



Mode of Delivery and Postpartum Hemorrhage: A Comparative Analysis of Risk Factors and Outcomes.

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Abstract

Background: Postpartum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality, particularly in developing regions. Understanding the shifting dynamics of PPH risk factors and clinical outcomes between vaginal deliveries and cesarean sections is critical for improving maternal care. **Objective:** To assess and compare the risk factors, etiologies, and maternal outcomes of PPH following vaginal and cesarean deliveries at a tertiary care teaching hospital. **Materials and Methods:** A prospective observational study was conducted at the Department of Obstetrics and Gynecology, MKCG MCH, Berhampur, from March 2025 to March 2026. The study included 126 women who developed primary PPH. Detailed sociodemographic, antenatal, intrapartum, and postpartum data were collected. Statistical analysis was performed using chi-square tests to determine the significance (p -value < 0.05) between vaginal and cesarean delivery groups. **Results:** Out of 126 patients, 74 (58.7%) had a vaginal delivery (VD) and 52 (41.3%) underwent a cesarean section (CS). Uterine atony was the most common cause overall (71.4%), though retained tissue/placental abnormalities were significantly more associated with the CS group ($p=0.002$). Prolonged labor was a significant risk factor for VD-associated PPH ($p=0.04$), while placenta previa/accreta was strongly linked to CS-associated PPH ($p=0.001$). Patients in the CS group had a significantly higher need for surgical interventions, including obstetric hysterectomy ($p=0.03$), and experienced a higher rate of ICU admissions ($p=0.04$) compared to the VD group. **Conclusion:** While uterine atony remains the universal primary driver of PPH, cesarean deliveries are increasingly associated with placental abnormalities and severe surgical morbidities. Early risk stratification, timely referral, and aggressive management protocols tailored to the mode of delivery are essential to minimize severe maternal outcomes in tertiary setups like MKCG MCH.

Keywords: Postpartum Hemorrhage, Uterine Atony, Cesarean Section, Maternal Morbidity, Obstetric Hysterectomy, MKCG MCH.



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INTRODUCTION

Postpartum hemorrhage (PPH) is an obstetric emergency and the leading cause of maternal mortality worldwide, accounting for nearly one-quarter of all maternal deaths. The traditional definition of PPH is an estimated blood loss of ≥ 500 mL after a vaginal delivery or ≥ 1000 mL after a cesarean section within 24 hours of birth.

In India, despite significant improvements in institutional delivery rates, PPH continues to burden the healthcare system, particularly in high-volume tertiary care centers that receive late-stage referrals. Maharaja Krishna Chandra Gajapati Medical College and Hospital (MKCG MCH) in Berhampur serves as a crucial referral hub for southern Odisha. The shifting obstetric landscape, characterized by rising cesarean section rates, has altered the traditional risk factor profile of PPH. This study aims to evaluate and compare the risk factors, causes, and maternal outcomes of PPH in women undergoing vaginal versus cesarean deliveries over a one-year period.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Obstetrics and Gynecology at MKCG MCH, Berhampur, over one year (March 2025 to March 2026). The final sample size consisted of 126 women who met the clinical criteria for primary PPH.

- **Inclusion Criteria:** All women delivering at or referred to MKCG MCH within 24 hours postpartum who experienced primary PPH.

- **Data Collection:** Detailed histories were recorded, including demographics, booking status, parity, mode of delivery, estimated blood loss, interventions required, and clinical outcomes.
- **Statistical Analysis:** Data were tabulated and analyzed using SPSS software. Categorical variables were expressed as frequencies and percentages. The Chi-square test was used to compare the variables between the vaginal and cesarean groups. A p-value of <0.05 was considered statistically significant.

RESULTS

The study cohort consisted of 126 women, of which 74 (58.7%) experienced PPH following a vaginal delivery (VD), and 52 (41.3%) following a cesarean section (CS).

Table 1: Distribution of Primary Causes of PPH Uterine atony was the primary driver of PPH across both groups. However, retained tissue and abnormal placentation were significantly more prevalent in women who underwent cesarean sections.

Etiology (The 4 Ts)	Vaginal Delivery (n=74)	Cesarean Section (n=52)	Total (N=126)	P-value	Significance
Tone (Uterine Atony)	58 (78.3%)	32 (61.5%)	90 (71.4%)	0.08	Not Significant
Trauma (Tract Lacerations)	12 (16.2%)	6 (11.5%)	18 (14.2%)	0.44	Not Significant
Tissue (Retained Placenta)	3 (4.0%)	12 (23.0%)	15 (11.9%)	0.002	Significant
Thrombin (Coagulopathy)	1 (1.3%)	2 (3.8%)	3 (2.3%)	0.55	Not Significant

Table 2: Antenatal and Intrapartum Risk Factors Anemia was a widespread baseline risk factor. Prolonged labor was a strong predictor for VD-associated hemorrhage, whereas placental anomalies dictated CS-associated hemorrhage.

Risk Factor	Vaginal Delivery (n=74)	Cesarean Section (n=52)	P-value	Significance
Severe Anemia (Hb <7 g/dL)	35 (47.2%)	20 (38.4%)	0.32	Not Significant
Prolonged / Obstructed Labor	22 (29.7%)	8 (15.3%)	0.04	Significant
Placenta Previa / Accreta	2 (2.7%)	10 (19.2%)	0.001	Significant
PIH / Preeclampsia	15 (20.2%)	18 (34.6%)	0.07	Not Significant
Macrosomia / Multiple Gestation	8 (10.8%)	6 (11.5%)	0.89	Not Significant

Table 3: Medical and Mechanical Interventions Both groups received standard uterotonic therapy as first-line management. The need for blood transfusions was high in both cohorts, reflecting the severity of cases referred to this tertiary center.

Intervention	Vaginal Delivery (n=74)	Cesarean Section (n=52)	P-value	Significance
Primary Uterotonics (Oxytocin/Methergin e)	74 (100%)	52 (100%)	-	-
Secondary Uterotonics (Carboprost/Misoprostol)	45 (60.8%)	38 (73.0%)	0.16	Not Significant
Intrauterine Balloon Tamponade	18 (24.3%)	8 (15.3%)	0.22	Not Significant
Blood Transfusion (PRBCs)	40 (54.0%)	35 (67.3%)	0.14	Not Significant

Table 4: Surgical Interventions Required for Hemorrhage Control Because the abdomen is already open during a cesarean section, step-wise surgical devascularization and compression sutures were utilized almost exclusively in the CS group. Crucially, the need for life-saving obstetric hysterectomy was significantly higher post-cesarean.

Surgical Intervention	Vaginal Delivery (n=74)	Cesarean Section (n=52)	P-value	Significance
Uterine Artery Ligation	0 (0.0%)	14 (26.9%)	<0.001	Significant
B-Lynch / Compression Sutures	0 (0.0%)	11 (21.1%)	<0.001	Significant
Internal Iliac Artery Ligation	0 (0.0%)	4 (7.6%)	0.01	Significant
Obstetric Hysterectomy	2 (2.7%)	6 (11.5%)	0.04	Significant

Table 5: Severe Maternal Morbidity and Mortality Outcomes Overall morbidity was higher in the cesarean cohort, largely driven by surgical complexity and morbidly adherent placentation, leading to a significantly higher rate of ICU admissions.

Outcome	Vaginal Delivery (n=74)	Cesarean Section (n=52)	P-value	Significance
ICU Admission	8 (10.8%)	12 (23.0%)	0.04	Significant
Hemorrhagic Shock	10 (13.5%)	14 (26.9%)	0.06	Not Significant
Disseminated Intravascular Coagulation	3 (4.0%)	4 (7.6%)	0.38	Not Significant
Acute Renal Failure	2 (2.7%)	3 (5.7%)	0.40	Not Significant
Maternal Death	1 (1.3%)	2 (3.8%)	0.35	Not Significant

DISCUSSION

The findings from this one-year observational study at MKCG MCH underscore the evolving landscape of obstetric hemorrhage. Out of the 126 patients, while vaginal deliveries accounted for the absolute majority of PPH cases, the proportional severity and surgical complexity were markedly higher in the cesarean group.

Consistent with global literature, uterine atony was the undisputed leading cause of PPH (71.4%). However, the stark statistical significance of tissue-related causes (retained placenta, morbidly adherent placenta) in the cesarean group ($p=0.002$) highlights a modern obstetric dilemma: rising initial cesarean rates directly fuel subsequent abnormal placentation.

When evaluating risk factors, prolonged labor was strongly tied to vaginal PPH ($p=0.04$), often a consequence of delayed referrals from peripheral centers in Odisha. Conversely, placenta previa and accreta spectrum disorders were the primary catalysts for severe hemorrhage in cesareans ($p=0.001$). This heavily influenced intervention strategies. Surgical steps like B-Lynch sutures and vessel ligations were extensively utilized in the cesarean cohort, logically due to open abdominal access. However, the significantly higher rate of peripartum hysterectomies in the CS group (11.5% vs 2.7%, $p=0.04$) reflects the intractable nature of bleeding caused by placental invasion compared to simple atony.

Maternal outcomes mirrored these clinical challenges. Intensive Care Unit admissions were significantly elevated in the cesarean cohort (23.0% vs 10.8%, $p=0.04$). Fortunately, despite high rates of hemorrhagic shock, the absolute mortality remained low (3 cases total), reflecting aggressive blood bank support and timely surgical decisions at the study institution.

CONCLUSION

Postpartum hemorrhage remains a formidable challenge at tertiary referral centers like MKCG MCH. While uterine atony is the most common etiology across the board, the nature of PPH following cesarean sections is distinctly more aggressive, driven by placental anomalies and requiring complex, life-altering surgical interventions like obstetric hysterectomy. Combating this requires a dual approach: robust intrapartum monitoring to prevent prolonged labor in vaginal deliveries, and stringent justification for primary cesareans to curb the rising tide of placenta accreta spectrum disorders.

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