

The state of the cardiovascular system in women during pregnancy

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Abstract

The work is devoted to the study of the impact of pregnancy on the state of the cardiovascular system in women. The process of pregnancy is accompanied by significant changes in the rhythm of the heart performance and blood pressure, and the duration of the ECG waves and segments are not significantly fluctuated. The heart rhythm, gradually increasing, reaches its maximum value of 87.3 beats per minute ($P < 0.001$) in the last trimester, in women of the reference group 69.8. The minimum level of systolic blood pressure is 105.6 mm Hg, diastolic 69.5 mm Hg, detected in the second trimester of pregnancy, and the maximum - 146.4 and 88.0 mm Hg, respectively in the third one. The time of the P wave during pregnancy tends to decrease. The minimum time 0.151 s and maximum 0.162 in the reference is used for excitation from the atria to the ventricles in the third trimester. The coverage time of the ventricular excitation during pregnancy is reduced. Thus, the excitation in the third trimester occurred in 0.077 s, and 0.083 s in the reference group. In the reference group of women, the duration of QT was 0.346 s, and 0.331 s by the end of pregnancy.

Keywords

Pregnancy, Heart rate, Blood pressure, ECG indicators

Imprint

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The social and economic problems which remain unsolved for the population is the main cause of high mortality and low birth rates.

Due to the demographic problems which Russia has been facing in the last few decades, the birth of

every healthy baby is a big event that requires appropriate attention.

The state authorities recognize this fact and provide material support to every young family in which children are born and raised.

The decision to have a first pregnancy, due to the uncertainty of its consequences, poses a huge risk for a woman.

During the period of her life, a woman does not have to face such fears and anxieties.

In order to successfully survive this time, every woman should be aware of possible changes, both in her own body and the fetus.

Even in the old days in Russia, it was believed that in order to give birth to a healthy child, the expectant mother during the conception period should avoid looking at freaks and cripples.

Being in the womb, the future person feels the state of the mother, her experiences, sensations, thoughts and draws conclusions about the world: good; bad; accept me or not; poses a danger to me or not, and so on. The level of mother's love shown during pregnancy determines the state of the psyche of the fetus, its memory and its qualities as individuals that persist throughout life [3].

During this period, the following is strictly prohibited: fatigue; high physical activity; night duty; performance of work with body vibration and the influence of substances with a sharp odor on the body. The duration of sleep should be not less than 8 hours, and it should be preceded by a walk. A pregnant woman should isolate herself from infection with infectious diseases. She should wear comfortable and loose clothing, avoid constricting belts and tight bras.

To support the abdomen in the second half of pregnancy, it is necessary to wear a bandage. Shoes should not be high heels.

To preserve the health of a woman and ensure the proper development of the fetus, proper nutrition is important. The use of a diet is not mandatory for women in the first half of pregnancy, however, the food should be tasty and varied.

During pregnancy, a woman should eat at least six times a day. Since proteins are the plastic (building) material of the fetus, they play a special role in the nutrition of a pregnant woman.

High nutritional value of animal proteins should be noted that enter the mother's body with foods such

as eggs, meat, fish and dairy products. The need of a pregnant woman is also high in products containing plant proteins. These are soy and nut proteins.

In the diet, preference should be given to fruits, berries and vegetables. Fats should be used in the form of butter, sour cream and vegetable oils. During pregnancy, the need for vitamins increases, and therefore foods rich in vitamins should predominate in the diet.

Advances in the development of physiology put forward in the relationship between the mother and the fetus, the need to reassess the data on the functional activity of body systems [11].

This need is due to the fact that the mother and the fetus are two independent organisms, which are united by the satisfaction of the needs of the fetus, which ensure the normal development of the embryo.

Deviations in the embryonic development of the fetus can be caused both by disturbances in the genetic apparatus of the fetus, and by the influence of some environmental factors. This means that the optimal state of environmental conditions alone is not enough to ensure the normal development of the fetus.

Also, for this, it is necessary to maintain the constancy of the internal environment in the mother-fetus system, which ensures the development of the fetus according to the genetic plan.

Identification of changes occurring in the body of a pregnant woman will allow us, through preventive measures, to avoid the development of possible pathologies [14]. A woman's illness during pregnancy poses a threat not only to the body of the expectant mother, but also to the normal development of the fetus.

Therefore, the determination of indicators of the cardiovascular system, as one of the most important in the body, during pregnancy is important and relevant.

In order to identify changes in the cardiovascular system of women during pregnancy, we conducted research in the maternity department of the Urus-Martan district hospital.

Materials and methods

The object of our research were 50 clinically healthy women, whose age ranged from 23 to 25 years. Among them, two groups were formed, each group consisted of 25 women. Women in the reference group did not have a pregnancy, while the experimental ones were pregnant, and its duration was the same.

The conditions for the inclusion of women in the experimental group were their consent and the absence of contraindications for the course of pregnancy. Blood samples were taken at the end of each trimester of pregnancy, in the morning before taking water and food.

Heart rate and arterial blood pressure values were determined using expert digital automatic tonometer OMRON M3.

Electrocardiogram parameters were recorded using an Alton-03 electrocardiograph.

The "Biostatistics" software was used for statistical processing of the experimental data.

Results and Discussion

The dynamics of the cardiovascular system indicators in women during pregnancy is shown in Table 1 and in Figures 1 and 2 herein.

Table 1
The impact of pregnancy on the cardiovascular system indicators

Indicators	Reference	Trimester of pregnancy		
		1	2	3
HR, beats per minute	69.8±1.24	78.6±1.18****	81.5±1.26****	87.3±1.51****
Systolic blood pressure, mm Hg	117.0±2.03	116.2±1.67	105.6±1.82***	146.4±2.18****
Diastolic blood pressure mm Hg	78.2±1.41	77.7±1.52	69.5±1.62***	88.0±1.94***
P, s	0.076±0.0018	0.074±0.0015	0.073±0.0016	0.070±0.0032
PQ, s	0.162±0.0040	0.158±0.0043	0.156±0.0044	0.151±0.0047
QRS, s	0.083±0.0014	0.081±0.0025	0.080±0.0026	0.077±0.0029
QT, s	0.346±0.0033	0.340±0.0044	0.337±0.0045	0.331±0.0075

*** – P < 0,01; **** – P < 0,001

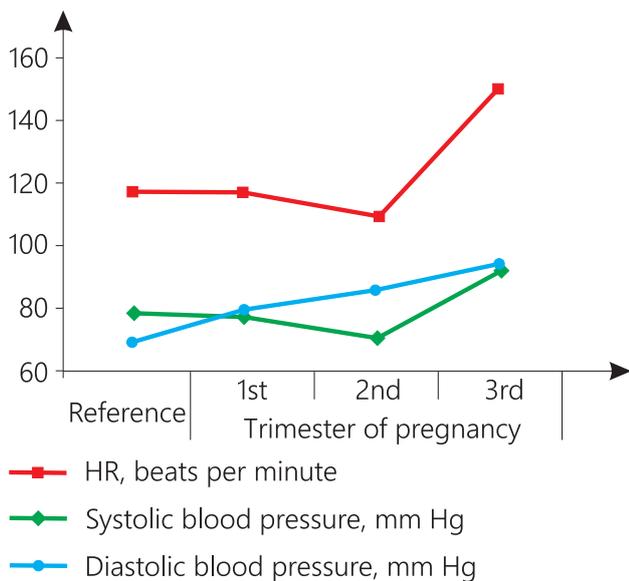


Figure 1. Cardiovascular system in women during pregnancy

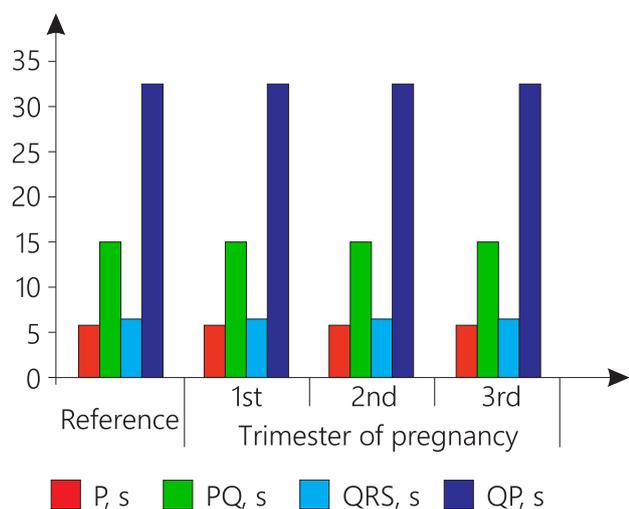


Figure 2. Electrocardiogram parameters in women during pregnancy

The table and figures herein show that with the course of pregnancy, the heart rate increases significantly, blood pressure decreases until the second trimester, then increases, ECG parameters do not undergo significant changes.

Thus, the heart rate increased in the first trimester of pregnancy by 8.8 beats per minute $P < 0.001$, 11.7 ($P < 0.001$) in the second and 17.5 ($P < 0.001$) in the third as compared to the reference.

Arterial blood pressure decreased in the first and second trimesters of pregnancy, and increased in the third.

The drop in systolic pressure in the 1st and 2nd trimesters was 0.8 mm Hg and 11.4 ($P < 0.001$), and in the diastolic one 0.5 and 8.7 ($P < 0.01$), as compared to non-pregnant women.

In the third trimester, the level of systolic pressure exceeds the initial one by 29.4 mm Hg ($P < 0.001$) and the level of diastolic pressure by 9.8 ($P < 0.01$).

Apparently, a significant increase in heart rate and fluctuations in blood pressure during pregnancy is a consequence of stimulation of the cardiac activity, as well as a decrease in peripheral blood pressure due to the uteroplacental circulation [12].

Our data are also confirmed by other authors. So, in the second trimester of pregnancy, due to a decrease in peripheral vascular resistance owing to an additional uteroplacental circulation, there is a decrease in blood pressure by 8-15 mm Hg, and in the third an increase therein, but no more than 10-15% [5].

During pregnancy, there is an increase in cardiac output by 30-40%, and at the same time, the activity of the left ventricle is enhanced [7].

Joanna S. [10] reports on the basis of her research that in the first trimester of pregnancy there is an increase in the heart rate by 5-7 beats per minute, and by the end of the third by 15-20.

According to A.A. Kikshun [4], with the development of pregnancy, the stroke volume of the heart increases by 30% and the heart rate by 15-20 beats per minute. From the beginning of pregnancy, the pulse value increases by 10-15 beats per minute and remains at this level until childbirth [1, 13]. Such factors of the pregnancy process as an increase in the amount of blood in the vascular system and the appearance of additional blood circulation that feeds the fetus enhance the load on the heart and blood vessels [6].

Simkin P, et al [9] found that during pregnancy there was an increase in the amount of circulating blood by 40-55%. At the beginning of pregnancy, the increase in circulating blood volume was 30-45%.

In the absence of pathologies, arterial blood pressure (BP) does not undergo to significant changes during pregnancy.

From the beginning of pregnancy, there is an increase in cardiac output, reaching its maximum value of 6-7 l/min by the middle of the third trimester [1].

The duration of P, PQ, QRS and QT intervals decreases slightly with the course of pregnancy. Thus, the shortening of the P wave in the third trimester was 0.006 seconds.

The time of excitation from the atria to the ventricles decreased by 0.011 s at the end of pregnancy.

The difference between the extreme values of the duration of the QRS wave was 0.006 seconds.

The ventricular systole in the third trimester took 0.015 s less time than that in the reference women.

In the normal course of pregnancy, the electrocardiogram parameters do not undergo to any significant changes [2].

According to Savelieva G.M., Sukhikh G.T., Serov V.N. and Radzinsky V.E. [8], pregnancy is accompanied by significant changes in the performance of the organs and systems in the woman's body.

They are adaptive in nature and are aimed both at meeting the needs of the growing fetus and at creating the necessary conditions for a favorable course of the birth process.

Thus, pregnancy leads to a significant increase in the heart rate, significant fluctuations in blood pressure in both directions and an unreliable reduction in the time of electrocardiogram indicators.

Conclusions

1. During pregnancy, women experience significant changes in heart rate and blood pressure.

2. Heart rate increases in the first trimester by 12.6%, in the second and third ones by 16.8 and 25.1%, respectively.

3. Systolic blood pressure drops in the second trimester by 9.7%, and the diastolic one by 11.2%.

4. An increase in systolic blood pressure by the end of pregnancy was 25.1%, and that in the diastolic pressure reached 12.5%.

5. Duration of the waves and segments of the electrocardiogram during pregnancy is slightly reduced.

Statement on ethical issues

Research involving people and/or animals is in full compliance with current national and international ethical standards.

Conflict of interest

None declared.

Author contributions

The authors read the ICMJE criteria for authorship and approved the final manuscript.

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