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Etiological factors and management of post-partum haemorrhage in tertiary care teaching hospital

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Abstract
Background: Postpartum haemorrhage (PPH) remains a major cause of maternal morbidity and mortality, particularly in low-resource settings. Early identification of risk factors and timely intervention are essential to improving outcomes. This study investigates the aetiologies, risk factors, management patterns, and outcomes of PPH in a tertiary care centre.
Methods: A prospective observational study was conducted on 80 cases of PPH among 14, 442 deliveries between August 2022 and July 2024. Detailed clinical assessment, quantification of blood loss, laboratory evaluation, and management according to institutional protocols were undertaken. The findings were compared with established national and international literature.
Results: Primary PPH accounted for 92.5% of cases. Emergency or referred admissions constituted 80%, while 20% were registered patients. Most affected women were aged 25-30 years (50%). Uterine atony was the predominant cause (64.86%), followed by traumatic PPH (27.02%). Significant risk factors included previous caesarean section (25%), multigravidity (16.66%), placenta previa (12.5%), anaemia (14.5%), preeclampsia (8.3%), and placental abruption (8.3%). Medical management alone was effective in 32.5% of atonic PPH cases, primarily using oxytocin and misoprostol; uterine tamponade was used in selected cases. Surgical intervention was required in 67.5% of cases, including uterine artery ligation, internal iliac ligation, repair of genital tract injuries, manual removal of placenta, and one hysterectomy. Postoperative complications occurred in 18 patients. Maternal mortality was 2.5%, with deaths due to acute renal failure with DIC and dilated cardiomyopathy. Blood component therapy was required in most patients.
Conclusion: PPH is a preventable emergency requiring rapid recognition, coordinated multidisciplinary care, and access to effective medical and surgical interventions. Strengthening antenatal care and emergency referral systems can significantly reduce PPH-related maternal morbidity and mortality.

Keywords: Atonic postpartum haemorrhage, maternal morbidity, obstetric emergencies, postpartum haemorrhage, uterotonic agents

Introduction

Ion Donald's assertion that "the third stage of labour is the unforgiving stage" underscores the critical vulnerability of this period, during which postpartum haemorrhage (PPH) most commonly occurs [1]. PPH—defined as blood loss ≥500 ml after vaginal delivery or ≥1000 ml following caesarean section, accompanied by clinical signs of hypovolemia within 24 hours [2]—remains the leading cause of maternal mortality globally. Despite substantial reductions in mortality in high-income countries, women in low- and middle-income countries continue to bear a disproportionate burden, particularly in sub-Saharan Africa and South Asia. Primary PPH, the most frequent and life-threatening type, is characterized by blood loss exceeding 500 ml within 24 hours or any amount causing hemodynamic instability [3, 4], whereas secondary PPH (24 hours to 6 weeks postpartum) also contributes significantly to morbidity. True blood loss is commonly underestimated due to limitations of visual assessment [5].

PPH accounts for one-quarter to one-third of maternal deaths worldwide [6], with the WHO estimating approximately 127, 000 deaths annually, reaffirming its position as the leading cause of maternal mortality [3]. Globally, it complicates 2-4% of vaginal births and nearly 6% of caesarean deliveries, with uterine atony responsible for about half of all cases. Data from the Indian Council of Medical Research (2003) similarly identify PPH as a major contributor to maternal mortality in India, where haemorrhage accounts for 53.19% of maternal deaths and PPH alone contributes 21.27%. Notably, most PPH-related deaths occur within the first 24 hours of admission [7].

Timely recognition and prompt management of PPH are therefore essential. The "Four T's" mnemonic—Tone, Trauma, Tissue, Thrombin—offers a structured approach to identifying common aetiologies and directing rapid, coordinated interventions that markedly reduce morbidity and mortality. As emphasized in Williams Obstetrics, obstetric haemorrhage remains part of the triad of leading maternal killers and is a major cause of intensive care unit admission.

Given its persistent burden and preventable nature, the present study aims to identify high-risk factors, evaluate preventive strategies, and review management protocols to improve maternal outcomes in postpartum haemorrhage.

Materials and Methodology

This prospective clinical study included 80 cases of postpartum haemorrhage (PPH) occurring during the third stage of labour at a tertiary care centre from August 2022 to July 2024. During which 14, 442 deliveries took place, from these, 80 patients meeting the predefined inclusion criteria were selected for detailed assessment. A comprehensive obstetric history and thorough clinical examination were undertaken to identify the underlying causes of PPH. Blood loss was quantified through direct measurement of soaked linens, mops, and surgical sponges. All participants underwent relevant laboratory investigations, and management was provided according to standard institutional protocols. The collected data were systematically analysed, tabulated, and compared with findings from established Indian and international studies to derive evidence-based conclusions.

Inclusion Criteria

1. Patients who developed postpartum haemorrhage
2. Patients with atonic PPH
3. Patients with traumatic causes of PPH
4. Patients with retained placenta, including morbidly adherent placenta
5. Patients developing coagulopathy
6. Patients with uterine inversion
7. Patients developing secondary PPH

Exclusion Criteria

1. Patients with antepartum haemorrhage
2. Patients with bleeding due to any cause occurring before the third stage of labour

Results and Discussion

This prospective observational study included 80 cases of postpartum hemorrhage identified among 14, 442 deliveries conducted at our hospital between August 2022 and July 2024.

Table 1: Antenatal Registration Status and Postpartum Hemorrhage

Registration Status	No. of Cases (Present Study)	Latika Duhan *et al* [8] (2016) n=76
Emergency	64 (80%)	55 (72.4%)
Registered	16 (20%)	21 (27.6%)
Total	80 (100%)	76 (100%)

Table 1 compares the antenatal registration status of patients who developed postpartum haemorrhage (PPH) in the present study with findings reported by Latika Duhan *et al*. [8]. In the present study, the majority of PPH cases occurred among emergency or unregistered patients, who accounted for 64 cases (80%), whereas only 16 cases (20%) were from the registered group. A similar trend was observed in the study by Latika Duhan *et al*. (2016), where 55 out of 76 cases (72.4%) were emergency presentations and 21 cases (27.6%) were registered. These findings indicate that unregistered or emergency admissions are consistently associated with a higher incidence of PPH compared to patients receiving regular antenatal care.

Table 2: Maternal Age and Postpartum Hemorrhage

Age in years	No. of cases (n = 80)	%
19-24	25	31.25%
25-30	40	50%
Above 30	15	18.75%
Total	80	100%

Table 2 presents the distribution of postpartum hemorrhage cases according to maternal age. In the present study (n = 80), half of the patients were between 25 and 30 years of age, accounting for 40 cases (50%). The second most affected age group was 19-24 years, comprising 25 cases (31.25%). Women above 30 years constituted the smallest proportion, with 15 cases (18.75%). Overall, the findings indicate that PPH was most frequently observed among women in the 25-30-year age group.

In the present study, the occurrence of postpartum haemorrhage was higher among multiparous women. These findings are consistent with those of Chigozie Ozoemena Ifeadike *et al*. [9] and Babinszki *et al*. [10], who also reported an increased risk of PPH in multiparous and grand multiparous patients. Among primiparous women in our study, genital tract lacerations emerged as a significant cause of PPH. Similar observations were documented by Kaul *et al*. (2006) [11] and Gilbert *et al*. [12], who noted a higher incidence of PPH among primipara. Babinszki *et al*. (1999) [10] further demonstrated that postpartum maternal complications, including PPH, increased significantly with parity, with reported rates of 0.3% in multiparous and 1.9% in grand multiparous women. This elevated risk in grand multipara has been attributed to factors such as increased fetal size, higher incidence of malpresentation, reduced uterine and abdominal wall tone, and greater likelihood of ruptured uterus, placenta previa, and antepartum haemorrhage.

As a tertiary care centre situated centrally within the city, our hospital caters to both urban and rural populations. In this study, 65% of patients were from urban areas, while 35% belonged to rural regions. The incidence of PPH was notably higher among women from lower socioeconomic classes, likely due to poor nutritional status, limited awareness of contraception, irregular antenatal visits, and inadequate dietary practices.

Table 3: Significant Past Obstetric History and PPH

Obstetric History	Present Study (n=16)	Sinha *et al* (n=23) [13]
Previous caesarean section	12(75%)	6(26.1%)
Previous D & E	1(6.25%)	3(13%)
H/O Ante partum hemorrhage	1(6.25%)	2(8.8%)
H/O Severe sepsis	1(6.25%)	3(13%)
H/O Manual removal of placenta	1(6.25%)	9(39.1%)

Table 3 presents the distribution of significant past obstetric history among patients who developed postpartum haemorrhage (PPH) in the present study and compares these findings with those reported by Sinha *et al*. [13]. In the present study (n = 16), a previous caesarean section was the most common contributory factor, observed in 12 cases (75%), which is notably higher than the 26.1% reported by Sinha *et al*. Prior dilation and evacuation (D&E) was documented in 1 case (6.25%) in the present study compared to 3 cases (13%) in Sinha *et al*.'s cohort. A history of antepartum haemorrhage, severe sepsis, and manual removal of placenta were each identified in 1 case (6.25%) in the present series, whereas Sinha *et al*. reported higher proportions for severe sepsis (13%) and manual removal of placenta (39.1%). Collectively, the findings highlight the strong association between prior obstetric complications—particularly previous caesarean section—and an increased risk of PPH in subsequent pregnancies.

Table 4: Modes of delivery in PPH

Modes of Delivery		No of Cases	C. Dupont (2009) *et al.*, [14]
Vaginal Delivery	Vaginal Delivery	34 (42.5%)	78.32%
	Vaginal Birth after CS	3 (3.75%)	
C- Section		43 (53.75%)	21.68%

Table 4 outlines the modes of delivery among patients who developed postpartum haemorrhage in the present study and compares these findings with data reported by C. Dupont *et al*. (2009) [14]. In the present study, vaginal deliveries accounted for 34 cases (42.5%), and an additional 3 cases (3.75%) occurred following vaginal birth after caesarean (VBAC). Caesarean section was the predominant mode of delivery, representing 43 cases (53.75%). In contrast, C. Dupont *et al*. reported a significantly higher proportion of PPH following vaginal delivery (78.32%) and a lower proportion associated with caesarean section (21.68%). These differences suggest that, in the present setting, PPH occurred more frequently following caesarean deliveries, whereas in Dupont's series, vaginal deliveries were more commonly associated with PPH.

L. Gilbert (1987) [12] reported a higher incidence of postpartum hemorrhage (PPH) following forceps-assisted deliveries compared with spontaneous vaginal births and observed that PPH occurred more frequently in induced than in spontaneous labors. Similarly, Dupont *et al*. (2009) [14] noted that the majority of PPH cases (78.3%) followed vaginal delivery, while 21.68% occurred after caesarean section. In the present study, 92.5% of cases were classified as primary PPH, whereas 7.5% were secondary PPH, indicating that most hemorrhagic events occurred within the first 24 hours postpartum.

Table 5: Etiology of Primary Postpartum Hemorrhage

Etiology	No. of Cases	Cases in%	Kaul *et al*., (2006) [11] (N=90)
Atonic PPH	48	64.86%	47.7%
Traumatic PPH	20	27.02%	38.8%
Retained Placenta	03	4.05%	4.4%
Uterine Inversion	01	1.35%	2.2%
Coagulopathy	02	2.70%	1.1%

Table 5 summarizes the etiological factors responsible for primary postpartum hemorrhage (PPH) in the present study and compares them with findings reported by Kaul *et al*. (2006) [11]. Among the 74 cases of primary PPH in the present study, uterine atony was the leading cause, accounting for 48 cases (64.86%), which is comparable to the 47.7% reported by Kaul *et al*. Traumatic PPH was the second most common etiology, observed in 20 cases (27.02%), though this proportion was lower than the 38.8% noted by Kaul *et al*. Retained placenta contributed to 3 cases (4.05%), closely aligning with Kaul *et al*.'s finding of 4.4%. Uterine inversion and coagulopathy were relatively uncommon, representing 1 case (1.35%) and 2 cases (2.70%), respectively, findings that are broadly consistent with the lower incidence reported in the comparative study. Overall, the pattern of etiologies demonstrates that uterine atony remains the predominant cause of primary PPH across studies.

Table 6: Factors Predisposing to Atonic Postpartum Hemorrhage

Risk Factors	Present Study	%
Previous C Section	12	25
Placenta Previa	6	12.5
Placental Abruption	4	8.3
Pre-Eclampsia	4	8.3
Twins	3	6.25
Polyhydramnios	2	4.1
Anaemia	7	14.5
Multigravida	8	16.66
Others	2	4.1
Total	48	100%

In the present study, identifiable risk factors for postpartum haemorrhage were documented in 48 patients. Among these, a previous caesarean section was the most common factor, observed in 12 cases (25%). Placenta previa was present in 6 cases (12.5%), while 8 patients (16.66%) were multigravidas. Preeclampsia and placental abruption were each noted in 4 cases (8.3%). Anaemia contributed to 7 cases (14.5%), whereas twin gestation accounted for 3 cases (6.25%). Polyhydramnios was identified in 2 cases (4.1%), and another 2 cases (4.1%) were attributed to miscellaneous causes. These findings align with those reported by Bibi Shamshad *et al*. [17], who observed that atonic postpartum haemorrhage was most frequently associated with multiparity (20.9%), followed by prolonged labour (21.9%), abruptio placentae (10.4%), and placenta previa (8.3%).

Table 7: Traumatic Causes of PPH

Site of Injury	Number of Patient (N = 20)	%
Cervical Tear	8	40%
Vaginal Tear	6	30%
Lower Uterine Segment Tear	2	10%
Complete Perineal Tear	3	15%
Ruptured Uterus	1	5%

Table 7 presents the distribution of traumatic causes of postpartum haemorrhage among the 20 affected patients in the present study. Cervical tears constituted the most common traumatic etiology, accounting for 8 cases (40%). Vaginal tears were the second most frequent, observed in 6 cases (30%). Complete perineal tears contributed to 3 cases (15%), while lower uterine segment tears were identified in 2 cases (10%). Uterine rupture was the least common traumatic cause, occurring in 1 case (5%). These findings highlight that cervical and vaginal tears represent the predominant traumatic sources of haemorrhage in this group.

Table 8: Management of Post Partum Haemorrhage

Atonic Post Parum Haemorrhage (48)	
Only Medical	26(32.5%)
Medical + Uterine Tamponade	10(12.5%)
Medical + B/L Uterine Artery Ligation	6(7.5%)
Medical +Compression Sutures	4(5%)
Medical with B/L Uterine Artery Ligation and Internal Iliac Ligation	2(2.5%)
Traumatic PPH (20)	
Cervical Tear Repair	8(10%)
Vaginal + Perineal + Complete Perineal Tear Repair	9(11.25%)
Lower Segment Tear Repair + B/L Uterine Artery Ligation	2(2.5%)
Ruptured Uterus Repair	1(1.25%)
Secondary PPH (6)	
Medical Management	2(2.5%)
D & E	3(3.75%)
Obstetric Hysterectomy	1(1.25%)
Uterine Inversion (1)	
Reposition of Uterus	1(1.25%)
Retained Placenta (3)	
Manual Removal of Placenta	3 (3.75%)
Coagulopathy (2)	
Obstetric Hysterectomy	2 (2.5%)

In the present study, 26 patients (32.5%) with atonic postpartum haemorrhage (PPH) were managed successfully with medical therapy, including oxytocin, prostaglandins, methylergometrine, and antifibrinolytics; uterine tamponade was required in 10 cases.

Traumatic PPH cases underwent combined medical and surgical management, with all cervical, vaginal, perineal, and lower uterine segment tears appropriately repaired, including one successfully sutured uterine rupture. Retained placenta was managed by manual removal in three cases, and uterine inversion was corrected operatively. Surgical intervention was required in 54 cases (67.5%), with uterine artery ligation performed in 10 cases and internal iliac ligation in 2 cases.

These outcomes are comparable to published evidence, where stepwise devascularisation and uterine artery ligation have shown success rates exceeding 95% [18, 19]. Among medically treated cases, 8 responded to oxytocin alone, while 18 required oxytocin with misoprostol, consistent with studies demonstrating enhanced efficacy of combined uterotonics [20-23]. Maternal mortality in the present series was 2.5%, with deaths attributed to acute renal failure with DIC and dilated cardiomyopathy. Most patients required blood component therapy, including PCV (97.5%), FFP (76.25%), cryoprecipitate (48.75%), and PRC (51.25%).

Table 9: Post-operative complications associated with PPH

Types of Complication	No of Cases	%
Febrile Illness	8	10%
Wound Complications (Discharge, resuturing)	7	8.75%
Rectus Muscle Hematoma	1	1.25%
Blood Transfusion Reaction	2	2.5%

In the present study, postoperative complications occurred in 18 of the 80 cases. Fever developed in 8 patients and was managed conservatively. Wound-related complications were observed in 7 patients, including 4 cases requiring resuturing and 3 cases with wound discharge. One patient developed a rectus sheath hematoma necessitating laparotomy and drainage. Additionally, two patients experienced blood transfusion reactions, presenting with rashes and breathlessness, both of which were managed conservatively.

Table 10: Secondary PPH

Causes Secondary PPH	Management	No of Cases	%
Puerperal Sepsis	Medical Management	2	33.3%
Retained Placental Tissue	D & E	3	50%
Atonic Uterus	Obstetric Hysterectomy	1	16.67%
Total Cases		6	100

In the present study, six cases of secondary postpartum haemorrhage were identified. Two cases were attributed to puerperal sepsis and were managed medically. Three cases resulted from retained placental tissue and required dilatation and evacuation. One case necessitated obstetric hysterectomy five days postpartum.

Conclusion

In conclusion, postpartum haemorrhage remains a major yet preventable cause of maternal morbidity and mortality, particularly in low-resource settings. Strengthening early recognition, ensuring skilled attendance at birth, and improving referral and emergency obstetric services are essential for reducing its impact. Active management of the third stage of labour, timely medical and surgical interventions, and coordinated multidisciplinary care significantly improve outcomes. The increasing use of conservative surgical techniques offers effective haemorrhage control while preserving fertility. Continued investment in healthcare infrastructure, training, and context-appropriate innovations is crucial to further reducing the global burden of PPH and enhancing maternal survival.

Conflict of Interest

Not available.

Financial Support

Not available.

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