

DIAPER RASH – CLINICAL CONSIDERATIONS AND EVALUATION

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DIAPER RASH – CLINICAL CONSIDERATIONS AND EVALUATION

DEFINITION:

Diaper rash, or diaper dermatitis, is a general term describing any of a number of inflammatory skin conditions that can occur in the diaper area.

CATEGORIES:

1. Rashes that are directly or indirectly caused by the wearing of diapers and are often the result of poor hygiene. This category includes dermatitis resulting from moisture and stool contamination, miliaria, intertrigo, candidal diaper dermatitis, secondary infections and granuloma gluteal infantum.
2. Rashes in this category include contact dermatitis resulting from sensitivity to diaper fabric, soaps used in laundry, dyes, lotions, etc. This category will not be emphasized since it has more to do with substances contained in diapers, detergents, and other products used in diaper manufacturing and hygiene.
3. Rashes that appear elsewhere but can also occur in the groin and perineum and can be exaggerated due to the irritating effects of wearing a diaper. Rashes that appear in the diaper area irrespective of diaper use include atopic dermatitis, seborrheic dermatitis, and psoriasis. This category includes such unusual rashes as bullous impetigo, Langerhans cell histiocytosis (Letterer-Siwe disease, a rare and potentially fatal disorder of the reticuloendothelial system), acrodermatitis enteropathica (zinc deficiency), congenital syphilis, scabies, and HIV.

INCIDENCE OF THE CONDITION:

Diaper rash is the most common dermatitis found in infancy. Prevalence has been variably reported from 4-35% in the first 2 years of life; incidence triples in babies with diarrhea. It is not unusual for infants to have at least 1 episode of diaper rash by the time he or she is toilet-trained.

Because fewer than 10% of all diaper rashes are reported by the family, the actual incidence of this condition is likely underestimated if office visits are used as the screening site. The incidence is lower among breastfed infants—perhaps due to the less acidic nature of their urine and stool. Babies wearing superabsorbent disposable diapers with a central gelling material have fewer episodes of diaper dermatitis compared with their counterparts wearing cloth diapers. However, keep in mind that superabsorbent diapers contain dyes that were suspected to cause allergic contact dermatitis (ACD).

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY:

Diaper rash likely results from a combination of factors that begin with prolonged exposure to moisture and the contents of the diaper (i.e., urine and feces). The main irritants in this situation are fecal proteases and lipases, whose activity is increased greatly by elevated pH. An acidic skin (neutral or low pH) surface is essential for the maintenance of the normal microflora, which provides innate antimicrobial protection against invasion by pathogenic bacteria and yeasts. Fecal lipase and protease activity is also greatly increased by acceleration of gastrointestinal transit; this is the reason for the high incidence of irritant diaper dermatitis observed in babies who have had diarrhea in the previous 48 hours. The wearing of diapers causes a significant increase in skin wetness and increase in the pH level. Prolonged wetness leads to maceration (softening) of the stratum corneum, the outer, protective layer of the skin, which is associated with extensive disruption of intercellular lipid lamellae. Weakening of its physical integrity makes the stratum corneum more susceptible to damage by (1) friction from the surface of the diaper, and (2) local irritants. The normal pH of the skin is between 4.5 and 5.5. When urea from the urine and stool mix, urease breaks down the urea, decreasing the hydrogen ion concentration (increasing pH). Elevated pH levels increase the hydration of the skin and make the skin more permeable. At full term, the skin of infants is an effective barrier to disease and is equal to adult skin with regard to permeability. However, dampness, lack of air exposure, acidic or irritant exposures, and increases in skin friction begin to break down the skin barrier.

Previously, ammonia was believed to be the primary cause of diaper dermatitis. Recent studies have disproved this, showing that when ammonia or urine is placed on the skin for 24-48 hours, no apparent skin damage occurs.

DIFFERENTIAL DIAGNOSIS:

In order to understand the clinical approach to history taking and examination of the infant who is suffering from a problematic diaper rash, a differential diagnosis must be held in mind when approaching the problem. The questions asked concerning the condition and the focus of the examination and investigation then makes more sense.

Category I

Miliaria: Occurs when the sweat gland ducts get plugged due to dead skin cells or bacteria such as *Staphylococcus epidermidis*, a common bacterium that occurs on the skin, which is also associated with acne. The trapped sweat leads to irritation (prickling), itching and to a rash of very small blisters, usually in a localized area of the skin (heat or sweat rash).



Intertrigo: Occurs when moist skin, usually lying within skin creases and folds, becomes more fragile, is hot and a good culture area for bacteria. It has a higher coefficient of friction, becomes damaged from maceration and chafing, eventually resulting in a skin-infected area.



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Contact dermatitis: Irritant contact dermatitis is most likely made up of some combination of intertrigo and miliaria. In addition, it has been shown to result from the irritating effects of mixing urine with feces. This alkaline urine causes activation of fecal lipases, ureases, and proteases. These, in turn, irritate the skin directly and increase its permeability to other irritants.

Candidal diaper dermatitis: Once the skin is compromised, secondary infection by the yeast organism, *Candida albicans*, is common. Between 40% and 75% of diaper rashes that last for more than 3 days are colonized with *C. albicans*. *Candida* has a fecal origin, and is not an organism normally found on perineal skin. Amoxicillin was found to increase the colonization by *C. albicans* and worsens the diaper dermatitis.



Bacterial diaper dermatitis: Bacteria may play a role in diaper dermatitis through reduction of fecal pH, resulting in the activation of enzymes. Additionally, fecal microorganisms probably contribute to secondary infections, when they occur. This is particularly evident with bullous impetigo in the diaper area, which causes bullae that are flaccid but sometimes tense due to *Staphylococcus aureus* infection, or a cellulitis due to cutaneous streptococci, or even a folliculitis due to *S. aureus* infection.

Polymicrobial growth is documented in at least half of diaper rash cultures. *Staphylococcus* species are the most commonly grown organisms, followed by *Streptococcus* species and organisms from the family Enterobacteriaceae. Nearly 50% of isolates are anaerobes.

GENERAL HISTORY TAKING QUESTIONS FOR DIAPER RASH:

1. How long has the rash been present? When did it start?
2. Is there associated pain, itching, scratching, bleeding?
3. Any accompanying fever?
4. Is the rash wet and weeping? or dry and scaling?
5. Are there food issues causing diarrhea or allergies?
6. Have there been recent infections, such as colds, sore throat, other skin infections?
7. Have other family members had infections, rashes, or intestinal upsets?
8. What factors worsen, and what factors might alleviate the problem?
9. Has there been any skin trauma, for example burns from hot water?
10. Is there family history of other rash-like conditions?

CLINICAL EVALUATION OF DIAPER RASH – CORRELATION OF HISTORY AND EXAMINATION:

Diagnosis of condition	History	Physical examination
Category I conditions – these are the more common causes of diaper rash		
Miliaria (heat or sweat rash)	<ul style="list-style-type: none"> • Usually follows a bout of diarrhea • Exacerbated by scrubbing and the use of commercial wipes or strong detergents • Lasts < 3 days after more diligent diaper changing practices are initiated 	<ul style="list-style-type: none"> • Consists of multiple discrete, pruritic, erythematous papulovesicles, and sterile vesiculopustules • Similar lesions on the face, neck, and axilla may be present
Irritant contact dermatitis	<ul style="list-style-type: none"> • Usually follows a bout of diarrhea • Exacerbated by scrubbing and the use of commercial wipes or strong detergents • Lasts < 3 days after more diligent diaper changing practices are initiated • Asymptomatic 	<ul style="list-style-type: none"> • Mild forms consist of shiny erythema with or without scale • Margins are not always evident • Moderate cases have areas of papules, vesicles, and small superficial erosions • It can progress to well-demarcated ulcerated nodules that measure a centimeter or more in diameter • It is found on the prominent parts of the buttocks, medial thighs, and genitalia • Skin folds are spared or involved last • Tidemark dermatitis refers to the bandlike form of erythema of irritated diaper margins

		<ul style="list-style-type: none"> • Diaper dermatitis can cause an id (autoeczematous) reaction outside the diaper area
Intertrigo (irritated folds)	<ul style="list-style-type: none"> • Usually follows a bout of diarrhea • Exacerbated by scrubbing and the use of commercial wipes or strong detergents • Lasts < 3 days after more diligent diaper changing practices are initiated • Asymptomatic 	<ul style="list-style-type: none"> • Occurs in skin creases where skin surfaces are in apposition • Characterized by slight to severe erythema in the inguinal area, intergluteal area, or folds of the thighs • Pustules or erosions are not present. May become infected
Candidal diaper dermatitis	<ul style="list-style-type: none"> • Lasts even after more diligent diaper changing practices are started • Should be suspected in all rashes lasting > 3 days (<i>Candida</i> is isolated in 45-75% of such cases) • Painful - Parents often report severe crying during diaper changes or with urination and defecation • May follow recent antibiotic use 	<ul style="list-style-type: none"> • Distinctive clusters of erythematous papules and pustules are present, which later coalesce into a beefy red confluent rash with sharp borders • Satellite lesions frequently are found beyond these borders • Skin folds commonly are involved • White scales may be observed occasionally • The oropharynx should be inspected for the white plaques of thrush
Secondary bacterial infection	<ul style="list-style-type: none"> • Fever • Pustular drainage • Lymphangitis 	<ul style="list-style-type: none"> • Edema • Erythema • Tenderness • Purulent discharge • Red streaking
<p>Category III conditions – these are uncommon and even rare conditions, which can cause diaper rash and are included to complete the differential diagnosis</p>		
Granuloma gluteal infantum	<ul style="list-style-type: none"> • Rash lasts months • Resistant to treatments with barrier creams, antifungal agents, and topical steroids • Not very well understood, but probably represents an unusual inflammatory response to long-standing irritation, candidiasis, or fluorinated corticosteroids • Rare disorder • Asymptomatic 	<ul style="list-style-type: none"> • Uncommon disorder • Painless reddish-brown to purplish nodules are observed • These granulomatous nodules can have large, raised erosions with rolled margins and a purple, almost Kaposi sarcoma–like color • Nodules range in size from 0.5-4 cm

		<ul style="list-style-type: none"> • Limited to prominent areas of the groin, such as the thighs, abdomen, and genitalia • Axilla and neck involvement has been reported • Jacquet diaper dermatitis (dermatitis syphiloides posterosiva) is a term used to describe a severe noduloerosive lesion with an umbilicated or craterlike presentation in the diaper area. It is probably closely related to granuloma gluteal and is a variant of diaper dermatitis
Atopic dermatitis	<ul style="list-style-type: none"> • Family or personal history of allergic rhinitis, hay fever, or asthma is common • Pruritic • Associated with current or previous flares of rash on the face and extensor limb surfaces in infants 	<ul style="list-style-type: none"> • Acute lesions appear as poorly demarcated, erythematous, scaly, weepy, and crusted • Chronic lesions are poorly defined, thickened, hyperpigmented, and often excoriated • Lichenification can occur with chronic disease • Distribution rarely involves the diaper area. It is more commonly observed on the face and extensor limb surfaces in children of diaper-wearing age
Seborrheic dermatitis	<ul style="list-style-type: none"> • Usually occurs in infants aged 2 weeks to 3 months • Consists of an eruption of an oily, scaly, crusted dermatitis of the scalp (cradle cap), face, retroauricular regions, axilla, and presternal areas • Any child with widespread seborrheic dermatitis, diarrhea, and failure to thrive should be evaluated for Leiner disease, a functional defect of the C5 component of complement • Asymptomatic 	<ul style="list-style-type: none"> • Well-demarcated erythematous patches or plaques with an occasional greasy yellow scale • When found in the groin area, the skin creases show more severe involvement • Skin folds are not spared • There are no satellite lesions • Oily, scaly, crusted lesions also can be found in areas with a predominance of sebaceous glands (e.g., scalp, face, retroauricular regions, axilla, presternal area)

Psoriasis	<ul style="list-style-type: none"> • A family history of psoriasis can be a clue • Not responsive to barrier creams, antifungal agents, and standard topical steroids • Involved areas include the scalp and nails 	<ul style="list-style-type: none"> • Bright, red, well-defined plaques • Unlike typical psoriatic lesions elsewhere, silvery scales usually are not present in the diaper area due to the dampness of the area • Inguinal folds typically are involved • Involvement outside the diaper area is most common (>90% of cases) and may appear as retroauricular erythema or as nail dystrophy or pitting
Impetigo	<ul style="list-style-type: none"> • Common in the first 6 months of life • Usually occurs during the warmer summer months • Potentially contagious 	<ul style="list-style-type: none"> • Vesicles, pustules, bullae, or crusts are commonly found in the periumbilical area • In the diaper area, bullae are not usually intact • They actually present as superficial erosions with a thin peripheral rim of bullous tissue • Usually a group A streptococcal infection
Langerhans cell histiocytosis	<ul style="list-style-type: none"> • Severe hemorrhagic diaper dermatitis unresponsive to any treatment • Other involved areas include the scalp and retroauricular areas • Diarrhea 	<ul style="list-style-type: none"> • Discrete, yellow-brown scaly or erythematous papules, purpuric papules, petechiae, deep ulcerations, and skin atrophy are present • Hemorrhagic features are typical • Usually involves skin folds • May have associated anemia, lymphadenopathy, and hepatosplenomegaly • May have associated involvement of the CNS, lungs, bones, and bone marrow
Acrodermatitis enteropathica	<ul style="list-style-type: none"> • Associated with diarrhea, hair loss, and erosive perioral dermatitis • Patient may have a predisposition for malabsorption (i.e., cystic fibrosis) or malnutrition 	<ul style="list-style-type: none"> • Typically involves the perioral, perineal, and acral areas • Erythematous, well-demarcated, scaly plaques and erosions • Alopecia and growth failure • Irritability

Congenital syphilis		<ul style="list-style-type: none"> • Symmetric desquamation of palms and soles can be found • Papulosquamous, reddish-brown lesions are observed in the diaper area. Rarely, these can be erosive or bullous • Associated with anemia, hepatosplenomegaly, jaundice, and osseous lesions
Scabies	<ul style="list-style-type: none"> • Acute onset • Pruritic • History of close contacts with recent onset of a similar erythematous serpiginous eruption • Concurrent rash may be found in web spaces of hands or feet 	<ul style="list-style-type: none"> • Papules, vesicles, burrows, nodules, and excoriations are found • The generalized distribution has a predilection for the palms, soles, face, scalp, and genitalia
Human immunodeficiency virus	<ul style="list-style-type: none"> • History of HIV exposure or risk factors • Associated cytomegalovirus or herpes infection • Mild forms consist of shiny erythema with or without scale 	<ul style="list-style-type: none"> • When this presents as a diaper rash, severe erosions and ulcerations are often present • Distribution to the perineal area, especially the gluteal cleft, may be observed
Perianal pseudoverrucous papules		<ul style="list-style-type: none"> • This condition is characterized by 2-8 shiny, smooth, red, moist, flat-topped, round lesions with acanthosis or psoriasiform spongiotic dermatitis • Most commonly confused with genital warts • Perianal pseudoverrucous papules and nodules can occur in the context of Hirschsprung disease

LABORATORY STUDIES:

Routine tests

- The primary forms of diaper rash generally can be diagnosed clinically. Laboratory studies have few indications and limited utility.
- A complete blood count may be helpful, especially if a fever is present and a secondary bacterial infection is suspected.
- The finding of anemia in association with hepatosplenomegaly and the appropriate rash may suggest a diagnosis of Langerhans cell histiocytosis or congenital syphilis
 - When suspecting congenital syphilis, relevant serology should be sent
 - Dark field microscopic examination for spirochetes from any bullous lesion scrapings can be performed.
- Cultures of draining lesions and obvious infections are indicated for antibiotic sensitivity.
- Gram stain or culture of the characteristic bullae of impetigo for *S. aureus* can confirm this diagnosis.
- Routine cultures demonstrate polymicrobial infections (e.g., streptococci, Enterobacteriaceae, and anaerobes) in nearly one half of cases.
- Potassium hydroxide (KOH) scrapings from a fresh papular or pustular lesion may demonstrate pseudohyphae in suspected cases of candidiasis. However, these may be absent in long-standing cases.
- Finding mites, ova, or feces on a mineral oil preparation of a burrow scraping can confirm the diagnosis of scabies.

Other Tests

- Serum zinc level of less than 50 mcg/dL can confirm acrodermatitis enteropathica.

Procedures

- Skin biopsy can be performed to help differentiate granuloma gluteal infantum from granulomatous and neoplastic processes.
 - Histopathology: granuloma gluteal infantum presents as nonspecific dermal inflammatory infiltrate composed of neutrophils, lymphocytes, histiocytes, plasma cells, occasional giant cells, and eosinophils, sometimes with an increase in the number of capillaries.
 - Examination of granuloma gluteal using an electron microscope reveals 3 types of giant cells: in the first type, the cells have widely enlarged endoplasmic reticulum; in the second type, they phagocytize erythrocytes; and in the third type, they have vesicles and granules and are similar to histiocytes. The name

granuloma gluteal infantum is a misnomer since no granulomas are found in these lesions.

- Skin biopsy also is used to confirm the diagnosis of Langerhans cell histiocytosis.

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