



Original Article



Comparison of Frequency of Postpartum Haemorrhage in Augmented Versus Spontaneous Labour

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ABSTRACT

Postpartum haemorrhage (PPH) remains a major cause of maternal morbidity and mortality. Labour augmentation is commonly practiced but may increase the risk of excessive bleeding.

Objectives: To determine the frequency of PPH and compare its occurrence in spontaneous versus augmented labour. **Methods:** A descriptive cross-sectional study was conducted at the Department of Obstetrics and Gynaecology, Mardan Medical Complex, from August 2023 to January 2024. A total of 151 women aged 18–40 years with singleton pregnancies at ≥ 36 weeks were enrolled using non-probability consecutive sampling. Data on age, parity, gestational age, hypertension, socioeconomic and residential status, labour type, and PPH were collected through a structured proforma. PPH was defined as blood loss >500 ml within 24 hours of vaginal delivery. Data were analyzed using SPSS version 25.0, and associations were tested using Chi-square and Fisher's exact tests. **Results:** The frequency of PPH was 13.2%. PPH occurred more frequently in spontaneous labour (15.7%) compared to augmented labour (10.3%), though this was not statistically significant ($p=0.333$). A significant association was found between hypertension and PPH ($p=0.017$), with hypertensive women showing a higher risk. **Conclusions:** It was concluded that Hypertension was significantly associated with postpartum haemorrhage, underscoring the importance of careful monitoring. Labour augmentation did not significantly increase PPH risk. Ongoing evaluation of maternal risk factors is crucial for improving outcomes.

INTRODUCTION

Postpartum haemorrhage (PPH) remains a major contributor to maternal morbidity and mortality worldwide [1]. Despite advances in obstetric care, excessive bleeding after childbirth continues to claim the lives of thousands of women each year, particularly in low- and middle-income countries. Defined clinically as a blood loss of more than 500 ml following vaginal delivery, or more than 1000 ml following caesarean section, PPH demands prompt recognition and effective intervention to prevent serious outcomes [2, 3]. Recent changes in obstetric practice and

variations in clinical definitions have made the true burden of PPH difficult to quantify [4]. While traditional estimates rely on visual assessment of blood loss, more accurate methods, such as weighing blood-soaked materials, have revealed that actual rates of PPH may be higher than previously documented. Moreover, symptoms such as hypotension and tachycardia may not manifest until a woman has lost a significant portion of her total blood volume, highlighting the danger of relying solely on clinical signs [5, 6]. Among the risk factors contributing to PPH,

labour induction and augmentation have drawn increasing attention. Induced or augmented labour, often necessary for medical or obstetric reasons is associated with a higher risk of uterine atony, a leading cause of PPH [7]. The use of oxytocin and prostaglandins, while effective for initiating or intensifying contractions, may also increase the likelihood of uterine muscle fatigue, thereby impairing postpartum contractility and elevating haemorrhage risk. With the growing trend of elective inductions, particularly for reasons such as post-term pregnancy or maternal preference, it is essential to examine whether these interventions contribute significantly to adverse maternal outcomes [8]. Evidence from local studies suggests a discrepancy in PPH rates between women undergoing spontaneous and augmented labour. For instance, research conducted in Pakistan has reported higher rates of haemorrhage among those whose labour was medically managed compared to those with spontaneous onset [9, 10]. However, these findings remain underexplored in many clinical settings, particularly in regional hospitals where resources may be limited and monitoring protocols variable. Given the clinical importance of timely recognition and management of postpartum haemorrhage, especially in induced or augmented labours, this study seeks to fill the gap by comparing the frequency of PPH in women who underwent spontaneous versus augmented labour. Findings from this research are expected to guide obstetric decision-making, improve maternal safety protocols, and contribute to broader public health efforts aimed at reducing preventable maternal deaths.

Postpartum haemorrhage (PPH) remains one of the leading causes of maternal morbidity and mortality worldwide, particularly in low- and middle-income countries. Labour augmentation using pharmacological agents such as oxytocin is widely practiced to manage slow labour progress; however, its potential association with increased risk of PPH remains debated. Although several international studies have examined this relationship, evidence from local clinical settings in Pakistan is still limited and inconsistent. Therefore, evaluating the frequency of PPH in spontaneous versus augmented labour in regional tertiary care hospitals is important to generate context-specific data and guide obstetric management strategies. This study aims to determine the frequency of PPH and compare its occurrence in spontaneous versus augmented labour.

METHODS

The descriptive cross-sectional study was conducted at the Department of Obstetrics and Gynaecology, Mardan Medical Complex, in collaboration with Bacha Khan Medical

College, Mardan. The duration of the study was six months, from August 2023 to January 2024. This study aimed to determine the frequency of postpartum haemorrhage (PPH) in women undergoing spontaneous versus augmented labour. Before the initiation of data collection, formal ethical approval was obtained from the Institutional Ethical Committee of Bacha Khan Medical College, Mardan (Approval No. 353/BKMC). Additionally, the synopsis was approved by the Research Evaluation Unit (REU) of the College of Physicians and Surgeons Pakistan (CPSP) under reference number CPSP/REU/OBG-2022-028-11418. Written informed consent was secured from all participants, ensuring confidentiality, voluntary participation, and the right to withdraw at any stage. A sample size of 151 participants was calculated using WHO sample size software, with a 95% confidence level and an expected postpartum haemorrhage rate of 11%. A non-probability consecutive sampling technique was used, enrolling all eligible women who met the inclusion criteria during the study period. Participants were eligible if they met the criteria like, aged between 18 and 40 years, singleton pregnancy confirmed on ultrasound, gestational age greater than 36 weeks (based on last menstrual period), any parity and undergoing vaginal delivery. Women were excluded if they had a known history of bleeding disorders such as disseminated intravascular coagulation (DIC), aplastic anaemia and thrombocytopenia. Participants were enrolled after verification of inclusion and exclusion criteria. A structured, pre-tested proforma was used to collect patient demographics, obstetric history, and clinical data, including maternal age, gestational age, parity, residential status (urban or rural), socioeconomic status (poor, middle, rich), hypertension status, labour type (spontaneous or augmented), and PPH outcome. Labour type was defined as follows: Spontaneous labour was determined by the presence of regular uterine contractions with progressive cervical dilation >3 cm without medical intervention. Augmented labour involved the use of intravenous oxytocin, starting at 12 ml/hour and increasing by 12 ml/hour every 30 minutes up to a maximum of >192 ml/hour. In some cases, prostaglandin E2 vaginal gel (1 gram) was administered, repeated at six-hour intervals up to three doses. Postpartum haemorrhage was identified based on a blood loss exceeding 500 ml within 24 hours after vaginal delivery. Blood loss was measured using soaked gauze, surgical pads, and visible clots, following a gravimetric method where a 1-gram weight difference equalled 1 ml of blood loss. To ensure consistency and accuracy, data collectors received uniform training on identifying labour types and estimating blood loss. Standard clinical definitions were strictly followed. The proforma was reviewed by obstetric consultants for face

and content validity. Daily cross-checking with patient files and labour ward registers was conducted to maintain data integrity. Data were entered and analyzed using IBM SPSS version 25.0. Descriptive statistics, including mean and standard deviation, were used for continuous variables like age, parity, and gestational age. Categorical variables hypertension status, labour type, parity, and residential status, were presented as frequencies and percentages. To compare the frequency of PPH across different categories, the Chi-square test or Fisher's exact test was applied where appropriate. A $p\text{-value} \leq 0.050$ was considered statistically significant. Post-stratification analysis was conducted for factors such as maternal age group, parity, gestational age, hypertension, socioeconomic status, and labour type to assess their association with PPH.

RESULTS

The study included a total of 151 participants. The mean maternal age was 28.29 ± 6.78 years, with a range between 18 and 40 years. The average gestational age at delivery was 39.31 ± 0.94 weeks, ranging from 37.08 to 41.48 weeks. The mean number of births (parity) was 1.40 ± 1.45 , with a range from 0 to 4. Most participants (40.4%) were between 26–35 years of age, while 38.4% were 18–25 years, and 21.2% were in the 36–40 age bracket. The majority (58.3%) were delivered between 39–40 weeks of gestation. A higher proportion of women were multiparous (58.3%) compared to primiparous (41.7%). Most resided in urban areas (64.2%), and the largest group belonged to the middle socioeconomic class (50.3%). Regarding comorbidities, 31.8% had hypertension. Spontaneous labour was observed in 55.0% of cases, while 45.0% underwent augmented labour. The overall frequency of postpartum haemorrhage (PPH) in this sample was 13.2% (Table 1).

Table 1: Demographic and Clinical Characteristics of Participants (n=151)

Categorical Variables	Categories	Frequency (%)
Age Group (Years)	Range: 18–40	28.29 ± 6.78
	18–25	58 (38.4%)
	26–35	61 (40.4%)
	36–40	32 (21.2%)
Gestational Age (Weeks)	Range: 37.08–41.48	39.31 ± 0.94
	37–38	41 (27.2%)
	39–40	88 (58.3%)
	>40	22 (14.6%)
Parity	Range: 0–4	1.40 ± 1.45
	Primiparous	63 (41.7%)
	Multiparous	88 (58.3%)
Residential Status	Urban	97 (64.2%)
	Rural	54 (35.8%)
Socioeconomic Status	Poor	52 (34.4%)
	Middle	76 (50.3%)

Hypertension	Rich	23 (15.2%)
	Yes	48 (31.8%)
Labour Type	No	103 (68.2%)
	Spontaneous	83 (55.0%)
Postpartum Haemorrhage	Augmented	68 (45.0%)
	Yes	20 (13.2%)
	No	131 (86.8%)

There was no statistically significant association between maternal age group and the occurrence of PPH ($\chi^2 = 1.080$, $df=2$, $p=0.583$). Although the highest rate of PPH (18.8%) was seen among women aged 36–40 years, the distribution across all age groups did not show meaningful differences. This suggests that maternal age alone may not be a strong predictor of postpartum bleeding in this sample. Gestational age at the time of delivery was not significantly associated with PPH ($\chi^2 = 2.989$, $df=2$, $p=0.224$). However, a trend was noted where the incidence of PPH increased with advancing gestational age, rising from 4.5% in post-term pregnancies (>40 weeks) to 17.0% in those delivering at 39–40 weeks. Despite this trend, the statistical analysis did not support a meaningful correlation. Parity did not show a significant association with the risk of PPH ($\chi^2 = 1.672$, $df=1$, $p=0.196$). However, primiparous women had a higher incidence of PPH (17.5%) compared to multiparous women (10.2%). Though not statistically significant, this pattern may reflect a clinical tendency for first-time mothers to be more vulnerable to labour complications, warranting further exploration (Table 2).

Table 2: Association Between Age Group, Gestational Age Parity and Postpartum Haemorrhage (n=151)

Variables	PPH Yes (n)	PPH No (n)	Total (n)	% with PPH	χ^2 (df), p-Value
Age Group (Years)					
18-25	7	51	58	12.1%	$\chi^2 = 1.080, (df=2), p=0.583$
26-35	7	54	61	11.5%	
36-40	6	26	32	18.8%	
Total	20	131	151	13.2%	
Gestational Age (Weeks)					
>40	1	21	22	4.5%	$\chi^2 = 2.989, (df=2), p=0.224$
37-38	4	37	41	9.8%	
39-40	15	73	88	17.0%	
Total	20	131	151	13.2%	
Parity					
Primiparous	11	52	63	17.5%	$\chi^2 = 1.672, (df = 1), p=0.196$
Multiparous	9	79	88	10.2%	
Total	20	131	151	13.2%	

The relationship between place of residence and PPH was not statistically significant ($\chi^2 = 2.493$, $df=1$, $p=0.114$). Nevertheless, PPH was more frequently observed in urban residents (16.5%) than in rural counterparts (7.4%). While not statistically conclusive, the difference may reflect disparities in maternal care access, healthcare-seeking

behaviour, or obstetric interventions across settings. No significant association was identified between socioeconomic status and PPH ($\chi^2 = 4.380, df=2, p=0.112$). However, a notably higher rate of PPH (26.1%) was found among women in the high-income category. This could potentially be due to increased rates of elective interventions or underlying risk factors, although the finding did not reach statistical significance. Labour type was not significantly associated with PPH in this cohort ($\chi^2 = 0.938, df=1, p=0.333$). Interestingly, spontaneous labour had a slightly higher rate of PPH (15.7%) compared to augmented labour (10.3%), contrary to expected trends. However, due to the lack of statistical significance, this difference may be attributed to random variation rather than a causal link (Table 3).

Table 3: Association Between Residential Status, Socioeconomic Status, Labour Type and Postpartum Haemorrhage (n=151)

Variables	PPH Yes (n)	PPH No (n)	Total (n)	% with PPH	χ^2 (df), p-Value
Residential Status					
Rural	4	50	54	7.4%	$\chi^2 = 2.493, (df=1), p=0.114$
Urban	16	81	97	16.5%	
Total	20	131	151	13.2%	
Socioeconomic Status					
Poor	7	45	52	13.5%	$\chi^2 = 4.380, (df=2), p=0.112$
Middle	7	69	76	9.2%	
Rich	6	17	23	26.1%	
Total	20	131	151	13.2%	
Labour Types					
Augmented	7	61	68	10.3%	$\chi^2 = 0.938, (df=1), p=0.333$
Spontaneous	13	70	83	15.7%	
Total	20	131	151	13.2%	

Hypertension showed a statistically significant relationship with PPH ($\chi^2 = 5.728, df = 1, p=0.017$; Cramér's V=0.195). Women with hypertension experienced more than twice the rate of PPH (22.9%) compared to normotensive women (8.7%). This finding highlights hypertension as an important clinical risk factor for postpartum bleeding, underlining the need for close monitoring and preventive strategies in hypertensive pregnancies (Table 4).

Table 4: Association Between Hypertension and Postpartum Haemorrhage (n=151)

Hypertension	PPH Yes (n)	PPH No (n)	Total (n)	% with PPH	χ^2 (df), p-Value	Cramér's V
Yes	11	37	48	22.9%	$\chi^2 = 5.728, (df=1), p=0.017$	0.195
No	9	94	103	8.7%		
Total	20	131	151	13.2%		

The chart shows that the most represented age group was 26–35 years, followed closely by 18–25 years. A significant portion of deliveries occurred between 39–40 weeks of gestation. Multiparous women formed the majority, and

most participants lived in urban areas. Middle-income status was the most common socioeconomic group. From a clinical standpoint, a considerable proportion of the sample had hypertension (31.8%). Spontaneous labour was more frequent than augmented labour. Although only 13.2% of participants experienced postpartum haemorrhage (PPH), the graph emphasises that high-risk categories such as hypertensive patients, primiparous women, and urban residents showed a noticeable share of PPH cases. Visually, the gap between frequency and percentage bars also reflects distribution weight across categories, while “PPH No” cases dominate in count, the PPH Yes group still presents critical clinical implications in terms of relative proportion among certain subgroups.

DISCUSSION

This study explored the frequency of postpartum haemorrhage (PPH) in women undergoing spontaneous versus augmented labour at a tertiary care facility in Mardan. The overall frequency of PPH was 13.2%, which is slightly higher than the global average reported by the World Health Organization, where PPH complicates approximately 10% of vaginal deliveries. This variation could be attributed to local obstetric practices, population characteristics, or referral patterns. Our findings showed that maternal age did not significantly influence the likelihood of PPH, although the highest rate (18.8%) was observed in women aged 36–40 years. This was consistent with Rafiq et al., Bernitz et al., and Cheng et al., 2025 and suggests that advanced maternal age may be linked with reduced uterine contractility and vascular changes, but such associations may not always reach statistical significance in mid-sized samples [11–13]. Similarly, gestational age did not demonstrate a significant correlation with PPH. While a rising trend in PPH was seen with increasing gestational duration peaking at 17% in the 39–40-week group, this did not meet statistical criteria. Previous literature, like Kumar et al., Mentzoni et al., and Khurshid et al., indicates that prolonged gestation may increase uterine atony risk, though confounding factors such as induction method and birth weight may play a role, which were not the focus of this study [14–16]. Parity also failed to show a statistically significant association. However, primiparous women exhibited a higher incidence of PPH (17.5%) compared to multiparous women (10.2%). This aligns with previous reports like Zhu et al., Pettersen et al., and Girault et al., that suggest first-time mothers may be more prone to labour-related complications due to prolonged second-stage labour, ineffective uterine contractions, or lack of delivery experience among attending staff in certain settings [17–19]. Residential status and socioeconomic status, while not statistically significant, revealed notable trends. Urban residents and

women from higher-income groups experienced more PPH than their rural and lower-income counterparts. These findings were counterintuitive to the assumption that better-resourced populations have improved outcomes. However, elective labour interventions, stress, or delayed presentation in urban centres might contribute to this disparity [20, 21]. Importantly, hypertension emerged as a significant risk factor for PPH, with a rate of 22.9% among hypertensive women compared to 8.7% in normotensive patients ($p=0.017$). This finding echoes multiple studies where hypertensive disorders in pregnancy, preeclampsia, were linked with abnormal placentation, coagulopathy, and uterine atony, increasing bleeding risks post-delivery. Therefore, early detection and close management of hypertensive women during labour are essential to reduce maternal morbidity [22, 23]. Contrary to some expectations, the type of labour, spontaneous versus augmented, did not significantly impact the risk of PPH. Interestingly, PPH was slightly more common in spontaneous labour (15.7%) than in augmented cases (10.3%). This may suggest that with proper monitoring and protocol-driven augmentation using oxytocin and prostaglandins, blood loss can be controlled. Alternatively, it may reflect an underestimation of bleeding in spontaneous cases, where the anticipation of complications may be lower.

This study has certain limitations, including its single-center design and relatively small sample size, which may limit the generalizability of the findings to broader populations. Additionally, the cross-sectional nature of the study restricts the ability to establish causal relationships between labour type and postpartum haemorrhage. Other potential risk factors such as duration of labour stages, birth weight, and obstetric interventions were not extensively evaluated. Future multicenter studies with larger sample sizes and inclusion of additional clinical variables are recommended to better understand the determinants of PPH and improve maternal care outcomes.

CONCLUSIONS

The study highlights that postpartum haemorrhage remains a pressing concern in obstetric care, affecting over 13% of women delivering vaginally. While maternal age, parity, gestational age, labour type, and socioeconomic status did not show statistically significant associations, hypertension was identified as a major contributor to PPH. These findings underscore the need for vigilant monitoring of hypertensive patients and the development of standardized labour protocols irrespective of delivery method. Improving labour ward preparedness, ensuring active management of the third stage of labour, and early identification of high-risk pregnancies can

significantly reduce the burden of PPH. Future research with larger sample sizes and inclusion of factors such as birth weight, duration of labour stages, and care provider experience would provide a more comprehensive understanding of the determinants of postpartum haemorrhage in our setting.

Authors' Contribution

Conceptualization: MT

Methodology: MT, SR, SJ, CA, IR

Formal analysis: SR, CA, BSH, IR

Writing and Drafting: MT, CA, IR

Review and Editing: MT, CA, IR, SR, SJ, BSH

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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