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Case Report

Vitamin D deficiency and recurrent lower respiratory tract infections: a case based discussion

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Abstract. Lower respiratory tract infections (LRTI) are among the most prevalent infectious diseases. Vitamin D deficiency has been found to be a risk factor for LRTI. We here report a case with the diagnosis of recurrent LRTI treated safely by empirical antibiotherapy and vitamin D supplementation in order to underline the importance of assessment and treatment of vitamin D deficiency in pediatric patients with the diagnosis of LRTI.

Keywords: Lower Respiratory Tract Infections, Children, Rickets, Vitamin D

Introduction

Lower respiratory tract infections (LRTI) are among the most prevalent infectious diseases which may cause considerable morbidity and mortality during childhood [1, 2]. Development of LRTI is closely related with different risk factors including malnutrition, low socio-economic status, passive smoking and presence of systemic diseases (e.g immune deficiency, congenital heart diseases and prematurity) [3-8]. Previous studies have shown that low serum hydroxyvitamin D3 (25(OHD) status is associated with increased risk of LRTI in children [9, 10]. This issue is a particular concern because the prevalence of vitamin D deficiency is notably high in all over the world including tropical countries [9]. We here report a pediatric case with the diagnosis of recurrent LRTI treated safely by empirical antibiotherapy and vitamin D supplementation.

Case Presentation

A 6-month-old boy was admitted to pediatric outpatient clinic with complaints of cough and wheezing. Medical history taken from mother revealed that he was born at 39 weeks of gestation. Pregnancy, labor, and delivery were uneventful. She reported that the boy was also hospitalized with the diagnosis of LRTI one month ago. The infant was exclusively breastfed without vitamin D supplementation until the age of 6 months. His mother did not receive any vitamin D supplementation either.

Upon arrival to the hospital, the patient's vital signs were stable, with a body temperature of 37.1°C, pulse rate of 100/min, blood pressure of 90/50 mmHg, respiratory rate of 35/min, and oxygen saturation of 96% on room air. Height was 65 cm (25 percentile), weight was 7500 gr (50th percentile). At Anterior fontanel was 2x2 cm and posterior fontanel was closed. The rest of physical evaluation was normal except bilateral diffuse rhonchus and rales on chest and bilateral wrist enlargement. Initial laboratory data revealed a white blood cell count: 13.500/mm3, calcium: 7.5 mg/dL, phosphorus: 2.5 mg/dL, alkaline phosphatase: 421 IU/L, albumin: 4.5 g/dL, 25(OH)D: 11.7 ng/mL, parathyroid hormone: 70.5 pg/dL. Urine calcium excretion was normal. Anteroposterior chest radiograph showed infiltration of the right hemi-thorax (Fig. 1) and the plain radiography of the wrist showed evidence of cupping, fraying, metaphyseal widening, and demineralization of the distal radial and ulnar metaphyses (Fig. 2). According to the clinical, radiological and laboratory findings, the patient was hospitalized with the diagnosis of recurrent LRTI and rickets. The treatment was initiated with 200 mg/kg/day ampicilin-sulbactam and 50 mg/kg/day of elemental calcium therapy. One week after this therapy he was clinically recovered and the patient was discharged along with 5000 IU/day of cholecalciferol for two weeks. Calcium, phosphorus and alkaline phosphatase concentrations were normalized four weeks after initiation of vitamin D supplementation. Follow up radiographs obtained at a clinic visit 3 months after the completion of treatment were found to be normal. The patient did not have LRTI attack in during a follow up period of six month.

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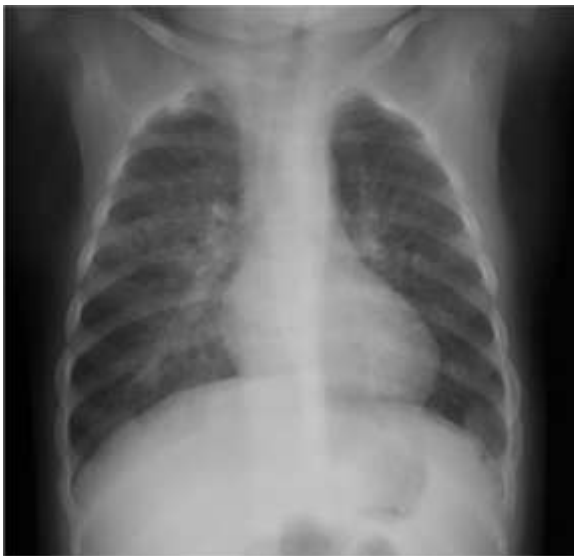

Figure 1 Chest radiography revealed infiltration of the right hemi-thorax.

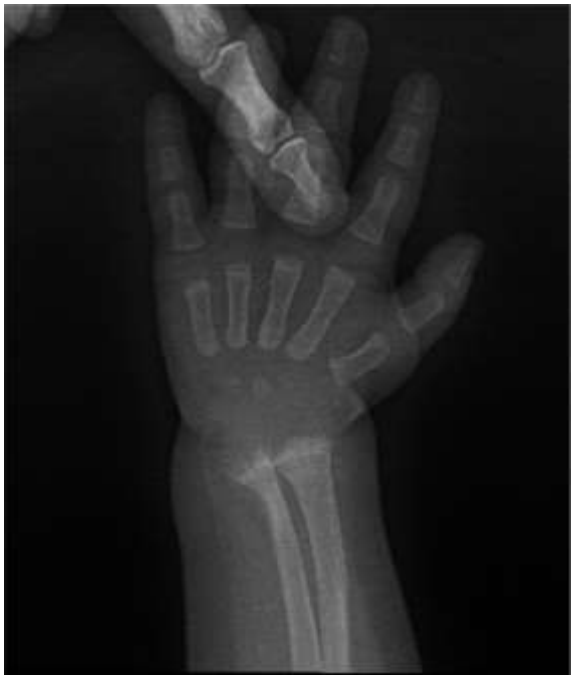

Figure 2 Plain radiography of the wrist showed evidence of cupping, fraying, metaphyseal widening, and demineralization of the distal radial and ulnar metaphyses.

Discussion

Vitamin D deficiency is a major health problem especially in pregnant women, infants and adolescents. It has been estimated that one billion people worldwide have vitamin D deficiency or insufficiency [11, 12]. The causes of vitamin D deficiency are; increased skin pigmentation, living at higher latitudes, aging, winter time, poor vitamin D nutrition, low maternal vitamin D (in only breast-fed infants), obesity (increased sequestration of 25(OH)D in fat tissue), malabsorption (including chronic liver disease and cystic fibrosis), drugs (phenobarbital, carbamazepine, phenytoin, valproic acid, and rifampicin) **[**13-21].

Symptomatic vitamin D deficiency (i.e. rickets) is more frequently reported in infancy and adolescence than in childhood. This is due to the increased calcium demand secondary to the rapid growth velocity during these two periods. It is well known that severe vitamin D deficiency impairs bone mineralization, leading to clinical manifestations such as rickets in children and osteomalacia in adults [22]. Patients with rickets like our patient have skeletal alterations such as, cupping, fraying and irregularity of the metaphyseal regions, loss of definition of the epiphyses, widening of the epiphyseal-metaphyseal junctions, and in severe cases, pathologic fractures [23]. Although 25(OH)D is primarily responsible for the regulation of calcium and bone metabolism, vitamin D receptor (VDR) and the vitamin D activating enzyme 1-α-hydroxylase (CYP0B1) are expressed in many cell types such as intestine, pancreas, prostate and cells of the immune system [12, 24]. Previous studies have suggested that vitamin D deficiency and insufficiency not only have negative consequences on bone health but are also likely to be a risk for many acute and chronic illnesses including autoimmune diseases (Type 1 diabetes, multiple sclerosis), cardiovascular diseases, type 2 diabetes mellitus, several types of cancer (Non-Hodgkin lymphoma, colorectal, prostate, oesophagus and breast cancer), neurocognitive dysfunction and mental illness, infertility, adverse pregnancy-birth outcomes and infectious diseases [25-39]. Vitamin D stimulates the production of antibodies and has positive effect on phagocyte activity of macrophages [40, 41]. Data have shown that low 25(OH)D status was related to the increased risk of developing LRTI [9, 10, 26, 42)] Therefore, it was assumed that the repletion/ supplementation of vitamin D along with antibiotherapy in LRTI, would reduce the length of hospital stay and possibility of recurrence of LRTI over the next 3-months period of discharge [43]. However, many questions remain. What is the optimal dose of vitamin D? What is the 25(OH)D threshold for an anti-infective effect? How long does it take for vitamin D to become effective? Are daily doses required or will weekly or monthly doses prevent infections?

In order to prevent vitamin D deficiency and related health problems, the American Academy of Pediatrics (AAP) recommends that all infants, children and adolescent have a minimum intake of 400UI of vitamin D per day [44], but it was shown that most US infants were not consuming adequate amounts of vitamin D according to the 2008 AAP recommendation [45]. Unfortunately the use of vitamin D may be neglected by the families and this might be overlooked during routine follow-up if not carefully questioned and physically examined.

As vitamin D deficiency is a risk factor for recurrent LRTI, all children with the diagnosis of LRTI should be checked for 25(OH)D status and should receive repletion therapy in addition to antibiotic treatment if they found to be vitamin D deficient.

Conflicts of Interest

The authors declare no conflicts of interest.

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