Vitamin D status in preeclampsia
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SUMMARY: Vitamin D status in preeclampsia.

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Objective. The objective of this research was to estimate frequency of occurrence of vitamin D deficiency and insufficiency in pregnant women with preeclampsia.

Materials and methods. Cohort retrospective and prospective study. There were examined 99 pregnant women in reproductive age (mean age 29±2.1 years) at 30-38 weeks of pregnancy, from September 2013 to June 2014, who lived in Saint Petersburg and Leningrad region. In main group (N=48) there were pregnant with severe and moderate preeclampsia. In control group (N=51) there were pregnant with physiological pregnancy. At early gestation term all patients got multivitamin complex, which contained 400 IU of vitamin D. Estimation of blood serum level of 25-hydroxyvitamin D (25-OH-D) was conducted with the use of electrochemiluminescent method on the analyzer Architect 2000.

Results. There were analyzed 2 groups of pregnant. On the base of the conducted study there was determined a frequency of occurrence of vitamin D deficiency in main group was 73%, in control group 14%. Frequency of normal level of vitamin D in main group was 2% in control group- 86%. Analyzed groups differ significantly P<0.0001.

Conclusion. This research showed that pregnant women with the revealed insufficiency and deficiency of vitamin D refer to a group of risk to develop preeclampsia. In patients with preeclampsia low serum level of vitamin D occurs 2.5 times more often (less than 30 ng/ml). Received data demonstrate pathogenetic role of vitamin D in the development of hypertension in preeclampsia.

KEY WORDS: Vitamin D - 25-OH-D - Preeclampsia - Pregnancy.

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original article
What is new in this paper. Vitamin D insufficiency and deficiency in North-West region of Russian Federation is very relevant and serious problem. According to our research these conditions are etiopathogenetic risk factors for the development of preeclampsia. However, there are no clinical recommendations, which indicate the necessity of the use of extra doses (except multivitamin complex) of vitamin D in this group of pregnant women. That is why opportune diagnosis and correction of vitamin D deficiency and insufficiency at time of pregnancy planning and all pregnancy duration.

Introduction

In recent years in Russia frequency of preeclampsia increased up to 20.6%, as one of the main causes of maternal mortality (1).

Recent epidemiological data testify about unfavorable perinatal outcomes in vitamin D deficiency, such as rachitis, demineralization of bone structure (2). Vitamin D deficiency increases frequency of premature delivery, weight-loss at birth, and hypertension during pregnancy (3-8). Authors suppose that these conditions may appear because of the insufficient influence of vitamin D on immunosuppression or placental development among patients with vitamin D deficiency (3, 9, 10). Thus, vitamin D deficiency may be involved in pathophysiology of preeclampsia.

Vitamin D is a steroid hormone, which is mainly synthesized in skin by ultraviolet radiation. Vitamin D is exposed to hydroxylation in liver with the formation of its inactive form - calcidiol [25 - OH - vitamin D (25-OH-D)]. Under the effect of 1-α-hydroxylase of renal tubule or placenta calcidiol turns into active form of vitamin D - calcitriol [1,25- (OH) 2-vitamin D] or D-hormone (11). Half-life of 1,25- (OH) 2 vitamin D is few minutes; more explicit evaluation of the condition of vitamin D is defined by measuring of 25-OH-D, half-life of which is 2-3 weeks (12).

There are distinguished 3 normative classes of gradation in accordance to the level of serum 25-OH-D concentration: 1st class “vitamin D deficiency” in the concentration of 25-OH-D < 20 ng/ml; 2nd class “vitamin D insufficiency” in the concentration of 25-OH-D > 21 < 30 ng/ml; 3rd class “normal range of vitamin D” in the concentration of 25-OH-D ≥ 30 ng/ml (13).

In uterine, ovarian, placental, pituitary tissues there are receptors to vitamin D and 1a-hydroxylase. Vitamin D suppresses renin - angiotensin system and cell proliferation of vascular unstripped muscles, decreases the level of insulin in blood, enriches endothelial-dependent vasodilatation, prevents anticoagulant activity thereby avert hypertension. Active form of vitamin D regulates transcription and function of genes, which are concerned with trophoblast invasion, normal implantation and angiogenesis (14-16).

Deviations in the process of angiogenesis play the leading role in the pathogenesis of preeclampsia. In placenta angiogenesis undergoes two phases: proliferation at the beginning of the pregnancy and vascular remodeling at the second period of pregnancy with peaks in the middle of gestation and before delivery (17, 18). Endothelial dysfunction develops as a result of the disturbance of angiogenesis and decreased ability to recovery of endothelium. Vitamin D improves angiogenic properties of endothelial precursor cells, thereby decrease the risk of the development of preeclampsia (19-21). Today there are no clinical recommendations about the use of vitamin D, which are necessary for the prevention of gestational complications and preeclampsia.

Objective

To estimate frequency of occurrence of vitamin D deficiency and insufficiency in pregnant with preeclampsia.

Materials and methods

Cohort retrospective and prospective study was made in Department of Pathologic Pregnancy of Institute of Perinatology and Pediatriy of NWFMC V.A. Almazov. There were examined 99 pregnant in reproductive age (mean age 29±2,1 years) at 30-38 weeks of pregnancy, from September 2013 to June 2014, lived in Saint Petersburg and Leningrad region. All pregnant were made blood sampling with the following detection of the level of 25-hydroxycalciferol (25-oH-d). All patients at early gestation term got multivitamin complex, which contained 400 IU of vitamin D.

Inclusion criteria for the patients of two groups were: the age - 20-40 years, the sign of inform consent. Exclusion criteria from study: hypertension, diabetes, renal diseases: chronic renal failure; GIT diseases; women with the history of GIT-surgery; oncological diseases; psoriasis; rheumatic diseases: rheumatoid arthritis, systemic lupus erythematosus, spondylarthritis; who take preparations, which influence on the uptake of vitamin D: corticosteroids, immunosuppressants, anticonvulsants, antiacids, which contain alu-
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Results

On the base of the conducted study mean level of 25-hydroxy calciferol in blood serum conform to the level of the deficiency – 16,3 ng/ml, in control group – conform to normal range-38, 3 ng/ml (Table 1).

Joint distribution diagram of the vitamin D ranges in the examined groups shows significant differences of the levels of vitamin D in studied groups (Figure 1).

Mann-Whitney criteria confirm absolutely significant difference of the main and control groups (P < 0.0001).

We determined frequency of occurrence of vitamin deficiency in group №1 - 73% (35 pregnant); in group №2 vitamin D deficiency was not found. Frequency of occurrence of vitamin D insufficiency in group №1 was 25% (12 pregnant), in group №2 14% (7 pregnant). Frequency of normal level of vitamin D in group №1 was 2% (1 pregnant), in group №2 86% (44 pregnant) (Table 2). Group №1 and group №2 differ significantly in specified graduation (P<0,0001).

Table 1 - Mean values of 25-HydroxyCalciferol in Blood Serum in Comparison Groups.

<table>
<thead>
<tr>
<th>Level of 25-HydroxyCalciferol in Blood Serum</th>
<th>Group №1 (N=48)</th>
<th>Group №2 (N=51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficiency (&lt; 20 ng/ml)</td>
<td>13,18±0,3</td>
<td>-</td>
</tr>
<tr>
<td>Insufficiency (21-30 ng/ml)</td>
<td>23,76±0,2*</td>
<td>27,92±0,3</td>
</tr>
<tr>
<td>Normal range (≥ 30 ng/ml)</td>
<td>36,6±0**</td>
<td>45,75±0,4</td>
</tr>
</tbody>
</table>

Significance of differences with control group *P<0.0001; ** P<0.0001

Figure 1 - Joint distribution diagram 25-OH-D serum to groups.

Discussion

Studying of the role of vitamin D deficiency and insufficiency mean for the prevention of related with pregnancy. Recent research data has confirmations in literature.

Vitamin D deficiency and insufficiency during pregnancy lead to the increase of the number of cases of preeclampsia, diabetes mellitus, preterm delivery, bacterial vaginosis, and also influence on newborns’ health. According to recommendations, published in 2009, supplement of vitamin D in pregnant must be from the second trimester in daily dose 800-1000 IU (22).

Presence of vitamin D and its receptors in placenta, and also ability of vitamin D to modulate immune, inflammatory and vascular reactions allows to justify the role of vitamin D deficiency in the pathogenesis of preeclampsia in pregnant (23).
In recent study of the 25-hydroxycalciferol level in blood serum during pregnancy before the onset of the preeclampsia, there were demonstrated the level of vitamin D, measured in early trimester, is lower among women with the developed preeclampsia. In the level of blood serum of vitamin D before 20 ng/ml risk of the development of preeclampsia was two times higher (4). Powe et al. found that in first trimester the level of 25 (OH)D3 is not connected with the development of preeclampsia (24). Study conducted in Norway among 23,423 nulliparous women showed the daily vitamin D intake of 400-600 IU in comparison with women, who did not take vitamin D supplements 27% decreases the risk of the development of preeclampsia. These studies consider correlation between vitamin D deficiency and development of preeclampsia (7).

It is necessary to conduct additional studies, which could explain the impact of vitamin D deficiency during pregnancy and determine benefits of vitamin D supplements in decrease unfavorable outcomes of mother and child (2, 4).

Patients participated in our research lived in Saint Petersburg and Leningrad region.

Research was made from September to June and showed the insufficiency of the use of multivitamin complexes from early term of pregnancy, containing 400 IU of vitamin D.

As a result of our research the frequency of occurrence of vitamin D deficiency in the group of pregnant with preeclampsia was 73%, at the same time in the group with physiologic pregnancy vitamin D deficiency was not found. Frequency of occurrence of vitamin D insufficiency in group №1 was 25%, in group №2 -14%. Thus, only one pregnant from the group №1 had normal level of 25-hydroxycalciferol in blood serum; at the same time in the group №2 the majority of pregnant [44 out of 51 (that correspond – 86%)] had normal levels of 25-hydroxycalciferol in blood serum. In main group mean level of 25-hydroxycalciferol in blood serum correspond to the level of vitamin D deficiency - 16,3 ng/ml, in control group mean level of 25-hydroxycalciferol in blood serum was at normal range - 38,3 ng/ml.

Thus, in pregnant with preeclampsia vitamin D deficiency and insufficiency authentically meet more often, that is illustrated in joint diagram (Figure 1). Mann-Whitney criteria confirm absolutely significant difference in main and control group (P < 0.0001).

**Conclusion**

This study showed that low blood serum level of vitamin D in patients with preeclampsia met 2,5 times more often (less than 30 ng/ml). Pregnant with revealed vitamin D insufficiency and deficiency refer to group of risk for the development of preeclampsia. Received data testify the pathogenetic role of vitamin D in the development of hypertension in preeclampsia.

Research showed the necessity to measure 25-hydroxycalciferol level in blood serum among women with the high risk for the development of preeclampsia with the following selection of individual dose of vitamin D for achievement of objective level of 25-hydroxycalciferol in blood serum more than 30 ng/ml.

**References**

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