

Department of Gynaecological Surgery, 1st Chair of Obstetrics and Gynaecology,
University School of Medicine, Lublin
Klinika Ginekologii Operacyjnej I Katedry Położnictwa i Chorób Kobiących
Akademii Medycznej w Lublinie

WIESŁAWA BEDNAREK, ARTUR CZEKIERDOWSKI,
NORBERT STACHOWICZ, JAN KOTARSKI

*An attempt of evaluation of the use of triple test
and Doppler examination during the second trimester
in neonatal birth weight prognosis*

Próba oceny przydatności testu potrójnego badania dopplerowskiego w II trymestrze
ciąży w prognozowaniu masy urodzeniowej noworodków

The determination of concentration of selected proteins produced by the fetus and placenta was introduced into the screening examination of Down syndrome in 1989 [15]. It turned out in the following years, that with no defects in fetus nervous system, high concentrations of free beta hCG, alphafetoproteins (AFP) and low estriol concentrations (triple test) can also be connected with higher risk of intrauterine growth disturbances and low neonatal birthweight [3, 8, 9, 11]. The research performed by Davenport and associates [6] revealed, that very low AFP concentrations in the second trimester can also suggest the possibility of pregnancy complications.

Doppler ultrasonography is a non-invasive and commonly used method of evaluation of uteroplacental and fetal blood flow. In a number of papers, including the ones from our center, it was shown that the disturbances of blood flow revealed through this method can be accompanied by abnormal concentrations of the placental proteins which indirectly indicates the malfunction of this organ [2, 4, 5]. On the other hand, the disturbances of the blood flow and materno-fetal exchange in the placenta can be revealed by the inhibition of intrauterine fetal growth later in pregnancy [10, 11]. The aim of the paper was the investigation stating whether the triple test and Doppler examination performed between the 18th and the 24th week of gestation can be useful in neonatal birth weight prognosis.

MATERIALS AND METHODS

The investigated group included 122 women who turned up for the routine ultrasonographic examination between the 18th and 24th week of unifetal pregnancy. After the elimination of patients with incomplete clinical data for the analysis, 69 pregnant women were qualified. The same day, apart from ultrasonographic examination of the blood flow in utero-placental circulation, they were taken venous blood samples in order to make the triple test. The gestational age was calculated on the basis of the last menstrual period and verified with the use of ultrasonographic measurements of biparietal diameter (BPD), abdomen circumference (AC) and femoral bone length (FL). In case of difference of both evaluations higher than 11 days, the gestational age determined in the USG examination was qualified for the analysis. Each newborn birth weight and possible occurrence of malformations were noted.

The concentrations of AFP, estriol and beta hCG were measured with the commercially available RIA kits purchased from POLATOM (Świerk, Poland). The method of regression analysis was used for the search of possible dependence between the gestational age and the investigated hormone concentrations. The level of statistic importance was evaluated with the use of single variation analysis (ANOVA). Statistically accepted crucial value was $p < 0.05$.

RESULTS

The average pulsation index value PI in the umbilical artery and resistance index RI in the uterine artery as well as medians of the concentrations of biochemical markers stating the range between the upper and lower quartile (oblique distribution of the examined variables) is shown in Table 1. The dependence of beta hCG, AFP, E3 concentrations in the serum of the examined pregnant women in reference to the fetal bodyweight and the gestation week is graphically shown in Figure 1 (A, B, C). The use of multiple regression analysis revealed that the best-fit prognostic model

Table 1. The results of Doppler and biochemical tests in the investigated group

Average rates PI in the umbilical artery	1.16 ± 0.25
Average rates RI in the uterine artery	0.53 ± 0.1
AFP concentration*	46 IU/ml (31–62)
Beta hCG concentration*	11.7 ng/ml (6.1–18.0)
Estriol concentration*	6.1 ng/ml (4.7–7.9)

* Concentration rates were given as median considering the range between upper and lower quartile.

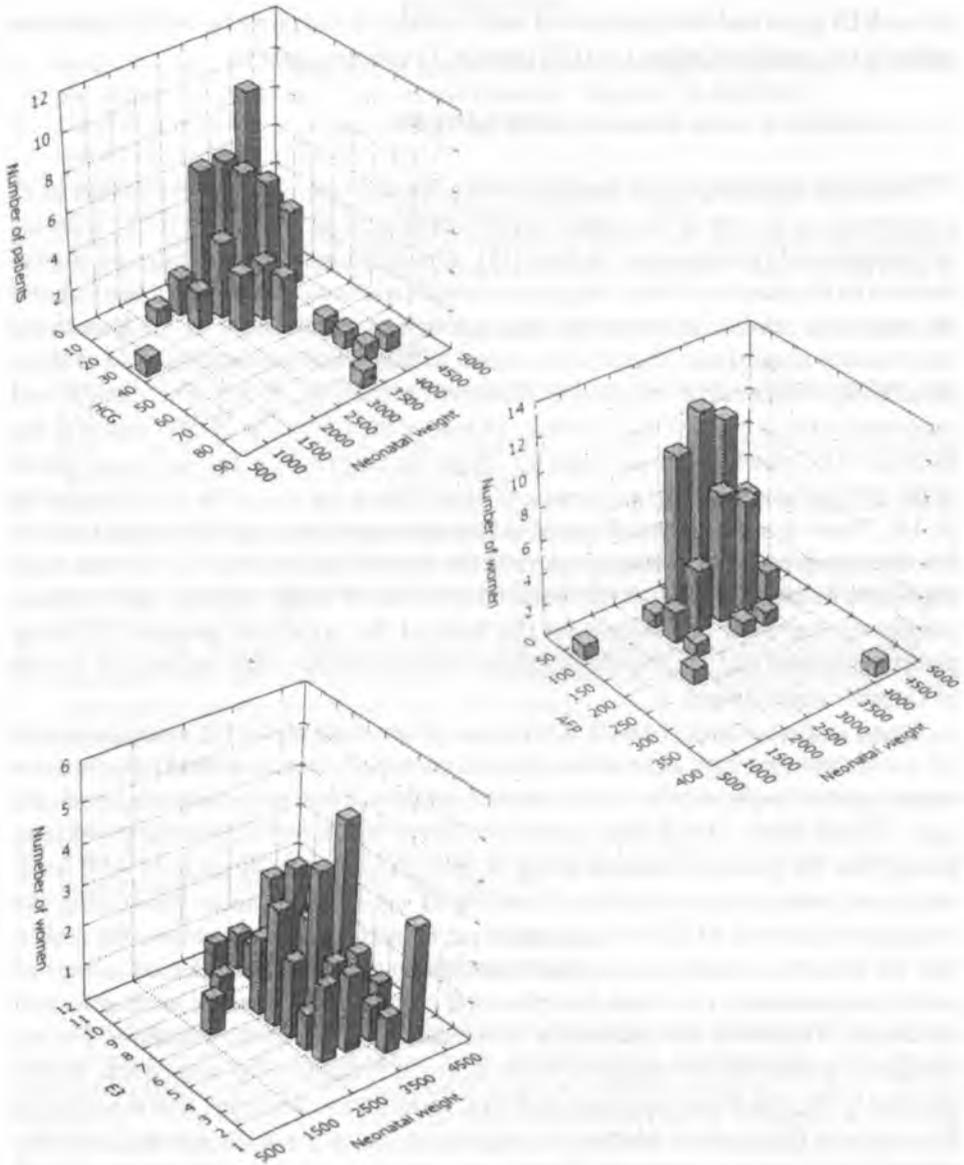


Figure 1. hCG (ng/ml), AFP (ng/ml), E3 (ng/ml) concentrations in the serum of pregnant women in the 2nd trimester in relation to the neonatal birth weight (G).

explained only 13% of the fetal body weight variation in the evaluated group of pregnant women. None of the examined independent variables reached the level of statistic importance allowing their use in the prediction of birth weight, treated in this analysis as dependent variable. The p values calculated with the use of variation analysis

for each Doppler and biochemical test were included in the range from 0.38 (pulsation index in the umbilical artery) to 0.79 (beta hCG concentration).

DISCUSSION

From the beginning of the nineties it is known, that increased AFP and beta hCG concentrations as well as decreased estriol concentrations are related to the increase of frequency of chromosomal defects [15]. Abnormal secretion of these substances can also be the marker of other pregnancy complications such as hypertension induced by pregnancy and/or intrauterine fetal growth retardation [4, 6, 7]. Numerous observations suggest that there exists mutual pathophysiological mechanism of these disturbances dependent on normal placenta function [8, 9, 12]. The clinical and experimental data suggest that hypoxia can induce the formation of new vessels in the placenta. The growing fetus demand for oxygen and nutrients in the successive weeks of the 2nd trimester requires the increase of blood flow in the utero-placental circulation [4, 14]. These changes can be observed in Doppler examination and indirectly through the measurement of the concentration of the biochemical markers [2, 5]. The most important finding in our research is the observation we made that one can't credibly predict the neonatal birthweight on the basis of the regression analysis regarding placenta proteins and estriol concentrations evaluated in the triple test and the results of Doppler examination.

Spong and associates stated that pregnant women with high AFP concentration in the serum had also high angiogenin concentration in the amniotic fluid [13]. In these women, more frequently than in the control group occurred pregnancy complications such as fetal death, IUGR and preterm delivery. The authors drew the conclusion stating that the placental ischaemia can be the reason for the increase of AFP level, which may induce the formation of new blood vessels. Substances stimulating the angiogenesis such as VEGF or angiogenin can be markers of this process. We realize that the presented results are only introductory evaluation of the selected aspects of possible dependences of various fetoplacental proteins present in the utero-placental circulation. Therefore, the research is continued in the prospective manner. Frozen samples of serum will be employed in the future to evaluate other angiogenic factors released by the placenta, deciduous and fetal membranes. We think, that it will bring the answer to the question whether the decrease of secretion of the selected markers, especially indicating angiogenesis disturbances, can be correlated with abnormal blood flow indirectly evaluated in Doppler ultrasonography in the 2nd trimester. It may also answer the question whether this observation can be helpful in the prediction of low neonatal birthweight.

CONCLUSIONS

The results of the triple test and Doppler examination in the selected vessels of the utero-placental circulation in the 2nd trimester are not useful in the prognosis of neonatal birth weight.

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STRESZCZENIE

Celem pracy była próba oceny przydatności testu potrójnego i ultrasonograficznego badania dopplerowskiego w prognozowaniu masy urodzeniowej noworodków. Do analizy zakwalifikowano 69 pacjentek z pojedynczą ciążą prawidłową pomiędzy 18-tym a 24-tym tygodniem. U wszystkich ciężarnych wykonano dopplerowską ocenę przepływu w tętnicach pępowinowych i macicznych oraz oznaczono stężenia AFP, estriolu i podjednostki beta hCG w surowicy krwi. Zastosowanie analizy regresji wielokrotnej jako metody modelowania statystycznego wykazało brak istotnych zależności pomiędzy ocenianymi parametrami biochemicznego i biofizycznymi (zmienne niezależne) a masą noworodka (zmienna zależna).

