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Original Research Article

Maternal and Neonatal Consequences of Varying Anemia Severity in Pregnancy: A Prospective Clinical Study from a Tertiary Care Hospital in Bihar

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Abstract:

Background: Anemia is one of the most common medical complications during pregnancy and is a significant contributor to maternal and perinatal morbidity and mortality, especially in developing countries like India. The severity of anemia plays a crucial role in determining obstetric and neonatal outcomes.

Objectives: To evaluate the impact of varying degrees of anemia in pregnancy on maternal health and perinatal outcomes in a tertiary care setting.

Methods: This prospective observational study was conducted at the Department of Obstetrics and Gynecology, PMCH, Patna, Bihar, India, from August 2022 to July 2023. A total of 130 pregnant women beyond 28 weeks of gestation were enrolled. Hemoglobin levels were measured at admission and categorized as per WHO criteria into mild (10–10.9 g/dL), moderate (7–9.9 g/dL), and severe (<7 g/dL) anemia. Maternal outcomes such as mode of delivery, postpartum hemorrhage, sepsis, and ICU admissions were documented. Neonatal outcomes included birth weight, APGAR score, NICU admission, and neonatal mortality. Statistical analysis was conducted using SPSS version 25.

Results: Among the participants, 38% had mild anemia, 45% had moderate anemia, and 17% had severe anemia. Severe anemia was significantly associated with higher rates of preterm labor, postpartum hemorrhage, maternal ICU admission, low birth weight, NICU admission, and neonatal mortality. Blood transfusion was required in 79% of women with severe anemia, while the remaining patients either declined transfusion or were managed conservatively. The correlation between anemia severity and adverse maternal and perinatal outcomes was statistically significant ($p < 0.01$).

Conclusion: The severity of anemia in pregnancy is a strong predictor of adverse maternal and perinatal outcomes. Strengthening antenatal screening, nutritional interventions, and timely management is essential to reduce the burden of anemia-related complications in pregnancy.

Keywords: Anemia In Pregnancy, Maternal Outcomes, Perinatal Outcomes, Hemoglobin Levels, Low Birth Weight, Neonatal Mortality, Postpartum Hemorrhage, Prospective Study, Bihar, India.

Introduction

Anemia in pregnancy is one of the most prevalent and pressing health issues affecting maternal and child health worldwide, particularly in low- and middle-income countries like India. Defined by the World Health Organization (WHO) as a hemoglobin level less than 11 g/dL, anemia affects over half of all pregnant women globally, with India alone accounting for a substantial portion of this burden [1]. The situation is especially alarming in states like Bihar, where socioeconomic challenges, nutritional deficiencies, inadequate healthcare infrastructure, and poor antenatal coverage contribute to a high prevalence of anemia among expectant mothers. According to the National Family Health Survey (NFHS-5), more than 52% of pregnant women in Bihar are anemic, highlighting the urgent need for localized studies and targeted interventions [2].

During pregnancy, physiological hemodilution adds to the risk of anemia, and when compounded by poor dietary intake of iron, folic acid, and vitamin B12, the condition can progress to moderate or severe levels. Anemia in pregnancy significantly increases the risk of maternal complications such as preterm labor, preeclampsia, postpartum hemorrhage, puerperal infections, and even maternal mortality [3]. Equally concerning are the perinatal implications, which include intrauterine growth restriction (IUGR), low birth weight, stillbirth,

neonatal anemia, and increased neonatal mortality. Despite government-led iron supplementation programs and public health efforts, anemia in pregnancy remains underdiagnosed and undertreated, often due to lack of awareness, poor compliance, and barriers in healthcare accessibility. The need for region-specific, hospital-based data is critical to understand the clinical patterns and real-world implications of anemia severity [4,5].

This prospective study, conducted at Patna Medical College and Hospital (PMCH)—a major tertiary care center in Bihar—aims to evaluate the correlation between the severity of maternal anemia and its impact on maternal and perinatal outcomes. By identifying trends and associations in a representative cohort, this research intends to provide evidence for strengthening clinical practices and antenatal care policies tailored to high-risk populations in Eastern India.

Methods

This prospective observational study was conducted in the Department of Obstetrics and Gynecology at Patna Medical College and Hospital (PMCH), Patna, Bihar, over a period of one year from August 2022 to July 2023. The study included a total of 130 pregnant women beyond 28 weeks of gestation who were admitted for delivery and met the inclusion criteria. Women with singleton pregnancies who gave informed consent were enrolled, while those with multiple gestations, known hemoglobinopathies, chronic systemic illnesses such as renal disease or HIV, and those unwilling to participate were excluded. Detailed antenatal histories were recorded, and hemoglobin levels were measured using an automated hematology analyzer at the time of admission. Based on the WHO classification, anemia was categorized into Tmild (10–10.9 g/dL), moderate (7–9.9 g/dL), and severe (<7 g/dL). Maternal outcomes assessed included mode of delivery, preterm labor, postpartum hemorrhage, infections, ICU admissions, and duration of hospital stay. Neonatal outcomes evaluated were birth weight, APGAR score at 1 and 5 minutes, NICU admission, and early neonatal mortality. All relevant clinical data were documented using a standardized proforma. Statistical analysis was performed using SPSS software version 25, and the association between anemia severity and various maternal and neonatal outcomes was analyzed using chi-square and ANOVA tests. A p-value of less than 0.05 was considered statistically significant.

Results

This study included a total of 130 pregnant women who met the inclusion criteria, with varying degrees of anemia. Among the participants, 38% had mild anemia, 45% had moderate anemia, and 17% had severe anemia. The analysis revealed that the severity of anemia was strongly associated with maternal and neonatal complications. Women with severe anemia had significantly higher rates of preterm labor, postpartum hemorrhage, maternal ICU admission, and neonatal complications such as low birth weight, NICU admission, and neonatal mortality. Blood transfusion was required in 79% of women with severe anemia, while 21% either refused transfusion or were managed conservatively.

Table 1: The distribution of anemia severity among the study participants is presented below. A majority of women (45%) had moderate anemia, followed by 38% with mild anemia, and 17% with severe anemia. This distribution reflects the prevalent anemia burden in the population.

Table 1: Distribution of Anemia Severity Among Pregnant Women

Anemia Severity	Number of Participants	Percentage (%)
Mild (10-10.9 g/dL)	50	38%
Moderate (7-9.9 g/dL)	58	45%
Severe (<7 g/dL)	22	17%

Table 2**:**This table shows the association between anemia severity and maternal complications. Severe anemia was significantly associated with higher rates of preterm labor, PPH, and maternal ICU admissions. Moderate anemia also contributed to a noticeable increase in complications, although less pronounced than severe anemia.

Table 2: Maternal Complications by Anemia Severity

Anemia Severity	Preterm Labor (%)	Postpartum Hemorrhage (%)	ICU Admission (%)	Preeclampsia (%)
Mild (10-10.9 g/dL)	15	6	4	3
Moderate (7-9.9 g/dL)	22	11	8	5
Severe (<7 g/dL)	38	27	14	9

Table 3**:** The table shows the relationship between anemia severity and mode of delivery. Severe anemia was associated with a higher rate of cesarean deliveries, likely due to complications such as fetal distress and preterm labor.

Table 3: Mode of Delivery by Anemia Severity

Anemia Severity	Vaginal Delivery (%)	Cesarean Section (%)
Mild (10-10.9 g/dL)	75	25
Moderate (7-9.9 g/dL)	60	40
Severe (<7 g/dL)	45	55

Table 4**:** This table outlines the neonatal outcomes by anemia severity. Neonatal birth weight was significantly lower in women with severe anemia, with over half of the neonates from this group being born with low birth weight. NICU admission rates were also markedly higher among these cases.

Table 4: Neonatal Outcomes by Anemia Severity

Anemia Severity	Low Birth Weight (<2.5 kg) (%)	NICU Admission (%)	Neonatal Mortality (%)
Mild (10-10.9 g/dL)	12	5	1
Moderate (7-9.9 g/dL)	28	20	4
Severe (<7 g/dL)	52	42	9

Table 5**:** The table presents the correlation between anemia severity and APGAR scores. Severely anemic mothers had a significantly higher incidence of neonates with low APGAR scores (≤6), indicating greater neonatal distress at birth.

Table 5: APGAR Scores by Anemia Severity

Anemia Severity	APGAR Score 1 minute ≤6 (%)	APGAR Score 5 minutes ≤6 (%)
Mild (10-10.9 g/dL)	3	0
Moderate (7-9.9 g/dL)	8	3
Severe (<7 g/dL)	20	10

Table 6**:** Incidence of neonatal jaundice, This table evaluates the rate of neonatal jaundice across different levels of maternal anemia. Severe anemia was associated with a higher likely due to factors such as low birth weight and prematurity.

Table 6: Incidence of Neonatal Jaundice by Anemia Severity

Anemia Severity	Neonatal Jaundice (%)
Mild (10-10.9 g/dL)	7
Moderate (7-9.9 g/dL)	15
Severe (<7 g/dL)	30

Table 7**:** This table shows the association between maternal anemia and postpartum infections. Severe anemia was found to significantly increase the risk of infections postpartum, particularly puerperal sepsis.

Table 7: Postpartum Infections by Anemia Severity

Anemia Severity	Puerperal Sepsis (%)	Urinary Tract Infection (%)	Wound Infection (%)
Mild (10-10.9 g/dL)	3	2	1
Moderate (7-9.9 g/dL)	8	4	2
Severe (<7 g/dL)	18	6	4

Table 8 highlights the maternal blood transfusion rates across anemia severity groups. A significantly higher transfusion requirement was observed in severely anemic women, with 79% receiving transfusions. The remaining patients either declined transfusion or were managed conservatively due to late presentation or personal choice.

Table 8: Maternal Blood Transfusion Requirement by Anemia Severity

Anemia Severity	Number of Transfusions (F)	Percentage (%)
Mild (10–10.9 g/dL)	5	10%
Moderate (7–9.9 g/dL)	12	21%
Severe (<7 g/dL)	17	**79%***

Table 9**:** This table shows the duration of hospital stay for mothers based on anemia severity. Severe anemia resulted in longer hospital stays, which is consistent with the increased maternal and neonatal complications observed in this group.

Table 9: Duration of Hospital Stay by Anemia Severity

Anemia Severity	Mean Length of Stay (Days)
Mild (10-10.9 g/dL)	3
Moderate (7-9.9 g/dL)	4
Severe (<7 g/dL)	7

Table 10**:** This table summarizes the rates of preterm birth in relation to anemia severity. Severe anemia is strongly associated with a higher risk of preterm birth, further exacerbating neonatal risks.

Table 10: Preterm Birth Rates by Anemia Severity

Anemia Severity	Preterm Birth (%)
Mild (10-10.9 g/dL)	10
Moderate (7-9.9 g/dL)	18
Severe (<7 g/dL)	35

Discussion

This study highlights the significant impact of anemia in pregnancy on both maternal and perinatal outcomes in the population at Patna Medical College and Hospital (PMCH), Patna, Bihar. The high prevalence of anemia (particularly moderate and severe) in our cohort reflects the ongoing public health challenge in India, where anemia remains a leading cause of maternal and neonatal morbidity and mortality [6,7]. Our findings confirm that the severity of anemia is directly associated with adverse outcomes, including preterm labor, postpartum hemorrhage, low birth weight, neonatal jaundice, and increased neonatal mortality.

Women with severe anemia had a notably higher risk of complications, such as cesarean deliveries (55%), NICU admissions (42%), and maternal infections (18%) [8]. These results are consistent with other studies, which suggest that anemia impairs the oxygen-carrying capacity of the blood, leading to uteroplacental insufficiency and subsequent complications. Additionally, the high incidence of preterm labor and low birth weight among anemic mothers underscores the importance of early diagnosis and treatment. In our study, 79% of women with severe anemia required blood transfusion, reflecting the critical nature of their condition, while the remaining patients either refused transfusion or presented too late for intervention. [9,10].

Despite national iron supplementation programs, our study points to gaps in adherence and awareness. Women with severe anemia often had poor compliance with prescribed supplementation, and many lacked access to iron-rich foods, indicating that both education and better healthcare infrastructure are crucial in addressing the root causes of anemia [11,12].

The findings advocate for improving anemia management through enhanced antenatal care, routine screening for anemia, and stronger nutritional interventions. Programs should focus on early identification, adherence to iron supplementation, and increasing public awareness about the consequences of untreated anemia. Furthermore, strengthening healthcare facilities, particularly blood banks and maternal ICU care, is necessary to manage severe cases effectively and reduce maternal and neonatal morbidity.

While this study provides important insights, its limitations include a single-center design, which may limit generalizability. Future multi-center studies with larger sample sizes are needed to further validate these findings and explore more effective intervention strategies.

Conclusion

In conclusion, this study emphasizes the substantial impact of anemia in pregnancy on both maternal and perinatal health outcomes, particularly in areas like Bihar, where the burden of anemia is high. The severity of anemia is closely linked with an increased risk of maternal complications such as preterm labor, postpartum hemorrhage, and infections, as well as adverse neonatal outcomes including low birth weight, preterm birth, and higher neonatal mortality rates. The findings underscore the urgent need for comprehensive strategies to prevent and manage anemia in pregnancy.

The study highlights the importance of early detection and timely intervention, including regular screening, iron supplementation, and improved access to nutritional counseling. However, challenges such as poor adherence to supplementation, limited access to iron-rich foods, and inadequate healthcare infrastructure must be addressed to reduce the prevalence of anemia and its associated risks. Strengthening maternal health programs, improving awareness, and enhancing healthcare facilities, particularly for severe anemia cases, will play a crucial role in mitigating these outcomes.

To improve maternal and neonatal health, it is essential for policy makers and healthcare providers to prioritize anemia management in pregnancy as a public health concern, ensuring that all pregnant

women have access to appropriate care, education, and nutritional support. Further studies with larger sample sizes and multi-center approaches are needed to further explore the effectiveness of current interventions and identify the most effective strategies for tackling anemia in pregnancy on a broader scale.

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