Original Research Article

Study to assess the Vitamin D deficiency in term neonates and efficacy of oral vitamin D supplement

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Abstract

Background: Vitamin D deficiency is a significant health problem throughout India irrespective of gender, age, race and geography. It plays important role in neonatal period in fetal skeletal growth, prevention of rickets, sepsis, respiratory tract infections, cancer, cardiovascular diseases, diabetes and other endocrine disorders. The aim of the study was Vitamin D deficiency in term newborn and efficacy of oral vitamin D supplement.**Materials and Methods:** This was a prospective interventional study conducted in the Department of Pediatrics, Kalawati Saran Children Hospital, New Delhi, India for1 year.Total 120 normal term normal babies were randomly selected. Cord blood was collected in plane tube, serum separated and tested for serum vitamin D, calcium, phosphorus and ALP by immune fluorescence assay technique. The babies with the vitamin D deficiency/insufficiency were supplemented with single high dose of vitamin D 50,000 IU given orally. These investigations were repeated after 60 days.**Results:** out of 120, 55% were male babies and 45% were female babies. Over all 120 babies cord blood was send for serum vitamin D, calcium, phosphorous and ALP levels at the time of birth in that only 14(11.67%) babies had normal serum vitamin D levels,70(58.33%)/36(30%)babies had deficiency/insufficiency respectively. Babies with vitamin D deficiency/insufficiency at the time of birth had given single high dose i.e. 50,000IU of vitamin D orally and follow up has been done after 60 days to check serum vitamin D, calcium, phosphorous and ALP levels. All babies vitamin D levels were normalized and none of the babies had hypervitaminosis (>100mg/dl) with serum mean value of vitamin D was 47.39ng/ml. 70(58.33%) of the neonate have vitamin D deficiency in our population. 36(30%) of the neonate have vitamin D insufficiency in ourpopulation. Only 11.67% of term neonates have normal Vitamin D status in our population. Single Oral dose of 50,000 IU Vitamin D normalizes, Vitamin D status in them.**Conclusion:** A single high dose of Oral vitamin D 50,000 IU is sufficient to normalise serum vitamin D levels with none developing hypervitaminosis.

Keywords: Vitamin D, Calcium, Vitamin D deficiency, New-born, Dietary supplements, Outcome assessment.

Introduction

There has been increasing global interest regarding the role of vitamin D in health and disease. In fact, more and more scientific evidence linking vitamin D to various chronic diseases in children and adults is emerging.

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Prevention of vitamin D deficiency and achieving adequate intake of vitamin D and calcium throughout childhood may reduce the risk of osteoporosis as well as other long-latency disease processes that have been associated with vitamin D-deficiency states in adults. Despite food fortification policies in many countries and recommendations for vitamin D supplementation of at-risk groups, vitamin D deficiency and infantile rickets remain major public health challenges in many developed and developing countries. There is evidence that the current supplementation recommendations, particularly for pregnant and lactating women, are inadequate to ensure vitamin D sufficiency in this groups.[1-4] Vitamin D deficiency is a significant

health problem prevalent in India despite plentiful sunshine. Vitamin D deficiency is widespread in individuals irrespective of gender, race, geography and age. Vitamin D plays important role in neonatal period. Effects of vitamin D deficiency on fetal health are plenty; some being short term and others may become apparent in later life. Vitamin D has direct effects on neonatal immune system effecting both innate and adaptive immunity. Vitamin D has well documented role in causation of rickets. With severe maternal vitamin D deficiency, the fetus rarely may develop rickets in utero with manifestation at birth.[5] Throughout gestation, it does play a role to certain extent in fetal skeletal development, tooth enamel formation and general fetal growth and development.[6] Further, it has been seen that cardiovascular risk factors may have origin in fetal vitamin D deficiency.[7] Vitamin D plays an important role in prevention of sepsis and morbidities in neonatal period.[8] The manifestations of deficiency may vary from hypocalcemic seizures, tetany in infancy and adolescence to florid rickets in toddlers. Vitamin D deficiency is associated with increased risk for infants to develop type 1 diabetes mellitus, cancers and other endocrine disorders in later life. Vitamin D deficiency is also associated with respiratory tract infections in newborns and wheezing episodes later in life.[9] Vitamin D deficiency at birth is also associated with higher risk of developing atopic dermatitis.[10] Low vitamin D levels has also been considered as one of the risk factor for respiratory distress syndrome.[11] Vitamin D is a fat-soluble vitamin which plays an important role in the optimal functioning of vital organ systems, it has immunomodulatory and anti-inflammatory effects.Vitamin D status of pregnant mothers (20-40 years) showed that 20% of the mothers had VDD and 24% had vitamin D insufficiency.However, maternal risk factors for having newborn with decreased vitamin D levels have not been studied very much. The neonatal vitamin D level depends wholly on the maternal vitamin D level because vitamin D crosses the placenta during the last trimester of pregnancy.[12] If the mother has VDD, less vitamin D will be transported across the placenta with resultant low vitamin D stores at birth.The amount of UV exposure available for the synthesis of vitamin D depends on many factors other than just time spent outdoors. These factors include the amount of skin pigmentation, body mass, degree of latitude, season, the amount of cloud cover, the extent of air pollution, the amount of skin exposed, and the extent of UV protection, including clothing and sunscreens.[13-15]

Material and methods

This was a prospective interventional study conducted in the Department of Pediatrics, Kalawati Saran Children Hospital, New Delhi, India for 1 year.

Out of 200 neonates born within this period, 30 baby's parents didn't give consent, 10 babies were preterm and 5 babies were IUGR. 35 babies were excluded due to exclusion criteria.

Inclusion criteria

Normal term babies were include

Excluded criteria

- Any renal, parathyroid hormone abnormality in mother. (Maternal parathyroid state was assumed to be normal when her serum calcium, phosphorus levels arenormal
- Mother with Diabetes mellitus
- Familial vitamin D resistance like hypophosphatemic rickets.
- Baby with severe renal or hepatic disorders

Methodology

Total 120 normal term normal babies were randomly selected. After taking informed consent by the parents and fulfilling inclusionand exclusion criteria, cord blood was collected in plane tube, serum separated and tested for serum vitamin D, calcium phosphorus and ALP by immune assay technique. The values are noted. Then the babies with the vitamin D deficiency /insufficiency were supplemented with single high dose of vitamin D 50000 IU orally and followed up after 60 days with estimation of serum vitamin D, calcium phosphorus and ALP.

Statistical analysis

All characteristics were summarized descriptively. For continuous variables, the summary statistics of mean, standard deviation (SD) were used. Data were analysed using SPSS software v.23.0. and Microsoft office.

Results

Out of 200 babies delivered in our labour room. 35 babies didn't qualify the inclusion criteria, 30 babies parents didn't give consent 10 babies were preterm and 5 babies were IUGR. Out of 120, 55% were male babies and 45% were female babies. Over all 120 babies cord blood was send for serum vitamin D, calcium, phosphorous and ALP levels at the time of birth in that only 14(11.67%) babies had normal serum vitamin D levels,70(58.33%)/36(30%) babies had deficiency/insufficiency respectively. Babies with vitamin D deficiency/insufficiency at the time of birth had given single high dose i.e. 50,000IU of vitamin D orally and follow up has been done after 60 days to check serum vitamin D, calcium, phosphorous and ALP levels. All babies vitamin D levels were

normalized and none of the babies had hypervitaminosis (>100mg/dl) with serum mean value of vitamin D was 47.39ng/ml. 70(58.33%) of the neonate have vitamin D deficiency in our population. 36(30%) of the neonate have vitamin D insufficiency in ourpopulation.Only 11.67% of term neonates have normal Vitamin D status in our population.Single Oral dose of 50,000 IU Vitamin D normalizes Vitamin D status in them.

Table 1: Gender distribution of babies

No. of Babies(120)	Male	Female
	66(55%)	54(45%)

Table 2: Status of serum vitamin d in our 120 babies at birth

No. of babies	Normal	Deficient	Insufficient
	14(11.67%)	70(58.33%)	36(30%)

Out of 50 term normal new born status of vitamin D levels at the time of birth shows normal for 5(10%), deficient for 31(62%) and inefficient for 14(28%) of the babies.

Table 3: Serum Vitamin D levels at Follow Up (60 Day)

No. of Babies	Normal	Deficient	Insufficient
	120 (100%)	Nil	Nil

Discussion

In our study, we aimed to confirm low serum vitamin D levels in neonates and also the efficacy of vitamin D Single high dose therapy i.e. 50,000 IU ORAL. We assessed the serum levels of vitamin D in neonate born ourhospital. According to recent studies, a significant percentage of vitamin D deficiency is noted in the neonate. Vitamin D deficiency has been defined as a 25(OH)D level less than 20 mg/ml (50 nmol/l) while vitamin D insufficiency is defined as a 25(OH)D level between 21 and 29 ng/ml(52–72 nmol/).

In our study it was found that severe deficiency (<20 ng/dl) was present in majority of new born (88.33%) whereas with only 11.67% babies has normal vitamin D. which was comparable to various studies which have been conducted throughout the world. Kumar P et al found that 83% of the new-borns had hypovitaminosis with mean cord blood level was 12.8 ng/dl.[16] Similar results were found in study done by Khuri N in Jordan, Park S in Korea, Yu X in China, with deficiency in 94%, 91.7%, 84.1% neonates respectively.[17,18] Sachan A et al found low levels of cord blood 25 (OH) D (8.4±5.7 ng/mL).[19] Dawodu et al found 44% of Arab infants had moderately severe deficiency with mean serum vitamin D levels 14.5nmol/.[20] Fallahi M found 56% of neonates had vitamin D deficiency in Tehran.[21]

In the present study it was found that higher prevalence of vitamin D deficiency was present in term new born. Total 120 babies were enrolled in this study. Among them 70(58.33%)/36(30% Babies were vitamin D deficient/insufficient and 14(11.67%) babies were in normal range. All 106 babies low Vit. D were given vitamin D Single high dose therapy i.e. 50’000 IU(ORAL).Gender of the babies was compared and correlate with vitamin D and we found no statistically significant difference found among our study at birth. Mode of delivery of the study babies compared for vitamin D status at birth, with no statistically significant difference found among our study groups. But study by Gurmeet Singh et al shows that low vitamin D levels in neonates born by LSCS than those delivered by NVD[22]. Even though we didn’t give “Single high vitamin D therapy” to baby having normal serum vitamin D as it will be unethical. But we believe that even Single high vitamin D therapyinbabies with normal vitamin D status at birth, will not cause harm to the babies.

Hence we suggest that larger studies be done to confirm our results (88.33% of otherwise normal term babies have Vitamin deficiency at birth.), so that, a single dose Vitamin D at birth will help most babies.In our study, mean serum vitamin D levels increased to106 ng/ml, after supplementation. This proves that

single high dose of vitamin D 50,000 IU at birth is very effective, safe and has notoxicity.

Limitation

Study involved only term new-born. Study didn't involve the vitamin D status of the mother. As serum vitamin D status of the mother during pregnancy is significantly correlated with serum vitamin D levels in new-born in some study. We couldn't assess the serum PTH level in any of the babies.

Conclusion

A single high dose of Oral vitamin D 50,000 IU is sufficient to normalise serum vitamin D levels with none developing hypervitaminosis.

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