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Impact Of Maternal Anaemia On Pregnancy: A Prospective Observational Study

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Abstract: **Background and Objectives**-Maternal anaemia during pregnancy, defined as haemoglobin (Hb) levels <11 g/dL, adversely impacts maternal and fetal health. It is a prevalent condition in both developing and industrialized nations, with iron deficiency as the leading cause. Multiparity, short inter-pregnancy intervals, and physiological haemodilution during pregnancy further exacerbate the risk. This study aims to assess maternal and perinatal outcomes associated with anaemia during pregnancy.

Methods- This Prospective Observational study was conducted over 18 months (November 2024–May 2025) in a tertiary care center in Madhya Pradesh. A total of 100 antenatal women with Hb<11 g/dL were enrolled based on predefined inclusion and exclusion criteria. Participants underwent detailed history taking, physical and systemic examinations, and serial investigations, including serum ferritin and complete blood counts, over four antenatal visits. Standard prophylactic and therapeutic iron and folic acid supplementation were provided. Maternal and neonatal outcomes were recorded, including haemoglobin trends, infection history, comorbidities, postpartum hemorrhage (PPH), NICU admissions, and lengths of stay.

Results- The mean age of participants was 25.2 ± 3.05 years, with a gestational age of 13.9 ± 4.6 weeks at the first visit. Multiparous women comprised 63% of the study population. Haemoglobin levels showed an initial decline from 9.3 ± 1.2 g/dL at <14 weeks to 8.4 ± 1.2 g/dL at 14–32 weeks, followed by improvement to 10.0 ± 0.9 g/dL by the final visit. Infections peaked during 14–32 weeks, with 12% having urinary tract infections and 10% having multiple infections. Pre-eclampsia was the most frequent comorbidity, rising to 28% by the last visit. NICU admissions were primarily due to mild asphyxia (44%) and low birth weight. PPH occurred in 54% of cases, with 14% requiring medical management for severe PPH. The mean neonatal and maternal lengths of stay were 4.4 ± 2.0 days and 6.1 ± 1.9 days, respectively.

Conclusions- Anaemia during pregnancy is associated with significant maternal and perinatal morbidity. Early detection, timely iron supplementation, and adequate antenatal care can improve outcomes. Strategies to address nutritional deficiencies, inter-pregnancy intervals, and infection control are essential in managing anaemia and mitigating its adverse effects on pregnancy

Index Terms - Anaemia, pregnancy, maternal outcomes, perinatal outcomes, iron deficiency, multiparity, postpartum hemorrhage, NICU admissions.

INTRODUCTION

Maternal anaemia during pregnancy, defined by the World Health Organization as haemoglobin (Hb) concentration <11 g/dl, bodes poorly to the mother and the fetus. The adverse effects depend upon the severity and duration of anaemia and the stage of gestation. Women with chronic mild anaemia, where anemia is well compensated, may go through pregnancy and labour without any adverse consequences. Maternal morbidity and mortality increase with worsening severity of anaemia. More than 40% of all pregnant women experience anaemia in both developing and industrialised countries.[1,2]

The most common cause of anaemia during pregnancy is iron deficiency, which is also the most widespread nutritional deficiency, especially in developing countries. Apart from iron deficiency, anaemia during pregnancy is also associated with deficiencies of key nutrients (e.g. folic acid, vitamin A and vitamin B12), parasitic diseases (malaria, hookworm infections, schistosomiasis), and infections (HIV/AIDS, tuberculosis). Several studies have demonstrated that multiparity, that is having given birth previously, is associated with an increased risk of anaemia during pregnancy [3,4]. Short inter-pregnancy intervals in multiparous women further increase the risk of anaemia during pregnancy (based on a comparison of intervals of <6 months to 18–23 months). This has been attributed to a reduction in serum ferritin concentrations during early pregnancy among multiparous women; in nulliparous women, serum ferritin concentrations only become deficient at a much later stage.

The reduction in Hb concentrations associated with pregnancy is partially due to physiological haemodilution: the plasma volume increases by 50% during pregnancy, but the red blood cell mass increases only by 35%.[5] Pregnancy increases the need for iron, which is required to meet this increased demand for plasma volume and red blood cell mass, and to enable adequate growth of the placenta and fetus in the uterus. The maximum reduction in Hb concentration usually occurs during the first 20 weeks of gestation, after which levels plateau until the 30th week and then increase slightly until the 36th week.[6]

A systematic review and meta-analysis indicated that anaemia (defined as Hb concentration <10 g/dL to <11.5 g/dL) during pregnancy is associated with an increased likelihood of low birthweight (LBW <2500 g) and preterm birth (<37 weeks of gestation), and suggested that iron consumption during pregnancy reduces the risk of anaemia and iron deficiency anaemia, while also increasing the birthweight of the offspring.[7]

RESEARCH METHODOLOGY

It was a Prospective Observational study conducted for a period of 18 MONTHS (NOVEMEBER 2024 to MAY 2025) among 100 Antenatal women with Hb< 11g/dl.

Inclusion criteria:

- Antenatal women willing for the study and to do relevant investigations.
- Gestational age < 36 weeks
- Hb value < 11 g/dl
- Primi and Multigravida

Exclusion criteria:

- History of bleeding disorders/ coagulation disorders
- History of malignancies
- Active liver disorders
- History of renal disorders
- History of drug intake causing aplastic anemia
- History of seizure disorder
- History of Smoking and alcohol consumption
- Antenatal women with COPD

Methodology-

This is a Prospective Observational study including 100 Cases of Anemia complicating pregnancy admitted in our institute including all emergency as well as registered cases. Patients included in this study came from various socio-economic classes and had different level of education. Each patient was asked for detailed history. A careful general physical examination and systemic examination were carried out in all the patients. The information pertaining to the study Number of visits, Nutritional status, past history of bleeding disorders, Malignancies, H/o blood transfusion in previous pregnancy (if any) were noted. All routine and specific investigations like serum ferritin were done.

Patients were followed up by 4 visits. History taking, general examination, systemic examination, routine investigations along with peripheral smear and Serum Ferritin were done in the 1st visit to know the baseline state. Complete Blood Count with platelet, S. Ferritin and peripheral smear was done and recorded. Then complete blood count was repeated at 2ND, 3RD and 4th visit. S. Ferritin and Peripheral smear was repeated in 34 weeks. The final visit was when she was admitted for delivery. History, General examination, and systemic examination were repeated in every visit. Gestational age was estimated by considering the last menstrual period, an ultrasound dating scan and the symphysis-fundalheight measurement on clinical examination.

All women received prophylactic iron therapy (oral ferrous sulfate 200 mg) and folic acid5mg daily. If anemia was present, then therapeutic doses of iron (oral ferrous sulfate 200mg thrice daily and folate 5mg daily) were prescribed together with information on appropriate dietary intake. This management is a standard clinical practice at the study site.

Then in the Post natal period a detailed history about gestational period at birth, Birth weight of the baby, H/o post-partum hemorrhage or any post natal complications were noted and recorded.

Statistical Analysis-

Once the data was collected, they were compiled in Microsoft excel and analysed in SPSS (Statistical package for social sciences) version 26.

RESULTS

Table 1-DISTRIBUTION OF AGE AND GESTATIONAL AGE AT THE FIRST OPD VISIT AMONG THE STUDY POPULATION

	N	Mean	SD	Range
Age in years	100	25.2	3.052	20 - 32
Gestational age (weeks) at first visit to OPD	100	13.9	4.6	7.6 - 32.7

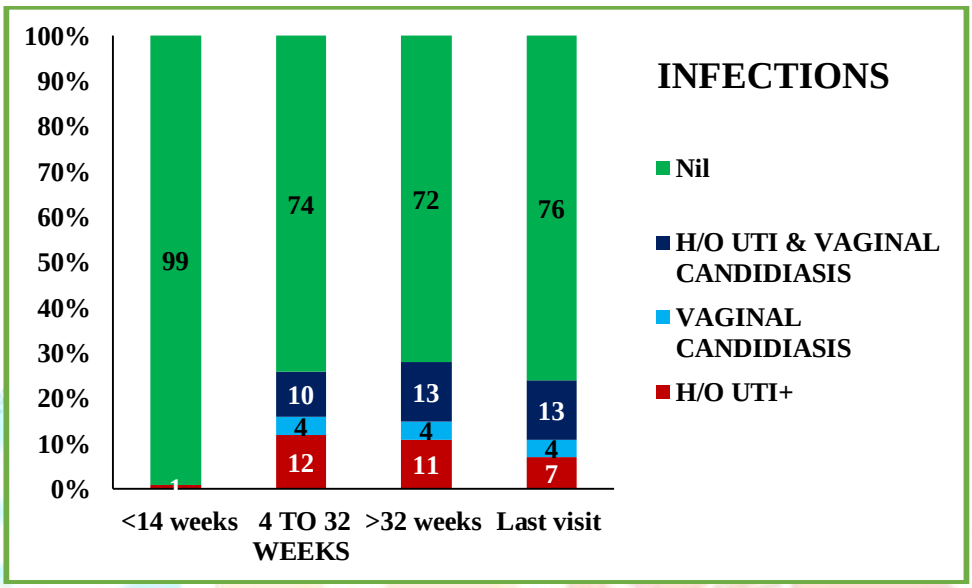
The mean age of the mothers was 25.2 years with a standard deviation of 3.052, ranging from 20 to 32 years. The mean gestational age at the first OPD visit was 13.9 weeks with a standard deviation of 4.6, ranging from 7.6 to 32.7 week. In terms of parity, 37% were primiparous and 63% were multiparous. This data provides a demographic overview of the study population.

Table 2- DISTRIBUTION OF HAEMOGLOBIN LEVELS AT DIFFERENT STAGES OF PREGNANCY IN THE STUDY POPULATION

	N	Haemoglobin	
		Mean	SD
At <14 weeks	98	9.3	1.2
At 14 TO 32 WEEKS	99	8.4	1.2
>32 weeks	100	9.2	1.0
Last visit	100	10.0	0.9

Haemoglobin levels were also tracked throughout the pregnancy. At less than 14 weeks, the mean haemoglobin level was 9.3 g/dL with a standard deviation of 1.2. Between 14 to 32 weeks, the mean level dropped to 8.4 g/dL with the same standard deviation. However, by greater than 32 weeks, the mean haemoglobin level rose to 9.2 g/dL with a standard deviation of 1.0, and at the last visit, it further increased to 10.0 g/dL with a standard deviation of 0.9. This trend suggests that while there was an initial decline in haemoglobin levels, they eventually improved, possibly due to medical interventions.

Figure 1- DISTRIBUTION OF TYPES OF INFECTIONS DURING ANTENATAL PERIOD AMONG THE STUDY POPULATION



The history of infections varied across different stages. At less than 14 weeks, only 1% had a history of UTI. Between 14 to 32 weeks, 12% had a history of UTI, 4% had vaginal candidiasis, and 10% had both. Greater than 32 weeks saw 11% with a history of UTI, 4% with vaginal candidiasis, and 13% with both. At the last visit, 7% had a history of UTI, 4% had vaginal candidiasis, and 13% had both.This data suggests that infections were more prevalent in the middle stages of pregnancy.

Table 3- DISTRIBUTION OF PRESENCE OF COMORBIDITIES DURING ANTENATAL PERIOD AMONG THE STUDY POPULATION

NEW ONSET COMORBIDITIES	<14 weeks	14 TO 32 WEEKS	>32 weeks	Last visit
GDM	0	0	1	1
GHTN	0	4	9	2
PRE ECLAMPSIA	0	2	13	28
NIL	100	94	77	69
Total	100	100	100	100

New onset comorbidities were tracked throughout the pregnancy. At less than 14 weeks, no new comorbidities were observed. Between 4 to 32 weeks, 4% had gestational hypertension (GHTN) and 2% had pre-eclampsia. Greater than 32 weeks saw 9% with GHTN and 13% with pre-eclampsia. At the last visit, 1% had gestational diabetes mellitus (GDM), 2% had GHTN, and 28% had pre-eclampsia.This indicates an increasing trend of pre-eclampsia as the pregnancy progressed.

Table 4- DISTRIBUTION OF INDICATION FOR NICU ADMISSIONS FOR THE FOETUSES AMONG THE STUDY POPULATION

Indication for NICU admission	Frequency	Percent
ELEVATED BILIRUBIN	1	1
MILD BIRTH ASPHYXIA	1	1
RESPIRATORY DISTRESS AND ELEVATED BILIRUBIN	1	1
ELEVATED BILIRUBIN	1	1
I/V/O LOW BIRTH WEIGHT AND MODERATE ASPHYXIA	1	1
I/V/O LOW BIRTH WEIGHT AND RESPIRATORY DISTRESS	1	1
I/V/O LOW BIRTH WEIGHT WITH ASPHYXIA	1	1
LOW BIRTH WEIGHT, MILD ASPHYXIA	6	6
LOW BIRTH WEIGHT, MODERATE ASPHYXIA	8	8
MILD ASPHYXIA	44	44
MODERATE ASPHYXIA	11	11
SEVERE ASPHYXIA	3	3
NIL	21	21
Total	100	100

Elevated bilirubin accounts for 1% of admissions. Both mild birth asphyxia and respiratory distress combined with elevated bilirubin are also responsible for 1% each. Admissions due to low birth weight and moderate asphyxia, as well as low birth weight with respiratory distress, each make up 1%. Another 1% is attributed to low birth weight accompanied by asphyxia. Low birth weight combined with mild asphyxia constitutes 6% of the cases, while low birth weight with moderate asphyxia represents 8%. Mild asphyxia is the most common reason, accounting for 44% of admissions. Moderate asphyxia is responsible for 11%, and severe asphyxia for 3%. Notably, 21% of the cases had no specified indication for NICU admission.

Table 5-DISTRIBUTION OF POST PARTUM HAEMORRHAGE AMONG THE STUDY POPULATION

H/O PPH	Frequency	Percent
Nil	46	46
MILD	40	40
SEVERE PPH MANAGED BY MEDICAL METHODS	14	14
Total	100	100

Postpartum haemorrhage was observed in varying degrees. 46% of mothers had no PPH, 40% had mild PPH, and 14% had severe PPH managed by medical methods. This data underscores the need for effective management strategies to handle PPH, a significant cause of maternal morbidity.

Table 6-DISTRIBUTION OF NEONATAL AND MATERNAL LENGTH OF STAY AMONG THE STUDY POPULATION

	N	Mean	SD	Range
Neonatal stay length in days	79	4.4	2.0	1 - 10
Length of stay in days	100	6.1	1.9	0 - 10

The mean neonatal stay length was 4.4 days with a standard deviation of 2.0, ranging from 1 to 10 days. The mean maternal length of stay was 6.1 days with a standard deviation of 1.9, ranging from 0 to 10 days. These lengths of stay reflect the need for extended care in cases of maternal anaemia.

DISCUSSION

This was a Prospective Observational study done on 100 antenatal women with anemia complicating pregnancy in a tertiary care center in Madhya Pradesh. As per the analysis the aim of this study was to understand the maternal and perinatal mortality and morbidity associated with this condition. The patients were observed over 4 antenatal visits and following delivery their delivery details, post natal data and neonatal data was also collected and analysed. As per the present study in this institution anemia complicating pregnancy was common in the age ranging from 20 to 32 years with a mean age of 25.2 (SD-3.052). Their booking visit in this institution ranged between 7.6 weeks to 32.7 weeks with mean gestational week being 13.9 weeks having a standard deviation of 4.6. Out of this though, 93% of women belonged to <30 age group hinting that anemia complicating pregnancy exist more in younger age group which could be attributed to inadequate nutrition or awareness regarding proper nutrition during pregnancy.

In this study 63% of the women affected by anemia were multiparous while only 37% of the women were primigravida. This is more compared to the study by IbtihalABukhariet al where they found 50.2% of women with anemia complicating pregnancy were multiparous. This could be due to lowinterpregnancy interval which will reduce the iron stores and make women more predisposed to anemia, lower awareness regarding nutrition during pregnancy and inadequate nutrition[8]. Out of this, 24% of the patients with decreased serum ferritin had hemoglobin> 10 g/dl who later in their 4th visit improved their hemoglobin to >11g/dl with double dose oral iron supplementation. This indicates that serum ferritin can help in early diagnosis and prevention of anemia in pregnancy which is especially important in NAID (non anemic iron deficiency). This was more than the study done byLindsey M. Lockset al in which they found 21% of women had ID and anemia while only 19% ID in the absence of anemia. This could be due to the smaller sample size[9].

Antenatal complications were recorded in every visit. Out of that one of the common complications were UTI and vaginal infections. Between 14 to 32 weeks, 12% had a history of UTI, 4% had vaginal candidiasis, and 10% had both. While >32 weeks, 11% had a history of UTI, 4% with vaginal candidiasis, and 13% with both. At the last visit, 7% had a history of UTI, 4% had vaginal candidiasis, and 13% had both % had both. This coincides with prevalence of anaemia in antenatal woman which peaked in second trimester. So, this shows a positive association between history of infections like UTI, vaginal infections and anaemia complicating pregnancy. This was somewhat than the prevalence seen in study done by Lekshmi Balachandran et al in which they got a prevalence of 15% pregnant women having UTI.[10]

Out of the 100 babies of the antenatal women, the mean birth weight was 2.3 kg with a standard deviation of 0.4 ranging from 1.6 to 3.6 kg. Out of this 61% of the babies had a weight <2500gm and 39% of the babies had birth weight > 2500gm. According to Biswas (Biswas et al., 2019), there is a significant risk of low birth weight newborns due to maternal anemia. From both the studies we can infer that anemia complicating pregnancy predispose the babies to having lower birth weight. Correction of anemia at the right time can prevent this.[11] Delivery of the baby ranged between 34 to 39 weeks with a mean gestational age of delivery at 37.3 weeks with a standard deviation of 1.2. In this study we can see that most of the deliveries were either in late preterm or early term. This was similar to the study done by Najam et al as in their study they found 17.4% babies were born before 37 weeks of gestation while 82% were term babies [12].

Out of the hundred babies 79% of the babies required NICU admission. This indicates the importance of making sure that anemic antenatal women's delivery should be conducted in a tertiary care center with adequate neonatal care and neonatal intensive care unit. Out of this the most common indication for NICU admission was mild asphyxia (44%), 17% of NICU admission were due to low birth weight. Only 1% was due to hyperbilirubinemia.

Among these antenatal women in this study, 54% of the women developed PPH out of which 40% of the women had developed mild PPH while 14% had developed severe PPH which was managed with medical methods. None of the cases required surgical measures to control PPH. This was less than the finding seen in the study done by Parks et al in which they had 84.4% of mothers had developed PPH of varying severity. This difference could be attributed to the additional measures that had been taken in the third stage of labour to avoid PPH. Both the studies indicate the importance of anticipating PPH in anemic mothers so that adequate measures can be taken [13].

The mean neonatal stay length was 4.4 days with a standard deviation of 2.0, ranging from 1 to 10 days. The mean maternal length of stay was 6.1 days with a standard deviation of 1.9, ranging from 0 to 10 days. This indicates that anaemia complicating pregnancy is an important comorbidity that can cause prolonged hospitalisation.

These findings give us an important idea about how to provide antenatal, intrapartum and postpartum care for women with anaemia complicating pregnancy. This is particularly important in a developing country like India where the prevalence of anaemia is high owing to the low socioeconomic status of the patients and inadequate nutrition.

CONCLUSION

This study has found out that anemia complicating pregnancy is associated with higher risk of developing hypertensive disorders, infections like vaginal candidiasis and UTI during the antenatal period. So starting low dose aspirin in the presence of anaemia complicating pregnancy can prevent the development of pre-eclampsia. Good hygiene should be practiced in mothers with anemia so as to prevent infections. In case of infections, it should be treated with antibiotics or antifungal treatment to prevent sepsis.When it comes to perinatal morbidity the most common adverse outcome seen were low birth weight and mild asphyxia. There is a higher risk of NICU admission for infants of anemic mothers therefore the delivery of anemic mothers should be done in a centre with good neonatal intensive care. This study can help us be more vigilant about the adverse outcomes in one of the most common but still dangerous comorbidity in pregnancy.

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