 DOI: 10.18231/2394-2754.2019.0001

Levels of vitamin D in labour

Salil D. Barsode[1], Vaishali Taralekar[2], Aakanksha Kumar[3,*], Savita Mehendale[4]

[1]Associate Professor, [2,4]Professor, [3]Junior Resident, Dept. of Obstetrics and Gynaecology, Bharati Vidyapeeth Deemed to be Medical College, Pune, Maharashtra, India

***Corresponding Author: Aakanksha Kumar**
Email: aakankshakumar61@gmail.com

Received: 22nd December, 2018 **Accepted:** 8th February, 2019

Abstract

Introduction: The prevalence of vitamin D deficiency has been reported to range from 15% to 80%.
In present study, we aimed to evaluate the prevalence of vitamin D deficiency in pregnancy and it correlation with the maternal complications and perinatal outcome.

Materials and Methods: A hospital based observational study was conducted at Department of obstetrics and gynecology of a tertiary care center. The aim was to evaluate the vitamin D status among pregnant women and its effect on neonatal outcome. Vitamin D levels of 200 ANC females was computed and cases were categorized as per vitamin D levels into following 4 categories: normal, hypovitaminosis, insufficiency and deficiency.

Results: Normal vitamin D levels were seen in 5.5% cases only while hypovitaminosis D, vitamin D insufficiency and deficiency was seen in 59.5%, 28% and 5.5% cases respectively while 94.5% cases had decreased levels.
A significant association was observed between incidence of caesarean section and vitamin D status with 71.4% caesarean deliveries in deficit group as compared to 18.2% in normal group ($p<0.05$).
Low birth weight was seen in 30.5% cases. NICU admission was seen in 46% cases.

Conclusion: We therefore recommend the screening of all pregnant women for vitamin D deficiency. Considering such a high prevalence, routine supplementation of pregnant mothers with daily 400 IU vitamin D with 1000 mg calcium can be considered.

Keywords: Vitamin D, NICU, Low birth weight.

Introduction

Vitamin D deficiency is prevalent in India, a finding that is unexpected in a tropical country with abundant sunshine. Vitamin D deficiency is recognized as the most untreated nutritional deficiency currently in the world.[1]

In the last three years, an increasing amount of research suggests that some of the damage done by vitamin D deficiency is done in-utero while the fetus is developing. Much of that damage may be permanent, it cannot be fully reversed by taking vitamin D after birth. The prevalence of vitamin D deficiency has been reported to range from 15% to 80%.[2]

In present study, we aimed to evaluate the prevalence of vitamin D deficiency in pregnancy and it correlation with the maternal complications and perinatal outcome.[3,4]

Materials and Methods

A hospital based observational study was conducted at Department of obstetrics and gynecology of a tertiary care center. The aim was to evaluate the vitamin D status among pregnant women and its effect on neonatal outcome. Vitamin D levels of 200 ANC females was computed and cases were categorized as per vitamin D levels into following 4 categories: normal, hypovitaminosis, insufficiency and deficiency. The cases were followed till delivery and outcome of the neonates in terms of birth weight, APGAR and NICU admissions was noted.

Results

A hospital based observational study was conducted at Department of obstetrics and gynecology of a tertiary care center. The aim was to evaluate the vitamin D status among pregnant women and its effect on neonatal outcome. Vitamin D levels of 200 ANC females was computed and cases were categorized as per vitamin D levels into following 4 categories: normal, hypovitaminosis, insufficiency and deficiency. The cases were followed till delivery and outcome of the neonates in terms of birth weight, APGAR and NICU admissions was noted. Following observations were made during the study:

1. Most of the subjects were between 21-30 years of age (82.5%) while only 9% were below 20 years of age. Mean age of study participants was 25.4 years.
2. Out of the total 200 cases, 155 cases were registered during their ANC period.
3. Out of the 200 pregnant females, 91% delivered at or after 37 weeks of gestation.
4. Out of the 200 cases, 47.5% were primi-gravida while 52.5% were multi-para.
5. A total of 55% were in active phase of labour while 43.5% were in latent phase of labour.
6. Out of total 200 cases, 87.5% had history of vitamin D Intake.
7. Normal vitamin D levels were seen in 5.5% cases only while hypovitaminosis D, vitamin D insufficiency and deficiency was seen in 59.5%, 28% and 5.5% cases respectively while 94.5% cases had decreased levels.
8. A significant association was observed between incidence of caesarean section and vitamin D status with 71.4% caesarean deliveries in deficit group as compared to 18.2% in normal group ($p<0.05$)

9. Low birth weight was seen in 30.5% cases. NICU admission was seen in 46% cases.
10. No significant association was seen between vitamin D status with ANC registration, obstetric history, gestation age, past history of vitamin D/ Calcium Intake and birth weight (p>0.05).
11. NICU admission was seen in 27.3% cases with normal vitamin D levels as compared to 41.4%, 50.4% and 42.9% cases of hypovitaminosis D, vitamin D insufficiency and deficiency respectively. The difference was however statistically non-significant.
12. No difference was observed in mean APGAR scores across different vitamin D categories.

Normal vitamin D levels were seen in 5.5% cases only while hypovitaminosis D, vitamin D insufficiency and deficiency was seen in 59.5%, 28% and 5.5% cases respectively.

A significant association was observed between incidence of caesarean section and vitamin D status with 71.4% caesarean deliveries in deficit group as compared to 18.2% in normal group (p<0.05)

NICU admission was seen in 27.3% cases with normal vitamin D levels as compared to 41.4%, 50.4% and 42.9% cases of hypovitaminosis D, vitamin D insufficiency and deficiency respectively. (p value 0.394)

Table 1: Distribution of cases as per Vitamin D status

Vitamin D Status	N	%
Deficient	14	7.0%
Insufficient	119	59.5%
Hypovitaminosis	56	28.0%
Normal	11	5.5%
Total	200	100.0%

Table 2: Association of vitamin D status with mode of delivery

Mode of Delivery	Vitamin D group				Total
	Deficient	Insufficient	Hypovitaminosis	Normal	
LSCS	10	56	19	2	87
	71.4%	47.1%	33.9%	18.2%	43.5%
Vaginal	4	63	37	9	113
	28.6%	52.9%	66.1%	81.8%	56.5%
Total	14	119	56	11	200
	100.0%	100.0%	100.0%	100.0%	100.0%
p- value <0.05					

Table 3: Association of vitamin D status with NICU admission

NICU Admission	Vitamin D group				Total
	Deficient	Insufficient	Hypovitaminosis	Normal	
Yes	6	60	23	3	92
	42.9%	50.4%	41.1%	27.3%	46.0%
No	8	59	33	8	108
	57.1%	49.6%	58.9%	72.7%	54.0%
Total	14	119	56	11	200
	100.0%	100.0%	100.0%	100.0%	100.0%
p- value - 0.394					

Discussion

Vitamin D is an important hormone in the body. Vitamin D deficiency during pregnancy is associated with the non-classical actions of this hormone, being linked with preeclampsia, insulin resistance, gestational diabetes mellitus, bacterial vaginosis, and an increased risk for caesarean section delivery.[5]

Vitamin D deficiency results in proximal muscle weakness and decreased lower extremity muscle function perhaps contributing to the risk for cesarean section.[6]

Recently, Merewood et al. found that there was an inverse association between serum 25(OH) D levels and the risk of having a primary caesarean section. In multivariable, logistic, regression analysis, controlling for race, age, education level, insurance status and alcohol use, women with 25(OH)D < 37.5nmol/L were almost four times more likely to have a caesarean section than women with 25(OH)D ≥ 37.5nmol/L (adjusted OR=3.84; 95% CI: 1.71-8.62).[7] This finding can be explained partly by poor muscular function, which has been an established consequence of vitamin D deficiency.[8]

The importance of vitamin D for fetal and infant skeletal development has long been recognized. Several studies have reported association between infant size,

weight and vitamin D status.[9,10] Reduced concentration of 25-hydroxyvitamin D in mothers during late pregnancy is associated with reduced whole body and lumbar-spine bone mineral content in their children at the age of 9 years.[11] Several studies hypothesized that low prenatal and perinatal vitamin D concentrations affect the functional characteristics of various tissues of the body, which leads to lower birth weight and greater risk in later life of multiple sclerosis, cancer, insulin-dependent diabetes mellitus and schizophrenia.[12,13]

Role of Vitamin D

Vitamin D helps in gene transcription and expression. Vitamin D receptors (VDRs) initiate a cascade of events that leads to transcription of specific genes[16] vitamin D has genomic and non-genomic actions. $1,25(OH)_2D$ interacts with nuclear vitamin D receptors to cause gene transcription. Source of nuclear receptors for $1,25(OH)_2D$ include bone, intestine, kidney, lung, muscle and skin. $1,25(OH)_2D$ also acts like a steroid hormone. It activates the signal transduction pathways connected to vitamin D receptors on cell membranes. Majority of it acts on bone, intestine, parathyroid, liver and pancreatic beta cells[16].

Major function of vitamin D is to maintain calcium homeostasis which possesses an impact on cellular metabolic processes and neuromuscular functions. Vitamin D increases intestinal calcium absorption by regulating the epithelial calcium channel protein, which in turn enhances the transport of calcium through the cytosol and across the basolateral membrane of the enterocyte. Vitamin D also helps in the absorption of intestinal phosphate. $1,25(OH)_2D$ indirectly affects bone mineralization by maintaining plasma calcium and phosphorus concentrations. With the parathyroid hormone, 1, $25(OH)_2D$, also causes demineralization of bone when calcium concentrations decrease to maintain plasma concentrations within a narrow range.[15]

Other tissues and cells that are influenced by vitamin D include five biological systems. These are immune system, pancreas, cardiovascular, muscle and brain.$1,25(OH)_2D_3$ also inhibits tumor cell growth, by decreasing angiogenesis and thus causing apoptosis of the tumor cells. In addition, $1,25(OH)_2D$ inhibits renin production in the kidney and has an immunomodulatory activity on monocytes and activated T and B lymphocytes. Presently, there are around 200 genes that respond to 1,25-dihydroxyvitamin D.[14]

Cellular Differentiation

Vitamin D plays a pivotal role in cellular differentiation by decreasing proliferation of cells and their maturation. It's a very important function to prevent cancer.

Vitamin D as an Immunomodulator

Vitamin D receptors are located on activated T and B lymphocytes, monocytes, and macrophages, hence it's an immunomodulator. It may lead to the prevention of autoimmune diseases when adequate serum levels of vitamin D are maintained.[14]

Insulin Secretion

Vitamin D and the prevention of diabetes is correlated. VDRs are located on the beta cells of the pancreas. Whenever the body requires increased amounts of insulin, vitamin D helps in the secretion of insulin. Recent studies have concluded that when an insufficient amount vitamin D3 is present, glucose intolerance and impaired insulin secretion are observed in people with type 2 diabetes.[16]

Hypertension

Adequate vitamin D3 level decrease risk for cardiovascular disease. VDRs are located on vascular smooth muscle, endothelium, and cardiomyocytes.[17]

Vitamin D Deficiency

Vitamin D deficiency is defined as a serum 25(OH) D level of less than 20 ng/mL (50 nmol/L).[18]

Vitamin D insufficiency has been defined as a serum 25(OH)D level of 21-29 ng/mL (52-72 nmol/L).[18] It's based on the physiological changes in calcium absorption and parathyroid hormone levels which occur with changes in vitamin D levels. But in this study it is included in deficient category.

Vitamin D sufficiency has been defined as serum 25(OH) D levels of 30 ng/mL (75 nmol/L).[18]

Conclusion

In conclusion, high prevalence of vitamin D deficiency/ insufficiency was observed among pregnant women (66.5%). We also observed an association of low vitamin D levels with caesarean section and NICU admission.

We therefore recommend the screening of all pregnant women for vitamin D deficiency. Considering such a high prevalence, routine supplementation of pregnant mothers with daily 400 IU vitamin D with 1000 mg calcium can be considered. The high prevalence found in this study, the size of the population groups at risk, and the consequences of inaction make this screening and treatment necessary.

We also recommend further research on the daily dosage recommendations along with other factors affecting vitamin D levels in pregnant females like eating pattern, compliance to prescribed drugs and sun light exposure.

Conflict of Interest: None.

References

1. Van Schoor N. M and Lips P. Worldwide Vitamin D status. *Best Pract Res Clinl Endocrinol Metab* 2011;25:671-680.
2. Kazemi A, Sharifiii F, Jafari N, Mousavinasab N. High prevalence of Vitamin D among pregnant women and their new born in an Iranian population. *Jwomens Health (Larchmt)* 2009;18:835-839.
3. Bikle D. Non classic action of Vitamin D. *J Clin Endocrinol Metab* 2009;94:26-34.
4. Brannon P M, Picciano MF. Vitamin D in pregnancy and lactation in humans. *Annu Rev Nutr* 2011;31:89-115.
5. MacKay AP, Berg CJ, Atrash HK. Pregnancy-related mortality from preeclampsia and eclampsia. *Obstet Gynecol* 2001;97:533-538.

6. Kaushal, Manila, and Navneet Magon. Vitamin D in pregnancy: A metabolic outlook. *Indian J Endocrinol Metab* 2013;17(1):76-82.
7. Merewood, Anne. Association between vitamin D deficiency and primary cesarean section. *J Clin Endocrinol Metab* 2009;94(3):940-945.
8. Ceglia, Lisa. Vitamin D and skeletal muscle tissue and function. *Mol Aspects Med* 2008;29(6):407-414.
9. Schol To, Chen X. Vitamin D intake during pregnancy: association with maternal characteristics and infant's birth weight. *Early Hum Dev* 2009;85:231–234.
10. Mannion CA, Gray-Donald K, Koski KG. Association of low intake of milk and vitamin D during pregnancy with decreased birth weight. *CMAJ* 2006;174:1273–1277.
11. Javid MK, Crozier SR, Harvey NC, Gale CR, Dennison EM, Boucher BJ, Arden NK, Godfrey KM, Cooper C, Princess Anne Hospital Study Group Maternal vitamin D status during pregnancy and childhood bone mass at age 9 years: a longitudinal study. *Lancet* 2006;367:36–43.
12. McGrath J. Dose imprinting with low prenatal vitamin D contribute to the risk of various adult disorders? *Med Hypotheses* 2001;56:367–371.
13. Barker DJP. Mothers, Babies and Health in Later Life. 2nd ed. Edinburgh, UK: Churchill Livingstone; 1998.
14. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine.Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D and fluoride. Washington, DC: National Academy Press, 1999.
15. Hyderabad, India: Indian Council of Medical Research; 1998. National Institute of Nutrition. Dietary guidelines for Indians – a manual.
16. Papapetrou PD. The interrelationship of serum 1,25-dihydroxyvitamin D, 25-hydroxyvitamin D and 24,25-dihydroxyvitamin D in pregnancy at term: a meta-analysis. *Hormones (Athens)* 2010;9:136–144.
17. Tamblyn JA, Hewison M, Wagner CL. Immunological role of vitamin D at the maternal–fetal interface. *J Endocrinol* 2015;224:R107–R121.
18. Kiely M, Hemmingway A, O'Callaghan KM. Vitamin D in pregnancy: current perspectives and future directions. *Ther Adv Musculoskelet Dis* 2017;9(6):145-154.

How to cite this article: Barsode SD, Taralekar V, Kumar A, Mehendale S. Levels of vitamin D in labour. *Indian J Obstet Gynecol Res* 2019;6(1):1-4.