Original Article

The Effect of Iron Deficiency Anemia on the Course and Outcome of Pregnancy

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Abstract

Iron deficiency anemia is a serious public health problem among pregnant women. Iron is an important element involved in various physiological functions and cellular activity. It is a cofactor of many enzymes and is involved in the oxygen transfer by hemoglobin in erythrocytes, as well as in various cellular processes, including DNA synthesis and redox reactions. In addition, iron deficiency in the early stages alters the structure and metabolism of brain cells. Insufficient iron levels lead to a decrease in the function of enzymes and a decrease in the production of red blood cells, followed by a decrease in the supply of oxygen to tissues. During pregnancy, a woman's need for iron increases for the growth of the fetoplacental complex, the synthesis of maternal erythrocytes, an increase in plasma volume, and, as a result, compensation for iron loss during childbirth. Unidentified and untreated iron deficiency anemia can hurt the health of both mother and fetus. At the same time, the consequences for both the young mother and the child may differ significantly depending on the severity and duration of anemia, as well as the period of pregnancy at which it occurred. The most common complications are a high risk of premature birth and low newborn weight, and cases of intrauterine death of a child are also not uncommon. Timely detection and treatment of mild anemia is extremely important, which will help prevent the development of severe anemia.

Keywords: Iron deficiency anemia, Pregnancy, Iron deficiency, Premature birth, Intrauterine mortality

Introduction

Iron deficiency is the most common form of anemia during pregnancy. In turn, anemia is one of the most common causes of complications during pregnancy [1, 2]. According to the World Health Organization (WHO), the prevalence of iron deficiency anemia among pregnant women worldwide is approximately 41.8%, with 23.0% in industrialized countries, 52.0% in developing countries and 34.7% in Russia [3]. The United States has the lowest prevalence of anemia (5.7%), the highest – 75% in the Gambia and 65-75% in India [4].

Anemia during pregnancy can cause stress reactions in a woman and fetus, enhance the synthesis of corticotropin-releasing hormone in the body, lead to its secretion by T and B cells, suppress the activity of neutrophils and macrophages and weaken the immunity of pregnant women to external factors, causing complications such as premature rupture. membranes and premature birth [5, 6]. In this context, the question of the potential impact of iron deficiency anemia on the course and outcome of pregnancy remains relevant.

Materials and Methods

As part of this scientific research, a literature search was conducted for articles in English and Russian using PubMed and Cyberleninka databases. The following search queries were used: "iron deficiency anemia in pregnant women", "iron deficiency", "pregnancy" and "intrauterine mortality". First of all, we considered the complications of pregnancy and childbirth associated with iron deficiency anemia. Links to the received articles and citations have also been checked to ensure relevance. In the end, the information gathered was analyzed and organized logically to ensure a comprehensive understanding of the topic.

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Results and Discussion

There is a general opinion that iron deficiency anemia contributes to the development of various complications of pregnancy and childbirth. Dystrophic changes in the myometrium with iron deficiency, and impaired neuromuscular transmission lead to a violation of the contractile activity of the myometrium and contribute to the development of premature detachment of the normally located placenta; prolonged labor or violent and sudden possible.

The increased risk of premature birth in anemia in the second trimester can be explained by chronic hypoxia caused by anemia. This hypoxia can lead to a stress reaction, which, in turn, can lead to the production of cortisol-releasing hormone. Elevated levels of this hormone have been identified as a major risk factor for premature birth. In addition, oxidative damage to erythrocytes and the fetoplacental apparatus may also contribute to an increased risk of prematurity [7, 8]. In their study, Klebanoff and co-authors demonstrated an increase in the frequency of premature birth in anemia in the second trimester of pregnancy [9].

Smith and others argue that women with anemia are more likely to develop postpartum urinary tract infections and other infections after childbirth, and are also more likely to use antibiotics during childbirth [5]. In addition, newborns from mothers with anemia had a higher risk of bacterial infections. The incidence of neonatal diseases and death varied depending on the severity of maternal anemia, with mild anemia being associated with an increased risk, and severe anemia leading to less favorable outcomes. This negative association may reflect a physiological response to pregnancy, as some women experience a significant increase in blood volume during pregnancy, which manifests itself as mild anemia and leads to optimal outcomes. However, moderate to severe anemia in pregnant women can create a physiological burden on both the mother and the fetus, leading to less desirable outcomes for both.

Another study conducted by Chen and others showed that pregnant women with anemia have reduced immunoglobulin synthesis due to insufficient blood supply and lack of nutrients, which reduces their immunity, thereby increasing the risk of postpartum infections [10]. Moreover, iron deficiency can stimulate the expression of matrix metalloproteinases, which, in turn, can reduce the contractility of the uterus and cause postpartum bleeding [11].

Iron deficiency anemia in pregnant women is the main cause of iron deficiency and anemia in newborns. The Colomer study revealed an increased risk of anemia (5.7 times) in infants born to mothers who had anemia during childbirth, compared with children without anemia. Several articles have reported a correlation between maternal anemia and lower birth Apgar scores [12].

Iron deficiency hurts the condition of the fetus, contributing to the development of intrauterine fetal growth retardation and the birth of young children (<2500 g). In their work, Kumar and others have identified a relationship between pregnant women with anemia in the third trimester and the low birth weight of their children **(Figure 1)** [13]. And Badfar and co-authors claim that the frequency of fetal growth retardation syndrome increases in the presence of anemia in pregnant women in the first trimester **(Figure 2)** [14].

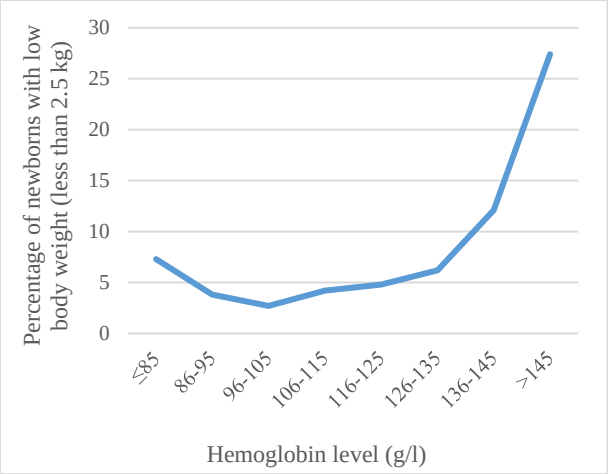

Figure 1. Percentage of low birth weight babies, depending on the mother's hemoglobin level during pregnancy

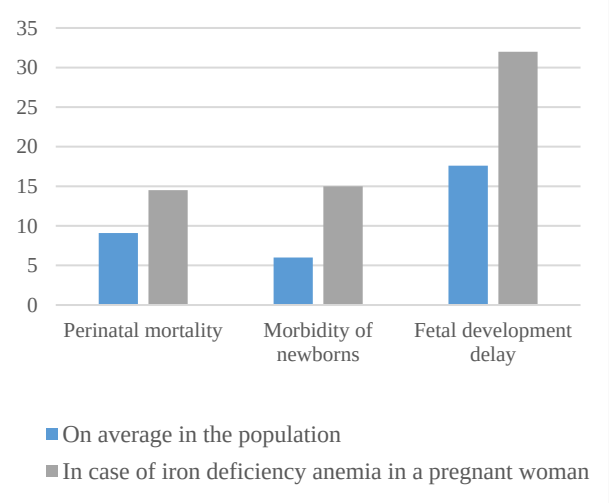

Figure 2. The effect of iron deficiency anemia on perinatal problems

Conclusion

Iron deficiency during pregnancy leads to dystrophic changes in the uterus and placenta, leading to the formation of placental insufficiency. At the same time, the fetus does not receive enough nutrients and oxygen, which subsequently causes chronic fetal hypoxia, intrauterine fetal delay, and the birth of small children. The main complications of pregnancy with iron deficiency anemia are premature placental

abruption, premature birth, and bleeding during childbirth. In the postpartum period, urinary tract infection may occur, complicated by bacterial sepsis.

To prevent the development of adverse maternal and perinatal outcomes, timely administration of iron preparations and maintenance of optimal hemoglobin levels throughout pregnancy is advisable.

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