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CENTRAL HEMODYNAMIC STATUS IN PREGNANT WOMEN COMPLICATED BY MITRAL VALVE INSUFFICIENCY OF RHEUMATIC ETIOLOGY

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ABSTRACT

Background. Nowadays, congenital heart defects of rheumatic etiology, including mitral valve insufficiency and pregnancy, are one of the most important and urgent problems of modern obstetrics. Mitral valve insufficiency is the most common organic disease among congenital heart defects, which is more common in industrialized countries with poor environmental conditions than in underdeveloped countries.

Aim. consists of studying the state of central hemodynamics in pregnant women complicated by mitral valve insufficiency of rheumatic etiology/

Materials and methods. This research study studied 100 pregnant women with mitral valve insufficiency of rheumatic etiology who applied to the Department of Pregnancy Pathology of the Maternity Complex of the Bukhara Branch of the State Institution of the Republican Specialized Scientific and Practical Medical Center for Maternal and Child Health and the Zhandor District Medical Association during 2022-2023, of which 70 were in the main group and 30 were in the control group, with uncomplicated pregnancies.

Results. Pregnant women with active clinical manifestations of rheumatic processes, systolic arterial blood pressure, diastolic arterial blood pressure, heart rate, and mean arterial blood pressure were 12.8%, 3.72%, 9.71%, and 8.43% lower than in pregnant women who received medical treatment, respectively, while in the control group, these indicators were 25.6%, 35.5%, 15.1%, and 12.5% lower, respectively. That is, pregnant women who received medical treatment, was statistically significant compared to the control group, being 11.2, 30.6, 4.84, 3.75%, respectively. Pregnant women with mitral valve insufficiency with rheumatic activation, the minute volume, pulse index, and cardiac index decreased by 1.23, 1.29, and 1.27 times, respectively, compared to the indicators of the group receiving medical treatment ($P<0.01$, $P<0.001$), while this decrease was 1.28, 1.48, and 1.36 ($P<0.01$, $P<0.001$) times, respectively, compared to the corresponding indicators of the control group.

Conclusions. The conducted studies have shown that adaptive hemodynamic processes in a single functional system of the mother - placenta - fetus are designed to ensure the physiological course of pregnancy, fetal growth and development. Blood circulation in the mother-placenta-fetus system, formed with the development of the pregnancy process, is one of the main factors determining the normal development of the fetus.

Key words: mitral valve insufficiency, rheumatism, pregnancy, cardiohemodynamics, central hemodynamics.

СОСТОЯНИЕ ЦЕНТРАЛЬНОЙ ГЕМОДИНАМИКИ У БЕРЕМЕННЫХ, ОСЛОЖНЕННЫХ НЕДОСТАТОЧНОСТЬЮ МИТРАЛЬНОГО КЛАПАНА РЕВМАТИЧЕСКОЙ ЭТИОЛОГИИ

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АННОТАЦИЯ

Введения. В настоящее время врожденные пороки сердца ревматической этиологии, в том числе недостаточность митрального клапана и беременность, являются одной из важнейших и актуальных проблем современного акушерства. Недостаточность митрального клапана является наиболее распространенным органическим заболеванием среди врожденных пороков сердца, которое чаще встречается в индустриально развитых странах с неблагополучной экологической обстановкой, чем в слаборазвитых странах.

Цель. изучение состояния центральной гемодинамики у беременных женщин, осложненных недостаточностью митрального клапана ревматической этиологии.

Материалы и методы. В ходе исследования обследовано 100 беременных женщин с недостаточностью митрального клапана ревматической этиологии, обратившихся в отделение патологии беременности родильного комплекса Бухарского филиала Государственного учреждения Республиканского специализированного научно-практического медицинского центра охраны здоровья матери и ребенка и Жандорского районного медицинского объединения в течение 2022-2023 годов, из них 70 составили основную группу и 30 - контрольную группу, с неосложненным течением беременности.

Результаты. У беременных с активными клиническими проявлениями ревматических процессов систолическое артериальное давление, диастолическое артериальное давление, частота сердечных сокращений и среднее артериальное давление были ниже, чем у беременных, получавших медикаментозное лечение, на 12,8%, 3,72%, 9,71% и 8,43% соответственно, тогда как в контрольной группе эти показатели были ниже на 25,6%, 35,5%, 15,1% и 12,5% соответственно. То есть у беременных, получавших медикаментозное лечение, разница была статистически значимой по сравнению с контрольной группой и составила 11,2, 30,6, 4,84, 3,75% соответственно. У беременных с недостаточностью митрального клапана с ревматической активацией минутный объем, пульсовой индекс и сердечный индекс снизились в 1,23, 1,29 и 1,27 раза соответственно по сравнению с показателями группы, получавшей медикаментозное лечение ($P<0,01$, $P<0,001$), тогда как это снижение составило 1,28, 1,48 и 1,36 ($P<0,01$, $P<0,001$) раза соответственно по сравнению с соответствующими показателями контрольной группы.

Выводы. Проведенные исследования показали, что адаптивные гемодинамические процессы в единой функциональной системе мать - плацента - плод призваны обеспечивать физиологическое течение беременности, рост и развитие плода. Кровообращение в системе мать - плацента - плод, формирующееся по мере развития процесса беременности, является одним из основных факторов, определяющих нормальное развитие плода.

Ключевые слова: недостаточность митрального клапана, ревматизм, беременность, сердечная гемодинамика, центральная гемодинамика.

РЕВМАТИК ЭТИОЛОГИЯЛИ МИТРАЛ КЛАПАН ЕТИШМОВЧИЛИГИ БИЛАН АСОРАТЛАНГАН ҲОМИЛАДОР АЁЛЛАРДА МАРКАЗИЙ ГЕМОДИНАМИКА ҲОЛАТИ

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АННОТАЦИЯ

Кириш. Ҳозирги вақтда ревматик этиологияли туғма юрак нуқсонлари, шу жумладан митрал қопқоқ етишмовчилиги ва ҳомиладорлик замонавий акушерликнинг энг муҳим ва долзарб муаммоларидан биридир. Митрал қопқоқ етишмовчилиги туғма юрак нуқсонлари орасида энг кўп учрайдиган органик касаллик бўлиб, у саноати ривожланган ва экологик жиҳатдан ноқулай бўлган мамлакатларда ривожланмаган мамлакатларга қараганда кўпроқ учрайди.

Мақсад: ревматик этиологияли митрал клапан етишмовчилиги билан асоратланган ҳомиладор аёлларда марказий гемодинамика ҳолатини ўрганиш.

Тадқиқот материаллари ва усуллари: Тадқиқот давомида Республика ихтисослаштирилган она ва бола саломатлиги илмий-амалий тиббиёт маркази Бухоро филиали туғруқ мажмуаси ҳомиладорлар патологияси бўлимига ревматик этиологияли митрал клапан етишмовчилиги билан мурожаат қилган 100 нафар ҳомиладор аёл текширувдан ўтказилди.

Натижалар. Ревматик жараёнларнинг фаол клиник кўринишлари бўлган ҳомиладорларда систолик қон босими, диастолик қон босими, юрак уриш тезлиги ва ўртача қон босими дори-дармонлар билан даволанган ҳомиладорларга қараганда мос равишда 12,8%, 3,72%, 9,71% ва 8,43% га паст бўлган бўлса, назорат гуруҳида бу

кўрсаткичлар мос равишда 25,6%, 35,5%, 15,1% ва 12,5% га паст бўлган. Яъни, дори-дармонлар билан даволанган ҳомиладорларда назорат гуруҳига нисбатан фарқ статистик жиҳатдан аҳамиятли бўлиб, мос равишда 11,2, 30,6, 4,84, 3,75% ни ташкил этди. Ревматик фаоллашув билан кечган митрал қопқоқча етишмовчилиги бўлган ҳомиладорларда дақиқалик ҳажм, пульс индекси ва юрак индекси дори-дармонлар билан даволанган гуруҳ кўрсаткичларига нисбатан мос равишда 1,23, 1,29 ва 1,27 марта (P<0,01, P<0,001) пасайган бўлса, бу пасайиш мос равишда 1,28, 1,48 ва 1,36 (P<0,01, P<0,001) мартани ташкил этди.

Хулосалар. Ўтказилган тадқиқотлар шуни кўрсатдики, она-йўлдош-ҳомила ягона функционал тизимидаги мослашувчан гемодинамик жараёнлар ҳомиладорликнинг физиологик кечишини, ҳомиланинг ўсиши ва ривожланишини таъминлашга қаратилган. Она-йўлдош-ҳомила тизимида қон айланиши ҳомиладорлик жараёнининг ривожланиши билан шаклланиб, ҳомиланинг нормал ривожланишини белгиловчи асосий омиллардан бири ҳисобланади.

Калит сўзлар: митрал клапан етишмовчилиги, ревматизм, ҳомиладорлик, юрак гемодинамикаси, марказий гемодинамика

Introduction. Rheumatic diseases are considered a social problem worldwide, and the development of economic, cultural, social opportunities and the improvement of medical services contribute to the reduction of rheumatism and related serious heart diseases, in particular mitral valve insufficiency [2]. Nevertheless, the problem of heart defects due to rheumatic causes in pregnant women remains relevant.

In the Republic of Uzbekistan, mitral valve pathology due to various causes among cardiovascular diseases occurs in 7% to 10%. According to the World Health Organization (WHO), congenital heart defects (CHD) are the main cause of death from cardiovascular diseases in pregnant women under the age of 40. In medical practice, it can be seen that mitral heart defects are the most common pathology. Overall, rheumatic heart disease ranks third among the causes of chronic heart failure (18.4%), but according to recent data, it ranks second among the causes of heart failure when combined with ischemic heart disease and arterial hypertension [3,4].

Pregnancy and the periods associated with it cause significant hemodynamic changes in the body, which are further enhanced during labor and the postpartum period. During pregnancy, the load on the heart increases as a result of placental blood flow and hormonal effects: the amount of blood pumped by the heart increases by 30-50%, the heart rate (HR) increases by 10-20 beats, and the circulating blood volume increases by 30-50%. Vascular resistance decreases, so that despite the increased blood output, blood pressure remains low. Due to the increase in blood volume and the unchanged mass of erythrocytes, the hematocrit decreases. Hemodynamic changes during pregnancy begin mainly in the first half of the first trimester, reach their peak in the second trimester, and enter a phase of decline in the third trimester [6,8].

During physiological pregnancy, as a result of the reorganization of the circulatory system, total peripheral vascular resistance (TPVR) decreases and intravascular blood volume increases, leading to an increase in cardiac output, stroke volume (SV), and cardiac output (CO). In the first half of pregnancy, a decrease in diastolic blood pressure (relative to blood pressure in healthy non-pregnant women) occurs due to a decrease in peripheral vascular resistance and progressive vasodilation. In uncomplicated pregnancies, PTVR decreases throughout pregnancy and increases slightly towards the end of pregnancy[5,7].

Pathological changes in the structure of the main elements of the connective tissue of the heart and mitral valve, as well as peripheral and hemodynamic disorders, lead to the development of various complications during pregnancy. In the early stages of pregnancy, the risk of regurgitation and miscarriage increases, while in the second trimester, isthmic-cervical insufficiency, the risk of premature birth, preeclampsia, and placental insufficiency may occur. During the labor period, premature rupture of membranes, trauma, and impaired labor function are observed[1].

The purpose of the study: consists of studying the state of central hemodynamics in pregnant women complicated by mitral valve insufficiency of rheumatic etiology

Materials and methods. This research study studied 100 pregnant women with mitral valve insufficiency of rheumatic etiology who applied to the Department of Pregnancy Pathology of the Maternity Complex of the Bukhara Branch of the State Institution of the Republican Specialized Scientific and Practical Medical Center for Maternal and Child Health and the Zhandor District Medical Association during 2022-2023, of which 70 were in the main group and 30 were in the control group, with uncomplicated pregnancies.

We studied pregnant women who participated in the study and divided them into 3 groups:

Group 1 – hospitalized with clinical manifestations of rheumatic processes (n=35);

Group 2 – pregnant women who were examined from the early stages of pregnancy and received appropriate preventive treatment in a timely manner (n=35).

Control group – a group of pregnant women with a physiological pregnancy (n=30);

The data obtained as a result of the study were subjected to statistical processing on a personal computer using the Microsoft Office Excel-2012 software package.

Results

We know that Doppler echocardiography is an easy and accurate method for diagnosing mitral valve insufficiency, and for this purpose, we examined pregnant women included in our study using this method and obtained the following data.

Increased oxygen demand and blood volume during pregnancy, as well as physiological hemodilution during pregnancy, lead to an increased load on the cardiovascular system. In addition to the effects of tachycardia, increased arterial blood pressure and peripheral vascular resistance variability, increased ejection fraction, and other regulatory factors, pathological changes may also occur due to dysfunction of the sympathoadrenal system.

We also studied systolic, diastolic, and mean arterial blood pressure, as well as heart rate, in pregnant women who participated in the study, which are presented in the table below. In order to compare the indicators between the groups, their corresponding indicators are presented.

Table 1

Indicators of the peripheral circulatory system in pregnant women of the studied groups, (n=100)

Indicators	Control group, (n=30)	1- group, (n=35)	2- group, (n=35)
Systolic arterial pressure, mm.rt.st.	108,1±0,74	135,8±2,70***^^	120,3±1,85**∞∞
Diastolic arterial pressure, mm.rt.st.	65,7±0,44	89±1,26***^	85,8±1,42***∞
Heart rate frequency, min	80,5±0,55	92,6±1,05**^^	84,4±0,80**∞∞
mean arterial blood pressure, mm.rt.st.	80±0,44	90±1,38*^	83±1,03*∞∞

Note: * - differences are significant compared to control data (* - P<0.05, ** - P<0.01, *** - P<0.001), ^ - differences are significant compared to group 2 data (^- P<0.05, ^^ - P<0.01,),∞- differences are significant compared to group 1 data (∞- P<0.05, ∞∞ - P<0.01)

The data presented in the table show that statistically significant changes were observed in the systolic, diastolic, and mean arterial blood pressure of pregnant women with rheumatic mitral valve insufficiency compared to the control group and group 2, that is, pregnant women who received medical treatment.

In group 1, that is, pregnant women with active clinical manifestations of rheumatic processes, systolic arterial blood pressure, diastolic arterial blood pressure, heart rate, and mean arterial blood pressure were 12.8%, 3.72%, 9.71%, and 8.43% lower than in pregnant women who received medical treatment, respectively, while in the control group, these indicators were 25.6%, 35.5%, 15.1%, and 12.5% lower, respectively.

Group 2, that is, pregnant women who received medical treatment, was statistically significant compared to the control group, being 11.2, 30.6, 4.84, 3.75%, respectively.

Rheumatic mitral valve insufficiency is the most common heart disease in women during pregnancy, leading to an increase in heart volume and heart rate during pregnancy, which was also reflected in our study.

The central hemodynamic parameters of the pregnant women included in our study were examined and the following results were recorded (see Table 2).

Table 2

Central hemodynamic parameters in pregnant women of the studied groups, (n=100)

Indicators	Control group, (n=30)	1- group, (n=35)	2- group, (n=35)
Minute Volume, l/min.	7,5±0,14	5,87±0,08**^^	7,25±0,09*∞∞
Impact Index, ml/m².	58,9±0,96	39,7±0,82***^^^	51,4±0,86*∞∞∞
Cardiac index, l/min/m².	4,61±0,09	3,39±0,05*^	4,29±0,02*∞

GPVR, din.sec.cm-5	948,6±10,4	1199,8±23,7***^^	1132,8±4,78**∞∞

Note: * - differences are significant compared to control data (* - P<0.05, ** - P<0.01, *** - P<0.001), ^ - differences are significant compared to group 2 data (^- P<0.05, ^^ - P<0.01, ^^^ - P<0.001,),∞ - differences are significant compared to group 1 data (∞- P<0.05, ∞∞ - P<0.01, ∞∞∞ - P<0.001).

As can be seen from the data presented in the table, the analysis of central hemodynamic parameters showed that in pregnant women with active clinical manifestations of rheumatic processes and complicated by mitral valve insufficiency, the minute volume (VL) was 5.87±0.08 l/min [6.9-5.1 l/min], the stroke index (SI) was 39.7±0.82 ml/m² [49-32.5 ml/m².], the cardiac index was 3.39±0.05 l/min/m² [3.9-2.9 l/min/m².], and the total peripheral vascular resistance (TPVR) was 1199.8±23.7 dyn.sec.cm-5 [1408-1013 dyn.sec.cm-5]. In group 2, that is, in pregnant women who received medical treatment, the mean arterial pressure was 7.25±0.09 l/min [8-6 l/min], the mean arterial pressure was 51.4±0.86 ml/m². [60-42 ml/m².], the mean arterial pressure was 4.29±0.02 l/min/m². [5.1-3.5 l/min/m².], and the mean arterial pressure was 1132.8±4.78 dyn.sec.cm-5 [1215-1057 dyn.sec.cm-5], and both groups were statistically significant compared to the control group.

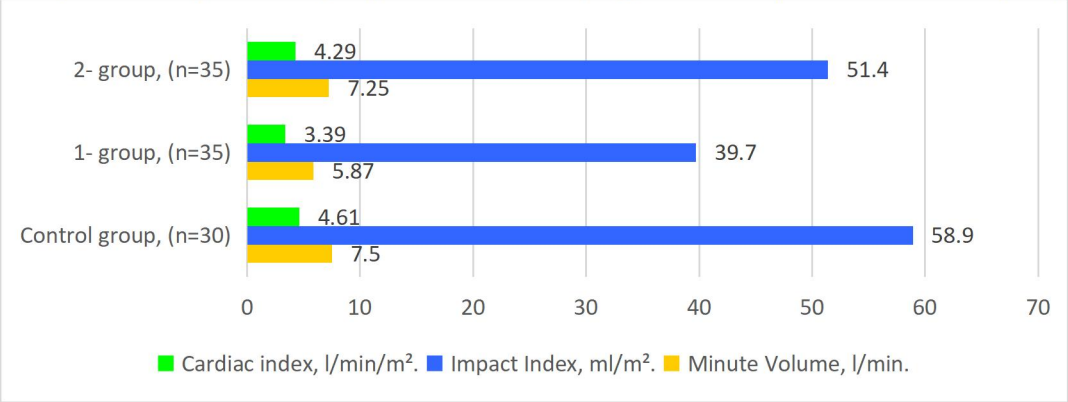

Figure 1. Central hemodynamic parameters in pregnant women of the studied groups

The data presented in Figure 1 show that statistically significant and reliable changes were observed in pregnant women in group 1 compared to the control and group 2 pregnant women.

For example, in group 1, that is, pregnant women with mitral valve insufficiency with rheumatic activation, the minute volume, pulse index, and cardiac index decreased by 1.23, 1.29, and 1.27 times, respectively, compared to the indicators of the group receiving medical treatment (P<0.01, P<0.001), while this decrease was 1.28, 1.48, and 1.36 (P<0.01, P<0.001) times, respectively, compared to the corresponding indicators of the control group.

At the same time, when analyzing the UPTQ index between the groups, it can be seen that the GPVR index in pregnant women of group 1 was 5.9% higher than that in group 2, and 26.5% higher than that in the control group.

From the analysis of the data obtained, it can be seen that the clinical manifestations of rheumatic processes in pregnant women with activation indicate a significant deterioration in central hemodynamics, i.e. minute volume, pulse index, cardiac index, which is expressed in a slight increase in GPVR due to tachycardia.

Changes in central hemodynamic parameters, i.e., the clinical manifestations of rheumatic processes, indicate the presence of significant disorders in the circulatory system of pregnant women, which undoubtedly also affects the violation of blood circulation in the feto-placental system.

The conducted studies have shown that adaptive hemodynamic processes in a single functional system of the mother - placenta - fetus are designed to ensure the physiological course of pregnancy, fetal growth and development. Blood circulation in the mother-placenta-fetus system, formed with the development of the pregnancy process, is one of the main factors determining the normal development of the fetus.

Discussion

A number of foreign studies have provided information on the possibilities of predicting perinatal adverse outcomes associated with mitral valve insufficiency. Fetoplacental circulation disorders during pregnancy due to mitral valve insufficiency lead to a lag in the internal development of the fetus, hypoxia, and every fourth baby is born with signs of hypotrophy and morphofunctional immaturity[5]. Pregnant women with active clinical manifestations of rheumatic processes, systolic arterial blood pressure, diastolic arterial blood pressure, heart rate, and mean arterial blood pressure were 12.8%,

3.72%, 9.71%, and 8.43% lower than in pregnant women who received medical treatment, respectively, while in the control group, these indicators were 25.6%, 35.5%, 15.1%, and 12.5% lower, respectively.

According to modern views, pathological changes associated with any decrease in the activity of myocardial cells occur at the level of myocardial and left ventricular cells, as well as interstitial tissue. A minimal increase in total peripheral vascular resistance (TPVR) or its normalization in pregnant women with mitral valve insufficiency leads to an increase in the pumping function of the heart, which can further increase the load on the heart[2,6]. This initial increase in load increases the diastolic tension of the left ventricular (LV) wall, the sarcomere systems of cardiomyocytes are stretched, the LV cavity is widened, and its shape changes. Pregnant women with mitral valve insufficiency with rheumatic activation, the minute volume, pulse index, and cardiac index decreased by 1.23, 1.29, and 1.27 times, respectively, compared to the indicators of the group receiving medical treatment ($P<0.01$, $P<0.001$), while this decrease was 1.28, 1.48, and 1.36 ($P<0.01$, $P<0.001$) times, respectively, compared to the corresponding indicators of the control group.

Studies have shown that when the hearts of pregnant women with mitral valve insufficiency are examined by echocardiography, changes in the size and thickness of the heart chambers are detected. In such pregnant women, an increase in the end-diastolic and systolic dimensions, as well as end-diastolic and systolic volumes, is observed. As the gestational age increases, circulatory disorders increase[8]. At the same time, in the second and third trimesters, the diameter of the right ventricle also increases significantly, and these changes are even more pronounced in pregnant women complicated by mitral valve insufficiency.

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