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Original Research Article

Postpartum Hemorrhage: Risk Factors and New Management Protocols

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Abstract

Background: Postpartum hemorrhage (PPH) remains one of the main contributors to maternal morbidity and mortality around the world, especially in low-resource settings. Causes of PPH include uterine atony most commonly, while maternal anemia and prolonged labor increase the risk, as well as the severity of hemorrhage. Although obstetric care has improved over the decades, early identification of risk factors and timely implementation of standardized management protocols are essential to achieve better maternal outcomes.

Methods: A prospective observational study was conducted for a period of six months, from January 2024 to June 2024, at the Department of Obstetrics and Gynecology of S.K.M.C.H, Bihar. A total of 90 women diagnosed with primary PPH were included. Data regarding demographic characteristics, antenatal history, obstetric risk factors, mode of delivery, management protocols, transfusion, ICU admissions and maternal outcome were collected using a structured proforma. Statistical analyses were performed using descriptive statistics and the chi-square test, as a P-value <0.05 was regarded as statistically significant.

Results: The most common cause of PPH was uterine atony (53.3%) and trauma (26.7%), respectively. Maternal anemia (46.7%) and prolonged labor (28.9%) were important risk factors for severe hemorrhage (p< 0.005). Uterotonics and Active Management of the Third Stage of Labour (AMTSL) were successful in most cases. The early administering tranexamic acid and balloon tamponade also reduced the need for surgical intervention. Blood transfusion was needed in 57.8% of cases, ICU admission in 11.1%, and the maternal mortality rate was 1.1 %.

Conclusion: The main cause of PPH is still uterine atony and the severity is increased by anemia and prolonged labor. Management based on a protocol early on reduces complications and appears to improve maternal outcomes. Further reductions in maternal morbidity and mortality will require improved antenatal screening and adherence to standardised management protocols.

Keywords: Active management, Obstetric risk factors, postpartum hemorrhage, uterine atony, maternal morbidity, Tranexamic acid.

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Introduction

PPH remains among the most dangerous and possibly deadly complications of childbirth globally [1]. Clinically, it is defined as blood loss ≥500 ml after a vaginal delivery or ≥1,000 ml after a cesarean section, or any bleeding leading to hemodynamic instability [2]. PPH is one of the most common causes of maternal morbidity and mortality globally, especially in low- and middle-income countries (LMICs), even though much of the burden can now be prevented through improved obstetric care [3]. PPH contributes to nearly one quarter of all maternal deaths around the world, and most happen in the first 24 hours, according to the World Health Organization (WHO) [4]. This burden is disproportionately high in LMICs with limited access to skilled birth attendants, timely blood transfusion, and emergency obstetric care. Maternal mortality has declined in India over the last decade, but PPH continues to remain one of the leading causes of preventable maternal mortality [5]. States with less developed healthcare infrastructure certainly face larger challenges, such as the higher prevalence of maternal anemia, delayed referral systems in these states and poor

emergency obstetric services, including Bihar [6]. The referral pattern regarding high-risk pregnancies and their management at tertiary care centre like S.K.M.C.H., Bihar, therefore, reduces an assessment of the risk factors and treatment outcome regarding PPH particularly relevant to the regional context [7].

PPH is generally classified into two major types includes primary PPH, which occurs in the first 24 hours after delivery and secondary PPH, which occurs after 24 hours up to 6 weeks postpartum [8]. There are varying types of primary PPH, which is the one that is more common as well as more severe and requires intervention immediately [9]. The etiological factor PPH usually has common causes often remembered by the "4 T's": Trauma, Tone, Thrombin and Tissue [10]. The most common type is uterine atony or loss of uterine muscle tone. Trauma refers to lacerations of the genital tract or uterine rupture; tissue indicates the retained placental fragments and thrombin relates to coagulopathy that prevents effective clot development [11].

The obstetric morbidity and mortality are unacceptably high in low-resource settings and early detection of risk factors and evidence-based management will play a critical role in improving their outcomes. Revised management techniques, such as active management of the third stage of labor and early pharmacological management, are promising in preventing serious complications. As a result, decided to study the risk factors and effectiveness of new management protocols for PPH in S.K.M.C.H., Bihar.

Objectives

- To identify the major risk factors related to PPH.
- To evaluate the efficiency of new organization procedures.
- To assess maternal outcomes ensuing intervention.

Materials and Methods

Study Design: This study was performed as a prospective observational study of the risk factor and management outcome of PPH.

A prospective design enabling real-time data collection and systematic follow-up of patients from diagnosis until management and final maternal outcome. There was no intervention, other than the observation of existing management practices used in the institution.

Study Setting: The study was carried out in the Department of Obstetrics and Gynecology, S.K.M.C.H, Bihar. S.K.M.C.H is a tertiary care teaching hospital serving a mixed population of urban and rural Bihar and adjoining areas. The hospital is the largest referral center for high-risk obstetric cases in the region and an appropriate site to study PPH and its maternal complications.

Study Duration: The study duration was from January 2024 to June 2024 (6 months). In this period, systematic follow-up until discharge or final outcome was performed for all eligible cases of PPH diagnosed in the department.

Sample Size: A total of 90 postpartum women with primary PPH during the study period were included. Eligibility of cases was restricted to those presenting within the specified timeframe, and the sample size was thus conveniently defined. All patients were treated according to institutional guidelines, and clinical data were captured.

Inclusion Criteria: A prospective observational study was conducted at all obstetrical units to provide care for women aged 18 years and over who were diagnosed as having primary PPH (within 24 hours of delivery) and who delivered at S.K.M.C.H during the study period. Eligible participants included both vaginal and cesarean deliveries if the clinical diagnosis of primary PPH was based on standard clinical criteria.

Exclusion Criteria: To avoid confounding within patients, excluded all patients with pre-existing bleeding or coagulation disorders. In order to ensure data accuracy and reliability, referred cases with incomplete medical records were also excluded from the analysis. Finally, secondary PPH cases were not included that occurred after 24 hours and up to 6 weeks postpartum.

Data Collection: Data were collected in the structured proforma, which was designed for the study. Maternal age, parity, antenatal history (including anemia and obstetric complications), and mode of delivery (vaginal/ instrumental, cesarean section). The inclusion of clinical parameters, including pre-delivery hemoglobin level and identified obstetric risk factors, was documented. The protocol of management, requirement of blood transfusion, need for ICU admission, and final outcome maternal were also recorded. Patients who were observed throughout their hospital stay for outcomes of interventions and complications.

Management Protocols Studied: An updated management protocol was developed and assessed against conventional management practices in the study population. Conventional management consisted of uterine massage and usual uterotonic administration. The improved protocol included AMTSL, early use of uterotonics (oxytocin and misoprostol), timely tranexamic acid use, and mechanical measures (balloon tamponade when indicated). Surgical interventions were necessary to save their lives in obstetric bleeding resistant to conservative measures, even in cases that lost their

uterus with these procedures, including uterine compression sutures, arterial ligation or hysterectomy.

Statistical Analysis: Data were collected and then analyzed using SPSS software. Demographic and clinical variables were summarized using descriptive statistics, including the mean, standard deviation, and percentages. Chi-square test was performed to test the association of risk factors determined above with the severity or outcome of PPH. Statistical significance was set at a p-value of <0.05.

Results

Demographic Characteristics: The patients with the highest proportion of cases were between the ages of 21 and 30 years. The average age of the participants in the study was 26.8 ±4.5 SD years.

Women under 20 years of age made up a lower proportion, and women older than 35 years made up a smaller but clinically important group, being at increased obstetric risk.

In terms of parity, multiparous women were more frequently impacted than primiparous women. A smaller but higher-risk subgroup experienced grand multiparity. More than half of patients (almost two-thirds) were from rural backgrounds, likely reflecting the large rural catchment area of the hospital as well as higher rates of antenatal anemia and delayed referrals in the rural population.

Table 1: Demographic Profile of Study Participants

Variable	Category	Number (n)	Percentage (%)
Age	<20 years	12	13.3%
	21–30 years	52	57.8%
	31–35 years	18	20.0%
	>35 years	8	8.9%
Parity	Primipara	34	37.8%
	Multipara	46	51.1%
	Grand multipara	10	11.1%
Residence	Rural	62	68.9%
	Urban	28	31.1%

Obstetric Risk Factors Identified: Common obstetric risk factors identified included uterine atony, maternal anemia, and prolonged labor. Many women had multiple risk factors. Prior cesarean section and labor induction were also significant factors. Multiple pregnancy and polyhydramnios were rare but significantly linked to major severe blood loss.

Table 2: Distribution of Obstetric Risk Factors

Risk Factor	Number (n)	Percentage (%)
Uterine atony	48	53.3%
Anemia (Hb <10 g/dL)	42	46.7%
Prolonged labor	26	28.9%
Previous cesarean section	22	24.4%
Induction of labor	20	22.2%
Multiple pregnancy	8	8.9%
Polyhydramnios	6	6.7%

Mode of Delivery: Most cases of PPH were reported for vaginal delivery.

Hemorrhage was specifically related to cesarean section (second mode) and specifically related to instrumental deliveries (a small percentage).

- Vaginal delivery: 50 cases (55.6%)
- Instrumental delivery: 10 cases (11.1%)
- Cesarean section: 30 cases (33.3%)

Classification for the PPH cause: Based on the 4T classification of PPH (Trauma, Tone, Thrombin, Tissue), the majority of cases were secondary to uterine atony (Tone).

The second most common cause was trauma (e.g. cervical and vaginal tears). Other less frequent entities included retained placental tissue and coagulation disorders.

Table 3: Cause 4T Classification

Cause (4T)	Number (n)	Percentage (%)
Tone (Atony)	48	53.3%
Trauma	24	26.7%
Tissue	12	13.3%
Thrombin	6	6.7%

Management Outcomes: With the updated protocol, most patients were treated with uterotonics alone successfully.

A large proportion of moderate to severe cases required blood transfusion.

In cases where medical management failed, balloon tamponade had a role. Surgery has been performed only when the case was refractory. In severe cases, ICU admission was needed, but maternal death was rare.

- Pregnancies managed with uterotonics only: 40 (44.4%)
- Transfusion requirement: 52 (57.8%)
- Used balloon tamponade: 14 (15.6%)
- Needed Surgery: 8 (8.9%)
- ICU admission: 10 cases (11.1%)
- Maternal mortality: 1 case (1.1%)

Table 4: Management Protocol and Outcome

Management/Outcome	Number (n)	Percentage (%)
Uterotonics alone	40	44.4%
Blood transfusion	52	57.8%
Balloon tamponade	14	15.6%
Surgical intervention	8	8.9%
ICU admission	10	11.1%
Maternal mortality	1	1.1%

Table 5: Association between Major Risk Factors and Severe PPH

Risk Factor	Severe PPH (n=30)	p-value
Uterine atony	22	<0.01
Anemia	18	<0.05
Prolonged labor	12	<0.05
Previous LSCS	10	0.04

A statistically important as associated with observed among the uterine atony as well as severe in PPH ($p<0.01$). Maternal anemia and prolonged labor which is showed by the significant correlation that increased severity of the hemorrhage.

Discussion

The most prevalent diagnosis contributing to PPH during the immediate postpartum period in the present study was uterine atony, contributing to more than half of the cases. Among all the risk factors considered, the most significant were maternal anemia and uterine atony. The significant link between antenatal anemias with adverse maternal outcomes was reflected by the high proportion of women with hemoglobin levels < 10 g/dL that on to develop moderate to severe hemorrhage in the present series. Other important risk factors were the length of labor and having had a previous cesarean section, especially for the most severe PPH. The predominance of Tone as the main etiology fits well with the existing knowledge that ineffective uterine counter remains the key driver of excessive postpartum bleeding.

Comparison with Other Studies: The results of this study are comparable to the global data available from the WHO, which identifies PPH as one of the major causes of global maternal deaths and identifies uterine atony as the most common cause. PPH accounts for almost a quarter of all maternal deaths worldwide, mainly in low-resource settings, according to WHO estimates [12].

PPH is similarly identified as one of the leading causes of maternal mortality in India according to national data from the Ministry of Health and Family Welfare. Similar to the results, antepartum anemia is common among pregnant women in India and a risk factor for massive hematuria. While national programmes have announced the declining maternal mortality ratios due to rising institutional deliveries and active management protocols, rural states such as Bihar face issues of referral delays and accessing blood banks during crucial emergency hours [13]. The higher percentage of severe cases of PPH where the present study was conducted also could be due to the proportion of women with complicated or high-risk pregnancies that tinge the tertiary care referral pattern of S.K.M.C.H.

Effectiveness of New Protocols: The encouraging outcome from the updated management protocols. The early administration of tranexamic acid

appeared to reduce the overall degree of hemorrhage, and it may have helped to prevent some cases from having extreme blood transfusion requirements [14]. AMTSL, including the timely use of oxytocin, were shown to be effective in the prevention of progression to severe atony. The low rate of surgical intervention indicates effective early treatment of hemorrhage (by means of pharmacological management or mechanical measures like balloon tamponade) [15]. These findings support growing evidence of the impact a standardised, protocol-based approach to early intervention can have on maternal outcomes.

Clinical Implications: The findings strengthen the need for early recognition of high-risk pregnancies, notably those associated with anemia, prolonged labor, or previous uterine surgery. Improving antenatal screening programs with a focus on treatment of anemia has the potential to significantly reduce the severity of PPH. Considering that a high proportion of the patients were from rural areas, addressing the rural obstetric care infrastructure, referral in a timely manner, and availability of emergency obstetric services are paramount. In addition, reinforced application of rigid protocols of standardized management at all primary and secondary health centers have the potential to increase care uniformity and reduce preventable maternal complications.

Strengths and Limitations: One of the main strengths of this study is its prospective design that allowed for systematic data collection and close outcome assessment. The use of real-time hospital-based data also provides a useful insight into PPH management in the tertiary care setting of Bihar.

However, some limitations need to be considered, and the sample size of 90 cases is small and limits generalizability. The results of this study may not represent the underlying trends in other areas and regions as this was a single-center study. In addition, the 6-month interval may encompass seasonal or longer-term variations in obstetric trends.

Conclusion

PPH is one of the most common emergencies during the delivery of a pregnant woman. This study found that the cause of postpartum hemorrhage is most commonly uterine atony. Severe haemorrhage was associated with maternal anaemia and duration of labor as major risk factors. The results show that initial management of PPH with a protocol, which includes AMTSL, uterotonics and tranexamic acid, can be an effective strategy in reducing complications and the need for invasive surgical interventions. Antennal strengthening on screening for anemia and delivery point preparedness are crucial. Focused adherence to standardized management protocols for PPH at primary health centers, with strengthened interfacility referral systems, is needed to achieve further reductions in maternal morbidity and mortality. The findings need to be tested in larger multi-center studies to inform policy-level interventions.

Recommendation: AMTSL should be made mandatory, and antenatal care must strengthen routine screening and treatment of maternal anemia. Emergency PPH management training must be routinely provided to healthcare providers, including balloon tamponade. Moreover, functional blood bank facilities and timely availability of transfusion services at least in district & tertiary care level centres are the need of the time for improved maternal survival.

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