THE FEATURES OF HAEMODYNAMIC PREGNANCY SUPPORT WITN GESTATIONAL ENDOTHELIOPATHY

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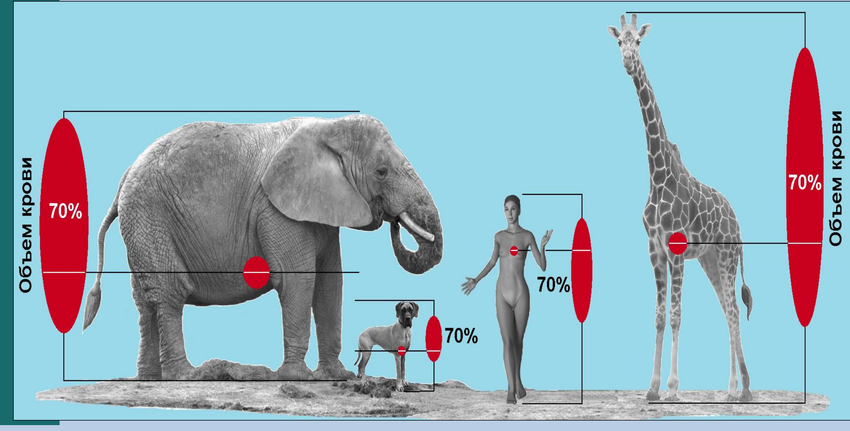

The preeclampsia is a multisystem pregnancy-specific disease. The incidences of preeclampsia (PE) are 5 to 14% of all pregnancies in the world, contributes to 18% of preterm birth, and 10%-27% of global maternal deaths worldwide, while severe PE can develop to about 25% of all cases of preeclampsia. The formally defined as new-onset hypertension with proteinuria or other organ damage occurring after 20 weeks of gestation, PE characterized by endothelial dysfunction can clinically manifest anytime thereafter, including into the post-partum period. Although the cause of this pregnancy-specific syndrome is unclear, accumulating evidence suggests that preeclampsia results from an imbalance between pro- and anti-angiogenic factors, which damage maternal vascular endothelium, leading to the clinical manifestations of this condition.

The process of optimal trophoblast invasion is often defective in preeclampsia, particularly in early-onset preeclampsia, affecting the endothelium (gestational endotheliopathy) but not the interstitial invasion pathway; the remodeling of myometrial spiral artery segments is particularly affected. However, defective remodeling is also seen in other cases of perinatal pathology and even rarely in normal pregnancy.

It is important to understand that all organism mechanisms providing pregnancy depend, foremost, on the hemodynamic system and the priority role of the perfusion complex (volume–tube–pump–pressure–blood flow) and pumping function of heart. More research assures that preeclampsia is examined not so much as the first event in subsequent development for women with cardiovascular diseases, but rather as a special circulatory state due to not insufficient, in our view, but tense adaptation of the cardio-vascular system (CVS) in women, as straight-walking creatures, in pregnancy. However, a faithful parcel in determination of relations reason-result determines the necessity of establishment of certain factor or terms, according to which such adaptations show up in the CVS in pregnancy, and also determination of hemodynamic structure of perfusion mechanisms lying in and defining the orientation of this adaptation at physiological and pathological pregnancy.

It is thus necessary to mean that blood pressure (BP) in pregnant, to that attention is brought over its determination of the state of PE, is the external display (a result, but not reason) of adaptation changes of all difficult complex of maternal circulation of blood, especially its basic mechanisms of perfusion, in the hemodynamic fetoplacental complex and, actually, maternal organism of. Orthostatic proteinuria, which in preeclampsia is associated with arterial high BP, reflects tension of kidney link in the adaptation of the CVS to the gravitational factor of circulation of blood and out of pregnancy. The prediction of preeclampsia early in gestation, before symptoms present, could guide the prophylactic use of potential therapeutic agents.

The aim of the study was an anthropophysiological analysis of the circulatory components of hemodynamic gestational support in physiological pregnancy (PhP) and women with gestational endotheliopathy who had high risk of PE and their association with the state of the pumping function of the heart.

Material and Methods. The study was performed at the National Pirogov Memorial Medical University, Vinnytsya, Ukraine, under budget grant No. 0121 U109141. Observational clinical studies were undertaken on 114 women with FP and 127 pregnant women with gestational endotheliopathy (GEP). The former group consisted of 23 women in their first trimester, 36 women in their second trimester, and 52 women in their third trimester, whereas the latter group consisted of 20 women in their first trimester, 36 women in their second trimester, and 75 women in their third trimester. A control group was formed by 115 healthy nonpregnant women. General age of pregnant women was 17–30 years (n = 241).

We enrolled pregnant women with GEP, who were diagnosed when microalbuminuria was more than 5.0 mg/mmol (screening test) and endothelium-dependent vasodilation was less than 10% (approving test).

Multicentral description of “hemodynamic model” of the examined conditions was made basis on antropophysiological research of the circulatory state of the CVS, using the diagnostic system ANTROPOS-CAVASCREEN, which is an innovative diagnostic complex for analyzing the performance of various blood circulation sections using noninvasive methods (thoracal and regional tetrapolar rheography, electrocardiography, BP measurement).

There was presented by three types of blood circulation: type I or hypokinetic state, with the decrease of BP in standing position (93% and less) comparing to its size in a prone position; type II or eukinetic state, with BP of 94-106% from standing to lying position; and type III or hyperkinetic state, with increase of BP up to 107% or more in the upright position.

For the integral estimation of the analyzed condition of the CVS we additionally used system characteristics, including syndrome of greater biological age (aging, age-related depreciation) and syndrome of hemodynamic risk on the index of hemodynamic non-optimality (IHU > 30%), as well as regional and system estimation of syndrome of resistance (vasoconstrictions) of the arterial vessels of the head, lungs, stomach, pelvis, femur, and calf, and increases of the systolic post-loading (post+) on the left (LV) and right (RV) ventricles of the heart.

Results It is necessary to mean that in position upright taking into account expression of the hypertensive state totally with a normative increase of MAP the stake of the states of CVS of pressor orientation for women arrived at 90–92%, demonstrating actuality of the tense of pressure adjustment in adaptation of CVS to the gravitational factor of circulation of blood for a human as straight-walking creature. There was a background to examine it as physiological basis of forming of the hypertensive condition, including, for pregnant women.

Our research for PhP showed clear reduction of the hypertensive states to their absence in the lying position, and it was especially shown in the upright position up to the third trimester. Such dynamics at PhP demonstrated optimization of the circulatory state of the CVS, at least on the mode of BP especially it was important for maturing of pregnancy in terms of straight-walking (sitting, upright, at walking). Clear increase of expression of hypotonic states was thus marked in the lying position, with 10% for women from control group to the first (39%) and the second trimesters of pregnancy - 32% ($P < 0.01$). The results of investigations also showed less expressed marked orientation in distribution of the modes for BP in the upright position determined at GEP. The hypertensive state was absent only in the first trimester. It appears in the second and third trimesters, though at lower levels (3–5%; $P \leq 0.05$) compared to nonpregnant women (10%). For GEP, the hypertensive states were presented in the lying position during all three trimesters, increasing three times (from 5% for nonpregnant women to 15% in GEP; $P < 0.05$).

It should be noted, that according to optimization of the state of the CVS on the mode of BP for pregnant raising of systolic function of heart, especially clearly expressed at physiological pregnancy, was marked. MVB (minute volume of blood), APR (antropophysiological ratio), and cardiac index on body weight (CI, ml/kg) are homogeneous hemodynamic indexes and therefore they were taken for systole descriptions (parameters) of the hemodynamic providing of pregnancy on the PFH.

The optimization of the circulatory state of the CVS during pregnancy accompanied by the clear increase of systolic descriptions on the pumping function of heart (PFH) and shows up on all three trimesters, especially at PhP. On MVB such orientation simply shows up during all three trimesters as at PhP—lying and upright totally for 24 descriptions from 24 ($P < 0.01$) and at GEP—also for 18 from 24 ($P < 0.05$) (Figure 1).

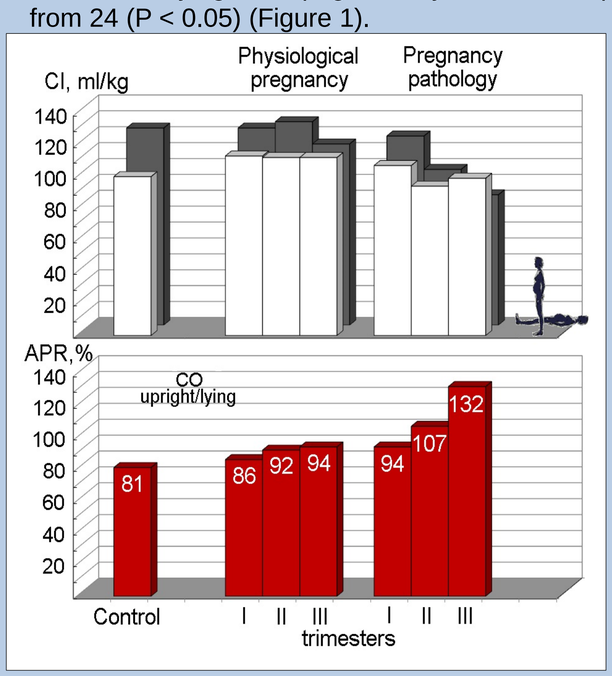

Fig 1. Dynamics of the haemodynamic providing of physiological pregnancy (PhP) and pathological pregnancy (GEP) on CI and APR

The orientation in the MVB unambiguously manifested itself during all three trimesters as with PhP—lying and standing in total according to 24 characteristics out of 24 ($P < 0.01$), while with GEP —by 18 out of 24 ($P < 0.05$). If the manifestation of type III under hypotonic, normotonic, and hypertonic regimes in blood pressure was 8, 12, and 6%, respectively, then in case of PhP it was 21, 36, and 50%, respectively (for all P positions <0.01) and for GEP, 48, 66, and 76% (for all positions $P < 0.01$). For gestational endotheliopathy in all modes of blood pressure, the representativeness of the hyperkinetic state in the PFH standing (type III) was significantly higher compared to PhP ($P < 0.01$).

According to it, the marker of tension of hemodynamic alteration was a transition on the MVB to the hyperkinetic state in position from standing to lying—to type III of dynamic organization of the circulator state of CVS and system hyperresistance of arterial vessels, and by the predictor of insufficiency of adaptation of CVS was displayed mostly in the position upright by perfusion type, combining with circulatory syndromes limiting adaptive possibilities of arterial circulation.

Conclusion

Expression of autonomic “slipping out” of arterial vessels of abdominal and pelvic circulation from under system vasoconstriction, probably because of endothelium-depending humoral mechanism, determine phenomenon of optimization of the circulatory state of CVS at the beginning of pregnancy, especially expressed at FP, and inhibition of pathological changes.

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