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Could Plateletcrıt, in The Fırst 24 Hours of Lıfe, Be an Early Indıcator of Poor Etıology and Prognosıs in Preterm Infants?

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Background: Platelet indices such as mean platelet volume (MPV) and platelet numbers (Plt) have been used as predictive indicators in many diseases of preterm infants. However, there is limited data regarding use of plateletcrit (PCT) as an indicator of many detrimental conditions (ie, gestational diabetes, hypertension and infection) and also clinical conditions such as necrotizing enterocolitis (NEC), sepsis and mortality in preterm neonates.

Objective: The aim of this retrospective study was to investigate if PCT in the first 24 hour could indicate above mentioned conditions and predict poor prognosis compared to other blood parameters such as Hemoglobin (Hgb), Mean Corpuscular Volume (MCV), Red Blood Cell Distribution Width (RDW), White Blood Cell (WBC), Plt, MPV and Platelet Distribution Width (PDW).

Design/Method: All premature babies ≤ 32 weeks and admitted to NICU of Selcuk University between January 2018 to June 2019 were investigated. Their maternal conditions for gestational hypertension (GH), diabetes and infection during pregnancy were analysed to reveal potential relation between antenatal conditions and postnatal markers. Infants were also reviewed according to their clinical prognosis and presence of intrauterine growth restriction (IUGR), sepsis, NEC and mortality. The first blood parameters (Hgb, MCV, RDW, WBC, Plt, MPV, PDW and PCT were recorded and evaluated.

Results: Of the 186 infants (GW: 29±1weeks, BW: 1300±100 gr), 92 (49.5%) were girls and 94 (50.5%) were boys. Mean maternal age was 28 ± 1years and 3.8% of these mothers had gestational diabetes, 10.2% hypertension and 9.7% infection. From baby standpoint, 20 infants (10.8%) had IUGR, 50 (26.8%) infants had sepsis, and 18 (9.6%) infants had NEC. Thirty five infants (18.8%) died during hospital course.

In term of gender, there was no difference between BW, Mother's age, although male infants were heavier than females ($p<0.05$). Hematological parameters were similar between 2 genders ($p>0.05$). WBC, Plt, RDW parameters were affected from GH. Interestingly MPV was not affected from any antenatal and postnatal conditions, but PCT levels were significantly low in IUGR, sepsis and in mortality group. Although, platelet numbers are closely related with PCT, they were also affected from IUGR. Both sepsis and mortality were found associated with GW and BW.

Conclusions: Unlike to many studies showing benefits of MPV as a marker of poor prognosis in preterm babies, our study did not show such a benefit of MPV. On the other hand we found PCT as a good marker for detection of antenatal and postnatal detrimental factors on the newborn babies. We believe that prospective studies are needed to understand value of using PCT in this tiny population.

Keywords: *Plateletcrit, preterm babies, marker, prognosis.*

Introduction

Plateletcrit is the volume occupied by platelets in the blood as a percentage and calculated according to the formula PCT = platelet count × MPV / 10,000 (1-2). Under physiological conditions, the amount of platelets in the blood is maintained in an equilibrium state by regeneration and elimination. The normal range for PCT is 0.22–0.24% (1,2,3). In healthy subjects, platelet mass is closely regulated to keep it constant, while MPV is inversely related to platelet counts (2,3,4). A simultaneous reduction of Plt and PCT indicates that platelets have been excessively consumed (5). Platelet indices have been shown to have diagnostic value in certain inflammatory diseases, such as inflammatory bowel diseases, rheumatoid arthritis, ankylosing spondylitis, ulcerative colitis, and atherosclerosis (4, 6-7). Mean platelet volume shows the activity of disease in systemic inflammation, acute pancreatitis, unstable angina, and myocardial infarction (8-9).Sepsis is one of the most common causes of death among hospitalized patients in newborn intensive care units (NICUs). Necrotizing enterocolitis (NEC) is also one of the most common and serious preterm-related complications with high surgical rate and mortality in premature infants. The morbidity of NEC can be as high as 28% in very low birthweight infants (10-14). There are many factors which can affect babies' conditions for mortality and morbidities. However, our diagnostic tools are in limited number for this purpose. Our study aimed to investigate if PCT in the first 24 hours could be helpful for grossly recognizing of many detrimental conditions (ie, gestational diabetes, hypertension and infection) and also clinical conditions such as necrotizing enterocolitis (NEC), sepsis and mortality in preterm neonates.

Materials and methods

In this study, we retrospectively checked the data of all premature infants hospitalized in the NICU department of Selcuk University between January 1, 2018 and June 30, 2019.Initial maternal and newborn history were taken from patient records and electronic databases. Infants born 32 weeks or earlier were included and their hemogram in the first 24 were reviewed. Parameters that we checked were mean platelet volume (MPV), mean corpuscular volume (MCV), platelet distribution width (PDW), plateletcrit (PCT), haemoglobin (Hgb), platelet numbers (Plt) and white blood cells (WBC). We also evaluated the mothers' history for diabetes, hypertension and infection from the records. Infants were reviewed in terms of IUGR, sepsis, NEC and mortality. Data was entered into a Microsoft Office excel 2010 database and imported into SPSS statistical software for analysis.

Statistical analysis

Prenatal factors (gestational diabetes, infection and GH) and postnatal outcomes (IUGR, Sepsis, NEC and Death) were categorized. Non-parametric numeric values of Hgb, MCV, RDW, WBC, Plt, MPV, PDW and PCT were compared for each group by using Mann-Whitney test. $p<0.05$ was considered to be statistically significant.

Results

The general characteristics of groups are shown in Table 1&2 (n=186). A total of 186 infants who met our criteria were reviewed. Ninety four (%50.5) of them were boys and 92 (%49.5) were girls (Table1). Their average GW was 29 ± 1, and the BW was 1300 ± 100 g. Maternal age was 28 ± 1 years and 3.8% of the mothers were gestational diabetes, 10.2% GH, 9.7% infection. In addition, 20 infants had IUGR when postnatal period was evaluated. 50 infants had sepsis and 18 infants had NEC. Thirty five infants (18.8%) died during hospital course. (Table2&3)

Table 1
General characteristics of the study groups.

	N(%)	NEC	Sepsis	IUGR	Exitus
Male	94(%50.5)	8	22	7	15
Female	92(%49.5)	10	28	13	20
Total	186(%100)	18(%9.7)	50(%26.9)	20(%10.8)	35(%18.8)

Table 2

	Birth weight mean(gr)	Gestational weeks mean	Mother's age
Male	1417	29	27
Female	1226	28	29
Total Mean	1300±100	28±1	28±1

Table 3

	Gestational diabetes	Gestational hypertension	Gestational infection
N (%)	7(%3.8)	19(%10.2)	18(%9.7)

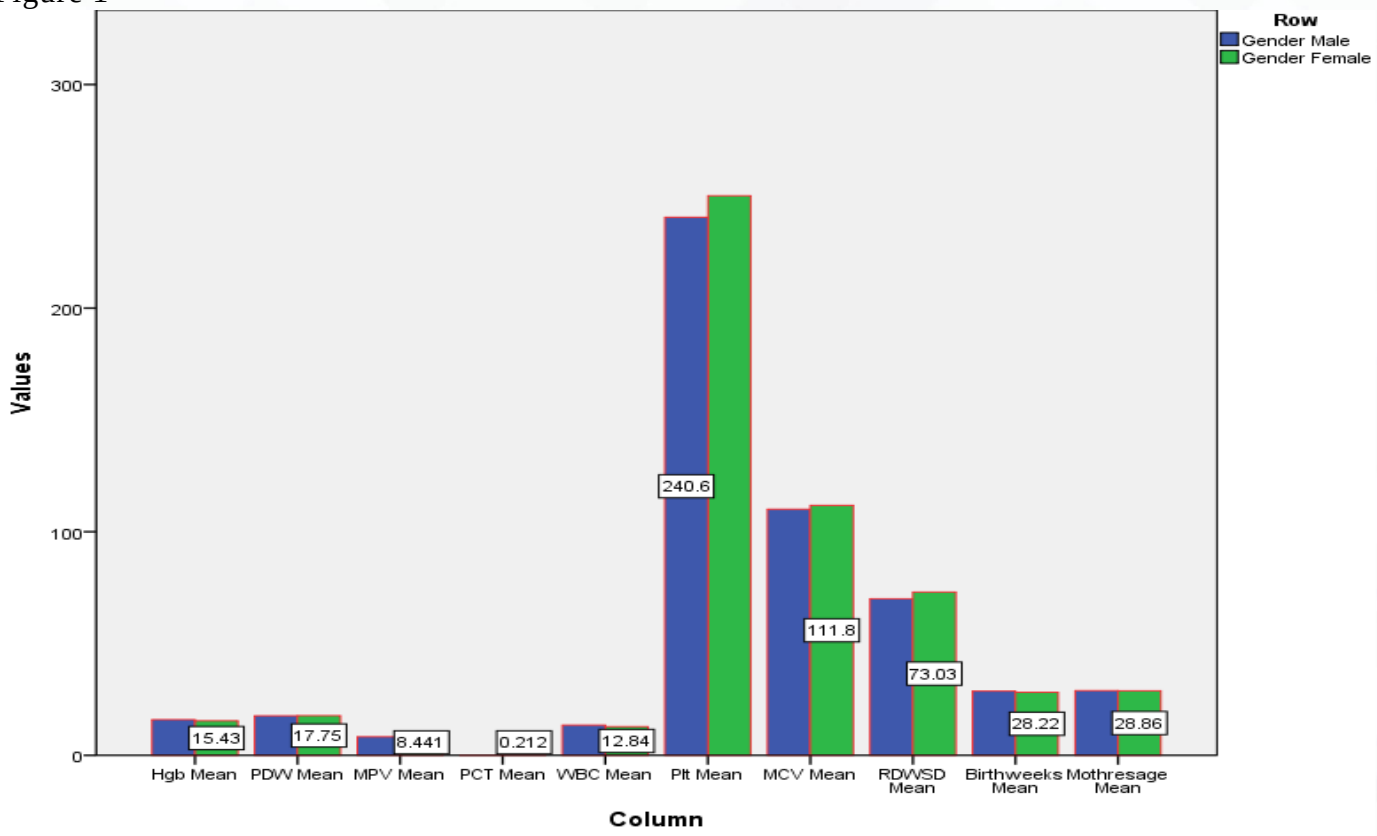
According to statistical results, babies of GH mothers had low WBC and Plt values and high RDW values ($p<0.05$) however in terms of Hgb , MCV, MPV, PDW and PCT there was no significant difference ($p>0.05$).
There was no significant difference among the other parameters ($p>0.05$) in gestational diabetes except MCV. Infants whose mothers are with gestational diabetes had low MCV ($p<0.05$).
On the other hand, IUGR infants had high RDW, MCV and WBC values while PCT and Plt values were low ($p<0.05$).
MCV, RDW and PDW values were higher in infants with sepsis and PCT and Plt values were low ($p<0.05$).
There was no significant difference between the blood parameters that we investigated between infants with and without NEC ($p>0.05$).
PCT, Plt and Hgb values were low and MCV and RDW values were high in infants who died ($p<0.05$).
There was no significant difference in Hgb, WBC and MPV between sepsis positive and negative premature babies ($p>0.05$).
There was no difference in terms of Hgb, MPV and PDW between infants with and without IUGR ($p>0.05$) Table 4.
Also the blood parameters we investigated in gestational infection were not affected among the premature($p>0.05$) Table 4.
The results were summarized on Table 4.

Table 4

Prenatal/Postnatal factors	Hgb	WBC	Plt	MCV	MPV	RDW	PDW	PCT
Gestational diabetes	N	N	N	p=0.043	N	N	N	N
Gestational infection	N	N	N	N	N	N	N	N
Gestational hypertension	N	p=0.018	p=0.044	N	N	p=0.036	N	N
IUGR	N	p=0.033	p=0.000	p=0.001	N	p=0.000	N	p=0.000
Sepsis	N	N	p=0.013	p=0.001	N	p=0.003	p=0.023	p=0.007
NEC	N	N	N	N	N	N	N	N
Mortality	p=0.000	N	p=0.000	p=0.041	N	p=0.003	N	p=0.000
Gender	N	N	N	N	N	N	N	N

Hematological parameters were similar between two gender (p>0.05) Figure 1.

Figure 1



Discussion

Despite the best current medical and surgical treatment, the overall prognosis of infants with sepsis remains poor. Therefore, it is of great importance to identify novel biomarkers for treatment. Biomarkers are biologically relevant molecules that indicate the presence, progression, or possible outcome of disease conditions. For sepsis, biomarkers have the

potential to diagnose the responsible pathogen, stage of the disease, and possible response to treatment.

Our study demonstrated that infants with sepsis had lower PCT levels compared to infants without sepsis. Furthermore, infants with intrauterine growth restriction and mortality also had lower PCT levels. But overall PCT was the best marker that shows affiliation with IUGR, sepsis and death. Although another popular and novel marker MPV was more extensively studied in many newborn studies and found to be very useful, was affected from gestational diabetes in our study. Considering high frequency of gestational diabetes in pregnant women, it makes MPV weaker than PCT because of contamination according to our results .

Over 178 protein biomarkers have been proposed for sepsis detection, including procalcitonin (15), C-reactive protein (16), interleukin(IL)-6, and soluble urokinase-type plasminogen activator receptor (suPAR). In agreement with the studies above, our study confirmed the important role of platelet indices in infants. Moreover, our study can form the basis for further mechanistic studies and ultimately aid in patient-tailored selection of therapeutic strategies. There are several limitations of this study. First, the current study was a retrospective analysis with a limited number of patients. Thus, a more thorough investigation in a larger series of patients is necessary to confirm the results. Second, the patients were composed of only Selcuk University. External validation is still needed to confirm whether our results can be generalized to a new patient population.

Conclusion

Monitoring the changes of PCT maybe contribute to early detection of sepsis in infants. In addition, IUGR and mortality in infants were related with low level of PCT. The results underlined the importance of PCT involved in infants and pointed out the need for further mechanistic research.

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