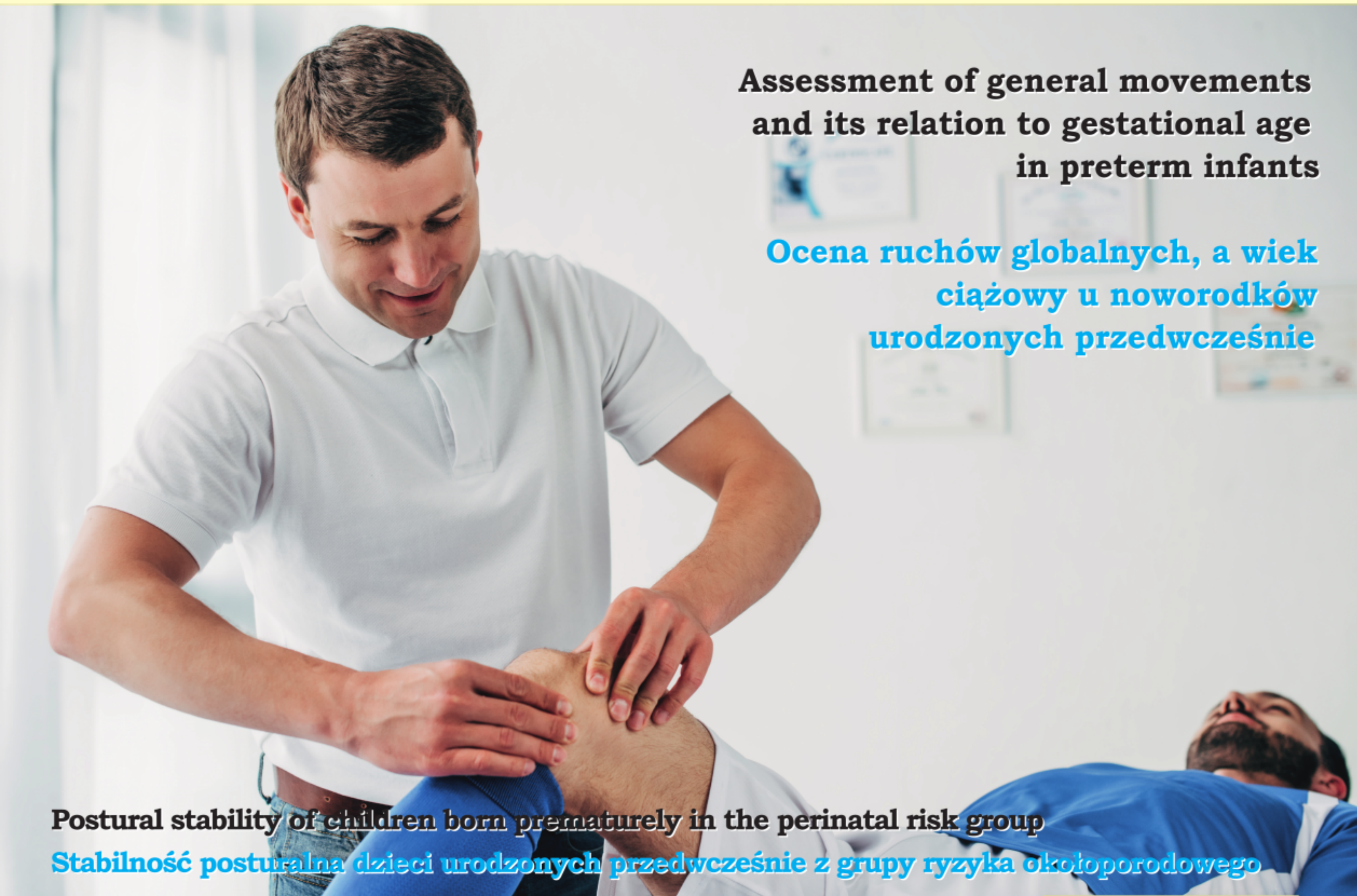
fizjoterapia polska

POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 2/2022 (22) DWUMIESIĘCZNIK ISSN 1642-0136



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fizjoterapia polska
nr 2/2022 (22)

Postural stability of children born prematurely in the perinatal risk group

Stabilność posturalna dzieci urodzonych przedwcześnie z grupy ryzyka okołoporodowego

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Abstract

Introduction. With advances in neonatal care, children born prematurely have a greater chance of survival, but their organ immaturity puts them at increased risk for central developmental disorders. The most common risk factors for such disorders are neonatal respiratory distress syndrome (RDS) and intraventricular hemorrhage (IVH grade III, IV).
Object. Based on the assumption that early central motor disorders are accompanied by impaired postural control, we compared measures of postural stability in infants born prematurely and at high risk for central motor disorders, i.e.: 1) IVH stage III or IV; or 2) RDS with infants born prematurely with normal brain ultrasound results and no perinatal burden (control group).
Materials and Methods. For this purpose, in a group of 76 prematurely born infants qualified for the SYNAGIS program, a posturometric examination was performed in a supine position using a stabilographic platform (device designed and manufactured in the Department of Biomedical Electronics of the Institute of Electronics of the Silesian University of Technology in Gliwice).
Results. Analysis of stability measures in individual subgroups showed that in both groups of infants with perinatal risk (IVH and RDS), the values of all evaluated posturometric parameters were lower than those presented by infants without perinatal stress.
Conclusions. 1. Evaluation of stability measures in the supine position is an original proposal for the evaluation of postural control of infants born prematurely in the first months of life.
2. Differences in stability measures between children born prematurely with the risk of central disturbances due to hypoxia (RDS) or intraventricular hemorrhage (IVH) and their peers without perinatal stress with normal head ultrasound results may indicate the appearance of postural control development disorders in the former.

Key words:
prematurely born children, perinatal risk factors, infant postural control disorders, posturometry, stabilographic platform

Streszczenie

Wstęp. Wraz z postępem w opiece neonatalnej dzieci urodzone przedwcześnie mają większe szanse na przeżycie, jednak niedojrzałość narządowa naraża je na zwiększone ryzyko wystąpienia ośrodkowych zaburzeń rozwojowych. Jednymi z czynników ryzyka najczęściej stanowiących przyczynę takich zaburzeń są zespół zaburzeń oddychania noworodków (RDS) oraz krwotok dokomorowy (IVH III, IV stopnia).
Cel. Wychodząc z założenia, że wczesnym ośrodkowym zaburzeniom ruchowym towarzyszą zaburzenia kontroli posturalnej porównano miary stabilności posturalnej niemowląt urodzonych przedwcześnie i obciążonych dużym ryzykiem zaburzeń ośrodkowych, tj.: 1) IVH III lub IV stopnia lub 2) RDS z niemowlętami urodzonymi przedwcześnie z prawidłowym wynikiem USG mózgu i bez obciążeń okołoporodowych (grupa kontrolna).
Materiał i metoda. W tym celu w grupie 76 niemowląt urodzonych przedwcześnie, zakwalifikowanych do programu SYNAGIS, przeprowadzono badanie posturometryczne w pozycji supinacyjnej, z wykorzystaniem platformy stabilograficznej (urządzenie zaprojektowane i wykonane w Zakładzie Elektroniki Biomedycznej Instytutu Elektroniki Politechniki Śląskiej w Gliwicach).
Wyniki. Analiza miar stabilności w poszczególnych podgrupach wykazała, że w obu grupach niemowląt z ryzykiem okołoporodowym (IVH i RDS) wartości wszystkich ocenianych parametrów posturometrycznych były mniejsze od tych prezentowanych przez niemowlęta bez obciążeń okołoporodowych.
Wnioski. 1. Ocena miar stabilności w pozycji supinacyjnej stanowi oryginalną propozycję oceny kontroli posturalnej niemowląt urodzonych przedwcześnie w pierwszych miesiącach życia.
2. Różnice w miarach stabilności pomiędzy dziećmi urodzonymi przedwcześnie, u których wystąpiło ryzyko zaburzeń ośrodkowych na tle niedotlenienia (RDS) lub krwawienia dokomorowego (IVH) a ich rówieśnikami bez obciążeń okołoporodowych z prawidłowym wynikiem USG głowy, może wskazywać na występowanie u tych pierwszych zaburzeń rozwoju kontroli posturalnej.

Słowa kluczowe:
dzieci urodzone przedwcześnie, okołoporodowe czynniki ryzyka, zaburzenia kontroli posturalnej niemowląt, posturometria, platforma stabilograficzna

Introduction

Every year, approximately 15 million babies are born prematurely worldwide [1,2]. According to the definition of the World Health Organization (WHO), a preterm infant is a newborn born after the 22nd week of gestation and before the 37th week of gestation, regardless of the newborn's birth weight [1]. Furthermore, any newborn, regardless of maturity, with a birth weight of less than 2500 g is classified as a low birth weight newborn (LBW). Given that birth weight is a strong determinant of neonatal morbidity, the LBW group was divided into the following subgroups: 1) moderately low birth weight newborns (1500-2499 g; MLBW); 2) very low birth weight newborns (1000-1499 g; VLBW; and 3) extremely low birth weight newborns (500-999 g; ELBW) [1–5]. In prematurely born babies, the prevalence rate increases significantly [6].

With advances in neonatal care, babies born prematurely have a better chance of survival, but prematurity puts them at increased risk of cerebral palsy (CP) due primarily to immaturity of the respiratory and circulatory systems. The immaturity resulting from preterm birth increases the risk of postnatal hypoxia (including respiratory disorders syndrome (RDS), bronchopulmonary dysplasia (BDP), and intraventricular hemorrhage (IVH)) and are associated with the appearance of CP [7, 8].
One of the risk factors for central nervous system (CNS) disorders is respiratory distress syndrome (RDS), which occurs most frequently in babies born prematurely immediately after birth or within a few hours after birth. Repeated episodes of hypoxia and bradycardia caused by apnea can cause brain damage [8, 9]. RDS occurs as a result of postnatal surfactant deficiency or inactivation in the context of the immature lungs of a baby born prematurely [10, 11]. Prematurity affects both of these factors, which directly contributes to RDS. The incidence of RDS is inversely proportional to the gestational age of the newborn. The lower the birth weight and postconceptional age of the newborns, the more severe the course of the RDS symptoms is observed. Although treatment methods, including antenatal corticosteroids, surfactants, and advanced neonatal respiratory care, have improved the outcome of patients affected by RDS, it is still a major cause of morbidity and mortality in preterm infants.

Intraventricular hemorrhage (IVH) is another important risk factor for developmental abnormalities in low-birth weight babies. It leads to several complications, including CP, posthemorrhagic hydrocephalus, and periventricular infarction. Treatment in these cases is very complex due to comorbidities of multiple organs, requiring the participation of a large group of specialists. On the other hand, many factors influence prognosis here, including fetal age, birth weight and additional complications, forming a group of further risk factors for developmental disorders. Previous reports on the incidence of IVH among children born prematurely show that the incidence of bleeding in very low birth weight babies (VLBW; < 1500 g) has halved over the last half century [12]. However, despite improvements in prenatal and neonatal care, IVH still occurs in approximately 25–30% of preterm infants. These phenomena have a destructive effect on brain tissue, which, as the organ that manages neuronal motor control, ceases to function properly. As a consequence, one of the frequent consequences of preterm birth is impaired development of CNS-dependent postural and motor control mechanisms, and the most severe form of these disorders is CP [4–8].

Based on the assumption that normal motor development includes both normal development of postural and motor control, it can be assumed that early central motor disorders (often heralding the occurrence of central disorders, including CP) are accompanied by postural control disorders. Functional evaluation and clinical observation of motor development in infants born prematurely burdened with risk factors such as hypoxia or intraventricular hemorrhage suggest the appearance of signs of CNS damage, manifested by early disturbances of postural stability and motor activity.

Assuming that there is an association between the occurrence of the above risk factors, that is, RDS (confirmed by clinical observation) and IVH (grade III and IV bleeding confirmed by ultrasound) in children born prematurely, it can be hypothesized movement disorders of central origins (lat. dysfunctio motorica originis centralis; DMOC) will be present [13,14]. The aim of the present study was to compare measures of postural stability, such as the path length of the CoP trajectory in the plane of support, as well as CoP displacements in the X axis in the lateral direction from the midline of the body and CoP displacements in the Y axis for the anteroposterior direction relative to the midline of the body, as well as the area of CoP under the developed trajectory in infants born prematurely and at high risk of central disorders, i.e.: 1) intraventricular hemorrhage (grade III or IV confirmed by ultrasound) (IVH, III & IV bleeding to the cerebral ventricles, confirmed by ultrasound) or 2) respiratory distress syndrome (RDS) confirmed by clinical observation with infants born prematurely with normal brain ultrasound results and without perinatal burdens (control group). The research hypothesis was that measures of stability of infants born prematurely and at risk of central disorders differed from measures of stability of infants born prematurely without perinatal burdens. The second hypothesis also assumed a difference in stability measures between the respiratory distress group (RDS) and the intraventricular hemorrhage group (IVH) of infants.

Material and Method

The study was approved by the Bioethics Committee of the Silesian Medical University in Katowice by resolution no. KNW/0022/KB1/148/14, and informed consent was obtained from all participating families. This is in accordance with the Declaration of Helsinki. All parents/legal guardians of the children gave their written informed consent prior to the study, including enrollment in the study and data collection.

Material

The study comprised 76 infants born prematurely, under the care of the Neonatology Clinic, qualified for the SYNAGIS (prophylactic for respiratory syncytial virus infection) programme, children evaluated for the quality of their motor development at the Rehabilitation and Medical Centre "NEUROMED" in Katowice. Infants who met the following inclusion criteria were included in the study: 1) they were born between 25 and 32 weeks of gestation, 2) they were nourished through the gastrointestinal tract; 3) they were in a stable clinical condition and cardiovascularly and respiratorily efficient; 4) their parents/legal guardians gave informed written consent to participate in the study. The study excluded those newborns who had risk factors for abnormal developmental outcomes not directly related to psychomotor development, such as inborn metabolic disorders, developmental defects, chromosomal abnormalities. The characteristics of the subjects are presented in Table 1.

Table 1. Baseline characteristics of prematurely born babies (N = 76) enrolled in the study

Parameters	M	Me	SD	Min.	Max	Sk.	Kurt.	S-W	p
Gestational birth age [weeks]	27.0	27	1.8	25.0	32.0	0.54	0.26	0.91	0.0000
APGAR [score]	5	6	2.0	2	9	−0.14	−1.46	0.88	0.0000
Mother's age [years]	31.0	31	5.5	21	44	0.27	−0.64	0.96	0.0185
Duration of hospitality [days]	27	22	14.2	9	66	0.93	−0.09	0.79	0.0000
Neonatal Medical Index NMI [score]	3.0	3	1.2	1.0	5.0	−0.36	−0.99	0.88	0.0000
Birth weight, [grams]	946	930	251	560	1850	1.3	2.97	0.90	0.0000
Mode of delivery, caesarean section, n (%)	59 (76%)								

M – mean, Me - median, SD – standard deviation, Min – minimum value, Max – maximum value, Sk. skewness; kurtosis; s-w – Shapiro-Wilk test statistic; p – significance; kurtosis; s-w – Shapiro-Wilk test statistic; p – statistical significance of the W test

Method

The study consisted of two parts:1) analysis of medical records; 2) posturometric tests in the horizontal supine position.

Analysis of the medical records of the study participants included the following data:

gestational age at delivery, APGAR score, maternal age, duration of hospitalization of the baby after birth, Neonatal Medical Index (NMI) score, birth weight, and mode of delivery.

The posturometric examination was carried out on each subject at an age between 52 and 54 postconceptional weeks, that is, between 12 and 14 weeks from the planned date of on-time birth (corrected age), that is, the number of weeks missing from the calendar age of the child was subtracted from the calendar age of the child (e.g., if the child was born 3 weeks earlier, if the calendar age was 2 months, the corrected age of the child was 5 weeks).

For the posturometric study, the infant was placed on the platform in the supine position in such a way that its navel was located at the center of the platform, i.e., at the point of intersection of the two diagonals marking the geometric centre of the geometric grid of the platform. Posturometric data were recorded for 15 min while the infant was in the supine position on the platform during its usual spontaneous activity. It was required that the infant was active (ie awake) but calm during the study. If the infant was irritable or crying, the examination was postponed or rescheduled. No dummies or touching was allowed during the measurement. Special attention was paid to maintain the central position of the infant's body in relation to the geometric grid of the platform.

A stabilographic platform with dedicated software and a video recorder connected to a computer with special software (a device designed and produced in the Department of Biomedical Electronics of the Institute of Electronics of the Silesian University of Technology in Gliwice) were used to perform the posturometric test. The platform consisted of a large top plate with dimensions of 100 cm x 80 cm, four MEGATRON KM 500 series strain gauge transducers with a measuring range of 0-50 N [approximately 5 kG] and a sensitivity of 2 mV / V (nonlinearity): 0.05% of the measurement range; hysteresis: 0.08% of the measurement range (Figure 1).

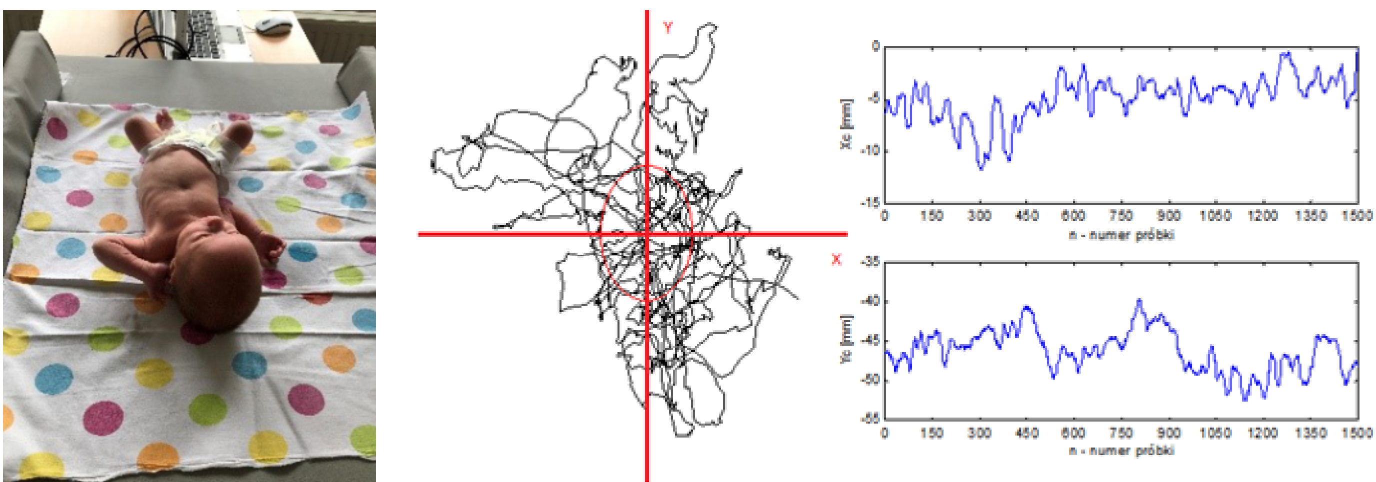

Figure 1. Stabilographic test bench for small children: 100 cm x 78 cm platform top plate, four MEGATRON KM 500 series strain gauge transducers with a measuring range of 0–50N (approximately 5 kG) and a sensitivity of 2 mV / V (nonlinearity: 0.05% of the measuring range; hysteresis: 0.08% of the measuring range).

Posturographic measurements consisted of analysis of the trajectory and trajectory field of the center of pressure (CoP)

displacements while the child was lying in a supine position on the platform. The registration of posturographic parameters resulted from the transformation of changes in pressure forces on transducers into changes in voltage values at their outputs, which were then amplified 1000 times by AD623 instrumental amplifiers. Posturometric signal processing from the platform, trajectory parameterisation, and data archiving were performed on the basis of a specially created computer program. Three recordings of 30 s each (that is, between 4.30-5.00 min; 9.30–10 min and 14.30-15.00 min) were selected for further analysis.
The arithmetic mean of the three measurements was used for statistical analysis and intergroup comparisons were made using the following posturometric parameters (Table 2).

Table 2. Basic posturometric parameters

Posturometric indices based on CoP shifts during lying		
SPL	Sway path length of the CoP [mm]	
MCoPx	Mean medial-lateral linear displacement of the CoP [mm]	$R_{XCSr} = \frac{\sum_{i=1}^{N} \lvert x_C(i) - X_{C0} \rvert}{N}$
MCoPy	Mean posterior-anterior displacement of the CoP [mm]	$R_{YCSr} = \frac{\sum_{i=1}^{N} \lvert y_C(i) - Y_{C0} \rvert}{N}$
ACoP	Area of CoP shifts under the unrolled trajectory [cm^2]	

Statistical analysis
For statistical analysis, all subjects were divided into 3 subgroups:
1. RDS study group, comprising children with respiratory distress syndrome (RDS).
2. IVH study group - including children with intraventricular hemorrhage (IVH) confirmed by ultrasound,
3. control group (control) - including children with normal head USG results without confirmed IVH or RDS.
The mean values of the posturometric parameters evaluated from these three measurements were used for statistical analysis. The resulting data were entered into a database created in an MS Excel 2016 spreadsheet. To verify the research hypotheses, statistical analyzes were performed using the IBM SPSS Statistics package version 13.3. The distribution of variables was checked by calculating skewness and kurtosis and using the Shapiro-Wilk test. The descriptive statistics of the parameters evaluated were presented by means and standard deviation for values with normal distribution and by median and range for those whose distribution differed significantly from the normal distribution. A nonparametric test was then applied, and a one-way Kruskal-Wallis rank analysis of variance was performed to examine the discrepancies in the subgroups studied. Differences between results (values with normal distribution) of posturometric parameters obtained in the RDS and IVH study subgroups with the control group were evaluated using one-way analysis of variance (ANOVA) followed by a multiple comparison test with Bonferroni correction ($p < 0.01$). All results were considered significant at the $p < 0.05$ level.

Results

The demographic data and anthropometric characteristics of the study participants in the study groups, i.e. 1) infants with respiratory distress syndrome - RDS group (n = 29); 2) infants with intraventricular hemorrhage – IVH group (n = 26) and 3) infants with no changes found on head ultrasound from the control group (Control; n = 21) are presented in Table 3.

Table 3. Characteristics of infants born prematurely enrolled in a group with respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), and in the control group of babies with normal ultrasound results (Control)

Parameters	RDS, N = 29				IVH, N = 26				Control, N = 21			
	M	SD	Min.	Max	M	SD	Min.	Max	M	SD	Min.	Max
Gestational birth age [weeks]	27.5	1.3	25	29.0	27.0	2.0	25.0	32.0	27.5	2.1	25.0	32.0
APGAR [score]	5	1	3	8	5	2	2	9	6.5	1.5	4	8
Mother's age [years]	29.2	5.2	21	39	31.4	5.6	25	44	32.9	5.4	24.0	43.0
Duration of hospitality [days]	27	10	19	62	31	15	19	66	24.6	17.3	9	58
Neonatal Medical Index NMI [score]	2.8	1.3	1.0	5.0	3.0	1.2	1.0	5.0	3.5	1.2	1.0	5.0
Birth weight, [grams]	1000	281	610	1850	920	240	560	1430	903	216	610	1400
Mode of delivery, caesarean section, n (%)	21 (73%)				17 (66%)				11 (51%)			

M – mean, SD – standard deviation, Min – minimum value, Max – maximum value,

The mean birth age in the study groups was similar at approximately 27 weeks postconception (in the RDS, IVH and Control group it was 27.5; 27.0 and 27.5 weeks, respectively). All three subgroups were also similar in terms of birth weight. Although the mean birth weight of all babies studied was 946 g, infants presented slightly lower mean weight values at birth in the control group (mean 903 g), and higher means were recorded in the RDS group (mean 1000 g). There were no statistically significant differences here (Table 4).

Similarly, the mean age of mothers at delivery was 31 years ± 5.5 years and was similar in all subjects (Table 3, Table 3). All study infants, due to preterm delivery, required clinical neonatal support immediately after birth. The longest period of support was required for infants diagnosed with IVH and the shortest for infants with normal head ultrasound results, that is, infants in the control group. Although significant individual differences were observed in the length of hospital stay of infants in the perinatal risk groups (27 and 31 days, respectively), the length of stay was not significantly different from the average stay of 24 days of infants in the control group (Table 3). However, it should be noted that there were no significant differences between the study groups in terms of Apgar scores received, despite significant differences (resulting from the assumptions of the project) in the clinical status of the infants (Table 3). In the study population, up to 3/4 of all births were delivered by caesarean section. The highest number of such terminations was recorded in the RDS-loaded group and the lowest in the control group.

To sum up this part of the results, it can be stated that the population of the studied was homogeneous with respect to basic demographic and anthropometric characteristics, which made the results of intergroup comparisons performed in the field of posturographic characteristics more reliable.

Table 4. Kruskal-Wallis rank analyses of variance between the respiratory distress syndrome (RDS) group, the intraventricular hemorrhage (IVH) group and the control group of children with normal ultrasound results (Control)

Parameters	RDS, N = 29		IVH, N = 26		Control, N = 21		Statistical test p-value
	Me	Q1–Q3	Me	Q1–Q3	Me	Q1–Q3	
Gestational birth age [weeks]	28	27–29	27	25–28	28	26–29	0.1898
APGAR [score]	6	3–7	4	4–7	7	5–8	0.0524
Mother’s age [years]	29	25–33	30	27–37	33	28–37	0.0974
Duration of hospitality [days]	24	21–28	22	21–41	18	10–41	0.0543
Neonatal Medical Index NMI [score]	3	2–4	4	2–4	3	3–5	0.2103
Birth weight, [grams]	970	850–1050	995	750–1050	860	765–1020	0.3449

Me – median, Q1-Q3 – lower and upper quartiles, p – value of statistical significance

Table 5. Mean values and standard deviations and range (min-max) of posturometric parameters in a group of infants with distress syndrome (RDS) and intraventricular hemorrhage (IVH) and a control group (Control)

Parameters	RDS, N = 29				IVH, N = 26				Control, N = 21			
	M	SD	Min.	Max	M	SD	Min.	Max	M	SD	Min.	Max
SPL [mm]	1796	791	648	3459	1774	532	835	2710	2567	545	1879	3747
MCoPx [mm]	5.2	3	2	12	4.4	2	0.4	8	7.4	2	4	11
MCoPy [mm]	5.2	2	1	10	5.1	2	0.7	9	7.5	3	3	13
ACoP [cm^2]	225	108	29	472	249	108	26	455	330	191	72	738

SPL – path length of CoP excursions; MCoPx – mean CoP excursions in the lateral direction, X-axis; MCoPy – Average CoP excursions in the anterior-posterior direction, Y axis; ACoP – area under the developed trajectory; M – mean; SD – standard deviation; Min – minimum value; Max – maximum value

Analyzing the values of the basic stability measures recorded in the individual subgroups, one can observe a clear tendency for higher values of all assessed posturometric parameters to be obtained by children unburdened by risk factors, i.e., from the control group (Table 5). In both groups of infants with perinatal risk (IVH and RDS), the values of all assessed parameters were higher than those presented by their peers in the control group (Table 5). Apart from the only case in which the area under the developed trajectory did not differ between the ultrasound-confirmed intraventricular hemorrhage group (IVH) and the control group (Figure 3 D), all other parameters were statistically significantly different between the control group and both groups of infants with perinatal risk (RDS and IVH) (Figure 2 A–C). Although it was observed that the posturometric parameters obtained by infants with intraventricular hemorrhage (IVH) were slightly lower than the corresponding parameters obtained by infants with respiratory failure, thus further diverging from the results of infants in the control group, no statistically significant differences were recorded here (Figure 2 A–D).

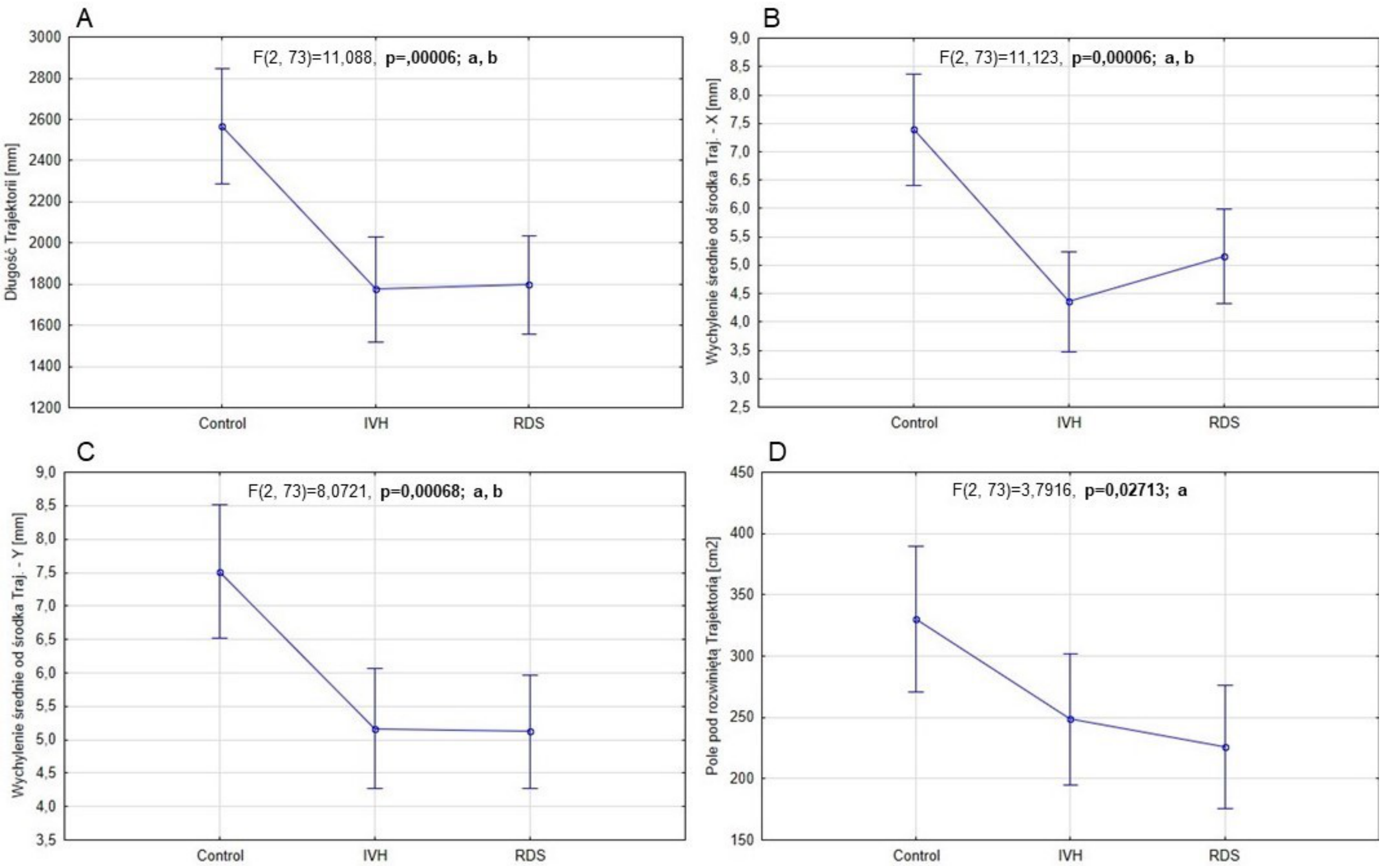

Figure 2. Comparison of posturometric parameters: A) trajectory length; B) mean excursion from the center of the trajectory – X; C) mean excursion from the centre of the trajectory – Y; D) area under developed trajectory, between the group of infants with respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), and control group (Control). Mean values and confidence interval (95%CI). One-way ANOVA. Bonferroni post-hoc analysis; a. difference between the control group and RDS; b. difference between the control group and IVH

Discussion

Postural control can be measured in several ways [15-28]. One method used to assess prospective postural control during movement is to quantify and describe the trajectory of displacement of the centre of pressure (CoP) of the body in the support plane [20]. The results presented above describing the displacement of the CoP projection on the support plane during the infant's maintenance of the supine position reflect in some way the infant's postural regulation abilities and create a series of temporal and spatial changes that can be analysed using posturometric measurements. The results of the posturometric measurements obtained in the present study confirmed the research hypothesis, assuming that the stability measures in children with a risk factor burden such as RDS or IVH are characterised by different values than in children without perinatal burdens. The most important finding of the presented study is that two basic posturometric parameters, such as the mean length of the CoP trajectory (SPL) and the area under the developed trajectory (ACoP), which testify to the frequency and amplitude of movements performed by the infant, as well as two other parameters (MCoPx, MCoPy) that testify to the range of CoP displacements in the lateral and anteroposterior directions, were statistically significantly higher among children in the control group. Although there were no significant differences between the subgroups of infants distinguished due to the risk factors involved, this does not change the fact that infants at risk of central developmental disorders (including CP) show different measures of stability while remaining in the supine position. It appears that the longer stride and the larger area of sway of CoP (SPL and ACoP, respectively) recorded among infants without perinatal risk are due to variability and variation in normal motor patterns and qualitatively better postural control strategies during supine lying. While abnormal, possibly stereotyped motor patterns and imperfect postural strategies in infants with IVH or RDS may represent early signs of central developmental disorders (including CP). Furthermore, significantly smaller CoP swings in both the anteroposterior (i.e., cephalo-caudal) and lateral directions that characterize children with severe risk factors also suggest the presence of less perfect postural response strategies to changes in body position and gravity compared to non-risk peers.

A review of the literature on the subject allows us to state that the study presented here is the first attempt to objectively assess the level of postural control in horizontal positions in a child during the first months of life. Hence, it is not possible to compare the results obtained with other studies. However, the present study is part of a wider research project related to the search for objective, measurable and comparable methods of assessing postural strategies presented by infants in horizontal positions, especially in the group of children born prematurely. However, the results presented here, as well as the other results included in our other studies (in review), seem to be very promising for the diagnosis of central developmental disorders in children born prematurely in their early development. Early and reliable identification of negative developmental tendencies, in turn, creates an opportunity for early physiotherapeutic intervention, which will allow for early modification of abnormal and introduction of optimal posture and movement patterns for the child's development. Despite this, the authors are aware of some limitations of this study. First, the presence of perinatal risk factors, even

those as serious as RDS or IVH, is not a sufficient criterion to distinguish infants at risk for central developmental disorders, including CP. Epidemiological data show that some infants with a perinatal history of stress do indeed have central disorders, but a significant proportion of them develop normally [29]. At the same time, the results of studies conducted by many authors have shown that up to half of the population of children with CP are children without risk in the perinatal history [30].
Therefore, in our other studies (in review) of the research project undertaken, other more reliable criteria were used for infant division. Summarizing the obtained results, it can be stated that posturometric measurement gives the possibility not only to register, but also to measure posturographic parameters characterising the level of postural control in infants in horizontal positions.

Conclusions

Although the results of the conducted studies do not authorise drawing definite conclusions as to the value of differentiating normal and impaired postural control in infants, it can be stated on the basis of them that:
1. The evaluation of measures of stability in the supine position represents an original proposal for assessing the postural control of an infant born prematurely in the first months of life.
2. Differences in stability measures between children born prematurely with the risk of central disturbances due to hypoxia (RDS) or intraventricular hemorrhage (IVH) and their peers without perinatal stress with normal head USG results may indicate the appearance of postural control development disorders in the former.
3. The results of the study should be continued in order to determine the repeatability of the obtained results and to standardise the parameters characterising stability in horizontal positions.

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