Int J Clin Exp Med 2023;16(2):31-40
www.ijcem.com /ISSN:1940-5901/IJCEM0136496

*Original Article*

# Investigation and analysis of high-risk factors of postpartum hemorrhage in singleton primiparous women: a cross-sectional study

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Received June 18, 2021; Accepted July 27, 2022; Epub February 15, 2023; Published February 28, 2023

**Abstract:** Objective: To investigate the risk factors of postpartum hemorrhage in single primiparas. Methods: The clinical data of 532 cases of single primiparas who delivered in the First Affiliated Hospital of Jinan University from August 2020 to December 2020 were retrospectively analyzed, and the primiparas were divided into the bleeding group (32 cases) and the non-bleeding group (500 cases) according to postpartum hemorrhaging or not. The general conditions, medical history, psychological status and the pregnancy process of the two groups were compared, and logistic regression was used to analyze the high-risk factors of postpartum hemorrhage in singleton primiparas. Results: The comparison of uterine fatigue, hemoglobin content, and prenatal GAD-7 score between the two groups was statistically significant ($P < 0.05$), which were the high-risk factors for postpartum hemorrhage in single primipara women. Conclusions: The incidence of postpartum hemorrhage in primiparas was 6.02%, and uterine weakness, antenatal anxiety, and moderate to severe anemia were the influencing factors of postpartum hemorrhage in primiparas. Timely correction of anemia before childbirth, psychological guidance for primiparas' anxiety, prenatal education, and early prevention of postpartum hemorrhage caused by uterine weakness are very important for reducing the incidence of postpartum hemorrhage.

**Keywords:** Antenatal anxiety, primipara, postpartum hemorrhage, risk factors, GAD-7

## Introduction

Childbirth is a natural physiological process, but due to the lack of experience of the primipara and the lack of pregnancy knowledge and understanding of the process of childbirth, it is easy to induce different degrees of anxiety, tension, depression and other negative emotions, and even postpartum depression. Pregnancy is a period when women are vulnerable and their psychological condition may be affected, with various psychological problems that can be particularly prominent, among which anxiety is the most typical psychological reaction [1]. Anxiety disorders during pregnancy are particularly common, with a prevalence rate of 15.2% with symptoms ranging from mild to severe [2]. The prevalence of perinatal anxiety varies from study to study. In high-income countries, the prevalence of antenatal anxiety is between 7% and 20% [3], and in low- and middle-income countries it has reached 20% or higher [4, 5]. Studies have shown that anxiety during pregnancy is related to complications regarding pregnancy. Obstetric complications related to high levels of anxiety during pregnancy include premature delivery, habitual abortion, prolonged labor, fetal intrauterine developmental disorders, and postpartum hemorrhage [6, 7].

Postpartum hemorrhage is a common and serious complication seen in obstetrics. A large amount of blood loss in a short period of time seriously endangers the life of the pregnant women. Studies have shown that more than 90% of maternal deaths related to obstetric hemorrhage can be prevented [8]. Therefore, analyzing and exploring the related risk factors of postpartum hemorrhage and actively taking preventive measures are the key to reducing its morbidity and mortality. Postpartum hemorrhage can cause a series of adverse outcomes,

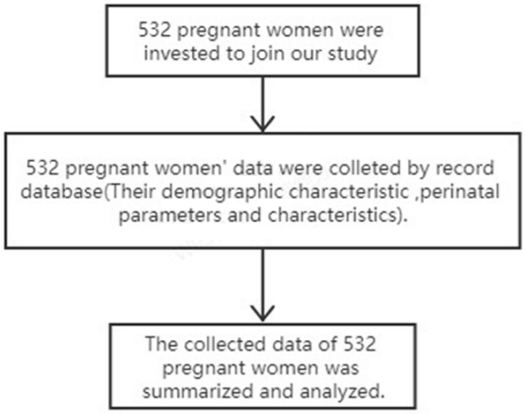


**Figure 1.** Study flow.

such as hysterectomy, shock, respiratory distress syndrome, DIC (diffuse vascular coagulation), anemia, puerperal infection, Sheehan syndrome, multiple organ failure, and infectious diseases (such as hepatitis, syphilis, AIDS) caused by a large number of allogeneic transfusions in the treatment of hemorrhagic shock, that cause serious physical and psychological harm to women [9-11]. Through the investigation of the prenatal anxiety of selected primiparas, we aimed to understand the relationship between prenatal anxiety and postpartum hemorrhage, and provide a theoretical basis for improving the physical and mental status of pregnant women. In this paper, the clinical values of nearly 40 data related indicators (including maternal age, laceration of birth duct, placental factors, coagulation function, abortion history, pre-pregnancy BMI, weight gain during pregnancy, moderate and severe anemia, prenatal anxiety, and other factors) of 532 cases of single birth primiparas were analyzed by univariate and multivariate Logistic regression analysis, to explore the prenatal risk factors of postpartum hemorrhage, formulate monitoring projects and prevention measures, and reduce maternal mortality. At the same time, we hope to provide basic reference information for medical research and disease prevention.

## Methods

### *Data*

**Figure 1** is our study flowchart, and it shows every step of our study. Our researchers collected data from the medical records database of The Affiliated Hospital of Jinan University from August 2020 to December 2020. In the first stage, through questionnaire survey in the obstetrics ward of the First Affiliated Hospital of Jinan University, we selected subjects meeting the inclusion criteria for data collection. After the puerpera was hospitalized for delivery and completed the hospitalization procedures, the purpose and significance of the investigation were explained in detail to the research subjects, and informed consent was given. Pregnant women were instructed to fill out the Generalized Anxiety Disorder Scale (GAD-7), Pittsburgh Sleep Quality Index (Pittsburgh Sleep Quality Index). PSQI), Patient Health Questionnaire Depression Scale (PHQ-9). In the second stage, we collected maternal related data retrospectively through the medical record system, the data included the antenatal laboratory tests, anthropometric measures of labor with recorded and blood loss after delivery.

### *Participants*

All participants (n = 532) were primipara with singleton births who gave birth between August 2020 and December 2020. Inclusion criteria: ① Primiparous women in the hospital for delivery, gestational age ≥ 37 weeks; ② Normal pelvis and fetal position, estimated fetal weight between 2500 and 4000 g; ③ Volunteered to participate in this study and signed an informed consent; normal cognitive ability, able to cooperate and complete the questionnaire. Exclusion criteria: ① Patients with severe physical disorders and neuropsychiatric diseases; ② Twin or multiple fetuses; ③ Test results show that the fetus has obvious malformations in the abdomen; ④ Those with pregnancy complications and complications.

### *Measures*

*Demographic characteristics:* The self-reported questionnaire was used to obtain demographic information of the pregnant women, including age, occupation, education level.

*Pregnancy characteristics:* Pregnancy characteristics included whether there was abnormal uterine contractions, birth canal laceration, an abnormal placenta, abnormal blood coagulation, pre-pregnancy body mass index (BMI), gestational weight gain (GWG), fundal height (FUH), abdominal circumference (AC), whether

they suffer from myoma of the uterus, vaginitis, HBV infection, favism, thalassemia, or pregnancy complications (including polyhydramnios, oligoamnios, premature rupture of membranes, amniotic fluid pollution). Antenatal laboratory tests including platelet count (PTL), hematocrit (HCT), erythrocyte count (RBC), and hemoglobin (HGB).

Height and pre-pregnancy weight were used to calculate the pre-pregnancy BMI, according to the Chinese adult BMI classification, into pre-pregnancy underweight (BMI < 18.5 kg/m$^2$), pre-pregnancy normal weight (18.5 kg/m$^2$ ≤ BMI < 24.0 kg/m$^2$), pre-pregnancy overweight (24.0 kg/m$^2$ ≤ BMI < 28.0 kg/m$^2$), or pre-pregnancy obese (BMI ≥ 28.0 kg/m$^2$). Gestational weight gain (GWG) based on the 2009 IOM (Institute of Medicine) guidelines: namely pre-pregnancy underweight women gained 12.5-18.0 kg in weight, pre-pregnancy normal weight women gained 11.5-16.0 kg, pre-pregnancy overweight women gained 7-11.5 kg, and pre-pregnancy obese women gained 5-9 kg; weight gain below the guidelines is inadequate GWG, while within the guidelines is the recommended GWG, and above the guidelines is excessive GWG.

*Outcome measurements*

*Antenatal anxiety:* Anxiety symptoms before delivery were assessed using the Generalized Anxiety Disorder-7 (GAD-7). As a self-rating scale, GAD-7 is a reliable tool for general hospitals to screen emotional disorders, and it is convenient to use. It is widely used in psychosomatic diseases [12]. GAD-7 has been proven to have good reliability and validity, and can help clinicians diagnose anxiety disorders in perinatal population [13]. In the latest screening for perinatal anxiety disorders, the prevalence of GAD-7 positive was 17%, and GAD-7 showed a sensitivity of 89.0% and specificity of 82.3% at cut-off score of 7, in this study, the total scores ≥ 7, indicated prenatal anxiety [14].

*Postpartum hemorrhage:* The classification was blood loss of vaginal delivery that exceeds 500 ml within 24 hours after the fetus is delivered, and the blood loss of cesarean delivery exceeds 1000 ml within 24 hours.

*Uterine inertia:* Uterine contractility is the main force initiating the delivery of the fetus and placenta. During childbirth, if the rhythm, symmetry and polarity of uterine contractility are abnormal or the intensity and frequency change, this is called abnormal uterine contractility. Abnormal uterine contractility is coordinated (hypotonic) uterine atony and less commonly uncoordinated (hypertonic) uterine atony. Coordinated (hypotonic) anemic contractions can be classified into primary and secondary anemic contractions depending on when they occur. Primary uterine contraction weakness is defined as: uterine contraction function that is low from the beginning of labor, manifested as weak contraction intensity, with low uterine pressure, short duration of contractions, long time interval, lower frequency than normal, with contractions < 2 times/10 minutes [11]. Secondary uterine atony is defined as: at the beginning of labor, there is normal uterine contractility, and the labor progresses normally, but when the labor progresses to a certain stage (mostly in the active phase or the second stage of labor), and when the cervix is dilated to a certain degree, the uterine contractility becomes weak, thin, slow progress of labor, or stagnation can occur [15, 16].

*Other relevance factors:* This study used the Pittsburgh Sleep Quality Index (PSQI) to evaluate maternal sleep quality. Sleep component scores were summed to yield a total score ranging from 0 to 21 with a higher total score indicating worse quality. In this study, the total scores ≥ 7, indicated sleep disorders, and the Chinese version of the PSQI questionnaire which has been widely accepted as a sleep quality assessment method in mainland China with good reliability and validity was also used.

The Patient Health Questionnaire-9 (PHQ-9) was used to evaluate the depression of women before delivery, with a total score ranging from 0 to 27, total scores of 5-9, 10-14, 15-19, and 20-27 corresponded to mild, moderate, moderately severe, and severe depression symptoms, respectively. Studies have shown that using a cut-of score of 10 is a good way to distinguish depression from non-depressions. In this study, the total scores ≥ 10, indicated depressive symptoms [17].

*Statistical analysis*

SPSS 23.0 was used to analyze the data. Continuous variables were converted into categorical data that were written as frequency (n) and percentages (%), independent samples

**Table 1.** Demographic information of primiparas and distribution of postpartum hemorrhage (n = 532)

| Characteristic | | Total n (%) | Postpartum hemorrhage | | *P* value |
|---|---|---|---|---|---|
| | | | Yes n (%) | No n (%) | |
| n | | 532 (100.0) | 32 (6.0) | 500 (94.0) | |
| Age | < 30 | 402 (72.6) | 23 (5.8) | 279 (94.2) | 0.075 |
| | ≥ 30 | 130 (24.4) | 9 (6.9) | 221 (93.1) | |
| Education level | High school or below | 62 (11.7) | 25 (4.8) | 421 (95.2) | 0.365 |
| | College or above | 470 (88.3) | 7 (8.1) | 79 (91.9) | |
| Occupation | Employee | 446 (83.8) | 3 (6.2) | 59 (93.8) | 0.896 |
| | Unemployed | 86 (13.2) | 29 (8.1) | 441 (91.9) | |
| HBV carrier | Yes | 504 (94.7) | 30 (6.0) | 474 (94.0) | 0.880 |
| | No | 28 (5.3) | 2 (7.2) | 26 (92.8) | |
| Favism | Yes | 505 (94.9) | 28 (5.5) | 477 (94.5) | 0.119 |
| | No | 27 (5.1) | 4 (14.8) | 27 (85.2) | |
| Thalassemia | Yes | 505 (94.9) | 29 (5.7) | 476 (94.3) | 0.467 |
| | No | 27 (5.1) | 3 (11.1) | 24 (88.9) | |

t-test was used to compare independent groups, and chi-squared and Fisher exact tests were used to compare. Binary regression logistic regression models were used to calculate odds ratios (OR) and 95% confidence intervals (CI), and it was considered statistically significant if the *P* value was less than 0.05.

## Results

### *Sample characteristics*

All pregnant women were aged 18-45 years (mean = 28.00 ± 3.37), and 24.4% (130) of the pregnant women ≥ 30 years old. Most of the pregnant women had college education and above as their highest education (88.6%). Most of the pregnant women were working (83.8%). In our study, the prevalence rates of anxiety and depression symptoms were 7.52% (40) and 9.4% (50), respectively. A total of 68.2% (363) of pregnant women had good sleep quality, and 31.8% (169) had poor sleep quality. The results are shown in **Tables 1-3**.

Among the 532 singleton primiparas, 6.02% (32) had postpartum hemorrhage. There were 374 vaginal deliveries, and the incidence of postpartum hemorrhage was 7.75% (29); 158 pregnant women delivered by cesarean section, and the incidence of postpartum hemorrhage was 1.90% (3). Among 32 patients with postpartum hemorrhage, 31.25% (10) occurred within two hours after delivery, and 68.75% (22) occurred within 24 hours after delivery. The minimum amount of blood loss was 500 ml and the maximum was 1,690 ml. The minimum blood loss was 500 ml and the maximum was 1,690 ml. Severe postpartum hemorrhage was defined as blood loss ≥ 1,500 ml within 24 hours after delivery. In this study, the incidence of severe postpartum hemorrhage was 9.38% (3).

### *Influencing factors of postpartum hemorrhage in primiparas*

The results of $x^2$ test showed that uterine inertia, red blood cell count, hemoglobin content, anxiety symptoms were significantly correlated with postpartum hemorrhage in primiparas (all $P < 0.05$). The results are shown in **Tables 1-3**. Multivariate binary logistic regression results shows that in primiparas, the odds of postpartum hemorrhage were increased by uterine inertia (OR = 8.917, 95% CI = 1.133-70.191), hemoglobin content being less than 90 g/L (OR = 5.707, 95% CI = 1.641-19.848) and prenatal anxiety (OR = 3.475, 95% CI = 1.323-9.131). The results are shown in **Table 4**.

## Discussion

### *Prevalence of postpartum hemorrhage*

Our study reported that the prevalence rate of postpartum hemorrhage was 6.02% in primiparas. The main influencing factors were uterine inertia, anemia, and prenatal anxiety. These findings suggested that medical institutions

**Table 2.** Pregnancy information of primiparas and distribution of postpartum hemorrhage (n = 532)

| Characteristic | | Total n (%) | Postpartum hemorrhage | | *P* value |
|---|---|---|---|---|---|
| | | | Yes n (%) | No n (%) | |
| Uterine inertia | No | 528 (99.2) | 30 (5.7) | 498 (94.3) | 0.008 |
| | Yes | 4 (0.8) | 2 (50.0) | 2 (50.0) | |
| Abnormal placenta | No | 523 (98.1) | 30 (5.7) | 493 (94.3) | 0.175 |
| | Yes | 9 (1.9) | 2 (22.2) | 7 (77.8) | |
| Coagulation dysfunction | No | 481 (90.4) | 28 (5.8) | 453 (94.2) | |
| | Yes | 51 (9.6) | 4 (7.8) | 47 (92.2) | |
| Birth canal laceration | No | 229 (43.0) | 12 (5.2) | 217 (94.8) | 0.513 |
| | Yes | 303 (57.0) | 20 (6.6) | 283 (93.4) | |
| Pre-pregnancy BMI (kg/m$^2$) | < 18.5 | 82 (15.4) | 1 (1.2) | 81 (98.8) | 0.116 |
| | 18.5~23.99 | 357 (69.0) | 25 (6.8) | 342 (93.2) | |
| | 24.00~27.99 | 66 (12.4) | 4 (6.1) | 62 (93.1) | |
| | ≥ 28.0 | 17 (3.2) | 2 (11.8) | 15 (88.2) | |
| Gestational weight gain (GWG) | Below IOM guidelines | 58 (10.9) | 3 (5.2) | 55 (94.8) | 0.628 |
| | Within IOM guidelines | 143 (26.9) | 11 (7.7) | 132 (92.3) | |
| | Above IOM guidelines | 331 (62.1) | 18 (5.4) | 313 (94.6) | |
| Abortions | 0 | 442 (83.1) | 26 (5.8) | 416 (94.2) | 0.075 |
| | ≥ 1 | 90 (16.9) | 6 (6.7) | 84 (93.3) | |
| Method of pregnancy | Spontaneous pregnancy | 512 (96.2) | 29 (5.7) | 483 (94.3) | 0.213 |
| | Artificial pregnancy | 20 (3.8) | 3 (15.0) | 17 (85.0) | |
| Delivery mode | Vaginal delivery | 374 (70.3) | 29 (7.8) | 345 (92.3) | 0.001 |
| | Cesarean delivery | 158 (29.7) | 3 (1.9) | 155 (98.1) | |

can support women with mental health screening during pregnancy examination, and provide prenatal education and psychological counseling for the prenatal anxiety of primiparas, which will help reduce the level of antenatal anxiety, and this is very useful for preventing postpartum hemorrhage caused by uterine weakness.

*Influence factors of postpartum hemorrhage*

*Uterine inertia:* Uterine weakness is the primary factor leading to postpartum hemorrhage, which can occur after, vaginal delivery, forceps delivery and cesarean section. Uterine smooth muscle contraction amplitude, contraction frequency and contractile activity are reduced during delivery, and primiparas are prone to fear, tension and other emotions, uterine contractions are not coordinated, and uterine muscle recovery ability is decreased, resulting in uterine weakness [15]. The causes of uterine weakness can be divided into two broad categories: systemic and local. (1) Systemic factors can be due to bad mood and psychology, where mothers are afraid of pain and are mentally over-stressed, which leads to prolonged labor time, excessive physical energy consumption, where the cerebral cortex is in a suppressed state, and the hypothalamic impulse is reduced, resulting in reduced oxytocin secretion from the posterior lobe of the pituitary gland, eventually leading to postpartum hemorrhage and uterine weakness. Being prenatal combined with high risk factors, such as hypertension, diabetes, maternal malnutrition, anemia, tissue hypoxia, edema, microvascular lesions, result in increased vascular fragility and abnormal coagulation function, which are prone to causing postpartum hemorrhage [16]. (2) Local factors include: excessive uterine swelling, such as in twin pregnancies, macrosomia, hyperhydramnios, etc., that cause the uterine muscle fibers to be excessively stretched. Uterine muscle fiber dysplasia, such as uterine malformation or combined uterine fibroids, affects normal uterine contractions. Uterine wall scarring or improper use of oxytocin drugs may cause abnormal uterine systolic function, which may lead to postpartum hemorrhage [18]. The contraction of uterine smooth muscle requires the participation of calcium ions ($Ca^{2+}$).

**Table 3.** Other relevance factors of primiparas and distribution of postpartum hemorrhage (n = 532)

| Characteristic | | Total n (%) | Postpartum hemorrhage | | *P* value |
|---|---|---|---|---|---|
| | | | Yes n (%) | No n (%) | |
| Prenatal anxiety | No | 492 (92.5) | 25 (5.1) | 467 (94.1) | 0.005 |
| | Yes | 40 (7.5) | 7 (17.5) | 33 (82.5) | |
| Use oxytocin | No | 311 (58.5) | 23 (7.4) | 288 (92.6) | 0.112 |
| | Yes | 221 (41.5) | 9 (4.1) | 212 (95.9) | |
| Premature rupture of membranes | No | 399 (75.0) | 20 (5.0) | 379 (95.0) | 0.135 |
| | Yes | 133 (25.0) | 12 (9.0) | 130 (90.0) | |
| Polyhydramnios | No | 512 (96.2) | 31 (6.0) | 482 (94.1) | 0.498 |
| | Yes | 20 (3.8) | 2 (10.0) | 18 (90.0) | |
| Oligohydramnios | No | 505 (94.9) | 29 (5.7) | 476 (94.3) | 0.467 |
| | Yes | 27 (5.1) | 3 (11.1) | 24 (88.9) | |
| Fundal height (FUH) | < 35 | 379 (71.2) | 19 (5.0) | 360 (95.0) | 0.126 |
| | ≥ 35 | 153 (28.8) | 13 (8.5) | 140 (01.5) | |
| Abdominal circumference (AC) | < 100 | 246 (46.2) | 14 (5.7) | 232 (94.3) | 0.771 |
| | ≥ 100 | 286 (53.8) | 18 (6.3) | 268 (93.7) | |
| platelet count (PTL) ($10^9$/L) | < 125 | 18 (3.4) | 2 (11.1) | 16 (88.9) | 0.288 |
| | 125~350 | 503 (94.5) | 29 (5.8) | 474 (94.2) | |
| | > 350 | 11 (2.1) | 1 (9.1) | 10 (90.9) | |
| platelet count (PTL) (%) | < 35 | 347 (65.2) | 26 (7.5) | 321 (92.5) | 0.05 |
| | ≥ 35 | 185 (34.8) | 6 (3.2) | 179 (96.8) | |
| erythrocyte count (RBC) ($10^{12}$/L) | < 3.8 | 273 (51.3) | 25 (9.2) | 248 (90.8) | 0.002 |
| | ≥ 3.8 | 258 (48.7) | 7 (2.7) | 252 (97.7) | |
| hemoglobin(HGB) (g/L) | > 110 | 257 (48.3) | 6 (2.3) | 251 (97.7) | 0.001 |
| | 91~110 | 232 (43.6) | 18 (7.8) | 14 (92.2) | |
| | ≤ 90 | 43 (8.1) | 8 (18.6) | 35 (81.4) | |

**Table 4.** Factors associated with postpartum hemorrhage (n = 532)

| Variables | | *B* | *SE* | *Wald* | OR | 95% CI | *P* value |
|---|---|---|---|---|---|---|---|
| Uterine inertia | No | | | | | | (Reference) |
| | Yes | 2.188 | 1.053 | 4.320 | 8.917 | 1.133-70.191 | 0.038 |
| Anemia | No | | | | | | (Reference) |
| | Mild | 0.830 | 0.538 | 2.378 | 2.294 | 0.799-6.589 | 0.123 |
| | Moderate to severe | 1.742 | 0.636 | 7.502 | 5.707 | 1.641-19.848 | 0.006 |
| Prenatal anxiety | No | | | | | | (Reference) |
| | Yes | 1.246 | 0.493 | 6.389 | 3.475 | 1.323-9.131 | 0.011 |
| Red blood cell count | ≥ $3.8\times10^{12}$/L | | | | | | (Reference) |
| | < $3.8\times10^{12}$/L | -0.542 | 0.501 | 1.169 | 0.582 | 0.218-1.553 | 0.280 |
| Delivery mode | Cesarean delivery | | | | | | (Reference) |
| | vaginal delivery | 1.141 | 0.626 | 3.320 | 3.129 | 0.917-10.672 | 0.068 |

During pregnancy, it is in a low-calcium state, and the total serum calcium content decreases to the lowest point of the physiological range in the third trimester, where low extracellular $Ca^{2+}$ concentration can cause insufficient or disorder of oxytocin synthesis, and less activation of uterine smooth muscle contractile proteins which can cause uterine contractions and lead to postpartum hemorrhage [19]. As a coagulation factor IV, calcium ions are conducive to the formation of thrombosis on the uterine placental detachment surface, and can significantly reduce postpartum hemorrhage [20].

*Anemia:* Anemia is a common complication of pregnant women. Moderate and severe anemia is obviously associated with postpartum hemorrhage. Chinese women have a high incidence of anemia during pregnancy, and the total incidence of severe postpartum anemia is 7.3%, which can increase depressive symptoms, cognitive function, fatigue, and cause decline in work and social function. Especially in poor economic conditions, with poor nutritional status, with rare prenatal examination, the incidence of anemia is far higher than in the general population [21]. Fetal growth and development and increased blood volume during pregnancy, lead to an increase in iron requirements of pregnant women, and if the pregnant woman's iron intake is low or there is poor absorption it can cause anemia. Low prenatal hemoglobin content is related to increased risk of postpartum hemorrhage [22]. Every 10 g/L increase in hemoglobin reduces the chance of PPH by 16%. Studies have shown that the probability of postpartum hemorrhage with hemoglobin level less than 120 g/L is 2.2 times that of that with non-postpartum hemorrhage [23]. Since anemia before delivery is a modifiable prenatal risk factor, early detection and treatment of anemia can reduce the incidence of postpartum bleeding [24].

*Prenatal anxiety:* Emotional anxiety will lead to hormonal changes in the body and highly active sympathetic and parasympathetic nerves, which will affect uterine contraction and uterine blood flow, resulting in high mental tension, which can lead to uncoordinated contractions, a prolonged labor process, and development of arrested labor, and increase the risk of postpartum hemorrhage [25]. Most pregnant women have a fear of the pain and discomfort of childbirth, and anxiety symptoms are more obvious for primiparas who have no birth experience [26]. With fear of pain, physical injury and death caused by childbirth, this will increase tension and pain, which will adversely affect the delivery process, prolong the labor process, and cause uterine weakness, leading to postpartum hemorrhage [3, 7].

If women are often in a state of anxiety before and after pregnancy and childbirth, this will have a negative impact on immunity, resulting in a decline in resistance. It can also cause a series of reactions in the brain. The hypothalamus and pituitary gland are stimulated, and the adrenal glands secrete glucocorticoid, leading to the reduction of antibody production [27]. The increase of inflammatory factors, during the delivery of invasive procedures, and due to the decline of immune function, makes women prone to infectious diseases, thereby increasing the risk of postpartum bleeding [28, 29].

Studies have shown that mental health education before delivery can help ease the anxiety and fear of childbirth. Instructing puerpera to perform appropriate exercises, such as a birth dance, resistance exercises, aerobic gymnastics, and using childbirth balls, etc [30], as well as massage, music therapy, and mindfulness-based therapy can effectively reduce anxiety symptoms, and can avoid the occurrence of postpartum hemorrhage due to anxiety. It is important to pay attention to postpartum care, monitor and observe mothers for at least two hours in the delivery room after delivery, and actively communicate with parturients, to help them focus and inquire about the chief complaint, and strengthen the observation of their mental state and complexion, in order to prevent postpartum hemorrhage caused by uterine contractions due to poor mood and physical exhaustion [31]. Early mother-to-child skin contact and nipple sucking can promote the release of endogenous oxytocin, it can also effectively promote uterine contractions and reduce bleeding, thereby avoiding the use of oxytocin drugs [32], which is a protective factor for postpartum hemorrhage, and it can also help the woman shift their focus and move into the role of motherhood more quickly [33].

*Delivery mode:* Studies show that cesarean delivery postpartum blood loss and incidence of postpartum hemorrhage was obviously higher than that of vaginal delivery, but the conclusion of this research, by contrast, show that vaginal delivery has higher risk of postpartum hemorrhage than in cesarean section delivery cesarean delivery with low incidence of postpartum hemorrhage, this may be related to the innovation and application of hemostasis in cesarean section in recent years [34]. At present, uterine body binding, transverse ligation of the anterior and posterior walls of the cervix, and ligation of the ascending branches of the bilateral uterine arteries can be used for bleeding during cesarean section, which can quickly and effectively reduce the amount of intraoperative bleeding [35]. In vaginal delivery, drug

treatment is mainly used when bleeding is found to increase. Other methods such as uterine gauze packing and uterine balloon compression are inaccurate, resulting in increased postpartum hemorrhage and further interventional embolization and vascular balloon obstruction. Amputation not only requires high technical conditions of medical units, but also takes a long time to perform, which is not conducive to rapid hemostasis. Therefore, the treatment for increased bleeding in vaginal delivery is far less rapid than in cesarean section. In addition, sometimes a side incision, or birth canal injury causing bleeding results in postpartum bleeding, and the postpartum bleeding rate in vaginal delivery is higher than cesarean delivery [36]. Therefore, the management of increased bleeding in vaginal delivery is far less rapid than in cesarean section. It is suggested to strengthen the prevention of postpartum hemorrhage after vaginal delivery, including active treatment of the third stage of labor, skilled suturing of lateral incisions and birth canal injuries, and it is also necessary to innovate and improve hemostasis techniques for postpartum hemorrhage during vaginal delivery. In addition, the subjects of this study were primiparas without comorbidities, and the vaginal delivery rate was relatively high, which led to a certain bias in the analysis results.

## Acknowledgements

This work was supported by the Medical Science and Technology Research Fund of Guangdong Province, China (Project number: B2019058). The funders of this work had no role in the study design, data collection, analysis and interpretation of data, preparation of the manuscript, or decision to submit this article for publication.

## Disclosure of conflict of interest

None.

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