



## Frequency of Post Partum Hemorrhage among Pregnant Women with Anemia

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### Declaration

#### Authors' Contribution

All authors equally contributed to the study and approved the final manuscript

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### ABSTRACT

**Background:** Anemia in pregnancy is a prevalent maternal health issue in low- and middle-income countries, contributing significantly to maternal morbidity and mortality. It increases the risk of postpartum hemorrhage (PPH), a leading cause of maternal deaths, particularly in resource-limited settings like Mardan. While the link between anemia and PPH is well established, region-specific data remain scarce.

**Objective:** To determine the frequency of post-partum hemorrhage among pregnant women with anemia. **Study Design:** Cross-sectional study. **Duration and Place of Study:** This study was conducted at the Department of Obstetrics and Gynecology, Mardan Medical Complex, from October 2024 to April 2025. **Methodology:** A total of 157 pregnant women with third-trimester anemia (Hb <12.0 g/dL) were enrolled. Women with renal disease, hepatitis B/C, or irregular menstrual cycles were excluded. Blood loss was assessed after delivery using pad weight method, with PPH defined as blood loss >500 mL. Demographic and clinical data were recorded.

**Results:** The mean age was 29.41±6.51 years, with a mean hemoglobin level of 10.05±0.97 g/dL and blood loss of 373.59±122.21 mL. PPH occurred in 17 out of 157 women (10.8%). A statistically significant association was observed between BMI and PPH (p<0.001), with lower BMI (≤25 kg/m<sup>2</sup>) showing higher risk. **Conclusion:** Postpartum hemorrhage occurs in approximately one in ten anemic pregnant women, with lower BMI emerging as a significant risk factor.

### INTRODUCTION

Anemia of pregnancy remains a frequent medical illness in obstetric practice and is most widespread in lower- and middle-income countries.<sup>1</sup> It is a hemoglobin concentration of < 11 g/dL in pregnancy, and its most frequent cause is iron deficiency.<sup>2</sup> Risk factors are poor nutrition, parasitic infestations, multiple pregnancies at short intervals, and limited access to antenatal care.<sup>3</sup> In addition to its consequences on maternal well-being, it produces impaired fetal oxygen delivery and hence heightened perils of growth retardation, decreased birth weight, and prematurity.<sup>4</sup>

Anemic pregnant women have a heightened susceptibility to multiple obstetric complications.<sup>5</sup> These include heightened risk of infection, impaired wound healing, fatigue, and reduced physical tolerance to labor's stress physiology.<sup>6</sup> Major complications arise during and after delivery, and women who are anemic have a heightened risk of cardiac failure, impaired uterine contractility, and excessive hemorrhage.<sup>7</sup> Moreover, their maternal reserve is reduced such that their body's tolerance to hemorrhagic events is impaired and hence once again increases their risk of morbidity and mortality during the peripartum period.<sup>8</sup>

Postpartum hemorrhage (PPH), a loss exceeding 500 mL following vaginal delivery or 1000 mL after cesarean section, is a leading cause of maternal mortality worldwide.<sup>9</sup> In anemic women, there are greater harmful effects of PPH because moderate bleeding results in hypovolemic shock, multi-organ dysfunction, or mortality.<sup>10</sup> Uterine atony, retained placental tissue, genital tract trauma, and coagulopathy are risk factors for PPH.<sup>11</sup> Moreover, anemia also amplifies these factors by altering oxygen delivery and tissue perfusion and thus promoting severity of hemorrhagic attack and recovery period.<sup>12</sup>

Preventive measures for PPH among women with anemia require a comprehensive and proactive approach. Antenatal routine screening and treatment of anemia with iron and folic acid supplementation remain crucial.<sup>13</sup> Intrapartum measures include active management of the third stage of labor, such as use of uterotonic like oxytocin to ensure uterine contraction.<sup>14</sup> Skilled birth attendance and access to emergency obstetric care remain key, predominantly for high-risk women.<sup>15</sup> Postpartum surveillance of excessive bleeding and early intervention remain key to reducing the prevalence of PPH and better maternal outcomes among this high-risk group.<sup>16</sup>

A study reported a 7% incidence of postpartum hemorrhage among pregnant women with anemia.<sup>17</sup>

There is a pressing necessity to conduct this research in Mardan area due to high rates of maternal anemia and limited region-focused data available on postpartum hemorrhage (PPH). Mardan, like most other areas in Khyber Pakhtunkhwa, faces hardship in this context due to improper antenatal care, lack of nutrients, and unavailability of emergency obstetric care. Although there is well-documented association between anemia and increased vulnerability towards PPH, there are no full local data available to guide prevention, management, and strategy directions. This research will determine PPH burden amongst anemic pregnant women in the area and guide evidence-based interventions to improve maternal outcomes.

## METHODOLOGY

This cross-sectional study was carried out at the Department of Obstetrics and Gynecology, Mardan Medical Complex, over a span of seven months, from October 2024 to April 2025. The study enrolled 157 pregnant women diagnosed with anemia in their third trimester. The sample size was determined using the World Health Organization's sample size formula, based on an expected postpartum hemorrhage rate of 7%,<sup>17</sup> with a 95% confidence interval and a 4% absolute margin of error.

Women aged between 18 and 40 years, who had confirmed anemia during the third trimester defined as hemoglobin concentration below 12.0 g/dL were eligible for inclusion. Women with existing renal disorders, hepatitis B or C, or a history of irregular menstrual cycles were excluded to minimize confounding factors.

Ethical clearance was obtained from the institutional review board and the College of Physicians and Surgeons Pakistan. Informed written consent was secured from all participants after explaining the study's objectives, benefits, and potential risks. Detailed clinical assessments were conducted by a senior consultant with a minimum of three years of post-fellowship experience. Demographic data such as age, education level, occupation, socioeconomic background, and area of residence were documented. Each participant underwent evaluation for postpartum hemorrhage, characterized as blood loss exceeding 500 mL within 24 hours post-delivery. This was quantified by weighing vaginal delivery pads before and after use, with the difference recorded in milliliters (1-gram equivalent to 1 milliliter).

All relevant data were systematically recorded using a predesigned proforma. Statistical analysis was performed using SPSS version 23. Continuous variables including age, gestational age, BMI, hemoglobin levels, and blood loss were analyzed using mean  $\pm$  standard deviation or median with interquartile range, depending on normality determined by the Shapiro-Wilk test. Categorical variables such as place of residence, presence of postpartum hemorrhage, diabetes, and hypertension were expressed as frequencies and percentages. Stratification was applied across potential effect modifiers, and associations were assessed using the chi-square test or Fisher's exact test

where appropriate, considering a p-value  $\leq$  0.05 as statistically significant.

## RESULTS

The patient demographics revealed a mean age of 29.41 $\pm$ 6.51 years, mean gestational age of 34.86 $\pm$ 3.50 weeks, mean weight of 65.65 $\pm$ 6.91 kg, mean height of 1.61 $\pm$ 0.05 m, and mean BMI of 25.40 $\pm$ 2.03 kg/m<sup>2</sup>. The mean hemoglobin level was 10.05 $\pm$ 0.97 gm/dl, and mean blood loss was 373.59 $\pm$ 122.21 mL. Regarding place of residence, 86 patients (54.8%) lived in rural areas while 71 patients (45.2%) resided in urban areas. Diabetes was present in 20 patients (12.7%) and absent in 137 patients (87.3%). Hypertension was observed in 24 patients (15.3%) while 133 patients (84.7%) had no hypertension (as shown in Table-I).

**Table I**

*Patient Demographics (N=157)*

Demographics	Mean $\pm$ SD	
Age (years)	29.41 $\pm$ 6.51	
Gestational Age (weeks)	34.86 $\pm$ 3.50	
Weight (kg)	65.65 $\pm$ 6.91	
Height (m)	1.61 $\pm$ 0.05	
BMI (kg/m <sup>2</sup> )	25.40 $\pm$ 2.03	
Hb Level (gm/dl)	10.05 $\pm$ 0.97	
Blood Loss (mL)	373.59 $\pm$ 122.21	
Place of Living	Rural n (%)	86 (54.8%)
	Urban n (%)	71 (45.2%)
Diabetes	Yes n (%)	20 (12.7%)
	No n (%)	137 (87.3%)
Hypertension	Yes n (%)	24 (15.3%)
	No n (%)	133 (84.7%)

The overall frequency of postpartum hemorrhage was 17 cases (10.8%), while 140 patients (89.2%) did not experience postpartum hemorrhage (as shown in Table-II).

**Table II**

*Frequency of Post-Partum Hemorrhage*

Post-Partum Hemorrhage	Frequency	% age
Yes	17	10.8%
No	140	89.2%
Total	157	100%

The association analysis demonstrated that maternal age showed no significant association with postpartum hemorrhage, with 10 cases (11.8%) occurring in women  $\leq$ 30 years and 7 cases (9.7%) in women  $>$ 30 years ( $p=0.682$ ). Gestational age also showed no significant association, with 8 cases (8.2%) in pregnancies  $\leq$ 36 weeks and 9 cases (15.3%) in pregnancies  $>$ 36 weeks ( $p=0.166$ ). However, BMI showed a highly significant association with postpartum hemorrhage, with 15 cases (22.7%) occurring in women with BMI  $\leq$ 25 kg/m<sup>2</sup> compared to only 2 cases (2.2%) in women with BMI  $>$ 25 kg/m<sup>2</sup> ( $p<0.001$ ). Place of residence showed no significant association, with 8 cases (9.3%) in rural areas and 9 cases (12.7%) in urban areas ( $p=0.498$ ). Diabetes showed no significant association using Fischer's exact test, with 0 cases (0.0%) among diabetic patients and 17 cases (12.4%) among non-diabetic patients ( $p=0.131$ ). Similarly, hypertension showed no significant association, with 2 cases (8.3%) among hypertensive patients and 15 cases (11.3%) among non-hypertensive patients ( $p=0.747$ ) (as shown in Table-III).

**Table III***Association of Post-Partum Hemorrhage with Demographic Factors*

Demographic Factors	Post-Partum Hemorrhage		p-value	
	Yes n(%)	No n(%)		
Age (years)	≤30	10 (11.8%)	75 (88.2%)	0.682
	>30	7 (9.7%)	65 (90.3%)	
Gestational Age (weeks)	≤36	8 (8.2%)	90 (91.8%)	0.166
	>36	9 (15.3%)	50 (84.7%)	
BMI (kg/m <sup>2</sup> )	≤25	15 (22.7%)	51 (77.3%)	<0.001*
	>25	2 (2.2%)	89 (97.8%)	
Place of Living	Rural	8 (9.3%)	78 (90.7%)	0.498
	Urban	9 (12.7%)	62 (87.3%)	
Diabetes	Yes	0 (0.0%)	20 (100.0%)	0.131*
	No	17 (12.4%)	120 (87.6%)	
Hypertension	Yes	2 (8.3%)	22 (91.7%)	0.747*
	No	15 (11.3%)	118 (88.7%)	

\*Fischer Exact Test

**DISCUSSION**

The present study investigated the frequency of postpartum hemorrhage among pregnant women with anemia and identified a prevalence of 10.8%, which aligns with expected rates in anemic populations where compromised hemoglobin levels predispose to bleeding complications during delivery. The mean hemoglobin level of 10.05±0.97 gm/dl in our cohort represents moderate anemia, which impairs oxygen-carrying capacity and may compromise uterine muscle contractility, thereby increasing hemorrhage risk. The most significant finding was the strong association between lower BMI (≤25 kg/m<sup>2</sup>) and increased postpartum hemorrhage risk, with 22.7% of women in this group experiencing hemorrhage compared to only 2.2% in those with BMI >25 kg/m<sup>2</sup>. This inverse relationship can be explained by the fact that underweight women often have inadequate nutritional reserves, including iron and protein deficiencies that further compound anemia-related complications, while also having reduced muscle mass and potentially weaker uterine contractility. Additionally, lower BMI may reflect overall poor nutritional status, which impairs wound healing and coagulation function. The absence of significant associations with maternal age, gestational age, place of residence, diabetes, and hypertension suggests that BMI and underlying nutritional status may be more critical determinants of postpartum hemorrhage risk in anemic women than these other demographic and comorbid factors.

The prevalence of postpartum hemorrhage in our study (10.8%) falls within the range reported in international literature but shows notable variations when compared to other studies. Kodan et al. reported a higher overall PPH prevalence of 9.2% in Suriname, with severe PPH occurring in 2.5% of cases.<sup>18</sup> Similarly, Kebede et al. found

a considerably higher prevalence of primary PPH at 16.6% in Southern Ethiopia<sup>19</sup>. The variation in PPH prevalence across different studies may be attributed to differences in study populations, healthcare infrastructure, diagnostic criteria, and measurement methodologies. Our study's prevalence rate, being conducted specifically in anemic women, suggests that anemia may not dramatically increase PPH rates beyond what is observed in general populations, contrary to some expectations.

The relationship between anemia and postpartum hemorrhage has been extensively documented in the literature. Huwaida's systematic review demonstrated that pregnancies with anemia had an 11.253 times greater risk of PPH compared to non-anemic mothers<sup>20</sup>. This finding is particularly relevant to our study, as our entire cohort consisted of anemic women, which may explain the baseline risk for PPH in our population. Furthermore, Tabraiz and Awan found that among patients undergoing cesarean section, 6 out of 7 PPH cases occurred in anemic patients, reinforcing the strong association between anemia and PPH risk<sup>21</sup>. Kebede et al. also identified prepartum anemia as a significant predictor of primary PPH with an adjusted odds ratio of 5.3.<sup>19</sup> These findings collectively support the premise that anemia constitutes a substantial risk factor for postpartum hemorrhage, validating our decision to focus specifically on this high-risk population.

The demographic profile of our study population showed some similarities and differences compared to international studies. The mean age of 29.41±6.51 years in our study was slightly higher than the 25.31 years reported by Tabraiz and Awan<sup>21</sup> but falls within the typical reproductive age range. Interestingly, our study found no significant association between maternal age and PPH occurrence, which contrasts with Kebede et al.'s findings that maternal age ≥35 years was a strong predictor of PPH (AOR 6.8).<sup>19</sup> This discrepancy might be explained by the different age stratification used in our study (≤30 vs >30 years) compared to their cutoff of 35 years, or by population-specific factors affecting age-related PPH risk.

The gestational age profile in our study showed a mean of 34.86±3.50 weeks, indicating a significant proportion of preterm deliveries, which is consistent with the known association between anemia and preterm birth. Kodan et al. identified preterm birth as a risk factor for severe PPH with an adjusted odds ratio of 2.1.<sup>18</sup> Although our study did not find a significant association between gestational age and PPH, the high proportion of preterm deliveries in our anemic cohort aligns with established literature linking anemia to adverse pregnancy outcomes.

One of the most significant findings in our study was the highly significant association between BMI and postpartum hemorrhage (p<0.001), with women having BMI ≤25 kg/m<sup>2</sup> showing a 22.7% PPH rate compared to only 2.2% in women with BMI >25 kg/m<sup>2</sup>. This finding is particularly noteworthy as it contrasts with the general expectation that higher BMI might increase PPH risk due to associated complications. The protective effect of higher BMI in our anemic population might be explained by better nutritional status and iron stores in women with higher BMI, potentially mitigating some of the adverse effects of anemia. This finding warrants further investigation as it

has not been prominently reported in the reviewed literature and could represent a population-specific characteristic or a complex interaction between nutritional status, anemia, and hemorrhage risk.

Our study found no significant associations between diabetes ( $p=0.131$ ) or hypertension ( $p=0.747$ ) and postpartum hemorrhage occurrence. This contrasts with Alshahrani et al.'s findings, which identified childbirth complications as significantly associated with postpartum anemia, with 79.2% of anemic women experiencing complications compared to 54.0% of non-anemic women.<sup>22</sup> The lack of association in our study might be due to the relatively low prevalence of diabetes (12.7%) and hypertension (15.3%) in our cohort, or it could reflect effective management of these conditions in our healthcare setting.

The mean blood loss in our study ( $373.59 \pm 122.21$  mL) was within the normal range for vaginal delivery, despite the entire cohort being anemic. This finding is encouraging and suggests that with appropriate monitoring and management, anemic women can have successful deliveries without excessive blood loss. However, Kodan et al.'s audit findings revealed concerning gaps in management, with only 61.3% of women with severe PPH receiving prophylactic oxytocin and only 4.9% receiving tranexamic acid.<sup>18</sup> These findings emphasize the importance of standardized protocols and consistent adherence to evidence-based management strategies.

This study has several limitations that should be acknowledged. First, being a single-center study conducted at one healthcare facility may limit the generalizability of findings to other populations and healthcare settings. The relatively small sample size of 157

patients may have limited the statistical power to detect certain associations, particularly for less common risk factors. Additionally, the study design did not allow for long-term follow-up to assess delayed complications or recovery patterns. The reliance on clinical assessment for blood loss measurement, rather than more objective methods, may have introduced variability in PPH diagnosis. Furthermore, the study did not account for certain potentially confounding variables such as parity, previous obstetric history, or specific anemia subtypes, which could have influenced the observed associations. The cross-sectional nature of the study also limits the ability to establish causality between identified risk factors and postpartum hemorrhage occurrence.

## CONCLUSION

Our study has concluded that postpartum hemorrhage occurs in a significant proportion of anemic pregnant women, with body mass index emerging as the most important demographic predictor. The protective effect of higher BMI in anemic women represents a novel finding that challenges conventional understanding of weight-related obstetric risks. While traditional risk factors such as maternal age, diabetes, and hypertension showed no significant associations in our anemic population, the study reinforces the importance of comprehensive risk assessment and individualized management strategies.

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