

Kwashiorkor from a severe dietary restriction in an 8-month infant in suburban Detroit, Michigan: case report and review of the literature

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Abstract

Kwashiorkor is a type of protein-calorie malnutrition often seen in children of impoverished countries and famine. The condition occurs in the setting of insufficient protein intake in the presence of sufficient caloric intake. We report a case of a 8-month-old male infant in the suburban Detroit, MI, USA who presented with diffuse edema, erythroderma and desquamation, a “bull-dog” face, diarrhea, and irritability, consistent with kwashiorkor as a result of severe dietary restriction. The mother had placed the child on a severely restrictive diet, consisting only of RICE DREAM[®] milk, sweet potatoes and bananas, with the assumption that it would help his rash. Nineteen prior cases of kwashiorkor induced in infants by dietary restriction of “well intending” parents have been reported in the US literature. Malnutrition is often under diagnosed or misdiagnosed in developed countries such as the United States. The results, if unrecognized or untreated, may be devastating. This makes it imperative that physicians consider this diagnosis, recognize potential risk factors and be prepared to accurately assess overall nutritional status of patients.

Background

Kwashiorkor is a type of protein-calorie malnutrition most often seen in children of impoverished countries or areas of famine.^{1–3} Causes are controversial, but the most commonly accepted theory is inadequate dietary protein in the presence of sufficient caloric intake.^{1–3} Children placed on restrictive diets by “well-intending” parents, as a result of concern for food allergies, have been reported to be previously at risk of nutritional deficiency, such as kwashiorkor.^{4–9,21}

Cicely Williams, a British pediatrician, introduced the name Kwashiorkor in her 1935 article in the *Lancet*, where she described its presence in children with maize diets.¹ Associated physical findings may include a dermatitis, protuberant abdomen, thinning hair, and “bull-dog” face.^{1–3} Clinical findings may also include weight loss/failure to thrive, delayed linear growth, irritability, and lethargy.^{1–3} We describe an 8-month-old male infant with kwashiorkor protein-calorie malnutrition in suburban Detroit, Michigan.

Case report

An 8-month-old male Caucasian infant presented to Pediatric Dermatology clinic with diffuse erythema and prominent tense edema of the cheeks, abdomen, and upper and

lower extremities. On the face, extending down on to his neck as well as his chest, his abdomen, back, and upper and lower extremities he had confluent beefy red erythematous plaques, including the skin folds in the axilla, groin and gluteal cleft, with overlying desquamation and superficially yellow scaling and crusting (Fig. 1, clinical presentation pre-treatment). Past medical history was significant for a large-for-gestational-age infant who weighed 10½ pounds at birth. The patient was from a middle class family in the suburbs of Detroit, MI, USA. Pregnancy and delivery were without complications and testing for diabetes was negative. The parents report that the child had been increasingly fussy since the onset of the rash and they noted that he had up to 14 bowel movements a day. Prior to presentation in Pediatric Dermatology Clinic, treatments for the rash included a 2-week course of PO erythromycin, which did not result in significant improvement of the rash and resulted in increasing amounts of diarrhea. Subsequent treatment included topical fluticasone 0.05% ointment, hydrocortisone 2.5% ointment and Aquaphor ointment, which also did not improve the rash.

Dietary history

From birth to 2 weeks, the patient was started on soy-based formula. The patient’s mother never attempted breast feeding as she reported that her child’s older sibling was “allergic” to breast milk. At 2 weeks of age, blood



Figure 1 Initial clinical presentation of kwashiorkor, pre-treatment

in stool was noted and child was changed to Nutramigen LIPIL[®] formula (Mead Johnson Nutrition, Glenview, IL, USA) which he was maintained on until 4 months of age. Whereas on this formula, the patient's mom noticed some spitting up and a scaly, itchy scalp and thus, at 4 months of age he was switched to a diet of RICE DREAM[®] milk (The Hain Celestial Group, Boulder, CO, USA) with the gradual introduction of one new food per week (bananas and sweet potatoes were added) There were no other source of protein or lipid in the diet.

Laboratory studies

Radioallergosorbent testing (RAST) (from the Allergist's office) was positive for milk (8.26, III/VI) and peanuts (3.64, III/VI) and negative for all others. On presentation to Dermatology at 8 months of age the child's potassium was 6.6 (3.5–5.0), albumin 2.0 (3.8–5.4), total protein 3.7 (4.4–7.6), serum zinc 915 (600–1200), AST 117, ALT 131, WBC 11.3, HCT 35.5, and PLT 350.

Treatment course

Given the presentation of a very fussy child, with an erythrodermic, scaly rash, copious diarrhea and markedly elevated potassium and low serum albumin in the setting

of a severely restricted diet, the diagnosis of kwashiorkor was made. The infant was hospitalized at Detroit Children's Hospital for IV hyper-alimentation and correction of electrolyte abnormalities. After treatment with IV albumin and formula, the child's diarrhea improved (child was having up to 14 bowel movements/d prior to hospitalization), he became significantly less fussy and started to talk for the first time. In the hospital he was started on Neocate formula with vanilla flavoring, rice cereal, vegetables and meats. His rash also dramatically improved with the implementation of proper nutrition and topical emollients (Eucerin cream twice daily to the skin) (Fig. 2, clinical presentation posttreatment).

Kwashiorkor

British pediatrician Cicely D. Williams introduced the name kwashiorkor into international scientific circles in the *Lancet* in 1935.¹ The name is derived from one of the Kwa languages of coastal Ghana and means "the one who is displaced," reflecting the development of the condition in the older child who has been weaned from the



Figure 2 Clinical presentation at 1 week after initiation of appropriate dietary protein intake (after serum albumin and electrolytes had normalized)

breast once a new sibling is born.² When a child is nursing, he/she receives essential amino acids vital to growth from its mother's milk.^{2,3} If a child is not breast fed or when the child is weaned, if the diet is deficient in protein, the child may develop kwashiorkor.^{2,3}

Kwashiorkor, a manifestation of severe protein-calorie malnutrition, occurs primarily in areas of famine, limited food supply and low levels of education.³ The incidence of kwashiorkor in children in the USA is extremely low and only nineteen prior cases have been reported in the USA literature.^{4-9,21} Each of these cases have resulted from either restricted diets imposed by "well-intending" parents as a result of concern for food "allergies" or other dietary sensitivities (Table 1).^{4-9,21}

Early symptoms of kwashiorkor are very general and include fatigue, irritability, and lethargy.⁴⁻¹⁴ As protein deprivation continues, growth failure, loss of muscle mass, generalized swelling (edema), and decreased immunity occur.^{4-9,21} A large, protuberant belly is common.^{4-9,21} The swollen abdomen is generally attributed to two causes: ascites because of altered oncotic pressure, as a result of hypoalbuminemia, and grossly enlarged liver because of fatty infiltration.^{4-9,21} In addition, the child has a characteristic clinical appearance with a "bull-dog" face and skin conditions, such as dermatitis (which has been described as exfoliative or "flaky paint in appearance"), loss of skin pigmentation and thinning of hair.^{4-9,21} Profound irritability and anorexia are common.^{4-9,21} Improving calorie and protein intake will correct kwashiorkor; however, full growth potential and normal IQ will never be achieved in children with this condition.^{4-9,21}

Kwashiorkor differs from other forms of malnutrition in that it is the specific deficiency of dietary protein which results in the unique features of massive edema of the hands and feet, profound irritability, anorexia, a desquamative rash, hair discoloration, and a large fatty liver.¹⁰⁻¹⁷ Other conditions in the differential diagnosis for kwashiorkor include other nutritional deficiencies, such as zinc, free fatty acid, or multiple carboxylase deficiency; marasmus; immunodeficiencies; metabolic disorders; malabsorption syndromes; cystic fibrosis; and Langerhans cell histiocytosis.¹⁰⁻²¹ Acrodermatitis enteropathica (zinc deficiency) often overlaps with kwashiorkor, where patients with kwashiorkor often present with low serum zinc levels and clinical features of both conditions. In a recent series of ten patients with kwashiorkor in the US presented by Liu *et al.*¹⁰⁻²¹, half of the patients presented with low serum zinc levels, where all of these patients improved clinically after refeeding in conjunction with zinc supplementation. Moreover, the two conditions are very clinically similar in presentation, where both present clinically with dry, scaly eczematous skin that can evolve into vesicular, bullous, and pustular lesions.¹⁰⁻²¹ One of the primary features

allowing differentiation of acrodermatitis enteropathica from kwashiorkor is the distribution of lesions, which in acrodermatitis enteropathica, there is a predilection for a periorificial and acral pattern on the face, the scalp, the hands, the feet, and the anogenital areas.¹⁰⁻²¹ Edema and hypoalbuminemia, which are virtually always present in kwashiorkor, are not characteristic features of acrodermatitis enteropathica.¹⁰⁻²¹ Given the significant prevalence of zinc deficiency in patients with kwashiorkor, checking serum zinc levels and where appropriate, providing dietary zinc supplementation is often essential in the treatment of kwashiorkor.¹⁰⁻²¹

Marasmus is thought to result primarily from a generalized depletion of calories in the diet and is characterized by massive wasting and decreased physical activity.¹²⁻¹⁸ Marasmus, unlike kwashiorkor, has a less severe effect on appetite and mental and physical activity. With stimulation, patients with marasmus typically display normal mental status and appetite.¹²⁻¹⁹ The factors determining whether marasmus or kwashiorkor will develop in a patient with severe malnutrition is thought to depend on the individual's adaptation to the state of malnutrition.¹³⁻¹⁹ Marasmus has been described as a disease where there is adaptation to inadequate energy and protein intake; whereas with kwashiorkor, the prognosis for children is often worse, as there is a failure to adapt to inadequate nutrition.¹⁹⁻²¹

Review of the literature

The largest case series reported in the literature from Liu *et al.*²¹ described a cohort of 12 infants presenting with kwashiorkor (Table 1). Half of the cases were the result of a deliberate placement of children by "well-intending parents" on a protein-deficient diet as a result of a perceived "intolerance" to formula or milk. Financial and social stresses were a factor in only two cases, and in both cases, social chaos was more of a factor than an absolute lack of financial resources. Misleading dietary histories and the presence of edema masking growth failure prevented the initial diagnosis in several cases. Initial diagnostic impressions by the referring physicians included atopic dermatitis, viral exanthem, staphylococcal scalded skin syndrome, zinc deficiency, scabies, tinea corporis, Langerhans cell histiocytosis, epidermolysis bullosa, and hypothyroidism. Therapeutic trials of empirical oral and topical therapy had failed in several patients before referral to pediatric dermatologists, which led to delays of up to several weeks in diagnosis.

Carvalho *et al.* in 2001 reported a similar case as our patient, of an infant who developed kwashiorkor in the setting of consuming a diet composed of strictly a health-food "rice beverage."⁴ The mother initially started the patient

Table 1 Prior case reports of kwashiorkor in the USA

Reference	Patient Gender/Age (months)	Race/Ethnicity	Medical history	Contributing factors	Premorbid diet	Duration of signs	Initial diagnosis
Tierney <i>et al.</i> (this study)	Male/8 months	White	Large-for-gestational-age infant who weighed 10½ pounds at birth	Parents felt that food allergies (milk) was causing his skin rash	Rice Dream Milk with bananas and sweet potatoes	3 months	Acrodermatitis Enteropathica vs. Kwashiorkor
Carvalho <i>et al.</i> ⁴	Male/13 months	White	N/A	N/A	Health-food "rice beverage."	8 months	Atopic Dermatitis
Lozoff <i>et al.</i> ⁵	Male/9 months	White	N/A	Major abnormality of feeding had been neither recognized nor corrected during contact with medical personnel.	"Severely restrictive" diet	6 months	Kwashiorkor: presented with edema, growth failure, irritability, skin and hair changes, and anemia
Katz <i>et al.</i> ⁶	Female/14 months Male/7 months	White	N/A	Perceived "milk allergy" by parents	Diets of both infants consisted almost entirely of Rice Dream, a rice-based, protein-poor beverage.	9 months (female) 6 months (male)	Kwashiorkor: both infants presented with a diffuse dermatitis, whole body edema, and hypoalbuminemia.
Eastlack <i>et al.</i> ⁷	Girl/42 months	African American	Viral meningitis at 10 months of age and a seizure disorder which began at 14 months of age. The child had a history of developmental delay, the cause of which was not known	"Food aversion" of child	Severely restrictive diet of potato chips, graham crackers, and fruit juice	2 months	Kwashiorkor: presented with "flaky paint dermatitis": multiple annular plaques with hyperkeratotic borders and desquamated hypopigmented centers resembling "flaky paint." They varied from 1 cm to 7 cm in diameter and were confluent over the face, chest, extremities, and diaper area. In addition, the child had angular cheilitis and fine silky hair with diffuse alopecia prominent over the temporal and occipital scalp
Schreiber <i>et al.</i> ⁸	Female/8 months	N/A	N/A	Diagnosis of "milk intolerance" was given to patient due to frequent vomiting and regurgitation while being fed homogenized cows' milk	Cream soda	5 months	
Cundiff <i>et al.</i> ⁹	Female/5 months	N/A	N/A	Strict vegan diets with inadequate protein and total caloric intake		5 months	Child died secondary to severe malnutrition

Table 1 Continued

Reference	Patient Gender/Age (months)	Race/Ethnicity	Medical history	Contributing factors	Premorbid diet	Duration of signs	Initial diagnosis
Liu <i>et al.</i> ²¹	Male/9 months	Black	Premature at 34 week of gestation	Financial and social stress and chronic constipation	Breastfed four times daily, occasional formula supplements and Karo syrup with water <i>in lieu</i> of breastfeeding	1 month	Langerhans cell histiocytosis vs. hypothyroidism vs. atopic dermatitis vs. acrodermatitis enteropathica vs. Wiskott-Aldrich syndrome "Skin rash"
Liu <i>et al.</i> ²¹	Female/1 month	Hispanic	N/A	Financial and social stress, chronic diarrhea, and secondary milk protein allergy	Isomil and Nutramigen	15 d	
Liu <i>et al.</i> ²¹	Male/11 months	Native American	N/A	Nutrition ignorance	Potatoes and juice	2 weeks	Encephalitis
Liu <i>et al.</i> ²¹	Female/5 months	Hispanic	N/A	Nutrition ignorance (preference of only liking potatoes)	Juice, cereal, and applesauce (no milk)	1 month	Atopic dermatitis
Liu <i>et al.</i> ²¹	Female/5 months	White	N/A	Chronic constipation and vegan family	Brown rice emulsion, molasses, chlorophyll, acidophilus, flaxseed oil, and vitamins	3 weeks	Atopic dermatitis and dermatophytosis
Liu <i>et al.</i> ²¹	Male/9 months	Hispanic	N/A	Chronic vomiting and milk protein allergy	Table foods and a barley water, and cinnamon emulsion	2 weeks	Staph scalded skin syndrome
Liu <i>et al.</i> ²¹	Male/22 months	Hispanic	Premature at 27 weeks, asthma, atopic dermatitis and developmental delay	Suspected food allergy to milk (pulmonary congestion and diarrhea)	Plantains, lentils and other vegetables	2 months	Atopic dermatitis
Liu <i>et al.</i> ²¹	Male/8 months	Hispanic	N/A	Vomiting and perceived dislike of formulas	Rice flour water and baby food	4 weeks	Superinfected atopic dermatitis or scabies
Liu <i>et al.</i> ²¹	Male/4 months	White	N/A	Colic, feeding problems and secondary ileitis	Rice Dream milk and Poly Vi Sol	20 d	Viral exanthem
Liu <i>et al.</i> ²¹	5 months	Black	Enterococci urinary tract infection	Chronic diarrhea and poor oral feeder	Similac with iron, Isomil, Nutramigen, and water	Unknown	Atopic dermatitis vs. nutritional deficiency
Liu <i>et al.</i> ²¹	8 months	Hispanic	N/A	Nutritional ignorance	Eight jars of baby food a day (mostly fruit – mangoes, tropical fruit, peach cobbler, and applesauce) and 240 ml of Similac a day	2 months	Epidermolysis bullosa vs. nutritional deficiency

on cow's milk at 13 months of age after she stopping breast feeding. As the child had several episodes of vomiting and appeared to have worsening "eczema" with the cow's milk, she switched the child to a diet of primarily a health-food "rice beverage." After 8 months of the "rice beverage" diet (child received 3 g/d of protein: 2.6 g from rice beverage, 0.4 g from other sources, 790 calories/d: 780 calories from rice beverage, 10 calories from other sources), the child developed the classical features of kwashiorkor.

Similarly, Katz *et al.*⁶ reported the development of kwashiorkor in two infants in Philadelphia, whose diet consisted exclusively of a "RICE DREAM[®]" beverage. The authors reported that while "RICE DREAM[®]" and other similar rice beverages are frequently referred to as rice "milk," parents often erroneously assume that rice beverages have similar nutritional content as breast milk. While "RICE DREAM[®]" packages are labeled in small print under the list of ingredients – as "not intended for use as infant formula," the product's website includes no such warning.²² It is also interesting to note a recent case of manslaughter in Australia, where the magistrate ruled that warnings on "RICE DREAM[®]" packages sold there were "totally inaccurate."²³

Similarly, In 1985, Schreiber *et al.*⁸ reported an iatrogenic case of kwashiorkor in an 8-month-old girl on a strict diet of "cream soda," started by her parents after her physician had given a diagnosis of "milk intolerance" because of frequent vomiting and regurgitation while being fed homogenized cows' milk.

Eastlack *et al.*⁷ presented the case of a 3½-year-old African American girl presenting with kwashiorkor. Her past medical history was complicated by viral meningitis at 10 months of age, a seizure disorder which presented at 14 months of age. The mother reported that since weaning from bottle feeds, the child had never eaten normally, which she attributed to the child's previously diagnosed "developmental delay." However, the mother had never sought treatment for the infant's "developmental delay" or her nutritional intolerance. Notably, in the 2 months prior to her admission for a severe rash and total body edema, she had consumed a diet of potato chips, graham crackers, and fruit juice. On review of her medical chart, while she was previously noted to be "vitamin-deficient" by her pediatrician, this had never been addressed as a serious concern as she was noted to be "large size for age," given her significant edema.

In 2006, Cundiff *et al.* reported a child who died secondary to chronic wasting from protein-calorie malnutrition.⁹ This 5-month-old infant died suddenly and an autopsy confirmed the cause of death as dietary malnutrition. After further investigation, the parents are now facing trial for aggravated manslaughter after feeding all six of their children, ages from 18 months to 6.5 years, strict

vegan diets with inadequate protein and total caloric intake. The other five children also have diagnoses of severe malnutrition, one of whom has been diagnosed with rickets, and another child with severe developmental delay secondary to malnutrition.

Treatment and prognosis

The key to re-alimentation in patients with kwashiorkor is the gradual, progressive introduction of enteral feeds.¹⁶⁻¹⁹ Alimentation is initiated first in the form of carbohydrates, simple sugars, and fats.¹⁶⁻¹⁹ Proteins are started after other caloric sources have already provided increased energy.¹⁶⁻¹⁹ Many malnourished children will have developed lactose intolerance and will need to be given supplements with lactase, in order for them to be able to tolerate milk products.¹⁸ In developed countries the condition often results from a perceived "allergy" to milk where in most cases, on allergy testing of such patients, milk sensitivity is not confirmed.^{4-9,21} Thus, starting feeding with cow's milk is the treatment of choice in patients with kwashiorkor whose milk allergy can not be confirmed by allergy testing.^{4-9,18-21} However, if allergy to milk is confirmed, as was the case in our patient, initial refeeding with a protein hydrolysate formula is the safest approach.^{16-19,21}

Treatment early in the course of kwashiorkor generally produces good results;^{16-19,21} however, without treatment or if treatment is delayed, this condition can lead to failure to reach normal growth and developmental milestones and in the most severe cases, it can be fatal.^{16-19,21} Mortality rates have been reported in the literature as high as 60%, which results primarily from cellular immunodeficiency, leading to infection and profound electrolyte imbalances which can cause cardiac arrhythmias.^{16-19,21}

Conclusions

Despite its association with developing countries, kwashiorkor also affects infants in the developed world, as evidenced by the case reported herein and our review of the literature, which now confirms twenty cases of kwashiorkor reported in the USA. On review of these cases, the majority have occurred as an outcome of severely restricted diets, imposed by "well-intending" parents, as a result of concern for adverse reactions to certain foods, particularly, milk and other food allergies. The seriousness of the disease, including the potential for fatal outcomes reported in the literature, strongly advocates that dermatologists and other physicians continue to consider kwashiorkor in the differential diagnoses of infants with widespread dermatitides and other

suggestive signs and symptoms. On review of the literature, four prior cases to ours in the US, occurred as a result of infants being fed a Rice milk diet, where on review of the website for the product fed to our patient, RICE DREAM®, there is no clear stipulation that this product is not intended for use as infant formula.^{22,23} In the future, cases of kwashiorkor may be prevented by the addition of more prominent warnings by the manufacturer of this beverage, both of the product packaging and the website, about the lack of nutritional content in popular “rice beverages.”

In conclusion, kwashiorkor does occur in developed countries. Particularly in patients who present with refractory dermatitides, doctors should consider nutritional deficiencies and should take a thorough social and dietary history for factors including fussy eating habits, frequent dietary manipulations, unorthodox diets, and food allergies. Proper nutritional status clearly impacts a child’s total picture of health.

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