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Prevalence and Risk Factors of Anemia among Pregnant Women Attending a High-Volume Tertiary Care Center for Delivery

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Abstract:
Objective: *The aim of this study was to identify the prevalence of anemia and predisposing factors contributing to anemia in pregnant women prior to delivery.*
Material and Methods: *A prospective case-control study was conducted on 1000 women who delivered between 28 and 42 weeks of gestation in the month of September and October 2017 at Government General Hospital, Kakinada. Data on the subjects' socioeconomic and demographic characteristics, pregnancy outcomes and hemoglobin levels within 24 hour prior to delivery were collected. The study population was divided into two groups on the basis of presence of anemia within 24 hours prior to delivery. Anemia defined as hemoglobin level<11g/dL. The prevalence of pre-delivery anemia estimated, and antenatal predictors of anemia were determined using multivariate logistic regression analysis.*
Results: *Prevalence of anemia in women attending our center for delivery was 64.3% [95% confidence interval (CI) =57.73–70.87]. After multivariate logistic regression analysis, parity >3 [odds ratio (OR) =1.13, 95% CI=0.69-1.84, p=0.062], household monthly income per person <938 Indian rupees (OR=1.19, 95% CI=0.89-1.60, P=0.002) and occurrence of preeclampsia (OR=1.55, 95% CI=1.03–2.1, p=0.041) were independently associated with anemia*
Conclusion: *Socioeconomic determinants constitute most of anemia cases and, hence, should be considered as major risk factors of anemia in women attending for delivery.*
Keywords: *Demographic Area, Socioeconomic factors, Type of Delivery, Perinatal outcome.*

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I. Introduction

Anemia is the most common medical disorder in pregnancy. Globally it contributes to more than 1,15,000 maternal deaths annually[1]. In India it contributes to 20-40% deaths directly or indirectly[1,2]. Of these 16% are direct deaths due to anemia[3]. Majority of maternal deaths (80%) due to anemia in South Asia are from India[2]. Anemia is associated with an increase in incidence preterm birth, IUGR and low Apgar at birth with resultant increase in perinatal morbidity and mortality. Anemic mothers give birth to anemic infants who are more likely to suffer from Cognitive dysfunction and possibly long-term morbidities in the form of diabetes and cardiovascular disease[4,5]. Although in 1997, United Nations declared anemia as a major public health problem needing total elimination, two decades later it still remains an important factor contributing significantly to adverse maternal and perinatal outcome. Anemia is more common in developing countries. It is estimated that worldwide 500 million women in reproductive age group are anemic[6]. WHO estimated 56% of all women in developing countries as anemic[7]. In India, National Family Health Survey (NFHS-3) in 2005-2007 has shown that 55% of Indian women are anemic[8]when compared to only 2-4% in USA[9]. Pregnant women with anemia, going into labor and delivery, have the highest potential of complications related to anemia and transfusion[11,13]. A modest blood loss at delivery may not impair the hemodynamic response of women with normal hemoglobin but may be hazardous for anemic women[10,12,14] and there may not be enough time for clinicians to normalize the hemoglobin levels of delivering women, in this study we aimed to determine prevalence of anemia and identify the factors contributing to anemia in pregnant women attending our center for delivery.This study was conducted prospectively in women who delivered at Government General Hospital, Kakinada in the month of September October 2017. Research protocol was approved by the Ethics Committee of our center. Informed consent was obtained from all participants. The study population consisted of all pregnancies that delivered between 28 and 42 weeks of gestation. Chronic diseases leading to anemia such as renal, cardiac, lung diseases and hemoglobinopathy were excluded. Total of 1000 women were enrolled in the study, all the women who had

delivered were interviewed using a questionnaire to collect their socioeconomic and demographic data. .Hemoglobin value within 24 h prior to delivery, maternal age, number of parity and abortus, educational level, occupational status, demographic status, number of antenatal care visits, number of ultrasonography examinations done during pregnancy, gestational age at the time of first admission, gestational age at delivery, and duration of iron and folic acid supplementation. Household monthly income per person was calculated by modified BG Prasad scale (2017). Adverse perinatal outcomes were recorded as dichotomous variables (yes or no) and included antenatal bleeding, hypermesis gravidarum, placenta previa, gestational diabetes, preeclampsia, intrauterine growth restriction, and congenital anomalies. We categorized patients into two groups according to the presence or absence of anemia within 24 h before the onset of delivery. Anemia was defined as a hemoglobin level of <11g/dL according to the World Health Organization criteria[15]. The prevalence and antenatal predictors of anemia in pregnant women attending our center for delivery was determined.

II. Statistical Analysis

Statistical analyses were performed using Statistical Package for the Social Sciences. (SPSS version 20.0). Continuous and categorical data were expressed as mean±standard deviation and the number of patients, respectively. The means of the continuous variables were compared using t-test between the two groups after checking that the variables were normally distributed. The distribution of categorical variables was examined using chi-square statistics. Risk factors and perinatal outcomes associated with anemia were determined using multivariate logistic regression modeling with backward elimination. Odds ratio(OR) and their 95% confidence intervals (CI) were calculated. P<0.05 was considered statistically significant.

III. Results

A total of 1000 women attended our center for delivery during the study period, among which 643 (64.3%, 95% CI=57.73–70.87) had a hemoglobin level <11 g/dL and 357 (35.7%, 95% CI=33.2–35.8) had a level of ≥11 g/dL. The socioeconomic and demographic characteristics for groups with normal and low hemoglobin level are shown in Table 1. Maternal age>35 years (OR=2.36, 95% CI=0.76-7.30, p=0.1375), parity >3(OR=0.95, 95% CI=0.57-1.61, p=0.3), illiterate (OR=1.74, 95% CI=1.25-2.43, p=0.0011),primary education level (OR=0.79,95%CI=0.52-1.21,p=0.29) and absence of occupation (OR=0.76, 95% CI=0.52-1.11, p=0.164), household monthly income per person< 938rupees (OR=0.71, 95% CI=0.51-0.97, p=0.035),938-1875rupees (OR =2.64,95%CI=1.90-3.70), number of antenatal visits <5 (OR=0.74, 95% CI=0.56-0.99, p=0.049) and 5–10(OR=1.34, 95% CI=1.00-1.79, p=0.049), admission to antenatal care at third trimester of gestation(OR 0.86,95%CI=0.64-1.17,p-0.35),duration of iron supplementation <3 months (OR=1.69,95%CI=1.28-2.24) and <3–6 months (OR=0.58, 95% CI=0.44–0.77, p=0.0002) were significantly associated with anemia at the time of delivery. The perinatal outcomes associated with anemia are presented in Antenatal bleeding(OR=0.75, 95% CI=0.06–8.35, p=0.81) and preeclampsia(OR=1.20, 95% CI=0.21–6.88, p=0.83) were associated with an increased risk of anemia. To further identify the predictors of anemia within 24 h before delivery, multiple logistic regression analysis was performed to control for potential confounders (Table 2). Among the risk factors, parity >3 (OR=1.82, 95% CI=1.24–2.96, p=0.002), illiterate(OR=2.23, 95% CI=1.35–3.45, p=0.001) and primary educational level (OR=2.01, 95% CI=1.28–3.39, p=0.008), household monthly income per person <938 rupees (OR=2.34, 95% CI=1.49–3.89, p<0.001), duration of iron supplementation <3 months (OR=2.62, 95% CI=1.51–4.17) and 3–6 months (OR=1.68, 95% CI=1.13–2.91), and occurrence of preeclampsia (OR=1.55, 95% CI=1.03–2.1, p=0.041) were independently associated with anemia.

Table1. Association between clinical characteristics and anemia in women attending our center for delivery

Maternal Age	Hb< 11g/dL n(%)	Hb> 11g/dL n(%)	OR(95%CI)	P value
Maternal Age (y)				
<20	105(65.62)	55(34.37)	1.09(0.76-1.56)	0.6403
20-29	452(63.60)	258(36.33)	1.03(0.67-1.56)	0.882
30-34	68(62.96)	40(37.03)	0.026(0.0084-0.08)	<0.0001
>35	18(81.82)	4(18.18)	2.36(0.76-7.30)	0.1375
Parity				
0	228(62.6)	136(37.3)	0.43(0.33-0.5)	<0.0001
1-3	370(65.7)	193(34.2)	1.19(0.72-1.97)	0.49
>3	45(61.4)	28(38.3)	0.95(0.57-1.61)	0.3
Abortion				
0	425(69.1)	190(30.8)	1.85(1.40-2.44)	<0.0001
1-2	180(54.7)	149(45.2)	0.57(0.31-1.04)	0.069
>2	38(67.8)	18(32.1)	0.94(0.52-1.69)	0.85
Education level				
Illiterate	185(74.2)	64(25.7)	1.74(1.25-2.43)	0.0011
Primary	338(62.3)	204(37.6)	0.79(0.52-1.21)	0.29
Secondary	81(67.5)	39(32.5)	2.62(1.51-4.69)	0.0007

Higher	39(43.8)	50(56.18)	0.27(0.16-0.44)	<0.0001
Occupational status				
No	543(63.4)	313(36.5)	0.76(0.52-1.11)	0.164
Yes	100(69.4)	44(30.5)	1.31(0.89-1.91)	0.16
Household monthly Income per Capita				
<938	157(63.3)	91(36.6)	0.71(0.51-0.97)	0.035
938-1875	390(70.78)	161(29.22)	2.64(1.90-3.70)	<0.0001
1876-3126	96(47.7)	105(52.2)	0.52(0.36-0.77)	0.001
No. of Antenatal Visits				
<5	152(59.3)	104(40.6)	0.74(0.56-0.99)	0.049
5-10	490(66.2)	250(33.7)	1.34(1.00-1.79)	0.049
No. of USG				
<5	241(64.9)	130(35.0)	1.04(0.80-1.36)	0.74
5-10	402(63.9)	227(36.08)	0.95(0.73-1.25)	0.74
Area				
Urban	186(58.12)	134(41.8)	0.69(0.52-0.92)	0.0116
Rural	370(66.67)	185(33.3)	0.87(0.57-1.33)	0.52
Tribal	87(69.6)	38(30.4)	1.64(1.06-2.56)	0.026
Mode of Delivery				
NVD	388(60.6)	258(39.93)	0.51(0.25-0.98)	0.044
Forceps	36.00	12	1.99(1.01-3.90)	0.044
LSCS				
Primary Elective	6(75.0)	2(25.0)	1.11(0.21-5.7)	0.9
Primary Emergency	100(72.99)	37(27.00)	1.17(0.65-2.12)	0.58
Repeat Elective	62(69.66)	27(30.33)	0.94(0.47-1.86)	0.87
Repeat Emergency	51(70.8)	21(29.1)	0.809(0.15-4.33)	0.8
Gestational Age at the time of Admission				
Preterm	66(66.66)	33(33.33)	1.19(0.76-1.85)	0.44
Term	484(62.6)	288(37.3)	0.65(0.43-0.98)	0.04
Post term	93(72.09)	36(27.90)	1.29(0.73-2.277)	0.377
Maternal Outcome				
Intrapartum				
Prolonged Labour	6(66.66)	3(33.33)	0.66(0.14-3.08)	0.6
Instrumental Delivery	36(75)	12(25)	1.5(0.32-6.9)	0.6
Postpartum				
PPH	62(68.88)	28(31.11)	2.19(0.04-113)	0.69
Puerperal sepsis	0.00	0	0(0-0)	0
Gestational age at first antenatal Registration				
1st trimester	382(64.9)	206(35.03)	0.93(0.63-1.35)	0.698
2nd trimester	98(66.67)	49(33.33)	1.24(0.81-1.89)	0.311
3rd trimester	164(61.65)	102(38.3)	0.86(0.64-1.17)	0.35
Iron Supplementation				
<3 months	258(71.8)	101(28.1)	1.69(1.28-2.24)	0.0002
3-6 months	385(60.6)	256(39.9)	0.58(0.44-0.77)	0.0002
Folic acid Supplementation				
None	232(69.6)	101(30.3)	1.43(1.08-1.89)	0.012
1 st trimester	411(61.6)	256(38.3)	0.69(0.52-0.92)	0.012
Hb: Hemoglobin; OR: Odds Ratio; CI: Confidence Interval				

IV. Discussion

This study revealed that the prevalence of anemia in women within 24 h before delivery was 64.3%, which is higher than the estimated average prevalence rate of 32.6% documented by World Health Organization (WHO) for our country [15]. This high prevalence of anemia among pregnant women in this study may be explained by the distribution of socioeconomic status of the population. Another point is the variation in the gestational age at the time of measurement. Contrary to previous studies, the hemoglobin values of the women in our study were evaluated in the third trimester of pregnancy, in which fetal growth and red blood cell expansion increases the prevalence of anemia[10,16]. Additionally, in this study, it is demonstrated that pre-delivery anemia was related to parity, educational level, household monthly income per person, number of hospital admissions, gestational age at the first admission, duration of iron supplementation, and preeclampsia.

Results in our study showed that pregnancies with parity > 3 were 1.8 times more likely to have an anemia than those with parity ≤3. Higher parity was documented in a number of studies as a cause of anemia in pregnancy[17].

Table 2. Multivariate logistic regression analysis of risk factors

	OR	95% CI	P
Maternal age>35	1.23	0.92-1.61	0.223
Parity>3	1.82	1.24–2.96	0.002
Unemployment	1.20	0.89–1.57	0.121
Educational level			
Illiterate	2.23	1.35–3.45	0.001
Primary	2.01	1.28–3.39	0.008
Household monthly income/person (rupees)			
<938	2.34	1.49–3.89	<0.001
938–1875	1.74	0.98–3.51	0.071
No. of antenatal visits			
<5	1.45	1.05–2.11	0.012
5–10	1.30	1.03–2.09	0.028
Gestational age at first admission			
Second trimester	1.63	1.24–2.81	0.006
Third trimester	2.45	1.41–4.06	<0.001
Iron supplementation (months)			
<3	2.62	1.51–4.17	<0.001
3–6	1.68	1.13–2.91	0.001
Antenatal bleeding	1.34	0.94–3.47	0.212
Preeclampsia	1.55	1.03–2.10	0.041
CI: confidence interval; OR: odds ratio			

In addition, the severity of anemia was also found to be inversely related to educational status and family income[18]. Similar observations were made in several studies that documented a reduction in the prevalence of anemia at the end of pregnancy after routine supplementation of iron to pregnant women[19,20]. Therefore, for anemia intervention to be most effective, it is important that women should attend antenatal clinics in the first trimester of their pregnancies. An earlier gestational age at first admission will increase the total antenatal care visits at the end of pregnancy and will also prevent the depletion of iron stores because of early supplementation. The possible explanation why some pregnant women did not benefit from supplementation is that most of them could have been suffering from deleterious effects of undiagnosed medical disorders and were possibly anemic before pregnancy. Therefore, iron and folic acid supplementation is an important part of anemia control program, but supplements should be viewed as one of the several tools in the battle against anemia.

V. Conclusion

In conclusion, our study provides evidence about the underlying factors for anemia among pregnant women attending our center for delivery. Socioeconomic determinants constitute most of the anemic cases and hence should be considered as major risk factors of anemic women attending for delivery. We recommend that socioeconomic determinants, which cause limited access to adequate food and antenatal care. Therefore, those women should be encouraged to begin antenatal care early after conception to allow adequate time for restoring iron stores.

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