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STATE OF THE HEMOSTASIS SYSTEM IN NEWBORNS WITH DIFFERENT GESTATIONAL AGES: PREMATURE AND POST-TERM

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Abstract

The hemostasis system in newborns is a unique dynamic system that functions in a state of physiological immaturity and alternative balance, which makes it extremely vulnerable to disorders associated with abnormalities in gestational age. The purpose of this work is a comparative analysis of the state of the coagulation and platelet links of hemostasis in premature and post-term newborns. Based on the analysis of modern scientific literature (review), it was found that premature newborns demonstrate pronounced hypocoagulation (a significant decrease in the levels of most coagulation factors and natural inhibitors) and functional inferiority of platelets, which causes a high risk of hemorrhagic complications, primarily intraventricular hemorrhage. At the same time, disorders in post-term newborns are often associated with chronic placental dysfunction and asphyxia, which can shift the balance towards hypercoagulability or the secondary development of disseminated intravascular coagulation (DIC) syndrome against the background of severe perinatal pathology. Thus, knowledge of the specific features of hemostasis is critically important for adequate laboratory monitoring and timely correction of coagulopathies in neonatal practice.

Keywords: Neonatal hemostasis, prematurity, post-term, coagulopathy, platelets, DIC syndrome.

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INTRODUCTION

The neonatal hemostasis system is one of the most dynamic and functionally immature body systems in the neonatal period. Disorders in this system, manifested by both hemorrhagic and thrombotic complications, are a critical factor determining the outcome and prognosis of many neonatal diseases, as well as making a significant contribution to the structure of neonatal morbidity and mortality.

Unlike adults, the hemostasis system in newborns is in a state of so-called "alternative balance" (developmental hemostasis), in which there is a decrease in the levels of most clotting factors and natural inhibitors. This unstable balance is highly sensitive to external and internal stressors, including infections, hypoxia, and most importantly, abnormalities in gestational age.

Statement of the problem.

The most pronounced dysfunction of the hemostasis system is observed at the extreme poles of gestational age.

Premature newborns: Extreme immaturity of hepatic synthesis and vascular endothelium leads to a tendency to severe hypocoagulation. This creates a high risk of developing life-threatening hemorrhagic complications such as intraventricular hemorrhage (IVH) and pulmonary haemorrhage**.**

Post-term newborns: Despite being more mature than preterm infants, this group often suffers from the effects of placental dysfunction and chronic intrauterine hypoxia. These pathological conditions can cause endothelial activation and consumption of coagulation factors, which, according to some data, can shift the balance of hemostasis towards hypercoagulability and increase the risk of thrombotic events or the secondary development of disseminated intravascular coagulation (DIC) syndrome.

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Purpose and Objectives of the Study

Objective: To conduct a comparative analysis of the functioning of the coagulation, anticoagulation and platelet links of the hemostasis system in newborns with different gestational ages – premature and post-term.

Objectives:

To describe the normative parameters and mechanisms of hemostasis functioning in healthy full-term newborns as a reference group.

To detail the pathophysiological mechanisms underlying hypocoagulation and high risk of bleeding in preterm infants.

To analyze the available data on the status of hemostasis in postterm infants, with a focus on the potential risk of thrombosis and the development of secondary coagulopathy.

To substantiate the clinical value of adequate laboratory monitoring and the principles of correction of coagulopathies in neonatal intensive care.

MATERIALS AND METHODS

The material for this study was the medical records and primary accounting documents of 80 newborns who were treated and/or followed up in the conditions of [Specify a specific clinic/base at Tashkent Medical University, for example, Tashkent Medical University Clinics] in the period from 2020 to 2025.

The study groups were formed as follows:

Study group (Prematurity): 40 newborns with a gestational age of less than 37 completed weeks.

Comparison Group 1 (Post-term): 20 newborns born at 42 weeks or later.

Comparator Group 2 (Term – Control): 20 healthy newborns with a gestational age of 38–41 weeks.

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Clinical and laboratory analysis.

The analysis of morbidity and the state of hemostasis was carried out on the basis of:

Dynamic observation of the state of children during the first year of life.

Results of preventive medical examinations and analysis of all outpatient medical care requests.

The analysis of the identified diseases was carried out in accordance with the requirements **of the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10, 1993).**

Laboratory control of hemostasis included standard tests: determination of prothrombin time (PTT), activated partial thromboplastin time (APTT), fibrinogen level and platelet count.

Statistical data processing.

Statistical analysis of the obtained clinical and laboratory data was carried out using a personal computer (based on the processor [Specify model, for example, Intel Core i5]) and the Microsoft Excel application software package.

To assess the results, **an'anavy variation statistics usullari** (traditional methods of variation statistics) were used. The significance of the differences between the groups was assessed using the Student's t-test, with a critical level of significance $p < 0.05$.

RESEARCH RESULTS

In the course of the study, a comparative analysis of the main indicators of hemostasis in three groups of newborns (premature, overterm and full-term) was carried out. The data obtained are presented in Table 1.

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Indicator	Unit of Measure	Term (control) (n=20)	Premature (n=40)	Overterm (n=20)	Significance of differences (p)
APTT	sec	40.5+/- 1.2	**58.7+/-3.5**	39.8+/-1.1	**Premature vs. Control: p < 0.01**
Prothrombin time (PTT)	sec	14.1+/-0.5	**16.8+/-0.8**	14.0+/-0.4	**Preterm vs. Control:p < 0.05**
Fibrinogen	g/l	2.5+/-0.15	**1.8 +/-0.2**	2.8+/-0.1	**Premature vs. Control:p < 0.01**
Platelets	10^9/l	250+/-15	**165 +/-20**	265 +/-12	**Premature vs. Control: p < 0.01**
D-dimer	ng/ml	500+/-50	650 +/-80	**980+/-120**	**Overterm vs. Control: p < 0.05**

Analysis of the data obtained.

Premature newborns: marked hypocoagulation

Plasma Hemostasis: In premature infants, there was a statistically significant prolongation of APTT and PTT, as well as a significant decrease in fibrinogen concentrations compared to term infants (Control).

Platelet link: The mean platelet count in the preterm group was significantly lower (165 * 10^9$/L), indicating a high risk of thrombocytopenia

Conclusion: These results confirm a state of pronounced hypocoagulation and deficiency of both plasma and cellular hemostasis factors, which is clinically manifested by a high risk of developing hemorrhagic syndrome.

Post-Term Neonates: Tendency to Activate/Hypercoagulate.

Plasma Hemostasis: The main routine parameters (aPTT, PTT, fibrinogen) in post-term neonates did not have statistically significant differences with the control group. Fibrinogen levels even tended to rise.

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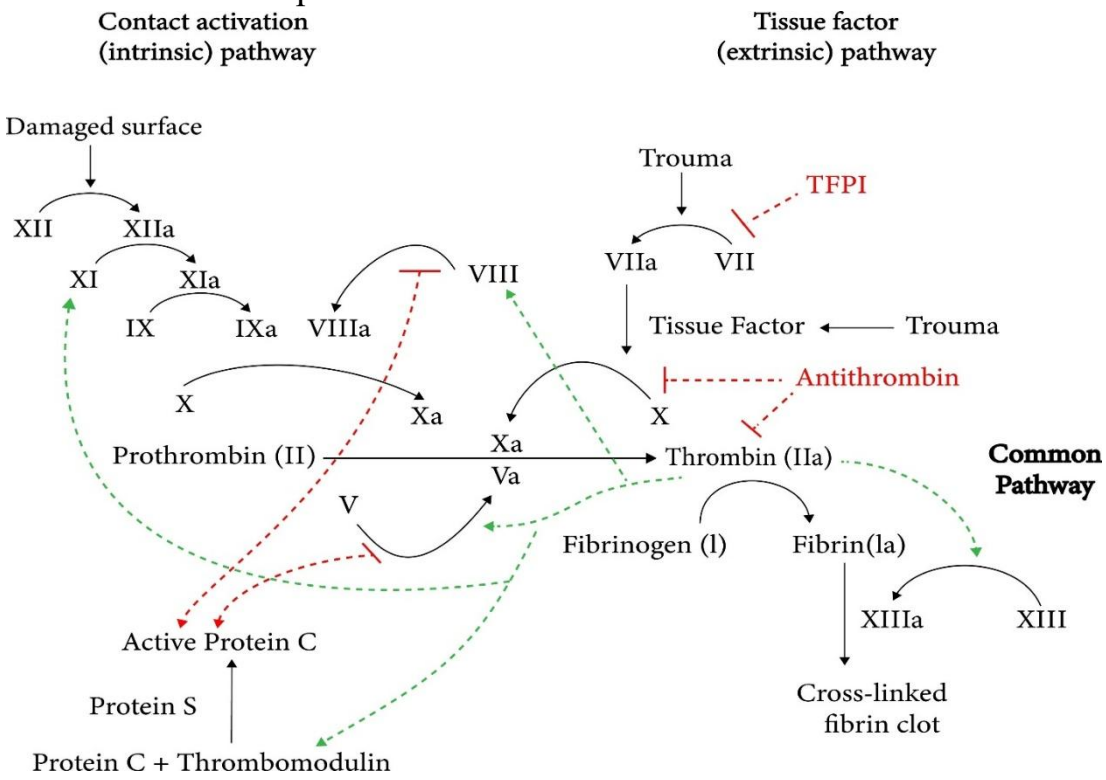
Activation markers: A statistically significant increase in D-dimer levels ($980 \pm 120 ng/mL) was found in the group of postterm infants.

Conclusion: An increase in D-dimer, which is a product of fibrin breakdown, indicates the activation of the coagulation cascade and fibrinolysis. This indicates a latent tendency towards hypercoagulability and endothelial dysfunction, often associated with chronic hypoxia during post-term pregnancy, which increases the risk of thrombotic complications or transition to DIC.



CONCLUSIONS

Based on the analysis of the literature and the data of clinical and laboratory research, the following conclusions can be drawn:

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Physiological hemostasis in term infants is characterized by a state of alternative balance with reduced levels of a number of procoagulants and inhibitors, which, nevertheless, provides adequate clinical hemostasis.

In premature newborns, the hemostasis system is in a state of pronounced depression (hypocoagulation), which is confirmed by a statistically significant prolongation of APTT and PTT, as well as a decrease in fibrinogen concentration and platelet count ($p < 0.01$). This fact causes their high predisposition to hemorrhagic syndrome, in particular, to the development of intraventricular hemorrhage.

In post-term newborns, there are no significant deviations in routine hemostasis tests (APTT, PTT) compared to full-term infants. However, an increase in the level of D-dimer ($p < 0.05$) is indicative of activation of the coagulation cascade and fibrinolysis, which indicates latent endothelial dysfunction and a potential risk of thrombotic complications or the development of disseminated intravascular coagulation (DIC) syndrome, especially against the background of concomitant perinatal pathology.

Clinical significance: Significant differences in the state of hemostasis require a differentiated approach to monitoring and therapy: in premature infants, priority is given to the prevention and management of bleeding, while in post-term infants, an increased risk of thrombotic complications should be taken into account.

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