

A Prospective Observational Study on Incidence, Etiology, Maternal Risk Factors, Management and Outcomes of Postpartum Haemorrhage in a Tertiary Care Hospital

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ABSTRACT

Background: Postpartum haemorrhage (PPH) is the most life-threatening complication responsible for 140,000 death per year, 26.5% occurring in developing country like India. In India, PPH incidence is 2-4% following vaginal delivery and 6% following caesarean section. Despite advancements in obstetric care, PPH continues to present significant clinical challenges due to its unpredictable nature and rapid progression.

Objective: This study aims at evaluating the incidence, etiological factors, associated maternal risk factors, management modalities and maternal outcomes of PPH in a tertiary care hospital. **Methods:** This prospective observational study was conducted in the Department of Obstetrics and Gynaecology at Dr. Rajendra Prasad Government Medical College, Kangra at Tanda, Himachal Pradesh, from 4 April 2024 to 3 April 2025. All women who developed PPH after vaginal delivery or caesarean section and who consented to participate in the study were included. Data on demographics, causes of PPH, risk factors, management strategies (medical and surgical), and outcomes were analyzed using descriptive statistics.

Results: Among 7,687 deliveries, 100 cases developed PPH, yielding an incidence of 1.3%. The most common cause was uterine atony (39%), followed by trauma (17%), multifactorial causes (15%), retained placenta (10%), placenta previa/accreta (9%), and coagulation disorders (10%). Major risk factors included hypertensive disorders of pregnancy (12%), anaemia (10%), previous caesarean delivery (9%), postdated pregnancy (9%), and multifetal gestation (8%). Medical management formed the first line of treatment, with uterotonics used in all cases. Surgical interventions included cervicovaginal repair (33%), compression sutures (15%), arterial ligation (12%), balloon tamponade (10%), and hysterectomy (1%). Maternal outcomes showed that 78% required blood transfusion, 30% required ICU/HDU admission or resuscitative measures, 24% had prolonged hospital stay and 9% developed shock. No maternal deaths occurred during study.

Conclusion: PPH remains a major obstetric emergency requiring prompt diagnosis and a multidisciplinary approach. Identification of high-risk cases, early initiation of uterotonic

therapy, and timely escalation to surgical interventions are crucial to improving maternal outcomes. Strengthening antenatal care, early referral, and adherence to standardized PPH protocols can further reduce morbidity.

Keywords: Postpartum Hemorrhage, Previous CS, Incidence, Causes, Atonic PPH, HDP.

I. INTRODUCTION

Postpartum haemorrhage remains the leading cause of maternal mortality and morbidity worldwide, accounting for nearly one-quarter to one-third of all maternal deaths.¹ The World Health Organization (WHO) defines PPH as blood loss ≥ 500 mL after vaginal delivery or ≥ 1000 mL after caesarean section within 24 hours postpartum.² According to the World Health Organization, PPH accounts for approximately 27% of all maternal deaths worldwide, with an even higher burden in developing countries where limited resources, delayed referrals, and inadequate access to emergency obstetric care worsen outcomes.

Although the condition is often unpredictable, numerous antenatal, intrapartum, and postpartum factors can increase a woman's susceptibility. The causes are summarized by the "Four Ts": *Tone* (uterine atony), *Trauma* (genital tract lacerations), *Tissue* (retained products), and *Thrombin* (coagulopathies).³ Uterine atony accounts for about 75% of cases⁴ whereas risk factors include uterine overdistension, induction or augmentation of labor, hypertensive disorders, placenta previa, previous caesarean delivery, multiple pregnancy, fibroids, coagulopathy, and maternal comorbidities.⁵ Sociodemographic factors such as advanced maternal age, ethnicity, and anaemia also increase risk.⁶ Globally, an estimated 140,000 women die annually from PPH—approximately one every four minutes.⁷ In India, the incidence is 2–4% after vaginal delivery and 6% following caesarean section, contributing to about 26.5% of maternal deaths.^{8, 9} Most PPH-related deaths occur within 24 hours and are preventable through timely interventions and adequate resources.¹⁰ The "Three Delays" model explains poor outcomes: delay in deciding to seek care,

delay in reaching a facility, and delay in receiving appropriate treatment.¹¹

Early recognition and timely management are critically important. Evidence-based management includes preventive uterotonics, active management of the third stage of labor (AMTSL), rapid assessment of bleeding source, medical therapy with additional uterotonics, and surgical procedures where required.¹²

This study aims to analyse the incidence, causes, predisposing risk factors, management approaches, and maternal outcomes in women diagnosed with PPH. The findings will help guide future strategies toward improving maternal health-care services in the region.

II. METHODS

Study Design and Setting

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology at Dr. Rajendra Prasad Government Medical College, Kangra at Tanda, Himachal Pradesh. The study duration was one year, from 4 April 2024 to 3 April 2025. This study included all women who developed PPH following either vaginal or caesarean delivery during the study period were included. Women who experienced antepartum haemorrhage without postpartum bleeding and refused to participate were excluded. A total of 100 women with PPH were identified from 7,687 total deliveries.

Data Collection

Data were collected using a structured proforma from Emergency, Labor Room, Post-operative Ward, and ICU. Information included demographic characteristics such as maternal age, height, education, socioeconomic status, accessibility to health facility, and pre-pregnancy BMI. Obstetric details included method of conception, number of foetuses, parity, gestational age,

mode of delivery, duration of hospital stay. Relevant antepartum and intrapartum risk factors were also documented, including hypertensive disorders such as severe pre-eclampsia, coagulation disorders, macrosomia and other known determinants that increase the likelihood of PPH. The primary cause of PPH was classified according to standard obstetric definitions. Medical and surgical interventions comprised, use of blood products, interventional radiology, laparotomy, ICU admission, uterotonics, vasoactive drugs, intubation, ventilator or dialysis requirement. Maternal outcomes included development of DIC, shock, cardiac arrest, re-operation, hysterectomy, or mortality

Definitions Used

Postpartum haemorrhage is when blood loss ≥ 500 mL after vaginal delivery or $\geq 1,000$ mL after caesarean delivery. Primary PPH defined as PPH occurring within 24 hours of delivery whereas secondary PPH defined as

PPH occurring after 24 hours but within 6 weeks of delivery

Statistical Analysis and Ethical Considerations

Data analyzed using *Epi Info* and presented as frequencies and percentages. The study received approval from the Institutional Ethics Committee. Informed consent was obtained from all participants.

III. RESULTS

A total of 100 PPH cases were recorded among 7,687 deliveries, resulting in an incidence of 1.3%. Table 1 shows PPH was commonest in the age group of 25-34 years (56%). Highest number of cases 58% have '0' parity and 35% cases were unbooked. Most women (70%) belonging to rural backgrounds with maximum number (69%) of cases were seen between 37-40 weeks gestation age and belonging to normal BMI range. PPH was more commonly occurred among vaginal mode of delivery accounting for 48%.

Table 1. Baseline Demographic Profile of Study Participants (n = 100)

Variable	Category	n (%)
Age (years)	<25	16 (16.0%)
	25-34	56 (56.0%)
	≥ 35	28 (28.0%)
Parity	Primigravida	58 (58.0%)
	Multigravida	42 (42.0%)
Residence	Rural	70 (70.0%)
	Urban	30 (30.0%)
Booking Status	Unbooked	35 (35.0%)
	Booked	27 (27.0%)
	Booked elsewhere	39 (39.0%)
Gestational age	<37 weeks	22(22.0%)
	37-40 weeks	69(69.0%)
	>40 weeks	9(9.0%)
BMI	<18.5	9(9.0%)
	18.5-24.9	74(74.0%)
	25-29.9	10(10.0%)
	>30	7(7.0%)
Mode of Delivery	Vaginal Delivery	48 (48.0%)
	Caesarean Section	34 (34.0%)
	Instrumental Delivery	14(14.0%)
	VBAC	4(4.0%)

Table 2 shows uterine atony was the predominant cause (39%), followed by trauma (17%). Multifactorial cases accounted for 15%, and coagulation

disorders contributed to 10%. Retained placenta (10%) and placenta previa/accreta (9%) were additional causes.

The most common risk factors identified were hypertensive disorders of pregnancy (12%), anaemia (10%), previous caesarean delivery (9%) and postdated pregnancy (9%).

Table 2. Causes of PPH (n=100)

Cause	n (%)
Uterine atony	39 (39%)
Trauma (cervical, vaginal, perineal tear)	17 (17%)
Multifactorial (atony+trauma+coagulation disorder)	15 (15%)
Retained placenta tissue	10 (10%)
Thrombin (coagulation disorders)	10 (10%)
Placenta previa/accreta	9 (9%)

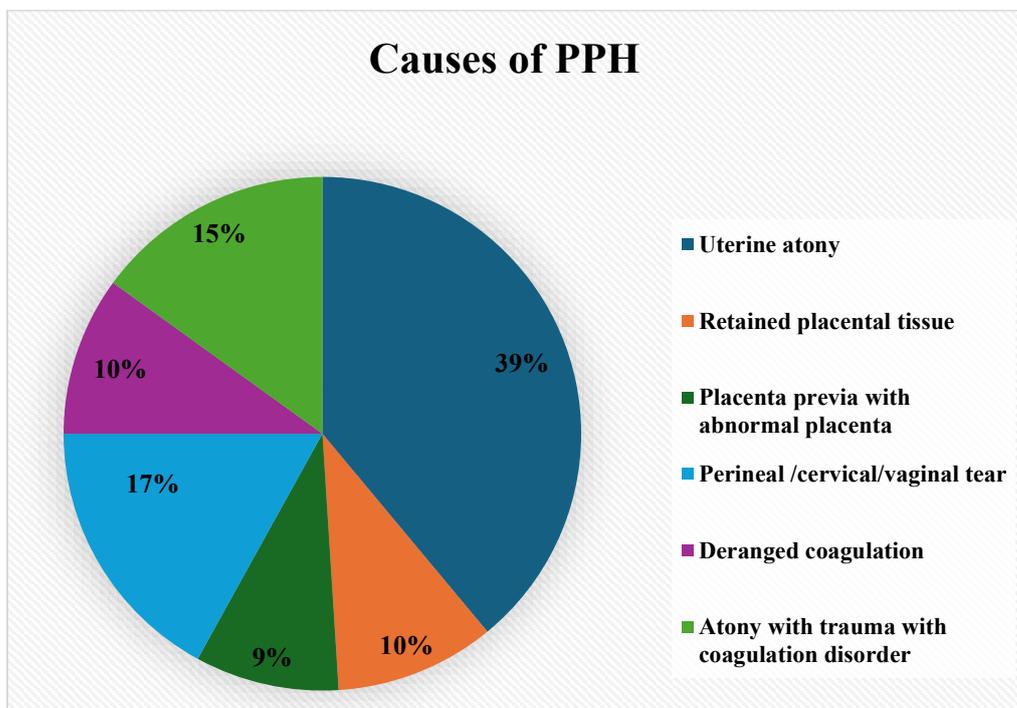


Figure 1: Causes of PPH.

Table 3. Associated Risk Factors for Postpartum Haemorrhage (n = 100)

Risk Factor	n (%)
Hypertensive disorders of pregnancy	12 (12%)
Anaemia (moderate/severe)	10 (10%)
Previous caesarean section	9 (9%)
Postdated pregnancy	9 (9%)
Multifetal gestation	9 (9%)
Antepartum haemorrhage with placenta previa/increta	8 (8%)
Previous h/o PPH	8 (8%)
Prolonged labor	8 (8%)
GDM with Macrosomia	7 (7%)
Obesity (>30kg/m ²)	7 (7%)
Anatomic (fibroid/unicornuate)	6 (6%)

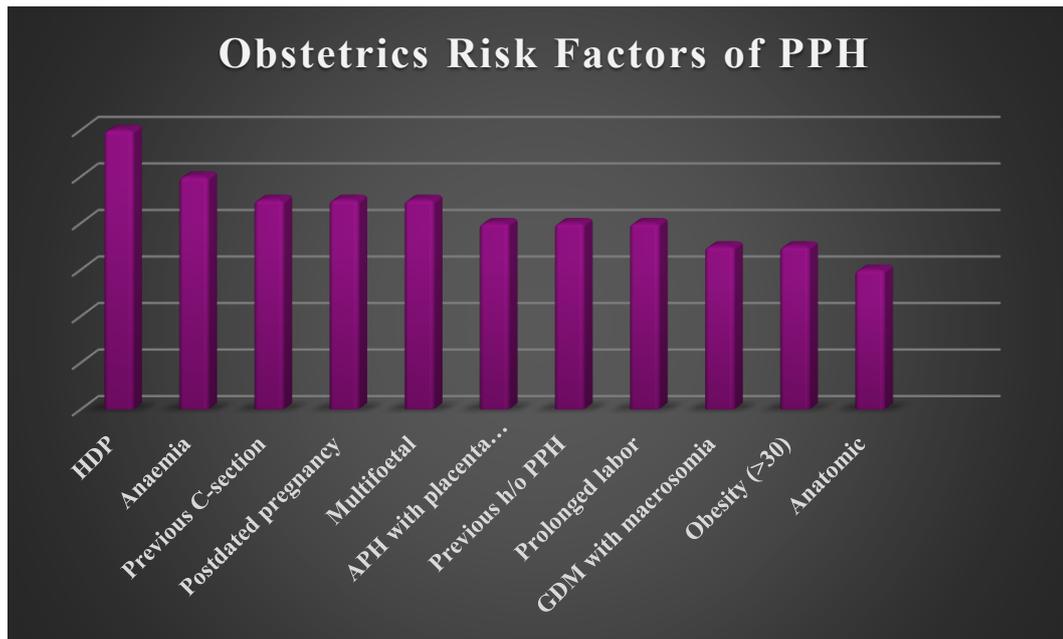


Figure 2: Obstetric risk factors of PPH.

Management included both medical and surgical interventions. All women received first-line uterotonics such as oxytocin. Second-line agents included carboprost, misoprostol, methergin and tranexamic acid used along with oxytocin and more than one management/ intervention was done in some cases. Surgical procedures were performed when medical therapy failed to control

haemorrhage and the most commonly done surgical intervention was cervicovaginal exploration with repair (33%). The most commonly observed maternal outcome among women with PPH was the requirement for blood transfusion (78%) followed by the need for ICU/HDU admission or resuscitative measures (30%).

Table 4. Medical Management Strategies (n = 100)

Intervention	n (%)
Oxytocin infusion	100 (100%)
Tranexamic acid	92 (92%)
Carboprost (PGF2 α)	80 (80%)
Misoprostol (rectal/oral)	46 (46%)
Methergine	35 (35%)

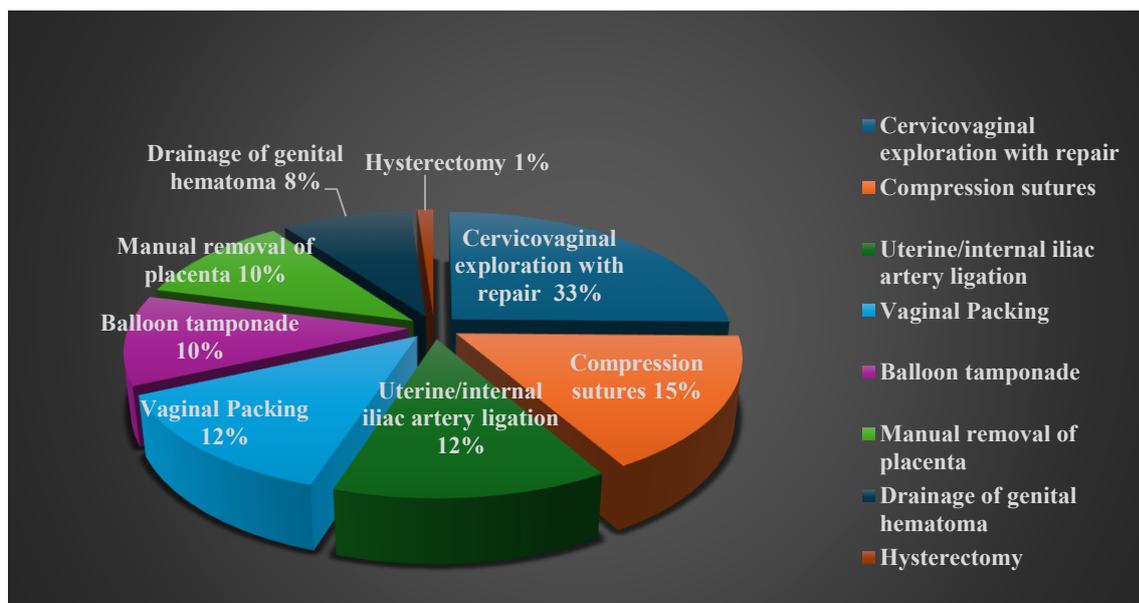


Figure 3. Surgical Management of PPH

Table 5. Maternal Outcomes of PPH

Outcome	n (%)
Blood transfusion requirement	78 (78%)
ICU/HDU admission	30 (30%)
Prolonged hospital stay (>7 days)	24 (24%)
Coagulation disorder	10 (10%)
Hypovolemic Shock	9 (9%)
Maternal death	0 (0%)

IV. DISCUSSION

This prospective study offers important insights into the incidence, etiological factors, risk determinants, management practices and outcomes of postpartum haemorrhage (PPH) in a tertiary care setting. The incidence of PPH was 1.3%, comparable to the 1.6% reported by Menezes RM et al.¹³ which is lower than national estimates of 2–6%. This difference likely reflecting efficient obstetric care, standardized protocols, and timely interventions. Regional variations may arise due to differences in patient demographics, referral loads, and availability of skilled intrapartum care.

Most affected women were aged 25–34 years, aligning with the findings of Gora K et al.¹⁴, indicating that PPH risk is not limited to extremes of maternal age but remains relevant during their peak reproductive years. A significant proportion belonged to rural areas (70%) and had unbooked pregnancies

(35%). Similar trends have been documented by Kamal S et al.¹⁵ who demonstrated significantly higher PPH-related morbidity among unbooked cases, highlighting gaps in antenatal care where risk factors such as anaemia, hypertensive disorders, or gestational diabetes may remain undetected. Uterine atony was the leading cause of PPH in our study (39%), consistent with global estimates indicating atony contributes to 60–80% of primary PPH cases. This finding aligns with RN Mjema et al.¹⁶ who reported atony in 25.6% of cases. Genital tract trauma was the second commonest cause (17%), comparable to the 16.3% reported by Gupta et al.¹⁷, highlighting the importance of skilled birth attendants and need for skilled intrapartum techniques.

Among maternal risk factors included hypertensive disorders (12%), anaemia (10%), previous caesarean section (9%), and multifetal pregnancy (9%) were

predominant. Similar trends have been reported by Nyflot et al.¹⁸ These conditions predispose women to PPH through various mechanisms such as impaired coagulation in preeclampsia or reduced physiological reserve in anaemic individuals.

Management primarily involved medical therapy, with universal administration of oxytocin and adjunctive use of tranexamic acid, carboprost, misoprostol, and methylergometrine. This reflects adherence to WHO-recommendations and AMTSL guidelines. Tasneem et al.¹⁹ and Girma et al.²⁰ reported 85% and 81% cases managed with uterotonics & combination. Surgical interventions were reserved for refractory cases, with cervicovaginal repair (33%), compression sutures (15%), uterine artery ligation (12%), and balloon tamponade (10%) being the most frequent. The low hysterectomy rate (1%) reflects effective stepwise escalation and availability of conservative surgical expertise. This distribution differs from Girma S et al.¹⁹ who reported lower rates of surgical repairs interventions.

Although 78% required blood transfusion and 30% required ICU/HDU care, no maternal mortality occurred during the study period. This favourable outcome indicates effective multidisciplinary care, early recognition and prompt intervention, consistent with global data demonstrating improved survival where standardized PPH bundles and rapid-response systems are implemented.¹² Despite declining incidence in well-resourced settings, PPH remains a major contributor to maternal morbidity. Strengthening antenatal care, early detection of high-risk pregnancies and ensuring immediate access to trained personnel and emergency interventions are essential to further reduce PPH-associated complications.

V. CONCLUSION

PPH continues to be a major obstetric emergency requiring rapid assessment and prompt multidisciplinary management. This study shows atonic PPH as the primary

cause, particularly among primigravida women. The high prevalence of unbooked patients and rural residence highlights gaps in antenatal care and access to timely interventions, contributing to severe outcomes like hypovolemic shock, ICU admissions and high transfusion rates.

Early identification of high-risk women, adherence to AMTSL, timely administration of uterotonics, and availability of trained personnel capable of performing surgical interventions are crucial for improving maternal outcomes. Regular emergency drills, improved antenatal detection of risk factors, and strengthening referral systems can further help reduce morbidity associated with PPH.

Declaration by Authors

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