Difficulty in Walking: Childhood Manifestations of a Micronutrient Deficiency

If you are a regular reader of our column, you may be aware that we run primary healthcare clinics called AMRIT Clinics in rural and tribal areas of South Rajasthan. This region is inhabited predominantly by tribal communities, and a large number of men migrate to cities for employment. Land sizes are small, and rain fall erratic. This causes food scarcity and inadequate food intake among children, as well as adults.

In the year 2015, we conducted a study across eight villages of Salumbar block to assess the nutrition levels of children under-3 years and their food consumption patterns and to understand the reasons for high levels of malnutrition. We used the semi-quantitative dietary recall method to estimate food consumption among children under-3 years of age. Out of the 500 children surveyed, only 7.6% of children had consumed any vegetables in the previous 24 h, and none had consumed any fruits. The study also revealed high levels of malnutrition among these children (33% wasted) and their mothers (54.6% had body mass index <18.5), respectively.[1] It is important to note that low consumption of vegetables and fruits is not restricted to the especially deprived areas in which we work. Conducted between 2016 and 2018, the Comprehensive National Nutrition Survey also revealed low and inadequate consumption of vegetables and fruits among children between 2 years and 4 years; only about half (55%) had consumed any vegetables in the past 24 h.[2]

We see high levels of anemia and Vitamin A deficiency among children and women among those who present to our clinics. Over the last few years, we have also seen several children presenting with other micronutrient deficiencies, such as acrodermatitis enteropathica. In this case, we present the report of a child who presented with difficulty in walking and the challenges we faced in establishing a diagnosis of scurvy in a limited resource setting.

Case Study

A 4-year-old boy was brought to the AMRIT Clinic located at Manpur, a remote, tribal village of South Rajasthan, with difficulty in walking for 2 months. According to the mother, the child's illness had started with an episode of high-grade fever 2 months back that had lasted for a few days. At that time, there was no associated cough, coryza, rashes, joint pain or swelling, jaundice, bleeding manifestations, diarrhea, vomiting, abdominal pain, or abdominal distension. The parents had consulted an unqualified private provider operating close to their home, who had administered some intramuscular injections.

When the fever subsided, the mother noted that her son found it progressively difficult to walk, and complained of severe pain in his legs. Over the next few weeks, he was unable to stand and walk. There were no symptoms suggestive of the involvement of the upper limbs or trunk. There was no history of seizures, loss of consciousness, slurring of speech, difficulty in swallowing, excessive drooling, cranial or focal neurological deficits, numbness, abnormal sensations, or photophobia. Bowel and bladder function was preserved. There was no history of any recent trauma to the head or spine, immunization, or dog bite.

When the child showed no waning of symptoms even after a few weeks, his grandfather took him to the nearest Community Health Center, which is located about 25 km away from their village. On reviewing the medical records, it was apparent that the clinician had suspected myositis or Guillan–Barre syndrome. The family was advised to take the child to the Government Medical College in Udaipur City, around 100 km from his home. However, they were unable to go since the father was a daily wage earner and the other family members were unfamiliar with the city and the hospital.

We learned that there were no similar cases in the neighborhood. The history was not significant. The child was delivered vaginally at full term in the local Primary Health Center. His birth weight was 3.28 kg, and the neonatal period was uneventful. The family history was not contributory. He had two elder siblings, who were reportedly healthy. According to his parents, the acquisition of developmental milestones had been similar to his peers and siblings, but they were unsure of his vaccination status. His diet mainly consisted of wheat with the little and occasional intake of seasonal vegetables and fruits. Some complementary feeding (although inadequate) had been started by 8 months of age, and the mother had continued to breastfeed him till around 3 years of age. The family had small landholdings, and the father was a labor-migrant, the only earning member.

When we examined him, he was lying on a bed in a semi-flexed position, and appeared irritable [Figure 1]. His vitals were normal, with a pulse rate of 83 beats/min, all peripheral pulses were palpable, a respiratory rate of 23 breaths/min, and he maintained normal oxygen saturation in room air. He weighed 9.7 kg (weight for age Z score <−3), and measured 87 cm (height for age Z score <−3), his weight for height being <−2. Based on these parameters, the child had severely underweight, with severe stunting and moderate wasting. The child had pallor, and his gums displayed swelling but no bleeding. There were no rashes, glossitis or cheilitis, sternal tenderness, or generalized lymphadenopathy. Generalized tenderness and swelling were noted over both lower limbs, but there was no discoloration. It was difficult to appreciate

individual joint involvement, as the child resisted movement of the limbs due to the pain.

His sensorium was normal, and he was oriented to time, place, and person. There were no cranial or focal neurological deficits. We were unable to assess the gait due to the pain; however, we found that the proximal and distal muscle power across all joints of both lower limbs was normal (grade 4/5), and that the tone and deep tendon reflexes were normal. The motor examination of the upper limbs was normal. There were no focal neurological deficits; and no signs of meningeal involvement or of raised intracranial pressure. The abdomen was soft, not distended, and without organomegaly. The cardiovascular and respiratory system examination was normal. Based on the clinical examination, our first differential diagnosis was pseudoparalysis; in view of the poor dietary intake, swelling of gums and malnutrition, scurvy was a strong possibility. Other differentials considered were acute myositis and septic or reactive arthritis. These were disregarded due to the absence of fever, and the absence of signs of inflammation like swelling and warmth over the muscles and joints, respectively. This also made the possibility of rheumatoid arthritis and acute leukemia (considered since the duration was 2 months) less likely.

The family was advised to take the child to a hospital as he would require investigations (which were not available in our setting) for establishing the diagnosis and further management, but they declined citing the aforementioned reasons. We ordered a few preliminary investigations to look for evidence of infection or inflammation. Since the clinic does not have X-Ray facilities, the family was asked to get it done elsewhere, but this was not feasible for them. His hemoglobin was 8.3 g/dL, total leukocyte count 10,000/mm^3 with 60% neutrophils, and platelet count 3.5 lakhs/ml. The peripheral smear was suggestive of microcytic, hypochromic anemia, and did not reveal any abnormal cells. The erythrocyte sedimentation rate was 20 mm at the end of 1st h. The rheumatoid factor was negative.

In view of a very low intake of vegetables and no intake of fruits, tenderness over limbs, gum swelling, exclusion of infection on investigations, and no obvious clinical evidence of arthritis or leukemia, we maintained our initial provisional diagnosis of scurvy. The child was initiated on oral Vitamin C (250 mg three times a day), as per the standard protocol. We also started him on iron (3 mg/kg/day), and prescribed a single dose of albendazole. The child was kept under close watch, and our team visited his home to monitor his status weekly. By 2 weeks, there was a dramatic improvement; he was able to walk with support [Figure 2] and his gum swelling had subsided. The treatment continued for 3 months, at the end of which he had become completely asymptomatic, was playing, and had resumed his activities of daily life [Figure 2].

Discussion

During evolution, human beings have lost a key enzyme in the biosynthetic pathway that converts glucose into ascorbic acid. Now, we are entirely dependent on dietary sources of Vitamin C, especially vegetables and citrus fruits. This vitamin plays several critical functions in the human body. it helps in the formation of collagen from procollagen, in protecting the cells from oxidant damage (anti-oxidant role), and generation of carnitine. Besides, Vitamin C is increasingly recognized to have an epigenetic role, underscoring its importance for promoting growth and development for children.

In high-income countries, fortification of infant food with vitamins has led to a significant reduction of Vitamin C deficiency in children. A nationwide survey in the USA in 2003–2004 revealed that only 1.1% of children below 6 years had this deficiency. However, many of these countries are seeing a resurgence of symptomatic children with Vitamin C deficiency.[3] This is largely seen in those with "picky" eating habits, mental or physical disabilities, and conditions with associated iron overload. We do not have any comparable nationwide data of Vitamin C deficiency among children in India. The Comprehensive National Nutrition Survey estimated deficiency of Vitamin A and Zinc among

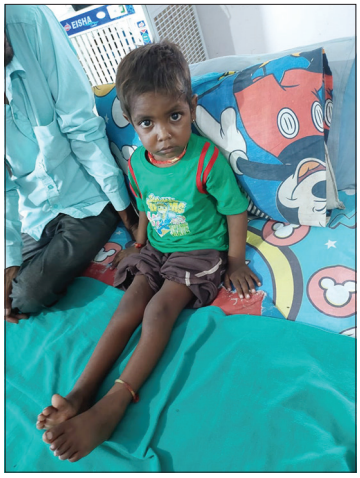

Figure 1: Child on his initial visit

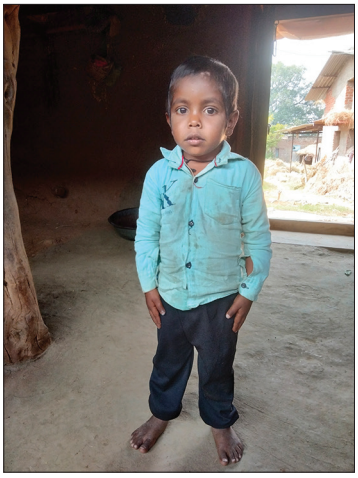

Figure 2: Child at the end of 3 months of treatment

children but did not estimate Vitamin C levels. However, the survey did reveal huge gaps in food intake in terms of adequate diversity and frequency: only 21% of children 6–23 months consumed food with minimum acceptable diversity, and 49% consumed meals with adequate frequency. Only 6.4% consumed food in adequate quantity and diversity.[2]

Vitamin C deficiency results in scurvy. Being a relatively uncommon condition in children nowadays as compared to other micronutrient deficiencies, it may not be suspected timely, leading to a delay in diagnosis. Untreated scurvy can be fatal; hence, timely diagnosis is essential. In a recent review of all related publications on scurvy in children over the last 20 years,[4] it was observed that the median age of children affected by scurvy was 42 months; 29% had associated severe malnutrition; and anemia was present in about half the cases. The common constitutional symptoms were fever (17%), irritability (10%), tiredness (13%), and loss of appetite (7%). Lower limbs related manifestations included severe pain (92%), difficulty in walking (88%), and limping (33%). About 57% of children had mucosal manifestations, most commonly gum bleeding. Petechiae and ecchymoses were the most common (42%) skin manifestations. Vitamin C levels could be estimated in less than half of the cases, though classical radiological findings were present in almost all.

In this case, we could not get a radiograph or the serum Vitamin C levels. Thus, we made the diagnosis based on knowledge of the local dietary practices, clinical signs, and the response to a therapeutic trial of Vitamin C. In resource-poor settings, while there is a need for improved access to diagnostics in rural areas, a strong clinical acumen, knowledge of local epidemiology, and close monitoring remain essential skills for successful management.

India has made big strides in food security, eliminating widespread famines. However, we are still far from nutrition security that ensures the availability of an adequate amount of nutritious food to all, especially children. Untreated micronutrient deficiencies significantly inhibit human potential. Only a second green revolution, coupled with public policies to ensure equitable distribution, would ensure that all our children reach their potential. As pediatricians, we should research on the dietary deficiencies, and advocate for the availability of adequate nutritious food and its consumption by all children-rural or urban, rich or poor.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the legal guardian has given his consent for images and other clinical information to be reported in the journal. The guardian understands that names and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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