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Maternal anemia and its impact on neonatal outcome: A retrospective study at a tertiary care teaching hospital

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Abstract

Maternal anemia is a very common problem in country like India. The prevalence of it is around 56%. As per WHO guidelines maternal anemia is defined as hemoglobin concentration $<11\text{g/dl}$. It results many complications like Post-partum hemorrhage, sepsis, PIH & death. This study is designed to look at the outcomes of neonates born to mother with anemia. The objective of this study is to find the impact of maternal anemia on neonatal outcome. This is a retrospective study conducted in IMS & SUM Hospital, Bhubaneswar. The study period was 6 months (01.02.2019-30.07.2019). In this study period, baseline data of the mothers admitted to Obstetrics units were collected. Total 370 mothers were enrolled. Participants in study were divided into 2 groups-maternal anemia or no anemia. Mothers with APH, anemia due to acute blood loss & multiple gestation were excluded. Immediate neonatal outcomes (NICU admission due to any reason, small for gestational age) of the neonates born to these mothers were documented from neonatal unit at IMS and SUM Hospital. Need of NICU admission was significantly high for neonates born to anemic mothers as compared to neonates born to nonanemic mothers (53.8% vs 18.5%, RD-35.3%, 95% CI: [34.1, 36.5], P value <0.001). On regression analysis after adjusting with gestational age and birth weight, for every 1gm/dl decrease of hemoglobin in mother, the risk of NICU admissions has increased by 39%. Our study suggests that low maternal hemoglobin increases NICU admissions and its severity further increases its number and other complications.

Keywords: Maternal anemia, neonatal outcome, hemoglobin, APH

Introduction

Anemia during pregnancy is a very common problem in developing countries like India. Most of the time it is nutritional in origin due to low socioeconomic status of the people. WHO & CDC defines anemia as hemoglobin (Hb) concentration $\leq 11\text{g/dl}$. Compared to developed countries where anemia incidence is 12%, in developing countries it is 43%. Incidence of anemia in India is 88%. 20% of maternal death is directly or indirectly related to low Hb level. Malnutrition, poor socio-economic status, parity, lack of education, worm infestation, lack of regular antenatal care, genetic disorder like SCD, heavy menstrual blood flow & closely spaced pregnancies are few common causes of anemia. Maternal anemia results in so much complications like PPH, preeclampsia, infection, increased maternal mortality & morbidity, subsequently increasing the risk of poor neonatal outcome.

Iron deficiency anemia during pregnancy is a known risk factor for preterm birth, low birth weight and small for gestational age babies [1] and increases the risk of postpartum hemorrhage (PPH) [2]. PPH is the leading cause of maternal mortality in India [3]. The incidence of PPH is much higher in India compared with the rest of the world and the Registrar General of India attributes this to the high prevalence of anemia among pregnant women [4]. A study investigating the causes of neonatal deaths among the tea garden laborers in Assam reported a high prevalence of low birth weight (43%) and preterm deliveries (34%) in the study population, contributing to more than 90% of the neonatal deaths [5]. While untreated iron deficiency anemia can itself lead to adverse outcomes, its negative effects may be aggravated by the presence of other risk factors such as infections during pregnancy like malaria [6], urinary tract infection (UTI) [7], helminthic infections [8]. Additionally, studies have suggested that induction of labour is associated with increased risk of PPH [9, 10]. There is variation in data from different studies on maternal Hb & adverse neonatal outcome. The aim of this study here is to look for impact of maternal anemia on neonatal outcome in

Tertiary Care Centre like IMS & SUM Hospital, Bhubaneswar.

Material and Methods

The study was conducted in tertiary health care centre, IMS & SUM Hospital, Bhubaneswar, Odisha. Relevant information were retrieved from medical case files from the Department of Obstetrics And Gynecology, IMS and SUM hospital for the duration of 6 months from January to June 2019. All pregnant women with singleton pregnancy were included in the study. Those with APH, anemia due to acute blood loss & multiple gestations were excluded. Neonatal parameters such as Birth wt, Gestational age at the time of delivery and neonatal outcomes (SGA, all NICU admission due to any cause within first three days) were recorded.

Gestational Age was estimated based on 1st day of Last Menstrual period. SGA was defined using Fentons growth chart (Birth weight <10th centile for that gestation). Preterm delivery was defined as delivery after 24wks & before 37 completed wks of gestation. IUD was defined as fetus without cardiac activity confirmed by USG after 24wks of pregnancy. Perinatal mortality includes both late fetal deaths (Still birth) & early neonatal deaths lasting from 20thwks of Gestation to 7th day after birth. APGAR score was recorded based on HR, Colour, Muscle tone & appearance of the baby. Neonates with Birth wt<2.5kg were defined as LBW baby. All the information regarding Gestational age, complications at delivery (LSCS, Obstructed labor, PPH, Preeclampsia, Premature delivery), neonatal outcomes (Birth Wt, Apgar score, SGA, NICU admission, Intrapartum death) were recorded. Department of Neonatology of the hospital has a uniform policy of admission for gestation less than 35 weeks and/or birth weight less than 1800gram. In addition to it, neonates were admitted to NICU on clinician’s discretion with documentation of any medical or surgical indication for it.

All the data were entered into Microsoft Excel 10.0 & analyzed in SPSS trial version 18. Descriptive statistics such as mean, percentage & tests of significance like Chi-Square test were used & the statistical significance level was fixed at *P*< 0.05.

Result

Total 370 pregnant mothers were enrolled in this study. 197 of them were anemic and 173 were nonanemic. Table 1, shows the demographic characteristics. Mean age of mothers in non-anemic group was 26.93yr and in anemic group was 27.30yr. Mean gestational age at delivery in non-anemic group was 37.42wk and 34.94wk in anemic group. Mean (SD) birth weight of babies in non-anemic group was 2811.11gms and in anemic group it was 2288.59gms. Similarly, median (IQR) APGAR scores at 1 and 5 min in non-anemic group were 8 (8, 8) and 9 (9, 9) while it was 8 (4, 8) and 9 (6, 9) in anemic group respectively.

Anemia is more prevalent in educated mothers compared to illiterate mother and it is more prevalent in nuclear family compared to joint family. Also we got primipara mothers

were more anemic than multipara mothers. The working status of mother data suggests that employed mothers were more anemic than unemployed mothers. Again cesarean sections were not significantly increased in women with anemia compared to non-anemic mothers.

According to table 2, more than half (106/197, 53.8%) of the neonates born to mothers with anemia required admission to NICU as against 18.5% (32/173) neonates born to mothers without anemia (RD- 35.3%, 95% CI- 34.1% - 36.5%, *P* value <0.001) which is statistically significant. 22% of babies born to non-anemic mothers were SGA compared to 27.4% in anemic mothers which is statistically insignificant.

Univariate analysis showed that significantly high risk of preterm delivery (RR: 3.32, 95% CI: 2.31-4.77), low birth weight baby (RR: 2.5, 95% CI: 1.86-3.36) and NICU admission (RR: 2.49, 95% CI: 1.76-3.53) was associated with presence of anemia in expectant mothers. On regression analysis after adjusting with gestational age and birth weight, for every 1gm% decrease of hemoglobin in mother, there was 39% (95% CI: 16.3-45.9) increase in risk of NICU admissions in the study population.

Table 1: Demographic characteristics of anemic group and nonanemic group

Demographic factors	Non-Anemic Group (n=173)	Anemic Group (n=197)	P value
Maternal Characteristics			
Maternal Age (yrs), Mean (SD)	26.93 (3.76)	27.30 (4.51)	0.398
Education level, n(%)			
Illiterate	5 (2.9)	52 (26.4)	<0.001
Primary education	55 (31.8)	65 (33)	
Graduation	113 (65.3)	80 (40.6)	
Family, n(%)			
Nuclear	64 (37)	114 (57.9)	<0.001
Joint	109 (63)	83 (42.1)	
Gravida Status, n(%)			
Primipara	106 (61.3)	101 (57.9)	0.053
Multipara	67 (38.7)	96 (48.7)	
Employment status, n(%)			
House wife	129 (74.6)	68 (34.5)	<0.001
Employed	44 (25.4)	129 (65.5)	
Neonatal Characteristics			
Gestational age at delivery (wks), Mean (SD)	37.42 (1.98)	34.94 (3.89)	<0.001
Birth weight (gms), Mean (SD)	2811.11 (601.3)	2288.59 (782.5)	<0.001
Gender, n(%)			
Male	101 (58.4)	96 (48.7)	0.063
Female	72 (41.6)	101 (51.3)	
Mode of Delivery, n(%)			
Vaginal delivery	87 (50.3)	91 (46.2)	0.431
Cesarean section	86 (49.7)	106 (53.8)	
APGAR at 1 min, Median (IQR)	8 (8,8)	8 (4, 8)	<0.001
APGAR at 5 min, Median (IQR)	9 (9,9)	9 (6, 9)	<0.001

Table 2: Comparison of Neonatal Outcomes among the anemic and nonanemic group

Parameters	Non-anemic group (n=173)	Anemic group (n=197)	P value
NICU Admission, n (%)	32 (18.5)	91 (34.5)	<0.001
Weight for gestation, n(%)			
SGA	38 (22)	54 (27.4)	0.235
AGA	132 (76.3)	136 (69)	

LGA	3 (1.7)	7 (3.6)	
Prematurity, n(%)			
Preterm	28 (16.1)	106 (53.8)	<0.001
Term	145 (83.8)	91 (46.1)	
Low Birth Weight, n(%)	40 (23.1)	114 (57.8)	<0.001
SGA: Small for Gestational Age, AGA: Appropriate for Gestational Age			
LGA: Large for Gestational Age			

Discussion

Anemia in pregnancy is a worldwide phenomenon but particularly more prevalent and severe in the developing countries [11]. In India, there is high prevalence of anemia among non-pregnant population and they start pregnancy in anemic state which is further aggravated by increased requirements of pregnancy and blood loss at delivery. Infections in the antenatal and postnatal periods and early advent of next pregnancy perpetuate it. Maternal anemia has been found to be associated with higher maternal mortality and morbidity and adverse perinatal outcome [12, 13].

Some studies have also demonstrated differences in outcomes between iron deficiency and physiological anemia of pregnancy [14]. The risk of prematurity and LBW is higher in anemic women. In populations in which the rate of anemia is low among non-pregnant women, the primary cause of anaemia during pregnancy is likely to be plasma volume expansion, and this anaemia is not associated with negative birth outcomes [15]. As it is estimated that about 7.3 million perinatal deaths occur annually in the world, most of these in developing countries especially Asia [16], one could assume many of these could be prevented by correcting maternal anaemia. Prematurity and birth asphyxia are the main causes of perinatal deaths in India. In the studied population, prematurity was the leading cause of perinatal death but less frequent than in other hospitals in India [17], indicating poor resuscitation facilities and neonatal care in the country. Severe anaemia (<8 g/dl) is associated with birth weight values that are 200-400 g lower than in women with higher (>10 g/dl) haemoglobin values, but these researchers generally have not excluded other factors that might also have contributed to both LBW and the severity of anaemia [18].

In our study the majority of the women (40.6% in the anemia group and 65.3% in the non-anemic group) had attended graduation. Most studies including the study by Ahmed *et al*, anemia is more prevalent in poor, uneducated population [19]. However our results suggested that maternal anemia is more common in educated and working women. As we recruited our subjects admitted to a tertiary hospital in capital city of the state, probability of enrollment of educated women remains high. We also found that mothers belonging to nuclear family were more anemic than joint family. Again maternal health benefit schemes by Government also probably reduced the incidence of anemia in poor and uneducated people. The reason might be due to the busy schedule of educated working mothers who couldn't able to take care of their diet.

Studies have reported increased incidence of prematurity, LBW, low Apgar score associated with maternal anemia. Results of this study has also similar findings. In our study, the NICU admission was higher in neonates delivered to anemic mothers which is in accordance to the published literature [20, 21]. This again highlights the fact that maternal anemia is one of the independent risk factors for postnatal morbidities in the neonate. After adjustment for gestational

age and LBW, there was 39% increase in NICU admissions for every 1gm% decrease in maternal hemoglobin. Targeting maternal anemia can be a strategical step to improve both MMR and NMR.

Fetal nutrition is dependent upon sufficiency of both macro and micronutrients in mother. Anemia, predominantly iron deficiency anemia has been implicated in poor fetal growth and resultant low birth weight babies [22, 23]. Findings of this cohort is also unison with this fact with half of the neonates born to anemic mothers being low birth weight baby. Poor growth and poor weight lower the chance of tolerating the labor process and risk of perinatal depression is high. Poor Apgar score at 1 minute and 5 minute both indicate the poor reserve in these neonates.

Good sample size enrollment and use of predefined case definitions are the strength of the study. Single center cohort and retrospective nature of the study remain as its limitation. Furthermore, the effect of anemia and its severity on morbidity and mortality in neonatal period should be studied in a multicenter setting.

Conclusion

The outcomes demonstrate the relationship of maternal anemia in pregnancy with risk of increased NICU admission. It also describes that this number further increases with its severity. It clearly shows that there is an exponential increase in NICU admissions with a sort of dose-effect relationship with maternal hemoglobin. NICU admission increases expense and provides stress to the mother and family mothers. Pregnant women should be counseled regarding the risks of adverse pregnancy outcomes with anemia and simultaneously should be taken care to prevent it.

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