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RESEARCH ARTICLE

Anemia in pregnancy and serum hepcidin levels

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Abstract

AIM: Anemia is common during pregnancy and is associated with higher perinatal maternal morbidity and mortality in developing countries. Identifying and finding the right treatment approach for iron deficiency in pregnant women is of great clinical importance because it can prevent unnecessary spelling of therapy with iron preparations.

DATA: We determined serum hepcidin levels using ELISA assay in 50 pregnant women. The samples were taken in the University Hospital "Michin Dom" for a period 2013 – 2014 year. We measure serum iron levels, CRP, ferritin and hemoglobin concentration. Patients were divided into three groups: pregnant without anemia; pregnant women with iron deficiency anemia (IDA) and pregnancy with anemia of chronic inflammation (ACI).

RESULTS: We found statistically significant differences in serum hepcidin levels between measured groups: pregnancy without anemia – 20.5 ± 6.2 μg/L; pregnancy with IDA – 1.3 ± 0.6 μg/L; pregnancy with ACI – 111.3 ± 24.4 μg/L. Serum ferritin levels showed significant differences between three groups: pregnancy without anemia – 59.1 ± 23.6 ng/mL; pregnancy with IDA – 17.6 ± 7.1 ng/mL; pregnancy with ACI – 118.2 ± 13.1 ng/mL.

CONCLUSIONS: We conclude that our results may support the right choice of a therapeutic approach to the iron-deficiency anemia or anemia of chronic inflammation during pregnancy.

INTRODUCTION

Anemia is common during pregnancy and is associated with higher perinatal maternal morbidity and mortality in developing countries (1). Iron deficiency is the cause of much of anemia among pregnant women (2). Hepcidin, a peptide composed of 25 amino acids, is considered to be a major regulator of iron metabolism and anemia of chronic inflammation (3). Hepcidin, is synthesized mainly in the liver. It regulates the metabolism of iron by the inhibition of iron absorption in the duodenum at the level of the intestinal epithelium and by affecting mobilization of iron from the liver and Slack. Hepcidin associated with intracellular iron exporter, ferroportin, causing its internalization and degradation (4-6). Ferroportin is required for materno-fetal transfer of iron from the duodenal enterocytes, macrophages and hepatocytes (7).

Materials and Methods

For a period 2013 - 2014 years 50 pregnant women from University hospital "Maichin Dom". Blood sampling was taken Pregnant women were divided into three groups by identifying clinical and laboratory indicators of inflammation and iron deficiency.

In pregnancy we classified anemia as iron deficiency (IDA) and anemia of chronic inflammation (ACI) by the following conditions:

• IDA – serum CRP level < 10 mg/L, transferrin saturation < 20% and the level of ferritin < 30 ng/mL.

• ACI – serum CRP level > 10 mg/L, transferrin saturation < 20% and ferritin > 100 ng/mL.

• Pregnant women without anemia were defined as controls.

We measure hepcidin levels using verified ELISA method (8).

Results

Age distribution and gestational week of pregnant women in the different groups is shown in Tables 1 and 2.

Table 1. Age distribution of pregnant women in groups

	no anemia	*IDA*	*ACI*
n	*10*	*20*	*20*
mean (age)	*19.1*	*21.6*	*26.1*
SD (age)	*2.6*	*4.8*	*3.6*

Table 2. Distribution of gestational weeks of included pregnant women

	no anemia	*IDA*	*ACI*
n	*10*	*20*	*20*
mean (age)	*12.7*	*12.7*	*12.6*
SD (age)	*7.1*	*7.2*	*7.0*

Patients were signing the informed consent according to the Declaration of Helsinki (Directive 2001/20 / EC).

The results of laboratory parameters are presented in Table 3.

Table 3. Laboratory parameters in studied groups

	no anemia in pregnancy		*IDA and pregnancy*		*ACI and pregnancy*	
	mean	*SD*	*mean*	*SD*	*mean*	*SD*
TSAT (%)	*26.2*	*3.3*	*12.8*	*3.4*	*12.8*	*3.6*
Ferritin (ng/mL)	*59.1*	*23.6*	*17.6*	*7.1*	*118.2*	*13.1*
Hgb (g/L)	*122.9*	*1.6*	*107.5*	*7.2*	*105.7*	*7.9*
CRP (mg/L)	*2.28*	*0.4*	*6.42*	*2.1*	*32.0*	*17.3*
Hepcidin (µg/L)	*20.5*	*6.2*	*1.3*	*0.6*	*111.3*	*24.4*

The results obtained from the serum hepcidin are presented in Figure 1.

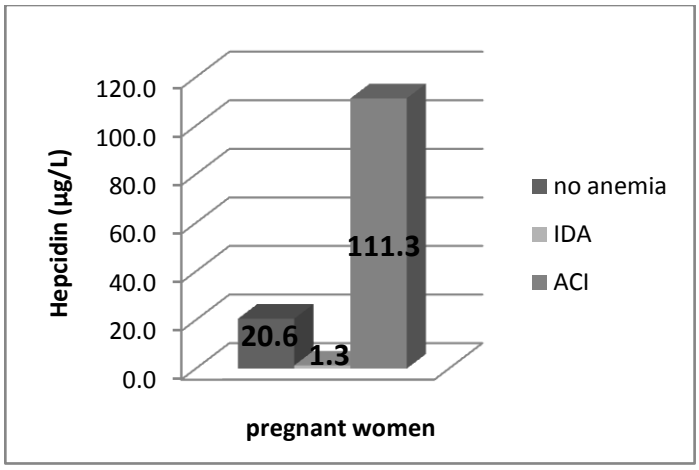

Figure 1. Serum hepcidin levels (in µg/L) in the different groups of pregnant women.

The results from serum ferritin are presented in Figure 2.

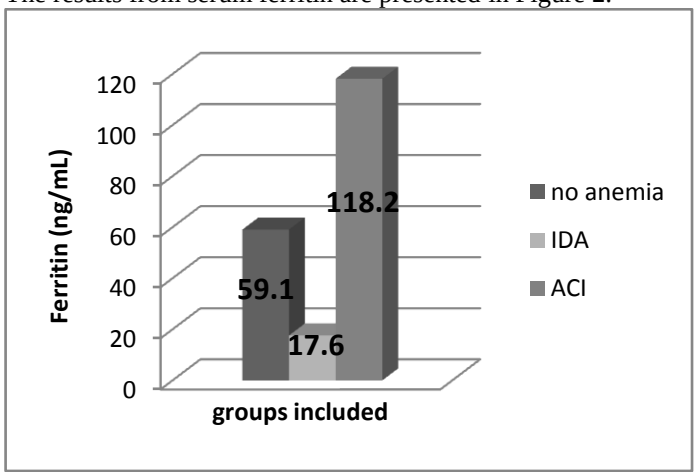

Figure 2. Serum ferritin levels (in ng/mL) in included pregnant women.

We found a significant correlation in serum hepcidin levels between different trimesters of pregnancy (Fig. 3). The correlation is positive between pregnant women with no anemia and IDA **(r = 0.654, P < 0.001)**. There is a negative correlation between pregnant women without anemia and pregnancy with ACI **(r = -0.862, P < 0.001)** and between IDA and ACI **(r = -0.660, P < 0.001)**

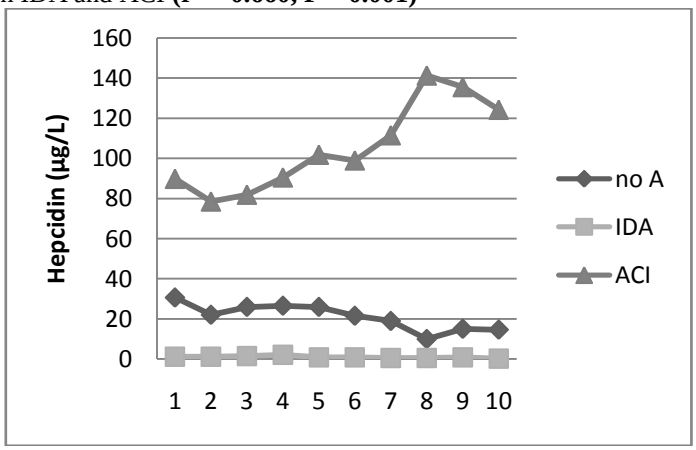

Figure 3. Serum hepcidin levels (in µg/L) in different trimesters

We found a significant negative correlation in serum ferritin levels between pregnant women with no anemia and with IDA **(r = -0.719, P < 0.001)**.

Discussion

Hepcidin concentration decreases gradually from the first to the second and third trimesters to undetectable levels. During pregnancy levels of hepcidin correlate with iron parameters, but not with inflammatory markers (9).

The results from different studies indicate that hepcidin is lower during pregnancy than in non-pregnant women, presumably to provide greater bioavailability of iron for both mother and fetus. Pregnant women with undetectable levels of hepcidin transfer a greater amount of iron taken from the mother to the fetus when compared to women with a detectable hepcidin, indicating that the levels of maternal hepcidin partially determine the bioavailability of the iron to the fetus. However, inflammatory conditions, including preeclampsia, malaria infection, and obesity are associated with a higher hepcidin pregnancies compared to healthy controls, suggesting that the bioavailability of the iron in the mother and the fetus may deteriorate under such conditions (10).

Patients with inflammatory and reduced hepcidin are expected to have an iron deficiency. In contrast, those with high level of hepcidin are diagnosed with ACI.

Using serum hepcidin levels would help in assessing the need for the application of preparations containing iron. The results suggest that patients with IDA may be subjected to treatment with such drugs, while patients with ACI do not need them.

Future of hepcidin is related to the possibility hepcidin antagonists and agonists can be used as a therapeutic agent in the treatment of anemia in inflammation and iron-deficiency anemia. Reducing of hepcidin levels or counteracting the biological effects of hepcidin may lead to a reduction in inflammation on erythropoesis by mobilization of stored iron and increases intestinal absorption of the element.

Conclusion

Determination of serum hepcidin is still a novelty in Bulgarian medical practice. The introduction of a reliable routine method for the study of hepcidin in biological fluids is a step forward in the treatment of diseases with impaired iron homeostasis. Our study in pregnant women and different anemia confirms the ability of verified immunochemical method to differentiate the increase and decrease in serum hepcidin. It provides a basis for choosing the correct therapeutic approach in the treatment of anemia.

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