

The Approach to Tetanic Hypocalcemia Caused by Vitamin D Deficiency

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ABSTRACT: Recently studies have shown that over half of infants, children and teenagers may be inadequately supplemented. A high prevalence of vitamin D deficiency in children has been observed worldwide, even in sunny countries. Regardless of the recommendations, vitamin D supplementation is sometimes underestimated, supporting the idea that for children in sunny country it is unnecessary. In the modern area of supplementation, tetany seems to be a problem of the past. Usually it occurs at 3 to 6 months of age, that's why diagnostic suspicion may be low after this age. We report a case of severe hypocalcemia presented with tetany, in an 18-months-old child with severe vitamin D deficiency, because of not receiving vitamin D as supplementation. With underestimation of vitamin D supplementation, tetany may emerge again. Through our report we aim to highlight the aggressive approach to tetanic hypocalcemia in children with vitamin D deficiency and to sensitize a rigorous surveillance in order to ensure adequate vitamin D supplementation by pregnant, breastfeeding mothers, children and adolescents.

KEYWORDS: Vitamin D deficiency, Hypocalcemia, Tetany

Introduction

In the modern area of vitamin D supplementation, tetany seems to be a problem of the past. Recently, regardless of the recommendations, vitamin D supplementation is sometimes underestimated, supporting the idea that for children in sunny country it is unnecessary. That's why vitamin D deficiency remains to be a worldwide health problem. Once thought to be eradicated, is becoming a frequent occurrence in children, caused mainly by dietary insufficiency [1,2].

With the increasing prevalence of vitamin D deficiency, pediatricians need to keep in mind tetanic hypocalcemia which require an immediate treatment. Through our case report we aim to highlight the aggressive approach to tetanic hypocalcemia in children with vitamin D deficiency and to sensitize a rigorous surveillance in order to ensure adequate vitamin D supplementation by pregnant, breastfeeding mothers, children and adolescents.

Case Report

An 18 old months child has been transferred from a regional hospital in our Pediatric Intensive Care Unit (PICU) with excessive crying and Carpopedal spasms, by two hours, without any clinical suspicion about the diagnosis (Figure 1). No clinical signs were present the day before admission and he had no history of any medical problems before

admission. The baby, born at term, had a birth weight of 3.8kg. He was exclusively breastfed till 6 months. His actual weight was 12kg. (Percentile=77.0). He has normal feeding. There were no clinical signs for intestinal failure. The child had no signs of Rickets. The neuropsychic and physical development was normal. There were no abnormal reflexes.

After the first laboratory assessment we confirmed severe hypocalcemia (Ca total-5.6mg/dL; C^{++} -0.76mmol/L; Phosphorus-3.9mg/dL; Magnesium 2.1mg/dL, ALP-604U/L; total protein-6.4g/dL, normal amylasemia, AST 34U/L, ALT 12U/L, normal urea, normal creatinemia, normal urinalysis, abdominal echography normal). Surprising was that the child had never taken the vitamin D supplementation, regardless of the recommendations given by the pediatrician since the birth of the baby. There were no previous blood tests to indicate if the child had a calcium metabolism imbalance. His 5-year-old sister was healthy. They live in an urban area. We started the treatment with 100mg/kg of Ca gluconate 10% i/v over 10 minutes, to continue afterward with continuous infusion of 500mg/kg/day Ca gluconate 10% i/v. The 25(OH)D level resulted 3.5ng/mL, confirming a severe vitamin D deficiency, presented with tetany in this case. The Parathormone level-218.2ng/L (normal range: 15-65ng/L) supported furthermore the diagnosis. Beside Calcium gluconate therapy, we added vitamin D 300000UI i/m, one dose. Clinical improvement was remarkable.

The second day, total calcium level was 8.79mg/dL and C^{++} 0.94mmol/L). Two days after, the child was sent home with vitamin D supplement and oral calcium. After discharge, the child was followed for one year. This condition had never recurred. A written informed consent was obtained from the patient's parents accepting the publication of the case.



Figure 1. Carpal spasms of the child's hand.

Discussion

Epidemiological data have pointed out that vitamin D deficiency is widespread among children worldwide, regardless of age and geographical position, with a prevalence 2.7% to 45% [3-16].

At our knowledge there are no data about vitamin D deficiency in our country. Its prevalence in the pediatric age in the Mediterranean countries has ranged from 6.6% in Greece preschool children, 26% in Portugal (2-16 years), 57.8% in Italy. In children aged 6-10 years, at least one third had a deficiency level of 25(OH) D according a French multicenter study [17-20].

Similar levels of vitamin D deficiency have been observed in various countries in Europe, Canada and USA [21]. To underline is the fact that even countries with abundant sunshine, are reporting recently similar data about Vitamin D deficiency. Australia is one of the sunniest countries in the world, but ironically the levels of vitamin D deficiency are high [22].

Children and adolescents in Qatari and United Arab Emirates are at high risk for vitamin D deficiency [23,24].

According to a study in Sao Paulo, a high prevalence of hypovitaminosis D in healthy adults was observed at the end of the winter [2,23].

Based on its serum concentration, vitamin D status can be insufficient at levels: 12 to 20ng/mL (30-50nmol/L) and deficient at levels

<12ng/mL (<30nmol/L). (In our case report the level of 25(OH)D was 3.5ng/mL-severe deficiency).

Inadequate circulation of 25(OH)D is associated with elevated PTH [14]. PTH level begins to increase when the level of 25(OH)D falls below 31ng/mL. Although it is not always necessary for the diagnosis of vitamin D deficiency, PTH levels can be helpful in establishing the diagnosis. After correction of vitamin D deficiency, PTH levels decrease [14].

Most children with vitamin D deficiency are asymptomatic. Symptoms are common in infants and toddlers and sometimes can be challenged. In children >12 months old with a vitamin D deficiency, a vitamin replacement is recommended where the starting dose of 2000 IU/day is kept for 6-12 weeks and then the treatment is continued with a maintenance dose of 600 to 1000 IU/day [15].

The "stoss therapy", where we have a short-term administration of high dose vitamin D, has been shown to be an effective alternative and a good solution for some patients [15].

This was the strategy that we choose for our case. The correction of vitamin D deficiency and the normalization of PTH levels may precipitate significant hypocalcemia. That's why concomitant calcium supplementation with vitamin D should be done for patients with elevated levels of parathyroid hormone (PTH) replacement. Calcium replacement takes two to four weeks. Calcium is given at a dose of 30 to 75mg/kg/day of elemental calcium, in two or three divided doses [15].

Severe vitamin D deficiency may be associated with hypocalcaemia, which may cause tetany or seizures, that require a more aggressive approach, including intravenous infusions of calcium [15,25].

Tetany is unlikely to occur, except if ionized calcium concentration drop below 4.3mg/dL (1.1mmol/L), which usually is equivalent to a serum calcium concentration of 7.0 to 7.5mg/dL (1.8 to 1.9mmol/L) [26].

(Serum calcium concentration resulted 5.6mg/dL in our case). Tetany can display a range of symptoms from mild (muscle cramps, paresthesia of the hands and feet and perioral numbness), to severe as in our case (carpopedal spasm, laryngospasm and focal or generalized seizures) [26].

In case of severe hypocalcemia (presented with tetany as in our case), is recommended i/v replacement. [27-29].

Doses of 100-300mg of elemental calcium dissolved in 50-100ml in 5% dextrose (D5W) should be administrated slowly, over 5-10 minutes. Calcium infusion should be started at 0.5mg/kg/ hr. Infusion rate may be increased up to 2mg/kg/hr as needed [27].

Serum calcium levels should be kept at 8-9mg/dL, therefore serum calcium measurement every 4-6 hours are crucial. If low albumin levels are present, the monitoring of ionized calcium should also be acquired.

Studies have shown that over half of infants, children and teenagers may be inadequately supplemented [3,30].

A rigorous surveillance is needed to ensure adequate vitamin D supplementation by pregnant, breastfeeding mothers, children and adolescents.

Conclusion

Tetany seems to be an old and forgotten problem, which may emerge again if we don't insist in vitamin D supplementation.

It is important to sensitize pediatrician to recognize and treat vitamin D deficiency.

It is important to encourage a rigorous national surveillance in order to ensure adequate vitamin D supplementation.

Abbreviations

PICU-Pediatric Intensive Care Unit.

Acknowledgment

IB conceptualized, supervised data collection and drafted the initial manuscript. EC, DS, IG, DK contributed to the acquisition of data. IB and EK revised the manuscript. DK corrected the final English version. All authors have read and approved the manuscript critically.

Competing interests

None to declare.

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