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Predictors of postpartum hemorrhage in vaginal deliveries: Retrospective observational study

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***Abstract*---**In this study we aimed to identify the risk factors for acute postpartum hemorrhage in pregnant women. We investigated a number of potential risk factors, including the maternal age, gestational age, parity, birth weight, single or multiple pregnancies, episiotomy, tears requiring vaginal or perineal suturing, and placental retention. Data from 1628 deliveries performed from 2019 to 2020 were included. The maternal age ranged between 18 to 41 years, with a mean age of 26.6±3.2 years. The average blood loss postpartum was 234.4±229.7 ml. Among traditionally delivered patients, 309 (18.9%) experienced standard postpartum hemorrhage while of 27 (1.65%) had severe postpartum blood loss. Retained placenta was the major risk factor for both standard and severe postpartum hemorrhage (OR=4.31, 95% CI 1.85-10.04, p<0.001 vs OR=10.25, 95% CI 2.13-49.2, p<0.01). Similarly multiple pregnancy, macrosomia as well as episiotomy was associated with any postpartum hemorrhage. Women with previous history of deliveries and low weight neonates were less likely to experience postpartum hemorrhage (OR=0.69, 95% CI 0.54-0.90, p=0.006 and OR=0.54, 95% CI 0.29-0.97, p=0.04). Risk variables for postpartum hemorrhage were macrosomia, retained placenta, episiotomy, multiple pregnancy, and the necessity for perineal suture. Low birth weight and multiparity have been identified as protective factors for standard postpartum hemorrhage.

***Keywords*---**postpartum, hemorrhage, vaginal, delivery, risk factors.

1 Introduction

In developing countries, maternal mortality and morbidity are primarily caused by postpartum hemorrhage (Picetti et al., 2020). Approximately 14 million women worldwide experience bleeding after giving birth each year (Liu et al., 2021). About 529,000 females each year are die due to complications during or after pregnancy, up to 30% of these deaths occur because of postpartum hemorrhage in the developing countries (Ruppel et al., 2021). Therefore, heavy bleeding is the leading cause of maternal mortality worldwide. Research has been conducted to discover prenatal risk factors for postpartum hemorrhage and the underlying causes of this complication. Obstetrics textbooks often list multiple risk factors without specifying their relative importance or frequency. Several publications (Ende et al., 2021; Huque et al., 2018; Nyfløt et al., 2017) discuss factors that influence postpartum hemorrhage. Postpartum hemorrhage is more common in vaginal births when certain factors are present, including nulliparasy, multiparasy, prolonged or enhanced labor, hypertension, episiotomy, and multiple pregnancy. In this study we aimed to identify the risk factors for acute postpartum hemorrhage in pregnant women.

2 Materials and Methods

Data collection

A retrospective observational study was carried out at the maternity section of the 1st Clinic at Samarkand State Medical University for the purposes of this research. Data from eligible patients was collected beginning at the moment patients entered the department and continuing until the conclusion of the six-month period following delivery.

Of the 2359 deliveries recorded in the database, 1628 deliveries performed from 2019 to 2020 were met data requirement for current analysis (Fig. 1). The patients information was recorded on a general prenatal clinical history form that was created specifically for the research project. On this form, information is recorded regarding the mother's obstetric history, as well as her prenatal treatment, labor, delivery, and neonatal outcomes.

Definitions of outcome variables

In this study we used definition of standard and severe postpartum hemorrhage (PH), recommended by the World Health Organization. Vaginal deliveries with blood loss between 500 to 1000 ml were categorized as standard PH. As per recommendation, blood loss of over 1000 ml after delivery is considered as severe PH.

The current study took into account a number of potential risk factors, including the maternal age, gestational age, parity, birth weight, single or multiple pregnancies, episiotomy, tears requiring vaginal or perineal suturing, and placental retention. Age was divided into three categories: adolescent (defined as under the age of 19), reproductive age (19-34 years), and elder reproductive age (defined as over the age of 35). There were three different types of parity

categorized: nullipara, previous parity (up to three previous deliveries), and multipara (more than three previous deliveries). The infant's birth weight was classified as either low (<2500 grams), normal (2500-3999 grams), or macrosomia (>4000 grams). According to the gestational age, births were classified as either preterm (<37 weeks), term (37-41 weeks), or postterm (>41 weeks).

Statistical analyses

R studio, version 3.6.2, was used for each and every analysis of the data. The mean values (M) with standard deviations (SD) and percentage of continuous and categorical variables, respectively, were calculated for the distribution characteristics. In order to establish whether or not independent variables were substantially linked with postpartum hemorrhage, unadjusted and adjusted odds ratios (ORs) together with their corresponding 95% confidence intervals (CIs) were performed. On these data, we used logistic regression modeling to make adjustments for interrelated variables.

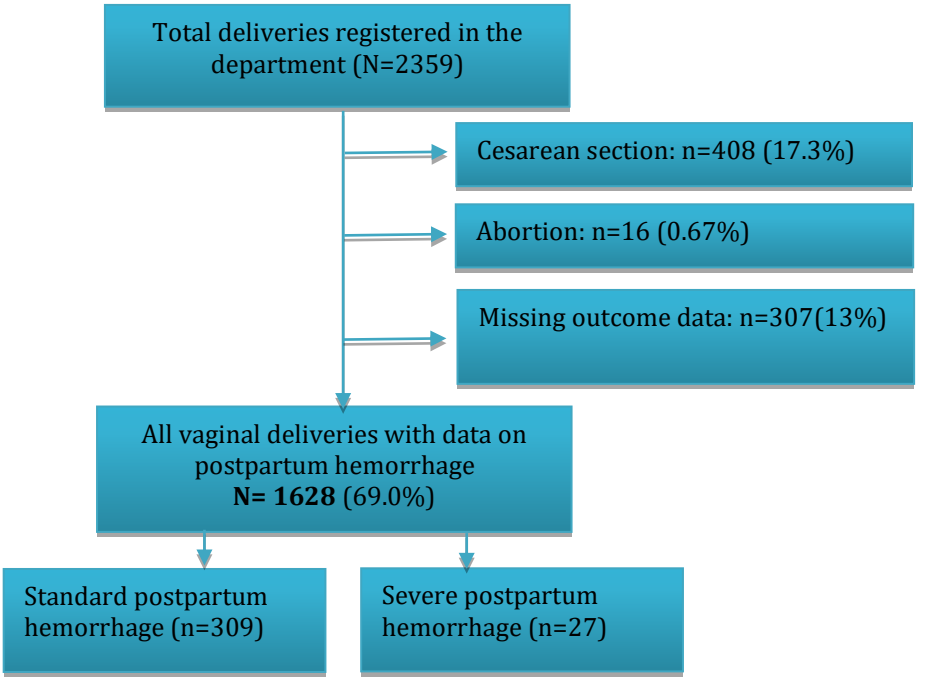

Figure 1. Selection of study population

3 Results and Discussions

The mean maternal age was 26.6±4.2 years (range 18-41 years). The average blood loss in all deliveries was 234.4±229.7 ml (range 67 mL-1875 mL) respectively. 309 (18.9%) traditionally delivered patients experienced moderate postpartum hemorrhage and 27 (1.65%) had severe postpartum hemorrhage. Blood transfusions were performed in 15 (0.9%) cases out of all 1628 vaginal deliveries. The characteristics of the study population are shown in Table 1. Majority of patients were aged between 19 to 34 years and had a previous history

of deliveries. Also, up to 95% of neonates were delivered on term (37-41 weeks) and had normal weight (2500-4000 g). The incidence of fetal death was low as 0.5%. The rates of episiotomy among of women with PH were slightly higher (55.9%, 59.3% vs 36.8%) compared to deliveries in women without any postpartum bleeding.

In the bivariate logistic regression model, we found association between postpartum hemorrhage, retained multiple pregnancy, placenta, macrosomia, perineal tear, episiotomy, need for perineal suture, low birth weight and nulliparity. After adjustment, almost all the risk factors remained significantly associated with standard postpartum hemorrhage (table 2). We performed multivariate logistic regression models to identify risk factors for each type of postpartum hemorrhage (standard vs severe) separately (table 2 & table 3). It should be also noted that the number of severe postpartum hemorrhage cases were low which decreased the power of the possible associations in the second regression model.

Table 1. Characteristics of study population.

	Standard PH (n = 309) n(%)	Severe PH (n=27) n(%)	No PH (n=1292) n(%)
Maternal age			
<19 years	65 (21.0)	6 (22.2)	267 (20.7)
19-34 years	227 (73.5)	19 (70.4)	869 (67.3)
>35 years	17 (5.5)	2 (7.4)	156 (12.1)
Parity			
Nullipara	115 (37.2)	12 (44.4)	359 (27.8)
1-3	123 (39.8)	13 (48.2)	648 (50.1)
> 3	71 (22.9)	2 (7.4)	256 (19.8)
Birth weight			
< 2,500 gr	13 (4.2)	1 (3.7)	87(6.7)
2500-4000	263 (85.1)	23 (85.2)	1113 (86.1)
>4000gr	43 (13.9)	3 (11.1)	92 (7.1)
Gestational age*			
<37 weeks	15 (4.9)	1 (3.7)	75 (5.8)
37-41 weeks	283 (91.6)	24 (88.9)	1176 (91.0)
7>41 weeks	11 (3.6)	2 (7.4)	41 (3.2)
Multiple pregnancy	3 (0.9)	1 (3.7)	5(0.4)
Fetal death	1 (0.3)	0 (0.0)	6 (0.5)
Episiotomy	173 (55.9)	16 (59.3)	476 (36.8)
I degree tear	51 (16.5)	6 (22.2)	136 (10.5)
II degree tear	22 (7.1)	1 (3.7)	57 (4.4)
III-IV degree tear	3 (0.9)	1 (3.7)	7 (0.5)
Suture	208 (67.3)	21 (77.8)	679 (52.6)
Retained placenta	12(3.8)	2 (7.4)	11 (0.8)

Despite adjustments to interrelating factors, associations between majority of risk factors and standard PH remained statistically significant (table 3). Multiple

pregnancy showed strong trend towards postpartum hemorrhage, however, significant association between the variables was not observed (OR=2.52, 95% CI 0.59-10.61, p=0.20). Retained placenta, on the other hand, was the major risk factor for both standard and severe postpartum hemorrhage (OR=4.31, 95% CI 1.85-10.04, p<0.001 vs OR=10.25, 95% CI 2.13-49.2, p<0.01).

Table 2. The results of multivariate analyses for standard PH

	Odds ratio (OR)	95% CI	P value
Retained placenta	4.31	1.85-10.04	<0.001
Multiple pregnancy	2.52	0.59-10.61	0.20
Episiotomy	2.23	1.74-2.87	<0.001
Macrosomia	2.16	1.47-3.18	<0.001
Suture	1.80	1.39-2.34	<0.001
Tear (all degrees)	1.71	1.27-2.32	<0.001
Multipara	0.69	0.54-0.90	0.006
Low birth weight	0.54	0.29-0.97	0.04

Second regression model investigating risk factors for severe PH, revealed significant associations between multiple pregnancy (OR=9.9, 95% CI 1.11-87.7, p=0.03), macrosomia (OR=2.99, 95% CI 1.10-8.10, p=0.03), episiotomy (OR=2.50, 95% CI 1.15-5.43, p=0.02) and severe postpartum hemorrhage. Maternal multiparity and low birth weight of neonates were negatively associated postpartum hemorrhage (table 2,3). Women with previous history of deliveries and low weight neonates were less likely to experience postpartum hemorrhage (OR=0.69, 95% CI 0.54-0.90, p=0.006 and OR=0.54, 95% CI 0.29-0.97, p=0.04). However, due to sample reduction, the association between severe postpartum hemorrhage and multiparity as well as low birth weight were not statistically significant in second regression model.

Table 3. The results of multivariate analyses for severe PH

Risk factors	Odds ratio (OR)	95% CI	P value
Multiple pregnancy	9.9	1.11-87.7	0.03
Retained placenta	10.25	2.13-49.2	<0.01
Macrosomia	2.99	1.10-8.10	0.03
Episiotomy	2.50	1.15-5.43	0.02
Suture	2.57	1.08-6.14	0.03
Tear (all degrees)	1.91	0.79-4.57	0.14
Multipara	0.48	0.22-1.03	0.06
Low birth weight	0.53	0.07-3.97	0.53

This research aimed to identify risk factors for postpartum hemorrhage among Samarkand's Uzbek population. In this study, data collection was conducted independently by three researchers. To verify the correctness of the data, all of the records for this research were gathered using rigorous methodologies and quality control procedures. The primary drawback of this research is the lack of some characteristics that may be deemed critical risk factors in the dataset. Although augmentation with oxytocin may be a possible confounding factor, our findings

were not corrected for this variable. In addition, the observed incidence of severe postpartum hemorrhage was low, limiting the statistical power to identify meaningful relationships. Lastly, it is crucial to examine two key aspects of selection bias. The data was obtained only from the 1st Clinic of Samarkand State Medical University, which may not be representative of other maternity hospitals in Samarkand or other areas of Uzbekistan.

Our data indicate that multiple pregnancy, retained placenta, macrosomia, episiotomy, and suture are all risk factors for postpartum hemorrhage. In a similar vein, these risk factors have been recognized in earlier published studies as being associated with postpartum hemorrhage [1-3,5] (Andrikopoulou & D'Alton, 2019; Bienstock et al., 2021; Pacheco et al., 2019). In this study we did not find an association between the risk of postpartum hemorrhage and maternal age, premature birth and nulliparity. According to the findings of our study, having a low birth weight and being a multiparous woman (having more than three children) are both protective factors against the development of a normal postpartum hemorrhage. Numerous prior studies have shown that multiparity is a substantial risk factor (Ende et al., 2021; Nyfløt et al., 2017; Ruppel et al., 2021), and practitioners have employed it as an important clinical predictor for postpartum hemorrhage. Nonetheless, the disparity may be attributable to the threshold for parity used in studies. Similarly, maternal age as a risk factor has been disputed in prior studies (Finlayson et al., 2019; Ruppel et al., 2021).

4 Conclusion

In the present research, risk variables for postpartum hemorrhage were multiple pregnancy, macrosomia, retained placenta, episiotomy, and the necessity for perineal suture. Low birth weight and several pregnancies have been identified as protective factors. In order to avoid postpartum hemorrhage in vaginal births, clinicians should take into account the given risk factors and use preventative strategies throughout delivery.

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