

## Case Reports

# Very Prolonged Breastfeeding Causing Nutritional Rickets in a 4-year-old Local Hong Kong Boy

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### Abstract

Nutritional rickets is a rare disorder in modern society. We report the case of a patient with rickets presenting with genu valgum (knock-knees). Subsequent investigations revealed the patient had insufficient total blood 25-hydroxyvitamin D owing to prolonged breastfeeding. He was treated successfully with calciferol for a period of 6 months followed by maintenance therapy with multivitamins and nutritional advice. To our knowledge, this is the first report of nutritional rickets due to prolonged breastfeeding in Hong Kong. The ensuing discussion highlights the need to provide adequate guidance on vitamin supplementation to breastfeeding mothers to prevent vitamin deficiency in their infants.

### Key words

Breast feeding; Genu valgum; Rickets; Vitamin D deficiency

### Introduction

Rickets is characterised by impaired mineralisation and ossification of the growth plates of growing children, potentially leading to fractures or deformities. While many disorders can cause rickets, the majority of cases are attributable to vitamin D deficiency.<sup>1</sup> Although considered a disorder of the past, rickets has not been eliminated from the world; an increasing incidence of rickets has been observed in the United States.<sup>2</sup> Here, we report a rare instance of nutritional rickets in a local Hong Kong patient. To our best knowledge, there has been no previous report of such a case in Hong Kong.

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### Case Report

A 4-year-old Chinese male presented at the Queen Elizabeth Hospital in September 2011. He had good past health, had up-to-date vaccinations, and had been hospitalised only once previously for roseola infantum. His family history was unremarkable; both his parents were healthy and there was no parental consanguinity. The mother had no difficulty in breastfeeding. Neither the mother nor the patient received any vitamin supplementation during the period of breastfeeding. The mother strongly believed that breast milk was the best food for children because it contains all the nutrients necessary for optimal infant growth and development. Weaning occurred at 6 months with no obvious complications, and the patient continued to be breastfed. However, the mother noted that the patient's appetite for solid food intake was low. From 2 to 4 years of age, the patient attended school, as a consequence of which there was gradual reduction in frequency of breastfeeding (to approximately once a day) and an increase in solid food intake. However, his dietary intake was small and included little meat. Further, he had little exposure to sunlight. Physical examination showed that he was short; the height and weight were just below the 3rd percentile and the head circumference was in the 25th percentile. While there was no dysmorphism, the

presence of genu valgum (knock-knees; Figure 1) and bilateral costochondral swelling (rickety rosary) over the chest were noted. There were no other signs of rickets. A provisional diagnosis of rickets was made and the patient was started on one multivitamin tablet (300 IU vitamin D) daily for 4 weeks while awaiting blood results.

Blood reports later revealed normal complete blood count, liver function tests, renal function tests and alkaline phosphatase (194 IU/L; reference range, 93-309 IU/L), with borderline-low calcium (2.18 mmol/L; reference range, 2.19-2.64 mmol/L) and borderline-high phosphate (1.82 mmol/L; reference range, 1.05-1.80 mmol/L). In a subsequent report, parathyroid hormone was normal (1.9 pmol/L; reference range, 1.6-6.9 pmol/L). Blood iron, total iron binding capacity and transferrin saturation were all at the lower limit of normal. Total blood 25-hydroxyvitamin D level was insufficient, at 48 nmol/L (reference range, 50-250 nmol/L). Thus, in addition to the multivitamins, the patient was started on a vitamin D supplement in the form of calciferol oral drops (6,000 IU), daily for 3 months.

The patient complied with the treatment, and showed gradual reduction in knock-knees (Figure 2A). By March 2012, his total blood 25-hydroxyvitamin D had risen to within the normal range (140 nmol/L). He continued with maintenance treatment of one multivitamin tablet daily (300 IU vitamin D). By September 2012, the bilateral costochondral swelling had subsided and the patient showed

no obvious knee deformity. Figure 2B depicts the patient's knees at his most recent follow-up in May 2014.

Notably, the patient's younger brother, a 2-year-old male who was similarly breastfed, was also found to have insufficient total blood 25-hydroxyvitamin D level (49 nmol/L) in October 2011. However, he did not show any external features of rickets and was given low-dose calciferol (800 IU) for 2 months. By January 2012, the younger brother's blood level of total 25-hydroxyvitamin D had risen to within the normal range (94 nmol/L). Finally, the patient's mother was also found to have insufficient total 25-hydroxyvitamin D (35 nmol/L). She admitted that she ate little food, consumed little meat, and did not expose herself to sunlight. She had no signs of rickets. She was advised greater sun exposure and was prescribed multivitamins.

The mother and the two children were followed regularly and at their most recent follow-up in May 2014, their blood tests were normal. The patient's height was in the 10th percentile; weight, in the 25th percentile; and head circumference, in the 25th percentile (growth parameters of both parents are in the 10th percentiles). Neither child was observed to have bowlegs or knock-knees.

## Discussion

In an otherwise healthy infant, vitamin D deficiency



**Figure 1** Physical examination (A) and X-ray (B) of the patient in October 2011 revealed knock-knees.

results primarily from inadequate intake of vitamin D from food, and from insufficient exposure to sunlight which prevents the cutaneous synthesis of vitamin D. Other possible causes of vitamin D deficiency include intestinal malabsorption of fat, and the use of certain anticonvulsants which can accelerate vitamin D metabolism; both causes were unlikely in our patient, who was noted to have good past health and was not on any regular medication. Importantly, however, making an initial diagnosis of rickets was challenging, given that our patient's biochemical and radiographic findings were not typical of rickets.

While breastfeeding is the recommended method of infant feeding and provides infants with necessary nutrients and immune factors, breast milk alone does not necessarily provide an adequate supply of vitamin D, especially for a child that is 4 years old. The American Academy of Pediatrics, therefore, recommends a supplement of 400 IU per day of vitamin D for all breastfed infants.<sup>3</sup> Further, non-breastfed infants, as well as older children ingesting less than 1,000 mL/day of vitamin D-fortified formula or milk, should receive a vitamin D supplement of 400 IU/day to prevent vitamin D deficiency.<sup>3</sup> The treatment for vitamin D

deficiency with symptoms is 8 to 12 weeks' supplementation with vitamin D, at a dose of 1,000 IU daily for infants aged younger than 1 month, 1,000-5,000 IU daily for infants aged 1-12 months, and 5,000 IU or more for children older than 12 months, followed by maintenance therapy with 400-1,000 IU per day.<sup>4</sup>

Our case illustrates how vitamin D deficiency rickets can develop due to prolonged breastfeeding. The mother had an indoor lifestyle (she was a housewife), a relatively small diet, and frequently skipped breakfast. She did not alter her diet and did not take any vitamin supplements during breastfeeding. Her inadequate diet and avoidance of sunlight may explain her vitamin D insufficiency. Moreover, her lifestyle preference may have impacted her child's exposure to sunlight. A study in women of childbearing age (20-35 years) living in Hong Kong found that over 90% were vitamin D insufficient ( $\leq 50$  nmol/L) and 18% were vitamin D deficient ( $\leq 25$  nmol/L).<sup>5</sup> It has been suggested that this low vitamin D status is due to sun avoidance due to cosmetic reasons, shift work, an indoor lifestyle due to pollution, and heat.<sup>5</sup>

The mother believed that breast milk provided more



**Figure 2** Reduced knock-knees after supplementation of vitamin D: in March 2012 (A) and in March 2014 (B).

nutrients than solid food and breastfed as per the patient's demand. The patient also demanded breast milk when his younger brother was breastfed. However, at 4 years of age, the majority of a child's nutrients should come from solid foods. This case illustrates that mothers need more education on appropriate breastfeeding and weaning, as well as on vitamin D fortification or supplementation, to ensure that they and their children receive sufficient vitamin D when breastfeeding.<sup>6</sup>

Parents also need to help their children establish good eating habits by providing them a variety of different foods so that they may obtain nutrients required by their developing bodies. According to the Department of Health, if milk is given to the child, the quantity should not exceed more than 480 mL per day to allow the child an appetite for solid foods.<sup>7</sup> Likewise, parents and children must be educated and encouraged to receive sufficient exposure to sunlight while avoiding sunburn, as sensible sun exposure is the major source of vitamin D for most humans.<sup>8</sup> It is recommended to receive sun exposure between the hours of 10 am and 3 pm, as this produces vitamin D in the skin that may last twice as long in the blood compared with ingested vitamin D.<sup>9</sup> Sun exposure producing slight pinkness in light-skinned individuals results in vitamin D production equivalent to ingesting 10,000-25,000 IU.<sup>10</sup> Notably, increased skin pigmentation, excessive use of sunscreen, staying indoors for most of the day, wearing clothes covering most of the skin, and living in northern latitudes, all predispose to vitamin D deficiency; individuals with any of these attributes should make sure to receive daily sunlight exposure.

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## Declaration of Interest

None

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