

Indices' Dynamics of Microcirculatory Processes in Women with Habitual Miscarriage of Pregnancy Daily Wearing Prophylactic Trousers in the Course of the Third Pregnancy Term

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Abstract

It is acknowledged at present that habitual miscarriage of pregnancy is accompanied by disturbances of hemo-circulation process in vessels of little caliber. In our research we applied the author's variant of medicinal-prophylactic trousers' daily wearing in the course of the third term in women with habitual miscarriage of pregnancy who received traditional saving pregnancy therapy. In our research we applied instrumental, laboratory and statistical methods of investigation. The women wearing medicinal-prophylactic trousers were noted to have the improvement of microcirculation indices in lower extremities. It became possible in the result of the increase of linear systolic bloodstream speed by more than 16.4%, linear average bloodstream speed by more than 50.0%, and average volumetric bloodstream speed by more than 78.0% and level decrease of systolic bloodstream speed by more than 38.0%. The plasma of women with habitual miscarriage of pregnancy wearing medicinal-prophylactic trousers in the course of the third term, was reached to have leveling of existing imbalance of arachidonic acid metabolites on behalf of level decrease of thromboxane B2 and level rise of 6-keto-prostaglandin F1 until the values of the norm. It was accompanied by the rise of nitric oxide summary metabolites nearly till the control level in plasma of the examined women by the end of observation. Daily wearing of medicinal-prophylactic trousers was accompanied by content rise of erythrocytes-discocytes in blood of patients till $85.5 \pm 0.18\%$ at the decrease of erythrocytes' reversibly and irreversibly modified forms till $10.9 \pm 0.07\%$ and $3.6 \pm 0.04\%$, respectively. At the same time the group of observation reached normalization of erythrocyte aggregation on behalf of erythrocytes' sum decrease in aggregates by 30.8% and quantity of these aggregates-by 29.2% at number increase of non-aggregated erythrocytes by 20.4%. So, at wearing of medicinal-prophylactic trousers in the third term the women with habitual miscarriage of pregnancy reach potentiation of the conducted therapy with normalization of microcirculation indices and erythrocytes' rheological properties. Given alterations can optimize the processes of microhemodynamics and activate trophism in the field of small pelvis promoting successful carrying a baby to full term.

Keywords: Habitual miscarriage of pregnancy; The third term of pregnancy; Erythrocytes; Microcirculation course; Aggregation; Membrane surface properties; Medicinal clothes

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Introduction

Rather wide occurrence of habitual miscarriage of pregnancy is acknowledged at present an important social and medical problem [1,2]. Given state is registered in developed countries in 10-25% of women. In this respect habitual miscarriage of pregnancy is an important factor inhibiting the growth of population what dictates the need in the search of approaches to its elimination [3].

Habitual miscarriage of pregnancy has a lot of causative agents in its basis. However, it's far not always possible to find just one of them in every concrete case. There is an opinion that prominent place in pathogenesis of the given state belongs to rheological disturbances [4]. It is known that physiological activation of hemostasis somewhat worsening blood rheology, develops in pregnant women in the norm [5]. However, these alterations are not expressed and compensated in the norm [6]. These negative alterations of hemorheology are

not compensated in pregnant women with habitual miscarriage of pregnancy and negatively influence trophism. Such disturbances in these women quickly reach the level making normal hemocirculation in placenta impossible and promote preterm abortion [7].

Applied at present medicinal impacts which are directed at maintenance of pregnancy in the third term in women with habitual miscarriage of pregnancy, not always have satisfactory effect and allow bearing at full term [8,9]. It becomes clear that additional non-pharmacological impact on bodies of women from the given group positively influencing erythrocytes' rheology can be a reserve of efficiency rise of their application [10].

In conducted earlier clinical [11] and experimental [12,13] researches they managed to detect the possibility of lowering of erythrocytes' rheological properties [14]. Special interest was caused by the results of non-pharmacological impacts having no side effects and



strengthening the effect of traditionally applied at various disturbances medicines [15].

Most pregnant women are characterized by low attachment to regular exercises [16]. In this respect, other kinds of non-pharmacological correction that will be efficient and popular among pregnant women with habitual miscarriage of pregnancy, are of great interest [17,18]. The capacity of the impact to influence positively the significant for the state of placenta erythrocytes' aggregation is a very important criterion of its efficiency estimation. The author considered daily wearing of medicinal-prophylactic trousers (MPT) to be an alternative of medicinal physical training in women with habitual miscarriage of pregnancy. It was noted that attachment to MPT among pregnant women is higher than to medicinal physical training [19]. At the same time, MPT application can provide a pregnant woman with functionally favorable womb state and can positively influence the interposition of organs in small pelvis and abdominal cavity [20]. Taking it into account we put the following aim: to estimate the dynamics of pregnancy and hemorheological indices in women with habitual miscarriage of pregnancy who daily wore MPT in the course of the third pregnancy term.

Materials and methods

The conducted research was approved by the Local Ethic Committee of the Russian State Social University in May 17th, 2016 (Record №5). All the examined women gave written informed agreement on participation in the conducted research. The research involved pregnant women in the third term living in Central Russia (Moscow city and Moscow region). The age of all the observed women was 22-30 years. Under observation we took women either without deviations in the reproductive field (the control group) or having habitual miscarriage of pregnancy (two groups of observation).

The control group was composed 35 of clinically healthy pregnant women being at the term of 28 weeks with two and more physiological childbirths in the anamnesis. The women from this group were known to have favorable obstetrical anamnesis, absence of spontaneous abortions and other obstetrical disturbances.

The criterion of involvement into the groups of observation was the following one-habitual miscarriage of pregnancy, i.e. the presence of three and more spontaneous abortions iteratively at the terms before 22 weeks in the anamnesis of a woman. There were formed two groups of observation out of the examined pregnant women with habitual miscarriage of pregnancy. The first group of observation was composed of 42 women being at the term of 28 weeks' pregnancy and receiving standard maintaining pregnancy therapy. The second group of observation involved 44 women with habitual miscarriage of pregnancy also at the term of 28 weeks. The women from the second group of observation, except traditional therapy maintaining pregnancy, daily wore the author's variant of MPT.

Applied MPT had front and back halves. The upper part of the front half was made as a cut out detail of elastic material with raised belt-line and enlarged free fitting allowance. The upper part of trousers' back half was cut out of elastic material. Vertical leather stripes were stitched on it. They formed pockets where rigid plates were put. Similar leather stripes were also stitched on the upper part of trousers' front part. The lower line of vertical leather stripes' stitching had semicircular form on the front half of trousers and smoothly descended from the point 8-12cm lower than the top of the side seam till the point 10-15cm higher than the connection point of pace and middle seams of

trousers. Besides, on the front half of trousers in the fields of side seams at the level of vertical leather stripes' disposition in MPT there were stitched some rebounded regulating details which were provided by the band VELKRO. Its reciprocal fragments were situated on the back half of trousers. Vertical leather stripes were 2.5-3 cm wide and were evenly stitched on the front and back halves of trousers. Used for MPT production rigid plates were made from fluoroplastic and were 1-3 mm thick [20].

Pregnant women from both groups of observation were under dynamic control with examination according to mentioned below methods at 28 weeks' and 38 weeks' pregnancy terms. The control group was observed and examined in the same terms. In the result of absence of reliable differences between both results of researches the control values are presented by one value-arithmetic average between both examinations.

For the estimation of microhemodynamics in the extremities we used the noninvasive transcutaneous ultrasonic doppler-graphy which was equipped by the diagnostic system "Minimax-Doppler-K" produced by "Minimax" (Russia). The state of microcirculation was determined on the nail folds of the first toes and fingers applying ultrasonic detector 25 MH. In our research we took into account the following indices: linear systolic speed of bloodstream (Vas), linear average speed of bloodstream (Vam), volume systolic speed of bloodstream (Qas), average volume speed of bloodstream (Qam).

In our research we determined the activity of the processes of lipids' peroxidation (LPO) in blood plasma which was registered according to the content of thiobarbituric acid (TBA)-active products in it with the help of a set produced by the firm "Agat-Med" (Russia) and to the level of acylhydroperoxides (AHP). We also registered antioxidant activity (AOA) of blood [21].

In blood plasma of examined children we determined the content of thromboxane A₂ metabolite-thromboxane B₂ and prostacyclin metabolite-6-keto-prostaglandin F_{1α} by enzymoimmunoassay with the help of sets produced by the firm "Enzo Life science" (USA). We also determined the summary content of nitric oxide metabolites [22] in children's plasma.

Erythrocytes were washed and resuspended. Then we estimated quantitatively the levels of cholesterol (CS) in them by enzymatic colorimetric method with the help of a set produced by the firm "Vital Diagnostikum" (Russia), and common phospholipids (CPL) -according to the quantity of phosphorus in them [23].

The evidence of the processes of intra-erythrocyte LPO was found in washed and resuspended erythrocytes according to the concentration of malon dialdehyde (MDA) in the reduction reaction of thiobarbituric acid and to the quantity of AHP [21].

We judged the state of erythrocytes' microrheological features of children by their cytoarchitecture and aggregation. We determined the quantity of erythrocytes' normal and changed forms in blood with the help of light phase-contrast microscopy [24].

The ability of erythrocytes to spontaneous aggregation was determined with the help of light microscopy by calculating the quantity of erythrocytes' aggregates, the number of aggregated and non-aggregated erythrocytes [24] in Goryaev's box.

Received in our research results were processed by Student's (t) criterion.



Results of Research

Estimation of initial microcirculation indices in women with habitual miscarriage of pregnancy at the beginning of the third pregnancy term showed their deviation from the control values. Both groups of observation were noted to have significant decrease of bloodstream speed characteristics in lower extremities: linear speed into systole from the right side-approximately by 17.0%, from the left side-approximately by 23.0%; average linear speed from the right side-approximately by 50.0%, from the left side- approximately by 52.0%; average volumetric speed from the right side-approximately by 66.0%, from the left side-approximately by 52.0% at the increase of average volumetric speed into systole from the right side-by 36.0%, from the left side- nearly by 30.0%. There were found no statistically significant differences in microcirculation indices in tissues of upper extremities between groups of observation and the control one.

At the beginning all the involved into the research women with habitual miscarriage of pregnancy were noted to have strengthening of LPO processes (Table 1). The quantity of AHP and TBA products

in their plasma surpassed the control values approximately by 39.0% and 39.0%, respectively (the control values- $1.82 \pm 0.27 D_{233}/1ml$ and $3.37 \pm 0.32 mkmol/l$, respectively). It took place against the background of weakening of plasma antioxidant activity in them approximately by 44.0% (the control value- $34.7 \pm 0.45\%$).

Blood of women with habitual miscarriage of pregnancy at the beginning of the third term was noted to have imbalance of arachidonic acid metabolites: the level of thromboxane B_2 in their plasma turned out to be higher in comparison with the control level nearly by 25.0%, whereas the level of 6-keto-prostaglandin $F_{1\alpha}$ decreased nearly by 20.0% (Table 1). At the same time, they were noted to have content decrease of the quantity of nitric oxide summary metabolites in plasma nearly by 33.0% in comparison with the control values.

At the beginning erythrocytes' membranes of women from both groups of observation were noted to have the increase of CS level nearly by 9.0% and CPL decrease nearly by 10.0%. It was accompanied by LPO strengthening in their erythrocytes (AHP level in them rose nearly by

Table 1. Dynamics of taken into account the characteristics of women with habitual miscarriages of pregnancy against the background of wearing their medical-prophylactic pants in the third trimester of pregnancy.

Indicators	Women with a habitual miscarriage of pregnancy, M ± m				Control, n=34, M ± m
	Traditional treatment		Additional carrying MPT		
	28weeks of pregnancy, n=42	38weeks of pregnancy, n=30	28weeks of pregnancy, n=44	38weeks of pregnancy, n=44	
Vas right leg, cm/s	1.36 ± 0.034 p<0.01	1.42 ± 0.020 p ₁ <0.05 p ₂ <0.05	1.34 ± 0.018 p<0.01	1.56 ± 0.022 p ₁ <0.01	1.58 ± 0.026
Vam right leg, cm/s	0.18 ± 0.016 p<0.01	0.22 ± 0.014 p ₁ <0.05 p ₂ <0.05	0.18 ± 0.019 p<0.01	0.27 ± 0.011 p ₁ <0.01	0.27 ± 0.012
Qas right leg, ml/min	0.70 ± 0.024 p<0.01	0.63 ± 0.021 p ₁ <0.05 p ₂ <0.05	0.72 ± 0.018 p<0.01	0.52 ± 0.028 p ₁ <0.01	0.52 ± 0.026
Qam right leg, ml/min	0.15 ± 0.003 p<0.01	0.19 ± 0.008 p ₁ <0.05 p ₂ <0.05	0.14 ± 0.006 p<0.01	0.25 ± 0.009 p ₁ <0.01	0.25 ± 0.007
Vas left leg, cm/s	1.28 ± 0.012 p<0.01	1.39 ± 0.014 p ₁ <0.05 p ₂ <0.05	1.29 ± 0.018 p<0.01	1.57 ± 0.034 p ₁ <0.01	1.58 ± 0.032
Vam left leg, cm/s	0.17 ± 0.008 p<0.01	0.20 ± 0.005 p ₁ <0.05 p ₂ <0.05	0.18 ± 0.012 p<0.01	0.26 ± 0.011 p ₁ <0.01	0.26 ± 0.008
Qas left leg, ml/min	0.68 ± 0.020 p<0.01	0.59 ± 0.025 p ₁ <0.05 p ₂ <0.05	0.69 ± 0.031 p<0.01	0.52 ± 0.026 p ₁ <0.01	0.52 ± 0.023
Qam left leg, ml/min	0.16 ± 0.010 p<0.01	0.21 ± 0.012 p ₁ <0.05 p ₂ <0.05	0.15 ± 0.012 p<0.01	0.25 ± 0.014 p<0.01	0.26 ± 0.008
Vas right hand, cm/s	1.09 ± 0.027	1.10 ± 0.033	1.11 ± 0.034	1.10 ± 0.036	1.11 ± 0.036
Vam right hand, cm/s	0.09 ± 0.012	0.09 ± 0.008	0.09 ± 0.007	0.09 ± 0.009	0.09 ± 0.008
Qas right hand, ml/min	0.78 ± 0.032	0.79 ± 0.039	0.79 ± 0.035	0.78 ± 0.039	0.79 ± 0.040
Qam right hand, ml/min	0.08 ± 0.005	0.08 ± 0.006	0.08 ± 0.007	0.08 ± 0.008	0.08 ± 0.007
Vas left hand, cm/s	1.05 ± 0.032	1.07 ± 0.036	1.06 ± 0.030	1.07 ± 0.033	1.06 ± 0.025
Vam left hand, cm/s	0.11 ± 0.008	0.12 ± 0.004	0.12 ± 0.008	0.11 ± 0.005	0.12 ± 0.004
Qas left hand, ml/min	0.68 ± 0.023	0.67 ± 0.028	0.68 ± 0.041	0.69 ± 0.039	0.69 ± 0.032
Qam left hand, ml/min	0.06 ± 0.007	0.07 ± 0.009	0.07 ± 0.002	0.08 ± 0.006	0.07 ± 0.007



Acylhydroperoxides of plasma, D ₂₃₃ /l ml	2,56 ± 0,57 p<0,01	2,21 ± 0,49 p ₁ <0,05 p ₂ <0,05	2,52 ± 0,39 p<0,01	1,96 ± 0,34 p ₁ <0,01	1,82 ± 0,27
Thiobarbituric acid-products of plasma, mk mol/l	4,67 ± 0,50 p<0,01	3,92 ± 0,45 p ₁ <0,01 p ₂ <0,05	4,72 ± 0,54 p<0,01	3,45 ± 0,41 p ₁ <0,01	3,37 ± 0,32
Antioxidant activity of plasma, %	24,0 ± 0,48 p<0,01	29,2 ± 0,36 p ₁ <0,05 p ₂ <0,05	23,7 ± 0,42 p<0,01	34,0 ± 0,38 p ₁ <0,01	34,7 ± 0,45
thromboxanB ₂ , pg / ml	212.4 ± 0.55 p<0,01	186.0 ± 0.62 p ₁ <0,05 p ₂ <0,05	220.6 ± 0.49 p<0,01	168.9 ± 0.57 p ₁ <0,01	169.9 ± 0.66
6-keto-prostaglandin F _{1α} , pg / ml	83.7 ± 0.35 p<0,01	90.2 ± 0.36 p ₁ <0,05 p ₂ <0,05	81.8 ± 0.25 p<0,05	99.0 ± 0.36 p ₁ <0,05	99.2 ± 0.49
nitric oxide's metabolites, umol/l	29.9 ± 0.19 p<0,01	33.4 ± 0.30 p ₁ <0,05 p ₂ <0,05	29.0 ± 0.31 p<0,01	38.1 ± 0.29 p ₁ <0,01	38.6 ± 0.35
cholesterol of erythrocytes, mk mol/10 ¹² erythrocytes	1.05 ± 0.007 p<0,05	1.01 ± 0.004	1.04 ± 0.012 p<0,05	0.95 ± 0.013 p ₁ <0,05	0.95 ± 0.010
common phospholipids of erythrocytes, mk mol/10 ¹² erythrocytes	0.63 ± 0.006 p<0,05	0.65 ± 0.012	0.62 ± 0.010 p<0,05	0.70 ± 0.007 p ₁ <0,05	0.70 ± 0.008
acylhydroperoxides of erythrocytes, D ₂₃₃ /10 ¹² erythrocytes	4.12 ± 0.011 p<0,01	3.81 ± 0.019 p ₁ <0,05 p ₂ <0,05	4.18 ± 0.010 p<0,01	3.18 ± 0.017 p ₁ <0,01	3.16 ± 0.012
malonic dialdehyde of erythrocytes, nmol/10 ¹² erythrocytes	1.94 ± 0.009 p<0,01	1.70 ± 0.014 p ₁ <0,05 p ₂ <0,05	1.96 ± 0.007 p<0,01	1.44 ± 0.010 p ₁ <0,01	1.43 ± 0.014
erythrocytes-discocytes, %	75.0 ± 0.22 p<0,01	80.1 ± 0.27 p ₁ <0,05 p ₂ <0,05	75.3 ± 0.18 p<0,01	85.5 ± 0.18 p ₁ <0,01	85.6 ± 0.16
reversibly modified erythrocytes,%	16.0 ± 0.10 p<0,05	13.9 ± 0.08 p ₁ <0,05 p ₂ <0,05	15.5 ± 0.09 p ₁ <0,01	10.9 ± 0.07 p ₁ <0,01	10.9 ± 0.08
irreversibly modified erythrocytes,%	9.0 ± 0.08 p<0,01	6.0 ± 0.13 p ₁ <0,01 p ₂ <0,01	9.2 ± 0.06 p<0,01	3.6 ± 0.04 p ₁ <0,01	3.5 ± 0.07
sum of all the erythrocytes in an aggregate	43.8 ± 0.16 p<0,01	38.1 ± 0.12 p ₁ <0,05 p ₂ <0,05	42.9 ± 0.09 p<0,01	32.8 ± 0.19 p ₁ <0,01	32.6 ± 0.15
quantity of aggregates	8.6 ± 0.09 p<0,01	7.4 ± 0.12 p ₁ <0,05 p ₂ <0,05	8.4 ± 0.10 p<0,01	6.5 ± 0.19 p ₁ <0,01	6.4 ± 0.12
quantity of free erythrocytes	241.2 ± 0.39 p<0,01	269.3 ± 0.27 p ₁ <0,05 p ₂ <0,05	240.6 ± 0.44 p<0,01	289.8 ± 0.46 p ₁ <0,01	290.1 ± 0.29

Legend: p - the significance of the differences in the initial parameters in women with habitual miscarriage and parameters of the control group, p₁ - the significance of the dynamics of the indicators taken into account in women with habitual miscarriage in the course of correction in comparison with the outcome, p₂ - the significance of the differences in the results of the applied effect on the women's organism.

30.0%, MDA quantity increased nearly by 36.0%) in comparison with the control level.

At the beginning the examined women with habitual miscarriage of pregnancy were noted to have some lowering of erythrocytes-discocytes' percentage in blood approximately by 14.0% in comparison with the control value (Table 1). The quantity of erythrocytes' reversibly and irreversibly modified forms in blood of women from both groups of observation rose approximately by 46.0% and in 2.5 times, respectively. At the same time they were found to have strengthening of erythrocytes' aggregative properties. It was pointed by level rise of the index of erythrocytes' summary involvement into aggregates by 32.0% and quantity increase of these aggregates approximately by 33.0% at free erythrocytes' decrease by 20.0% in comparison with the levels of the control group.

Dynamic observation of the pregnant women from both groups of observation showed that only women wearing MPT managed in 100% of cases to maintain pregnancy till the term of 38 weeks and

fulfill delivery as it was planned with receiving of alive full-term newborns. This group of pregnant women in the course of the third term of pregnancy was noted to have satisfactory general state and normal womb tone; fetal heartbeats were clearly heard and genital tracts' discharges were absent. In the first group of observation only 30 women (71.4%) reached 38 weeks' term of pregnancy with consequent planned delivery. Pregnancy came to a standstill in two women from this group (4.8%) at the terms of 30 and 32 weeks. The rest women (23.8%) were registered to have preterm delivery with receiving of alive premature newborns in all the cases.

Daily wearing of the author's MPT against the background of the conducted saving pregnancy therapy provided the women with the improvement of microcirculation indices in lower extremities. By the end of observation we registered V_{as} increase in their legs from the right side by 16.4%, from the left side -by 21.7%; V_{am} from the right side-by 50.0%, from the left side-by 44.4% and Q_{am} value from the right side by 78.6% and from the left side-by 66.7% at lowering of Q_{as} value from the



right side by 38.5% and from the left side-by 32.7%. Reached dynamics of microcirculation parameters in lower extremities of women from the group where they wore no MPT, was far less evident. In both groups of observation blood rheology in arms preserved at the level of the optimum.

Existing at the beginning LPO activation gradually lowered in women from the groups of observation by the 38th week of pregnancy. In the group with daily MPT wearing it turned out to be possible to lower its intensity till the control level. So, in this group the quantity of AHP and TBA-products in plasma lowered by the end of observation from $2.52 \pm 0.39 D_{233}/1ml$ and $4.72 \pm 0.54 mkmol/l$ (control values- $1.82 \pm 0.27 D_{233}/1ml$ and $3.37 \pm 0.32 mkmol/l$ respectively) till $1.96 \pm 0.34 D_{233}/1ml$ and $3.45 \pm 0.41 mkmol/l$ respectively. It turned out to be possible in the result of evident strengthening of plasma antioxidant activity in them till $34.0 \pm 0.38\%$ by the end of observation (control value- $34.7 \pm 0.45\%$).

Plasma of women with habitual miscarriage of pregnancy who daily wore MPT, by the end of observation was noted to have leveling of initially existing imbalance of arachidonic acid metabolites. By the 38th week of pregnancy the level of thromboxane B_2 in their plasma fell by 30.6% and the level of 6-keto-prostaglandin $F_{1\alpha}$ rose by 21.0%, having reached the control level in both cases (Table 1). By the end of observation it was accompanied by content rise of nitric oxide summary metabolites in their plasma by 31.4%. Given indices didn't reach the control values in pregnant women receiving only traditional saving pregnancy therapy.

In the result of MPT wearing erythrocytes' membranes of women in the course of the third pregnancy term were noted to have lowering of CS level till $0.95 \pm 0.013 mkmol/10^{12}$ erythrocytes and CPL rise till $0.70 \pm 0.007 mkmol/10^{12}$ erythrocytes. Absence of MPT application was accompanied by less evident positive dynamics of erythrocytes' lipid composition having provided CS lowering in this group of women just by 4.0% and CPL rise only by 3.2%.

Initially activated LPO in erythrocytes of pregnant women significantly weakened in the result of daily MPT wearing (AHP lowered by 31.4%, MDA-by 36.1%). The content of LPO products in erythrocytes of pregnant women who received traditional therapy without continuous MPT usage, lowered less evidently (AHP-till $3.81 \pm 0.019 D_{233}/10^{12}$ erythrocytes and MDA-till $1.70 \pm 0.014 nmol/10^{12}$ erythrocytes, respectively).

Daily MPT wearing by pregnant women against the background of traditional therapy was accompanied by percentage growth of discocytes' content in their blood (Table 1). So, by the end of observation the level of discoid erythrocytes in their blood was equal to $85.5 \pm 0.18\%$. The quantity of erythrocytes' reversibly and irreversibly modified forms in this group of observation gradually lowered in the result of MPT wearing being equal by the 38th week of pregnancy to $10.9 \pm 0.07\%$ and $3.6 \pm 0.04\%$, respectively. Given indices in the group of women who wore no MPT improved significantly less.

Because of additional daily MPT application pregnant women reached lowering of erythrocytes' sum in aggregates by 30.8% and these aggregates' quantity-by 29.2% at the increase of freely laying erythrocytes by 20.4% what allowed reaching the control level by these indices. The improvement of erythrocytes' aggregation indices was less in the group of pregnant women who wore no MPT, significantly yielding to the same indices in the first group of women.

Discussion

Habitual miscarriage of pregnancy is at present a widespread state. It attracts much attention from the side of specialists of various profiles. Modern medicine acknowledges polyetiology of habitual miscarriage of pregnancy what points at the necessity of the search and detailed analysis of pathogenetic mechanisms of various etiological factors' realization. Recently, many researchers are inclined to believe that an important role in the development of habitual miscarriages is worsening microcirculation in the organs [25].

It is clear that presence of these changes at habitual miscarriage of pregnancy worsens metabolism and circulation processes in the womb thus weakening trophism of placenta and fetus [26,27]. Surplus erythrocyte aggregation lies in the basis of these disturbances [28]. Weakening of a body's antioxidant protection with the increase of LPO intensity in its plasma and cells is very significant here. Free radicals mostly disturb functioning of erythrocyte membranes. It is aggravated by CS growth in them in pregnant women with habitual miscarriage of pregnancy and decrease of CPL promoting the development of membrane-pathology [29,30]. It declares itself in pregnant women with habitual miscarriage of pregnancy by the increase of their erythrocyte capacity to hyperaggregation and formation of preconditions for metabolism inhibition [31,32].

The conducted estimation of microcirculation indices gives basis to consider that women with habitual miscarriage of pregnancy have its disturbances in lower extremities. Given dysfunction declares itself in this category of women by lowering of V_{as} , V_{am} and Q_{am} indices against the background of Q_{as} compensatory growth. It pointed at the formation of bloodstream bypassing type in these women.

It became clear that daily MPT wearing against the background of saving pregnancy therapy promoted optimization of microcirculatory processes on behalf of evident improvement of erythrocytes' rheological characteristics [33]. In this respect the achievement of activation of a body's antioxidant protection leading to normalization of LPO intensity in plasma and erythrocytes, has special signification [34]. It provided optimization of morpho-functional state of erythrocytes' membranes and, thus, stimulated tissue trophism. The reached optimum of lipid balance in erythrocytes' membranes gave great positive effect at MPT wearing. It had great significance for stabilization of many characteristics [35]. The achievement of optimal quantity and ratio of phospholipids and cholesterol in their membranes was a serious basis for normalization of erythrocyte membranes' selective permeability and viscosity. It positively influenced the state of membrane-bound proteins and promoted preservation of their normal secondary and tertiary structures [36]. Besides, optimality of membranes' lipid composition of circulating erythrocytes' basic mass provided minimization of erythrocytes' modified forms in blood of women with habitual miscarriage of pregnancy and raised erythrocytes-discocytes' quantity till normal values.

Found in worn MPT women weakening of erythrocytes' aggregation was the result of potentiation of the conducted saving pregnancy therapy on microrheological processes with the help of MPT [37,38]. Number lowering of erythrocytes' reversibly modified and their irreversibly modified forms led to quantity decrease of erythrocyte aggregates in their blood at degree lowering of the involvement of new erythrocytes into them. Found weakening of erythrocytes' aggregation in pregnant women with habitual miscarriage of pregnancy that wore MPT, could mostly be explained by weakening of catecholamines' effect on them. Their level in blood falls in case of any pathology weakening [39]. Given



process is always accompanied by lowering of α_2 -receptors' density on erythrocytes' membranes what leads to activation of adenylate cyclase, consequently, to quantity rise of cyclic adenosine monophosphate in their cytoplasm and lowering of Ca^{2+} content in it [40]. All these processes promote gradual weakening of erythrocytes' aggregation.

In the result of constant MPT wearing the synthesis of biologically active substances influencing erythrocytes' aggregation, balanced in vascular wall of women with habitual miscarriage of pregnancy in the third pregnancy term. It was established that the level of thromboxane A_2 fell in blood of these women against the background of daily MPT wearing. It was pointed by level lowering of its inactive form-thromboxane B_2 -in blood. It was accompanied in them by plasma concentration rise of its physiological antagonist-prostacyclin what promoted balance restoration of arachidonic acid metabolites' activity in their blood. Vessels' disaggregative properties strengthened in wearing MPT women on behalf of NO growth in their blood. Evidently, it was provided by activation of endothelial NO-synthase synthesis in the result of LPO processes' suppression in plasma [41]. Given situation minimized erythrocytes' microrheological disturbances what led to the improvement of microcirculation processes and strengthened trophism including womb vascular walls, thus, forming conditions for carrying a baby to full term [42].

Leveling of disturbances of bloodstream speed indices in the observed women in the course of MPT wearing against the background of standard therapy demonstrated evident positive reaction of microcirculatory course on the applied medicinal impact. Detected alterations showed evident positive MPT impact on vascular bed in the field of small pelvis. It provided lowering of peripheric resistance, elasticity increase of microvessels' walls, and rise of soft tissues' perfusion at the moment of systolic emission and increase of blood inflow into tissues of women who wore MPT. The rise of speed indices against the background of MPT application allowed considering that reached in these women positive dynamics of the indices of microcirculatory course was realized in the result of its reflex activation [43]. The detected unidirectional dynamics of bloodstream speed in right and left lower extremities should be considered as the result of evident reflex alterations and simultaneously an important functional basis for carrying a baby to full term.

So, it becomes clear that MPT wearing in the third pregnancy term by women with habitual miscarriage of pregnancy, who receive appropriate pharmacological treatment, promotes carrying a baby to full term. It is mostly connected with optimization of microcirculatory indices in them. In this respect it can be considered that given medicinal approach can potentiate traditionally applied medicinal impacts which are used for pregnancy saving at the threat of its preterm abortion. Taking into account availability, simplicity of application and absence of side effects in MPT, there is the basis to recommend them widely to patients with habitual miscarriage of pregnancy in addition to traditional variants of treatment.

Conclusion

High occurrence of habitual miscarriage of pregnancy is an important problem of our time demanding its solving. A significant role in pathogenesis of the given state is played by hemorheological disturbances worsening metabolic processes in the womb of a pregnant woman. Taking into account high readiness of pharmacological therapy of habitual miscarriage of pregnancy, it seemed to be perspective to look for variants of additional non-pharmacological impact at this state. It seemed to be important to design its variant which could

potentiate pharmacological therapy in the third pregnancy term. It was found out that daily wearing of medicinal prophylactic trousers between the 28th-38th weeks of pregnancy was accompanied in all the cases by maintenance of pregnancy till planned delivery. At the same time, erythrocytes' rheological properties normalized in these women. It becomes clear that wearing of medicinal-prophylactic trousers is an important and effective component of treatment saving pregnancy in its third term in women with habitual miscarriage of pregnancy. Received results allow recommending application of the given non-pharmacological impact as widely as possible.

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