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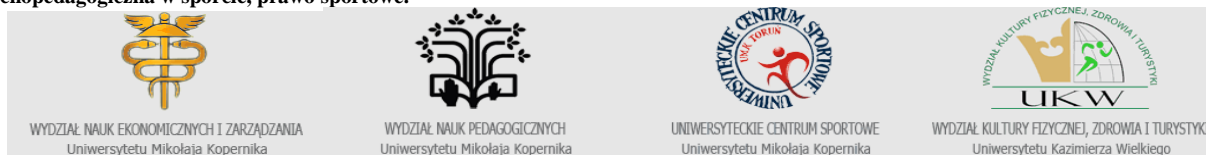
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W związku z zapotrzebowaniem na szukanie odpowiedzi dotyczącej jakości w sporcie oraz podnoszeniu efektywności wyników klubów sportowych Wydział Nauk Ekonomicznych i Zarządzania, Wydział Nauk Pedagogicznych, Uniwersyteckie Centrum Sportowe Uniwersytetu Mikołaja Kopernika, oraz Wydział Kultury Fizycznej, Zdrowia i Turystyki Uniwersytetu Kazimierza Wielkiego stworzyły projekt konferencji naukowej pt. **Jakość w sporcie.**

Bloki tematyczne: zarządzanie jakością w sporcie, sport jako forma autokreacji, oraz psychorehabilitacja i pomoc psychopedagogiczna w sporcie, prawo sportowe.



FEATURES OF THE HEMOSTASIS SYSTEM STATE IN PATIENTS WITH PULMONARY TUBERCULOSIS DETECTED BY THE METHOD OF LOW-FREQUENCY VIBRATION PIEZOELECTRIC HEMOCOAGULOGRAPHY

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Abstract:

Objective: to estimate the state of the hemostasis system in patients with tuberculosis by the method of LPHC.

Methods: the state of the hemostasis system in patients with tuberculosis was evaluated with the aid of the analyzer of the blood rheological properties ARP - 01 "Mednord" as well as by the use of a standard complex of laboratory coagulation tests. The indices characterizing the initial stages of the blood coagulation, the intensity of thrombin formation and fibrin polymerization was evaluated by the LPHC method as well as the indices, which characterize the intensity of the clot retraction and fibrinolytic activity.

Results: the comparative analysis of the state of the hemostasis system with the use of a standard coagulogram and LPHC express method in patients with tuberculosis revealed the presence of the processes of the moderate hyper-coagulation shift and suppression of fibrinolysis in them.

Conclusion: the comparative estimation of the state of the hemostasis system in patients with tubercular infection with the aid of the method of low-frequency vibration piezoelectric hemocoagulography and standard coagulation tests revealed unidirectionality of the processes. The determination of changes in the components of the regulation of aggregation of the blood condition (RABC) system by the LPHC method allows to diagnose the development of complications in the blood coagulation system in patients with tuberculosis without manifestations of the corresponding clinical symptoms.

Key words: hemostasis, fibrinolysis, tuberculosis, coagulogram, low-frequency vibration piezoelectric hemocoagulography.

Numerous clinical researches showed that pulmonary tuberculosis is characterized by a complex of the differently directed changes in the system of the hemostasis. The complications associated with hyper-coagulation shifts, combined with development of thromboses, thromboembolisms of the pulmonary arteries, formation of the chronic syndrome of the disseminated intravascular coagulation, still remain frequently undiagnosed ^[1].

Pathogenesis of the tubercular process is based on development of the syndrome of the systemic inflammatory response, which is a trigger factor for the intensification of the coagulation mechanisms. Reliable estimation of the state of the hemostasis system in patients with tuberculosis is an important, inherent stage in selection of the tactics of the basic disease treatment and timely development of the possible risks of complications of this pathology ^[2].

The existing complex of the standard methods of investigating the system of hemostasis is laborious, multistage and requires high accuracy of the observance of the rules of its preparatory stage as well as highly skilled interpretation of the data obtained ^[3]. A group of the Russian scientists developed the apparatus- program complex ARP -01M “MEDNORD” for clinical and diagnostic studies of the rheological properties of the blood, in which the method of low-frequency vibration piezoelectric hemocoagulography (LPHC) is used for evaluating the system of the regulation of the aggregation state of the blood ^[4].

The aim of the work is to estimate the features of the state of the hemostasis system in patients with tuberculosis with the aid of the method of low-frequency vibration piezoelectric hemocoagulography.

Materials and methods. Subject selection.

There were examined 261 patients with pulmonary tuberculosis who were treated in Odessa regional antitubercular hospital. Duration of the in-patient treatment was 2 months, mean age was 42.03 ± 0.85 .

The control group was composed of healthy persons (n=54) examined with the aid of the standard coagulogram (n=40) and by the LPHC method (n=14) at the age from 21 to 27.

The state of the hemostasis system in patients was evaluated with the aid of the standard complex of the laboratory tests, characterizing the state of primary and secondary hemostasis (n=224) as well as using the analyzer of the rheological properties of the blood (n=37) (portable ARP - 01 "Mednord", Tomsk, the Russian Federation). The device records even the insignificant changes, taking place in the blood in the processes of coagulation and fibrinolysis. The nature of changes is represented as a curve, which is formed during the entire study, the calculation of the amplitude and chronometric constants also occur automatically, which characterize the basic stages of the processes of hemocoagulation and fibrinolysis. The time of registration is 60 ± 10 minutes. The data are processed in the automatic regimen and are shown on the computer screen.

The blood for the study, as in standard laboratory methods, was taken from the cubital vein as much as 1.5 ml by the dry silicon needle with the opening of 1 mm in immediate proximity from the apparatus and it was placed in the cuvette of the device during 6-10 s, preliminarily heated to 37°C [5].

Detected parameters

The complex of standard laboratory coagulation methods included the determination: of amount of thrombocytes, rate of the spontaneous aggregation of thrombocytes, time of the plasma recalcification (TPR), activated partial thromboplastin time (APTT), prothrombin time, thrombin time (TT), general fibrinogen, fibrinolytic activity of the blood (FAB), fibrin-stabilizing factor (FSF) and retraction of blood clot (RBL) [6].

By the LPHC method there were evaluated: 1. indices, which characterize the initial stages of the blood coagulation: "A0" - the initial index of the aggregation state of the blood (usually equals 150 ± 10), "A1" - the amplitude of the contact phase of coagulation, "t1" - the time of the contact phase of coagulation, "ICC" - the intensity

of the contact phase of coagulation, which is calculated empirically. 2. indices, which characterize the intensity of thrombin formation and polymerization of the fibrin: “CTA” - the constant of thrombin activity, “A3” - the index, which characterizes the aggregation state of the blood at the stage of the beginning of the clot polymerization, “t3” - the time of the blood coagulation, “ICD” - the intensity of coagulation drive – it characterizes the integrative influence of pro-and anticoagulant systems by the rate of clot formation, “A4” – the amplitude of the clot polymerization, “t4” - time of the clot polymerization, “IPS” - intensity of the clot polymerization, it is characterized by the rate of combining the monomer molecules of fibrin. 3. indices, which characterize the intensity of the clot retraction and the fibrinolytic activity: “A5” - reflects the aggregation state of the blood at the stabilizer stage of thrombogenesis, “MA” - maximum density of the clot, “T” - time of the clot fibrin- thrombocytic structure formation, “ITS” - intensity of total coagulation of the blood, “ICRL” - intensity of clot retraction and lysis ^[7].

Statistical analysis

Statistical analysis of the results was conducted with the use of the program “Statistica 7.0” (StatSoft Inc., USA) and Microsoft Excel 2003 for Windows.

Results and discussion.

In the comparative analysis of the state of the hemostasis system with the use of a standard coagulogram and express LPHC method the patients with tuberculosis were revealed unidirectionality of shifts to the moderate hypercoagulation and fibrinolysis suppression, which coincides with the literature data ^[8-15].

In using the LPHC method the moderate hyper-coagulation shift in the patients with tuberculosis is manifested as a reliable increase in the constant of the thrombin activity, intensity of the coagulation drive, amplitude and time of the clot polymerization, maximum density of the clot and intensity of total coagulation. There is also noted a statistically reliable reduction in the intensity of clot retraction and lysis. There were not revealed a reliable increase in the time of the reduction of the

blood coagulation, as well as intensity of the clot polymerization and time of the formation of the clot fibrin- thrombocytic structure (Tabl. 1).

Table 1.

Results of investigating the Hemostasis system in patients with tuberculosis by the LPHC method ($\bar{X} \pm m_x$).

| № | Index | Healthy persons (n=14) | | Patients with tuberculosis (n=37) | |
|-----|-------|---------------------------|---------|---|----------------------|
| 1. | A1 | 226.36 | ± 12.33 | 134.76 | ± 1.84 ¹ |
| 2. | t1 | 0.94 | ± 0.04 | 0.73 | ± 0.05 ¹ |
| 3. | ICC | 109.11 | ± 10.92 | 22.55 | ± 0.78 ¹ |
| 4. | CTA | 29.40 | ± 4.10 | 43.80 | ± 2.31 ¹ |
| 5. | t3 | 7.55 | ± 1.30 | 9.90 | ± 0.56 |
| 6. | ICD | 29.55 | ± 3.61 | 56.27 | ± 2.38 ¹ |
| 7. | A4 | 468.21 | ± 27.86 | 818.46 | ± 26.62 ¹ |
| 8. | t4 | 15.62 | ± 1.23 | 20.36 | ± 0.57 ¹ |
| 9. | ICP | 13.78 | ± 1.38 | 13.43 | ± 1.28 |
| 10. | T | 28.69 | ± 3.01 | 25.92 | ± 1.55 |
| 11. | MA | 297.29 | ± 33.27 | 796.32 | ± 8.83 ¹ |
| 12. | ITC | 13.41 | ± 0.77 | 32.05 | ± 1.73 ¹ |
| 13. | ICRL | 2.34 | ± 0.63 | 0.39 | ± 0.05 ¹ |

Note: ¹ – Statistically reliable differences with the control group (p<0.01).

Visually the data can be presented as the corresponding diagrams (Fig. 1).

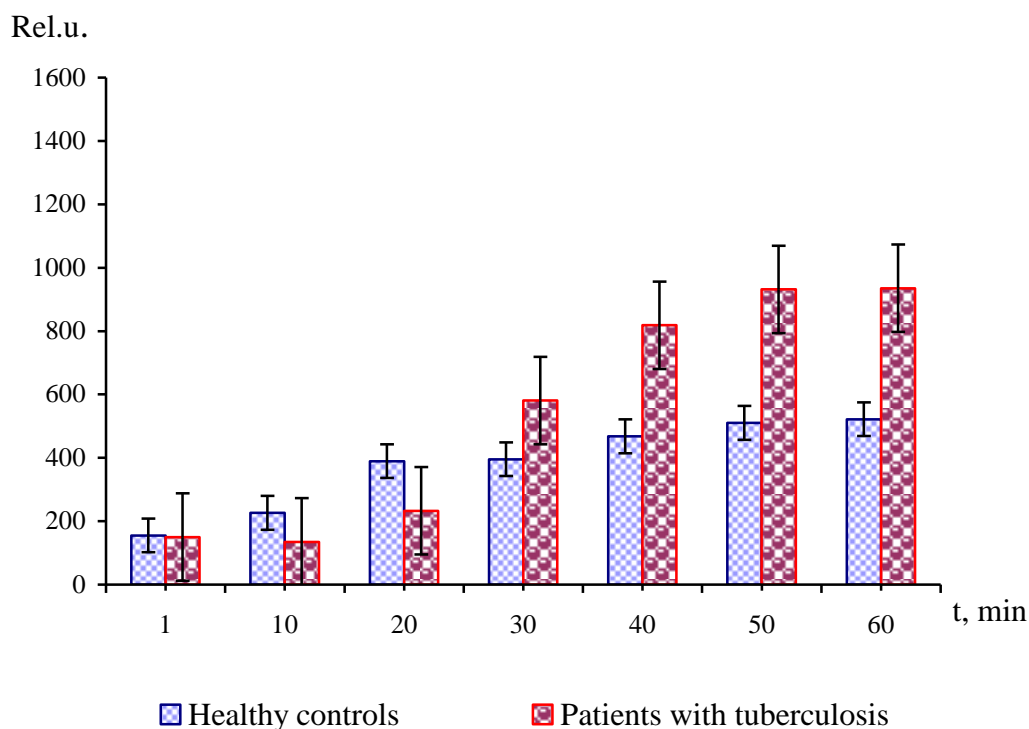


Fig.1. Graphic representation, which reflects the state of the moderate hyper-coagulation and suppression of fibrinolysis in patients with tuberculosis in comparison with the healthy persons.

The analysis of the study results, obtained with the aid of the standard coagulation methods of estimation confirmed the results of the hemostasis studies by the LPHC method. The hyper-coagulation shift was confirmed in patients, which was manifested in the vascular- thrombocytic and plasma components of the hemostasis system that was evidence of a statistically reliable increase in the rate of the spontaneous aggregation of thrombocytes (by 11.5%), prothrombin time (by 8.4%), an increase in the fibrinogen concentration (by 83.3%) and TPR reduction (by 10%) in comparison with the control group, which corresponded to the course of the tubercular inflammatory process.

The suppression of the fibrinolytic system is characterized by a reliable reduction in the fibrinolytic activity of the blood (by 3.6%). The activity of the fibrin-stimulating factor was also reduced (by 11.9%) (Tabl. 2).

Table 2.

Results of investigating the hemostasis system of patients with tuberculosis with the use of the standard laboratory methods ($\bar{X} \pm m_x$).

| № п.п. | Index | Healthy persons (n=40) | Patients with tuberculosis (n=224) |
|-----------|-----------------------------|---------------------------|---------------------------------------|
| 1. | Amount of thrombocytes | 259.50 ± 3.70 | 327.19 ± 8.80 ¹ |
| 2. | Aggregation of thrombocytes | 38.38 ± 1.04 | 42.77 ± 0.81 ¹ |
| 3. | TPR | 137.06 ± 5.80 | 123.37 ± 2.61 ¹ |
| 4. | APTT | 58.58 ± 1.01 | 64.94 ± 0.57 ¹ |
| 5. | Prothrombin time | 15.38 ± 0.31 | 16.75 ± 0.19 ¹ |
| 6. | Thrombin time | 16.59 ± 1.31 | 16.78 ± 0.19 |
| 7. | Fibrinogen | 3.00 ± 0.16 | 5.55 ± 0.19 ¹ |
| 8. | FAB | 170.80 ± 0.96 | 176.98 ± 1.28 ¹ |
| 9. | FSF | 66.40 ± 1.56 | 74.35 ± 0.95 ¹ |
| 10. | RBL | 0.40 ± 0.01 | 0.40 ± 0.01 ¹ |

Note: ¹ - Statistically reliable differences with the control group ($p < 0.05$).

Thus, the data obtained in the comparative analysis of two methods of study (standard coagulogram and low-frequency vibration piezoelectric hemocoagulography) are unidirectional.

The hyper-coagulation shift in the hemostasis system in patients with tuberculosis has probably both positive and negative value. Hyper-coagulation in the focus of the tubercular inflammation contributes to the limitation of infection ^[16], while the disturbance of the state of the hemostasis system at the level of organism, especially in its hemocoagulation component, leads to the development of the latent course of

intravascular coagulation in patients, which, in turn, negatively influences the process course, causing the development of thrombohemorrhagic syndrome with time ^[8]. The manifestation of these changes can vary from the latent processes to the sharp catastrophic forms with the disturbances of microcirculation and subsequent development of the polyorgan insufficiency and (or) hemorrhages as a result of coagulopathy of consumption ^[11].

Thus, the comparative estimation of the state of the hemostasis system in patients with tubercular infection with the aid of the method of low-frequency vibration piezoelectric hemocoagulography and standard coagulation tests also revealed the presence of the processes of the moderate hyper-coagulation shift and suppression of fibrinolysis in them.

The new instrumental express LPHC method allows to produce the integrated assessment of the state of the hemostasis system in patients, showing the kinetics of the proceeding changes in the system as a whole and, thus, it allows to control the functional state of the vascular - thrombocytic, coagulation and fibrinolytic components of the hemostasis system, possessing the wide spectrum of indices. It is of high-precision, informative, not requiring prolonged preliminary preparation, economical and easily interpretive method of diagnostics. The determination of changes in the vascular- thrombocytic, coagulation and fibrinolytic components of the RABC system by the LPHC method can be the marker of the estimation of the state of the hemostasis system and allows to diagnose the development of complications in the blood coagulation in patients with tuberculosis without manifestations of the corresponding clinical symptoms and they require the development of recommendations for further consideration in the clinical practice.

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