Original Article

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Evaluation of Anemia and Hematological Parameters in Antenatal

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ABSTRACT

Background: Anemia is one of the most commonly encountered medical disorders during pregnancy. The haematological profile have both an impact on pregnancy as well as its outcome. The hematologic status in a pregnant woman can be evaluated by measuring different blood indices such as haemoglobin concentration, packed cell volume (PCV), red blood cell count, total WBC count etc. The present study was undertaken to monitor haematological parameters during antenatal visits and the ability to predict and /or improve pregnancy outcome, with the help of hematological parameters.

Methods: The present study is a cross sectional study comprising of 173 pregnant females attending the antenatal care of the Department of Obstetric and Gynaecology

Result: Among the 173 pregnant females, majority 44.50% had mild anemia with hemoglobin levels between 10-10.9gm/dl while moderate anaemia was seen in 42.19% of patients. However severe anemia was seen in 13.29% patients.

Conclusion: The hematological status in pregnant women can be evaluated by measuring different hematological parameters and indices. RBC count is one of the important indications of anemia and indices like MCV, MCH, MCHC provide information about the hemoglobin content and size of blood cells which are useful in typing of anemia. The need of the hour is to monitor the various hematological parameters during pregnancy as anemia has very deleterious effects on both mother and fetus and is an easily preventable cause.

Keywords: *Anemia, Antenatal, Hematological, Pregnancy*

Introduction

Hematological profile is not only a reflection but also a reliable indicator of general health along with being a simple, fast and cost-effective test.[1] The pregnant state induces many changes in a woman amongst those seen in the haematological profile are important which not only has an impact on pregnancy but also its outcome. The hematologic status in a pregnant woman can be evaluated by measuring different blood indices such as haemoglobin concentration, packed cell volume (PCV), red blood cell count, total white blood cell count and differential count amongst others. Anemia is one of the most commonly encountered medical disorders during pregnancy defined by decreased hemoglobin level or circulating red blood cells. In developing countries prevalence is high leading to various adverse effects on the mother and the fetus causing high maternal mortality and foetal complications. It is one of the most common preventable causes of maternal morbidity and poor perinatal outcome. The main causes of anemia during pregnancy involve deficiencies of nutrients, infections, and parasitic diseases. Amongst the many factors that influence pregnancy some of which include culture, environment, socioeconomic status, and access to medical care, the impact of haematological indices on pregnancy and its outcome is significant. [2] Anaemia is known to contribute to intrauterine growth retardation, preterm labour, abortions alongwith primary cause of low immunity of both the mother and baby, making them prone for infections. [3]. Assigning a normal reference range for haemoglobin concentration during pregnancy is difficult. According to the standard laid down by WHO, anemia in pregnancy is present when the haemoglobin concentration in the peripheral blood is 11 gm / 100ml or less.[3] According to United Nation declaration 1997, anemia is a major public health problem requiring total elimination. It is estimated that globally about two billion people suffer from anemia or iron deficiency.[4]

The importance of monitoring haematological parameters during antenatal care lies in the ability to predict and /or improve pregnancy outcome, with this in mind the present study was undertaken.

Materials and Methods

A total of 173 pregnant female patients attending antenatal clinic, were analyzed in this study. All relevant data related to the patient's clinical presentation were collected. Venous blood samples were drawn from pregnant women attending antenatal clinic for the assessment of hematological parameters. EDTA tubes were used for adequate blood sample collection. The samples were analysed on three-part

auto analyzer for parameters including Hb concentration, PCV, RBC concentration, MCH, MCV, MCHC, WBC count, and Platelet count. Standardization and calibration of the instrument, and processing of the samples were done according to instructions.

Result

The present study is a cross sectional study comprising of 173 pregnant females attending the antenatal care of the Department of Obstetric and Gynaecology, with haemoglobin less than 11gm/dl. Age wise distribution of the patients showed a maximum of 53.2%cases in the age group 20-25 yrs followed by 35.8% in the age group 26-30 years. Out of the 173 pregnant females majority 44.50% had mild anemia with Hb between 10-10.9gm/dl while moderate anaemia was seen in 42.19% of patients and severe anemia was seen in 13.29% patients. (Table 1)

The hematologic status in pregnant women can be evaluated by measuring different blood parameter of which red blood cell count is an important indication of anemia. Red blood cell count was decreased (<4 million / cumm) in 87.2% of our patients. However normal RBC counts was seen in 10.9% cases while an increased RBC count was seen in 1.73% of the patients. (Table 2)

Blood indices i.e Mean Corpuscular Volume (MCV, normal range 80-100 fL), Mean corpuscular haemoglobin (MCH, Normal range: 27-31 pg/cell) and Mean Corpuscular Hemoglobin Concentration (MCHC, Normal range: 32-36 g/dl) were also calculated and evaluated in the present study group. (Table.3) These indices provide information about the hemoglobin content and size of red blood cells. Abnormal values indicate not just the presence of anemia but also type of anemia. MCV was found to be below normal range in majority of the patients (71%).

On further analyzing, the cases were classified into type of anemia on peripheral blood examination. In our study majority of the patients suffered from microcytic hypochromic (123,71.1%) while dimorphic anemia was seen in 14 patients (8.1%) indicating nutritional deficiencies. Distribution of cases according to age with their respective haematological parameters are depicted in Table 4 with the mean of each parameter

Religious and cultural beliefs often have a major bearing on the eating habits of women in our country.Keeping this in mind we also analyzed the haematological profile of these pregnant females according to their religious beliefs. Out of the 173 patients who formed the study group, 120 were Hindus and 53 were Muslims. The prevalence of anemia was more in pregnant females with Hindu beliefs as compared to Muslim patients.

Discussion

Hematological abnormalities, especially anemia, may have adverse impact on pregnancy outcome and in most

Table 1: Distribution According To The Degree Of Severity Of Anemia.

Anemia	No. of patients (n=173)	Percentage (%)
Mild anemia (10-10.9 gm/dl)	77	44.50
Moderate anemia (7-9.9gm/dl)	73	42.19
Severe anemia (<7gm/dl)	23	13.29
Total	**173**	**100**

Table 2: Distribution according to red blood cell count in pregnant women.

RBC count	No. of Patients	Percentage
Normal (4.0 – 5.2 million/cumm)	19	10.9
Decreased (<4.0 million/cumm)	151	87.2
Increased (>5.2 million/cumm)	3	1.7
Total	**173**	**100**

Table 3: Distribution of cases according to Red blood Cell indices.

RBCIndices	Below normal range	Within Normal Range	Above Normal Range
MCV (fl)	123	47	3
MCH (pg)	119	51	3
MCHC (g%)	126	47	-

Table 4: Type of anemia in pregnant women.

Type of anemia	No. of patients	Percentage
Normocytic & normochromic	20	11.5
Microcytic hypochromic	123	71.1
Normocytic & hypochromic	13	7.5
Microcytic & macrocytic (Dimorphic)	14	8.1
Macrocytic	3	1.7
Total	**173**	**100**

Table 5: Blood Parameters according to age group.

Age Group (years)	No. of Patients	Hemoglobin Mean ±SD	RBC Mean ±SD	PCV Mean ±SD	MCV Mean ±SD	MCH Mean ±SD	MCHC Mean ±SD	RDW Mean ±SD
< 19	9	8.84±1.24	3.97 ±0.34	32.86±3.37	72.94±8.64	26.63±3.43	32.04±1.54	29.67±3.4
20-25	92	9.83±1.60	3.91± 0.51	33.00±4.29	74.58±7.27	26.94±2.99	31.70±1.92	20.02±2.8
26-30	62	10.63±1.69	3.93± 0.50	33.00±4.20	78.18±7.10	27.10±3.18	32.26±1.97	15.2± 1.3
31-35	8	8.23 ± 1.84	3.37±0.58	32.6±4.794	75.06±6.18	26.61±2.75	31.57±1.49	21.2± 2.3
>35	2	9.31±1.13	3.63± 0.21	32.80±2.82	71±9.47	20.1±3.39	28.30±0.98	19.1± 2.2

Table 6: Blood Parameters According To Religion.

Haematological Parameter (Mean ±SD)	Hindu	Muslim
Hemoglobin	8.2±1.5	9.1±1.4
Red Blood Cell Count	3.35±0.50	3.91±0.46
Packed Cell Volume	33.4±3.9	32.8±4.2
Mean Corpuscular Volume	73.8±7.1	74± 5.9
Mean Corpuscular Haemoglobin	26.7±2.9	26.8±2.7
Mean Corpuscular Hemoglobin Concentration	31.8±1.6	31.8±0.8
Red Cell Distribution Width	18.2±11	17.2±10.3

Table 7: Blood Parameters in comparison to non pregnant females.

Haematological Parameter (Mean ±SD)	Non Pregnant Females	Pregnant Females
Hemoglobin	10.5±2.6	10.6±1.6
Red Blood Cell Count	3.8±0.9	3.9±0.5
Packed Cell Volume	33.2±7.6	33.1±4.2
Mean Corpuscular Volume	86.5±9.8	84.1± 7.3
Mean Corpuscular Haemoglobin	27.3±4.2	26.8±3.1
Mean Corpuscular Hemoglobin Concentration	31.5±2.1	31.8±1.9
Red Cell Distribution Width	16.1±3.4	39.9±15.4

Table 8: The findings of various studies of blood parameters according to age group(Table 5) are compared in a tabular form.

Age Group (year)	No. of Patients		Hemoglobin Mean ±SD		RBC Mean ±SD		PCV Mean ±SD		MCV Mean ±SD		MCH Mean ±SD		MCHC Mean ±SD	
	Present study	Swati Singh et al[K]	Present study	Swati Singh et al[K]	Present study	Swati Singh et al[K]	Present study	Swati Singh et al[K]	Present study	Swati Singh et al[K]	Present study	Swati Singh et al[K]	Present study	Swati Singh et al[K]
< 19	9	3	8.84 ± 1.24	8.6 ± 2.08	3.97 ± 0.34	3.23 ± 0.06	32.86 ± 3.37	30.2 ± 7.93	72.94 ± 8.64	83.06 ± 14.37	26.63 ± 3.43	26.9 ± 1.1	32.04 ± 1.54	30.06 ± 1.68
20-25	92	50	9.83 ± 1.60	8.08 ± 1.46	3.91 ± 0.51	3.46 ± 0.86	33.00 ± 4.29	28.73 ± 4.84	74.58 ± 7.27	76.45 ± 8.78	26.94 ± 2.99	27.4 ± 2.57	31.70 ± 1.92	30.89 ± 2.15
26-30	62	19	10.63 ±1.69	7.983 ± 1.48	3.93 ± 0.50	3.29 ± 0.66	33.00 ± 4.20	30.3 ± 6.64	78.18 ± 7.10	80.65 ± 8.77	27.10 ± 3.18	27.67 ± 2.91	32.26 ± 1.97	30.99 ± 2.46
31-35	8	8	8.23 ± 1.84	8.18 ± 1.76	3.37 ± 0.58	3.25 ± 0.27	32.6 ± 4.794	33.9 ±7.02	75.06 ± 6.18	85.36 ± 11.61	26.61 ± 2.75	28.0 ± 2.88	31.57 ± 1.49	32.38 ± 0.78

developing countries makes an important contribution to maternal mortality and morbidity, adding to the already stretched resources of these countries [5] According to the World Health Organization estimates, up to 56% of all women living in developing countries are anemic, as per its guidelines, hemoglobin level below 11gm/dl in pregnant women constitutes anemia while that below 7gm/dl is severe anemia.[6] The WHO definition for diagnosis of anemia in pregnancy is a Hb concentration of less than 11 g/dl(7.45 mmoL/L) and a hematocrit of less than 33% [6]

Anemia is the most common hematological disorder seen in pregnancy, as is well known pregnancy is influenced by many factors, some of which include culture, environment, socioeconomic status, education and access to medical care. In India, the statistics is almost the same, the National Family Health Survey -2 in 1999 shows that 54% of women in rural and 46% women in urban areas are anemic. The Center for Disease Control and Prevention (1990) defines anemia as less than 11gm/dl in the first and third trimester and less than 10.5gm/dl in second trimester.[7,8]. In this study, the prevalence of anemia in pregnant women was significantly high having 100% of pregnant females fall into the category. These findings were in concordance with the study conducted in Jaipur.[9] However as stated by Suryanarayana et al, the prevalence of anemia in pregnant women was 64% a study conducted in Karnataka and a higher prevalence was observed in studies of Ahmad et al and Kaul et al. being 74.8% and 91% respectively[10]

The mean hemoglobin level of pregnant women in this study was found to be 10.6±1.6 which was similar to studies of Suryanarayana et al and Bisoi et al having 10.3±1.53 g%, and 10.1± 0.98 g% respectively. [10] Out of the 173 pregnant females majority 44.50% had mild anemia with hemoglobin levels between 10-10.9gm/dl while moderate anaemia was seen in 42.19% of patients. However severe anemia was seen in 13.29% patients. (Table 1) These findings are comparable with the studies conducted by Suryanarayana et al where the prevalence of mild, moderate, and severe anemia were observed as 27%, 34%, and 3%, respectively. [10] Various other studies conducted by Sharma et al[9] in Rajasthan and by Wadgav HV. Mondal et al. reported that majority of the anemic women belonged to moderate anemia (91.46%) [10] whereas in our study majority of the females had mild anemia comprising 44.5% and 42.1% had moderate anemia. Findings of severe anemia were variable ranging from 0.6 % in a study by Kumar et al [11] to 18.9% in a study by Ahmed et al [12] which are comparable to our findings of 13.29%.

The higher prevalence of anemia in our study can be attributed to low socio economic group, non-availability or failure to utilize available medical facilities by females visiting the antenatal clinics, nutritional deficiencies like low dietary iron and folic acid intake and/or low bioavailability of iron along with any infections leading to chronic blood loss.

Various haematological changes take place during pregnanacy. Physiological anaemia is often attributed to increase in plasma volume, RBC volume and haemoglobin mass in cases of pregnant ladies. Expansion of plasma volume leads to RBC mass dilution resulting in physiological anemia of pregnancy. [13] These include, increases in plasma volume of 25%–80% between the sixth and twenty-fourth week of gestation.[14] ,increase in RBC mass approximately 30% between the twelfth and thirty-sixth week of gestation when iron and folate are supplemented[15] The discrepancy between the rate of increase in plasma volume and that in RBC mass leads to physiological anemia. In late pregnancy, plasma volume increases at a slower rate, inducing a slight rise in hematocrit level. These physiological changes during pregnancy make it difficult to define normal hematological reference intervals for pregnant women.[1]

The hematological status in pregnant women can be evaluated by measuring different blood parameters and blood indices. Red blood cell count is one of the important indications of anemia and blood indices like MCV, MCH, MCHC provide information about the hemoglobin content and size of blood cells which are useful in typing of anemia. The RBC count was decreased in majority of our study group constituting 87.2 % with 10.9% in normal range while 1.7% females had an increased RBC count (Table 2). Singh et al[15] found 67.5% women with below normal range RBC count, similar findings of majority females having low RBC count was found in study by Sharma et al [9] Below normal range of MCV, MCH and MCHC were found in 123, 119 and 126 pregnant women respectively. (Table 3) Similar findings were seen in a study by Shah et al where MCV was below normal range in 70.6% females as compared to our 71%, while MCH was below normal level in 58.9% pregnant women which is less as compared to our study.[16] However contrasting findings were seen in a study by Dhaliwal et al where there was no significant change in MCVvalues, on the other hand, MCHC and MHC showed significant decrease in pregnant women. [17]

On further analyses five types of anemia were seen in anemic women based on peripheral blood examination as shown in Table 4. In our study majority of the pregnant women suffered from microcytic hypochromic anemia (71.1%), followed by 11.5% normocytic normochromic while dimorphic anemia was seen in 8.1% women, 7.5% had normocytic hypochromic and a miniscule of 1.7% had macrocytic picture. These findings are comparable to a study conducted by Singh et al where also the majority cases were of microcytic & hypochromic 47.5%, followed by normocytic & hypochromic 32.5%, normocytic & normochromic 6.25%, dimorphic 7.5% and macrocytic anemia 6.25%. [15]

The findings of various studies of blood parameters according to age group(Table 5) are compared in a tabular form and findings are found to be in concordance to our study.

The prevalence of anemia was more in pregnant females with Hindu beliefs as compared to Muslim patients (Table 6) in our study and the same findings were seen in Sharma et al [9] study.

Effects of Anaemia on Pregnancy

Maternal effects[18,19] Mild, anemia may not have any effect on pregnancy and labour except low maternal iron stores and may become moderate to-severely anemic in subsequent pregnancies. Moderate anemia may cause increased weakness, lack of energy, fatigue and poor work performance. Severe anemia, however, is associated with poor outcome. Common symptoms like palpitations, tachycardia, breathlessness, increased cardiac output leading on to cardiac stress which can cause de-compensation and cardiac failure which can be fatal[12]. Increased incidence of pre-term labour (28.2%), pre-eclampsia (31.2%) and sepsis have been associated with anemia [19]

Fetal effects [18] Irrespective of maternal iron stores, the fetus still obtains iron from maternal transferrin, which is trapped in the placenta and which, in turn, removes, and actively transports iron to the fetus. In these cases, subsequently however, such fetuses tend to have decreased iron stores due to depletion of maternal stores. Adverse perinatal outcome in the form of pre-term and small-for-gestational-age babies and increased perinatal mortality rates have been observed in the neonates of anemic mothers. Iron supplementation to the mother during pregnancy improves perinatal outcome. Mean weight, Apgar score and haemoglobin level 3 month after birth were significantly greater in babies of the supplemented group.

Conclusion

The need of the hour is to monitor the various hematological parameters during pregnancy as anemia has very deleterious effects on both mother and fetus and is an easily preventable cause. In the developing countries with availability and access to medical care still having huge number of anemic pregnant females points towards the indifference and ignorance to health needs. Therefore, strategic efforts are needed to not just broaden the coverage of iron and folic acid distribution and its consumption but an urgent need to counsel and educate about the importance of antenatal care to pregnant women and their families. To fight this menace health education on reproductive health is the foremost step and subsequently the monitoring of compliance of antenatal care are the most important health care measures to be taken urgently and at all levels.

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