

5. SUMMARY

The correct platelet count in healthy newborns is 150-450 thousand / μl , similar to adults, however, these platelets differ in terms of morphology and function. They have a less visible tubular structure, a smaller number of granules and a smaller average density of receptors on their surface. During activation, they form a lower quantity of pseudopods, have less aggregation ability, show increased adhesion capacity. Neonatal blood platelets, especially of those born prematurely, are hyporeactive. In addition to significant functions in hemostasis, thrombocytes act as immune cells, initiate and modulate inflammatory and immunological reactions and perform phagocytic and bactericidal functions. There are numerous compounds involved in immune processes in platelet granules. Platelet glycoproteins, such as P-selectin, interact with neutrophils, monocytes, lymphocytes, vascular endothelial cells. The role of platelets in non-specific immunity in infants is not fully understood, especially the ability of platelets to absorb and kill bacteria. Neonates born preterm have not fully mature immune mechanisms, regarding cellular and humoral immunity, all the more they have fewer weeks of pregnancy. They are more vulnerable to infection, have less ability to fight infections.

The aim of the study was to investigate the phagocytic and bactericidal properties of blood platelets in „late preterms” and newborns with normal body weight delivered at term, healthy, without the features of infection. The plasma bactericidal activity, sP-selectin, as the activation of platelets and IL-6 were marked. The dependence of the examined parameters on the gestational age, gender and birth weight was assessed.

The group of "*late preterms*" are neonates born near term, between 34 (0/7) and 36 (6/7) weeks of pregnancy, they constitute the most numerous (about 70-75%) and a constantly growing part of all premature babies, they are often born via cesarean section. About this group of newborns in the literature is less data than about the more immature infants, born under 34 weeks gestation. Due to similar body dimensions to full-term newborns, they are often treated as fully mature and ready for extrauterine life. However, it is

a completely different group, characterized by biological immaturity and associated with numerous clinical consequences, there is more perinatal morbidity and mortality compared to newborns born at term. The consequences of immaturity are disorders of haemostasis, causing intracranial bleeding and increased susceptibility to infection and tendency to generalize the infection. Thrombocytopenia is more common than in full-term newborns.

The subject of the study were umbilical blood platelets of 66 neonates born near term, so-called "late preterms" born between 34 and 36 weeks of pregnancy and blood platelets of 74 full-term babies, born at 38, 39 and 40 weeks gestation, with normal body weight, without infection features, delivered at Clinical of Perinatology of Medical University of Białystok and Gynecological-Obstetrics Department of WSZ J. Śniadecki in Białystok. The approval of the Bioethical Commission of the Medical University of Białystok no. R-I-002/152/2015 was obtained for conducting the research. The tests were carried out at the Department of Laboratory Clinical Diagnostics UMB, Department of Hematology Diagnostics UMB, Department of Microbiological Diagnostics and Infectious Immunology UMB. The statistical analysis was conducted in the Department of Statistics and Medical Informatics UMB. For the research there were used bacteria *Staphylococcus aureus* ATCC 6538P.

Newborns delivered near term had a lower number of platelets than full-term neonates: $Me = 225 \times 10^3/\mu L$ ($Q1=188$; $Q3=267$) vs $Me = 258,5 \times 10^3/\mu L$ ($Q1=222$; $Q3=300$), $p=0,003$. The platelet count increased with body weight and gestational age. The average birth weight in the study group was 2450g (min: 1650g, max: 3150g), in the control group: 3415g (min: 2650, max: 4250g). Male neonates had a higher weight by about 300g than female babies.

The platelet phagocytic abilities determined by the percentage of phagocytic platelets and the phagocytic index were similar in both groups. The percentage of phagocytic platelets: $Me = 1,1$ ($Q1=1$; $Q3= 1,2$) vs $Me = 1,1$ ($Q1=1$; $Q3=1,2$). The phagocytic index: $Me = 1$ ($Q1=1$; $Q3=1,1$) vs $Me = 1$ ($Q1=1$; $Q3=1,1$). There were no differences between fetal age or gender. With the increase in birth weight, the percentage of phagocytic platelets and the phagocytic index increased. Bactericidal capacities of platelets were similar: $Me = 0$, $M =$

0,7 (Q1=0;Q3=1,2) vs Me = 0, M = 0,8 (Q1=0; Q3=1,6). The gestational age and sex of the newborn did not affect the ability of the platelets to kill bacteria.

Measurement of plasma bactericidal activity showed significant differences in the capacity to kill bacteria *Staphylococcus aureus* in both groups of newborns: Me = 41,6 (Q1=35,4; Q3=45,9) vs Me = 43,8 (Q1=38,3; Q3=48,4), $p=0,027$ and increased with fetal age and birth weight. In male babies bactericidal ability of plasma was Me = 40,82 (Q1=32,31; Q3=46,5) and statistically lower ($p=0,009$) than plasma bactericidal capacity in group of female infants: Me = 45,8 (Q1=38,4; Q3=48,8).

The concentration of soluble P-selectin (sP-selectin) determined by the ELISA method in the blood was lower in late preterms: Me = 63,9 ng/ml (Q1=50,8; Q3=78) vs Me = 71,1 ng/ml (Q1=58,4; Q3=83,5), $p=0,03$ and increased with fetal age and birth weight; no differences were found depending on gender. In the study group, the concentration of Interleukin-6 was lower: Me = 3,6 pg/ml (Q1=2,9; Q3=4,6) vs Me = 3,9 pg/ml (Q1=3,4; Q3=4,9), $p=0,02$ and increased with fetal age; did not depend on sex, on birth weight. The conducted research allowed to draw the following conclusions and practical implications:

1. Late preterms have a lower platelet count PLT and lower plasma bactericidal activity, which may indicate weaker non-specific immunity compared to full-term infants.
2. Neonates born near term and at term of delivery have similar phagocytic and bactericidal properties of platelets.
3. With the increase in fetal age and birth weight of newborns, the plasma bactericidal activity increases.
4. With the increase in birth weight of infants, the percentage of phagocytic platelets and the phagocytic index of platelets increases.

5. There were no differences in phagocytic and bactericidal activity of blood platelets depending on the gender of newborns, but female neonates had a higher plasma bactericidal activity.
6. In the group of late preterms, female newborns had higher plasma bactericidal activity than male babies.
7. Late preterms had lower platelet levels of sP-selectin and IL-6 than infants born at term.
8. In clinical practice platelets should be assessed not only as part of the hemostatic system, but also non-specific immunity in newborns, especially those born prematurely. In newborns with thrombocytopenia, more common in preterms, it is expected that a reduced number of platelets may cause clinical effects in the form of not only hemostatic disorders (bleeding, especially to the central nervous system), but also the ability to fight infections.
9. The indications for premature termination of pregnancy should be strictly analyzed, even near term, if there are no absolute medical premises, because late preterms have lower defense capabilities against infection, which results from decreased platelet count, decreased plasma bactericidal activity, lower plasma P-selectin concentration (cooperating with neutrophils, monocytes, lymphocytes in the fight against infection).