

Study on Correlation Between High Altitude Polycythemia and Maternal and Fetal Complications During Pregnancy

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Abstract

Objective: To explore the relationship between maternal and fetal complications during pregnancy and hyperredness, so as to find effective prevention and management measures. **Methods:** A total of 172 pregnant and parturients who were recorded, regularly examined and delivered in Naqu People's Hospital from January 2017 to January 2019 were retrospectively analyzed, including the general physiological data in the early pregnancy (10–12 weeks gestation), late pregnancy (36–37 weeks gestation) and postpartum (within one week). The complications during the perinatal period were followed up, and they were divided into high red group (observation group) and no high red group (control group) according to whether or not they had high red. The laboratory indexes such as maternal blood, urine, feces, liver function and kidney function during pregnancy and the clinical symptoms such as the postpartum state were analyzed and compared between the two groups. To analyze and compare the pathological and physiological indicators of the general state, liver and kidney functions, blood system, placental umbilical cord and other pregnancy appendages of the neonates of the high red syndrome pregnant women and the neonates of the normal healthy pregnant women. **Results:** For coagulation function test, FHG (g/L) 2.40 0.64, APTT (S) 54.6 4.13, PT (S) 12.8 0.64, TT (S) 16.2 1.4 in HAPC group; Plateau control group: FHG (g/l) 2,16 0,34. The results of APTT(s), 48.2 3.91PT (S), 12.5 0.96, and TT (S) 13.2 3.2 were statistically significant ($P < 0.05$). Compared with the complication rate in pregnancy, the complication rate in pregnancy of the parturients with hyperchromia was significantly higher than that in the control group, and the results between the two groups were statistically significant ($P < 0.05$). The comparison of the incidence of neonatal diseases showed that the incidence of neonatal diseases in the hyperchromia group was higher than that in the control group. **Discuss:** The combination of hyperchromia among pregnant women easily affected the coagulation function and caused the dereliction of duty of coagulation mechanism, manifested as the increased incidence of postpartum hemorrhage. At the same time, the combination of hyperchromia also aggravated the complications of pregnant mothers and infants.

Keywords

Maternal and fetal complications during pregnancy; High Altitude Polycythemia.

1. Introduction

The plateau is a complex environment with low temperature, low pressure and low oxygen content. High Altitude Polycythemia, HAPC), is a chronic altitude disease in which the human body is in high altitude (more than 2500 meters) for a long time and the compensatory excessive proliferation of red blood cells is caused by high altitude hypoxia [1]. Hyperchromia

can lead to lesions in various systems of the body, such as cardiovascular system, lung system, brain system, digestive system and reproductive system [2].

It has been clinically observed that female patients can cause poor prognosis even during pregnancy [3]. Previous studies have shown that long-term maternal exposure to high altitude during pregnancy may induce changes in fetal cardiac development procedures, leading to permanent changes in the structure and function of cardiac tissues and organs after birth [4]. In addition, there was a mild decrease in platelet count during pregnancy due to hemodilution. Thrombocytopenia during pregnancy is also a common complication during pregnancy [5]. At the same time, the blood of pregnant women is in a physiological hypercoagulable state, which has been listed as one of the risk factors for thrombosis [6]. The incidence of maternal complications is on the rise, and there are more and more complex complications. The common complications during pregnancy include gestational diabetes mellitus, gestational hypertension, eclampsia, and intrahepatic cholestasis of pregnancy. Premature birth is the main adverse neonatal outcome, and low birth weight infants are the main complications, but the average birth weight of neonates is increased.

In this study, 37 parturients and their neonates with hypererythrocytosis were compared with the general physiological indicators of normal healthy parturients and their neonates. The results are reported as follows:

1.1. Materials and Methods

General data: The clinical data of 172 pregnant and lying-in women admitted to Naqu People's Hospital from January 2017 to January 2019 were analyzed retrospectively, including 37 pregnant and lying-in women with hypererythrocytosis and their neonates as the observation group and 135 normal healthy pregnant and lying-in women and their neonates as the control group. The pregnant women were aged from 22 to 37 years old, with an average of (28.6 4.5) years old, Height (161.5±5.7) cm; Pre-pregnancy weight (57.6±10.2) kg; The pre-pregnancy body mass index, BMI) was (22.1 3.5) kg/m², Gestational weeks (38.7 1.6) were observed.

1.2. Inclusion/Exclusion Criteria

Inclusion criteria: (1) It met the relevant criteria for disease diagnosis and condition evaluation in the Guideline for Diagnosis and Treatment of Pregnancy Induced Hypertension (2020); (2) Primiparous women, aged 21–40 years old; (3) Natural conception, single pregnancy; (4) Regular antenatal examination shows that the clinical data are complete. Exclusion criteria: (1) Patients with concurrent hyperthyroidism, coagulation disorders, immune dysfunction, and history of acute and chronic infection during pregnancy; (2) Organic organ dysfunction such as heart, liver, lung and kidney; (3) Senior year; (4) Pre-pregnancy diseases such as hypertension, coronary heart disease and chronic nephritis exist; (5) Fetal chromosome abnormality and developmental deformity; (6) Pregnant women with mental and intellectual disabilities do not cooperate with the study; (7) Clinical data are incomplete.

1.3. Complications of Mother and Child During Pregnancy.

Complications of pregnancy refer to the disease state of pregnant women and parturients that occurs due to the growth and development of the fetus and aggravation of the burden on various systems and organs of the body, but do not exist before pregnancy, including gestational diabetes mellitus, gestational hypertension, eclampsia, and intrahepatic cholestasis of pregnancy.

1.4. Plateau Polycythemia/Polycythemia Vera Differential and Diagnosis

High Altitude Polycythemia, HAPC), is a chronic altitude disease in which the human body is in high altitude (more than 2500 meters) for a long time and the compensatory excessive proliferation of red blood cells is caused by high altitude hypoxia. In the "Qinghai Standard" of

2004, hyperchromia was defined as male hemoglobin concentration ≥ 210 g/L and female hemoglobin concentration ≥ 190 g/L, and hypoxemia caused by chronic respiratory diseases and cardiovascular diseases must be excluded. Normal hemoglobin concentration, 120–160 g/L (12.0–16.0 g/dL) for males; Female: 110-150 g/L (11.0-15.0 g/dL); • Newborn: 170-200g/L(18.0-19.0g/dl).

Polycythemia vera, (PV) is a myeloproliferative disease mainly caused by clonal polycythemia, with the main manifestation of abnormally high hemoglobin, up to 170–240 g/L.

The most striking difference between hyperchromia and polycythemia vera is the absence of malignant transformation.

1.5. The Research

content compares the complications during pregnancy of pregnant women with hyperchromia and healthy pregnant women, including gestational diabetes mellitus, gestational hypertension, eclampsia and intrahepatic cholestasis of pregnancy, and compares the routine blood test and coagulation routine of the pregnant women in the two groups, To compare the general states of neonates in pregnant women with hyperchromia, including temperature, respiration, heart rate, blood pressure, weight, and susceptibility, and the incidence of postpartum related diseases between the two groups.

1.6. Research Methods

The blood system related laboratory indexes of pregnant women with hyperchromia and healthy pregnant women were analyzed and compared, including thromboplastin time (APTT), prothrombin time (PT), thrombin time (TT), and fibrinogen (Fbg) levels. To analyze and compare the general conditions and the incidence of related neonatal diseases of neonates in high-redness pregnant women and healthy pregnant women.

1.7. Statistical Methods

In this study, the corresponding data were firstly cleaned and organized from the diagnostic fields on the first page of the medical record, and the maternal visit records were descriptively analyzed to extract the maternal demographic characteristics and pregnancy complications from the visit records, SPSS 19.0 statistical analysis software was used to process and study the data, The enumeration data were expressed as [Cases (%)] and the inter-group comparison was conducted using χ^2 test at the test level of $\alpha=0.05$.

2. Results

2.1. Statistics and Analysis

The incidences of complications during pregnancy and delivery of pregnant women in the two groups are shown in Tables 1 and 2.

Table 1. Cases of complications during pregnancy and delivery of pregnant women in two groups

Common complications	n	Gestational diabetes mellitus	Gestational hypertension	puerperal convulsion	Intrahepatic cholestasis of pregnancy	Premature rupture of membranes	postpartum hemorrhage
High red disease pregnant women group	37	2	3	1	1	3	5
Cases (n)							
Healthy Maternity Group	135	5	6	1	2	5	4
Cases (n)							

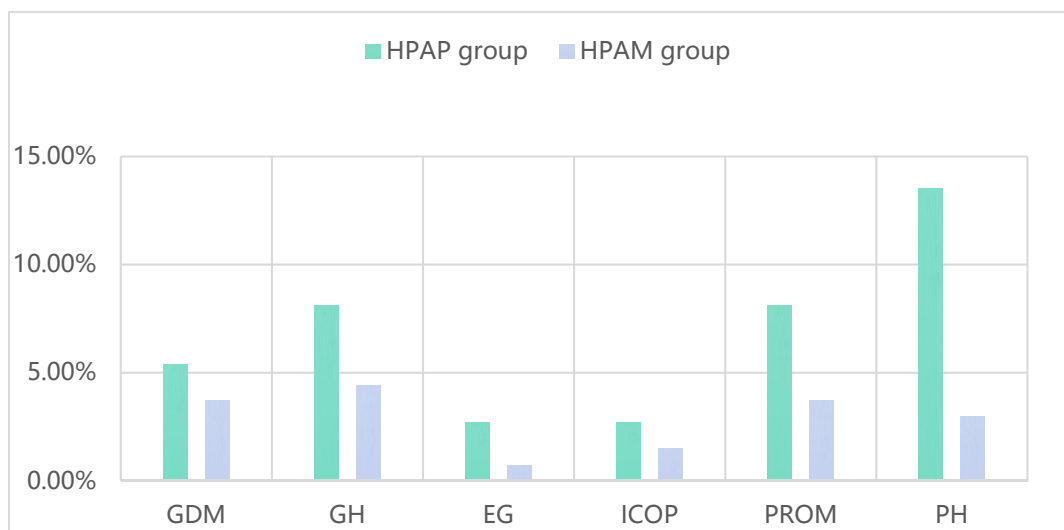


Figure 1. The incidence of complications during pregnancy and childbirth in the two groups

Note: Gestational diabetes mellitus: GDM Gestational Hypertension: GH eclampsia Gestational: EG Intrahepatic Chole Stage of Precancey: ICoP Premature Rupture of Membranes: PROM POST Partum Hematorhage: pH

Compared the incidence of complications during pregnancy between the two groups, the incidence of complications during pregnancy of the parturients with hyperchromia was obviously higher than that of the control group, The incidence of diabetes during pregnancy of the parturients with hyperchromia was 5.40%, the incidence of hypertension during pregnancy of the parturients with hyperchromia was 8.10%, the incidence of eclampsia of the parturients with hyperchromia was 2.70%, the incidence of intrahepatic cholestasis of pregnancy of the parturients with hyperchromia was 2.70%, the incidence of premature rupture of membranes of the parturients with hyperchromia was 8.10%, and the incidence of postpartum hemorrhage of the parturients with hyperchromia was 13.51 The incidence of gestational diabetes mellitus in the control group was 3.70%, the incidence of hypertensive disorder complicating pregnancy in the control group was 4.44%, the incidence of eclampsia in the control group was 0.74%, the incidence of intrahepatic cholestasis of pregnancy in the control group was 1.48%, the incidence of premature rupture of membranes in the control group was 4.44%, and the incidence of postpartum hemorrhage in the control group was 2.30%, The data were processed and studied using SPSS 19.0 statistical analysis software, and the results showed statistical significance ($P < 0.05$).

Table 2. Comparison of coagulation function during pregnancy between the two groups

Group	n	Fhg(gL)	APTT(s)	PT(s)	TT(s)
HAPC group	35	2.40±0.64	54.6±4.13	12.8±0.64	16.2±1.4
Plateau control group	137	2.16±0.34	48.2±3.91	12.5±0.96	13.2±3.2
P	—	<0.05	<0.05	>0.05	<0.05

Comparison of coagulation function during pregnancy between the two groups high red disease of pregnant women and healthy pregnant women newborn general physiological indicators of comparison, see table 3.

Table 3. Comparison of general physiological indexes of neonates of pregnant women with hyperchromia and those of healthy pregnant women

General status	Body temperature (C)	Respiration (timesminute)	Heart rate (timesminute)	Body weight (Kg)
Newborn of pregnant women with hyperchromia	36.2~37.1	41~52	123~176	3.2~3.9
Healthy pregnant woman and newborn	36.0~37.5	42~50	103~158	3.4~4.1

Comparison of the incidences of neonatal organ immaturity, bilirubinemia, respiratory distress syndrome, and neonatal pneumonia and aspiration pneumonia between the two groups are shown in Tables 4.

Table 4. Comparison of the number of neonatal related diseases between the two groups

Neonatal related conditions	Immature	Bilirubinemia	respiratory distress syndrome	Neonatal pneumonia	inhalation pneumonia
Newborn of pregnant women with hyperchromia	3 cases	2 cases	2 cases	3 cases	1 case
Healthy pregnant woman and newborn	2 cases	3 cases	2 cases	4 cases	2 cases

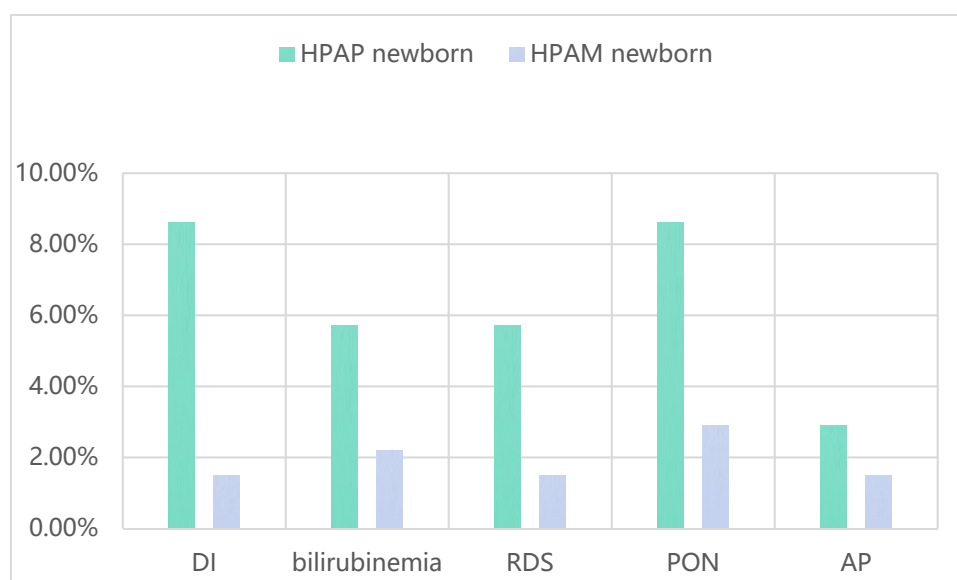


Figure 2. Comparison of the incidence rate of neonatal diseases between the two groups

Note: Developmental immunity: di respiratory distress syndrome: RDS PNEUMONIA of Newborn: PON ASPIRATION PNEUMONIA: AP

Compare with neonatal related disease, that incidence rate of neonatal immaturity in pregnant women with hyperchromia is 8.60%. The incidence of bilirubinemia, respiratory distress syndrome, neonatal pneumonia and aspiration pneumonia is 5.70%, 8.60% and 2.90%, respectively, The incidence of neonatal immaturity, bilirubinemia, respiratory distress syndrome, neonatal pneumonia and aspiration pneumonia in healthy pregnant women were 1.50%, 2.20%, 2.50% and 1.50%, respectively, SPSS 19.0 statistical analysis software was used for data processing and research, and the results showed statistical significance ($P < 0.05$).

3. Discuss

When the body was exposed to the plateau low-pressure and low-oxygen environment, in order to meet the oxygen demand of various tissues and organs, red blood cells would be caused to increase in compensation to improve oxygen carrying capacity against the effect of hypoxia on the body, The red blood cells, hemoglobin and hematocrit in the body would be increased, with corresponding symptoms and signs, However, when the red blood cell proliferation exceeded a certain limit, it would result in increased blood viscosity, increased blood flow resistance and decreased flow velocity, further aggravating the hypoxia, and leading to the occurrence of plateau polycythemia. According to the survey results of Zhao et al., the prevalence rate of HAPC11 in males and females was 6.14% and 1.03%, respectively, and the prevalence rate in males was significantly higher than that in females ($P < 0.01$).

Neonatal complications mainly included immature development and neonatal pneumonia. Platelet counts decreased slightly during pregnancy due to hemodilution. Thrombocytopenia during pregnancy is also a common complication during pregnancy. At the same time, the blood of pregnant women is in a physiological hypercoagulable state, which has been listed as one of the risk factors for thrombosis. The changes of platelets in pregnant women at high altitude are manifested as platelet activation and thrombocytopenia, which are related to the hypercoagulable state of blood, Pregnancy is a special physiological process for women of childbearing age, The blood is in a physiological hypercoagulable state from the normal three months of pregnancy, and it gradually aggravates with the progress of pregnancy. Studies such as Zhou Le have shown that platelet counts in healthy pregnant women tend to decrease as the pregnancy progresses. Therefore, the high-altitude hypoxic environment and changes in the hematological system during pregnancy have the manifestations of high risk of thrombosis and thrombocytopenia.

In conclusion, the combination of hyperredness in pregnant women easily affects the coagulation function, resulting in dereliction of duty of coagulation mechanism, manifested as increased incidence of postpartum hemorrhage, At the same time, the combination of hyperredness also aggravates the complications of pregnant mothers and infants. In clinical work at high altitude, routine blood test and coagulation test of pregnant women should be paid attention to, and the combination of hyperredness should be excluded. For pregnant women with hyperredness, more attention should be paid to reduce the occurrence of various complications during pregnancy and active treatment after the occurrence of complications. There are still some shortcomings in the aspects of treatment and sample size in this study, which will be further improved in the future work.

Acknowledgments

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