Original Article

Critical Evaluation Of Anaemia And Hematological Parameters In Pregnant Women: A Prospective Study

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ABSTRACT

Introduction: Maternal morbidity increases significantly in anaemic women. Practically all complications of pregnancy are aggravated quantitatively by anaemia. Hence, the present study was undertaken to carry out a critical evaluation of anaemia and hematological parameters in pregnant women using a prospective cross-sectional study design. **Materials and Method:** The present prospective cross-sectional study was carried out among 304 pregnant women. After the general, clinical and obstetric evaluation was done, a 5 ml blood specimen was obtained from all the participants under all aseptic conditions haematological assessments. Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 29.0. p values less than 0.05 was considered statistically significant. **Results:** Overall prevalence of anaemia was 61.5%. mild, moderate and severe anaemia was seen in 58 (19.1%), 124 (40.8%) and 6 (2%) pregnancies respectively. A total of 3 (1.6%) women had non-deficiency anaemia. Iron deficiency, vitamin B12 deficiency and mixed deficiency (iron+vitamin B12 deficiency) as the underlying anemic etiology was seen in 87.2%, 5.3% and 5.9% anemic women respectively, two (0.66%) anemic cases who were screened positive for hemoglobinopathies. **Conclusion:** Prevalence was significantly lower in rural/semiurban women (58.4%) as compared to that in urban women (71.8%) and a significant association of younger age, urban residence and history of malaria with anaemia was found. The findings of the study are helpful in understanding the problem and making appropriate intervention plans.

Keywords: Anaemia; Iron deficiency; Nutritional deficiencies; Pregnancy

INTRODUCTION

Ensuring complication-free and safe motherhood to the pregnant women is the ultimate goal of an obstetrician. However, not every pregnancy is complication free. In view of various physiological, psychological and physical changes taking place during the pregnancy, most of the pregnancies are complicated by one or more health issues. Some of the common health related issues having long term impact on the mother and fetus include anaemia, gestational hypertension, gestational diabetes and nutritional deficiencies that may affect the growth and development of the fetus, may result in maternal morbidity and could ultimately affect the perinatal outcome.[1,2] Incidentally, anaemia is a common health problem, especially in underdeveloped and developing countries where nearly 25% to 50% of the non-pregnant and almost half the pregnancies are affected by it.[3] In India, anaemia is widely prevalent and affects almost half the population. Despite numerous public health initiatives, almost half the pregnancies in India are

affected by anaemia.[4,5] Maternal morbidity also increases significantly in Anemic women. Practically all complications of pregnancy are aggravated quantitatively by anaemia. Given its wide prevalence, complications and high risk both to mother and the fetus, regional imbalances in the prevalence and types of anaemia, the understanding of anaemia during pregnancy is an important issue with wide impact. As a matter of fact, due to different etiologies and types, sometimes anaemia other than iron-deficiency anaemia remain undiagnosed. Changes in hematological parameters and red blood cell indices are helpful to recognize the exact cause of anaemia during pregnancy and thereby help to make appropriate interventions in accordance with the type of anaemia.[6]

Hence, the present study was undertaken to carry out a critical evaluation of anaemia and hematological parameters in pregnant women using a prospective cross- sectional study design.

MATERIALS & METHODS

The present prospective cross-sectional study was carried out among 304 pregnant women in the Department of Pathology in collaboration with Department of Obstetrics and Gynaecology, Career Institute of Medical Sciences and Hospital (CIMSH), Lucknow from January 2021 to December 2022.

Approval for the study was obtained from the Institutional Ethics Committee before the commencement of study. Informed consent was obtained from all the participating patients. All the patients were allowed voluntary participation and were permitted to withdraw from the study as per their wish without affecting the standard of their care in the hospital.

Inclusion Criteria consisted of all pregnant females of age more than 18 years attending ANC OPD/IPD who gave consent for participation in the study. Exclusion criteria comprised of pregnant females with other co-morbid conditions (CRF, malignancy, BT) which can contribute to anaemia and women who were not willing to be a part of our study and did not giveconsent. A total of 319 patients were screened, 8 did not provide consent to participate in the study and 7 did not fit in the selection criteria, hence finally 304 antenatal patients fulfilling the selection criteria and willing to participate in the study were enrolled in the study. At enrolment, socio demographic profile of the women was enquired. Their dietary preferences, relevant medical, infection and menstrual history was noted. Obstetric history was obtained and time since last pregnancy was noted. All the women subsequently underwent a thorough clinical and obstetric examination. Gestational age at the time of assessment was noted. After the general, clinical and obstetric evaluation was done, a 5 ml blood specimen was obtained from all the participants under all aseptic conditions and following assessments were carried out:

1. Haemoglobin
2. CBC
3. RBC indices (MCV, MCH, MCHC & HCT)
4. GBP, RDW
5. Special test
   a) Iron profile (S. Iron, S. Ferritin)
   b) Serum b12
   c) Hb electrophoresis

Microsoft Excel was used for creating the database and generating graphs, while the data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 29.0 for Windows. Mean and standard deviation were used to describe quantitative data meeting normal distribution. Continuous two independent groups were compared by parametric independent Student's t test. ANOVA was used for comparison of parametric data among more than two groups. Discrete (categorical) groups were compared by chi-square (X2) test. p values less than 0.05 ($p<0.05$) was considered statistically significant.

RESULTS

Hemoglobin levels ranged from 5.8 to 13.6 with a mean of 10.1±1.6 g/dl. Mean TLC, platelet count, RBC, MCV, MCH, MCHC, RDW and Hematocrit were 9.25±3.24 thousands/cumm, 2.07±0.62 Lacs/cumm, 3.7±0.6 x 10^{12}/L, 82.8±10.0 fl, 27.2±3.8 pg/cell, 32.1±3.7 g/dl, 15.3±2.6% and 32.0±6.0% respectively (table 1).

A total of 187 (61.5%) women had anaemia. Mild, moderate and severeanaemia was seen in 19.1%, 40.8% and 2% pregnant women respectively (table 2).

Vitamin B12 levels ranged from 120 to 715 pg/ml with a mean of 356.27±89.26 pg/ml. There were 27 (8.9%) cases with vitamin B12 levels below 200 pg/ml (table 3). Majority of cases had microcytic hypochromic picture (80.7%) followed by normocytic normochromic picture (7.5%), dimorphic and macrocytic (5.9% each) (table 4). Both the cases diagnosed as hemoglobinopathies had a microcytic hypochromic picture. Except for 3 (1.6%) cases, all the other patients had nutritional deficiency anaemia. Iron deficiency alone (n=163; 87.2%) was the most common underlying etiology followed by mixed deficiency (n=11; 5.9%) and vitamin B12 deficiency (n=10; 5.3%) respectively (table 5). All the cases with macrocytic anaemia had vitamin B12 deficiency (9/11 had vitamin B12 deficiency only and 2/11 had mixed Mean age of anemic women was significantly lower (25.43±3.58 years) as compared to that of non-anemic women (26.86±4.43 years) (p=0.029). Prevalence of anaemia was significantly lower in rural/semiurban women (58.4%) as compared to

that in urban women (71.8%) (p=0.041). No significant association of anaemia prevalence was observed with religion, annual family income, working status, education and socioeconomic status (p>0.05) (table 6).

No significant association of anaemia prevalence was observed with dietary preference, menstrual irregularity history and gravida status. However, positive history of malaria and interpregnancy gap <2 years were found to be significantly associated with prevalence of anaemia in pregnancy. No significant association of anaemia prevalence was observed with other risk factors like smoking, piles, obesity, worm and wound infection (table 7).

Anemic women had significantly lower Hb, RBC, MCV, MCH, MCHC and hematocrit and significantly higher mean RDW as compared to non-anemic women (p<0.001). There was statistically no significant difference between the two groups with respect to TLC and platelet count (table 8).

Table 1: Hematological profile of study population (n=304)

SN	Parameter	Min	Max	Mean	SD
1.	Hb (g/dl)	5.8	13.6	10.1	1.6
2.	TLC (thousands/cumm)	3.8	24.0	9.25	3.24
3.	Platelet count (Lakhs/cumm)	0.5	4.40	2.09	0.62
4.	RBC ($x10^{12}$/L)	1.0	6.8	3.7	0.6
5.	MCV (fl)	64.0	106.0	82.8	10.0
6.	MCH (pg/cell)	23.0	43.0	27.2	3.8
7.	MCHC (g/dl)	22.0	36.0	32.1	1.7
8.	RDW (%)	11.0	33.0	15.3	2.6
9.	Hematocrit (%)	19.0	48.0	32.0	6.0

Table 2: Distribution of cases according to Hemoglobin Status (as per WHOtrimester-based criteria)[7]

SN	Anemic Status	No. of women	Percentage
1.	No Anaemia	117	38.5
2.	Anaemia	187	61.5
	Mild	58	19.1
	Moderate	124	40.8
	Severe	6	2.0

Table 3: Vitamin B12 profile in study population (pg/ml)

SN	Variable	Statistic
1.	Range (min-max)	120-715.00
2.	Mean±SD	356.27±89.26
3.	No. of women with vitamin B12 below 200pg/ml	27 (8.9%)

Table 4: Distribution of Anaemia Cases according to General Blood Picture(n=187)

SN	General Blood Picture	No. of women	Percentage
1.	NCNC	14	7.5
2.	MCHC	151	80.7
3.	Dimorphic	11	5.9
4.	Macrocytic	11	5.9

Table 5: Distribution of cases according to Underlying Etiology

SN	Etiology	No. of women	Percentage
1.	Non-deficiency anaemia	3	1.6
2.	Vitamin B12 deficiency	10	5.3
3.	Iron deficiency	163	87.2
4.	Mixed deficiency (Iron+Vitamin B12 deficiency)	11	5.9

Table 6: Association of Anaemia with different sociodemographic factors

SN	Characteristic	Anaemia (n=187)		No Anaemia (n=117)		Statistical significance	
		No.	%	No.	%	$_c2$	'p'
1.	Mean Age±SD	25.43±3.58		26.86±4.43		t=2.189; p=0.029	
2.	Place of residence						
	Rural/Semiurban (n=233)	136	58.4	97	41.6	4.166	0.041
	Urban (n=71)	51	71.8	20	28.2		
3.	Religion						
	Hindu (n=155)	98	63.2	57	36.8	0.392	0.531
	Muslim (n=149)	89	59.7	60	40.3		
4.	Annual Family Income						
	<Rs 50,000/- (n=26)	20	76.9	6	23.1	7.378	0.061
	50,000-100,000/- (n=146)	81	55.5	65	44.5		
	100,000-200,000/- (n=93)	64	68.8	29	31.2		
	>200,000/- (n=39)	22	56.4	17	43.6		
5.	Working status						
	Non-working (n=272)	168	61.8	104	38.2	0.069	0.793
	Working (n=32)	19	59.4	13	40.6		
6.	Education						
	Illiterate (n=20)	15	75.0	5	25.0	2.645	0.450
	Upto Primary school (n=52)	24	58.5	17	41.5		
	Upto High School (n=134)	78	58.2	56	41.8		
	Above high school (n=109)	70	64.2	39	35.8		
7.	Socioeconomic status						
	Lower (n=26)	18	75.0	6	25.0	2.257	0.324
	Upper Lower (n=189)	116	61.4	73	38.6		
	Middle/Upper Middle(n=91)	53	58.2	38	41.8		

Percentages have been calculated row-wise

Table 7: Association of Anaemia with Dietary, Malaria history, Obstetric and Menstrual Profile

SN	Characteristic	Anaemia (n=187)		No Anaemia (n=117)		Statistical significance	
		No.	%	No.	%	$_c2$	'p'
1.	Dietary preference						
	Mixed (n=272)	170	62.5	102	37.5	1.082	0.582
	Vegetarian (n=28)	2	50.0	2	50.0		
	Non-vegetarian (n=4)	15	53.6	13	46.4		
2.	Malaria history						
	Yes (n=10)	10	100.0	0	0	6.489	0.011
	No (n=294)	177	60.2	117	39.8		
3.	Menstrual irregularities						
	Yes (n=12)	6	50.0	6	50.0	0.699	0.403
	No (n=292)	181	62.0	111	38.0		
4.	Gravida status						
	G1 (n=175)	108	61.7	67	38.3	0.774	0.856
	G2 (n=95)	60	63.2	35	36.8		
	G3 (n=24)	14	58.3	10	41.7		
	G4 or above (n=10)	5	50.0	5	50.0		
5.	Interpregnancy gap <2Years						
	Yes (n=59)	45	76.3	14	23.7	6.735	0.009
	No (n=245)	142	58.0	103	42.0		
6.	**Other risk factors**					Fisher exact test	
	Smoking	2	1.1	1	0.9	p=1	
	Piles	2	1.1	0	0	p=0.526	
	Obesity	6	3.2	0	0	p=0.086)	
	Worm infestation	2	1.1	2	1.7	p=1.000	
	Wound infection	0	0	3	2.6	p=0.055	

Table 8: Comparison of Hematological Profile of Anemic and Non-Anemicpregnant women (n=304)

SN	Parameter	Anaemia (n=187)		No Anaemia (n=117)		Statistical significance	
		Mean	SD	Mean	SD	't'	'p'
1.	Hb (g/dl)	9.15	1.14	11.61	0.83	20.288	<0.001
2.	TLC (thousands/cumm)	9.47	3.41	8.9	2.91	1.525	0.128
3.	Platelet count (Lakhs/cumm)	2.05	0.65	2.15	0.57	-1.406	0.161
4.	RBC ($x10^{12}$/L)	3.40	0.59	4.06	0.51	-10.110	<0.001
5.	MCV (fl)	80.55	10.45	86.49	7.87	-5.278	<0.001
6.	MCH (pg/cell)	26.41	4.02	28.33	3.05	-4.430	<0.001
7.	MCHC (g/dl)	31.84	1.77	32.51	1.60	-3.345	0.001
8.	RDW (%)	15.76	2.51	14.67	2.55	3.673	<0.001
9.	Hematocrit (%)	29.33	4.79	36.20	5.37	-11.598	<0.001

DISCUSSION

Nutritional anaemia is considered most important cause of maternal anaemia, in which iron deficiency and vitamin B12/folate deficiency are first two important causes. Furthermore, iron deficiency anaemia is major public health problem in developing countries.[8] Maternal anaemia during pregnancy is commonly considered to be a risk factor for poor pregnancy outcome and can result in complications that threaten life of both mother and fetus.[9] However, the extent to which maternal anaemia affects maternal and neonatal health is still uncertain. Some studies have demonstrated a strong association between low haemoglobin before delivery and adverse pregnancy outcome[10] while others have not found a significant association.[11] In the present study, prevalence of anaemia was found to be 61.5%. Mild, moderate and severe anaemia was seen in 58 (19.1%), 124 (40.8%) and 6 (2%) pregnancies respectively. Although reported prevalence of anaemia during pregnancy shows a high diversity ranging from 10%[12] to 91.3%,[13] yet most of the studies particularly those from India show prevalence of anaemia between 50 to 70% of pregnant women.[14-16] Among different studies from India, the maximum prevalence of severe anaemia among anemic women was reported as 6.9% by Grover et al[17] who had reported the overall prevalence of anaemia as 85.3%. Comparison of the findings of the present study with different other studies shows that the prevalence and severity ofanaemia shows a variation across different regions. These means that regional, environmental, socio-cultural, dietary and climatic factors have a detrimental effect on anaemia prevalence and its severity. In the present study, no significant association of anaemia during pregnancy was observed with TLC and platelet count. As such gestational thrombocytopenia is a known physiological response in pregnancy due to haemodilution, increased platelet activation and accelerated clearance.[18] Epidemiological studies, however, report its prevalence to be 5 to 10% in pregnancy.[18] A low prevalence of thrombocytopenia in some studies could be owing to adaptation of cut-off <100,000/cumm[19,20] instead of <150,000/cumm as used in the present study. Anaemia may be caused by various reasons. In the present study, there was a dominance of deficiency anaemia (98.4%). Similar to the present study, Shridevi[21] also found a dominance of deficiency anaemia (95.3%) with iron deficiency and dimorphic/nutritional deficiency in 82.3% and 13% cases respectively, thus resembling the findings of the present study where we also found iron deficiency as the single largest cause of anaemia (87.2%). In the present study, there were two (0.66%) anemic cases who were screened positive for hemoglobinopathies. Various studies have also reported very low prevalence of haemoglobinopathies in anemic pregnant women with their prevalence ranging from as low as 0.05 to 2.95%.[22,23] These findings suggest that haemoglobinopathies to be present in a small fraction of anaemic pregnant women, however, it cannot be ignored as it may help in explaining the unexplained underlying etiology. In the present study, both the cases diagnosed as haemoglobinopathies had iron deficiency. An undetected underlying haemoglobinopathy in such conditions may mask the exact underlying condition and could affect the management adversely. In the present study, we did not find a significant association of anaemia prevalence was observed with religion, annual family income, working status, education and socioeconomic status. However, we found a significant association of younger age, urban residence and history of malaria with anaemia. Contrary to the findings of the present study where urban residence was found to be significantly associated with anaemia, some other workers found rural residence[24,25] to be associated with anaemia. It could be owing to the fact that most of the urban residents visiting our facility come from an underprivileged class and despite coming from an urban background could have dietary deficiencies and low family income which have been recognized as the risk factors for anaemia by different previous workers.[24,26-28] As far as association of malarial infection is concerned, parasitic infections have been recognized as the cause of anaemia by other workers too.[29] The limitation of the present study was that those women who were lost to follow up experienced negative pregnancy outcome & did not see the importance of returning for follow up , hence underestimating the occurrence of pregnancy outcome. Furthermore, diagnosis of anaemia was based on laboratory analysis and did not depend on clinical assessments which resulted in lack of clinical correlations.

CONCLUSION

Prevalence was significantly lower in rural/semiurban women (58.4%) as compared to that in urban women (71.8%) and a significant association of younger age, urban residence and history of malaria with anaemia was found. The findings of the study were helpful in understanding the problem and making appropriate intervention plans. Keeping in view a high dependency of anaemia in pregnancy with regional, climatic,

environmental and sociodemographic factors, further studies at regular interval are recommended to be carried out to understand the problem in contemporary context and to evolve appropriate preventive andmanagement strategies to reduce its impact on perinatal outcomes.

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