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FEATURES OF ULTRASOUND IMAGING IN FETAL INTRAUTERINE GROWTH RETARDATION*

Berezhna V. A.

Department of Obstetrics and Gynecology No.1 Ukrainian Medical Stomatological Academy, Poltava

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Затримка внутрішньоутробного розвитку плода ускладнює в середньому 10% від усіх вагітностей. На сьогоднішній день в акушерстві для встановлення діагнозу використовується ультразвукове обстеження. Тому своєчасне виявлення даного ускладнення запорука адекватного лікування та зменшення перинатальних наслідків. Краще розуміння ранніх супутніх ультразвукових параметрів нададуть змогу своєчасного виявлення або попередження затримки внутрішньоутробного розвитку плода. Метою дослідження було проведення ультразвукового антенатального обстеження жінок із затримкою внутрішньоутробного розвитку плода. Проведена ультразвукова фетометрія та плацентометрія жінкам основної групи із затримкою внутрішньоутробного розвитку плода (n=41) та жінкам групи порівняння з фізіологічним перебігом вагітності (n=12). Результати: при початковому ультразвуковому обстеженні серед жінок основної групи вірогідно вищу частоту виявлення у плодів нижче 10 перцентилі складали знижені показники біпаріетального розміру голови та обвіду живота (p=0,001, p=0,08). При повторному ультразвуковому обстеженні зростає у 1.5 рази частота виявлення знижених показників біпаріетального розміру голови, обвіду голови, обвіду живота, довжини діафіза стегнової кістки нижче 10 перцентилі серед основної групи, дані зміни є вірогідно відмінними від показників групи порівняння. (p=0,0002, p=0,001). Зменшення біофілію плода до 6-7 балів супроводжують 63,4% вагітностей при затримці внутрішньоутробного розвитку плода. Індекс амніотичної рідини нижче 5-го перцентилі відповідно до даного терміну гестації у жінок при первинному огляді становив 2,4%, а при повторному огляді – 7,3%. Плацентарним ультразвуковим маркером є передчасне дозрівання до строку гестації у 21,4%, наявність петріфікатів у 58,5%. Своєчасне виявлення фетометричних та плацентометричних змін надає можливість з позиції сучасного акушерства розпочати етіопатогенетично терапію та профілактику даного ускладнення вагітності.

Ключові слова: затримка внутрішньоутробного розвитку плода, ультразвукове дослідження, ультразвукова фетометрія, ультразвукова морфометрія.

Fetal growth retardation complicates an average of 10% of all pregnancies. Today, ultrasound examination is used in obstetrics for diagnosis. Therefore, early detection of this complication is the key to adequate treatment and reduction of perinatal consequences. A deeper understanding of the early accompanying ultrasound parameters will allow timely detection or prevention of intrauterine fetal development. The aim of the research was to conduct an ultrasound antenatal examination of women with intrauterine growth retardation. Ultrasound fetometry and placentometry were conducted in women with intrauterine growth retardation (the main group, n=41) and women in the comparison group with the physiological course of pregnancy (n=12). At the initial ultrasound examination, among women in the main group, fetuses below the 10th percentile were probably more common and had a decrease in biparietal head size and abdominal circumference (p = 0.001, p = 0.08). With repeated ultrasound examination, the frequency of detecting decreased indicators of biparietal head size, head circumference, abdominal circumference, femoral shaft length below the 10th percentile among women in the main group increases by 1.5 times, and significantly differs from the indicators of the comparison group. (p = 0.0002, p = 0.001). A decrease in the biophysical profile of the fetus to 6-7 points accompanies 63.4% of pregnancies with intrauterine growth retardation. The amniotic fluid index below the 5th percentile in relation to the gestational age in women at the initial examination was 2.4%, and at the second examination - 7.3%. The placental ultrasound marker of premature maturation by gestational age 21.4%, the presence of petrification in 58.5%. In case of timely detection of the fetometric and placentometric changes, it is possible, from the standpoint of modern obstetrics, to start etiopathogenetic therapy and prevention of this complication of pregnancy.

Key words: intrauterine growth retardation, ultrasound examination, ultrasound fetometry, ultrasound morphometry.

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Fetal intrauterine growth retardation (IUGR) and its subsequent adequate vital activity are associated with the diagnostic prediction of complications during pregnancy. Delayed fetal development complicates an average of 10% of all pregnancies [1]. Babies born subsequently with low weight for gestational age have a large number of postnatal problems [2], [3]. Therefore, timely detection of fetal IUGR is a guarantee of adequate treatment and reduction of perinatal consequences [4].

The traditional method of detection is to measure the height of the uterine fundus from the upper edge of the pubic symphysis. Today, in modern obstetrics, the "gold standard" for diagnosis is ultrasound. And in the subsequent dynamic supervision of intrauterine fetal condition, the definition of deterioration of its condition is based primarily on ultrasound data [5], [6]. The data from ultrasonic fetometry and placentometry, which are performed in the dynamics, allow us to determine pathological changes and their progression. Dynamic fetometry is performed at intervals of several weeks, which evaluates not only the growth of the fetus but also its individual parameters. During the placental examination, placentometry is carried out and defines its localization, structure, degree of maturity. In addition, a prognostic unfavorable sign is a decrease in the amount of amniotic fluid. A better understanding of the early concomitant ultrasound parameters will allow for the timely detection or prevention of fetal IUGR.

The aim of the research was to conduct an ultrasound antenatal examination of women with intrauterine growth retardation.

Materials and methods

In accordance with the objectives, an ultrasound antenatal examination of women in the main group with intrauterine growth retardation (n=41) and women in the control group with the physiological course of pregnancy (n=12), who had undergone fetometry and placentometry was performed.

The main criteria for inclusion in the study were women with spontaneous, singleton pregnancies, previously diagnosed with fetal IUGR prior to ultrasound examination. The exclusion criterion was severe somatic pathology of the pregnant woman.

Ultrasound examination of pregnant women was performed on an ultrasound device RADMIR ULTIMA PA EXPERT with convex sensors with a frequency of 3 to 5 MHz. All formulas for calculating the fetometric dimensions are programmed in the ultrasound machine. Ultrasound in which fetal IUGR was detected was marked as initial, and ultrasound monitoring of the fetus was marked as repeated.

Statistical analysis of digital survey results was calculated using the program "MedStat" methods of descriptive statistics, calculating the average sample values (M) and the error of the mean value (m), qualitative indicators are given as frequencies and their percentages. Student's t-test or Mann-Whitney U-test was used to assess intergroup differences. Differences for analysis were considered statistically significant at $p < 0.05$.

Results and discussion

At ultrasonic research when the diagnosis of fetal IUGR was made, it was established at what terms of pregnancy this pathology occurs. In women of the main group, fetal IUGR was initially detected at 24-38 weeks

of pregnancy (32.8 ± 0.6 weeks on average), and in women of the control group at 30-35 weeks of pregnancy (32.4 ± 0.4 weeks on average; $p = 0.74$). Subsequently, women underwent ultrasound control in the dynamics to confirm the diagnosis and monitor the growth and condition of the fetus. Repeated ultrasound examination was performed earlier in women of the main group at 30-41 weeks of pregnancy (36.7 ± 0.4 weeks on average) than in women of the control group - at 38-41 weeks of pregnancy (39.4 ± 0.2 weeks on average; $p = 0.002$).

In analyzing the growth of the fetometric parameters of the fetus were measured to determine the percentile ratio to gestational age. The scope of fetometry included measurements of biparietal diameter (BPD) and head circumference (HC), mean abdominal circumference (AC), and femoral shaft length (FL).

Examining the size of the head, we compared the initial and repeated measurements of BPD and HC. At the initial examination, the BPD of the fetal head in mothers of the main group was 77.4 ± 1.6 mm, and the indicators of HC - 263.4 ± 9.8 mm, in the mothers of the control group - BPD 83.3 ± 1.1 mm, HC 303.0 ± 3.6 mm ($p = 0.064$, $p = 0.03$). These indicators at re-examination were probably lower in the main group - BPD 82.9 ± 1.3 mm, HC 277.7 ± 10.3 mm than in the control group - BPD 91.6 ± 0.6 mm and HC $323, 2 \pm 2.6$ mm ($p = 0.0006$, $p = 0.02$). A probable increase in BPD of fetal head and HC in the dynamics during pregnancy in both groups: in the main ($p = 0.00004$, $p = 0.03$) and in the control group ($p = 0.0001$, $p = 0.002$) was established.

The circumference of the abdomen in fetuses with fetal IUGR begins to decrease before all other indicators. Measuring indicators of the abdominal circumference at the initial examination was probably lower in the main group - 264.9 ± 6.1 mm than in the control group - 289.2 ± 4.6 mm ($p = 0.04$). In the repeated ultrasound examination, the indicators remained probably lower in the main group - 284.5 ± 4.8 mm than in the control group - 318.4 ± 3.7 mm ($p = 0.0005$). There was also a probable increase in the dynamics during pregnancy of indicators of AC in both groups: in the main ($p = 0.0004$) and the control group ($p = 0.0006$).

Studies of the indicators of FL at the initial examination in the main group were 61.72 ± 1.3 mm, and in the control group - 63.7 ± 1.04 mm, no significant difference between the groups was found ($p = 0.42$). These indicators at re-examination were probably lower in the main group - 65.7 ± 1.0 mm than in the control group - 76.8 ± 2.0 mm ($p = 0.000005$). A probable increase in FL during pregnancy was found in both groups: in the main group ($p = 0.00003$) and the comparison group ($p = 0.00002$).

Besides, the analyzed data of the fetometric parameters taking into account the percentiles revealed at the initial ultrasound examination probably led to a higher frequency of detection of BPD and AC in fetuses below the 10th percentile within the main group than in the control group (table 1). However, at repeated ultrasound examination the frequency of detection of indicators of BPD, HC, AC, FL increases 1.5 times below 10 percentile among the main group, these changes are probably different from the indicators of the control group.

Table 1.

Analysis of fetometry indicators according to the distribution by percentiles in the main group and the comparison group

Parameters	Main group n=41, n /%			Control group n=12, n /%			p
	< 10th percentile	< 50th percentile	<90 th percentile	< 10th percentile	< 50th percentile	<90th percentile	
Biparietal diameter							
Initial	22 / 53.66	19 / 46.34	0 / 0	0 / 0	9 / 75	3 / 25	0.001
Repeated	32 / 78.05	9 / 21.95	0 / 0	2 / 16.67	10 / 83.33	0 / 0	0.0002
Head circumference							
Initial	14 / 34.15	23 / 56.1	4 / 9.76	1 / 8.33	9 / 75	2 / 16.67	0.08
Repeated	21 / 51.22	20 / 48.78	0 / 0	2 / 16.67	10 / 83.33	0	0.04
Abdominal circumference							
Initial	18 / 43.9	22 / 53.66	1 / 2.44	0 / 0	9 / 75	3 / 25	0.007
Repeated	28 / 68.3	13 / 31.7	0 / 0	4 / 33.33	8 / 66.67	0 / 0	0.03
Femoral shaft length							
Initial	9 / 21.9	17 / 41.5	15 / 36.6	1 / 8.33	7 / 58.34	4 / 33.33	0.26
Repeated	22 / 53.7	16 / 39	3 / 7.3	0 / 0	8 / 66.67	4 / 33.33	0.001

Note: p - when comparing indicators <10th percentiles in the main group and the control group

Thus, the analysis of ultrasonic fetometric data shows that the group with fetal IUGR at initial examination revealed only probably lower values of fetal HC and AC. However, with increasing gestational age, such changes with a lag apply to all studied indicators of fetal size in comparison to women who had a physiological course of pregnancy. These changes indicate the development of a symmetrical form of fetal IUGR at a later date [7].

The data of the biophysical profile of the fetus (BPP) allow non-invasive assessment of the fetal condition and predict its antenatal distress. BPP - monitors the fetoplacental system by summarizing the results of CTG and ultrasound. Ultrasound examination determines, in points, several types of motor activity (generalized body movement, respiratory movements, muscle tone) of the fetus, as well as the volume of amniotic fluid [8].

Thus, according to the indicators of BPP (respectively on a scale of 6-7 points) the condition of the fetus, which can be assessed as doubtful due to chronic hypoxia, was determined in 63.4% of women in the main group, while the condition of 6 points is probably more common in this

group of pregnant women. However, on the contrary, according to the indicators of BPP (8 points and above) the condition of the fetus can be assessed as satisfactory in probably fewer women in the main group - 34.1% than in women in the control group - 91.7% [9].

Assessing the volume of amniotic fluid according to Moore's amniotic fluid index (AFI), it was found that at the initial ultrasound in the main group the figures were probably lower 165.5 ± 5.0 ml than in the control group - 198.2 ± 94 ml (0.003). Similarly, re-examination revealed significantly lower AFI values in the main group of 145.3 ± 6.8 ml than in the comparison group - 177.3 ± 7.9 ml ($p = 0.02$). Detailed analysis of AFI using percentiles according to gestational age is demonstrated in Fig. 1. In the main group for weight less than the 5th percentile, AFI at the initial examination was determined in 1 person (2.44%), and repeated - in 3 persons (7.3%), less than the 50th percentile was initially detected in 9 persons (21.9%), and repeated - in 16 persons (39.0%), less than the 95th percentile was initially detected in 31 persons (75, 6%), again - 22 people (53.6%).

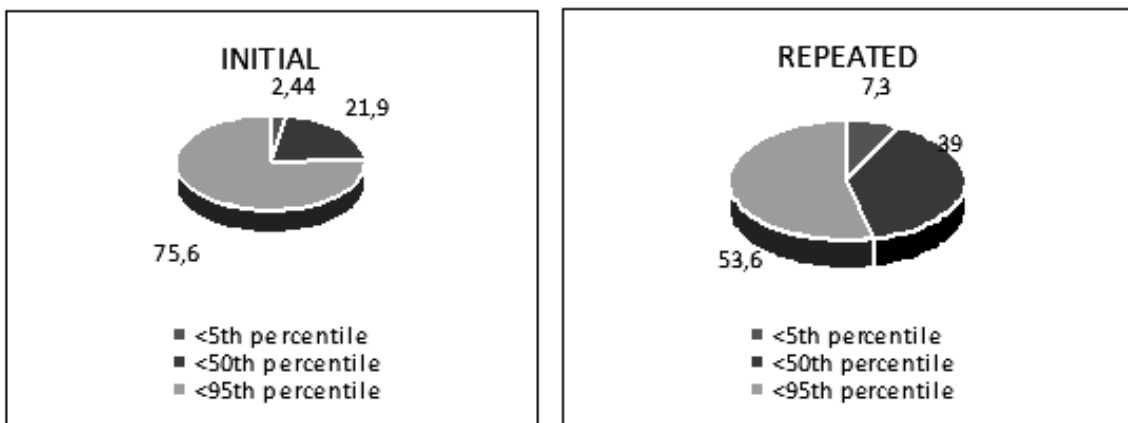


Fig. 1. Indicators of the amniotic fluid index (percentiles) at the initial and repeated examination of a group of women with fetal IUGR

Thus, in the main group, the frequency of detection of dehydration by AFI below the 5th percentile according to this gestational age in women at the initial examination is 2.4%, and at re-examination - 7.3% [10].

Assessing the condition of the fetoplacental complex according to placentometry in the 3rd trimester, I determined that the indicators of placental thickness in the main group were 41.5 ± 0.5 mm, and in the comparison group - 36.0 ± 0.9 mm. Therefore, the thickness of the pla-

centa was significantly greater in the main group than in the control group ($p = 0.0001$). Ultrasound examination revealed only 4 people from the main group (9.8%) with placental hypoplasia and 24 people (58.5%) had structural changes in the form of petrifications [11].

Ultrasound to determine the degree of maturity of placental tissue can indirectly assess the duration of pregnancy. Therefore, an increasing degree of maturity of the placenta indicates its premature aging. Placental maturity was determined in the main group mainly in the second degree in 13 people (31.7%) and the third degree - in 28 people (68.3%), while in the comparison group the first degree was established - in 1 person (8.3%), II degree in 9 people (75.0%) and the third degree in 2 people (16.7%). In the main group, people with the second degree of placental maturity were probably found less often, but on the contrary more often - with the third degree of placental maturity than in the comparison group ($p = 0.02$; $p = 0.002$, respectively).

A detailed analysis of placental maturity according to gestational age was conducted. Among women of the main group with premature aging of the placenta, as evidenced by the presence of the third degree of maturity at 32 weeks of pregnancy in 1 person (2.4%), at 34 weeks - in 1 person (2.4%), at 35 weeks - in 3 people (7.3%) and 36 weeks - in 4 people (9.8%).

Thus, in the main group structural changes in the placenta were revealed, namely in 58.5% of people - the presence of petrification, in 21.4% of people - premature maturation before gestation, as well as probably higher placental thickness due to accelerated premature aging of the placenta [12].

The obtained ultrasound results of placental dysfunction explain the high risk of perinatal complications in pregnant women with fetal IUGR. In this pathology, early reduction of BPD of the head, AC, and the presence of dehydration are often detected. Reduction of BPP to 6-7 points accompany 63.4% of pregnancies with fetal IUGR. Placental ultrasound marker of premature maturation to gestation in 21.4%, the presence of petrifications in 58.5% [13], [14].

Conclusions

Ultrasound examination of women whose pregnancies are complicated by fetal growth restriction allows prevention of the development of obstetric and perinatal complications. Timely detection of fetometric and placentometric changes provides an opportunity from the standpoint of modern obstetrics to begin etiopathogenetic therapy and prevention of this complication of pregnancy.

Prospects for further research this research creates the preconditions for further search for an earlier prognostic marker of fetal IUGR.

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