

ORIGINAL ARTICLE

Differential diagnoses of diaper dermatitis

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Abstract

Diaper dermatitis is the most common contact eczema present in early childhood. The main cause is an irritant reaction to urine and feces, which is facilitated by the occlusive conditions under the diaper, leading to hyperhydration of the stratum corneum (diaper dermatitis). In addition, diaper pressure and friction can increase the risk of skin inflammation, which also opens the skin up to other irritant agents, allergens, and infectious agents, such as *candida albicans*. However, a variety of diseases are associated with inflammation of the skin in the diaper region, therefore the term “diaper dermatitis” is merely descriptive and does not reflect anything about the etiopathogenesis. The term diaper dermatitis refers only to an inflammation in the diapering area and should not be automatically equated with reactions to diapers. Making the correct diagnosis requires a thorough examination of the skin in its entirety and a detailed report of the patient's medical and family history. Once a specific pattern is identified, a precise diagnosis, and an appropriate therapy, can be determined.

KEYWORDS

autoimmune diseases, diagnoses, diaper dermatitis, diaper rash, eczematous diseases, infectious diseases, napkin dermatitis, neoplasia, nutritional diseases, psoriasis

1 | INTRODUCTION

Diaper dermatitis can be identified as an irritating reaction to urine and stool under the occlusive condition of diapers. The term diaper dermatitis refers only to an inflammation in the diapering area and should not be automatically equated with reactions to diapers. Many dermatoses in early childhood involve the diaper region, either isolated or in the context of generalized dermatoses or systemic diseases. This ranges from inflammatory dermatoses such as psoriasis and atopic dermatitis, infections (eg, bullous impetigo), metabolic diseases (eg, Acrodermatitis enteropathica), and autoimmune diseases (eg, Lichen sclerosus) to neoplasias (eg, Langerhans cell histiocytosis).^{1,2}

Each disease shows its own pattern, which consists of the morphology, the distribution of the lesions, the general condition of the patient, the patient's medical history, and the familial medical history.

Besides the morphology and the distribution of lesions, anamnestic data are helpful to make the right diagnosis. The following questions have been proven as a diagnostic help:³

1. How long has the diaper dermatitis persisted? The average onset age of irritant diaper dermatitis is usually between 9 and 12 months of age. If there are skin lesions present before or after this time, there may be other reasons for the inflammation.
2. Which areas are mainly involved? The inflammation of the convex surfaces in contact with the diaper (inter alia medial thighs, genitalia as labia majora and scrotum, and lower abdomen) refer to standard diaper dermatitis.
3. Does the infant show stigmata or other findings of inflammatory disorders, like atopic dermatitis, psoriasis, or seborrheic eczema? Is there a family history of any of these diseases?
4. What is the cleansing routine? Do parents/caregivers use soap or baby wipes? How often is the infant washed?
5. Which diapers and which emollient creams are used (disposable or cloth)? Are there hints for allergic contact dermatitis due to agents of the diaper (rubber substances, dyes) or to the emollient crème (fragrances, preservatives)?
6. Is there a temporal context to weaning or to the introduction of new foods?

7. Does the infant suffer from gastroenteritis or other bowel diseases associated with diarrhea?
8. Does the child take antibiotics or other medications associated with diarrhea?
9. Are the skin lesions accompanied by pain or pruritus?

It is essential to properly diagnose diaper dermatitis and its accompanying inflammation in order to encourage healthy skin development in infants. This development is critical in the support of infants as they grow and their skin becomes fully functional. Failure to address the inflammation brought about by diseases in

diapered skin area could lead to long-term negative health outcomes.

The following article will focus on diverse diseases in the area of the diaper, including eczematous diseases, psoriasis, infectious diseases, nutritional diseases, autoimmune diseases, and neoplasia. As not all skin alterations in the diaper area can be attributed as diaper dermatitis, it is necessary to identify factors that differentiate individual reactions. The specific pattern of irritation can be determined by reviewing a combination of factors, consisting of morphology and distribution of skin lesions, general condition of the patient, and the patient and familial anamnestic data (Table 1).

TABLE 1 Diaper dermatitis: Differential diagnoses

Disease	Cause	Morphology/distribution	General condition	History of patient	Family history
Eczematous diseases and psoriasis					
Contact dermatitis					
Irritative	Scrubbing of diapers, contact to irritants (stool, urine)	Erythema, papules, scaling/convex surfaces	Good	Not specific	Not specific
Allergic	Allergy to substances of diaper and/or emollients	Erythema, vesicles, scaling/convex surfaces, areas of contact	Good	Not specific	Not specific
Infantile seborrheic dermatitis	Not known, association to <i>Malassezia spec.</i>	Yellowish scales, erythema/skin folds, scalp	Good	Not specific	Not specific
Infantile atopic dermatitis	Genetic and environmental influence	Convex surfaces, eczematous lesions/scalp, cheek, extensor of the extremities	Pruritus, associated with food allergy and infantile asthma	Not specific	Atopic diseases of parents and/or siblings
Infantile psoriasis	Genetic and environmental influence	Erythematous plaques/convex areas, navel, inguinal folds	Good	Not specific	Psoriasis of family members
Infections					
Scabies	<i>Sarcoptes scabiei</i> mites	Polymorphic lesions/skin folds, palmoplantar	Pruritus	Contact with affected persons	Family members also affected
Candida infections	<i>Candida albicans</i>	Papules and pustules/satellite lesions of diaper dermatitis	-	Follows irritative dermatitis	Not specific
Perianal streptococcal and staphylococcal dermatitis	Streptococci, Staphylococci	Perianal erythema, fissures	Pruritus, burn, pain, mainly after defecation	Tonsillitis in some cases	Tonsillitis of family members
Nutritional disease					
Acrodermatitis enteropathica	Mutation of SLE 39A gene	Psoriasiform plaques/periorificially, acral	Diarrhea, alopecia	2-3 wks after weaning	-
Autoimmune and diseases of unknown cause					
Lichen sclerosus	Unknown	Erythema, in the course of disease atrophy, hemorrhagic/vulvar, perianal	Pain, dysuria, pruritus	Not specific	Not specific
Kawasaki disease	Unknown	Erythema and edema/diaper area, hands, feet, lips	Coronary aneurysm	Fever, no response to antibiotics, lymphadenopathy	-
Neoplasia					
Langerhans cell histiocytosis	Unknown	Impetigo-like lesions in skin folds, exudative papules perianal, seborrheic dermatitis-like lesions at the temples	Related to involvement of other organs (mainly bones, lung, liver)	-	-

This article aims to aid in the differential diagnoses of skin issues on the diapered skin area. By taking into account the varied diseases and skin alterations, the following information will guide the ability to properly identify and treat common ailments that infants face.

2 | ECZEMATOUS DISEASES AND PSORIASIS

2.1 | Contact dermatitis

Contact dermatitis is mainly irritating in nature, although allergic contact dermatitis also occurs in infants, and has been associated with disperse dyes, preservatives, emulsifiers, fragrances, adhesives, and rubber accelerators. Modern disposable diaper construction avoids these materials, instead utilizing biologically inert polymers that commonly come into contact with the skin.^{4,5}

The irritant contact dermatitis is clinically characterized by erythema, papules, and scaling in the area of contact with the diaper. These are the convexities of the skin, including buttocks, inner sides of the thighs, mons pubis, and genitalia (labia, scrotum) (Figures 1 and 2).

The allergic contact diaper dermatitis involves the whole area, including the folds (Figures 3 and 4).

The differential diagnoses of contact dermatitis are psoriasis and seborrheic eczema, which can typically involve the diaper area. As for atopic eczema, lesions rarely appear in the diapered area for most infants with this diagnosis.

In recent history, the prevalence and severity of contact dermatitis has decreased with the use of disposable diapers, which have been designed to be superabsorbent and to help to prevent hyperhydration of the skin.

2.2 | Infantile seborrheic eczema

Infantile seborrheic eczema is a benign inflammatory skin disease which typically manifests during the neonatal period, around the third week of life. The identifying irritation appears on the face and the scalp, as well as in the diaper area and other skin folds



FIGURE 1 Classic irritant diaper dermatitis, involving the convexities of the genitoanal skin

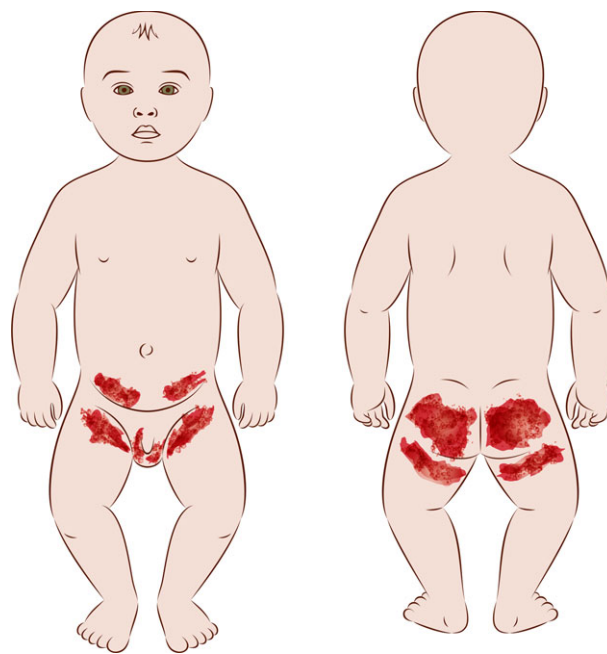


FIGURE 2 Irritative contact dermatitis



FIGURE 3 Allergic contact eczema of the folds and the convexities of the skin due to application of calendula ointment

(Figure 5). While *Malassezia* yeasts are associated with adult seborrheic eczema, their role in the etiology of infantile seborrheic dermatitis is conflicting.^{6,7}

In severe cases of this irritation, the trunk and extremities are also affected. Morphologically, salmon-colored plaques with yellow scales (on palpation very fatty aspect) are typical, and compared to atopic eczema, and contact eczema, there is only mild or no pruritus. Regression occurs after a few weeks.

2.3 | Infantile atopic eczema

Infantile atopic eczema (AE) is typically sparse in the diapered area due to high hydration under the occlusive conditions of the diaper (Figures 6A and 7). However, in rare cases, the disease is also seen

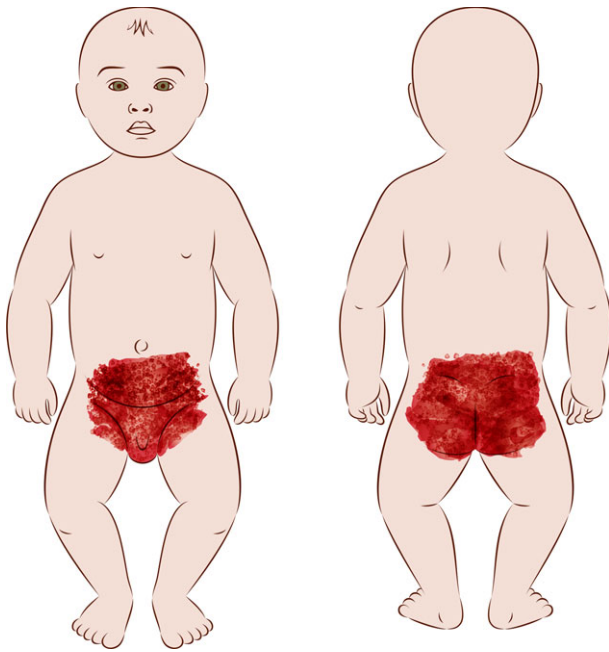


FIGURE 4 Allergic contact dermatitis

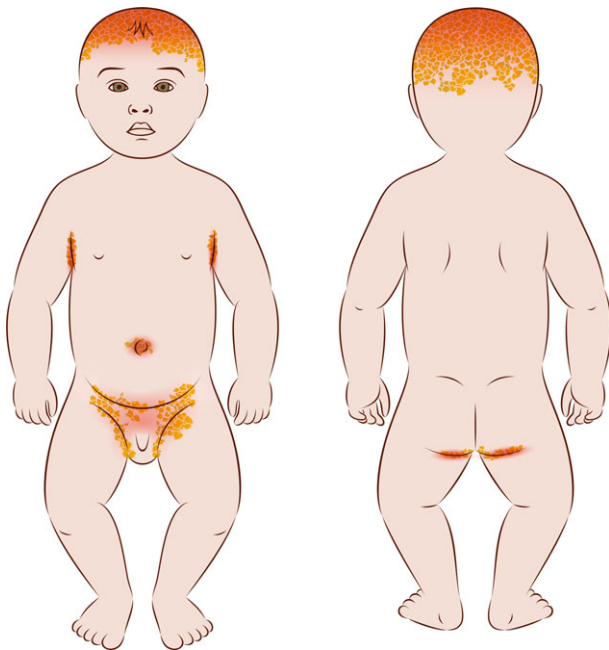


FIGURE 5 Infantile seborrheic eczema

in this area (Figure 6B). It is always necessary to look for other predilection sites of AE, stigmata of atopy and excoriations, and for a family history of atopic diseases.⁸

2.4 | Infantile psoriasis

The diaper area is a typical predilection site of infantile psoriasis, which may be triggered by group-A beta hemolytic streptococcus of pharyngitis or by perianal streptococcal dermatitis. Infantile psoriasis shows sharply demarcated red plaques with typical involvement of

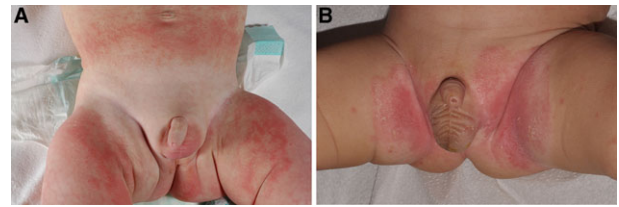


FIGURE 6 (A) Atopic dermatitis, sparing the area of the diaper. (B) Atopic dermatitis, including the diaper area (very rare)

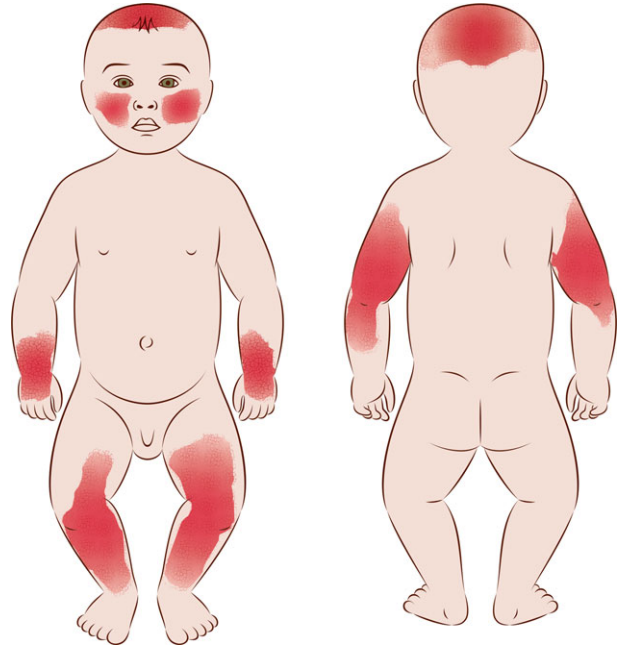


FIGURE 7 Infantile atopic eczema

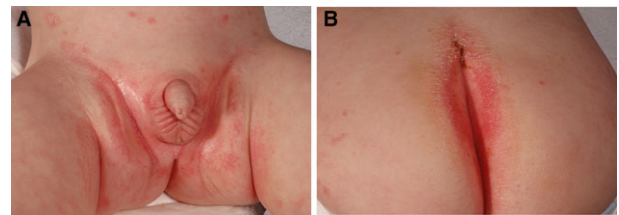


FIGURE 8 A&B, Infantile Psoriasis, mainly involving the folds with sharply demarcated erythematous plaques, which show only discrete scaling because of the hydration

the folds (Figure 8A, B). To properly diagnose psoriasis, it is necessary to look for psoriatic lesions in other predilection sites, including the scalp, umbilicus, external auditory canals, periauricular region, and perianal fold³ (Figure 9).

3 | INFESTATIONS AND INFECTIONS

3.1 | Scabies

Scabies is an exceedingly common infection diagnosed both world-wide and in every age group, including in infancy. The diaper area is

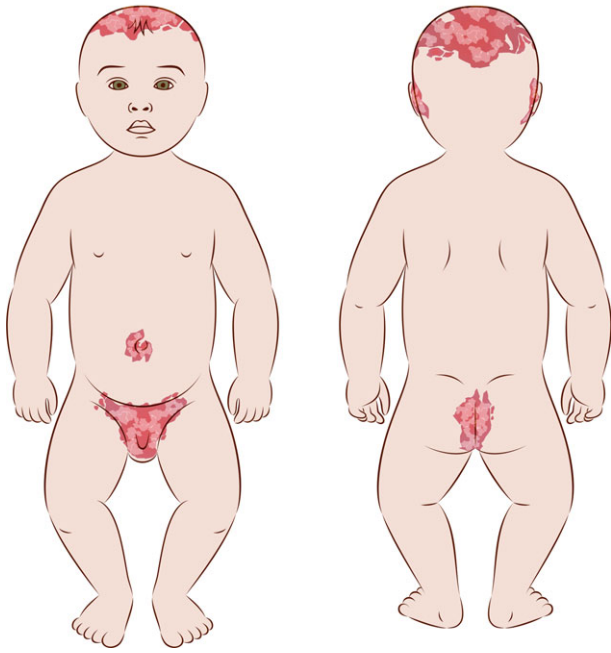


FIGURE 9 Infantile psoriasis

one of the predilection sites: not only in the active phase of scabies, but also after successful therapy with the postscabious granulomas. In the early stage of scabies, there are specific identifiers that aid in diagnosis: involvement of the face and head; developing polymorphic eczematous lesions with vesicles; papules, pustules, and scaling; and presenting vesicles and pustules palmoplantar⁹ (Figure 10). The eczematous lesions and pruritus are related to a cellular immune response to *Sarcoptes scabiei* mites, their eggs, and feces, which can be identified by microscopical and dermoscopic examinations.⁹ The

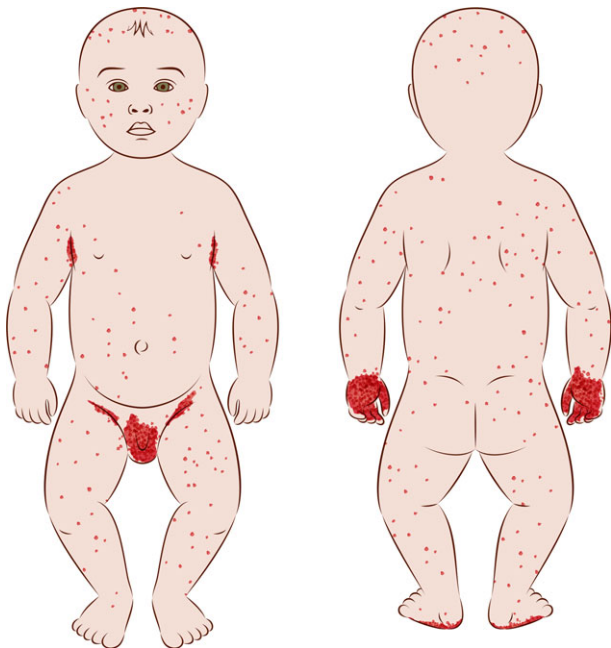


FIGURE 10 Infantile scabies



FIGURE 11 Diaper dermatitis with satellite pustules and papules reflecting *Candida albicans*-infection

therapy of choice is 5% permethrin, with alternative therapy options being Crotamiton and 10% Benzylbenzoate.^{9,10}

3.2 | Candida infection

A *Candida* infection diagnosis is not uncommon in the course of diaper dermatitis. Clinically erythematous and scaly plaques involving the folds with satellite papules and pustules are common characteristics¹¹ (Figures 11 and 12). Frequently, children are treated with systemic antibiotics, and since there may be other diseases that cause pustules, a potassium hydroxide preparation (KOH) should be used to confirm the diagnosis of candida diaper dermatitis and properly guide treatment.¹² The disease responds efficiently to topical anti-fungal therapy.

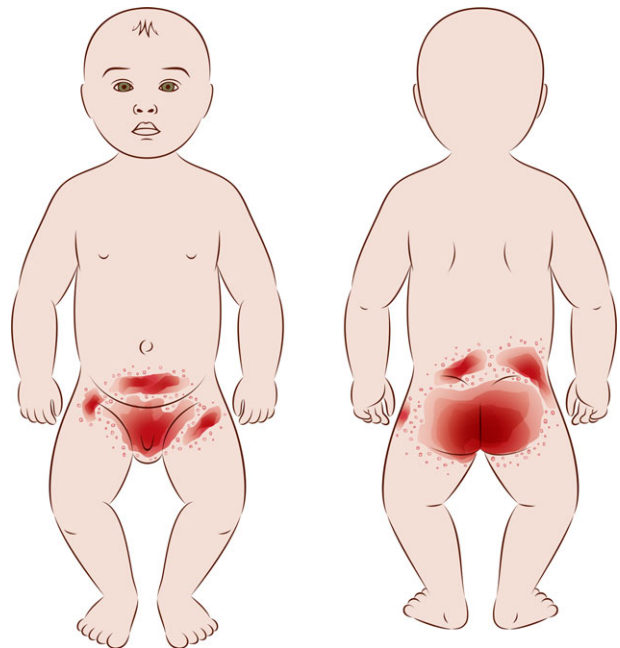


FIGURE 12 Candida infection

3.3 | Perianal streptococcal- and staphylococcal dermatitis

Perianal streptococcal dermatitis is related to *Streptococcus pyogenes*. The source of this infection has been identified to frequently originate from streptococcal tonsillitis of the patient or other family members. Morphologically, there is persistent localized erythema perianal accompanied by itching and burning, which may be very severe following defecation⁷ (Figures 13 and 14).

Therapy of choice is oral penicillin, which should be given over 3 weeks.⁷ Other authors recommend cephalosporins (eg, cefuroxime), based on their studies.¹³ It should be noted that perianal streptococcal dermatitis can also trigger infantile psoriasis, as can streptococcal tonsillitis.



FIGURE 13 Perianal streptococcal dermatitis, sharply demarcated erythema

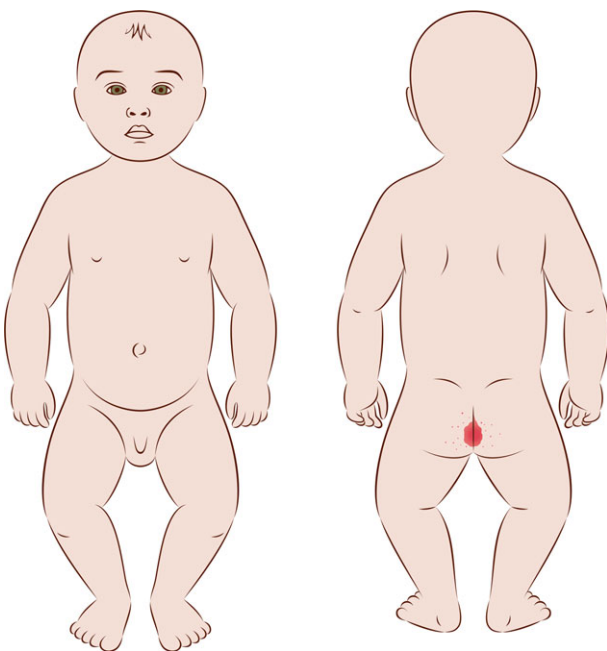


FIGURE 14 Perianal streptococcal and staphylococcal dermatitis

Perianal staphylococcal dermatitis is identical in clinical appearance to perianal streptococcal dermatitis and should be treated with systemic antibiotics, although some authors recommend topical treatment such as mupirocin.²

4 | NUTRITIONAL DISEASES

4.1 | Acrodermatitis enteropathica

Acrodermatitis enteropathica is an autosomal recessive disorder with hypozincaemia due to mutation in the SLC39A4 gene that encodes the zinc transporter protein ZIP4.¹⁴ The symptoms, which usually develop a few weeks after weaning, include skin lesions, alopecia, and diarrhea. Highly exudative periorificial and acral lesions are dermatological characteristics of this disorder (Figures 15A, B and 16). It is remarkable how quickly symptoms improve with zinc substitution, which should be administered consistently for the patient's life.¹⁴

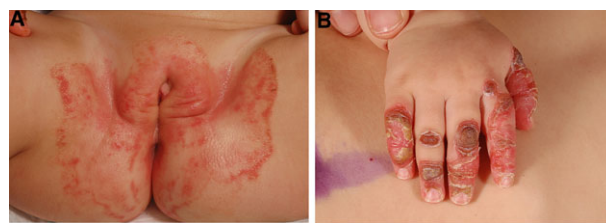


FIGURE 15 (15A) Acrodermatitis enteropathica (AE) with Tinea-like lesions in the diaper area. (15B) Exudative psoriasiform lesions

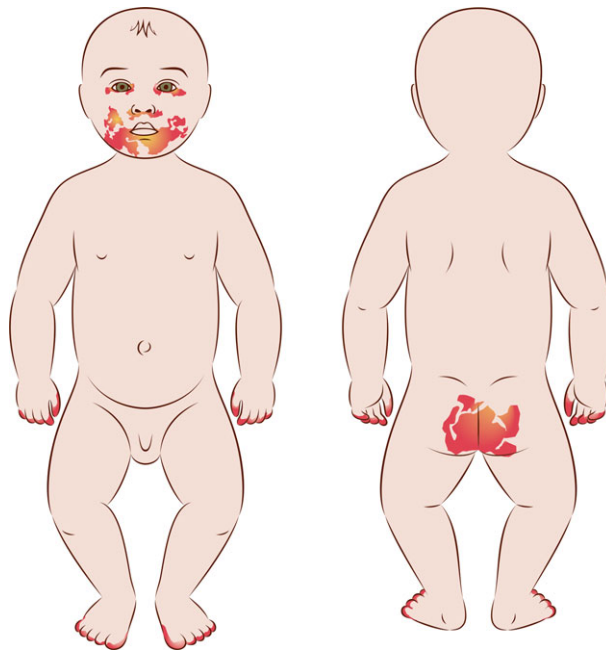


FIGURE 16 Acrodermatitis enteropathica

5 | AUTOIMMUNE AND DISEASES OF UNKNOWN CAUSE

5.1 | Lichen sclerosus

Lichen sclerosus (LS) (synonym: *Lichen sclerosus et atrophicus*) is not as common in childhood when compared with adults; however 7%–15% of cases are believed to occur in children.¹⁵

Lichen sclerosus is an autoimmune disease of unknown cause. The main predilection site is the anogenital area, while extragenital manifestation is rare. Morphologically, in early stage LS, there are sharply demarcated erythema and slight scaling. As the LS progresses, white, pearly, and/or atrophic patches are visual characteristics of the disease (Figures 17 and 18). These lesions form a “figure-17” distribution at the vulvar and perianal skin in girls and similar



FIGURE 17 Lichen sclerosus, white pearly patches of the labia and perianal region (figure eight distribution). Note the hemorrhagic lesions

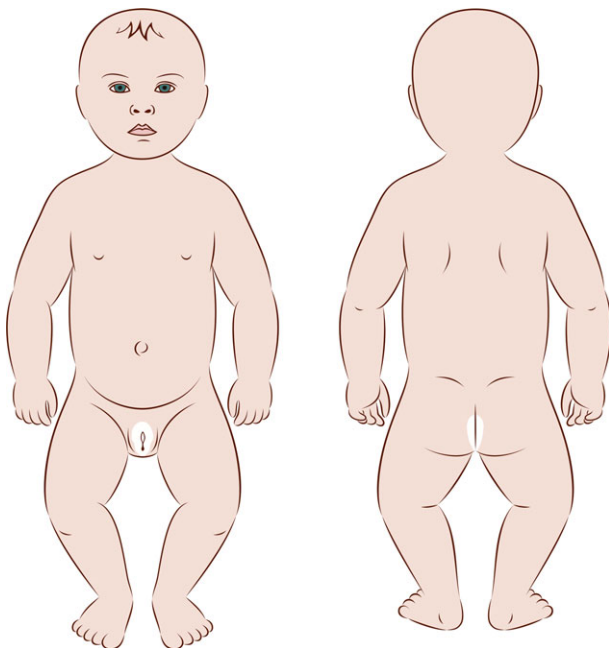


FIGURE 18 Lichen sclerosus

lesions on the foreskin in boys, both of which result in phimosis. Hemorrhagic lesions can occur in LS, and should not be confused with child abuse.

Other differential diagnoses include infections, such as candidiasis and perianal streptococcal dermatitis, as well as eczematous diseases, such as contact eczema and atopic eczema.

Therapies of choice are topical anti-inflammatory drugs, such as corticosteroids (potent options are recommended) and calcineurin inhibitors.¹⁵ The possibility of recurrence should be considered in treatment plans, as well as the development of carcinoma — however, the latter has only been seen in adults. Regular follow-up visits are recommended.

5.2 | Kawasaki disease

Kawasaki disease is the most common systemic vasculitis in children, and it affects mainly infants and young children. The cause is not known, but the diagnosis is based on a constellation of clinical findings that appear in a typical temporal sequence.¹⁶ Recent guidelines were proposed by the American Heart Association (AHA) in 2017.¹⁶

The initial symptoms include erythema and edema of the hand, feet, and lips, and, in some cases, the diaper area (Figures 19 and 20).¹⁷ In addition, symptoms can include conjunctival injection, strawberry tongue, and fever, the latter of which does not respond to antibiotics. As the disease progresses, the previously erythematous and edematous areas, including the diaper area, show desquamation. However, diagnosis and the initiation of the therapy should begin as early as possible, so to prevent severe complications. These complications can include of aneurysm of the arteries, mainly the coronary arteries, as well as obliteration of the vessels due to a thrombocytosis in the course of the disease. These risks help explain common treatment with high-dose aspirin, which should be given in combination with immunoglobulins.

If the disease is suspected, investigation of echocardiography and early therapeutic measurements are crucial. It should be considered that children can present with incomplete or atypical forms of Kawasaki disease.¹⁶

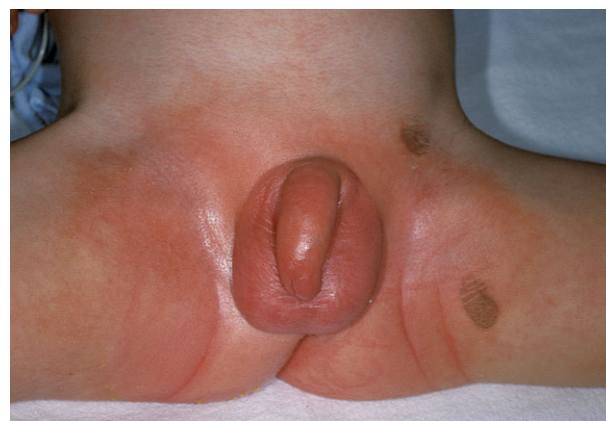


FIGURE 19 Erythema and edema in a patient with Kawasaki disease

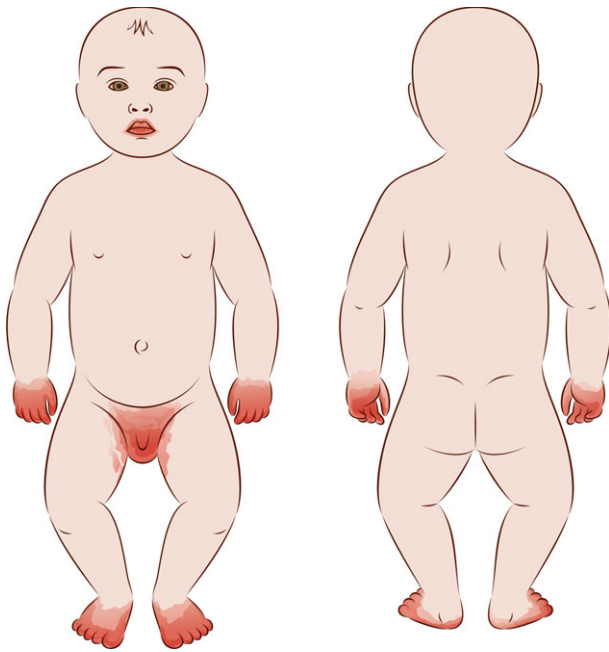


FIGURE 20 Kawasaki disease

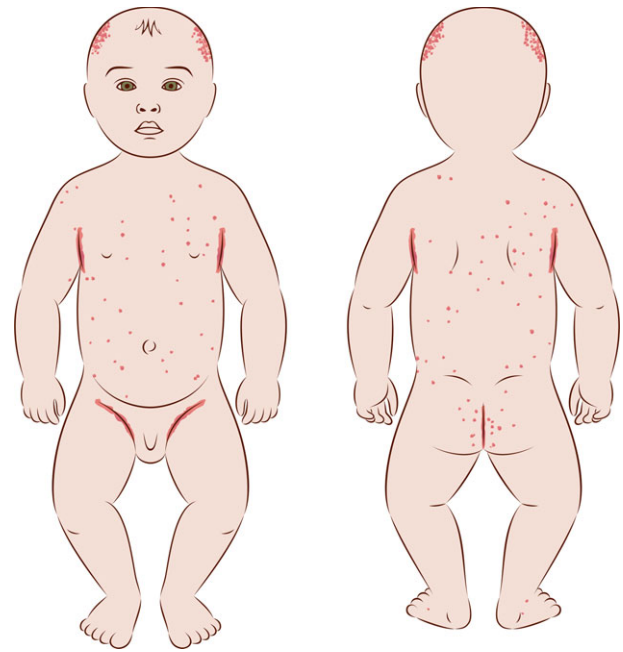


FIGURE 22 Langerhans cell histiocytosis

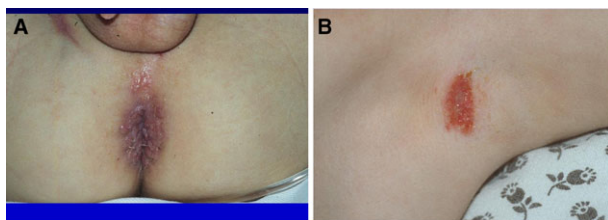


FIGURE 21 (21A) Langerhans cell histiocytosis, exudative papules around the anus. (21B) Langerhans cell histiocytosis, impetigo-like lesion in the axilla

6 | NEOPLASIA

6.1 | Langerhans cell histiocytosis

Infantile Langerhans cell histiocytosis (LZH) is a rare disease which occurs mainly in the first 3 years of life due to a proliferation of Langerhans cells in different organs. The cause is not known, and only the skin is often affected. The lesions are very distinct and include: impetigo-like lesions in the axillary and inguinal folds (Figure 21A); exudative papules around the anus (Figure 21B); a rash at the scalp resembling seborrheic dermatitis; and a rash of the trunk, characterized by yellowish to reddish-brown papules, commonly showing hemorrhagic crusts (Figure 22). The diagnostic measurement of immunohistology shows CD1a- and S-100-positive cells.

In general, treatment should be done with pediatric oncologists. The therapy is dependent on the number of organs involved and whether the spleen, lungs, liver, or the haematopoietic system are infiltrated.^{18–20} Systemic corticosteroids, vinblastine, etoposide, methotrexate, cyclosporine, and radiotherapy are used. Recently B-Raf and MEK

inhibitors are suggested as a promising therapy, however further studies are required.²¹

7 | CONCLUSION

Diaper dermatitis is characterized by inflamed skin in the area of the diaper. Since this inflammation is very common in early childhood, the lesions will be often prematurely diagnosed as diaper dermatitis, which occurs mainly due to an irritant reaction to urine and feces under the occlusive conditions of the diaper. This irritation is associated with infections such as candida infection and contact dermatitis (irritative and allergic causes). However, immediately diagnosing inflamed skin as diaper dermatitis is premature, as it is necessary to consider many other inflammatory diseases typically located in this region. Some are life-threatening, requiring timely diagnosis and therapy.

The differential diagnoses of diaper dermatitis include infections (eg, bullous impetigo), chronic inflammatory dermatoses, such as psoriasis and atopic dermatitis, metabolic diseases (eg, Acrodermatitis enteropathica), autoimmune diseases (eg, Lichen sclerosus), and also neoplasias (eg, Langerhans cell histiocytosis). Once a cause has been appropriately determined, as well as its associated disease state, these observations will inform the course of treatment moving forward. Misdiagnosis of critical skin conditions as diaper diagnosis can be harmful to the infant's health, delaying necessary (and occasionally life-saving) treatment.

CONFLICT OF INTEREST

Honoraria and consultancy fees: Procter & Gamble (World Congress of Pediatric Dermatology 2017, ESPD Meeting 2017). Research

grants and clinical research cooperations: Procter & Gamble. Cooperation (consultant, speaker of congresses, investigator of studies): Procter & Gamble, Astellas, Beiersdorf, Johnson & Johnson, La Roche Posay, Neubourg GmbH, Novartis Pierre Fabre, Regeneron.

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