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Research Article

Severe Maternal Anemia and Neonatal Outcome

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Abstract: Anemia is one of the most prevalent nutritional deficiency problems afflicting pregnant women. Anemia that complicates pregnancy threatens the life of both mother and fetus. Among pregnant women the prevalence of anemia was four fold higher in developing countries as compared to the developed countries. In India 40 – 90 % of the pregnant women are anemic. Most of the articles have reported an adverse pregnancy outcome related to anemia. Of late, reports are emerging suggesting anemia could be indeed beneficial. During the last two decades significant knowledge has been gained about the effects of iron deficiency anemia on work capacity, work performance, muscle function, resistance to infection. However, information on the effects of maternal anemia during pregnancy on the fetal outcome has been meager and conflicting. Hence we conducted a study to look into these aspects. Women were divided into cases and controls based on the hemoglobin levels. Those with Hb% level <7gm will be cases and those with >10g/dl will be controls. The mean birth weight and intra-uterine fetal demise in anemic and non anemic groups were compared using Student 't' test. Proportions were compared using 'chi square' test. Perinatal outcomes included preterm delivery, low birth weight (LBW) at delivery,intrauterine growth restriction, perinatal mortality, APGAR score at 1 and 5 min, intrauterine foetal demise (IUD).The risk of preterm delivery and LBW among exposed group was 1.7 times and 2.8 times higheramong anaemic women, respectively. Risk of IUGR was 2 times higher compared to the nonanemic groups. Newborns of anaemic mothers had 1.6 times increased risk ofhaving an APGAR score of <5 at 1 min and the risk of IUD was 1.8 times higher for anaemic women. Low maternal haemoglobin levels are associated with increased risk of preterm delivery, LBW babies, APGAR score <5 at 1 min and IUD.
Keywords: Maternal anemia, Low birthweight, IUGR, IUD, Premature birth, Perinatal mortality

INTRODUCTION

Anaemia is one of the most prevalent nutritional deficiency problems afflicting pregnant women [1, 2]. In one of the studies conducted on a large population, it was estimated that 87% of the Indian pregnant women are anemic[3, 4]. This figure is the highest among the neighboring South East Asian countries [4]. It has long been recognized that anaemia is amajor public health problem especially among poorer segments of the population in developing countries such asIndia, Pakistan and Bangladesh [5]. The WHO uses the following hemoglobin cutoffs to define anemia in pregnant women: 100 to 110 g/L for mild anemia, 70 to 100 g/L for moderate and 70 g/L for severe [6, 7].Several randomized control trials (RCTs) and meta-analyses have shown that routine iron supplementation [4]. It is not of much use[8,9]. Anaemia during pregnancy, especially severe anaemia, is associated with increased maternal morbidity and mortality and contributes to 20% of the maternal mortality in Africa [5, 10-12]. Anaemia during pregnancy is associated with a negative impact on both the woman and neonate. Fetal anaemia, low birth weight (LBW), preterm birth and stillbirth have been associated with anaemia [11,13-16].There is conflicting literature regarding the association between anaemia and perinatal outcomes. Some recent studies [16,18] have demonstrated a strong association between anaemia and adverse perinatal outcomes such as preterm delivery and LBW, while other previous studies found no association [19,20]. A meta-analysis showed that anaemia during early pregnancy, but not during late pregnancy, is associated with slightly increased risk of preterm delivery and LBW [21].

Therefore there is insufficient information to conclusively assess the effect of maternal anaemia on maternal and perinatal outcomes. Furthermore, most studies were not able to study anaemia according to its severity [12]. Hence we aimed to study the effect of severe maternal anemia on neonatal outcome.

Study design

This is a prospective case control study. No specific intervention for the sake of study was done.

Mothers were recruited when they arrived in third trimester.

All women getting delivered at Vani Vilas hospital during study period who will fulfill the inclusion criteria will be included in the study. Women were divided into cases and controls based on the hemoglobin levels. Those with Hb% level <7gm were cases and those with >10g/dl were controls. The hemoglobin estimation is done by 'Sahli's' method-The babies are weighed immediately after birth without any clothing on an electronic weighing machine. The gestational age is assessed by New Ballard scoring system.

Socio-economic status is assessed based on modified Kuppuswamy's classification into upper, middle and lower socio-economic groups. Occupation and education of the head of the family and per capita income of all the family members are taken into account.

Study setting

The study was conducted at Department of Pediatrics Vani Vilas hospital, attached to Bangalore medical college, Bangalore, Karnataka, India. This is a tertiary center with annual delivery rate of approximately 4,500.

Inclusion Criteria

- Age of pregnant ladies between 18 – 35 yrs.
- Hb level – Cases < 7g/dl, Controls > 10g/dl.
- Gravida 3 or less.
- Singleton pregnancy

Exclusion Criteria

- Age less than 18 yrs or more than 35 yrs.
- Height less than 145cm, weight less than 45 kg.
- Babies born with major congenital anomalies, syndrome complexes.
- Women with history of smoking, tobacco use, alcoholics, narcotic drug intake.
- Women with medical illness like diabetes mellitus, heart disease, and renalDiseases.
- Pregnancy induced hypertension, Eclampsia.
- TORCH infection, malaria during antenatal period.

Statistical analysis

This was designed as a prospective case control observational study.

Sample size; 100 pregnant women with Hb%<7g/dl and 100 controls with Hb%>10g/dl.

The mean birth weight and intra-uterine fetal demise in anemic and non anemic groups will be compared using Student 't' test. Proportions will be compared using 'chi square' test.

The results for each parameter (numbers and percentages) for discrete data and averaged (mean $\pm$ standard deviation) for continuous data.

The association between potential related risk factors with Case and control were studied initially through an univariate analysis. The categorical variables were assessed using Pearson chi-square. Odds Ratio (OR) and 95% Confidence Interval (CI) were calculated. To estimate the independent effect of the factors that were significantly associated with case and control the confounding effect they may have on each other, logistic regression analysis was done. The variables were included if their respective Univariate analysis yielded P <0.10. A backward stepwise elimination procedure based on the likelihood statistics (using removal probability of 0.10 and considering the change in classification accuracy) was also performed to identify the best subset of variables. Data analysis was carried out using Statistical Package for Social Science (SPSS, V 10.5) package.

Ethical committee approval

The medical college ethical committee had approved this study.

Consent

The details of the study were explained to the pregnant mothers. Informed consent was taken from them before recruitment.

RESULTS

Mean age among anemic group was 22.81+/-2.79 and non anemic group was 23.49+/-2.58.Majority of the anemic group belonged to the lower(41%), Lower middle(17%), and Upper lower(36%) group compared to the non anemic group in which majority were Upper middle(45%) and lower middle(24%). Significant number of the anemic mothers took irregular antenatal health checkups (56%) compared to non-anemic mothers(8%).

Anemia

Mean Hemoglobin % was 5.884 and standard deviation was +/-0.964 among anemic mothers compared to mean Hb% of 10.961 and standard deviation of +/-0.900 among non-anemic group (Table 1, Fig, 1).

Table 1: Mean hemoglobin % among Cases and Controls

	N	Mean HB(%)	Std. Deviation	Min	Max
Cases	100	5.884	.964	3.0	6.9
Controls	100	10.961	.900	10.1	14.0
Total	200	8.423	2.709	3.0	14.0

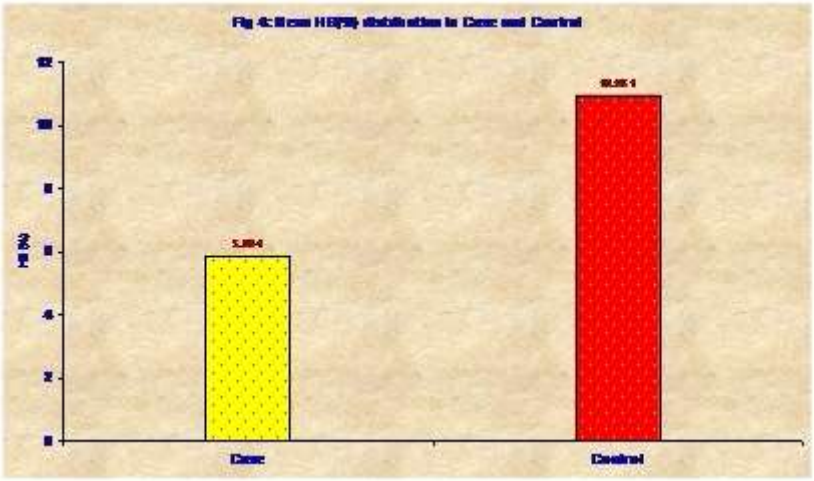

Fig. 1: Mean hemoglobin % among Cases and Controls

Birth Weight

Among the cases mean birth weight was observed to be 2321.80 g, with a standard deviation of +/- 531.06 and maximum birth weight observed was 3400 g and the minimum was 1000 g. and among the controls the mean birth weight was observed to be 2827.70 g, with a standard deviation of +/- 406.15 and maximum birth weight observed was 3750 g and the minimum was 1250g. With a p value of 0.000 which was significant. There is direct relationship between hemoglobin % and birth weight of the babies i. e., mean birth weight increased from 1576.67 g at hemoglobin level 3.0-4.5 g% to 2991.67 g at hemoglobin level > 13 g% (Table 2, Fig. 2).

Table 2: Birth weight in relation to hemoglobin % in Cases and Controls

Group		N	Mean Birth Weight (Gms)	Std. Deviation	Min	Max	F	'p' value
Cases	**3.0-4.5**	9	1576.67	368.82	1000	2250	23.844	.000
	4.6-5.5	23	2048.26	460.84	1200	3000		
	5.6-6.9	68	2512.94	439.77	1280	3400		
	Total	100	2321.80	531.06	1000	3400		
Controls	**10.1-11.5**	80	2857.13	360.06	2000	3750	3.252	.043
	11.6-13.0	14	2589.29	585.79	1250	3500		
	>13.0	6	2991.67	347.01	2500	3500		
	Total	100	2827.70	406.15	1250	3750		

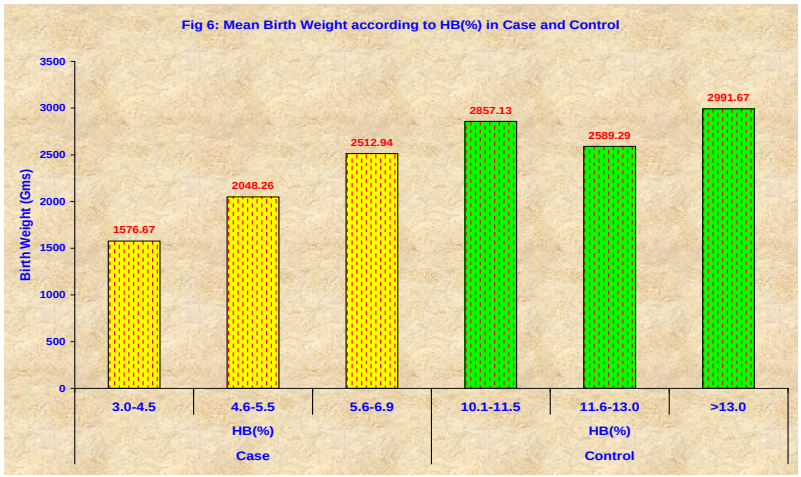

Fig. 2: Birth weight in relation to hemoglobin % in Cases and Controls

Table 3: Comparison of demographic and socio-economic status and perinatal outcomes among the two groups

Variable	Anemic group	Non-anemic group	P-value
Age (Mean±SD)	22.81±2.79	23.49±2.58	0.075
Socio-economic status			
Lower	41%	7%	
Lower middle	17%	24%	
Upper lower	36%	15%	0.000
Upper middle	6%	45%	
Upper	0%	9%	
Immunization status			
Yes	44%	92%	0.000
No	56%	8%	
Bitrh weight			
Very low birth weight	9%	1%	
low birth weight	54%	11%	
Appropriate for age	37%	87%	0.000
Large for gestational age	0%	1%	
Ponderal Index			
<2.5	33%	5%	0.000
>2.5	67%	95%	
Risk of premature deliveries			
<37 weeks	60.3%	12%	0.000
>37 weeks	39.7%	88%	
Mode of deliveries			
Normal	57%	81%	
Labour Induced	26%	12%	0.001
Caesarian section	17%	7%	
Low APGAR Scores at 1 min<5	11%	3%	0.027
Intrauterine Deaths	4%	1%	0.017

*P value<0.005 shows the difference is statistically significant

Table 4: Risk Factors Significantly Associated with Cases on MultivariateAnalysis

Risk factor	Odds ratio	95% confidence interval		P- value
		Lower	Upper	
Premature Birth	1.657	1.283	2.141	0.031
Low birth weight	2.838	2.128	3.784	0.043
IUGR	1.962	1.577	2.441	0.028
IUD	1.845	1.403	2.427	0.018
Apgar< 5 at 1 min	1.642	1.202	2.243	0.011

The above table outlines the multivariate analysis of neonatal outcome variables in the two groups. Risk of preterm delivery (<37 weeks) was 1.7 times higher among anemic women with a statistically significant association (95% CI= 1.3-2.1). There was a 2.8 times risk of low birth weight in the anemic group (95% CI=2.1-3.8) and a 2 times increased risk among anemic women of giving birth to IUGR babies(95% CI= 1.6-2.4). The risk of an APGAR score <5 at 1 min was 1.6 times (95% CI=1.2-2.2) for anemic women. They also were at 1.8 times increased risk of IUD compared to the non-anemic population(95% CI=1.4-2.4).

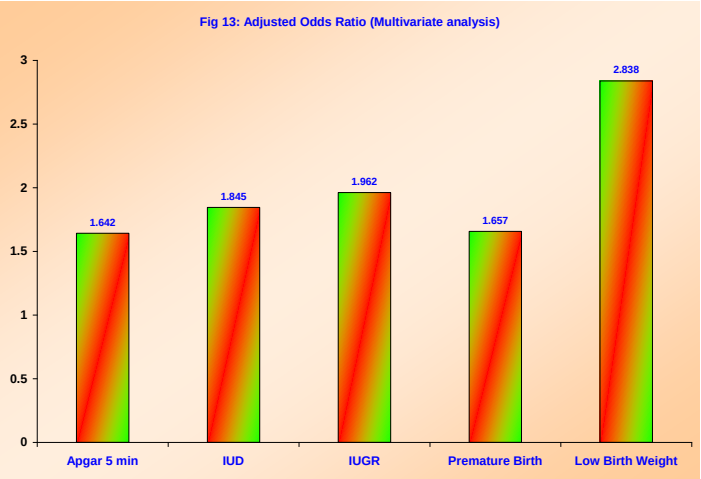

Fig. 4: Risk Factors Significantly Associated with Cases on MultivariateAnalysis

DISCUSSION

Anemia is one of the most prevalent nutritional deficiency problems afflicting pregnant women. Anemia that complicates pregnancy threatens the life of both mother and fetus and complications like prolonged labor, low birth weight, prematurity, IUGR, IUD, birth asphyxia in the newborn are common. In this prospective case control study an attempt is made to compare the neonatal outcome with respect to severe maternal anemia.

A total of 200 pregnant women – out of which 100 were severely anemic (i.e. cases with Hb<7gm%) and 100 were non anemic (i.e. controls with Hb>10gm%). cases and controls were well matched in terms of age and parity (mean age 22 and 23 yrs among cases and controls , parity < 3). All women were stratified by exclusion of other factors which also influence the birth weight, the relationship of maternal Hb% to birth weight was studied in a better perspective without other confounding factors.

In the present study the prevalence of anemia is 20 – 30 % among middle and higher socio-economic group and 50 – 70 % among the lower socio-economic group.This is similar to that reported by WHO statistics. The increased incidence of LBW in the present study could be due to low nutritional status, low income, illiteracy and poor antenatal care, as also brought out by other studies [24, 25].

In a retrospective study conducted by Abdel Aziem A Ali *et al*. severe anaemia is associated with a higher risk for preeclampsia and poor perinatal outcomes. The risk of LBW was 2.5 time higher in women with mild/moderate anaemia (95% CI: 1.1-5.7), and 8.0 times higher in women with severe anaemia (95% CI: 3.8-16.0). The riskof preterm delivery increased significantly with the severity of anaemia (OR = 3.2 for women with mild/moderate anaemia and OR = 6.6 for women with severe anaemia, compared with women with no anaemia). The corrected risk for stillbirth increased only in severe anaemia (OR = 4.3, 95% CI: 1.9-9.1, P < 0.001) [12].

A cohort study was conducted by Farah Wali Lone *et al*. The risk of preterm delivery and LBW among exposed group was 4 and 1.9 times higher among anaemic women, respectively. Newborns of anaemic mothers had 1.8 times increased risk of having an APGAR score of <5 at 1 min and the risk of IUD was 3.7 times higher for anaemic women [1].

Both the above mentioned studies substantiate our study indicating severe maternal anemia has poor perinatal outcome with respect to prolonged labor, low birth weight, prematurity, IUGR, IUD, birth asphyxia (Table 5 and 6).

Table 5: Percentage of adverse outcomes in neonates among the cases and controls in various studies

Study		Maternal Hb% among cases and controls	LBW among cases and controls	Premature birth among cases and controls	IUGR among cases and controls	IUD among cases and controls
El Guindi *et al*. [23]	n=100 n=100	<8g, >10g	–	29.2% Vs 9.2%	–	–
Present study	n=100 n=100	<7g, > 10g	63% Vs12%	38% Vs 12%	12% Vs 1%	4% Vs1%
Abdel Aziem A Ali *et al*. [12]	n=303 n=303	<7g, >10g	20.7% Vs3.3%	11.5% Vs2.3%	-	13.8% Vs 2.9%

Table 6:Odd's ratio of the variables studied among the cases and controls

Study	LBW among cases and controls	Premature birth among cases and controls	IUGR among cases and controls	IUD among cases and controls	Birth asphyxia among cases and controls
F. W. Lone *et al*.[1]	4 : 1	2.2 : 1	1.9 : 1	2.5 : 1	1.8 : 1
Geelhoed D *et al*.[22]	-	2.5 : 1	-	2 : 1	-
Abdel Aziem A Ali *etal*. [12]	8:1	6.6:1	-	4.3:1	-
Present study	1.6 : 1	2.8 : 1	1.9 : 1	1.8 : 1	1.6 : 1

CONCLUSION

From the present study it is concluded that severe maternal anemia definitely has a very poor outcome on the newborn in terms of LBW, prematurity, IUGR, IUD, and birth asphyxia.

- LBW- 2.8 times increased risk among cases
- Premature birth- 1.7 times increased risk among cases
- IUGR- 2 times increased risk among cases
- IUD- 1.8 times increased risk among cases
- Normal delivery- 57% vs 81% in cases and controls
- Operative, induced labor- 43% vs 19% in cases and controls
- Birth asphyxia- 1.6 times increased risk among cases

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