Reference Range of Platelet Count in Normal Pregnancy using Sysmex SE-9500

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We performed a study on 210 pregnant women to determine platelet reference ranges and to evaluate differences with a control group of 210 healthy non–pregnant women using the Sysmex SE-9500. During the second and third trimesters of pregnancy a decrease in platelet count (PLT) occurred but this was not statistically significant. However, during the same period statistically significant increases were noted in mean platelet volume (MPV), platelet large cell ratio (P-LCR) and platelet distribution width (PDW). It is important that haematologists and obstetricians are aware of these different reference ranges during pregnancy.

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INTRODUCTION

During normal pregnancy and the puerperium, changes in blood coagulation and fibrinolysis create a state of hypercoagulability[1, 2]. The platelets play a pivotal role in the initiation of the coagulation process. These phenomena, probably due to hormonal changes, protect the woman from fetal hemorrhage during delivery, but also predispose her to thromboembolism[3-5]. There is evidence that platelets play a substantial role in the pathogenesis of pre-eclampsia[6,7].

For these reasons, changes in platelet count (PLT) are very important during pregnancy. In pregnancy many platelet disorders are found[8]: thrombocytopenia is the most common haemostasis abnormality identified, and this has important implications for mother and fetus and not inconsiderable anxiety for the doctor and patient[9-11].

For the majority of women, the reduction in PLT is benign and not associated with pre-eclampsia or HELLP (haemolysis, elevated liver enzymes and low platelets) syndrome.

Before the mid-1980s, thrombocytopenia in the non-hypertensive pregnant patient was considered to be immune (idiopathic) thrombocytopenic purpura (ITP)[12,13], but after 1988 many reports documented that during normal pregnancy non-immune reduction in PLT occurred[14]. This appears late in the pregnancy, the PLT is only slightly reduced and unassociated with any adverse effect on the fetus.

In HELLP syndrome, on the other hand, PLT are much lower. The lower the PLT is, the greater is the maternal and perinatal morbidity[15, 16].

It is, therefore, important to establish the reference ranges for platelet parameters during pregnancy using an automated blood cell analyser. In view of existing information, we performed a study in a large group of pregnant women. The aim of the study was to determine reference ranges for platelet parameters during the three trimesters of pregnancy, using the Sysmex SE-9500 fully automated haematology analyser.

MATERIALS AND METHODS

The platelet parameters were measured by the Sysmex SE-9500 (Sysmex Corporation, Kobe, Japan) fully automated haematology analyser on venous samples collected in K_3EDTA from 210 non-pregnant women as a control group and 210 pregnant women in the three different trimesters of pregnancy. All women were free from platelet disorders of any type and in the pregnant group all obstetric parameters were normal.

The specimens were analysed within 1 hour from venesection. All specimens were analysed in duplicate and the mean values used for generating the reference ranges. The parameters analysed included the PLT, the mean platelet volume (MPV), the platelet-large cell ratio (P-LCR) and the platelet distribution width (PDW).

Observations based on the MPV were considered valid only if the specimens were analysed within 1 hour from venesection, to avoid the problems occurring when EDTA collected samples are analysed with impedance systems.

For statistical analysis, Descriptive Statistics and the Student t-test were used. Significance was assumed at $p<0.05$.

RESULTS

The platelet parameter reference ranges for non-pregnant women (control group) and pregnant women are shown in ***Table 1***.
Reference ranges for all Sysmex SE-9500 platelet parameters in the three trimesters of pregnancy are shown in ***Table 2a***; mean values, median and SD are shown in ***Table 2b***. Between the second and third trimesters statistically significant increases (t-test, $p<0.05$) in PDW, MPV, P-LCR occured. The PLT shows a reduction at the low decision point of the reference range but this does not attain statistical significance.

The behaviour of the means and medians of all platelet parameters in the three trimesters of pregnancy are shown in ***Fig. 1***.

DISCUSSION

Changes in PLT are very important during pregnancy: in fact many platelet disorders[8] occur and a reduction in PLT is the most common.
This study defines specific reference ranges for platelet parameters in pregnant women as measured with Sysmex SE-9500. We observed differences between the control

Table 1 *Reference ranges for platelet parameters in healthy non-pregnant women and in pregnant women*

	Normal non-pregnant women (reference group, n= 210)	Pregnant women (n= 210)
Platelets ($\times10^9$ /L)	150 - 350	110 -340
PDW (fL)	9 - 17	9 - 17
MPV (fL)	6.8 - 9	9 - 12.7
P-LCR (%)	13.0 - 43.0	17.3- 48.0

Table 2a *Reference ranges for platelet parameters in women in the three trimesters of pregnancy*

	First (I) trimester of pregnancy (n= 70)	Second (II) trimester of pregnancy (n= 70)	Third (III) trimester of pregnancy (n= 70)
Platelets ($\times10^9$/L)	125 - 325	111 - 335	78 - 346
PDW (fL)	9.7- 16.4	9.3 - 16.8	9 - 19
MPV (fL)	9.2- 12.4	9 - 12.6	9 - 13
P-LCR (%)	18 - 46	16.7 - 46.7	18 - 50

Table 2b *Mean±2SD and median of Sysmex SE-9500 platelet parameters in women in the three trimesters of pregnancy*

	First (I) trimester of pregnancy		Second (II) trimester of pregnancy		Third (III) trimester of pregnancy	
	Mean ± 2SD	Median	Mean±2SD	Median	Mean ± 2SD	Median
Platelets ($\times10^9$/L)	225.51 ± 100.48	222.00	223.66±112.9	213.00	212.09 ± 135.44	207.00
PDW(fL)	13.11 ± 3.36	12.75	13.11±3.76	12.65	14.14** ± 4.98	14.10
MPV(fL)	10.86 ± 1.68	10.70	10.80±1.84	10.70	11.13* ± 2.04	11.20
P-LCR(%)	32.16 ± 14.18	30.65	31.71±15.04	30.90	34.41* ± 16.46	35.25

* Statistical significance $p<0.05$
** Statistical significance $p<0.01$

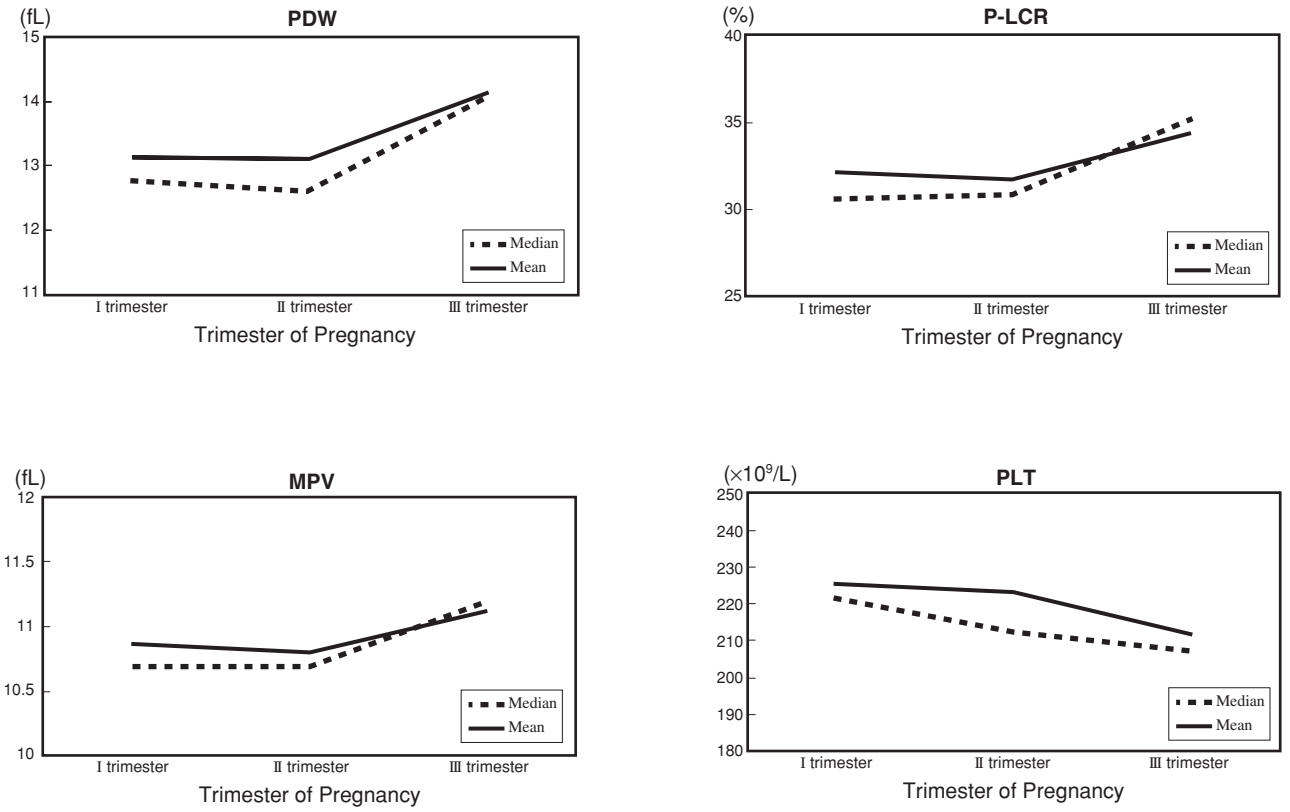

Fig. 1 *Mean and median pattern of all platelet parameters in the three trimesters of pregancy*

group and pregnant women. We analysed these differences in each of the three trimesters. The differences between first and second trimesters were not statistically significant, however between second and third trimesters differences were statistically significant for PDW, P-LCR and MPV. It would appear that during pregnancy there occurs an increase in the heterogeneity of human platelets caused by increased numbers of larger platelets. The larger platelets seem to be more reactive than the smaller ones[17].

The PLT showed lower reference values than the control group but this was not statistically significant.

In conclusion, our study defines specific reference ranges for platelet parameters in each trimester of pregnancy. As can be seen, there are differences compared to healthy non-pregnant women. It is very important that haematologists and obstetricians are aware of these differences, because deviations from reference range templates could indicate the emergence of complications.

Using these trimester specific reference ranges abnormality can be defined more accurately and promptly. At the moment the clinical significance of deviation from the defined reference is being studied in our pregnant population. This has important implications for both mother and fetus and for the classification of severity of pre-eclampsia (PET).

References

1) *Stirling Y, et al.: Haemostasis in normal pregnancy. Thromb Haemost, 52: 176-182, 1984.*
2) *Schafer AL: The hypercoagulable states. Ann Intern Med, 102: 814-828, 1985.*
3) *Coon WW: Epidemiology of venous thromboembolism. Ann Surg, 186: 149-164, 1997.*
4) *Bonnar J: Epidemiology of venous thromboembolism in pregnancy and the puerperium. In: Greer IA, Turpie AGG, Forbes CD, eds. Haemostasis and thrombosis in obstetrics and gynaecology. Chapman & Hall Medical, London, 257-266, 1992.*
5) *Rosendal FR: Risk factors for venous thrombosis: prevalence, risk and interaction. Semin Hematol, 34: 171-187, 1997.*
6) *Redman CWG: Platelets and the beginnings of pre-eclampsia. N Engl J Med, 323: 478-480, 1990.*
7) *Janes SL, et al.: Flow cytometric detection of activated platelets in pregnant women prior to the development of pre-eclampsia. Thromb Haemost, 74: 1059-1063, 1995.*
8) *Burrows RF: Platelet disorders in pregnancy. Curr Opin Obstet and Gynecol, 13: 115-119, 2001.*
9) *Burrows RF, Kelton JG: Incidentally detected thrombocytopenia in healthy mothers and their infants. N Engl J Med, 319: 142-145, 1988.*
10) *Letsky EA, Greaves M: Guidelines on the investigation and management of thrombocytopenia in pregnancy and neonatal alloimmune thrombocytopenia. Br J Haematol, 95: 21-26, 1996.*

11) *McCrae KR, Samuels P, Schreiber AD: Pregnancy-associated thrombocytopenia: pathogenesis and management. Blood, 80: 2697-2714, 1992.*
12) *George JN, Woolf SH, Roskob GE, et al.: Idiopathic thrombocytopenic purpura: a practise guideline developed by explicit method for the American Society of Hematology. Blood, 83: 3-40, 1996.*
13) *Paternoster DM, Santarossa C, Manfreda G: Idiopathic thrombocytopenic purpura and pregnancy. Int J Gynecol Obstet, 65: 207-208, 1999.*
14) *Burrows RF, Kelton JC: Incidentally detected thrombocytopenia in healthy mothers and their infants. N Engl J Med, 319: 142-145, 1988.*
15) *Martini JN, Rinehart BK, May WL, et al.: The spectrum of severe pre-eclampsia: comparative analysis by HELLP syndrome classification. Am J Obstet Gynecol, 180: 1373-1384, 1999.*
16) *Isler CM, Rinehart BK, Terrone DA, et al.: Maternal mortality associated with HELLP syndrome. Am J Obstet Gynecol, 181: 924-928, 1999.*
17) *Karpatkin S: Heterogeneity of human platelets. Correlation of platelet function with volume. Blood, 51: 307-316, 1978.*