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Does prematurity affect platelet indices?

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ABSTRACT

Purpose: The current study objective was to compare blood platelet indices in preterm newborns (PTN) and full term newborns (FTN).
Materials and Methods: We introduced to our study 51 PTN (25 females, 26 males) and 55 FTN (25 females, 30 males). Platelet indices were estimated in blood samples collected from the umbilical artery.
Results: PTN demonstrated a decreased count of blood platelets (197×103/μL) as compared to FTN (287×103/μL), p=0.0001. Platelet hematocrit (PCT) also showed substantial differences in both groups (PTN=0.16% vs. FTN=0.22%; p=0.001). Mean platelet volume (MPV) was found to be nearly the same (PTN=8.02fl, FTN=7.79fl). Platelet distribution width (PDW) was higher in PTN (50.64%) than in FTN (46.54%), p=0.021. Large platelet count (LPLT) was diminished in PTN (5.23%) in comparison with FTN (6.12 %).
Conclusions: A decreased count of blood platelets, platelet hematocrit and increased platelet distribution width may result from a low gestational age or a dysfunction of megakaryocytes and the placenta. Blood platelet indices may be vital in the diagnosis of haemostatic disorders.

Key words: platelet indices, prematurity

INTRODUCTION

Blood platelets in newborns, like in adults demonstrate several activities both in physiological and pathological conditions, including haemostasis, the integrity of blood vessels, transportation and phagocytosis. Haemostasis in newborns is characterized by a low efficiency in comparison to adults [1]. In preterm newborns, blood platelet count is found to be decreased, depending on birth weight and gestational age [2]. There is some evidence that the functions of blood platelets are related to gestational age [3]. Our interest has been focused on the determination of blood platelet indices in preterm newborns as compared to full term neonates. Our attention has been directed to whether or not prematurity affects platelet indices.

MATERIALS AND METHODS

The study involved 51 preterm newborns (PTN), 25 females and 26 males, gestational age 25-32 weeks, weight from 1,000 to 2,150 g, Apgar score 4-8 points at 1 min. As a control, there were 55 full term newborns (FTN), 25 females and 30 males, gestational age 38-41 weeks, weight from 2,900 to 4,250 g, Apgar score 8-10 points at 1 min. Both groups of newborns and their mothers were free of infections. Parturients demonstrated no maternal diseases, pregnancy and perinatal complications, normal delivery and no haematological complications or diseases were later diagnosed. No drugs affecting the functions of platelets were administered to mothers within ten days before delivery.

Blood samples were collected from the umbilical artery after the cutting of the umbilical cord. This is an easy way to collect enough blood for analysis. The first volume of 0.5 ml was discarded to avoid platelet activation. The 1 ml of blood samples were collected in haematological tubes with

Table 1. **Indices of blood platelets in preterm and full term newborns.**

Parameter	Preterm newborns PTNx ± SD			Full term newborns FTNx ± SD		
	Female + Male	Female	Male	Female + Male	Female	Male
PLT, platelet count, x 103/ µL	197 ± 44	208 ± 43	187 ± 43	287 ± 69	308 ± 56	269 ± 74
PCT, platelet hematocrit, %	0.16 ± 0.04	0.17 ± 0.03	0.16 ± 0.04	0.22 ± 0.05	0.24 ± 0.04	0.21 ± 0.05
MPV, mean platelet vol., fl	8.02 ± 0.92	8.06 ± 0.80	7.99 ± 1.03	7.79 ± 0.58	7.82 ± 0.47	7.75 ± 0.66
PDW, platelet distribution width, %	50.64 ± 10.32	53.38 ± 6.46	48.01 ± 12.58	46.54 ± 10.78	48.04 ± 6.71	45.29 ±13.25
LPLT (>20fl), large platelet count, %	5.23 ± 2.15	5.24 ± 2.10	5.23 ± 2.25	6.12 ± 3.93	7.72 ± 4.35	4.8 ± 3.02

Table 2. **Statistical evaluation of indices of blood platelets in preterm and full term newborns, (p<0.05 accepted as statistically significant).**

Parameter	Preterm newborns PTN: Full term newborns FTN	FTN female: FTN male	PTN female: PTN male	female FTN: female PTN	male FTN: male PTN
PLT, platelet count, x 103/ µ	0.0001	0.027	NS	0.0001	0.0001
LPCT, platelet hematocrit, %	0.001	NS	NS	0.0003	0.0005
MPV, mean platelet volume fl	NS	NS	NS	NS	NS
PDW, platelet distribution width, %	0.02	NS	NS	0.004	NS
LPLT (>20fl), large platelet count, %	NS	0.017	NS	0.021	NS

K_2-EDTA (Becton Dickinson, USA). The study was approved by the parturients and the Ethical Committee of the Medical University of Bialystok according to the Guidelines for Good Clinical Practice. The Technicon H3 System (Bayer, Germany) was used to determine the following indices: PLT (platelet count), MPV (mean platelet volume), PDW (platelet distribution width), PCT (platelet hematocrit and LPLT > 20fl (large platelet count). Data distribution in groups was verified with the Kolmogorov-Smirnov Goodness of Fit Test. When we found a distribution abnormality, we used the Mann-Whitney U test. A P-value of less than 0.05 was considered significant.

RESULTS

Blood platelet count in preterm newborns was lower in comparison with full term newborns ($197x10^3$/µL vs. $287x10^3$/µL). This difference was statistically significant (p=0.0001). We found a higher PLT count in female FTN ($308x10^3$/µL) than in male newborns ($269x10^3$/µL), p=0.027. In PTN, this effect of gender was not observed (female $208x10^3$/µL, male $187x10^3$/µL), p=0.17.

PCT (platelet hematocrit) was also significantly decreased in the study group (0.16% vs. 0.22% control), p=0.001. FTN females demonstrated increased PCT (0.24%) as compared to male newborns (0.21%), p=0.052, whereas no such effect was observed in PTN (p=0.39).

MPV (mean platelet volume) was found to be nearly the same in both groups (preterm newborns - 8.02 fl, controls -7.79 fl). Gender did not exhibit any effect on MPV in both groups of newborns.

The platelet anisocytosis index (PDW) was higher in the study group (50.64%) than in controls (46.54%), p = 0.02. PDW was not affected by gender.

The LPLT (large platelet count) was diminished in preterm newborns (5.23%) in comparison with term newborns (6.12%). The percentage of LPLT was evidently higher in female FTN (7.72%) than in male newborns (4.8%), p=0.017. In PTN, such a difference did not exist (p=0.87), (*Tab. 1, 2*).

DISCUSSION

Careful analysis of our findings reveals why preterm newborns demonstrate a tendency towards primary haemostatic dysfunction, as compared to term newborns. As a decrease in platelet count is related to gestational age and birth weight [4], it is found in preterm newborns [2]. What do we know about the mechanisms underlying this process? Sola-Uisner et al [5] suggest that neonatal megakaryocytes are smaller and of lower ploidy, and produce fewer platelets. In neonates, the megakaryocyte diameter is 15.3 µm, whereas in adults 19.4 µm. A higher proportion of large megakaryocytes is observed in the course of thrombocytopenia in adults, but not in newborns.

This may be due to developmental limitation in the ability to increase megakaryocyte size [5]. On the other hand, the degree of placental dysfunction may be responsible for a low platelet count in newborns at birth [6]. Platelets from preterm newborns demonstrated a decreased platelet adhesion as compared to full term neonates, which was correlated to gestational age [3]. The question arises of whether the presented findings may contribute to diagnostic and therapeutic strategies. The decreased PLT count and their reduced functions in relation to gestational age [3,4] may result in a higher risk of bleeding tendency in preterm newborns. Platelet production in the premature infant is usually assessed by interference, because of very small marrow space and technical difficulties in bone marrow sampling [7].

The elevated PDW without any changes in MPV [8] may indicate that the platelet anisocytosis index is a more sensitive marker for the estimation of changes in platelet size. The increased PDW in preterm newborns may be due to a negative correlation with gestational age and birth weight [4]. PDW may be useful in early detections of such pathological conditions as bacteraemia, schistocytosis, platelet consumption or aggregation [9]. On the other hand, the increased value of MPV may indicate platelet consumption and activation, which may take place in disseminated intravascular coagulation.

The results concerning platelet indices determined on haematological analysers may be vital in the diagnosis of haemostatic disorders and the risk of infections. They seem to confirm the tendency to primary haemostasis dysfunction in PTN.

Unexpectedly for us, we found no statistically significant increase in platelet count in female PTN in comparison to male newborns (p=0.17), which had been noted earlier in full term newborns [10]. This may result from a restricted maturity of the thrombocytopoietic system. Primary haemostatic dysfunction in preterm newborns may result in a low platelet count and the large platelet number decreased.

CONCLUSIONS

A decreased count of blood platelets, platelet hematocrit and increased platelet distribution width may result from a low gestational age or a dysfunction of megakaryocytes and the placenta. Blood platelet indices may be vital in the diagnosis of haemostatic disorders.

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