

Modern Approaches to Diagnosis and Correcting Magnesium Deficiency in Pregnant Women

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Abstract

Background: Maternal and child health, has always been, is and will continue to be a top and overriding priority in obstetric practice. Unfortunately, despite the constant improvement and progress of science and knowledge, preeclampsia remains a threatening (often fatal) factor, for both the future mother and the infant.

Aims of our research are the study of magnesium deficiency: highlighting of patients with clinical signs of magnesium deficiency, study of the use effectiveness of magnesium to prevent preeclampsia.

Materials and Methods: 200 pregnant women participated in the study. 100 respondents were at risk of preeclampsia, the degree of magnesium deficiency was established, and correctional therapy was conducted for them. 50 women formed a control group (magnesium preparations were not injected into their destination list). To correct the magnesium content of the body, oral magnesium drugs were used: magnesium oxide light, magnesium carbonate, microgranulated powder magnesium oxide.

Results: preeclampsia risk analysis showed a 100% magnesium deficiency, 76% of women had a significant magnesium deficiency, 24% - moderate. Treatment with magnesium oral preparations in pregnant women reduced the risk of pregnancy termination and placenta dysfunction; complications of childbirth and caesarean sections. Prevention of preeclampsia was 96.0%. Kids with magnesium-receiving mothers, were above according to the Apgar scale, there was a decrease in the incidence of nervous system damage.

Conclusions: Treatment with magnesium for pregnant women has demonstrated their safety and effectiveness in preventing preeclampsia; reduce the incidence of post-natal complications in newborns.

Keywords: Magnesium, pregnancy, preeclampsia, therapy, postnatal complications.

Introduction

Preeclampsia (PE) is one of the most threatening complications of pregnancy, indicator of both maternal and child pathology and mortality. Sadly, the frequency of PE emergency has no downward trend. Between 1.5 and 23.3% of all pregnancies are registered [1, 2], and the number of maternal deaths PE is second only to thromboembolism [3].

PE is characterized by the complexity of pathogenic development mechanisms, which in turn leads to difficulties in prevention and treatment.

Practitioners report treatment inefficiencies of moderately to severely preeclampsia, therefore, development of preventive measures remains an archival component of the struggle for maternal and child health. This requires, first of all, the timely identification of pregnant women with risk factors and sub-clinical forms of preeclampsia. The next step is an adequate correction of the pathological condition, which will prevent the development of clinical preeclampsia [1, 2, 4].

Oxidative stress in pregnant women is an etiological factor in the development of PE, and the pregnancy, in turn, is a physiological condition, which is characterized by a significant increase in the demand for magnesium (Mg) (for 20-30%). It should be noted that even the laboratory confirmed normal magnesium level in the blood serum of the pregnant woman does not exclude his intracellular deficiency, because in an intercellular substance, Mg is the minimum quantity, its maximum quantity is contained inside the cell. For example, the blood serum contains only 0.3% Mg of its entire body. In 2/3 cases, the pregnancy is accompanied by clinical symptoms of magnesium deficiency, and the leading place in the etopathogenesis of preeclampsia is precisely the magnesium deficiency [5-7].

Magnesium is involved in more than 350 physiological processes, stabilization of the DNA molecule, promotes nucleic acid integrity, proteins and mitochondria. Separately, its participation in cell fission mechanisms (mitosis and meiosis processes), that during pregnancy can lead to genetic pathologies of the fetus [7-9]. Plus, hypomagnesemia, reducing the placenta's proliferation capacity, results in the fetus's pituitary condition [10]. On the other hand, magnesium is the calcium antagonist, and his or her insufficiency in the body can cause hypertension in the muscle tissue (including the placenta) and which can cause premature termination of pregnancy [11]. In biochemical processes, this microelement is necessary for energy exchange. Magnesium deficiency leads to increased aldosterone concentrations fluid retention and edema. Relative hyperestrogenemia occurs, that causes angiotensin hyperproduction in the liver, increased level of aldosterone in blood and blood pressure (BP), which is a dangerous syndrome during pregnancy [12-14].

Mg influences the synthesis of protein and nitrogen oxide, lowers her uterus, stimulates vasodilation, improving blood flow in the placenta vessels, and also reduces platelet aggregation, increasing prostacycline activity and by reducing A2 thromboxane activity. This helps prevent endothelial dysfunction and its consequences (hypercoagulation, gestosis and placental dysfunction), adequate functioning of the central and peripheral nervous system, normalization of vascular tone, increased resistance of fetal tissues to hypoxia, lowers the incidence of fetal delay syndrome. Magnesium therapy reduces the risk of haemorrhaging to the brain tissue of a child. Implementation of the mechanism for energy support of central nervous system (CNS), the incidence of sudden neonatal death syndrome is reduced, resistance of tissues to hypoxia increases [5, 7, 15-16].

Bullarbo et al. [5] showed that due to the effect of muscle relaxation magnesium prevents convulsions and, like the calcium antagonist, lowers elevation and normalizes BP during pregnancy.

Since laboratory diagnosis of Mg deficiency can be poorly informative more attention should be paid to identification clinical signs of a deficiency in this element, in particular states of increased nervous and mental excitement (irritability, stress, anxiety, depressiveness, sleep-deprivation, asthenia), as well as increased muscular arousal (back pain, muscle cramps, increased uterine tone, urinary pain).

The purpose of our research was to study magnesium deficiency: highlighting of patients with clinical signs of magnesium deficiency, study of the effectiveness of magnesium in their use to prevent preeclampsia.

Materials and Methods

Study of the effectiveness of magnesium in their use to prevent pre-eclampsia, follow-up of pregnancy through detection and correction (magnesium prophylaxis) late gestosis (preeclampsia) in the group of women - 100 pregnant, who formed I Group. Risk identification and basic prevention

were conducted under the Protocol “Hypertensive disorders during pregnancy”, Decree № 676 HM of Ukraine [17]. All respondents had written consent to participate in the study. The results were compared with observations of 50 pregnant women (Group II) at risk of preeclampsia, which oral magnesium preparations have not been added to the prophylactic complex. The Control Group (KG) comprised 50 healthy women with the physiological course of pregnancy.

The presence of magnesium deficiency was determined by examination of the survey data, as recorded in our questionnaire for the study of magnesium deficiency in pregnant women. The questionnaire contained evidence of somatic pathology in the patient, pathology of the nervous system, aggravated obstetric-gynecological anamnesis, data on nutrition, lifestyle and general well-being. We developed the questionnaire based on the questionnaire materials, Proposed by O.O. Gromova and O.A. Limanova (2014), UNESCO Institute for Microelements RRC [18].

The results of the questionnaire were evaluated in terms of: 0 points feature missing; 1 point appearing periodically, mild flow observed; 2 marks of late gestosis present continuously. After the questionnaire, according to the results, patients requiring correction of Mg in the body, were divided into three groups. Patients in the first group required emergency magnesium therapy, lifestyle and nutritional changes (there was a significant magnesium deficiency) (31-132 points). Second group patients (11-30 points) there was a moderate deficiency requiring magnesium drugs, lifestyle and nutrition adjustments. For third-group patients (5-10 points) with Mg's marginal deficit, a correction of diet and lifestyle was sufficient. Magnesium monoprophyllaxis was performed by:

1. Magnesium oxide light (342 mg) and magnesium carbonate (670 mg), which equals to 365 mg Mg²⁺ ions: 1 powdered pill per day with intermittent courses of 10-12; 22-26; 30-32 weeks of pregnancy.
2. Microgranulated magnesium oxide powder (535 mg), which equals to 300 mg of magnesium and light oxide magnesium 403.0-435.2 mg equivalent to 243 mg Mg²⁺.

The medication was administered from 10 weeks for the duration of the pregnancy one pill per day.

Results and Discussion

Testing of 100 studied patients at risk of preeclampsia showed, that 76 respondents (76.0%) had a significant Mg deficit, requiring emergency magnesium therapy, lifestyle and nutrition (result of questionnaire from 31 to 132 points). 24 pregnant women were in the group with moderate deficiency Mg (11-30 points).

It should be noted that hypomagnemia is a common phenomenon in the world. Most pregnant women require additional doses of magnesium (300 mg of magnesium citrate per day) [19]. For example, according to Rocha et al. among 52 pregnant women examined in São Paulo (Brazil), where the magnesium content of erythrocytes and blood serum was in the physiological subdivision, 39% of patients with reduced excretion Mg with urine and in need of magnesium therapy have been identified [20].

For each of the patient categories identified in the survey, appropriate therapy was administered, aimed at correcting the concentration of Mg in the body. Results of oral magnesium prophylaxis were high, the harmlessness and good tolerance of the proposed therapy compared to the generally accepted approaches [17].

Our results (**Table 1**) show that, in the group of pregnant women taking magnesium (Group I) the threats of pregnancy termination and placental dysfunction were significantly lower. Prevention of pre-eclampsia was 96.0% in group I and only 68.0% in group, prevention of preeclampsia according to The Protocol (Group II). The percentage of obstetric complications and the frequency of caesarean sections were twice as high among women, for prophylaxis and treatment of preeclampsia.

Table 1.Incidence of complications of pregnancy and childbirth (P±m)

The studied parameter	Control Group (n=50)	I Experimental Group (n=100)	II Experimental Group (n=50)
Miscarriagerisk.	12,0±4,6*	17,0±3,8 ^Δ	44,0±7,0**
Placentaldysfunction	6,0±3,4*	11,0±3,1 ^Δ	32,0±6,7**
Preeclampsia	-	4,0±2,0 ^Δ	32,0±6,7
Obstructedlabour	8,0±3,8*	12,0±3,2 ^Δ	30,0±6,5**
Caesareansections	8,0±3,8*	15,0±3,6 ^Δ	32,0±6,7**

Notice: * – p<0,05between the CG and the I Group;** – p<0,05between the CG and the II Group;Δ – p< 0,05between the first and second groups.

Although international studies have shown that, the effect of adding magnesium drugsdoes not necessarily have a 100% positive effect.So de Araújo et al. indicates the inefficiency of oral treatment for 2 weeks for treatment of increased nervous and psychiatric excitement in (leg cramps) [21].

We also noted that positive effects of magnesium, are not only related to spasmolytic properties,as well as with a favourable impact on the woman's emotional statewhich reduces the negative effects of stressful situations.

Research results of Japanese scientists [22]indicate a decrease in toxicological effects on the fetusIf pregnant magnesium sulfate is introduced into the prescription sheet.

To determine the effect of the oral treatmentwith Mg drugs on the development of the fetus, we have monitored newborn patients in both groups (**Table 2**).

Table 2. Newborn conditions of patients under examination(P±m)

The studied parameter	Newborns from the Control Group (n=50)	Newborns from the IExperimental Group (n=100)	Newborns from the II Experimental Group (n=50)
GradeaccordingApgar scale 7 points and less	2,0±2,0	9,0±2,9*	22,0±5,9**
Incidence	2,0±2,0	13,0±3,4*	20,0±5,7**
Nervoussystemlesions,	-	7,0±2,6	18,0±5,4

Notice: * – p<0,05 between the CG and the I Group;** – p<0,05between the CG and the II Group.

Analysis of the data received indicates that, newborn babies who have given birth to magnesium prophylaxis drugs,were rated higher on the Apgar scale.For example, in the fifth minute, 22.0 % of children had a grade of 7 or lower,of mothers in the group, receiving treatment under the Protocol[17].In a group of patients who were taking magnesium to prevent preeclampsia, the rate was 9.0%, which is 2.5 times less than the number of patients per group, that didn't add magnesium to the prophylactics.Neonatal morbidity and perinatal disorders of the nervous systemwere also significantly higher in the group of patients without magnesium prophylaxis (Table 2). Neonatal nervous system damage is a critical health parameter in post-natal period. The percentage of resuscitation is increasing significantly, in case of convulsions in newborns.60% Mg in newborn is in bones, the rest is mostly intracellular,therefore, diagnosing Mg deficiency in newborns is problematic.In addition, use of oral medication for children in the post-natal periodmust be conducted with caution,especially if it is performed before the birth of the pregnant woman.The onset of convulsions is also influenced by the development of the child on the Apgar scale.Ball below 7 according to neonatologists exacerbates postnatal cramping[23-24].According to Aditiawarman et al.

[25] introduction of Magnesium sulfate in pregnancy prescription, reduces cerebral palsy in premature babies.

Conclusions

Pregnancy magnesium deficiency is a common pathology. In our study, 100.0% of patients at risk of developing preeclampsia, hypomagnesemia was found. At the same time, 76.0 per cent of patients have a significant deficiency, requiring emergency magnesium therapy (31-132 points) in combination with lifestyle correction, and nutrition. 24.0% moderate, requiring magnesium nutritional and lifestyle corrections (11-30 points). Preventive treatment of magnesium by patients at risk of developing pre-eclampsia has demonstrated its effectiveness and safety, according to the analysis of pregnant women and newborns. Prevention of preeclampsia was 96.0%.

The percentage of complications among pregnant women receiving magnet therapy has decreased during delivery and the frequency of caesarean sections.

Perinatal outcomes are more favourable for newborns, mothers who received pre-eclampsia prophylaxis with magnesium drugs.

Practical applications

Based on the results of our research, we consider it appropriate to use magnesium preparations for the prevention of preeclampsia, as basic drugs with the means, improving micro-circulation (aspirin, curantyl, Tivartotin, etc.). This combination is synergistic, which has a positive effect on PE therapy.

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