



Frequency and Etiology of Primary Postpartum Hemorrhage in Pregnant Women Undergoing Vaginal Delivery

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ARTICLE INFO

Keywords: Primary Postpartum Hemorrhage, Uterine Atony, Genital Tract Trauma, Vaginal Delivery, Maternal Morbidity.

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Declaration

Authors' Contribution

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

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 16-02-2025 Revised: 13-05-2025
Accepted: 20-05-2025 Published: 30-05-2025

ABSTRACT

Background: Primary postpartum hemorrhage continues to be among the most common causes of maternal mortality and morbidity worldwide, especially in resource-poor countries. Though vaginal delivery is safer compared to cesarean delivery in most respects, it is still associated with the threat of massive hemorrhagic complications. **Objective:** To determine the frequency and etiology of primary postpartum hemorrhage in pregnant women undergoing vaginal delivery at Hayatabad Medical Complex, Peshawar. **Study Design:** Cross-sectional descriptive study. **Duration and Place of Study:** The study was conducted from August 2024 to January 2025 at the Department of Obstetrics and Gynecology, Hayatabad Medical Complex, Peshawar. **Methodology:** A total of 233 women who underwent vaginal delivery were included. Women with coagulopathies, placenta previa/accreta, or cesarean deliveries were excluded. Blood loss estimation was done via gauze weighing. Etiologies such as uterine atony, genital tract tears, and retained placental tissue were clinically assessed under consultant supervision. **Results:** Primary PPH occurred in 19.7% of participants. Uterine atony was the leading cause (60.9%), followed by genital tract tears (34.8%) and retained placental tissue (4.3%). A significant association was found between socioeconomic status and PPH occurrence ($p=0.016$), with both poor and rich groups showing higher prevalence. Diabetes mellitus was significantly associated with specific PPH etiologies ($p<0.001$), particularly genital tract trauma and retained placenta. **Conclusion:** Primary postpartum hemorrhage remains a prevalent obstetric emergency in vaginal deliveries. Uterine atony is the predominant cause, with notable contributions from genital tract trauma.

INTRODUCTION

Primary postpartum hemorrhage (PPH) is the excessive loss of 500 mL or more of blood within the first 24 hours following spontaneous or instrumental vaginal delivery.¹ It continues as the most common obstetric complication and cause of maternal mortality and morbidity worldwide, most prominently in resource-poor regions.² Timely identification and management are vital in the prevention of the undesirable effects, owing to the quick timeline, which may lead to hypovolemic shock, multi-organ failure, and death.³ Enhanced risk is seen with factors that trigger PPH, such as anemia, prolonged labor, overdistended uteruses, and the administration of uterotonic agents.⁴ Postpartum hemorrhage is significant in the context of vaginal delivery because of the natural dynamics of the process of delivery that involves stretching of the soft tissues and the tearing away of the placenta.⁵ Vaginal deliveries, although safer than cesarean sections in terms of surgical complications, nevertheless, still carry the complication of the threat of hemorrhage.⁶ Primary PPH after vaginal delivery often goes undetected in the initial

periods, particularly in the context of out-of-hospital or limited clinical vigilance.⁷ Precise estimation of the loss of blood, periodic monitoring of maternal vital signs, and preparation to immediately intervene are significant factors in the prevention of the severity of hemorrhage.⁸

Uterine atony or the inability of the uterus to contract properly following delivery is the most common cause of primary PPH during vaginal delivery.⁹ When the placenta separates, the myometrial contracture compresses the blood vessels at the location of the placenta.¹⁰ When, however, the uterine tone proves to be incompetent, excessive hemorrhage occurs after that.¹⁰ High parity, long or rapid labor, overdistension of the uterus in multiple gestation or in polyhydramnios, and the history of PPH in the past are the factors that determine the atony.¹¹ Clinical management most frequently employs massage of the uterus, uterotonic agents such as oxytocin, and, if refractory, the application of balloon tamponade or surgery.¹² Other significant etiologies are trauma to the genital tract and retained placental tissue.¹³ Cervical, vaginal, or perineal tears may occur during spontaneous

vaginal delivery and result in torrential hemorrhage, if the uterus is very contracted and uterine atony is excluded.¹⁴ Timely identification and repair under proper anesthesia are the key to controlling hemorrhage due to lacerations. Retained placental tissue, on the other hand, compromises the contracture of the uterus and results in ongoing hemorrhage.¹³ Removal by hand or curettage is often required, along with antimicrobial prophylaxis to prevent endometritis.¹⁵ Both of these causes, in combination, underlie the multifactorial nature of primary PPH and the necessity of performing an integrated assessment during the third stage of labor.^{13,14}

A study reported that primary postpartum hemorrhage occurred in 18.6% of women who underwent vaginal delivery. Among the identified causes, uterine atony was the most common etiology, accounting for 57.6% of cases, followed by genital tract tears in 29.2% and retained placental tissue in 10% of the cases.¹⁶

There existed an imperative reason to conduct work on primary postpartum hemorrhage among vaginal delivery attending women in Peshawar, owing to the prevailing high rate of maternal mortality and morbidity with the complication. Poor identification and delayed treatment of major causes i.e., uterine atony, genital tract trauma, and retained placental tissue had resulted in detrimental maternal outcomes in clinical practice locally. Absence of location-specific data on the prevalence and patterns of such etiologies delayed the introduction of effective preventive and management measure policies. This work endeavored to provide enlightened information on the underlying causes among the population, guiding maternal healthcare provision improvements in the location.

METHODOLOGY

This cross-sectional analysis was conducted over a six-month period, from August 2024 to January 2025, at the Obstetrics and Gynecology Department of Hayatabad Medical Complex, Peshawar. A total of 233 participants were enrolled, with the sample size calculated using a 95% confidence interval, 5% margin of error, and an estimated frequency of primary postpartum hemorrhage of 18.6% in women delivering vaginally.¹⁶ Women aged 18 to 40 years who gave birth through the vaginal route were included. Vaginal delivery was defined as the expulsion of a live newborn through the birth canal without the aid of surgical procedures. Patients with known coagulopathies, who underwent cesarean section previously, or who had placenta previa or placenta accreta were excluded from participation. Approval was secured from the institutional ethics committee (*Approval No: 1893/Dated 15-06-2024*). After explaining the study objectives, confidentiality protocols, and absence of procedural risk, informed consent was obtained from each participant before data collection. Sociodemographic and clinical profiles including age, Body Mass Index, socioeconomic status and place of residence were documented. Additionally, history of hypertension and diabetes mellitus was recorded. Women who delivered vaginally were assessed for PPH, defined as blood loss of 500 mL or more within 24 hours following childbirth. Blood loss was estimated by weighing surgical gauzes before and after use, with 1 gram of weight difference considered equivalent to 1 milliliter of blood.

The likely cause of bleeding was identified in each case. Uterine atony was recognized when there was excessive postpartum bleeding accompanied by a soft, enlarged uterus detected through abdominal and bimanual palpation. Genital tract trauma was diagnosed when visible lacerations were observed in the vaginal or perineal region, particularly in those reporting moderate to severe pain during delivery, quantified as a score greater than 4 on the visual analog scale. Retention of placental tissue was considered when the placenta or parts of it failed to be expelled within 30 minutes of delivery, confirmed via clinical assessment. All examinations were carried out under the direct supervision of a consultant gynecologist with at least five years of post-fellowship experience.

Data were analyzed using IBM SPSS version 27. Continuous variables were presented as mean \pm standard deviation or median with interquartile range, depending on distribution as determined by the Shapiro-Wilk test. Categorical variables were summarized as frequencies and percentages. Stratification was used to examine potential confounding. Post-stratification comparisons were made using the Chi-square test or Fisher's exact test where appropriate, with statistical significance defined at a p-value <0.05 .

RESULTS

In this study the patient demographics revealed a mean age of 27.10 ± 6.31 years and mean BMI of 24.95 ± 2.16 kg/m². The majority of participants belonged to middle socioeconomic status (53.2%), while 31.8% were from poor backgrounds and 15% were rich. Educational status showed 64.4% were literate and 35.6% were illiterate. Most participants were unemployed (72.5%) compared to employed (27.5%), and 61.8% resided in rural areas versus 38.2% in urban areas. Regarding comorbidities, 12% had diabetes mellitus and 15.5% had hypertension (Table-I).

Table I
Patient Demographics (N=233)

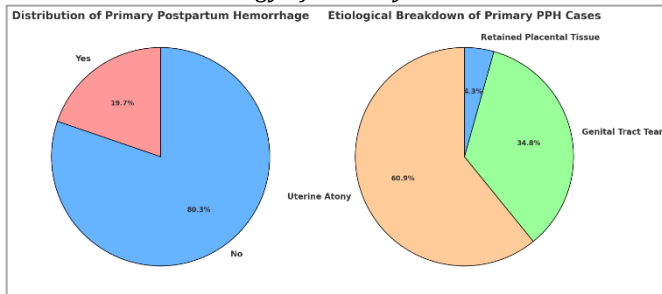
Demographics	Mean \pm SD
Age (years)	27.10 \pm 6.31
BMI (Kg/m ²)	24.95 \pm 2.16
Socioeconomic Status	
Poor n (%)	74 (31.8%)
Middle n (%)	124 (53.2%)
Rich n (%)	35 (15%)
Education	
Literate n (%)	150 (64.4%)
Illiterate n (%)	83 (35.6%)
Occupation	
Employed n (%)	64 (27.5%)
Unemployed n (%)	169 (72.5%)
Residence	
Rural n (%)	144 (61.8%)
Urban n (%)	89 (38.2%)
Diabetes Mellitus	
Yes n (%)	28 (12%)
No n (%)	205 (88%)
Hypertension	
Yes n (%)	36 (15.5%)
No n (%)	197 (84.5%)

The frequency of primary postpartum hemorrhage (PPH) was 19.7% (46 out of 233 cases), with 80.3% experiencing no PPH (Table-II). Among the etiological factors for primary PPH, uterine atony was the most common cause accounting for 60.9% (28 cases), followed by genital tract tear at 34.8% (16 cases), and retained placental tissue at 4.3% (2 cases) (Table-II and Graph-I).

Table II
Frequency and etiology of Primary PPH

Primary PPH	Frequency	Percentage
Yes	46	19.7%
No	187	80.3%
Total	233	100%
Etiology of Primary PPH		
Uterine Atony	28	60.9%
Genital Tract Tear	16	34.8%
Retained Placental Tissue	2	4.3%
Total	46	100%

Graph I
Distribution and Etiology of Primary PPH



The association analysis between primary PPH and demographic factors demonstrated that socioeconomic status was significantly associated with PPH occurrence (p=0.016), with poor socioeconomic status showing 25.7% PPH rate, middle class 12.9%, and rich 31.4% (Table-III). Age stratification showed 17.6% PPH in women ≤30 years versus 24.3% in those >30 years (p=0.231). BMI analysis revealed 16.1% PPH in women with BMI ≤25 kg/m² compared to 23.9% in those with BMI >25 kg/m² (p=0.139). Education showed 16.0% PPH in literate women versus 26.5% in illiterate women (p=0.054). Employment status demonstrated 26.6% PPH in employed women compared to 17.2% in unemployed women (p=0.108). Residence showed similar rates with 18.8% in rural and 21.3% in urban areas (p=0.628). Diabetes mellitus showed 17.9% PPH in diabetic women versus 20.0% in non-diabetic women (p=0.812), while hypertension showed 27.8% PPH in hypertensive women compared to 18.3% in normotensive women (p=0.188) (Table-III).

Table IV
Association of Etiology of Primary PPH with Demographic Factors

Demographic Factors		Etiology of Primary PPH			p-value
		Uterine Atony n(%)	Genital Tract Tear n(%)	Retained Placental Tissue n(%)	
Age (years)	≤30	17 (60.7%)	11 (39.3%)	0 (0.0%)	0.212*
	>30	11 (61.1%)	5 (27.8%)	2 (11.1%)	
BMI (Kg/m ²)	≤25	11 (55.0%)	9 (45.0%)	0 (0.0%)	0.351*
	>25	17 (65.4%)	7 (26.9%)	2 (7.7%)	

Table III
Association of Primary PPH with Demographic Factors

Demographic Factors		Primary PPH		p-value
		Yes n(%)	No n(%)	
Age (years)	≤30	28 (17.6%)	131 (82.4%)	0.231
	>30	18 (24.3%)	56 (75.7%)	
BMI (Kg/m ²)	≤25	20 (16.1%)	104 (83.9%)	0.139
	>25	26 (23.9%)	83 (76.1%)	
Socioeconomic Status	Poor	19 (25.7%)	55 (74.3%)	0.016*
	Middle	16 (12.9%)	108 (87.1%)	
	Rich	11 (31.4%)	24 (68.6%)	
Education	Literate	24 (16.0%)	126 (84.0%)	0.054
	Illiterate	22 (26.5%)	61 (73.5%)	
Occupation	Employed	17 (26.6%)	47 (73.4%)	0.108
	Unemployed	29 (17.2%)	140 (82.8%)	
Residence	Rural	27 (18.8%)	117 (81.3%)	0.628
	Urban	19 (21.3%)	70 (78.7%)	
Diabetes Mellitus	Yes	5 (17.9%)	23 (82.1%)	0.812*
	No	41 (20.0%)	164 (80.0%)	
Hypertension	Yes	10 (27.8%)	26 (72.2%)	0.188
	No	36 (18.3%)	161 (81.7%)	

***Fischer Exact Test**

The association between etiology of primary PPH and demographic factors revealed that diabetes mellitus was significantly associated with PPH etiology (p<0.001), with diabetic women showing 0% uterine atony, 60.0% genital tract tear, and 40.0% retained placental tissue, while non-diabetic women showed 68.3% uterine atony, 31.7% genital tract tear, and 0% retained placental tissue (Table-IV). Age groups showed uterine atony in 60.7% of women ≤30 years versus 61.1% in those >30 years, genital tract tear in 39.3% versus 27.8%, and retained placental tissue in 0% versus 11.1% respectively (p=0.212). BMI stratification demonstrated uterine atony in 55.0% of women with BMI ≤25 kg/m² versus 65.4% in those with BMI >25 kg/m² (p=0.351). Other demographic factors including socioeconomic status (p=0.277), education (p=0.073), occupation (p=0.682), residence (p=0.604), and hypertension (p=0.478) showed no significant associations with PPH etiology (Table-IV).

Socioeconomic Status	Poor	10 (52.6%)	7 (36.8%)	2 (10.5%)	0.277*
	Middle	9 (56.3%)	7 (43.8%)	0 (0.0%)	
	Rich	9 (81.8%)	2 (18.2%)	0 (0.0%)	
Education	Literature	18 (75.0%)	6 (25.0%)	0 (0.0%)	0.073*
	Illiterate	10 (45.5%)	10 (45.5%)	2 (9.1%)	
Occupation	Employed	11 (64.7%)	6 (35.3%)	0 (0.0%)	0.682*
	Unemployed	17 (58.6%)	10 (34.5%)	2 (6.9%)	
Residence	Rural	16 (59.3%)	9 (33.3%)	2 (7.4%)	0.604*
	Urban	12 (63.2%)	7 (36.8%)	0 (0.0%)	
Diabetes Mellitus	Yes	0 (0.0%)	3 (60.0%)	2 (40.0%)	<0.001*
	No	28 (68.3%)	13 (31.7%)	0 (0.0%)	
Hypertension	Yes	5 (50.0%)	5 (50.0%)	0 (0.0%)	0.478*
	No	23 (63.9%)	11 (30.6%)	2 (5.6%)	

*Fischer Exact Test

DISCUSSION

The present study demonstrated an incidence of primary postpartum hemorrhage of 19.7% among vaginal delivery women, which lies within the expectation range of this obstetric morbidity.¹⁷ The predominance of uterine atony (60.9%) as the leading cause is in concordance with established pathophysiology,¹⁸ wherein the failure of postpartum contracture of the uterine muscle leads to the failure of spiral artery compression and the continuance of hemorrhage at the placental site. Genital tract tears responsible for 34.8% of cases reflect the mechanical injury that may ensue during the expulsive efforts of labor, particularly among the primigravid or during precipitous labor with extreme stretching of tissues beyond their stretch limits. The significant association between socioeconomic level and the prevalence of primary PPH ($p=0.016$) is the result of multiple intertwined factors such as nutritional deficiencies, sub-optimal antenatal care and delayed recognition of complications in the lower socioeconomic groups, and the enhanced prevalence in the higher socioeconomic groups may be attributed to the prevalence of advanced maternal age or pregnancy complications requiring interventions. The non-significant trend of increased PPH beyond 30 years (24.3% vs 17.6%) suggests age-dependent contractility change of the uterine muscle and higher numbers of multiparity, which is likely to predispose to uterine atony. Similarly, the increased rate of PPH among women with BMI >25 kg/m² (23.9% vs 16.1%) is the result of obesity-associated factors such as macrosomia, prolonged labor, and poor contractility of the uterine muscle due to the fatty infiltration of the latter muscle. The strong association between diabetes mellitus and PPH etiology ($p<0.001$) reveals the disease influence on vascular and tissue integrity, with diabetic women presenting higher frequencies of genital tract tears and retained placental tissue, higher tissue fragility, and potential defects of placental adherence associated with maternal hyperglycemia.¹⁹

The frequency of primary PPH in our study (19.7%) was considerably higher than most reported studies from the region. Sultana et al.²⁰ reported a much lower prevalence of 0.74% among 27,000 deliveries in Lahore, while Majid et al.²¹ found 2.48% frequency in Karachi. Similarly, Gul et al.²² documented 3.14% frequency in Kohat, and Masood et al.²³ reported 7.03% in Multan. However, our findings were more consistent with Munir et al.¹⁶ who reported an 18.6% frequency in Lahore and Kebede et al.²⁴ who found 16.6% prevalence in southern Ethiopia. The higher frequency in our study might be

attributed to different study populations, referral patterns, or variations in healthcare facility levels and management protocols.

Regarding the etiology of primary PPH, our study's finding that uterine atony was the leading cause (60.9%) was consistent with the global pattern observed in most comparative studies. Tiruneh et al.²⁵ reported uterine atony in 73.4% of PPH cases in northwest Ethiopia, while Sultana et al.²⁰ found it in 83.2% of cases in Lahore. Ahmed et al.²⁶ reported uterine atony in 66% of cases in Karachi, and Kebede et al.²⁴ found it in 71.4% of cases in southern Ethiopia. Similarly, Munir et al.¹⁶ documented uterine atony in 57.6% of cases, and Masood et al.²³ reported it as the leading factor in 48.99% of cases. The slightly lower percentage in our study compared to some others might reflect differences in diagnostic criteria, patient populations, or management approaches. The demographic profile of our study population showed a mean age of 27.10±6.31 years, which was comparable to other regional studies. Tiruneh et al.²⁵ reported a mean age of 26.6±5.1 years, Sultana et al.²⁰ found 26.97±4.6 years, and Majid et al.²¹ documented 26.59±5.83 years. This consistency suggests similar maternal age distributions across different healthcare settings in the region.

Our finding that genital tract tears constituted 34.8% of PPH cases was notably higher than most comparative studies. Tiruneh et al.²⁵ reported trauma in only 12.8% of cases, while Sultana et al.²⁰ found trauma in 12.9% of cases. Munir et al.¹⁶ documented genital tract tears in 29.2% of cases, which was closer to our findings. The higher percentage in our study might indicate differences in delivery practices, instrumental delivery rates, or patient risk factors. The connection between socioeconomic level and prevalence of PPH in the current research ($p=0.016$) revealed an intriguing pattern, poor socioeconomic level attaining 25.7% PPH rate and rich 31.4%, middle class 12.9%. This finding indicates that both extremes of socioeconomic level are engaged with the augmented risk of PPH, which may be due to the underlying factors such as nutritional status, quality of antenatal care, or delivery location. Since the mortality rates cannot be compared directly given the influence of frequency and etiology and the fact that the present study did not conclude with regard to consequences, the mortality rates documented in the studies conducted by Tiruneh et al.²⁵ registered 7.4% mortality among the PPH cases, Sultana et al.²⁰ registered 3.9% maternal mortality, and Majid et al.²¹ registered 4.96% maternal mortality, lending credence to

the fact that PPH continues to remain an important cause of maternal mortality and morbidity in the region.

These results add significance to the adoption of the whole range of preventive techniques, namely, adequate antenatal care, skilled attendance during the process of delivery, and ready availability of blood products and surgical equipment. The strong relationship between diabetes mellitus and definite PPH etiologies deserves further study and may help shape specific interventions among the at-risk patients. Future studies must aim at making evidence-based algorithms available for the timely identification and management of the risk factors of PPH to decrease maternal mortality and morbidity in the healthcare facility.

There are specific limitations of this study that need to be considered while interpreting the results. First, being a single-center study based on one tertiary care hospital, the findings cannot be generalized to any other health care setup or population groups with differing demographic characteristics and resource availability. The cross-sectional design cannot lead to the derivation of temporal relationships and causality between the risk factors and the occurrence of PPH. The reasonably moderate sample size of 233 subjects may have limited the statistical power to detect associations that are lean, particularly for the rare risk factors. Documentation bias and inter-observer

variability of the clinical evaluation and diagnosis and classification of the cause of PPH may have been introduced due to the fact that hospital records and clinical evaluation were used. There is no detailed data on management specific protocols, timing of interventions, or long-term implications, which otherwise may have enlightened the clinical significance of the observed and determined risk factors.

CONCLUSION

Our study has established that primary postpartum hemorrhage is still an important obstetric emergency with an appreciable prevalence among the patients served in this tertiary hospital facility. Uterine atony was the most frequent causative agent, followed by genital tract lacerations and retained placental tissue, as the world trend in comparable health settings. The study demonstrated that socioeconomic class and diabetes mellitus had significant relationships.

Acknowledgments

Our heartfelt thanks go to the dedicated healthcare professionals in the department. Their meticulous attention to detail in documenting and organizing patient information has played a crucial role in supporting this work.

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