

Analysis of the Application Value of Blood Routine Test in the Clinical Diagnosis of Anemia in Pregnancy

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Abstract:

Pregnancy anemia is a common complication during pregnancy, often caused by nutritional deficiencies and lack of folic acid. Pregnancy anemia can lead to decreased immune function and weakened resistance in pregnant women, impacting not only the health of the mother but also potentially affecting the health of the fetus. Therefore, early detection of pregnancy anemia through complete blood count tests in the early stages of pregnancy can help improve correction of anemia symptoms, treatment effectiveness, and reduce the risk of anemia. This study retrospectively analyzes recent domestic and international research to explore the patterns of changes in various blood indicators between healthy pregnant women and pregnant women with pregnancy anemia. It discusses the relationship between maternal hemoglobin (Hb), mean corpuscular volume (MCV), red blood cell count (RBC), mean corpuscular hemoglobin (MCH), folic acid, ferritin (Fer), vitamin B12 (VB12) during pregnancy. The aim is to provide clinical assistance for the early prediction and treatment of high-risk pregnant women during the perinatal period, in order to reduce the incidence of adverse pregnancy outcomes and ultimately further lower maternal and neonatal mortality and disability rates.

Keywords:

Gestational Anemia, Blood Routine, Diagnostic Value

1. Introduction

Anemia is a common clinical condition characterized by a reduction in the volume of red blood cells in the peripheral blood, below the lower limit of the normal range. Patients with anemia typically present with symptoms such as fatigue, weakness, dizziness, and often exhibit mood swings and irritability. [1] The onset of anemia is insidious, and the clinical symptoms may not be enough to draw the patient's attention, leading to potential oversight during clinical diagnosis and treatment. However, as the condition progresses, the patient's overall health may be compromised, resulting in a reduced quality of life. There are various types of anemia, each with different symptoms, signs, and treatment options [2]. Therefore, it is crucial in clinical practice

to enhance early diagnosis of anemia in patients, accurately identify the type of anemia, and promptly develop a tailored treatment plan to correct the symptoms of anemia.

Complete blood count (CBC) is a widely used diagnostic method in clinical practice to evaluate various diseases. By examining relevant blood parameters, CBC can reflect the distribution and quantity of blood cells in the body, providing valuable insights into the hematopoietic system to improve the accuracy of clinical diagnosis and the effectiveness of treatment. [3]

In pregnant women, anemia is highly common due to physiological changes and altered nutritional requirements during pregnancy. Pregnancy-related anemia, as a high-risk factor during pregnancy, not only predisposes women to conditions like pregnancy-induced hypertension, heart disease, and even shock, increasing the risk of complications during childbirth, but also leads to adverse outcomes such as fetal anemia and intrauterine asphyxia, significantly affecting fetal development. [4] Moderate to severe anemia during pregnancy particularly impacts the fetal nervous system and intellectual development. Studies indicate that about 50% of pregnant women experience anemia, which compromises maternal immunity and heightens the risk of complications like premature rupture of membranes and preterm birth [5]. Throughout pregnancy, the maternal circulatory system needs to adapt to changes in placental blood circulation. This results in an increase in plasma volume and blood volume, further diluting the blood, leading to abnormalities in hemoglobin levels and red blood cell concentrations, hence causing anemia in pregnant women. Prolonged anemia in pregnant women can negatively affect fetal growth and development, necessitating timely treatment to enhance maternal and infant safety. [6]

Pregnancy anemia is a common complication during pregnancy, often caused by nutritional deficiencies and lack of folic acid. Pregnancy anemia can lead to decreased immune function and weakened resistance in pregnant women, impacting not only the health of the mother but also potentially affecting the health of the fetus. [7] Currently, clinical diagnosis of pregnancy anemia primarily relies on blood tests to observe the morphology and quantity of blood cells to determine the presence of pregnancy anemia. Additionally, results of complete blood count tests for anemia may vary during different stages of pregnancy. Therefore, early detection of pregnancy anemia through complete blood count tests in the early stages of pregnancy can help improve correction of anemia symptoms, treatment effectiveness, and reduce the risk of anemia [8].

This study retrospectively analyzes recent domestic and international research to explore the patterns of changes in various blood indicators between healthy pregnant women and pregnant women with pregnancy anemia. It discusses the relationship between maternal hemoglobin (Hb), mean corpuscular volume (MCV), red blood cell count (RBC), and mean corpuscular hemoglobin (MCH) during pregnancy. The aim is to provide clinical assistance for the early prediction and treatment of high-risk pregnant women during the perinatal period, in order to reduce the incidence of adverse pregnancy outcomes and ultimately further lower maternal and neonatal mortality and disability rates.

2. Analysis of Domestic and Foreign Research

Maternal hemoglobin concentration is an important item in prenatal examinations during pregnancy. Anemia is the most common complication during pregnancy and

falls under the category of high-risk pregnancies. In regions and countries where anemia is severe, it is a significant contributing factor to maternal mortality. Iron-deficiency anemia is the most common type of anemia that occurs during pregnancy [9].

In some researches, they found that the blood routine test and three indicators of anemia expressed abnormally in pregnant women, it has a significant value in clinical to combine those tests together to diagnose gestational anemia. Yanping Guo selected 97 pregnant women with gestational anemia admitted to Zhengzhou People's Hospital from January 2020 to January 2022 as the study group, while 32 healthy pregnant women undergoing prenatal examination during the same period were selected as the control group [10]. The blood routine includes Hb, RBC, MCV, MCH, and three indicators of anemia include folic acid, ferritin (Fer), vitamin B12 (VB12) were compared between the two groups. The correlation between blood routine and three indicators of anemia in the study group was analyzed, and the diagnostic value of related indicators for gestational anemia was evaluated. The results shows, compared with the control group, the Hb, folic acid, Fer and VB12 of the study group were lower, and the MCV was higher ($P < 0.05$). Pearson correlation analysis results showed that MCV was negatively correlated with folic acid, Fer and VB12 ($P < 0.05$). ROC curve results showed that the AUC of combined diagnosis of MCV, VB12, Fer and folic acid for gestational anemia was higher than that of each indicator alone ($P < 0.05$). These results show that the gestational anemia can be diagnosed effectively by combining tests together.

Another report selected 130 pregnant women who underwent routine prenatal examinations as the research subjects [11]. They were evenly divided into a control group and an observation group using a random number table method, with 65 women in each group, to analyze the value of complete blood count and three anemia tests in the diagnosis of anemia in pregnant women. The pregnant women in the control group underwent complete blood count tests, while those in the observation group underwent combined testing of the three anemia indicators using a fully automated chemiluminescence analyzer. The occurrence of anemia during pregnancy was compared between the two groups. The results showed that the incidence of anemia during pregnancy in the observation group was significantly lower than that in the control group, with a statistically significant difference ($P < 0.05$). This indicates that pregnant women are prone to insufficient hematopoietic materials in late pregnancy. Clinically, by combining complete blood count tests with the three anemia tests and intervening early, the occurrence of pregnancy-related anemia can be effectively reduced.

In another paper, the authors selected 31 pregnant patients with anemia as the observation group, and another 31 healthy pregnant women who received prenatal examination during the same period were selected as the control group, to explore the clinical value of blood routine and anemia combined detection in preventing anemia during pregnancy [12]. Blood routine and anemia tests were performed in both groups. The results showed that there were 30 patients with anemia combined with three tests, the coincidence rate was 96.77%. And 23 patients with blood routine test, the coincidence rate was 74.19%, the difference was statistically significant ($P < 0.05$). Folate, Fer and VB12 indexes in observation group were lower than those in control group, and the differences were statistically significant ($P < 0.05$). The indexes of Hb and MCV in the observation group were (74.41 ± 10.25) g/L and (76.58 ± 4.47) fL

respectively, which were lower than (141.36 ± 11.97) g/L and (86.28 ± 4.89) fL in the control group, and the difference was statistically significant ($P < 0.05$). It shows that blood routine and anemia combined detection are conducive to the diagnosis and differentiation of anemia in pregnancy. Based on the results of blood routine and anemia combined detection, clinical can develop a systematic prevention program or implement corresponding intervention.

In order to investigate the diagnostic value of combined routine blood test and the three combined anemia tests for different types of anemia in pregnancy, 160 pregnant women were selected as the subjects [13]. The study groups were classified into different types of anemia based on the levels of Hb and MCV. Various parameters including general information, routine blood test, and anemia indicators were compared among the groups. Results showed that among the 108 anemic pregnant women, 46 had macrocytic anemia and 62 had microcytic anemia, with the gestational stage being later in the macrocytic anemia group ($P < 0.05$). The Hb concentration in the experimental group was lower than that in the control group ($P < 0.05$); comparison of MCH and MCV results among the three groups showed that both the level of them in the macrocytic anemia group was higher than that in the control group, while both the level of MCH and MCV in the control group was higher than that in the microcytic anemia group ($P < 0.05$). Results of RDW among the three groups showed that the microcytic anemia group was higher than the macrocytic anemia group, which was higher than the control group ($P < 0.05$). Levels of VB12, serum folate, and serum ferritin showed that the control group was higher than the microcytic anemia group, which was higher than the macrocytic anemia group ($P < 0.05$). The sensitivity, specificity, and accuracy of combined blood routine test and the three combined anemia tests for diagnosing macrocytic and microcytic anemia of pregnancy were all higher than those of performing routine blood test alone ($P < 0.05$). This indicates the important clinical significance of using combined blood routine test and the three combined anemia tests in the diagnosis of different types of anemia during pregnancy.

Some other authors found that as the gestational ages increased, the severity of anemia would be aggravated. The incidence rate of microcytic anemia at the first and second trimester was higher than it at the third trimester, on the other hand, the macrocytic anemia at third trimester was higher than it at the first or second trimester[5]. In this study, 100 pregnant women with pregnancy anemia were chosen as the research group [14]. Another 100 pregnant women without pregnancy anemia during the same period were selected as the control group, both groups of pregnant women underwent complete blood count tests. The study compared the results of the complete blood count tests between the two groups, including Hb, RBC, MCH, MCV, and red blood cell distribution width (RDW). The study also compared the types of anemia and complete blood count test results among pregnant women with different stages of pregnancy anemia. The results showed that the levels of Hb, RBC, MCH, and MCV in the research group were lower than those in the control group, while RDW was higher, with statistically significant differences ($P < 0.05$). The incidence of microcytic anemia in early and mid-stage pregnancy anemia was higher than in late-stage pregnancy, while macrocytic anemia in late-stage pregnancy anemia was higher than in early and mid-stage pregnancy with statistical significance ($P < 0.05$). In mid-stage pregnancy anemia, the levels of Hb, RBC, MCH, and MCV were lower than in early-stage pregnancy anemia, and RDW levels were higher, showing statistically significant differences ($P < 0.05$). In late-stage pregnancy anemia, the levels of Hb,

RBC, MCH, and MCV were lower than in mid-stage pregnancy anemia, and RDW levels were higher, demonstrating statistically significant differences ($P < 0.05$). Therefore, using complete blood count tests for assessing anemia symptoms in pregnant women during pregnancy can provide auxiliary reference basis, improve early anemia diagnosis accuracy, and based on the different complete blood count test indicators during different stages of pregnancy anemia, early treatment recommendations can be provided to reduce the risk of anemia.

Another study showed that the author analyzed the blood routine test results and clinical application value of patients with pregnancy anemia in 2021 [15]. 50 patients with gestational anemia were selected to perform their blood routine test as the research object. According to the test results, the anemia severity and anemia type of patients were judged, and the anemia severity and anemia type of patients with different gestational weeks were compared. At the same time, 50 normal pregnant women were selected as the control, and the blood routine test results of the two groups were compared. The results showed that there were significant differences in RBC, Hb, HCT, MCV, mean corpuscular hemoglobin concentration (MCHC), MCH and RDW between patients with gestational anemia and normal pregnant women ($P < 0.05$). The levels of MCHC and MCH in the patients with gestational anemia were lower than those in the normal pregnant women. Specifically, the levels of MCH and MCHC in the patients with gestational anemia were (22.86 ± 2.42) pg and (298.98 ± 89.27) g/L, while those in the normal pregnant women were (30.98 ± 3.46) pg and (320.87 ± 67.25) g/L. The difference was statistically significant ($P < 0.05$). In addition, the RDW index of anemia pregnant women was significantly higher than that of normal pregnant women $(19.43 \pm 1.54)\%$ and $(12.32 \pm 0.48)\%$. Finally, they believe that increased gestational age is associated with an increased incidence of moderate to severe anemia and large cell anemia. So, to carry out continuous blood routine test during pregnancy is conducive to the adjustment of patients treatment plan and nutrition plan, improve patients' anemia, and reduce the risk of complications and adverse pregnancy outcomes caused by anemia.

Another author and his colleagues selected 145 pregnant women diagnosed with pregnancy-related anemia as the study group [16]. They also selected 146 healthy pregnant women undergoing routine prenatal examinations during the same period as the control group to analyze the clinical value of complete blood count test in diagnosing anemia in pregnant women. Both the study group and the control group underwent blood routine test. The study compared the detection rates of pregnancy-related anemia in different stages of pregnancy in the study group, compared the blood routine parameters between the two groups, and compared the blood routine parameters in different stages of pregnancy in the study group. The results showed that the detection rate of microcytic anemia in early pregnancy (93.33%) was higher than in mid-pregnancy (69.49%) and late pregnancy (76.79%), with a significance level of $P < 0.05$. The detection rate of macrocytic anemia in early pregnancy (6.67%) was lower than in mid-pregnancy (30.51%) and late pregnancy (23.21%), with a significance level of $P < 0.05$. This suggests that early blood routine test in pregnant women with pregnancy-related anemia can clearly define the severity of the patient's condition and provide a basis for formulating treatment plans.

In addition, other papers gave their opinion that the results of blood routine test showed obvious difference among different types of anemia. One of them conducted a study on the blood routine test for pregnant women with iron deficiency anemia, megaloblastic anemia, and healthy pregnant women; and analyzed the application

value of blood routine test in the clinical diagnosis of pregnant women with anemia [17]. They selected three groups of pregnant women to do the blood routine test: 20 pregnant women with iron deficiency anemia, 20 pregnant women with megaloblastic anemia, and 22 healthy pregnant women. The results of blood routine test for these three groups of pregnant women were compared and analyzed. It showed that pregnant women with iron deficiency anemia and megaloblastic anemia had lower levels of MCH, Hb, and MCV compared to healthy pregnant women, while the RDW levels were higher than those of healthy pregnant women. The RBC/MCV ratio in pregnant women with iron deficiency anemia was higher than that in healthy pregnant women and pregnant women with megaloblastic anemia, with a significant difference between the groups ($P < 0.05$). Pregnant women with megaloblastic anemia had higher levels of RDW and RBC count compared to healthy pregnant women and pregnant women with iron deficiency anemia, with a significant difference between the groups ($P < 0.05$). This indicates that blood routine test have a high application value in the clinical diagnosis of suspected anemia in pregnant women.

3. Conclusions

Anemia of pregnancy is a common complication during pregnancy, which seriously affects the health of mother and child, and it is the main cause of death in pregnant women. According to the World Health Organization, anemia kills hundreds of thousands of pregnant women every year. The main causes of anemia are rapid fetus growth, insufficient intake of nutrition and poor absorption capacity, which affects the health of pregnant women and fetus. Therefore, attention should be paid to the monitoring of anemia in pregnant women in clinical practice to prevent its occurrence. This study retrospectively analyzes recent research to explore the patterns of changes in various blood indicators between healthy pregnant women and pregnant women with pregnancy anemia. It discusses the relationship between maternal Hb, MCV, RBC, and MCH during pregnancy. During pregnancy, women's blood routine, Fer, VB12 and folate levels all will change to varying degrees, and with the extension of pregnancy, this change is becoming more and more significant, so timely improvement and dynamic monitoring of blood routine and three indicators of anemia tests can help better protect the safety of mother and fetus.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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