

PROGRESSIVE RASH IN A 5-MONTH-OLD Heard, S, OMS-III, Harpell, G, MD, Snow, C, MD, Karnes, J, MD University of New England College of Osteopathic Medicine, Biddeford, ME MaineGeneral Medical Center, Departments of Pediatrics & Dermatology, Augusta, ME

Introduction

Infantile zinc deficiency is caused by an acquired or primary pathologic process. Acquired zinc deficiency is often due to a nutritional deficiency in breastmilk or

- formula Primary zinc deficiency, or acrodermatitis enteropathica (AE), is an inherited disorder with increased prevalence in consanguineous communities due to its autosomal recessive inheritance pattern.
- It is important to maintain a high index of suspicion for mineral deficiencies when assessing a pediatric patient with a progressive rash.

Patient Information

Chief Complaint: A 5-month-old previously healthy girl from an Amish community presented to the emergency department with a 6-week history of a rash, worsening over the past week.

HPI: The rash first appeared on her chin and then spread to her diaper area, behind her knees, on her hands and feet and areas on her arms, legs and chest. The rash persisted despite treatment with herbs, talcum and "antibiotic ointment." The rash did not seem itchy, although the mother noted that the baby had seemed more irritable recently. The mother denied any other symptoms including fever, eye changes, cough, difficulty breathing, vomiting, diarrhea, change in appetite, or hair or nail changes. The parents denied any sick contacts at home and no one in the family had a rash like this before. The infant was initially exclusively breastfed; however, 6 weeks ago, the mother gradually introduced formula. The baby stopped breastfeeding entirely 2 weeks prior to presentation. The mother purchased formula in bags from another member of the Amish community, who bought it in bulk from a distributor in New York. She was unsure of the name or composition of the formula. The mother's older child as well as other children in the community had used this formula without known difficulty.

Birth History: The infant was born via normal spontaneous vaginal delivery at home.

Development: She was developmentally normal. She could roll from back to front and front to back. She had a social smile. She cooed, babbled and reached for objects and brought them to her mouth. When placed prone, she could support herself on her elbows and lift her head up.

Past Medical History: The baby had not had prior medical care, and she was unimmunized.

Allergies: There was no known food or drug allergy.



A) Erythema and crusting within the base of the umbilicus. B) Erythema over the entire genital area, including the inguinal and gluteal creases.

Clinical Course

In the ED, the child appeared somewhat uncomfortable, but was non-toxic in appearance and appropriately interactive for age. She was afebrile with normal vital signs. Her weight was at the 10th percentile per the WHO chart. Other than the skin lesions noted in the photographs, a complete physical exam showed no other significant findings. The patient was admitted to the hospital for ongoing monitoring and coordination of care, particularly given the family's lack of access to reliable transportation, communication or follow-up care. Laboratory studies were obtained to evaluate for the suspected diagnosis, and Dermatology was consulted.

The differential diagnosis for the rash in this infant included: atopic dermatitis, psoriasis, seborrheic dermatitis, contact dermatitis, candida infection, zinc deficiency.

Based on the characteristic appearance and distribution of the rash as well as the timing of the onset, a diagnostic hypothesis of zinc deficiency with candida superinfection was made. Laboratory results showed a mild normocytic anemia and low alkaline phosphatase (a zinc-dependent enzyme) level (24 u/L, reference range of 146-477 u/L.) A blood zinc level ultimately resulted as low (0.1 mcg/mL, reference range of 0.40-1.20 mcg/mL).

The patient was treated with zinc sulfate dosed at 3 mg/kg/day. The infant was also transitioned to Similac formula for nutrition since the zinc content of her previous formula was unknown. The suspected candida superinfection and areas of oral thrush were treated with nystatin oral suspension and topical ointment. The rash completely cleared within two weeks of treatment. The family declined genetic referral or testing.



C) Erythema and crusting in the nasal labial folds extending to the medial checks bilaterally, under the nose, on the chin extending from the angles of the mouth down to just under the chin, around the edge of lateral cheeks, and at the top of the ears bilaterally where the helices meet the face. D) Erythematous lesions on the toes and top of the foot.

Discussion

Zinc plays an important role in a variety of cellular processes, including nucleic acid and protein synthesis, freeradical scavenging, wound healing and immune function. It plays an integral part in the function of several metalloenzymes and transcription factors [2]. Human breast milk and other dietary sources including meat, shellfish, chickpeas, cashews and pumpkin seeds are rich sources of zinc. Zinc absorption occurs in the jejunum of the small intestine through the transporter protein ZIP4 [4].

Zinc deficiency presents with classic features of a perioral facial rash in a horseshoe or U-shaped pattern with cheeks to chin involvement, sparing the upper lip, with sharp demarcation between affected area and normal skin. There can also be symmetrical perianal excoriation and rash of the buttocks. The condition is often associated with alopecia and diarrhea, as well as nails that tend to be soft with bridging, dystrophy and paronychia. Non-cutaneous symptoms include conjunctivitis and sensitivity to light, loss of appetite, diarrhea, irritability, and growth failure. Acquired zinc deficiency is typically caused by inadequate intake, increased demand, malabsorption or excessive losses. Acrodermatitis enteropathica (AE) is an autosomal recessive genetic disorder caused by a mutation in the SLC39A4 gene on chromosome 8q24.3, which codes for the zinc transporter protein ZIP4 [3].



E) Bilateral erythema in the popliteal fossae as well as skin fold on right thigh. F) Thickened erythematous skin extending from the perianal area to the bilateral buttocks.

Conclusions

- evident.
- Inadequate intake was plausible, given the recent change from breast milk to a proprietary formula of unclear zinc content.
- consanguinity, making an autosomal recessive condition such as AE also possible. Human milk usually contains enough zinc to maintain adequate levels despite transporter defects, thus AE also tends to present at the time of weaning from
- However, the family is also part of a community among which there is known breast milk.
- The treatment for zinc deficiency is zinc supplementation.
- The degree of zinc supplementation differs depending on whether the condition is primary or acquired.
- For AE, treatment involves lifelong supplementation with 3 mg/kg/day of elemental zinc, as a higher dose of oral zinc supplementation is needed to overcome the zinc transporter defect [5].
- The only known side effect of zinc supplementation is copper deficiency because high zinc levels inhibit copper absorption by competitively inhibiting a common cationic transporter. Therefore, copper levels should be monitored during treatment of zinc deficiency.

References

- Pediatrics, Itasca, IL 2019. p.591
- 2. Andreini C., Bertini I. A bioinformatics view of zinc enzymes. J. Inorg. Biochem. 2012;111:150–156. doi: 10.1016/j.jinorgbio.2011.11.020.
- 3. Küry S, Dréno B, Bézieau S, Giraudet S, Kharfi M, Kamoun R, Moisan JP. Identification of SLC39A4, a gene involved in acrodermatitis enteropathica. Nat Genet. 2002;31:239–240.
- 4. Lee HH, Prasad AS, Brewer GJ, Owyang C. Zinc absorption in human small intestine. Am J Physiol. 1989;256(1 Pt 1):G87-G91. doi:10.1152/ajpgi.1989.256.1.G87
- 5. Maverakis E, Fung MA, Lynch PJ, Draznin M, Michael DJ, Ruben B, Fazel N. Acrodermatitis enteropathica and an overview of zinc metabolism. J Am Acad Dermatol. 2007 Jan;56(1):116-24. doi: 10.1016/j.jaad.2006.08.015. Epub 2006 Oct 30. PMID: 17190629.







In the case of this patient, the cause of her zinc deficiency was not immediately

• For acquired deficiency, the dose is 0.5-1 mg/kg/day until the symptoms resolve

1. American Academy of Pediatrics Committee on Nutrition. Trace elements. In: Pediatric nutrition, 8th, Kleinman RE, Greer FR (Eds), American Academy of