

Importance of Ultrasound Scan for Detection of Prenatal Hydrocephalus Syndrome, Fetal Hydrocephaly and Placentitis in Cytomegalovirus Pregnancy

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Abstract: Study Objective is to detect early sonographic signs of prenatal hydrocephalus syndrome, fetal hydrocephaly and placenta pathologies in the pregnant women infected with cytomegalovirus. The research was performed in the Sh.M. Aleskerova's Maternity Clinic No. 5 and the Maternity Welfare Centers No. 1 and No. 5 of Baku, the Azerbaijan Republic. The explorers observed and studied the features of gestation course and pregnancy termination for 155 women, while 115 of them were infected with cytomegalovirus (the 1st group-basic) and 40 were healthy (the 2nd group-control). The obtained findings allowed to determine the ultrasound symptoms typical for cytomegalovirus infection, in particular, fetoplacental insufficiency, placental hydrops, placentitis, changes in the cerebral formation that give evidences on the fetal involvement posing risk to immediate and remote effect concerning both mother and her baby.

Key words: Ultrasound • Cytomegalovirus • Hydrocephaly • Hydrocephalus syndrome • Placentitis

INTRODUCTION

Cytomegalovirus belongs to the most widespread fetal infections in gestation course. This is one of the most important issues of the modern medicine [1].

At this time, the fetal cytomegalovirus infection in the pregnant women is proven to be one of the main causes for congenital deformities, immature births and handicapped newborns [2-4].

This infection is the most often cause for congenital and perinatal complications resulted in the central nervous system and placenta infecting [5].

The possibility of ultrasonic diagnostics of fetal infecting with cytomegalovirus has still been the matter of argument up to these days, because there is no precise technique of both application and accuracy checking for the prenatal diagnostics. Nevertheless, some scholars are sure that the ultrasonic investigation allows to determine the etiological agent of the prenatal infection [6-9].

MATERIALS AND METHODS

The present research has surveyed 155 pregnant women. Their gestation course and pregnancy termination

were observed and studied. 115 women suffered from the cytomegalovirus infection (the 1st group-basic) and 40 were healthy (the 2nd group-control).

During the first trimester of pregnancy 50 patients (43.5 per cent) of the basic group and 12 (30.0 per cent) of the control one were examined. In the midpregnancy 41 women (35.7 per cent) from the basic group and 15 (37.5 per cent) from the control group were surveyed and finally, in the last trimester it was 24 patients (20.9 per cent) and 13 ones (32.5 per cent) respectively.

The pregnant women in the 1st group demonstrated the aggravated anamnesis. As concerning the anamnesis of the patients infected with cytomegalovirus (1st group), the spontaneous abortions were reported for 41 women (35.7±4.5 per cent), therapeutic abortions-for 44 cases (38.3±4.5 per cent) and genital infection-for 58 ones (50.4±4.7 per cent). As for the women from this group, they more often came across threatening miscarriage (46.1±4.6 per cent) and premature birth (28.7±4.2 per cent). The control group reported 2.5±2.5 per cent ($p<0.001$) and 7.5±4.2 per cent ($p<0.05$).

Aiming to fulfill the tasks of the research, the following specific analyses were applied alongside to common diagnostic techniques: blood enzyme

immunoassay, body secretion (i.e., urine, saliva, vaginal discharge) cytologic analysis and placenta morphological study. All surveyed pregnant women were investigated by means of dynamic ultrasound scan, also Doppler echocardiography and cardiotocography for specific indications.

The IgG antibodies were detected in all of 115 pregnant women in the quantity 3-10 times exceeding the normal value, while IgM antibodies were reported in 51 surveyed ones (44.3 ± 4.6 per cent). All IgM-positive patients participated in liquids (urine, saliva, vaginal discharge) cytologic examination.

The blood enzyme immunoassay appeared to be the most often used serum immunological technique for specific antibodies detection. This method's delicacy is 99 per cent and specificity is 95 per cent. The IgG and IgM antibodies specific to the cytomegalovirus infection were detected with the usage of Abbott Test System, USA. The cytomegalovirus diagnosis was proved by means of the DNA polymerase chain reaction (PCR) allowing to detect the virus's sequences in biological materials, such as, peripheral blood, saliva and urine.

In order to monitor the fetal development, all pregnant women were examined by the dynamic fetoplacental ultrasonic scan using Aloka 1700, 1400, 500 apparatuses, Japan, with 35 MHz and 5 MHz transducers and 6.5 MHz transvaginal sensor. The first ultrasonic scan was performed at the fifth week of pregnancy for greater certainty of intra-uterine pregnancy. In case of threatened miscarriage, the following ultrasonic scanning was performed only after doctor's approval. If the gestation course was normal, the ultrasonic scans were made once per each trimester. For high-risk pregnancy and also for women with aggravated obstetric and gynecological anamnesis, the dynamical ultrasonic scan was made. All women surveyed participated in common fetometry and sonographic examination of placenta. The standard set of evaluations involved: placenta localization, thickness detection, structure study and checking for pathologies. The placenta thickness was measured at the funicle confluence spot and then compared to standard value [10].

The Doppler echocardiography was performed with the use of Aloka 1700 machine. This technique is applied for blood circulation evaluation in various vessels. Both uterine arteries, umbilical artery and fetal's mesencephalic artery were examined. This diagnostics was fulfilled starting from 20 weeks of pregnancy for specific indications. The blood diastolic velocity was researched, in other words systolic-diastolic ratio.

Following this, the pulsation index was calculated, it means, the ratio of difference between maximal systolic and final diastolic velocities to the average blood velocity. Furthermore, the resistance index was also valued-as the ratio of difference between maximal systolic and final diastolic velocities to the maximal systolic blood velocity.

The cardiotocographic investigation was performed by TEAM-8000 cardiac monitor produced by the Oxford firm, Great Britain.

60 women, including 31 with aggravated obstetric and gynecological anamnesis (51.7 ± 6.5 per cent), were cardiotocographically examined at the 32nd week of pregnancy.

The obtained findings give evidences that both deceleration length (twice higher for infected pregnant women ($p < 0.001$)) and deceleration range (1.6 times higher than standard values ($p < 0.001$)) are the main characteristics changed in the conditions of cytomegalovirus infection. Moreover, the acceleration decrease-1.3 times lower for the infected women-was also reported. However, the most significant changes were fixed in course of oscillation range measurement. This very indicator was 2.1 times lower for the cytomegalovirus infected pregnancy than for the control group ($p < 0.001$).

The obtained numerical data were processed statistically applying medical record techniques, in respect to up-to-date requirements.

The static series difference was preliminary evaluated by means of the Student's test and segment difference estimation. The obtained results were further checked and adjusted applying non-parametric test: the Wilcoxon's rank sum test (Mann-Whitney U test), while the frequency response analysis was performed using the Pearson goodness-of-fit test ²[11].

RESULTS AND DISCUSSION

The performed prenatal screening allowed to detect the congenital deformities of the central nervous system in the midpregnancy both as the prenatal hydrocephalus syndrome in 32 (27.8 ± 4.2 per cent) women and fetal hydrocephaly in (19.1 ± 3.7 per cent) of 115 cytomegalovirus infected pregnant ones.

The undertaken study spelled out the incipient characters of the cerebral ventricles enlargement in 1.7 ± 1.2 per cent of cases appeared in bodies' depth enlargement of the lateral ventricles up to 8 mm, also occipital horns' enlargement of the lateral ventricles, though without enlargement of the 3rd and 4th ventricles. The moderate and

Table 1: Ultrasound Criteria of the Fetal Cerebral Ventricular System in the Prenatal Cytomegalovirus Infection

	Cytomegalovirus infected pregnancy (n=115)	
	Absolute	%
Bodies' depth enlargement of the lateral ventricles up to 8mm	2	1.7 ± 1.2
Bodies' depth enlargement of the lateral ventricles up to 9mm	4	3.5 ± 1.7
Bodies' depth enlargement of the lateral ventricles for more than 9mm	15	13.0 ± 3.1
Occipital horns' enlargement of the lateral ventricles for more than 13mm	10	8.7 ± 2.6
Frontal horns' enlargement of the lateral ventricles for more than 12mm	9	7.8 ± 2.5
3 rd ventricle's enlargement for more than 5mm	3	2.6 ± 1.5
4 th ventricle's enlargement for more than 5mm	3	2.6 ± 1.5

Table 2: Ultrasound Cephalometry in the Cytomegalovirus Pregnancy

Control Group (n=10)	Cytomegalovirus Infected Pregnancy (n=32)	p	
Lateral ventricle trigone's width, cm	0.5 (0.3-0.8)	1.0 (0.5-1.5)	<0.001
Frontal horn's width, cm	1.1 (0.6-1.3)	1.6 (1.4-1.9)	<0.001
Occipital horn's width, cm	1.0 (0.7-1.3)	1.4 (1.3-1.7)	<0.001
3 rd and 4 th ventricles' width, cm	0.5 (0.3-0.6)	1.7 (1.4-1.9)	<0.001
Cerebral (Sylvius) aqueduct's width, cm	0.3 (0.2-0.4)	0.6 (0.3-0.8)	<0.001

pronounced ventriculomegaly appeared in bodies' depth enlargement of the lateral ventricles up to 9mm and more was reported in 3.5±1.7 per cent of cases. The pronounced ventriculomegaly was also accompanied with the 3rd and 4th ventricles' enlargement in 2.6±1.5 per cent of cases. Finally, the occipital horns' enlargement of the lateral ventricles was stated in 8.7±2.6 per cent, while the frontal horns' enlargement of the lateral ventricles-in 7.8±2.5 per cent. All above mentioned changes were fixed both separately and combined.

The prenatal hydrocephalus syndrome manifested in course of the ultrasound diagnostics through the occipital horns' enlargement of the lateral ventricles up to 13mm in 5 women (4.3±1.9 per cent), frontal horns' enlargement of the lateral ventricles up to 14mm in 4 cases (3.5±1.7 per cent). The simultaneous enlargement of two or more cerebral structures: in particular, frontal horns' enlargement up to 13mm and right lateral ventricle's enlargement up to 9mm were reported in 7 pregnant women (6.1±2.2 per cent), while left lateral ventricle's enlargement up to 8mm and the 3rd ventricle's enlargement up to 7mm were detected in 5 patients (4.3±1.9 per cent). The ultrasound scan detected the multiple incurable indicators of cerebral structures' enlargement exceeding the standard values by 3-4mm that were assessed as hydrocephaly. The dynamic ultrasound diagnostics reported their slow enlargement. 3 women (2.6±1.5 per cent) gave up on the induced termination of pregnancy.

The symptoms typical for the placentitis were fixed in all above mentioned cases. The examination was performed within 21-31 weeks of the gestational age.

The cytomegalovirus infection has contributed to the fetal cerebral ventricles' enlargement reported by the ultrasound scanning. That, in its turn, made a negative impact on the gestation course within the 2nd trimester.

The fetal cerebral examination in the midpregnancy fixed in 22 patients the fetal hydrocephaly manifested through the free liquid's enlargement in several cerebral ventricles, causing the cerebral structures' malformation. Moderate and acute cerebral liquor accumulation was reported.

The placental hydrops was the most often visualized symptom in 93.0±2.4 per cent patients. It is the result from the placenta infecting stated in the various gestational age: 48 (41.7±4.6 per cent) women in the 1st trimester, 41 (35.7±4.5 per cent) patients in the midpregnancy and 18 (15.7±3.4 per cent) surveyed ones-in the 3rd trimester. Alongside with hydrops, some other symptoms of the placentitis, such as hyper echogenicity, rugged topography, hyper- and hypoechoic inclusions were reported.

Towards obtaining more detailed information concerning the status of the fetal-placental system, some surveyed pregnant women were examined by the Doppler echocardiography and cardiotocography on medical evidences, such as placentitis and fetal brain malformation.

The performed explorations surveyed 41 patients and reported uterus arteries' misperfusion with prominent features of diastolic component decrease and vascular resistance indices' increase in 32 (78.0±6.5 per cent) women. The diastolic notch was stated for 48.8±7.8 per cent, what gives evidences on more profound disorders of uteri-placental circulation. 68.3±7.3 per cent of women had only one uterus artery's malformation.

60 pregnant women were cardiotocographically examined at the 32nd week of the gestational age, while 31 (51.7±6.5 per cent) of them had aggravated obstetric and gynecological anamnesis.

The assessment of the obtained data allowed to determine the ultrasound symptoms typical for the cytomegalovirus infection: fetoplacental insufficiency, placental hydrops-placentitis, cerebral structures' malformation.

Thus, the ultrasonic diagnostics has detected the pathological characteristics of both the placenta and fetal giving evidences on intra-uterine disease. The congenital infection was proven by means of the overall laboratory tests: the virus extraction from saliva, urine or vaginal discharge, also by IgG and IgM antibodies specific to cytomegalovirus in peripheral blood. The performed ultrasonic examination of the pregnant women infected with cytomegalovirus has detected the signs of placenta's changes and fetal pathologies that give evidences on the fetal involvement posing risk to immediate and remote effect concerning both mother and her baby.

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