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ASSOCIATION BETWEEN MATERNAL ANEMIA AND PREGNANCY OUTCOMES: AN ANALYTICAL CROSS-SECTIONAL STUDY

Obstetrics & Gynaecology

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ABSTRACT

Introduction: Maternal and neonatal complications contribute significantly to morbidity and mortality in India. This study evaluates the association between maternal and neonatal conditions with varying severity levels. **Methods:** A observational study analyzing maternal and neonatal health conditions using odds ratios (OR) and confidence intervals (CI) to assess severity-related risks. **Results:** Severe cases of postpartum hemorrhage (OR: 11.36), low birth weight (OR: 4.24), small-for-gestational-age infants (OR: 3.33), and perinatal deaths (OR: 8.78) had significantly higher odds than normal/mild cases. **Conclusion:** The study findings indicate a significantly higher risk of adverse outcomes in severe cases, with perinatal deaths and postpartum hemorrhage showing the highest odds. Early identification and intervention are crucial to improving maternal and neonatal health outcomes.

KEYWORDS

Maternal health, neonatal outcomes, postpartum hemorrhage, low birth weight, perinatal mortality

INTRODUCTION

Anemia during pregnancy is a significant public health concern in India. According to the National Family Health Survey (NFHS-5) conducted between 2019 and 2021, approximately 52.2% of pregnant women aged 15 to 49 years were found to be anemic (1). This prevalence varies across different states, with higher rates observed in regions such as Ladakh (78.1%), Bihar (63.1%), Gujarat (62.6%), West Bengal (62.3%), and Odisha (61.8%) (1). Further analysis indicates that anemia is more prevalent among adolescent pregnant women (61.5%), those with no formal education (59.2%), individuals belonging to the lowest wealth quintile (61.9%), and members of scheduled tribes (59.3%) (2). Additionally, lifestyle factors such as smoking, tobacco use, or alcohol consumption are associated with a higher prevalence of anemia (63.0%) (2). These findings underscore the need for targeted interventions to address anemia among pregnant women in India, focusing on education, socioeconomic support, and lifestyle modifications (3).

The infant mortality rate (IMR) in India has been on a declining trend over the past decades. According to the World Bank, the IMR decreased from 37 deaths per 1,000 live births in 2015 to 30 per 1,000 live births in 2019 (4). Further estimates suggest that by 2022, the IMR had declined to approximately 25.5 deaths per 1,000 live births (5). It's important to note that these figures can vary based on the source and methodology used. For instance, the United Nations Inter-agency Group for Child Mortality Estimation reported an IMR of 28 per 1,000 live births for India in 2019 (6).

Anemia, defined as a low hemoglobin level, is a prevalent condition among pregnant women, particularly in low- and middle-income countries. It is commonly caused by iron deficiency but can also result from poor nutrition, infections, or chronic diseases (7). Maternal anemia is associated with poor pregnancy outcomes, including preterm birth, low birth weight, and neonatal mortality (8). PPH, defined as blood loss greater than 500 mL following vaginal delivery or 1000 mL after cesarean delivery, is a leading cause of maternal mortality (9). Anemia exacerbates the risk of severe outcomes in PPH due to the diminished ability of the body to compensate for blood loss (10). Studies have shown that anemic mothers are at higher risk of prolonged bleeding during labor, which further compromises maternal and neonatal survival (11). Maternal anemia during pregnancy indirectly contributes to infant mortality. It increases the risk of preterm birth, low birth weight, and impaired fetal development, all of which are key predictors of infant death (12). Additionally, maternal anemia linked to PPH further endangers neonatal survival by increasing maternal morbidity and mortality, affecting breastfeeding, and contributing to a lack of maternal care for newborns (13). The objectives of this study were to examine the association between maternal anemia and PPH, low birth weight, small-for-gestational-age babies, and perinatal death.

MATERIAL AND METHODS:

This study was an analytical cross-sectional study conducted in the Obstetrics and Gynecology (OBGY) department. Women admitted for labor were assessed for their hemoglobin (Hb) status and classified into normal, mild, moderate, and severe anemia categories. The study included 500 patients whose outcomes were analyzed based on their anemia status.

Women admitted for labor in the OBGY department were included in the study. Ethical approval was obtained from the Institutional Ethics Committee (IEC), and written informed consent was taken from all participants before their inclusion in the study.

Pregnant women who were admitted for labor in the Obstetrics and Gynecology department, had documented hemoglobin (Hb) levels before delivery, and provided written informed consent were included in the study. Only those who delivered within the study center were eligible. Women with incomplete medical records, those transferred to other centers before delivery, or those with a history of severe illnesses that could have interfered with pregnancy outcomes— Hypertensive disorders, metabolic and endocrine disorders, infectious diseases, autoimmune and hematological disorders, compromised renal, cardiac, respiratory or hepatic disorders, neurological and psychiatric conditions, were excluded.

Statistical Analysis

The primary outcomes analyzed included Postpartum hemorrhage (PPH), Small-for-gestational-age fetus, Low birth weight, Perinatal mortality. Comparisons between maternal and neonatal outcomes were conducted based on the Hb status before delivery. Descriptive statistics were used to summarize baseline characteristics. Categorical variables were analyzed using chi-square tests, and continuous variables were compared using t-tests or ANOVA, as appropriate. A p-value of <0.05 was considered statistically significant.

RESULTS

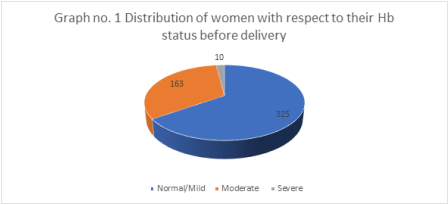

Table 1: Distribution of Maternal and Infant Characteristics

Characteristic	Severity of Anaemia		
	Normal/Mild (n=325)	Moderate (n=163)	Severe (n=10)
Maternal age <20	50 (10.0%)	20 (4.0%)	2 (0.4%)
Maternal age 20-25	180 (36.1%)	90 (18.1%)	5 (1.0%)
Maternal age 26-30	70 (14.1%)	40 (8.0%)	2 (0.4%)
Maternal age ≥30	25 (5.0%)	13 (2.6%)	1 (0.2%)
BMI Underweight	80 (16.1%)	40 (8.0%)	3 (0.6%)
BMI Normal	150 (30.1%)	80 (16.1%)	5 (1.0%)
BMI Overweight	40 (8.0%)	20 (4.0%)	1 (0.2%)
BMI Obese	55 (11.0%)	23 (4.6%)	1 (0.2%)
Parity Nulliparous	90 (18.1%)	45 (9.0%)	3 (0.6%)
Parity Multiparous	235 (47.2%)	118 (23.7%)	7 (1.4%)
History of anaemia during last pregnancy	120 (24.1%)	60 (12.0%)	5 (1.0%)
Belongs to BPL household	160 (32.1%)	75 (15.1%)	8 (1.6%)
Area of residence - Rural	290 (58.2%)	145 (29.1%)	9 (1.8%)
Area of residence - Urban	35 (7.0%)	18 (3.6%)	1 (0.2%)
Mode of delivery - Spontaneous vaginal	160 (32.1%)	105 (21.1%)	7 (1.4%)
Mode of delivery - Emergency C-section	165 (33.1%)	58 (11.6%)	3 (0.6%)

Table 2: Association Between Maternal Anaemia and Maternal/ Infant Outcomes

Condition	Severity	Present	Absent	Odds Ratio (95% CI)
PPH	Normal/Mild	7	318	1 (reference)
	Moderate	6	157	1.74 (0.57 – 5.25)
	Severe	2	8	11.36 (2.03 – 63.49)
Low Birth Weight	Normal/Mild	85	240	1 (reference)
	Moderate	49	114	1.21 (0.80 – 1.84)
	Severe	6	4	4.24 (1.17 – 15.37)
Small-for-Gestational Age	Normal/Mild	134	191	1 (reference)
	Moderate	81	82	1.41 (0.96 – 2.06)
	Severe	7	3	3.33 (0.84 – 13.09)
Perinatal Deaths	Normal/Mild	9	316	1 (reference)
	Moderate	5	158	1.11 (0.37 – 3.37)
	Severe	2	8	8.78 (1.63 – 47.34)

RESULTS:

The study analyzed the association between different maternal and neonatal conditions and their severity levels using odds ratios (OR) and 95% confidence intervals (CI). Postpartum hemorrhage (PPH) showed a significantly higher risk in severe cases (OR: 11.36, CI: 2.03–63.49) compared to normal/mild cases. Low birth weight had an increased risk in severe cases (OR: 4.24, CI: 1.17–15.37). Small-for-gestational-age infants had a higher risk in severe cases (OR: 3.33, CI: 0.84–13.09). Perinatal deaths exhibited the highest odds in severe cases (OR: 8.78, CI: 1.63–47.34). These findings highlight the need for early identification and intervention to mitigate adverse outcomes.

DISCUSSION:

The primary objective of this study was to evaluate the association between maternal and neonatal conditions with varying severity levels. The findings align with previous studies emphasizing the significance of early detection and intervention in high-risk pregnancies. Studies indicate that severe PPH is a major contributor to maternal morbidity and mortality, necessitating timely obstetric care [14]. Low birth weight is a known predictor of neonatal mortality and long-term developmental issues [15]. The increased odds of perinatal deaths in severe cases highlight the critical need for intensive monitoring and neonatal support [16].

PPH is a leading cause of maternal mortality in India, contributing significantly to maternal deaths, particularly in rural areas. The significant increase in odds for severe PPH cases in our study underscores the necessity of adequate obstetric preparedness, including active management of the third stage of labor and timely administration of uterotonic agents. A study by Kumar et al. [17] confirmed that inadequate management of PPH leads to hemorrhagic shock, multi-organ failure, and death. Interventions such as early administration of tranexamic acid and improved blood transfusion protocols can significantly reduce morbidity rates. The risk of severe PPH can also be reduced by identifying predisposing factors such as anemia, uterine atony, and hypertensive disorders during antenatal care.

Low birth weight remains a major concern in India, with significant regional variations. Recent data suggest that maternal malnutrition, anemia, and inadequate prenatal care are key contributing factors [18]. Addressing maternal nutritional deficiencies through government programs like the POSHAN Abhiyaan and improving antenatal care services can help mitigate these risks. Future research should focus on evaluating the effectiveness of these interventions in reducing low birth weight prevalence.

Small-for-gestational-age (SGA) infants are another vulnerable group requiring extensive monitoring. The increased odds for severe cases suggest that maternal factors such as hypertensive disorders, gestational diabetes, and inadequate nutrition play a crucial role in fetal growth restriction. A recent Indian study [19] emphasized that SGA infants have higher perinatal morbidity and mortality, making early detection essential. Strategies such as Doppler ultrasound assessment and maternal lifestyle modifications have shown promise in reducing complications.

Perinatal deaths remain a significant issue, with our findings highlighting the highest odds in severe cases. High perinatal mortality rates in India are linked to poor maternal health, inadequate intrapartum care, and limited neonatal resuscitation efforts [20]. Strengthening healthcare infrastructure, ensuring skilled birth attendants, and enhancing neonatal intensive care facilities, particularly in low-resource settings, are critical steps in improving perinatal survival rates.

In conclusion, our study highlights the importance of early detection and timely intervention in mitigating adverse maternal and neonatal outcomes in India. Future research should explore region-specific strategies to improve maternal and neonatal care outcomes through targeted interventions and policy implementation.

CONCLUSION:

The study findings indicate a significantly higher risk of adverse outcomes in severe cases of postpartum hemorrhage, low birth weight, small-for-gestational-age infants, and perinatal deaths compared to normal/mild cases. Perinatal deaths exhibited the highest odds, followed by severe postpartum hemorrhage. These results emphasize the need for early identification of high-risk pregnancies to prevent complications.

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