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FEATURES OF CLINICAL LABORATORY DIAGNOSTICS HYPERCOAGULATION SYNDROME IN PATIENTS TYPE 2 DIABETES MELLITUS

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Annotation: *Diabetes mellitus (DM) is a serious medical problem, which causes its high prevalence, continued growth rates in the number of patients, chronic forms that determine the cumulative nature of the disease, high disability of patients and the need to create a system of specialized care. The prevalence of type 2 diabetes (T2DM) is high on all continents and in different age and racial populations.*

Key words: *blood, coagulogram , thromboplastin , fibrinogen, anticoagulant, protein C*

Determination of coagulogram indicators

To determine the parameters of a routine coagulogram, blood was taken from the ulnar vein in the morning on an empty stomach into vacuum tubes containing 0.109 M sodium citrate solution as a preservative (blood: preservative ratio = 9:1). After venipuncture, she was centrifuged. Blood samples at a temperature of +10ºC were centrifuged at a speed of 3000 rpm for 15 minutes. The resulting plasma was analyzed on an automatic hemostasis analyzer from Human using the manufacturer's kits in the laboratory of clinical biochemistry of the FGU ERC. The following parameters of plasma hemostasis were determined:

- activated partial thromboplastin time (aPTT) screening test to assess the internal cascade of plasma coagulation;
- prothrombin index (PTI);
- thrombin time (TT) – a screening test for fibrinogen/fibrin polymerization and anticoagulant activity in plasma;
- fibrinogen concentration (according to Klaus).

Reference intervals for coagulogram parameters : APTT 28-40 s, PTI 70-120%, TV 14-21 s, fibrinogen 2.0-4.0 g/l.

Determination of indicators of the fibrinolysis system . Blood sampling to determine the indicators of the fibrinolysis system was carried out in the same way as for a routine coagulogram , but after centrifugation, plasma samples were frozen and stored at -50ºC until analysis.

When analyzing the fibrinolysis system , the active antigen of plasminogen activator inhibitor-1 (PAI-1) and the activity of tissue-type plasminogen activator (t-PA) were determined. The analysis was carried out by enzyme-linked immunosorbent and immunochromogenic methods using diagnostic kits from Technoclone (Austria). The results of the analysis were recorded at a wavelength of 460 nm on an enzyme immunoassay analyzer from Human .

Evaluation of the anticoagulant system. Blood sampling to determine the indicators of the anticoagulant system was carried out in the same way as for a routine coagulogram , but after centrifugation, plasma samples were frozen and stored at -50ºC until analysis. As indicators of the plasma anticoagulant system, the activity of antithrombin III and the anticoagulant system of protein C were determined.

The activity of antithrombin III was determined by the amidolytic method using diagnostic kits from NPO RENAM (RF).

The activity of the protein C anticoagulant system was determined using a protein C screening test. Incubation of normal plasma with an exogenous activator isolated from the venom of the stink bug Agkistrodon contortrix , causes activation of endogenous proteins C and S, which prolongs the clotting time of normal plasma in the activated partial thromboplastin time test. Without the addition of an activator, the aPTT of the same plasma does not change. In the plasma of patients with a deficiency of the protein C system or in the presence of mutant factor V (Leiden), the prolongation of aPTT with the addition of an activator is less pronounced than normal.

Table 2.7

Reference intervals for coagulogram parameters

Index	Reference interval
APTT, s	2 8-40
Prothrombin time, s	9.9-13.9
Thrombin time, s	1 4 -21
INR	0.8-1.15
Fibrinogen, g/l	2.0-4.0

The activity of the protein C system according to this method is usually expressed as a normalized ratio (NR):

$$НО = \frac{АЧТВактив / АЧТВбольн.}{АЧТВактив / АЧТВкалибр}$$

Statistical processing of material

Statistical processing of the material was carried out using a statistical analysis application package on an IBMPentiumIV computer with the calculation of the arithmetic mean (M), standard deviation (σ), standard error (m) of relative values (frequency%). The statistical significance of the obtained measurements when comparing average values was determined by the Student's t criterion . A significance level of $p < 0.5$ was accepted as statistically significant changes . In this case, the instructions for statistical processing of data from clinical and laboratory studies were taken into account.

CONCLUSIONS:

1. Indicators of vascular- platelet hemostasis in diabetes mellitus 2 are characterized by a significant increase in platelet aggregation activity, an increase in

retraction properties, manifested by a shortening of platelet aggregation time in 66.7% (46) of patients with diabetes mellitus 2.

2. Indicators of coagulation hemostasis are characterized by a significant increase in the concentration of fibrinogen and prothrombin index, a decrease in aPTT and positive paracoagulation tests, detected in 43.9% of patients with type 2 diabetes, which indicates a tendency to hypercoagulation .

3.Hemostasis parameters in T2DM are characterized by a significant increase in platelet functions; aggregation and retraction activity, which are detected at the onset of type 2 diabetes and persist for any duration of the disease. The coagulation link of hemostasis is characterized by a decrease in aPTT, an increase in the concentration of fibrinogen, prothrombin index, and a shortening of blood clotting time, which is observed in both the early and late stages of type 2 diabetes and may depend on multidirectional changes in protein-lipid blood parameters.

Practical recommendations

1. In patients with type 2 diabetes mellitus, it is necessary to monitor the blood coagulation system both at the onset and throughout the disease.

2. Taking into account the increase in hemocoagulation from all parts of hemostasis, it is necessary to study the following indicators; platelet count, platelet adhesion and aggregation, PTI, fibrinogen level, VSC and paracoagulation tests.

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