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Original Research Article

To Study Prevalence of Types of Anaemia in Pregnancy by Clinical Examination and Peripheral Smear

Vandana Agarwal[1], Sarika Gupta[2], Neetu Kumar[3], Varsha Rani Choudhary[4], Mudita Jain[5]

[1,2]Associate Professor Department of Obstetrics and Gynaecology, RKDF Medical College, Bhopal

[3]Professor Department of Pathology Chirayu Medical College and Hospital, Bhopal

[4]Assistant professor Department of Obstetrics and Gynaecology, RKDF Medical College, Bhopal

[5]Professor& Head, Department of Obstetrics and Gynaecology, RKDF Medical College, Bhopal

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Corresponding author: Dr. Varsha Rani Choudhary

Conflict of interest: Nil

Abstract

Objective: To classify the types of anaemia using clinical findings and peripheral smear in pregnant female. Peripheral smear examination reveals the morphological features of RBC's and help in determining the underlying etiology of anaemia.

Methods: Observational cross-sectional study was conducted. 392 women of antenatal clinic were screened for features of anemia. Sociodemographic variables including age, address, socioeconomic status was obtained from the study participants using preformed and peer reviewed proforma. Clinical history regarding presenting complaints, obstetrics history and relevant history was obtained and documented. All the study participants were then subjected to thorough clinical examination. They were investigated by Hb%. TLC, peripheral smear examination. The sample was analyzed to identify different types of anemia by peripheral smear according to pathological classification.

Results: Females with anaemia usually present with non-specific features such as pallor, fatigue, weakness, and giddiness. Specific features of iron deficiency anaemia include angular stomatitis and koilonychias, whereas hepatosplenomegaly is specifically observed in haemolytic anaemia. The demographic data examined revealed the mean age to be 25.96+ 4.2. 52% of women overall had a maximum age under 25. 75% of women had low socioeconomic status. Maximum 58% of the remainder were multipara, while 42% were nulliparous.

Conclusion: Anaemia is one of the most common clinical conditions observed during pregnancy. Hemoglobin estimation help in quantification of anaemia, and classifying anaemia according to severity and types. Iron deficiency anaemia is most common type of anaemia during pregnancy, other types of anaemia are also observed in few pregnant females and females may not respond to iron therapy.

Keywords: World Health Organization [WHO], NFHS, Angular Stomatitis, Koilonychias, Hepatosplenomegaly, Hemolytic Anemia.

Introduction

Anaemia in pregnancy is one of the major public health problems and has been defined as decrease in levels of hemoglobin or number of red blood cells. According to World Health Organization, anaemia in pregnancy is defined as hemoglobin concentration of less than 10 gm/L.12) Based upon the hemoglobin concentration, anaemia is categorized as mild (10 to 10.9 g/L), moderate (7 to 9.9 g/L) and severe (<7 gm/L) anaemia.2 Anaemia in pregnancy may be physiological or pathological. Physiological anaemia during pregnancy is due to physiological increase in blood and plasma volume during pregnancy. Overall, the blood volume increases by 1.5 liters during the pregnancy and the increase in plasma volume is more as compared to red cell mass. These physiological changes lead to hemodilution, which manifest as reduced hemoglobin concentration.134) Hemoglobin levels of less than 10 g/L in pregnancy indicate underlying pathology, most commonly nutritional deficiency. [1-5]

Anaemia is a common condition which is prevalent in both developed and developing countries. Literature suggests that globally 1.62 billion people are anemic attributing to 24.8% of the total population. The prevalence of anaemia in pregnant women according to World health Organization in 2019 was 36.5%. However, according to NFHS 5 data (2019-2021), the prevalence of anaemia in pregnant women in India was 52.2%, with 45.7% in urban and 54.3% in rural area. According to NFHS-5 State factsheet, the prevalence of anaemia in pregnant women in Madhya Pradesh was 52.9%, with higher prevalence in rural area (54.9%) as compared to urban area (45.1%). [4-5]

Though nutritional deficiencies (iron, folic acid, Vitamin B12, vitamin A) are the most common cause of anaemia in pregnancy in low middle income countries, anaemia attributed to other causes as well such as parasitic infections (malaria, hookworm infestation, giardiasis, schistosomiasis), chronic infections (tuberculosis, hemoglobinopathies (Glucose 6-phosphate dehydrogenase deficiency, sickle cell disease, thalassemia), hemorrhoids, antepartum hemorrhage etc. Iron deficiency anaemia is the leading cause of anaemia in pregnancy (>75%) whereas the Sickle cell trait and beta thalassemia are observed in 40% and 1-1.5% of pregnant women. [3-6]

Managing and preventing anaemia during pregnancy is one of the important strategies to reduce maternal and fetal morbidity and mortality as anaemia during pregnancy is associated with increased risk of maternal and fetal complications in terms of poor pregnancy outcomes (low birth weight, preterm birth). Anaemia not only has immediate effect but has long term effect on health of developing fetus such as impaired cognition development in neonate, diminished school performance, and diminished productivity and work performance during adulthood. Maternal and child health programmers mainly focus on prevention of nutritional deficiency anaemia during pregnancy by supplementing folic acid in first trimester and iron folic acid in second and third trimester. However, females may not respond to oral as well as injectable iron in case of non-iron deficiency anaemia. Also, the female may have multiple nutritional deficiency such as iron deficiency, folate deficiency, vitamin B12 deficiency etc. and thus the underlying anaemia may not respond to only iron therapy. [7-8]

Peripheral smear examination is an essential component for evaluation of hematological disorders. It helps in revealing size and hemoglobin content of the red blood cells. Normal RBCs are biconcave with central pallor appearing normochromic normocytic. However, in pregnancy the females may present with dimorphic or polymorphic blood picture as

iron deficiency on peripheral smear reveals microcytic micro chromic, whereas folate or B12 deficient RBCs are macrocytic. Blood smear also helps in determining the specific morphological abnormalities of RBCs such as spherocytes, Sickle cells and target cells etc. Sickle cell and target cells are seen in sickle cell anaemia, whereas spherocytes are observed in autoimmune hemolytic anaemia, hereditary spherocytosis, hemolytic transfusion reactions etc. Schistocytes are identified in microangiopathic hemoglobinopathy associated with severe Preeclampsia and HELLP syndrome. [9-10]

Thus, the peripheral blood smear examination is an important method for determining the type of anaemia in pregnancy and it supplements the complete blood picture. With the above background, the present study was conducted at tertiary care centre to study the prevalence of different types of anaemia in pregnancy using peripheral blood smear with its clinical and laboratory profile.

Materials and Methods

Study Design: Observational cross-sectional study

Study Area: Department of Obstetrics and Gynecology, RKDF Medical College Bhopal

Study duration: 18 months i.e., from December 2020 to May 2022.

Study Population: Pregnant women attending antenatal OPD during the study period.

Inclusion Criteria:

All pregnant women attending the antenatal OPD clinic and registered during the study period irrespective of trimester and gravida.

Exclusion Criteria:

Pregnant women not willing to give consent

Consent: Written consent was obtained from all the study participants after explaining them nature and purpose of study. They were ensured that confidentiality will be maintained and option to withdraw from the study was always kept open.

Methodology

Observational cross-sectional study was conducted. 784 women of ANC OPD were screened for features of anaemia. They were investigated by Hb%. TBC, Peripheral smear examination. The sample was analysed to identify different types of anaemia by peripheral smear according to pathological classification as below:

a) Microcytic hypochromic anaemia: RBC with diameter less than 7.0micrometer and MCV less than 80fl and central pallor more than 1/3 of the RBC. Pencil cells and tear drop cells are seen in peripheral smear in iron deficiency anaemia.

b) Macrocytic anaemia: RBCs larger than normal RBCs having a diameter more than 8.0micro meter and MCV more than 100fl seen in Megaloblastic anaemia. Howell jolly bodies, buffy coat appearance seen in peripheral smear.

c) Dimorphic anaemia: smear showing both anisocytosis and Poikilocytosis.

Macrocytic hypochromic (Poikilocytosis, pencil cell elliptical cells) seen in IDA + FA, B12 deficiency.

Macrocytic megaloblastic (anisocytosis, Howell jolly bodies) in FA and B12 Macrocytic non megaloblast: liver diseases and hypothyroidism d) Normocytic hypochromic: liver and renal disease, impaired bone marrow

After obtaining ethical clearance from Institute's ethical committee, all the pregnant women fulfilling the inclusion criteria and willing to participate in the study were enrolled. Sociodemographic variables including age, address, socioeconomic status was obtained from

the study participants using preformed and peer reviewed proforma. Clinical history regarding presenting complaints, obstetrics history and relevant history was obtained and documented. All the study participants were then subjected to thorough clinical examination. Preliminary hematological investigations were done for which 2 ml of venous blood was collected following all aseptic precautions in the EDTA vacutainer.

Observation Chart

Table 1: Distribution of Cases According to Diagnosis

Peripheral Smear	Frequency	Percentage
Normocytic Normochronic	**418**	**53.3**
Microcytic Hypochromic	**336**	**42.9**
Dimorphic Anaemia	**10**	**1.3**
Macrocytic	**12**	**1.5**
Sickling	**08**	**1.0**

Table 2: Distribution According to type of Anaemia

Anaemia Group	Total Percentage		No Anaemia Percentage	
Normocytic Normochromic	**418**	**53%**	**144**	**91.1%**
Microcytic Hypochromic	**336**	**42.85%**	**6**	**3.79%**
Macrocytic Normochromic	**12**	**1.53%**	**2**	**1.26%**
Dimorphic	**10**	**1.27%**	**2**	**1.26%**

Table 3: Distribution According to Findings of Peripheral Smear

Type of Anaemia	Frequency	Percentage
Liver Disorder	**06**	**.75%**
Iron Deficiency Anaemia	**578**	**73.7%**
Megaloblastic	**06**	**.75%**
Sickle Cell	**20**	**2.6%**
Thallesimia	**16**	**2%**
Normal	**158**	**20.2%**

Table 4: Association Between type of Anaemia and Peripheral Smear Findings

Type of Anaemia	Normocytic Normochronic	Microcytic Hypochromic	Dimorphic Anaemia	Macrocytic	Sickling
Liver Disorder	**2[0.5%]**	**4[1.2%]**	**0 [0%]**	**0[0%]**	**0[0%]**
Iron Deficiency Anaemia	**270[64.6%]**	**298[88.7%]**	**2[20%]**	**6[50%]**	**2[25%]**
Megaloblastic	**0[0%]**	**0[0%]**	**6[60%]**	**0[0%]**	**0[0%]**
Sickle Cell	**0 [0%]**	**8[2.4%]**	**2[20%]**	**4[33.3%]**	**6[75%]**
Thallesimia	**0 [0%]**	**16[4.8%]**	**0 [0%]**	**0 [0%]**	**0 [0%]**
Normal	**146[34.9%]**	**10[3%]**	**0 [0%]**	**2[16.7%]**	**0 [0%]**
Total	**418**	**336**	**12**	**10**	**8**
Chi-Square	**419.8**				
P-Value	**0.001**				

Table 5: Clinical Features with Different types of Anaemia

Symptoms/ Clinical Features	Total Sample	Microcytic Hypochromic	Macrocytic	Haemolytic
Pale Tongue	100%	100%	100%	100%
Giddiness Fatigue Weakness	92-99%	95%	98%	80%
Angular Stomatitis	44%	41%	33%	50%
Brittle Hair Brittle Nail	6%	5%	3%	2-4%
Hepatomegaly	10%	8%	0%	40%
Spleenomegaly	6%	5%	0%	34%

Results

Mean age of antenatal cases enrolled in present study was 25.96±4.285 years and about 75.3% cases belonged to lower socioeconomic status. Majority of females enrolled in present study were primigravida (42.1%), whereas 35.7% females were second gravida. Anaemia was observed in 79.8% cases and about 52.8% cases had mild anaemia, 25.2% cases had moderate anaemia and 1.8% cases had severe anaemia. Most common type of anaemia observed in pregnant females was iron deficiency anaemia (73.7%). Other types of anaemia observed in small proportions of antenatal females was sickle cell anaemia (2.6%), thalassemia (2%), megaloblastic anaemia (0.75%) and hemolytic anaemia (0.75%).

Peripheral smear revealed normocytic normochromic blood picture in 53.3% cases and microcytic hypochromic picture was observed in 42.9% cases. However, macrocytic, dimorphic and sickling was observed in peripheral smear in 1.5%, 1.3% and 1% cases respectively. About 64.6% and 88.7% cases with normocytic normochromic blood picture and microcytic hypochromic blood picture had iron deficiency anaemia. About 75% cases with sickling on peripheral smear had sickle cell anaemia.

Pale tongue was the most common mode of presentation observed in 100% cases, followed by weakness, fatigue and giddiness in 98.7%, 93.9% and 92.1% cases respectively. Hepatomegaly was found in 10.5% cases whereas 5.9% cases had splenomegaly. About 75% cases of thalassemia had angular stomatitis and hemorrhagic patches were observed in 12.5% cases. However, hepatomegaly and splenomegaly were documented in 37.5% and 12.5% cases respectively. In patients with sickle cell anaemia, 40% cases each had angular stomatitis and hepatomegaly each. Splenomegaly was noted in 30% cases with sickle cell anaemia. All the cases with megaloblastic anaemia had giddiness, fatigue, weakness, and pale tongue. About 33.3% cases each had angular stomatitis and brittle nails/hairs.

Iron deficiency anaemia was associated with angular stomatitis in 41.2% cases, 0.3% cases each had skin pigmentation, tingling/ numbness and jaundice. Hepatomegaly was observed in 8% and splenomegaly was reported in 4.5% cases. About 66.7% cases with hemolytic anaemia had hepatosplenomegaly. About 33.3% cases with hemolytic anaemia had jaundice, angular stomatitis, pearly white sclera, abdominal swelling, and dark urine each. History of pica was observed in 66.7% cases with megaloblastic anaemia, 50% cases with sickle cell anaemia, 40.1% cases with iron deficiency anaemia, 33% cases with hemolytic anaemia and 25% cases with thalassemia.

Statistical Analysis:

Data was compiled using MS Excel and analysis was done with the help of IBM SPSS software version 20. Categorical variables were expressed as frequency and percentage whereas continuous variables were expressed as mean and standard

deviation Association of type of anaemia with peripheral smear finding was done using chi square test. P value of less than 0.05 was considered statistically significant.

Discussion

Anaemia is defined as a condition in which the number of red cells or their oxygen-carrying capacity is insufficient to meet physiological needs. It is the most common disorder globally and one of the conditions that general practitioners most frequently encounter. In the World Health Organization global database, anaemia is estimated to affect 1.6 billion people. As anaemia manifests in a wide range of conditions, it is important to embrace a structured diagnostic approach. [1-3]

Anaemia occurs globally and is a major public health problem in women of reproductive age. It is a major direct and indirect cause of maternal mortality and is associated with high foetal wastage.Nutritional iron-deficiency anaemia (IDA) is the most common disorder in the world, affecting more than two billion people. The World Health Organization's global database on anaemia has estimated a prevalence of 14% based on a regression-based analysis. Recent data show that the prevalence of IDA in pregnant women in industrialized countries is 17.4% while the incidence of IDA in developing countries increases significantly up to 56%. Khalafallah et al worked-on iron deficiency anaemia in pregnancy and postpartum. [4]

Like our study, Asghar R et al did a cross sectional study comparison of peripheral blood smear examination with automated haematology analyzer for diagnosing different types of anemia. Diagnostic accuracy and frequency of anemia types was measured. There were 42(28.2%) male and 107(71.8%) female. Mean age of patients was 35.1±2.1SD. Peripheral blood smear and automated haematology analyzer showed sensitivity (68% vs 92%), specificity (59% vs 88%), PPV (72% vs 92%), NPV (55% vs 88%) and diagnostic accuracy (64% vs 91) respectively.It was concluded that automated haematyology analyzer had high diagnostic accuracy for diagnosis of anemia. Microcytic hypochromic anemia and normocytic normochromic are most common anemias diagnosed by peripheral blood smear and automated hematology analyzer and peripheral blood smear cannot be completely replaced by automated haemolytic analyzer. However, if both methods are used simultaneously, more accurate results can be obtained.[5]

Bain BJ et al did diagnosis from the blood smear.van den Broek NR et al studied etiology of anemia in pregnancy in south Malawi. Anemia in pregnancy is a major public health problem in developing countries. In sub-Saharan Africa, such anemia is generally accepted as resulting from nutritional deficiencies, particularly iron deficiency.In above studies authors comprehensively assessed the full spectrum of nutritional and nonnutritional factors associated with pregnancy anemia.It was concluded that the role of chronic inflammation as a possible contributing factor to anemia in pregnancy has important implications for the clinical evaluation and treatment of women.[6-7]

Ogunbode O et al discussed the environmental causes of anaemia in low- and middle-income countries. They described the main types of anaemia and states that identification and treatment of the causes as well as the correction of anaemia are the main principles of management. also highlighted the challenges of non-availability of adequate blood-banking facilities in sub-Saharan Africa and recommends parenteral iron therapy as a cheaper alternative. It opined that the prevalence of anaemia is strongly influenced by the low level of education and poor socio-economic status and recommended preventive measures such as vigorous campaigns for early booking for

antenatal care, dietary advice during the counselling classes at antenatal clinics, administration of anti-malarials and haematinics throughout pregnancy and the puerperium as well as education of the girl child thereby reducing early marriage and its attendant pregnancy-related complications.[8-9]

Ashok C et al in a very similar study like us did comparative study of peripheral smear with RBC Indices and RBC Histogram in diagnosis of anemia. Jacob EA et al on the other hand did a a review study on complete blood cell count and peripheral blood film, its significant in laboratory medicine. Breymann C et al did their study on Iron deficiency and anaemia in pregnancy. Barcellini W et al studied various clinical applications of hemolytic markers in the differential diagnosis and management of hemolytic anemia. Several hemolytic markers are available to guide the differential diagnosis and to monitor treatment of hemolytic conditions. They include increased reticulocytes, an indicator of marrow compensatory response, elevated lactate dehydrogenase, a marker of intravascular hemolysis, reduced haptoglobin, and unconjugated hyperbilirubinemia. Reticulocytopenia occurs in 20–40% of autoimmune hemolytic anemia cases and is a poor prognostic factor. Increased reticulocytes, lactate dehydrogenase, and bilirubin, as well as reduced haptoglobin, are observed in conditions other than hemolysis that may confound the clinical picture. Alli N et al gave a recommended approach which incorporates clinical and pathophysiological considerations, red cell characteristics, and bone marrow activity A comprehensive clinical and laboratory evaluation is advisable for a correct diagnostic and therapeutic workup of the different hemolytic conditions. [10-13]

Hematologic changes in pregnancy are common and can potentially lead to maternal and fetal morbidity. Patel P et al studied hematologic findings in pregnancy. Here, they present various hematologic manifestations seen in pregnant women. Iron deficiency anemia (IDA) is the most common cause of anemia in pregnancy. There is a wide range of etiology for thrombocytopenia in pregnancy from benign to life-threatening causes that require prompt diagnosis and treatment. These conditions include gestational thrombocytopenia, thrombotic thrombocytopenic purpura, pregnancy-associated atypical hemolytic-uremic syndrome, and immune thrombocytopenia. Acquired bleeding disorders that can cause major complications in pregnancy include von Willebrand disease (vWD) and coagulation factor deficiencies. Women with vWD are at increased risk of pregnancy bleeding and postpartum hemorrhage. Pregnancy can also produce a physiologic hypercoagulable state, leading to life-threatening conditions like thromboembolism. Diagnosis, treatment options, and guidelines for the management of these conditions will be explored in this review.[14]

Conclusion

Anaemia is one of the most common clinical condition observed during pregnancy. Hemoglobin estimation help in quantification of anaemia, and classifying anaemia according to severity. Iron deficiency anaemia is most common type of anaemia during pregnancy, other types of anaemia are also observed in few pregnant females and females may not respond to iron therapy.

Declarations:

Funding: None.

Availability of data and material: Department of Obstetrics and Gynaecology, RKDF Medical College, Bhopal.

Code availability: Not applicable.

Consent to participate: Consent taken.

Ethical Consideration: There are no ethical conflicts related to this study.

Consent for publication: Consent taken.

Limitations of our study

1. The study was conducted as a facility-based study, where individuals of all age and socioeconomic strata seek care, but majority of care seeking care at our center belonged to lower socioeconomic strata and this may be one of the causes of higher prevalence of anaemia in our study. However, a community bases cross-sectional study among pregnant women of all socioeconomic status would have revealed the.
2. The sample size of the study was small and thus findings may not be generalized.
3. Multicentric cross-sectional study as required to conclude for the utility of peripheral blood smear in routine clinical practice.

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