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Napkin lesions in pediatric patients

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Abstract
Napkin dermatitis and nappy rash are used to describe various skin conditions that affect the skin under a napkin or incontinence pad. Diaper rash (DR) is one of the most frequent problems of the first 2 years of life, even though older children or adults may be affected when wearing plastic pants for urinary incontinence or medical treatment. Characteristically, DR occurs on the convex surfaces of the pubic region, the glutei, and the genitoanal region, whereas the flexures are generally spared as they are less prone to chemical and mechanical damage. Despite advances in diaper technology, it is a condition that still occurs regularly in young children. To combat this, barrier preparations can be used to protect the skin by coating the surface of the skin and/or by supplying lipids that can penetrate the intercellular spaces of the stratum corneum. With conservative management, most cases of irritant diaper dermatitis are self-limited. When the condition persists, one must consider other diagnoses.

Keywords: Region, the glutei, and the genitoanal

Introduction
Napkin area represents the area of the skin covered by the napkins which involves the buttocks, perianal area, genitals, inner thigh and waistline. A wide range of inflammatory cutaneous skin lesions of various causes that occur in this area are called diaper rash (DR) [1].

Napkin rashes: although it rarely causes problems for long period of time, it can cause considerable distress to both infants and parents. Parents reported that there are prolonged periods of crying as the first symptoms of pain with agitation, sleep changes and decreased frequency of urination and defecation. The napkin rashes are frequent in children before toilet training, with no difference between both sexes [2].

Incidence and prevalence: About 50%-65% of infants suffer from napkin rashes during the first 2 years of life. They reach the peak around the age of 9-12 months. Also there is a difference in severity of the napkin rashes as reported with the majority being of mild type [3].

Classification of lesions affecting the napkin area
Depends on the diverse diseases in the napkin region including the following:

Eczematous diseases and psoriasis
a) Contact dermatitis.
b) Irritant contact dermatitis.
c) Allergic contact dermatitis.
d) Infantile seborrheic dermatitis.
e) Infantile atopic dermatitis.
f) Infantile psoriasis.
g) Mixed dermatitis.

Infestations and infections
a) Scabies
b) Candidiasis
c) Perianal streptococcal and staphylococcal dermatitis

Nutritional diseases
a) Acrodermatitis enteropathy
b) Biotin- responsive multiple decarboxylase deficiency
c) Cystic fibrosis

Autoimmune, bullous diseases and diseases of unknown etiology
a) Kawasaki disease
b) Lichen sclerosis
c) Bullous diseases

Neoplastic and miscellaneous diseases
a) Langerhans cell histiocytosis
b) Granuloma gluteal infantum
c) Child abuse

Eczematous Diseases and Psoriasis

a) Contact dermatitis: It occurs mainly due to disperse dyes, preservatives, emulsifiers, fragrances, adhesives, and rubber accelerators associated with the napkins [4].

b) Irritant contact dermatitis: It is commonly seen between 9-12 months but may develop early at the age of one week [5].

Causes [6]

- **Wetness and friction:** cause destruction of the skin barrier which allow easy penetration of different irritants.
- **Urine and feces:** due to the enzymes (proteases, lipases) of the feces which break down urea in urine into ammonia that cause elevation of pH and thus skin irritation.
- **Microorganisms**: the most common is Candida albicans. Bacterial infections as staphylococcus aureus and group A streptococci are involved. Viruses such as coxsackie, herpes simplex and human immunodeficiency viruses.
- **Nutritional factors:** due to biotin and zinc deficiency.
- **Chemical irritants:** as soap, detergents and antiseptics.
- **Antibiotics**: specifically, the broad-spectrum antibiotics.
- **Diarrhea**: due to passage of frequent liquid stool with short transit time and associated greater amount of residual digestive enzymes.
- **Developmental anomalies of the urinary tract:** due to constant passage of urine which cause repeated urinary tract infection.
- **Napkins**: use of the old traditional napkins has the main role in development of irritant dermatitis.

Pathogenesis

The normal acidic pH of the stratum corneum plays an important role in formation and maintenance of normal barrier function and antimicrobial defense of the skin. Thus any disruption of pH will cause irritation and inflammation of the skin [7]. Figure 1

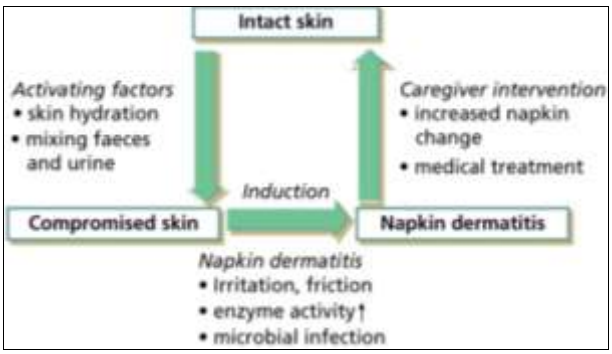

Fig 1: Pathogenesis of irritant napkin dermatitis [8]

Clinical presentation

It affects convex skin surfaces which have the greatest contact with the napkins and include buttocks, lower abdomen, genitalia and upper thigh while sparing the skin folds [9]. Figure 2

Fig 2: A) Classic irritant contact dermatitis, B) Irritant contact dermatitis showing erythema of the convex areas [8]

When irritant napkin dermatitis is left untreated for more than 3 days, it becomes secondarily infected with different organisms like Candida albicans, Staphylococcus aureus, *Streptococcus pyogenes* and Herpes simplex virus [10].

Therapeutic Treatment [11]

- **Barrier preparations:** The most common topical barrier used to contain petroleum, zinc or both. Some contain lanolin, paraffin or dimethicone. Sucralfate is very useful in the treatment of severe irritant napkin dermatitis due to its antibacterial action and physical barrier against irritants.
- **Topical corticosteroids:** Application of low potency topical steroid can reduce inflammation.

- **Antifungal agents:** They include nystatin, clotrimazole, miconazole, ketoconazole, and sertaconazole.

Allergic contact dermatitis: It is a much less common lesion in the napkin area. It is less common than irritant napkin dermatitis and less common than other napkin lesions. It affects children older than 2 years [12].

Causes: It occurs due to exposure to certain allergens such as [12]:

- Medications that are applied to the skin containing paraben, lanolin or neomycin.
- Dyes and chemicals which are present in the disposable napkins.
- Fragrances and laundry detergents used with closed napkins.
- Methylisothiazolinone present in napkins is most common allergen that is responsible for allergic dermatitis.

Pathogenesis

Allergic napkin dermatitis usually occurs when new products are introduced to the napkin region either to the skin or to the napkin itself [13].

Clinical presentation

It affects the area which is in direct contact with the napkins or applied allergen including the convex surfaces of the skin under occlusion with flexural prominence specifically when the applied material is concentrated in the folds. It is presented with erythema and small vesicles that may rupture leaving an eczematous lesion [14]. Figure 3

Fig 3: Allergic contact dermatitis showing the holster sign, due to rubber component of the napkins [8]

Infantile seborrheic dermatitis: It affects infants within the first 6 months of age and completely resolves by the age of 8 months. It usually appears at the age of 3 months but can affect infants few weeks after birth [9].

Causes and pathogenesis

Some studies report that it occurs due to combination of many factors that lead to over production and alteration of sebum such as: effect of maternal hormones during first few months of life and deficiency of essential fatty acids and biotin. Others consider that it occur due to commensal yeasts of the genus Malassezia (Pityrosporum) and associated immune response [15].

Clinical presentation

It is presented in the napkin region by sharply demarcated erythematous patches that include the inguinal folds but lacking yellowish scales of the scalp [9]. Figure 4

Fig 4: Infantile seborrheic dermatitis with affection of the inguinal folds [8]

Treatment

- **Topical corticosteroids:** Low potency corticosteroids creams are effective in acute cases with inflammation [16].
- **Topical antifungals:** As ketoconazole (2%) either shampoo or cream are very effective especially in acute cases with full clearance of lesions within 10 days [16].

Napkin psoriasis: Females have a higher prevalence of psoriasis than males. It is most common under 2 years of age [17].

Causes: The most important ones are genetic and environmental factors [18].

Genetic factors: There are about 20 genetic loci that are responsible for the development of psoriasis. The most important one is PSORS1 locus on chromosome 6p21.

Environmental factors: The most important are infections, especially sore throat with group B hemolytic Streptococci and psychological trauma.

Pathogenesis: It is an immune and chronic inflammatory mediated process. It depends on interaction between keratinocytes, dermal and different immune cells. T cells, keratinocytes, Langerhans' cells, macrophages and some cytokines play an important role in development of psoriasis [19].

Clinical presentation: Umbilical involvement is characteristic to napkin psoriasis and differentiates it from other napkin lesions. It may be associated with other cutaneous conditions like eczema, alopecia areata, allergic contact dermatitis and vitiligo [20]. Figure 5

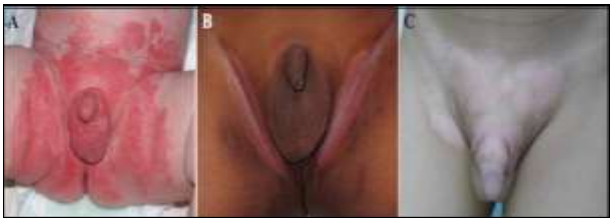

Fig 5: A) Classic napkin psoriasis. B) Inverse psoriasis of the groin with fissuring. C) Plaque psoriasis of the genital region [21]

Infantile atopic eczema: Although it is common in children and occurs in about 10%-20% of them, it is rare in the napkin region due to over hydration that results from napkin occlusion [22].

Pathogenesis: It is a complicated process that occur due to many mechanisms including [22]:
Alteration of barrier function. Disturbed cells mediated immune response. IgE mediated hypersensitivity. Environmental triggers like cold and dry weather, dampness, house dust mites, pet fur, pollen and mould.

Clinical presentation:
It is manifested by eczematous lesions that may affect other body sites like cheeks, antecubital and popliteal fossae. Secondary bacterial infection with Staphylococcus aureus may occur which leads to oozing and crustation of the lesion. With chronicity lichenification and excoriation develop. Pruritis is the main feature that makes the infant more irritable and discomfortable [23]. Figure 6

Fig 6: A) Atopic dermatitis affecting surrounding of the napkin region. B) Atopic dermatitis affecting the napkin region [14]

Treatment: Pharmacological lines which involve [22]

a) **Topical emollients:** are the standard as they maintain hydration of the skin through maintaining the epidermal barrier function by formation of an occlusive layer, reduction of trans-epidermal water loss and bacterial invasion and decreasing sensitivity to external triggers.
b) **Topical corticosteroids:** effective in reducing inflammation and pruritis.
c) **Topical calcineurin inhibitors:** include tacrolimus and tarolimus. They reduce inflammation through inhibition of calcineurin dependent T-cell activation. They are considered a second line for short term and intermittent care.

Infections and Infestations Affecting the Napkin Area
Napkin Candidiasis: It commonly occurs secondary to irritant napkin dermatitis and other inflammatory napkin lesions. It affects about 7%-35% of infants at the age of 9-12 months [24].

Causes [25]

- Moisture and wetness associated with chronic occlusion of the napkins.
- Colonization of gastrointestinal tract by candidal species which facilitate transmission of infection especially in cases of chronic diarrhea.
- Immature infants who are less than 27 weeks of age and less than 1500 g body weight.
- Increased CO_2 levels due to occlusion of the napkins.

Pathogenesis: Candida albicans represents a part of the normal flora of the skin and mucous membranes of genital and gastrointestinal tract in up to 70% of normal healthy individuals. Infection occurs when the balance between host immune system and candidal invasion is disturbed [26].

Clinical presentation: Burning and itching are common associated symptoms. It usually appears in the perianal region and may spread to perineum and inguinal area with affection of the skin folds [2]. Figures 7

Fig 7: A) A case of napkin candidiasis with satellite papules, B) Napkin candidiasis [8]

Therapeutic Treatment
Topical antifungals

a) **Nystatins:** They are usually used with a satisfactory clinical cure rate of about 85% [25].
b) **Azoles:** They include clotrimazole, miconazole, ketoconazole and bifonazole. They are very effective when applied twice daily for 7-10 days [16].

- **Systemic antifungal:** As nystatin oral drops are used in

recurrent cases associated with oral and intestinal candidiasis [16].

- **Topical antibiotics:** Which contain fusidic acid for associated secondary bacterial infections [27].
- **Topical corticosteroids:** Use of low potent steroids for a short period of time in case of moderate to severe candidiasis associated with severe erythema and irritation [11].

Infantile scabies: It is a very common infectious disease during infancy that mostly affecting the napkin area [11].

Cause: It is caused by Sarcoptes scabiei mites infection [4].

Pathogenesis
It results from a cell mediated immune response to Sarcoptes scabiei mites or their eggs and feces [11].

Clinical presentation
A persistent post scabies lesion may develop even after proper treatment and is characterized by reddish-brown infiltrated nodule that commonly affects groin, buttocks and genitalia. This nodule may be misdiagnosed as mastocytosis, histiocytosis or cutaneous lymphoma [28]. Figure 8

Fig 8: Infantile scabies [29]

Treatment

- Topical 5% permethrin cream is of choice for infants and neonates with high cure rates. A second dose may be needed after one week [30].
- Crotamiton and 10% Benzyl benzoate may be used as an alternative line for permethrin [31].

Bacterial infection (Perianal streptococcal and Staphylococcal dermatitis)
There is a high prevalence of perianal bacterial dermatitis due to the moisture associated with the napkins in both healthy and diseased skin. It is common in neonates and at age of 6 months [32].

Causes
The most common causative microorganisms are group A beta hemolytic streptococci and staphylococci. Other less common organisms include Propionibacterium, Corynebacterium and Lactobacillus species [33].

Pathogenesis
Frequent changes in pH and prolonged contact with urine and feces make the napkin suspected to repeated bacterial infections. Also direct contact of this area with the gastrointestinal tract, change in oxygen availability and water holding capacity of the skin provide a suitable environmental condition for microorganism colonization [34].

Clinical presentation: It is associated with episodes of irritability and discomfort. Perianal staphylococcal dermatitis is very similar to perianal streptococcal dermatitis with small papules and pustules. There is an association with low grade fever and malaise [35]. Figure 9

Fig 9: Perianal streptococcal dermatitis with erythema [31]

Nutritional Diseases Affecting the Napkin Area
Acrodermatitis enteropathica: It is a rare autosomal recessive genetic disorder that can affect infants after 6 months of age during the period of breast weaning. Both sexes are equally affected [36].

Causes
It occurs due to mutation in SLC39A4 gene located on chromosome 8q24.3 and is expressed in duodenum and jejunum which carries trans membrane proteins essential for zinc absorption (Zip4) [37].

Pathogenesis
Proper absorption of zinc occurs in the small intestine firstly in the jejunum by the zinc transporting protein ZIP4. So, mutation in gene carrying this protein can affect intestinal absorption of zinc causing zinc deficiency [37].

Clinical presentation
It is manifested by a triad of acral and periorificial eczematous erosive dermatitis that appears in the form of scaly, markedly demarcated crusted plaques in the napkin region, around mouth, nose and eyes and on the distal extremities. Also, paronychia, onychodystophy, angular stomatitis, cheilitis, conjunctivitis and photophobia may occur in severe cases [38]. Figure 10

Fig 10: Acrodermatitis enteropathica showing erosions and crustations affecting hand and napkin area [31]

Treatment
Enteral or parenteral supplementation of zinc is the gold standard for the treatment of acrodermatitis enteropathica. A lifelong daily dose of 3 mg/kg zinc sulfate is effective [39].

Biotin-responsive multiple carboxylase deficiency: It is a rare autosomal recessive disorder [40].

Clinical presentation: It is presented in infancy by a periorificial eruption in association with alopecia, seizures, ataxia and intermittent metabolic acidosis [40].

Cystic fibrosis: It occurs due to gastrointestinal malabsorption of zinc and essential fatty acids [40].

Clinical presentation: It is manifested by periorificial eruption and acrodermatitis like lesions in the napkin area. Abnormal increase of sodium concentration in the sweat leads to increase viscosity of secreted mucus [40].

Autoimmune and Bullous Diseases Affecting the Napkin Area
Kawasaki disease: It is commonly affecting males [Male to female ratio of 1.5-1] [41].

Cause: It has unknown etiology. It may occur due to infectious agents mainly viral or due to immune reaction in genetically predisposed patient [42].

Pathogenesis
The immunologic etiology is suggested by activation of both innate and adaptive immune response through neutrophils which invade arterial wall then activation of CD8þ T cells, dendritic cells and monocytes. Also activation of interleukin-1(IL-1) pathway is included through increasing transcription and proteins of this pathway [43].

Clinical presentation: It is manifested by many clinical signs that include [8]:

- Fever for more than 5 days.
- Non suppurative cervical lymphadenopathy.
- Conjunctival congestion and infection.
- Red cracked lips and strawberry tongue with erythema of oropharyngeal mucosa.
- Erythema, edema and desquamation of hands, feet and napkin region.
- There are cardiovascular abnormalities including coronary artery aneurysm which may cause coronary thrombosis, stenosis and myocardial infarction.
- In the napkin region, rashes may appear during the first week of the disease onset. These rashes are confluent, tender, macule and plaque erythema which become desquamated after a short period of time and involving all the perianal region. Figure 11

Fig 11: Erythema and edema of Kawasaki disease [31]

Treatment
Early treatment with intravenous gamma globulins in addition to high dose of aspirin is recommended in order to prevent cardiovascular complications [44].

Lichen sclerosus: It a rare disease that affects pre pubertal children and middle-aged adults. It is common in males than females during childhood period [45].

Cause: It is a disease of unknown etiology. It is considered as an autoimmune disease with genetic susceptibility [46].

Pathogenesis: It depends on some targets in the course of disease which include activation of auto immunogenic mechanisms (EMC1, TNF-α, IL-6 and others), enhancing sclerotic tissue formation and triggering oxidative stress [47].

Clinical presentation: It mainly affects the anogenital skin which becomes thin, white and patchy. It is characterized by well-defined erythema and slight scaling which with progression become pearly, white and atrophic. Itching is the most common symptom in the napkin area. It may cause painful defecation and constipation and also may increase risk of leukoplakia and squamous cell carcinoma in adults [48].

Treatment: Topical anti-inflammatory drugs as topical potent corticosteroids and topical calcineurin inhibitors are recommended as the drugs of choice for lichen sclerosus [48].

Bullous diseases

a) **Epidermolysis bullosa:** It is the most common form of bullous diseases [49].
b) **Cause:** It is a hereditary mechanobullous disease [49].
c) **Clinical presentation:** It is manifested in newborns and infants by bullae in sites exposed to trauma such as: hands, elbows, knee and periorificial skin especially the napkin area [49].
d) **Chronic bullous disease of childhood:** It is common to affect the napkin area and other body regions [50].
e) **Cause:** It is a disease of unknown etiology. It is an acquired bullous disease that may occur due to infections, drugs or autoimmunity [50].

Clinical presentation
It is characteristically seen in the napkin area, but other

body regions may be affected including face, trunk and legs. It is manifested by nonspecific constitutional symptoms and fever followed by appearance of large tense bullae which take an annular or polycyclic shape with a string of pearls pattern. The underlying skin is normal while the mucous membranes, especially oral mucosa are usually affected with erosions and intact bullae [50].

Neoplastic and Miscellaneous Lesions Affecting the Napkin Area

Langerhans cell histiocytosis (LCH) Incidence: It is a very rare disease that can affect children up to 15 years old. It mostly affects children aged 1-3 years. It may appear at or shortly after birth. It commonly affects males with male to female ratio of 2.5-1 [51].

Cause: The exact cause of LCH is unknown. There a familial predisposition with higher rates in monozygotic than dizygotic twins suggesting a genetic predisposition [52].

Pathogenesis

It is unclear. It may be reactive or neoplastic in nature. The reactive nature is related to spontaneous cure of LCH in addition to prominent inflammatory infiltrates and massive production of multiple cytokines. While the neoplastic nature returns to clonal proliferation of LCH cells, hematopoietic precursor proliferation, mutation of somatic activating gene in the mitogen activated protein kinase (MAPK) pathway, fatal outcome and proper response to chemotherapy [53].

Clinical presentation: It is considered as a systemic condition that ranges from a solitary eosinophilic granuloma to a widespread disseminated condition with multi organ affection [53].

Granuloma gluteal infantum Incidence: It is a rare condition that occurs mainly during infancy period [54].

Cause

It is of unknown etiology. It may occur as a complication of irritant napkin dermatitis or napkin candidal infection or due to previous treatment with fluorinated corticosteroids. It was believed to occur due to the use of bromide containing ointments [55].

Pathogenesis: It is unclear but may be due to chronic inflammation of the napkin area [54].

Clinical presentation

It affects buttock, inner thigh, and lower abdomen and may be in the skin folds as axilla and neck. It is manifested by elevated papules and nodules which are reddish, firm and painless with size of 0.5 to 4cm. It may regress spontaneously leaving atrophic scar [8].

Child abuse

Incidence: It is a rare condition that should be considered in severe napkin dermatitis resistant to treatment [56].

Cause: It occurs due to neglection by parents or caregivers or by sexual abuse especially when human papilloma virus (Condyloma acuminatum or genital warts) is suspected and by burns especially in scalding water [56].

Clinical presentation

It differs according to the agent used. When scalding hot water is used, red blistered buttocks which take a' dunking pattern' especially if the lateral aspects of the leg are affected. The lesion is sharply demarcated including the convexities of the buttocks while sparing the perianal region. With abusive ingestion of caustic laxatives, perianal erosive erythema appears [57].

Conflict of Interest

Not available

Financial Support

Not available

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