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Case Report

'Peeling paint' dermatitis as a presenting sign of cystic fibrosis

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Abstract

Presentation of cystic fibrosis with a rash is rare, with only 19 previously reported cases. This unusual presentation is associated with false negative sweat tests, delays in diagnosis and considerable mortality. Multiple nutritional deficiencies, the aberrant production of prostaglandins and free-radical mediated damage have been implicated in the pathogenesis of this kwashiorkor-like dermatitis. In spite of the rarity of this presentation, recognition of the rash is important, not only to expedite the diagnosis, but also to gain insight into the disease. We present a further case to highlight this unusual presentation and discuss potential pathophysiological mechanisms.

1. Case history

A five-month-old male infant was referred to the dermatology services for assessment of a rash. He was born at term by home delivery, weighing 4 kg, and was exclusively breast-fed. His parents had declined administration of postnatal vitamin K and routine vaccinations. He had a history of passing 5–8 unformed, greenish stools for the first 6 weeks of life, which then normalized. Serial laboratory investigations at 6 and 12 weeks revealed normal liver function and full blood counts. A rash appeared at 4 months of age, initially in the napkin area, and was resistant to treatment with topical anti-fungal and anti-bacterial preparations and mild potency steroids. At the time of presentation the rash was extensive, but was most accentuated around the mouth and perineum. The rash consisted of an erosive, desquamating dermatitis with classic 'pasted-on' scale — the so-called 'peeling paint' sign. Mucous membranes, nails and hair were normal. At 5.5 kg, his weight had fallen to below the third centile. Laboratory abnormalities included hemoglobin 7.3 g/dl (normal: 10.5–13.5), albumin 1.2 g/dl (normal 3.6–5.0), total protein 2.8 g/dl (normal 6.0–8.0), ALT 93 IU/L (normal:<35), AST 112 IU/L (normal:<110), vitamin A 0.26 Ku/L (normal: 0.7–1.5), vitamin E 3.5 mg/dl (normal: 11.5–24.4). He had a profound life-threatening coagulopathy, PT 70.2 s (normal: 10.0–14.2), APTT 57.8 s (normal 28.1–42.9), with a marked deficiency of vitamin K dependent clotting factors. His stool steatocrit at 85% was strongly positive in spite of a lack of reported gastrointestinal symptoms (normal:<11%). Serum zinc levels were normal. Sweat chloride was elevated at 92 mEq/L (normal:<60). Molecular genetic studies revealed a homozygous delta-F508 genotype, confirming cystic fibrosis. The rash was nutritionally responsive and resolved within 2 weeks of commencing pancreatic enzyme supplementation (Figs.1 and 2).

2. Discussion

Presentation of cystic fibrosis with dermatitis is rare, with only 21 previously reported cases [1–16,20,21]. The exact aetiology is not known, however it is postulated to represent the end product of multiple nutritional and metabolic derangements, resulting in a kwashiorkor-like state. Contributing factors appear to involve a complex interaction between deficiencies of protein, zinc and essential fatty acids [1,3,9]. Affected patients typically present at 3–7 months of age with a desquamative, 'peeling paint' rash, hypoproteinaemia, oedema, anaemia, a mild elevation of liver transaminases, malabsorption and a parallel failure to thrive. The rash generally precedes the onset of oedema by 1 month

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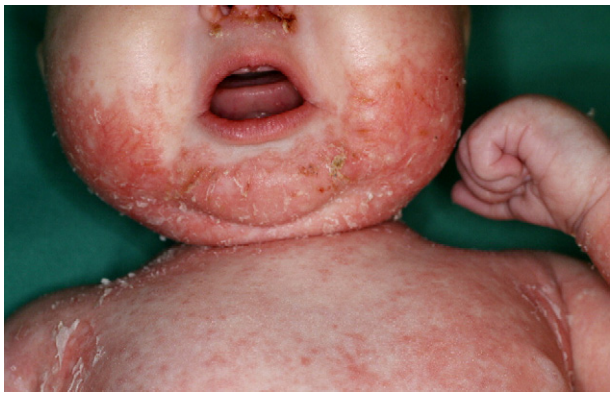

Fig. 1. Erosive desquamating dermatitis with classic 'pasted-on' scale.

and has a predilection for the orifices, perineum and extremities. Alopecia may be a feature, but hair and nails are usually spared [9].

Due to compromised epidermal function and severe malnutrition, affected patients are susceptible to invasive infections, further complicated by fluid and electrolyte imbalances. Our case had a profound coagulopathy at presentation (PT: 70.2 s), secondary to malabsorption and exacerbated by the lack of postnatal vitamin K. Characteristically, the diagnosis is delayed for several months, not only because of the rarity of the presentation, but also due to the presence of oedema, which may be associated with false negative sweat tests, and typically obscures the degree of failure to thrive.

The clinical and histopathologic appearance of the rash most closely resembles that of kwashiorkor, the oedematous form of protein-energy malnutrition most commonly seen in the Third World due to chronic malnutrition. There are however several notable differences, including the lack of hepatomegaly typically seen in classical kwashiorkor, and the absence of a 'flag sign', which manifests as alternating bands of light and dark bands of pigmentation along a single strand of hair, presumed due to the lack of intermittent nutritional rescue as would be experienced in developing countries [17]. It is likely that kwashiorkor represents a multifactorial condition, with multiple pathogenic factors, resulting in subtle, yet distinct clinical presentations. The traditional view that kwashiorkor is caused by protein deficiency and that the oedema is secondary to low albumin originally proposed by Williams [19] has been revisited, and free radical mediated damage implicated as the mechanism of injury [4]. The free radical induced damage, particularly affects mitochondrial and lipid membranes leading to dysfunction of skin, liver, marrow and fluid homeostasis, which would account for the multi-system involvement.

The dermatitis associated with cystic fibrosis may also mimic acrodermatitis enteropathica, an autosomal recessive primary zinc deficiency disorder, which usually manifests in infancy as an eczematous periorificial and acral dermatitis. Although zinc deficiency secondary to malabsorption is well described in cystic fibrosis, measured zinc levels in affected patients have been variable and previously documented low levels may be secondary to low albumin levels, the main serum protein carrier of zinc. Empirical treatment with zinc in one case did not halt progression of the rash [8]. Additionally, the rash in cystic fibrosis is more widespread with no changes in mucous membranes or nails, as is classical of acrodermatitis enteropathica, and histological changes are different.

Patients with severe essential fatty acid deficiency may develop a rash clinically indistinguishable from that seen in malnourished patients with cystic fibrosis. Deficiency of linoleic and arachadonic acid are common in patients with cystic fibrosis, particularly those with malabsorption and protein-calorie malnutrition, but a rash rarely occurs. Infants are at increased risk of developing essential fatty acid deficiency because of their increased requirements for growth, and their skin is a particularly susceptible organ due to its rapid turnover. Due to the infrequency of rash in cystic fibrosis patients with protein-energy malnutrition, however, essential fatty acid deficiency alone does not account for the presentation with rash [18].

Patients presenting with a 'peeling paint' dermatitis should thus undergo a broad evaluation including a complete full blood count, serum protein, albumin, zinc and biotinidase levels, sweat chloride, stool steatocrit, alpha-1-antrypsin levels, urine organic acids, serum amino acids, immunoglobulins, and a full septic screen. Careful correction of fluid and electrolyte imbalances and nutritional support is the mainstay of immediate treatment. Our patient responded dramatically to oral pancreatic enzyme supplementation, parenteral vitamin K and oral multivitamins, with resolution of cutaneous findings and correction of coagulopathy within 2 weeks of commencing treatment.

Overall, multiple nutritional deficiencies, the aberrant production of prostaglandins and free radical mediated damage to cellular membranes may be pathogenetic in the rash of cystic fibrosis. Identification of the exact mechanism has yet to be identified, however this rare presentation increases insight into the disease.

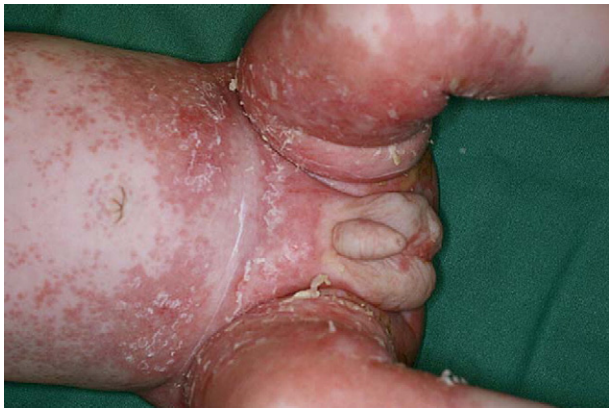

Fig. 2. Accentuation of rash in napkin area.

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