UTILITY-GRADE OF PHYSICIST PARAMETERS AT 36—42 WEEKS' MATURATION IN THE PROGNOSTICATION OF ANTAGONISTIC PERINATAL AFTER-EFFECTS IN APPROPRIATE-FOR-GESTATIONAL-AGE FOETUSES

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Article history:		Abstract:
Received:	October 4th 2023	**Abstract** to enquire the potentiality expenditure of physicist ultrasound and to determine cerebroplacental correspondence (CPR) in the prognostication of antagonistic perinatal after-effect characterized as Apgar reckoning < 7 at 1 minute. **Material and methods** This was a retroactive cross-sectional contemplate in chosen heavy with child women undergoing an ultrasound interrogation between 36 and 42 weeks of gestation. We mensurable estimated vertebrate dialect heft (EFW), penny-pinching umbilical arter pulsatility table of contents (UA PI), penny-pinching intermediate intellectual arter pulsatility table of contents (MCA PI), CPR, and Apgar reckoning in 1 minute. Multiples of medians (MoM) were calculable for MCA PI and UA PI. **Results** The study group consisted of 446 women, 236 were primipara and 210 were multipara. The average age was 29.6 years (range 16–46 years). The average week of delivery is 39.5 weeks of gestation (range 36–42). Mean MCA PI and UA PI were 1.3 (0.1–2.45) and 0.8 (0.39–1.66), respectively. The mean values were 1.03 (0.1–1.9) for MCA PI MoM and 1.04 (0.5–2.1) for UA PI MoM. Primiparas had lower values of MCA PI (1.27 vs. 1.34), MCA PI MoM (1.00 vs. 1.05), CPR (1.62 vs. 1.73), EFW (3479.53 g vs. 3579.25 g) and birth weight (3513.50 g vs. 3617.79 g). For CPR cut-off point of 1.08: sensitivity was (0.945), specificity 0.1, positive predictive values 0.979, negative predictive values 0.04 and accuracy 0.926. The ROC curves for CPR were: area under the curve was 0.52 at CI 95% (0.342–0.698), p = 0.8271. **Conclusion** showing in pregnancies with appropriate-for-gestational-age foetuses at 36–42 weeks of maturation victimisationing physicist parameters is not utilitarian in the prognostication of antagonistic perinatal after-effects according to an Apgar reckoning < 7 at 1 minute.
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INTRODUCTION

physicist ultrasound is euphemistic pre-owned to evaluate the menstruation in umbilical arter (UA) and vertebrate intermediate intellectual arter (MCA). The pulsatility table of contents (PI) is euphemistic pre-owned to estimate the cerebroplacental correspondence (CPR), which is euphemistic pre-owned for the classification of vertebrate oxygenation. unconventional physicist discoveries in the thirdly trimester are typically related with antagonistic perinatal outcome. virtually studies on the clinical application of physicist and CPR chalk up been focused on the classification of small-for-gestational-agefetuses, who are at accrued jeopardy for antagonistic perinatal after-effects and semipermanent neurodevelopmental impairment. on the other hand a comprehensive contemplate of Bakalis et al. with reference to singleton pregnancies at 30–34 weeks of maturation descriptions that the the greater part of containers for each classification of antagonistic perinatal after-effects

responsible foetuses that were appropriate-for-gestational-age (AGA). e.g., 70% of stillbirths and 80% of caesarean departments for vertebrate suffer eventualize in AGA group. as a result antenatal consternation should distinguish hypoxemic to a certain extent than inconsequential fetuses, and screenland for little CPR regardless of despite of the vertebrate size. It was furthermore according that the prognostication of an antagonistic perinatal after-effect by little CPR was more appropriate if the continuance separation between classification and transportation was ≤ 2 weeks and that the showing by CPR at 36 weeks hawthorn be bounteous influential than at 32 weeks.

The clinical of this contemplate has been to inquire into the purposefulness of physicist parameters obtained in third-trimester AGA foetuses for the prognostication of antagonistic perinatal outcomes.

MATERIAL AND METHODS

We performed a retroactive cross-sectional contemplate between jan 2023 and December 2023 in a accumulation of heavy with child women with appropriate-for-gestational-age fetuses, undergoing a subprogram third-trimester ultrasound interrogation between 36 and 42 weeks of gestation. The contemplate was sanctioned with an institutional another look gameboard acquiesce of the Obstetrics, Women's affliction and gynaecological Oncology commandment Department, Voivodeship infirmary cop

out Collegium Medicum of the Nicolaus astronomer lincoln in Toruń, Poland. each the exams were performed at our division by commissioned examiners victimisationing Voluson GE E 6 (General Electric, Zipf, Austria). The classification criteria for this contemplate were as come after singleton pregnancy, gestational generation mean business by antepenultimate catamenial amplitude (LMP) and habitual with crown-rump magnitude determination at 11–13 weeks, non-appearance of vertebrate morphologic misshapenness or a transmissible consideration habitual either pre- or post-natally, ultrasound interrogation performed no extremely than 2 weeks previously delivery. each heavy with child women included in the contemplate were Caucasian, excogitation was spontaneous, were non-smokers and had no examination narration of long-standing hypertension, dm, systemic tuberculosis erythematosus (SLE) or antiphospholipid syndrome (APS). The undermentioned ultrasound parameters were assessed: estimated vertebrate dialect heft (EFW) calculable mechanically victimisationing Hadlock's formula, penny-pinching UA PI, penny-pinching MCA PI, CPR was calculable disjunctive MCA PI by UA PI. physicist determination of UA and MCA was performed on the authority of ISUOG (International sovereign state of Ultrasound in midwiferies and Gynecology) guidelines. For UA Doppler, a complimentary loop-the-loop determination was performed, with an insonation intersection of <200 (Fig.

Fig. 1
Doppler assessment of pulsatility index (PI) in umbilical artery (UA)
The proper technique of MCA Doppler measurement was as follows(15):
1. Axial section of the brain (including thalami and sphenoid wings) and magnified.

2. Color flow mapping should be used to identify the circle of Willis and the proximal MCA (Fig. 2).
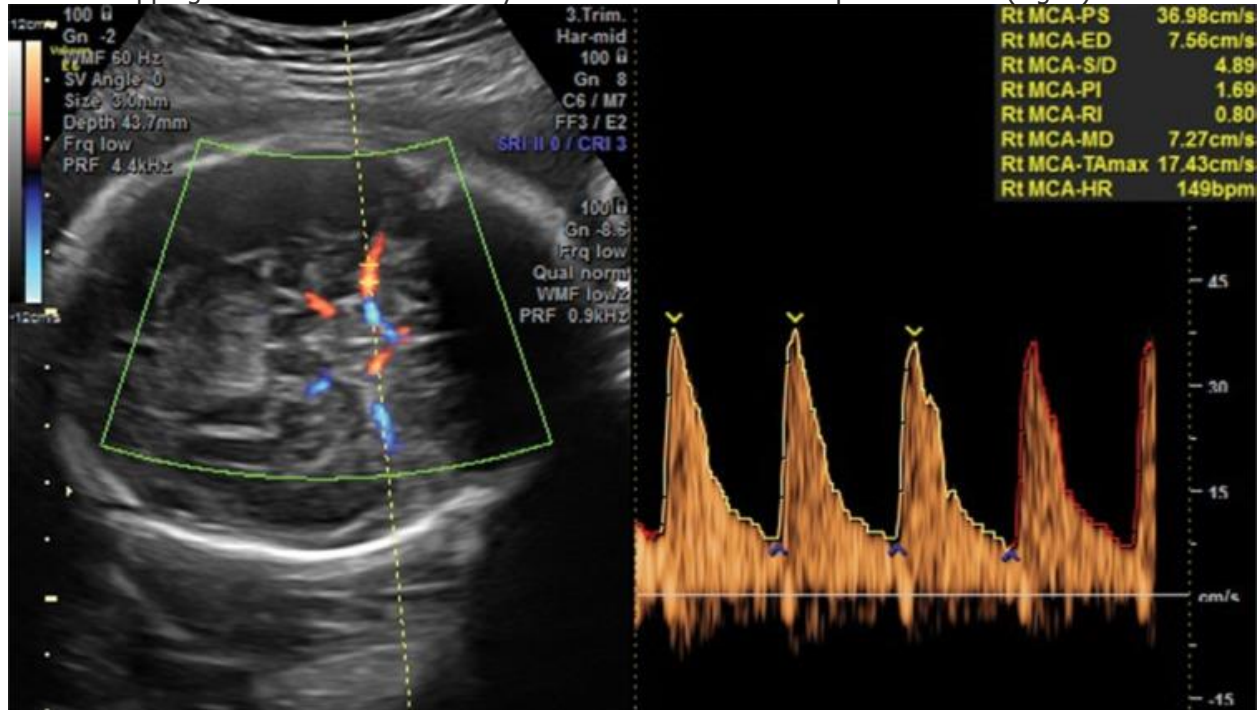

Fig. 2

Doppler assessment of pulsatility index (PI) in middle cerebral artery (MCA)

1. The pulse-wave Doppler gate should then be placed at the proximal third of the MCA, close to the origin in the carotid artery.

2. The angle between the ultrasound beam and the direction of blood flow should be kept as close as possible to 00 (Fig. 2).

3. At least three to 10 consecutive waveforms should be recorded.

4. PI is usually calculated using autotrace measurement.

We characterized antagonistic perinatal after-effects as Apgar reckoning of < 7 at 1 minute. In containers where the corresponding heavy with child women underwent perennial ultrasound examinations, we took into explanation the antepenultimate examination previously delivery. We did not psychoanalyse umbilical pH subsequently delivery, outstanding to the actuality that our accumulation consisted of low-risk pregnancies. what is more the resource of transportation was assessed with characteristic consideration to vertebrate suffer as an communication for operative transportation (vacuum, forceps, caesarean section).

STATISTICAL ANALYSIS

Statistical psychoanalysis of the obtained collections was performed victimisationing Statistica 10 software (StatSoft. uninterrupted variables were predominant:

father age, gestational age, UA PI, UA PI MoM, MCA PI, MCA PI MoM, CPR, EFW on ultrasound (US), confinement weight. moreover, thither was a unmarry qualitative variable: resource of delivery.

The W-Shapiro-Wilk evaluation was euphemistic pre-owned to appraise the conventional apportionment of uninterrupted variables. The Mann-Whitney U evaluation and Student's t-test were euphemistic pre-owned to make an analogy with uninterrupted variables according to the apportionment of data. ROC curves were euphemistic pre-owned to influence the suitableness of CPR as an Apgar reckoning predictor, gift the environment underneath the sheer (AUC) with 95% self-confidence separation and a significance level. For mensurable variables, the average, median, minimum, uttermost and touchstone abnormality were calculated. moreover, parcel of land for UA PI and MCA PI were aforethought for maturation generation verbalized at 95% self-confidence intervals.

For each calculations, $p < 0.05$ was advised as the statistical significance level.

RESULTS

The contemplate accumulation consisted of 446 heavy with child women, of which 236 were primiparas and 210 were multiparas. The intermediate generation was 29. 6 second childhood (range 16–46 years). The intermediate generation of primiparas was 27. 7 second

childhood (range 16–41 years) and of multiparas 31. 7 second childhood (range 19– 46 years).

tabularise 1 demonstrates the characteristics of the integral group. The intermediate workweek of transportation was 39. 5 weeks of maturation (range

36–42). The penny-pinching values of MCA PI and UA PI were 1. 3 (0. 45) and 0. 8 (0. 66), respectively. The penny-pinching values supported on aggregate of medians were 1. 03 (0. 9) for MCA PI MoM and 1. 04 (0. 1) for UA PI MoM (Tab.1)

Tab.1
Maternal and obstetric characteristics of the study population

Age (years)	Descriptive statistics							
	N	Mean	Median	Min.	Max.	Lower Quartile	Upper Quartile	SD
Mother age	446	29.6	30	16	46	27	33	5.044
Gestational age	446	39.5	40	36	42	39	41	1.420
MCA PI	446	1.30	1.27	0.10	2.45	1.09	1.50	0.306
MCA PI MoM	446	1.03	1.00	0.10	1.90	0.90	1.20	0.242
UA PI	446	0.80	0.78	0.39	1.66	0.69	0.90	0.159
UA PI MoM	446	1.04	1.00	0.50	2.10	0.90	1.20	0.206
CPR	446	1.67	1.62	0.16	3.87	1.39	1.90	0.472
EFW USG	446	3526.48	3553	2230	4680	3200	3860	457.060
Birth weight	446	3562.61	3550	2700	4480	3250	3860	412.195

N – number of cases; SD – standard deviation. MCA – middle cerebral artery. UA – umbilical artery. PI – pulsatility index. CPR – cerebroplacental ratio. EFW – estimated fetal weight. US – ultrasound. MoM – multiple of medians
Seventy women were at least 35 years of age. None of the tested fetal parameters was found to be significantly different between the groups of women more and less than 35 years of age (Tab. 2).
Tab.2
Statistical analysis of two groups <35 and ≥ 35 years old

Age (years)	*N*		Mean		Min.		Max.		SD		*P*
	<35	>35	<35	>35	<35	>35	<35	>35	<35	>35	
Mother age	376	70	28.1	37.6	16	35	34	46	3.880	2.441	0.0000
Gestational age	376	70	39.5	39.3	36	36	42	42	1.431	1.353	0.0942
MCA PI	376	70	1.29	1.34	0.10	0.57	2.45	2.16	0.299	0.342	0.2150*
MCA PI MoM	376	70	1.02	1.06	0.10	0.40	1.90	1.70	0.235	0. 74	0.1734
UA PI	376	70	0.80	0.80	0.39	0.44	1.66	1.14	0.160	0.157	0.9694
UA PI MoM	376	70	1.04	1.03	0.50	0.60	2.10	1.50	0.207	0.200	0.9521
CPR	376	70	1.66	1.74	0.16	0.53	3.87	3.51	0.463	0.516	0.3084
EFW US	376	70	3523.9	3540.39	2230	2500	4680	4525	458.578	451.826	0.7820*
Birth weight	376	70	3564.6	3552.14	2700	2710	4480	4330	414.126	404.435	0.8174*

Tab. 2
N – number of cases; Std. – standard deviation; p* – t-Student test; p – U Mann-Whitney test, MCA – middle cerebral artery, UA – umbilical artery, PI – pulsatility index, CPR – cerebroplacental ratio, EFW – estimated fetal weight, US – ultrasound, MoM – multiple of medians

When compared to multiparas, primiparas had lower values of MCA PI (1.27 vs. 1.34), MCA PI MoM (1.00 vs. 1.05), CPR (1.62 vs. 1.73), EFW USG (3479.53 g vs 3579.25 g) and birth weight (3513.50 g vs. 3617.79 g) (Tab. 3).

Tab.3
Statistical analysis of two groups of patients: primiparas vs multiparas

Parity (0 = primipara; 1 = multipara)	*N*		Mean		Min.		Max.		SD		*P*
	0	1	0	1	0	1	0	1	0	1	
Mother age	236	210	27.7	31.7	16	19	41	46	4.644	4.633	0.0000
Gestational age	236	210	39.5	39.4	36	36	42	42	1.468	1.366	0.3477
MCA PI	236	210	1.27	1.34	0.10	0.57	2.05	2.45	0.298	0.311	0.0119*
MCA PI MoM	236	210	1.00	1.05	0.10	0.40	1.60	1.90	0.233	0.249	0.0432
UA PI	236	210	0.80	0.80	0.49	0.39	1.45	1.66	0.152	0.167	0.9574
UA PI MoM	236	210	1.04	1.04	0.60	0.50	1.90	2.10	0.199	0.214	0.9504
CPR	236	210	1.62	1.73	0.16	0.53	2.99	3.87	0.437	0.503	0.0354
EFW US	236	210	3479.53	3579.25	2330	2230	4613	4680	471.895	434.880	0.0213*
Birth weight	236	210	3513.50	3617.79	2700	2710	4470	4480	429.786	385.075	0.0075*

N – number of cases; Std. – standard deviation; p*– t-Student test; p – U Mann-Whitney test, MCA – middle cerebral artery, UA – umbilical artery, PI – pulsatility index, CPR – cerebroplacental ratio, EFW – estimated fetal weight, US – ultrasound, MoM – multiple of medians

None of the parameters tested (mother age, MCA PI, MCA PI MoM, UA PI, UA PI MoM, CPR, EFW USG, birth weight) showed a difference across the groups with respect to Apgar score, or the method of delivery (Tab. 4 and Tab. 5). In our study, we used the cut-off point of 1.08, and we report a high sensitivity (0.945) but a low specificity (0.1), positive predictive values (PPV) 0.979, negative predictive values (NPV) 0.04 and accuracy (ACC) 0.926.

Tab.4
Statistical analysis of two groups of patients that deliver a fetus with: <= 7 Apgar vs >7 Apgar

Apgar	*N*		Mean		Min.		Max.		SD		*P*
	≤7	>7	≤7	>7	≤7	>7	≤7	>7	≤7	>7	
Mother age	10	436	29.6	29.6	25	16	35	46	2.875	5.085	0.9921
Gestational age	10	436	40.0	39.5	38	36	41	42	1.247	1.423	0.2476
MCA PI	10	436	1.29	1.30	1.01	0.10	1.90	2.45	0.285	0.307	0.9347
MCA PI MoM	10	436	1.02	1.03	0.80	0.10	1.50	1.90	0.225	0.242	0.7992
UA PI	10	436	0.80	0.80	0.63	0.39	0.98	1.66	0.120	0.160	0.8934
UA PI MoM	10	436	1.04	1.04	0.80	0.50	1.30	2.10	0.165	0.207	0.8165
CPR	10	436	1.67	1.67	1.05	0.16	2.97	3.87	0.531	0.471	0.8310
EFW USG	10	436	3618.80	3524.37	2650	2230	4330	4680	485.323	456.763	0.5189
Birth weight	10	436	3445.00	3565.30	2810	2700	3950	4480	393.340	412.656	0.3621

N – number of cases; Std.-standard deviation; p* – t-Student test; p – U Mann-Whitney test, MCA – middle cerebral artery, UA – umbilical artery, PI – pulsatility index, CPR – cerebroplacental ratio, EFW – estimated fetal weight, US – ultrasound, MoM – multiple of medians

Tab. 5
Statistical analysis of two groups of patients according to mode of delivery

Mode of delivery	N		Mean		Min.		Max.		SD		P
	ND	OP	ND	OP	ND	OP	ND	OP	ND	OP	
Mother age	273	173	29.2	30.2	16	17	42	46	4.890	5.237	0.1252
Gestational age	273	173	39.6	39.3	36	36	42	42	1.371	1.481	0.0390
MCA PI	273	173	1.29	1.31	0.10	0.60	2.45	2.16	0.309	0.303	0.5002
MCA PI MoM	273	173	1.02	1.03	0.10	0.50	1.90	1.70	0.244	0.239	0.8431
UA PI	273	173	0.80	0.80	0.39	0.49	1.66	1.45	0.167	0.146	0.9645
UA PI MoM	273	173	1.03	1.04	0.50	0.60	2.10	1.90	0.215	0.190	0.6633
CPR	273	173	1.67	1.68	0.16	0.61	3.87	3.51	0.492	0.439	0.6156
EFW US	273	173	3505.19	3560.08	2230	2330	4526	4680	461.068	449.938	0.2169
Birth weight	273	173	3539.24	3599.48	2700	2700	4460	4480	414.982	406.218	0.1328

N – number of cases; ND – natural delivery; Op – operational delivery; SD. – standard deviation; p* – t-Student test; p – U Mann-Whitney test, MCA – middle cerebral artery, UA – umbilical artery, PI – pulsatility index, CPR – cerebroplacental ratio, EFW – estimated fetal weight, US – ultrasound, MoM – multiple of medians

The results for the analysis of ROC curves for CPR were: AUC was 0.52 at CI 95% (0.342–0.698), p = 0.8271 (Fig. 3). Figures 4 and and55 show the relationships between UA PI and MCA PI and gestational age in weeks with a 95% confidence interval.
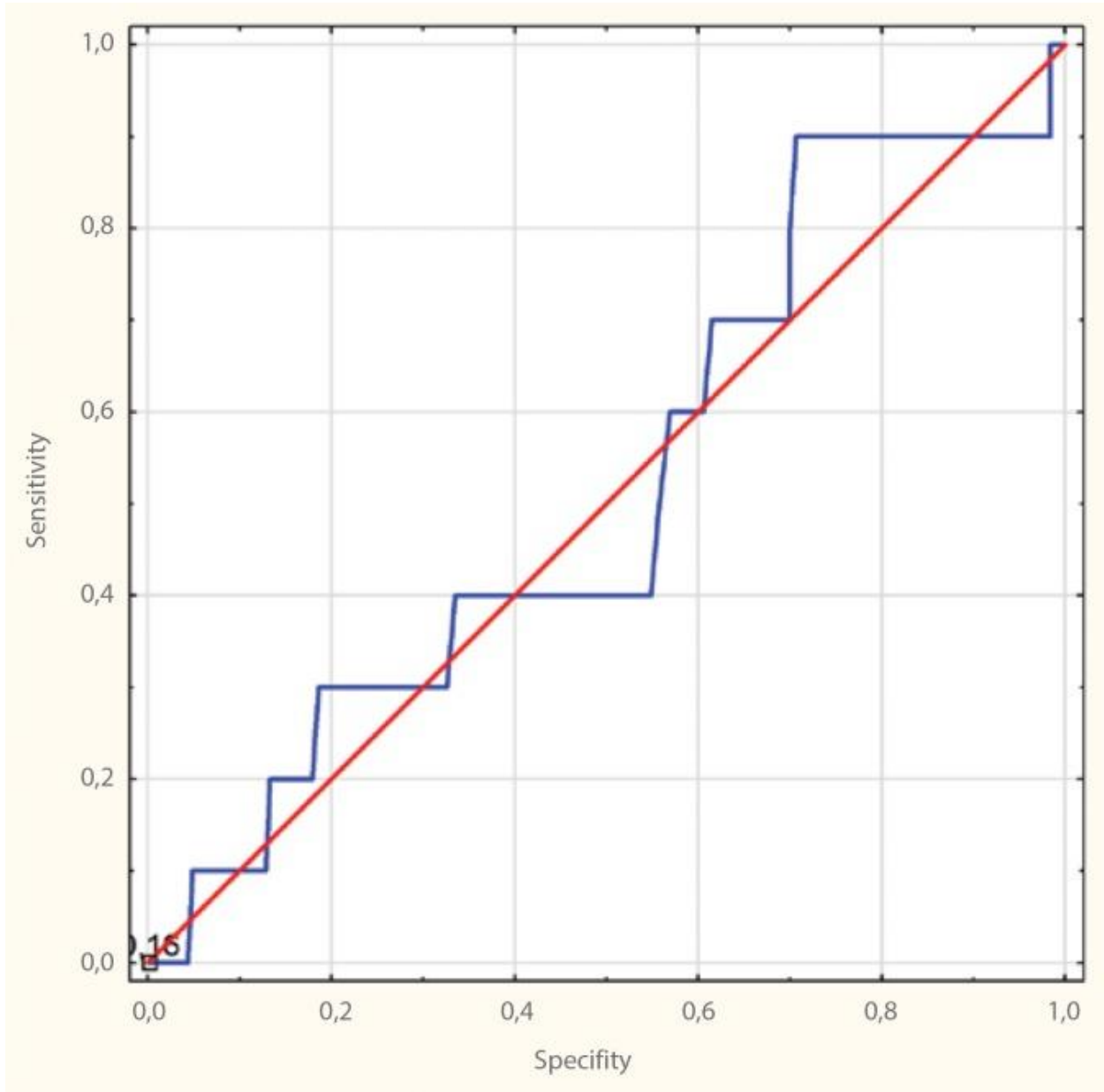
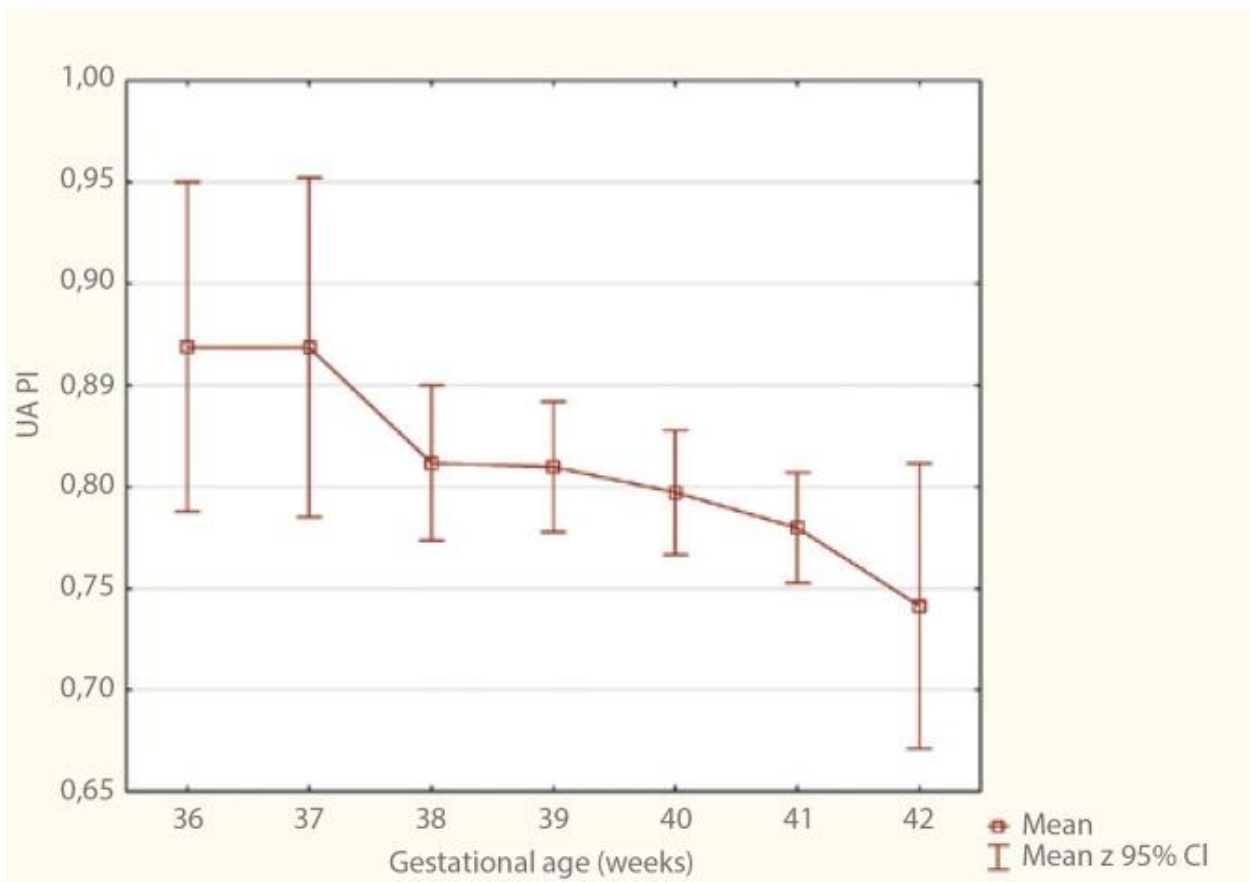Fig. 3
ROC curve for the cerebroplacental ratio (CPR)

Fig. 4
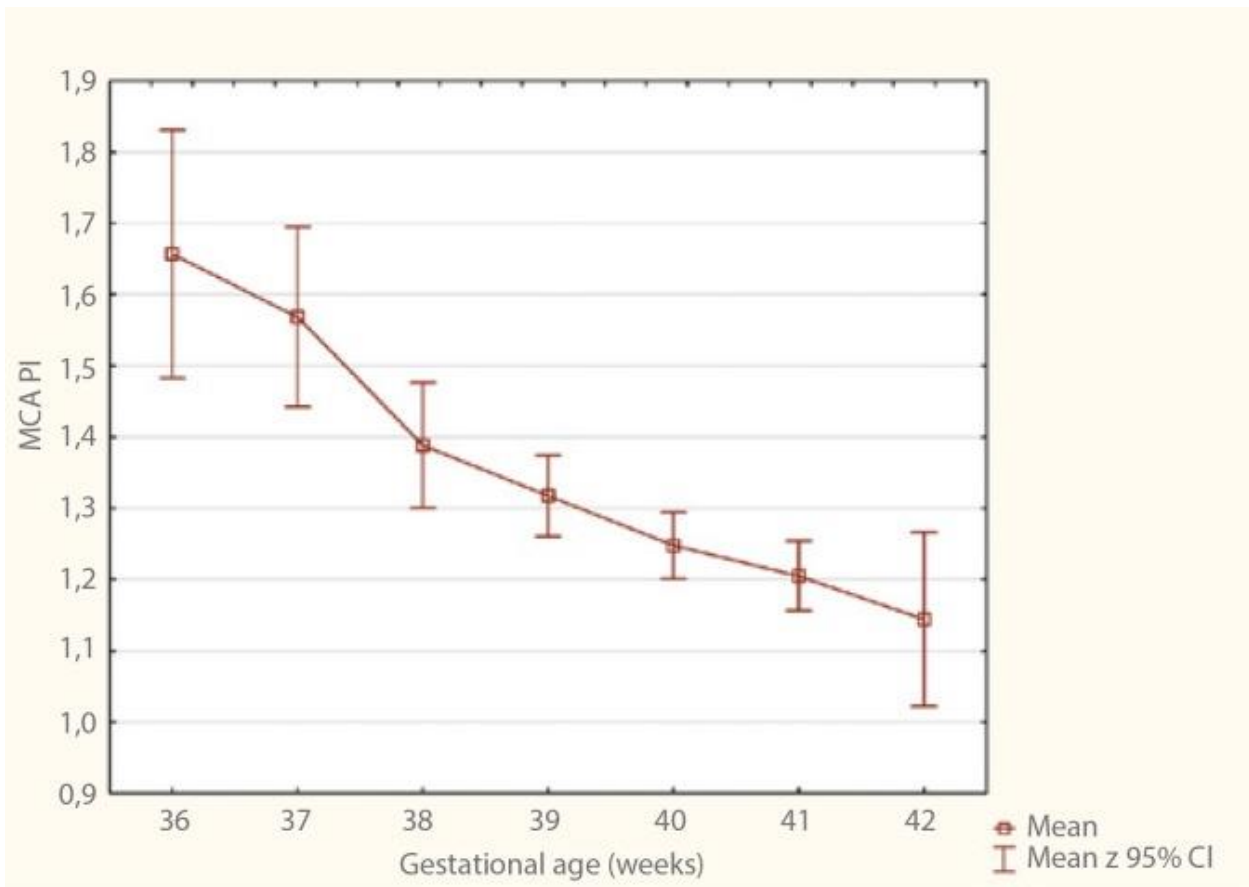Relationship between UA PI and gestational age in weeks with a 95% confidence interval

Fig. 5
Relationship between MCA PI and gestational age in weeks with a 95% confidence interval

DISCUSSION

In our study, we have assessed the utility of Doppler parameters as predictors of adverse perinatal outcomes in selected groups of pregnancies with AGA fetuses in the third trimester of pregnancy. CPR is more predictive of adverse perinatal outcomes compared to a single Doppler measurement like UA PI or MCA PI(1). Grammellini et al., as well as other researchers, report that CPR values are constant throughout the last ten weeks of pregnancy, and have established a value of 1.08 as a cut-off point, beyond which (<1.08) the ratio is regarded as abnormal. Other authors suggest a value of CPR <1.05 to be a good predictor of an adverse perinatal outcome, but included high-risk pregnancies, e.g. complicated with arterial hypertension or gestational diabetes. It is of paramount importance to properly define the MCA and UA PI values as normal or abnormal, since such parameters are to reflect placental insufficiency, especially in prolonged pregnancies between 41 and 42 + 6 weeks, where perinatal morbidity and mortality increase due to frequently postulated placental obsolescence. Even in uncomplicated pregnancies with no symptoms of abnormal placental function, an adaptive mechanism of brain-sparing effect is activated to protect the brain throughout the adverse conditions manifested as decrease of MCA PI values even before UA alterations appear. In our study, we demonstrate that during the third trimester of pregnancy, MCA PI and UA PI decrease with gestational age. Such findings are similar to results presented in previous studies. However, we found none of the analyzed Doppler parameters to be statistically significant in the prediction of adverse perinatal outcomes. In our opinion, this could have been expected, as we examined a low-risk pregnancy population. Our data are similar to Korbelak et al., who also report a low prediction rate of UA PI in predicting adverse perinatal outcomes in a low-risk population group. Yet, a major weakness of their study is a relatively small group of only 24 patients that were enrolled to the cohort. Recent studies, in contrast, investigate the power of Doppler parameters in predicting adverse perinatal outcomes using non-selected groups of patients, where the included complications, like small gestational age (SGA), fetal growth restriction (FGR), gestational hypertension or gestational diabetes mellitus, could influence significantly the results. In our study, we found no significant correlation of Doppler parameters with Apgar score < 7 at 1 min. Yet, we report that nulliparous women, compared to multiparas, had significantly lower values of: age, MCA PI, MCA PI MoM, CPR, EFW and fetal birth weight. In our population, there was a significantly higher number of patients younger than 35 years. Natural delivery was more frequent than operational delivery, and all were emergency cesarean sections. Our results contrast with those in a study by Valino et al., where half of the cases had elective cesarean section due to a maternal or fetal condition.

Our study had some limitations. Firstly, it was a retrospective study. Secondly, it was a relatively small cohort of one center-based study, with a small number of Apgar score < 7 cases. The strong side of the study is the homogeneity of population of Caucasian women without risk factors and the fact that examinations were performed within a short period of time before delivery by experts trained in Doppler examinations.

Screening in pregnancies with AGA at 36–42 weeks of gestation using Doppler parameters is not useful in the prediction of adverse perinatal outcomes like an Apgar score < 7 at 1 minute.

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