** lives with parents and 4-year-old sister
- **ROS:** negative
Case One: Skin Exam

How would you describe these exam findings?
Case One: Skin Exam

- Multiple patchy \textit{alopecic} areas of different sizes and shapes
- Hair shafts are broken off near the scalp surface
Case One, Question 1

Which of the following is the most appropriate next step?

a. Begin treatment with topical antifungals
b. Biopsy affected scalp
c. KOH exam and fungal culture
d. Wood’s light exam
Case One, Question 1

Answer: c

Which of the following is the most appropriate next step?

a. Begin treatment with topical antifungals (does not respond fully to topicals; oral antifungals are required for treatment)

b. Biopsy affected scalp (if fungal culture and KOH exam are repeatedly negative, skin biopsy may be considered)

c. KOH exam and fungal culture (see next slide for review of KOH exam)

d. Wood’s light exam (the likely organism for this infection will not fluoresce)
The KOH Exam Procedure

1. Clean and moisten skin with alcohol swab
2. Collect scale with #15 scalpel blade
3. Put scale on center of glass slide
4. Add drop of KOH and coverslip; heat slide gently with flame to adequately dissolve keratin
5. Microscopy: scan at 10X to locate hyphae; then study in detail at 40X if needed

Click [here](#) to watch the video
Make sure to turn on your computer volume
(video length 8min 41sec)
What are the diagnostic features in this KOH exam from infected hair?
KOH Exam

- Septate hyphae with parallel walls throughout entire length
- Arthrospores (spores produced by breaking off from hyphae)
Limitations of the KOH exam include:

- Sample may be too small or taken from an area where there is no fungus
- Previous treatment with topical antifungal medications may produce false negative results
- False negative results are more common with KOH exam than with fungal culture
Diagnosis: Tinea Capitis

- Tinea capitis is a dermatophytosis of the scalp and associated hair
- Common in inner city African American children
- Spread through direct contact with animals, humans and fomites
  - Fomite transmission is via shared hair brushes, combs, caps, helmets, pillows and other inanimate objects which may have spores with the potential to spread infection.
Tinea Capitis

- Majority of cases in the US are caused by the dermatophyte *Trichophyton tonsurans* (human to human or fomite to human transmission)
- The most common cause worldwide is *Microsporum canis* (animal to human transmission)
Tinea Capitis: Clinical Presentation

- Tinea capitis may be noninflammatory (black dot, seborrheic), inflammatory (kerion) or a combination of both
- Broken hairs are a prominent feature
- Often presents with postauricular, posterior cervical, or occipital lymphadenopathy
Differential diagnosis of tinea capitis includes:

- **Seborrheic dermatitis** (erythema and greasy scale but no broken hair)
- **Psoriasis** (erythematous plaques with overlying silvery scale)
- **Atopic dermatitis** (eczematous skin lesions, severe itching and occasional broken hairs from scratching)
- **Alopecia areata** (well-demarcated, circular patches of complete hair loss)
Noninflammatory Tinea Capitis Variants

Seborrheic variant

“Black dot” variant

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KOH preparation with Chlorazol Black stain of tinea capitis, hair shaft involvement
Inflammatory Tinea Capitis: Kerion

- A kerion is a painful inflammatory, boggy mass with broken hair follicles
- A significant percentage of untreated tinea capitis will progress to a kerion
- May have areas discharging pus, frequently confused with bacterial infection
- Kerion carries a higher risk of scarring than other forms of tinea capitis
- Expeditious referral to a dermatologist (i.e. within one week) is recommended
Case One, Question 2

Tinea capitis is most common in which of the following age groups?

a. 0-4 years
b. 4-14 years
c. 15-24 years
d. 25-40 years
e. 65 years and older
Case One, Question 2

Answer: b

Tinea capitis is most common in which of the following age groups?

a. 0-4 years (seborrheic dermatitis is more common in infants and tinea capitis is more common in school-aged children)

b. 4-14 years

c. 15-24 years (less prevalent, but still seen in this group)

d. 25-40 years (uncommon in adults)

e. 65 years and older (uncommon in elderly)
Tinea Capitis: Treatment

- Topical agents are ineffective in the management of tinea capitis.
- Griseofulvin is the drug of choice in the United States. Check current dosing recommendations. Children are often undertreated.
- Terbinafine granules* have been shown to be comparable in safety and efficacy to griseofulvin.
  - Shorter treatment course
  - More effective against *M. canis* (main cause outside U.S.)

* A different formulation than the oral terbinafine used in adult dermatophyte infections
Case Two

Karla Daley
Case Two: History

- HPI: Karla is a 4-month-old healthy female infant who presents with a one week history of a bright red rash in her diaper area.
- PMH: uncomplicated spontaneous vaginal delivery, vaccinations and well child visits are up to date.
- Medications: none.
- Allergies: none.
- Social history: lives at home with parents, only child.
Case Two, Question 1

Which elements of the history are important to ask in this case?

a. Frequency of diaper changes
b. Prior history of skin disease
c. Recent or current diarrhea
d. Therapies used to treat rash
e. All of the above
Case Two, Question 1

Answer: **e**

Which elements of the history are important to ask in this case?

a. Frequency of diaper changes (wet and dirty diapers that are not changed on a regular basis contribute to the development of diaper dermatitis)

b. Prior history of skin disease (consider seborrheic dermatitis, atopic dermatitis, infantile psoriasis)

c. Recent or current diarrhea (recent diarrhea may contribute to the development of irritant diaper dermatitis)

d. Therapies used to treat rash (has the diaper dermatitis improved with certain medications or barrier creams?)

e. **All of the above**
Case Two: Skin Exam

- Further questioning reveals that the Karla’s caretaker has tried applying zinc oxide diaper paste with every diaper change but the rash is not improving.
- How would you describe these exam findings?
Case Two: Skin Exam

- Beefy red plaques with very fine white scale in the groin area
- Skin creases are involved
- Satellite papules and pustules are noted on the inner thigh and abdomen
Case Two, Question 2

Which of the following is the most likely diagnosis?

a. Atopic dermatitis  
b. Diaper candidiasis  
c. Infantile psoriasis  
d. Irritant diaper dermatitis  
e. Tinea cruris
Case Two, Question 2

Answer: b

Which of the following is the most likely diagnosis?

a. Atopic dermatitis (red skin on an edematous surface with microvesiculation, very rare in diaper area)

b. Diaper candidiasis

c. Infantile psoriasis (sharply demarcated, erythematous papules and plaques involving the folds)

d. Irritant diaper dermatitis (would have expected improvement with a barrier cream)

e. Tinea cruris (well-demarcated red/brown/tan plaques, inguinal folds are affected, rarely involves labia, scrotum or penis)
Diaper Candidiasis

- Beefy red confluent erosions and marginal scaling in the area covered by a diaper in an infant
- Satellite papules and pustules help differentiate candidal diaper dermatitis from other eruptions in the diaper area
- Suspect diaper candidiasis when rash does not improve with application of barrier creams such as zinc oxide paste, petrolatum, triple paste, etc.
- KOH preparation and fungal culture may be helpful if the diagnosis is in question
Diaper Candidiasis: Pathogenesis

- Urease enzymes present in feces release ammonia from the urine, causing an acute irritant effect leading to a disruption of the epidermal barrier
- Disruption of the epidermal barrier allows the entry of *Candida* which is present in feces
- Wet and dirty diapers that are not changed on a regular basis contribute to the development of diaper dermatitis
Diaper Candidiasis: Topical Treatment

- Nystatin cream or ointment is inexpensive and effective, as are clotrimazole and miconazole
  - Imidazoles may be irritating when used in a cream base
  - Allylamines such as terbinafine and naftifine are not as effective against candida
- If inflammation is evident, hydrocortisone 1% cream or ointment may be added, however only for a limited time due to risk of skin atrophy and/or systemic absorption with prolonged use under occlusion
- Never prescribe combination therapies with high potency topical steroids (e.g. betamethasone/ clotrimazole combination)
Diaper Candidiasis: Oral Treatment

- Oral treatment – much less commonly used
  - Oral nystatin suspension can be added to the regimen if there is oral thrush, if the rash is peri-anal, or if it recurs quickly after treatment.
- Refer to a dermatologist if the eruption is unusually severe, if it does not respond to standard therapies, or if the diagnosis is in question
- Refractory diaper dermatitis may be a marker of an underlying serious metabolic or immunologic disease (e.g. zinc deficiency, HIV, Langerhans cell histiocytosis)
Classification of Diaper Dermatitis

- **Eruptions due to the diaper environment**
  - Irritant contact dermatitis ("ammoniacal" dermatitis)

- **Eruptions exacerbated by the diaper environment**
  - Inflammatory conditions (seborrheic dermatitis, atopic dermatitis, infantile psoriasis)
  - Infectious conditions (candidiasis)

- **Eruptions not due to diaper environment**
  - Nutritional deficiency (usually zinc)
  - Many other rare secondary causes
What Is This Rash?

What’s your diagnosis?

a. Diaper candidiasis
b. Infantile psoriasis
c. Irritant dermatitis
d. Nutritional deficiency
What Is This Rash?

Answer: c

What’s your diagnosis?

a. Diaper candidiasis
b. Infantile psoriasis
c. Irritant dermatitis
d. Nutritional deficiency
Irritant Diaper Dermatitis

Exam findings:

- Erythema
- Erosion
- Spares skin folds
- Severe cases may show ulcerated papules and islands of re-epithelization
Irritant Diaper Dermatitis: Basic Facts

- An erythematous dermatitis limited to exposed areas
- Distributed over convex skin surfaces
- The skin folds remain unaffected (unlike diaper candidiasis and inverse psoriasis)
- Infrequent diaper changes predispose infants to irritant dermatitis because chronically moist skin is more easily irritated
Irritant Diaper Dermatitis: Treatment

- Should improve with application of barrier creams such as zinc oxide paste
- More frequent diaper changes; looser-fitting diapers
- Disposable diapers (especially superabsorbent varieties) are associated with less dermatitis than cloth diapers
- Try to address cause of diarrhea if present
- Candidiasis may be a complicating factor:
  - Irritant diaper dermatitis becomes colonized with *C. albicans* after 72 hours in a significant percent of cases
  - If no improvement after a trial of treatment for irritant diaper dermatitis, treat for diaper candidiasis as well
Case Three

Ella Trotter
Case Three: History

- **HPI**: Ella Trotter is a 16-month-old toddler who presents with flaking skin and greasiness of the scalp for several months. Her parents have also noticed that she now has some red areas on her face.
- **PMH**: three ear infections, vaccinations are up to date
- **Medications**: none
- **Social history**: lives at home with her parents and her two older brothers
- **ROS**: negative
How would you describe these exam findings?
Case One: Skin Exam

Diffuse, yellowish greasy scale throughout scalp
Case Three, Question 1

Which of the following is the most likely diagnosis?

a. Atopic dermatitis
b. Psoriasis
c. Scabies
d. Seborrheic dermatitis
e. Tinea capitis
Answer: d
Which of the following is the most likely diagnosis?

a. **Atopic dermatitis** (presents as erythematous patches with tiny vesicles, evolving into moist oozing and crusted lesions, less common on scalp)
b. **Psoriasis** (presents as erythematous plaques with overlying scale)
c. **Scabies** (intensely pruritic papules, often with excoriation, burrows may be present)
d. **Seborrheic dermatitis**
e. **Tinea capitis** (presents as alopecic patches of different sizes, often with broken hairs)
Diagnosis: Seborrheic Dermatitis

- Seborrheic dermatitis is thought to be due to an inflammatory reaction to *Malassezia spp.*, yeasts that are part of normal skin flora.
- Also called cradle cap when it appears on the scalp in infants and dandruff when it appears in children and adults.
- Associated with increased sebaceous gland activity and found most commonly in *infants* and in *post-pubertal patients*.
Seborrheic Dermatitis: Clinical Presentation

- Commonly affects the face, eyebrows, scalp, chest, and perineum
- Typical skin findings range from fine white scale to erythematous patches and plaques with greasy, yellowish scale
- May also cause areas of hypopigmentation
- Infantile seborrheic dermatitis, while most common on the scalp, may involve the area behind the ears, neck creases, axillae and diaper area
Case Three, Question 2

Which of the following is the most appropriate next step in management?

a. Mild baby shampoos
b. Olive oil applied to scalp daily
c. Oral ketoconazole
d. Oral terbinafine
e. Triamcinolone 0.1% cream
Case Three, Question 2

Answer: a

Which of the following is the most appropriate next step in management?

- a. **Mild baby shampoos**
- b. Olive oil applied to scalp daily (May encourage growth of Malassezia. Mineral oil or baby oil sometimes used to soften and help remove coarse scale)
- c. Oral ketoconazole (No, but topical ketoconazole shampoo may be used if persists)
- d. Oral terbinafine (Not used in children < 4, also not first-line given potential side effects)
- e. Triamcinolone 0.1% cream (No, but topical hydrocortisone 1% or 2.5% may be applied for inflamed areas for a limited period of time)
Take Home Points

- Always do a diagnostic test (KOH prep and/or fungal culture) when a child presents with a scaling rash concerning for fungal infection.
- Tinea capitis is common in inner city children, and is commonly transmitted via fomites or animals.
- Topical agents are ineffective in the management of tinea capitis (oral griseofulvin and terbinafine are first line).
- Diaper dermatitis may happen through a variety of mechanisms including irritant, inflammatory, and infectious.
- Wet and dirty diapers that are not changed on a regular basis are associated with an increased incidence of diaper dermatitis.
Diaper candidiasis involves the skin folds, while irritant diaper dermatitis does not.

In non-resolving diaper dermatitis, consider combination therapy to treat both inflammation and Candida, as they frequently coexist.

Seborrheic dermatitis is thought to be due to an inflammatory reaction to a normal skin yeast.

In infants with cradle cap, look behind the ears, in neck creases, axillae and diaper area, which are other commonly involved areas.

Seborrheic dermatitis in infants usually resolves on its own with the use of mild baby shampoos; topical ketoconazole shampoo or cream may be considered in persistent cases.
<table>
<thead>
<tr>
<th>Disease</th>
<th>Causative Agent(s)</th>
<th>Diagnosis</th>
<th>Treatment</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tinea Capitis</td>
<td>Dermatophytes</td>
<td>Clinical, KOH, culture</td>
<td>Oral anti-fungal agent (griseofulvin or terbinafine) + shampoo</td>
<td>Oral agent is critical; if diagnosis uncertain, refer to dermatology</td>
</tr>
<tr>
<td>Kerion</td>
<td>Dermatophytes</td>
<td>Clinical, KOH, culture</td>
<td>Oral anti-fungal agent (griseofulvin or terbinafine) + shampoo</td>
<td>Referral to dermatology is recommended</td>
</tr>
<tr>
<td>Candidal Diaper Dermatitis</td>
<td>Candida yeast</td>
<td>Clinical, KOH, culture</td>
<td>Topical imidazole or nystatin; good diaper area hygiene and protectants also help</td>
<td>Other rashes in diaper area can look similar; if diagnosis uncertain, refer to dermatology</td>
</tr>
<tr>
<td>Seborrheic Dermatitis (Cradle Cap)</td>
<td>Malassezia spp. yeasts (likely)</td>
<td>Clinical</td>
<td>Gentle shampoos, antifungal shampoos, mild topical corticosteroids if needed</td>
<td>KOH or culture can be performed to exclude tinea capitis; if diagnosis uncertain, refer to dermatology</td>
</tr>
</tbody>
</table>
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- Primary authors: Iris Ahronowitz, MD; Ronda S. Farah, MD; Sarah D. Cipriano, MD, MPH; Erin F. D. Mathes, MD, FAAD, FAAP; Raza Aly, PhD, MPH; Timothy G. Berger, MD, FAAD.

- Peer reviewers: Teresa S. Wright, MD, FAAD, FAAP; Renee M. Howard, MD, FAAD.

- Revisions and editing: Sarah D. Cipriano, MD, MPH; Meghan Mullen Dickman.

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End of the Module

To take the quiz, click on the following link:

https://www.aad.org/quiz/pediatric-cutaneous-fungal-infections-learners