Physiological Changes in Hematological Profile among Healthy Pregnant Women

Dr Priyanka Gupta

(MD Pathologist,Cygnus Hospital,Kurukshetra,Haryana)
Corresponding Author: Dr Priyanka Gupta

Background: *Pregnancy is a period of reproduction during which several physiological changes that occur in hematological parameters. Pregnancy is characterized by an increase in white blood cell counts mainly neutrophils. This neutrophilia is attributed to physiological stress and it is known to increase with gestational age. While humoral immunity is unaltered in pregnancy, cell mediated immunity is depressed. It is important to note that leucocytosis even with a mild left shift and some toxic granulations may not necessarily indicate an infection in pregnant women.*
Objective: *To study the normal changes that occur to red blood cells, white blood cells, hemoglobin, platelets among pregnant women and compare it with within three different trimesters and non pregnant controls.*
Materials and Methods: *A total 50 apparently healthy pregnant women (gestational age 6-40 weeks) with age between 20 to 40 years were taken into the study as cases and 50 non pregnant controls aged between 18 to 65 years came with other gynecological complaints. They attended department of obstetrics and gynecology Cygnus hospital, Kurukshetra (Haryana). Hematological parameters including WBC, RBC, Hemoglobin and platelets were measured by SysmexXP100.*
Results: *The hematological parameters were represented as follows: mean value of WBC was 9122 ± 2556 cells/mm^3, RBC was $4.05\pm 0.74*10^{12}$/L, Hemoglobin was 11.39 ± 1.64 g/dl, and platelets was $227.1\pm64 *10^9$/L in case of pregnant women and mean values of WBC was 8124 ± 2034cells/mm^3, RBC was $4.31\pm0.52*10^{12}$/L, Hemoglobin was 12.14 ± 1.72g/dl, and platelets was $254.2\pm80*10^9$/L in case of non pregnant controls.*
Conclusion: *There was no statistical significance in RBCs, Hemoglobin, platelets and WBCs between pregnant women in their three different trimesters, however there is mild increase in WBC counts in third trimester than second and first but it was not found statistically significant.*
Key Words: *Neutrophilia, toxic changes, hematological parameters*

I. Introduction

Pregnancy is associated with profound anatomical, physiological, biochemical, and endocrine changes that affect multiple organs and systems[1]These changes are essential to help the woman adapt to the pregnancy state and to aid fetal growth and survival. The hematologic system must adapt in a number of ways, such as provision of vitamins and minerals for fetal hematopoiesis (iron, vitamin B12, folic acid), which can exacerbate maternal anemia and preparation for bleeding at delivery, which requires enhanced hemostatic function[2]. The most significant hematological changes are physiologic anemia, neutrophilia, mild thrombocytopenia, increased procoagulant factors[3]. Red blood cell (RBC) mass begins to increase at 8–10 weeks of gestation and steadily rises by 20%−30% (250–450 mL) above normal pregnant levels by the end of the pregnancy in women taking iron supplements[4] Pregnancy is also associated with enhanced platelet turnover[5]. The RBC indices change little in pregnancy. However, there is small increase in mean corpuscular volume, of an average of 4 fl. oz in an iron-replete woman, which reaches a maximum at 30–35 weeks gestation and does not suggest any deficiency of vitamins B12 and folate[6,7]. Also in white blood cells (WBCs) pregnancy is associated with leukocytosis, primarily related to increased circulation of neutrophils. The neutrophil count begins to increase in the second month of pregnancy and plateaus in the second or third trimester, at which time the total white blood cell (TWBC) counts range from 9,000 to 15,000 cells/micro liter[8].

II. Materials and Methods

This is a retrospective study at Cygnus Hospital , department of gynecology and obstetrics, Kurukshetra (Haryana). The study population comprised 50 apparently healthy pregnant women aged between 20 and 40 years were recruited into the study while attending for monitoring of their pregnancy. Subjects were divided into three pregnancy groups, depending on the duration of pregnancy in to the first, second, and third

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trimester of pregnancy. We used reference values of the health status of normal women who came with different gynecological problems as controls.

Sample
About 2.5ml of venous blood collected in K2EDTA for complete blood counts.

Method
Sysmex XP100 (hematology analyzer) was used for complete blood counts.

Statistical Analysis The results were statistically analysed by unpaired Student 't' test and by Pearson's correlation coefficient. A 2 tailed probability value of <0.05 was taken as indicating difference.

III. Result

According to the age, the study group was divided into four groups first group, the highest percentage (48%) of the pregnant women was between the age of 26 and 30, second group (38%) between 20 and 25, third group (12%) between 31 and 35, and finally the fourth group showed lowest percentage (2%) in the age above 35 years (Table 1) whereas age of non pregnant controls ranges from 18 to 65years. Also, according to the gestation period time cases divided into three groups, 38% in their first trimester, 20% in second trimester, and 42% in third trimester (Table 2). The hematological parameters were represented as follows: the mean value of WBC was 9122 ± 2556 cells/mm^3, RBC was $4.05\pm0.74*10^{12}$/L, Hemoglobin was 11.39 ± 1.64 g/dl, and platelets was $227.1\pm64*10^9$/L in case of pregnant women and mean values of WBC was 8124 ± 2034cells/mm^3, RBC was $4.31\pm0.52*10^{12}$/L, Hemoglobin was 12.14 ± 1.72g/dl, and platelets was $254.2\pm80*10^9$/L in case of non pregnant controls. WBCs increased progressively with gestational age, first trimester was 8805 ± 2967.5cells/mm^3-,second trimester was 8860 ± 2860 cells/mm^{3}and third trimester was 9450 ± 2012cells/mm^3.The differences between means were not statistically significant from first to second trimester(student's t-test p=0.96),from second to third (student's t test p=0.5) and from first to third (student's t test p=0.42).

Table1-Distribution of study group according to age

Age group	Frequency	Percentage
20-25	19	38
26-30	24	48
31-35	6	12
>35	1	2
Total	50	100

Table 1-Distribution of study group according to trimesters

Trimester	Frequency	Percentage
First	19	38
Second	10	20
Third	21	42
Total	50	100

Table 2-Statistical results of cases in three trimesters

Trimester parameters	First trimester mean	Second trimester mean	Third trimester mean	Normal mean
WBCcells/mm^3	8805 ± 2967.5	8860 ± 2860	9450 ± 2012	7000
RBC*10$^{12/L}$	4.2 ± 0.32	3.9 ± 0.84	4.1 ± 0.50	4.7500
Hb g/dl	11.52 ± 1.15	10.9 ± 2.3	11.5 ± 1.85	13.5
Platelets *10^9/L	233 ± 70	197 ± 76	230 ± 59	256.24

P value between **first and second trimester** came 0.33 for **hemoglobin** ,between **second and third trimester** came0.39,and between **first and third** came 1.00, p value of **RBC** came 0.17 in between **first and second trimester**,0.41 between **second and third** and 0.4 between **first and third**, p value of **platelets** came between **first and second trimester** is 0.2, between **second and third** is 0.19 and between **first and third** came 0.88 and lastly p value of **WBC** in between **first and second** came 0.96, between **second and third** came 0.5 and between **first and third** came 0.42.(P value derived by unpaired student't' test.

IV. Discussion

The physiology of a normal pregnancy involves major changes in the hematological parameters. These changes appear to be related to the development of the uteroplacental circulation and provide a protective mechanism during delivery. In this study, we focus in the primary hematological changes during pregnancy related to Hemoglobin, RBCs, TWBCs, Platelets among healthy pregnant women. In our finding, the RBCs

were within normal value and showed no significant differences among the three groups of subjects. This finding supported that during pregnancy, the total blood volume increases by about 1.5 L, mainly to supply the demands of the new vascular bed and to compensate for blood loss occurring at delivery[9].The result of the blood Hemoglobin showed no significant difference between those groups. Also, this may be due to supplementary intake. We found that the TWBCs count showed mild differences

among the three groups and was found statistically insignificant. The highest value was found in the third group followed by the second group and the lowest value found in the first group. Leukocytosis, occurring during pregnancy is due to the physiologic stress induced by the pregnant state[8], also this finding is contradictory with similar study done by Li et al[9] among pregnant women and concluded that there was no significant difference of hemogram changes. Platelets count found to be within normal range in vast majority of the women in all three trimesters. This finding agrees with another similar study done by Babiker et al[10] . Also this disagrees with the study done by Boehlen et al, reported that there were decrease in platelets count in normal pregnant women[11,12] . However the increase in leukocyte count with increasing gestational age is less marked in our study. This is probably because my study was cross sectional study with varying numbers of subjects at different gestational ages. To the clinician it is noteworthy that a mild to moderate leukocytosis is not a sure indicator of infection in pregnancy. However leukocytosis should be interpreted with caution and further tests should be requested to confirm the diagnosis of infection or any other problem during pregnancy.

V. Conclusion

This study concluded that pregnancy in women did not alter in findings of RBCs, Hemoglobin, platelets and no significant changes found among pregnant women. WBCs shown mild difference in counts and was statistically insignificant among the three groups, highest value was found in the third group followed by second and first. However leukocytosis should be interpreted with caution and further tests should be requested to confirm the diagnosis of infection or any other problem during pregnancy.

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