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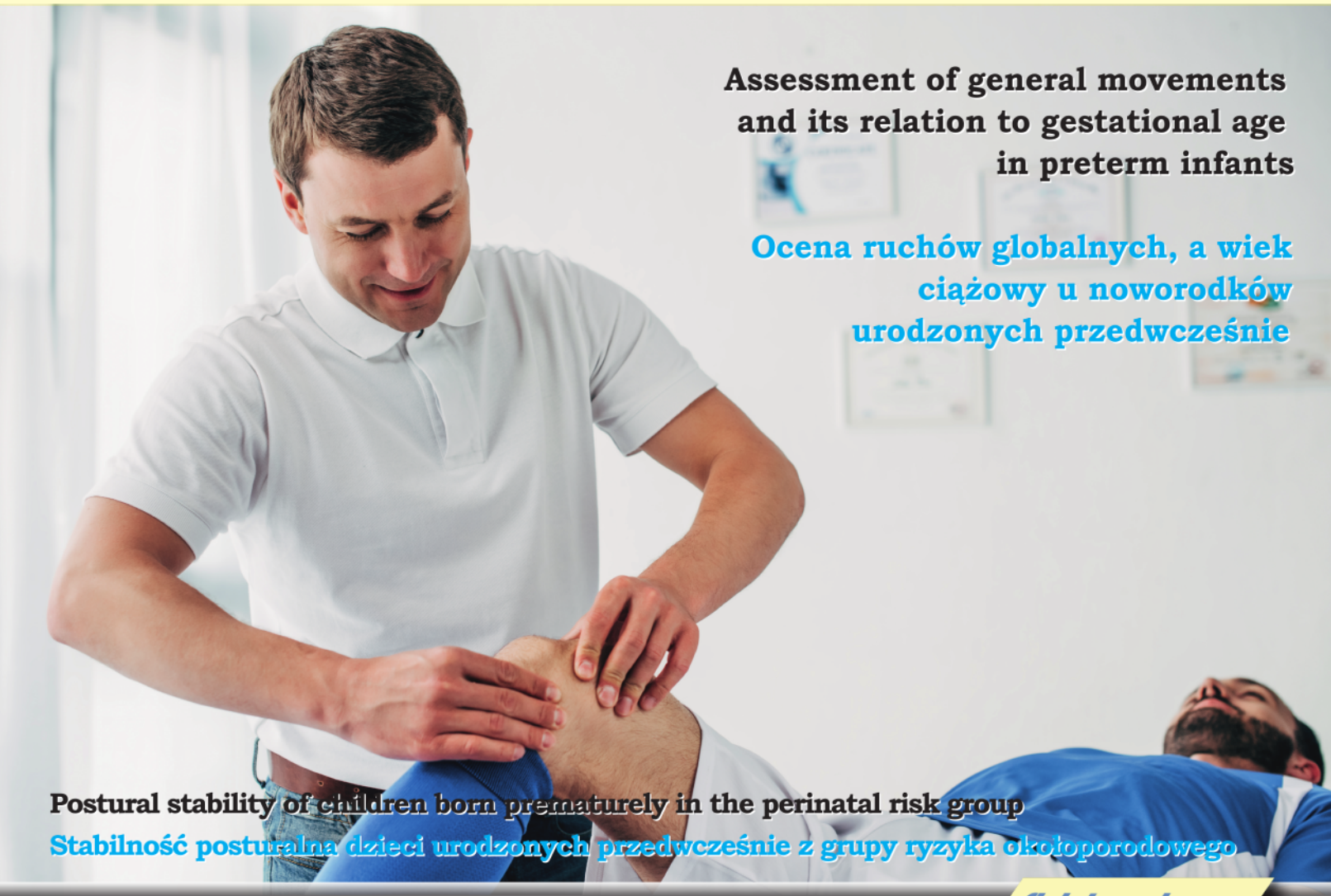

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Assessment of general movements and its relation to gestational age in preterm infants

Ocena ruchów globalnych a wiek ciążowy u noworodków urodzonych przedwcześnie

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Abstract

Introduction. The task of contemporary neonatology is not only to save the lives of children born prematurely, but also to provide them with the highest possible quality of life. One of the methods of assessing the quality of general movement patterns is the Prechtl method, which enables early identification of immaturity or damage to the central nervous system. Aim. Dynamic assessment of the type and quality of GMs (General Movements) in preterm infants to determine the indications for early neurodevelopmental support and to determine the relationship between the occurrence of maternal and neonatal perinatal risk factors, and the type and quality of general movements. Material and method. Assessment was conducted in 90 infantsborn between 28 and 36 weeks gestational age. Dominant cases (57 cases) were infants brn between32 and 36 weeks GE. Most cases (48) received low Apgar score at 1 minute (≤ 7), including two born in very severe condition. The study included three GM assessments: I –up to 14 day post-natally, II at term and III between12 and 15 weeks corrected age. The analysis included gestational age, general condition of the newborn in Apgar score. Results. There is a close correlation with the gestational age of a preterm newborn, and the occurrence of damage to the nerve centers and the finding of abnormal global movements.It was confirmed that gestational age is important variables affecting the occurrence of abnormal general movements.

Key words:

general movements, preterm infants, perinatal risk factors, neurodevelopmental physiotherapy

Streszczenie

Zadaniem współczesnej neonatologii jest nie tylko ratowanie życia dzieciom urodzonym przedwcześnie, ale także zapewnienie im możliwie jak najwyższej jakości życia. Jedną z metod oceny jakości globalnych wzorców ruchu jest metoda Prechtla, która umożliwia wczesne rozpoznanie niedojrzałości lub uszkodzeń ośrodkowego układu nerwowego. Cel. Dynamiczna ocena rodzaju i jakości GMs (General Movements – ruchy globalne) u noworodków urodzonych przedwcześnie, aby ustalić wskazania do wczesnego wspomagania neurorozwojowego oraz określenie zależności pomiędzy występowaniem perinatalnych czynników ryzyka a rodzajem i jakością ruchów globalnych.
Materiał i metody. Badania przeprowadzono u 90 noworodków urodzonych między 28. a 36. tyg. wieku ciążowego. Dominowały (57 przypadków) noworodki urodzone między 32. a 36. tygodniem ciąży. W 1 minucie życia większość noworodków (48 przypadków) otrzymała niską punktację według skali Apgar (≤ 7), w tym dwoje urodziło się w bardzo ciężkim stanie. Badanie obejmowało trzykrotną rejestrację GMs: I – do 14. doby życia po urodzeniu, II w terminie skorygowanego terminu porodu oraz III między 12. a 15. tygodniem życia dziecka wieku skorygowanego. W analizie uwzględniono wiek ciążowy oraz stan ogólny noworodka, oceniany według skali Apgar.
Wyniki. Istnieje ścisła zależność między wiekiem ciążowym noworodka urodzonego przedwcześnie a stwierdzeniem nieprawidłowych ruchów globalnych. Wiek ciążowy jest istotną zmienną wpływającą na występowanie nieprawidłowych ruchów globalnych.

Słowa kluczowe:

ruchy globalne, wcześniak, czynniki ryzyka, fizjoterapia neurorozwojowa

Introduction

The task of contemporary neonatology is not only to save the lives of children born prematurely, but also to ensure they have them with the highest possible quality of life. Every year, 2.9 million newly born infants die and the main cause is the preterm birth together with its complications which concern about 1 million infants [1]. In Poland, around 24 000 infants are born with birth weight < 2.5 kg which makes up around 6% of all births, from which 0.49% has extremely low birth weight [2]. Commonly, it is believed that both the improvement of children survival factors and the development of human resource depend mainly upon ensuring that every newly born infant, who is considered as the future citizen and worker, gets a healthy start straight after their birth. Improving survival rate and assuring the highest possible quality of life for preterm infants is a very difficult challenge which requires effective collaboration of a competent and multidisciplinary team. Moreover, reliable knowledge of changes occurring during fetal and postnatal life phases as well as endo- and exogenous factors which shape the process of development is essential. It is commonly understood that the younger and less developed the infants' organism, the greater the impact of environmental factors on its development [1, 3]. Therefore, this invites us to generally assume a universal principle that the most effective preventive actions are based on early detection of risks for a fetus and an infant which allows for its quick elimination through early and effective treatments and rehabilitation [1, 4, 5]. The problems with cognitive abilities, attention deficits, neuropsychological abnormalities of visual-motor integration, learning disabilities and behavioural dysfunctions as well as minor motoric disabilities are currently the most common neurodevelopmental disorders in preterm infants. These affect the majority (over 50%) of infants born prematurely with extremely low birth weight. The perinatal pathology has dominating influence to incur damages to the central nervous system and significance of the perinatal factor is inversely proportional to the gestational age.

This study aims to identify correlations between gestational age of preterm infants and the type and quality of their general movements.

Aim of the study

Evaluation of the motoric development in an infant has been the subject of studies for many years. The ideal aim is to create a credible, objective and fast but also non-invasive method for analyzing movement functions. The conventional analytical methods of examination are precise, yet very time consuming. In a neonatology department environment, the examination of an infant who is often a multi-week incubator resident demands undertaking an entire set of preparatory procedures which require a direct engagement of the child. One of the common and recognised methods for evaluating infants is the Prechtl method which offers a simple, non-invasive, objective and quick as well as comprehensive assessment. The benefits of the facts mentioned above gives a possibility to apply the same criteria of assessing general

movements in fetus, preterm infant and full-term newborn. The possibility of an early monitoring of general movements of the infant constitute to be a valuable supplement to the neurological examination. It can be a defining criterion for early recognition of developmental risks as well as application of improvement actions.

The aim of the study was realized through:
1. Dynamic assessment of the type and quality of the general movements in preterm infants to establish indication for early neurodevelopmental treatments.
2. Specifying correlations between the birth age in preterm infants and the type and quality of their general movements.

Material and methods

The assessments were conducted on 90 preterm infants born between 28th and 36th week of gestational age including 42 (46.7%) female and 48 (53.3%) male infants. All infants were hospitalized at the Neonatal Intensive Care Unit (NICU). Fig.1 represents specific distribution of the gestational age of 90 preterm infants.

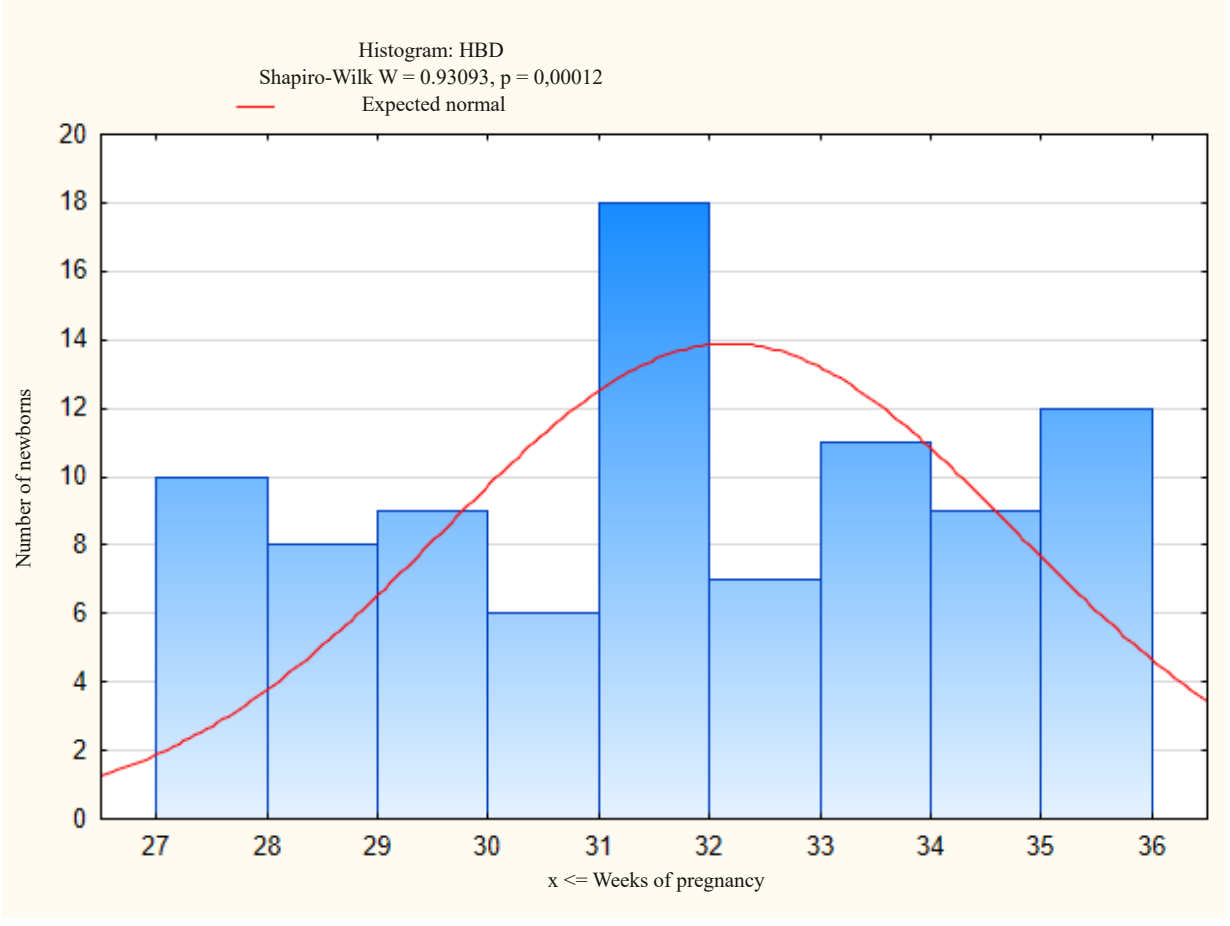

Fig. 1. Histogram of numerical distribution of gestational age of 90 preterm infants

Among the cases, the infants born between 32nd and 36th week of pregnancy were dominant (57 cases – 63%).

Median gestational age was 32 weeks (range 28–36, lower quartile 30,0 and upper quartile 34,0).

Methodology

Examination of spontaneous movements using the Prechtl method. The spontaneous movements in all 90 preterm infants were registered three times with the support of camera (Sony HDR-CX330) after which assessment of the type of movement was conducted using the Prechtl method [6–8]. The assessments were conducted under conditions of thermal comfort. The first assessments were carried out in the incubator and the following in a room at 24°C. The camera was located about 1m above the infant. Sequences of general movement patterns were selected from the 30 min recording and analysed using the Prechtl method as well as the scale developed by Ferrari et al. [9]. Results were marked on an Individual Developmental Trajectory [6].

8 factors of the global movements were assessed: amplitude, speed, sequence of movements, character of movements, arrangement of spatial sectors, fluidity, beginning – end, motoric qualities around distal body parts. From infant parameters, the analysis considered gestational age based on the date of last menstrual cycle and prenatal ultrasound examination. In the case of discrepancy of the results, the assessment of gestational age was conducted using the Ballard scale [10].

Elimination data, test results, global evaluation results were collected in a database in a database, and then followed by the help of STATISTICA 12.0 by StatSoft. The Shapiro-Wilk test, the city that the gestational ages of newborns are variables deviating from the normalization distribution rate. The results are presented in the form of the median, range of values, and the first and third quartiles. For the analysis of qualitative characteristics Chi-square test with Yates corrections. In the study of the results of achieving the results also the model statistical model of logistic regression with Wald statistic from working out o plus. Level for all tests.

Results

Assessment of general movements in preterm infants in three consecutive examinations and its correlation with gestational age. Research included three recordings and assessments of GMs: one up to 14th day of life, second at term and third between 12th and 15th week of corrected age.

The first assessment found presence of abnormal general movements in majority of infants (60%). The most common type was the poor repertoire movements (51,1%).

In the second assessment 60 (66,6%) infants presented normal global movements. Statistically significant lower number of infants with abnormal global movements was found in comparison to the first assessment. Poor repertoire movements were observed in 21 (23,3%) preterm infants. The third assessment demonstrated that 75 (83,3%) preterm infants have normal with fidgety movements from which 54 (60% of the whole) were born between 32nd and 36th pregnancy week.

Table 1. The infant's risk factor (chi-square test)

Types of perinatal risk factors	Chi-square	F1 ratio	Contingency ratio
Gestational age	p = 0.00002	0.4880626	0.4880626

It was found that there is a statistically significant correlation between gestational age of infants and presence of abnormal general movements.

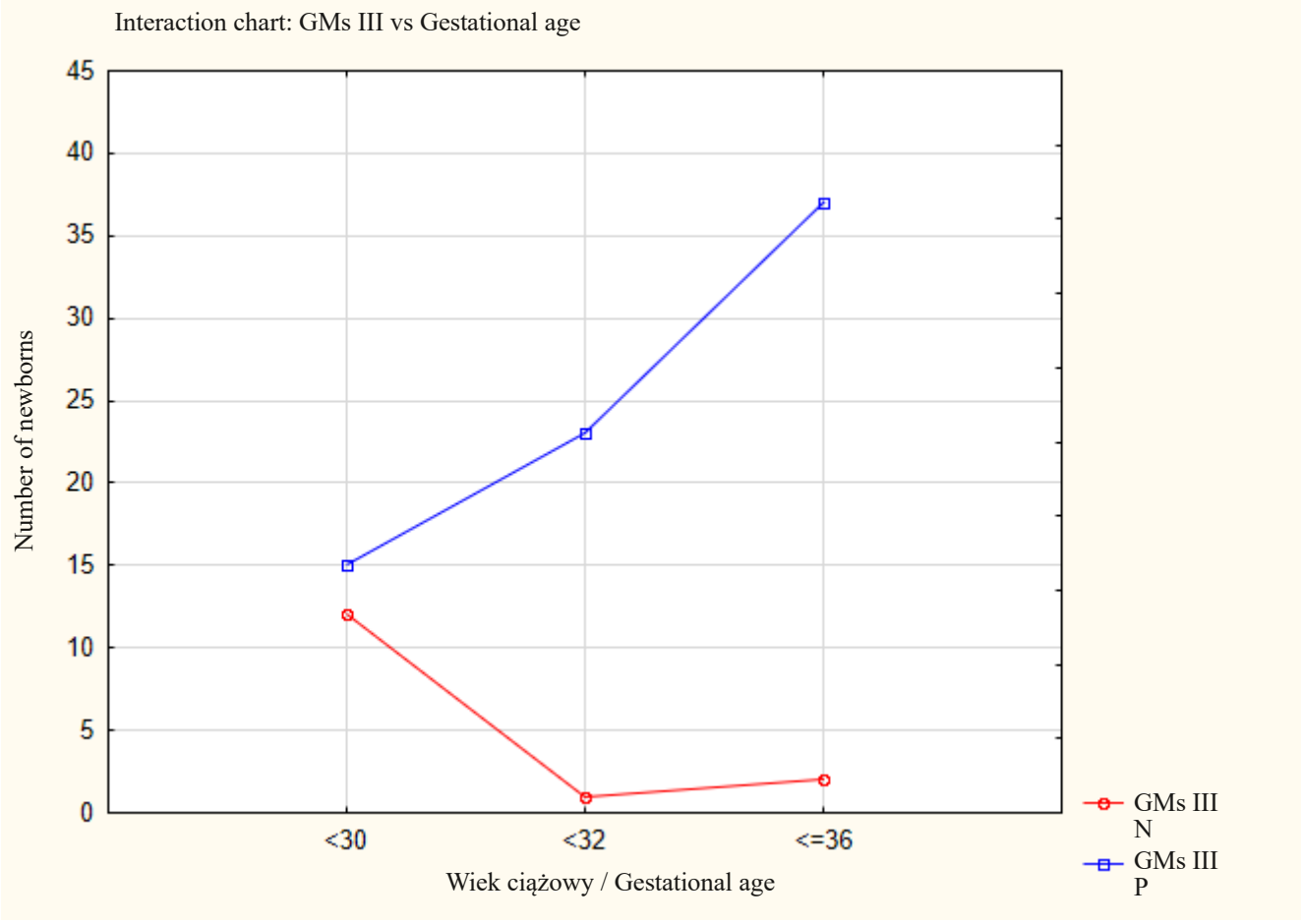

Fig. 2. Correlation between gestational age of infants and occurrence of abnormal general movements in the third assessment (GMs N – incorrect; GMs P – correct)

Assessments in this research study demonstrates that the lower the gestational age, the significantly more often incorrect general movements (including fidgety movements) can be observed (fig. 2). Based on the logistical model, it was confirmed that the gestational age is an important variable impacting occurrence of the incorrect global movements.

Discussion

The problem of development in preterm infant has been the subject of intense research for many years. It is widely acknowledged that the correct birth weight and the correct birth term are among the most important factors which

condition the chance for survival and normal development. One the other hand, preterm infants are burdened with a higher risk of morbidity and developmental disorders from which the primary ones relate to neurodevelopmental deficits [11-13].

Despite advancements in neonatology and clinical pharmacology as well as increase in parents' and carers' awareness regarding preterm infants, the problem of neurodevelopmental disorders stays open. Children born before the 36th week of pregnancy make up almost 2% of all newborns and should be the subject of special care because of the lower survival rate and higher risk of complications than full-term newborns. Thus, in the light of contemporary understanding, it is essential to recognise the value of diagnostics of disorders together with undertaking correct treatment based on suitable stimulation and early assistance of the development process.

In this study, the incorrect general movements with the poor repertoire character were already diagnosed in the first assessment (which was conducted up to the 14th day after birth) in more than half of infants. In the first assessment, these were present only in 23% of children. It has been also determined that 16,6% of the assessed infants between 12th and 15th week of corrected age (in the third assessment) had abnormal fidgety movements or their absence. Both infants with incorrect general movements observed in the second assessment and those who already presented movement disorders in the first assessment required further observations. Based on this research study it was found that together with maturation of the central nervous system of preterm infant there is a significant qualitative change of general movements. This can be connected to the fact that the number of infants with incorrect general movements (primarily poor repertoire movements) diminished before fidgety movements occurred.

It has been found that an early recognition of incorrect general movements should be an indication to initiate neurodevelopmental treatment and thus, be a fundamental step for priming correct posture functions and movement in infants.

Thus, it could be concluded that application of the easy, noninvasive Prechtl method to assess spontaneous movements allows for reliable monitoring and objective forecasting of further somatic and psychomotor development. A similar opinion was also expressed by Einspieler et al. and Snider et al. [14, 15]. Assessing infants born in the 32nd week or earlier with very low birth weight Snider et al. emphasise that the Prechtl method is a unique neurological method of examination in preterm infants. Authors suggest that assessment of general movements significantly differs from other assessment methods such as Albert scale (Alberta Infant Motor Scale) which evaluates motor skills of infants [15].

In their research on the quality of general movements in 60 infants born between 25th and 33rd week in which cerebral palsy was not recognised at later age, Bruqqink et al. demonstrated that occurrence of abnormal general movements in infants up to 8th week after term is correlated primarily with lower intelligence quotient in early school children between ages of 7 and 11. According to the authors, low intelligence quotient is much more prevalent in boys than girls who were born prematurely and presented abnormal general movements. The educational development of parents also turns out to be a

significant factor [16]. According to those authors, abnormal quality of general movements during early life phases can reflect damage in areas of the brain responsible for development of cognitive abilities while maintaining full motoric functions of school children. Similar conclusions were made by Einspieler et al. who summarised observations of seven multicenter studies in preterm infants in which the general movements continued up to 8th week after term [14]. This is also acknowledged by Bernhardt et al. who confirmed that infants born prematurely who maintain abnormal general movements for up to 8th week of life have lower intelligence quotient than children in which only normal general movements were observed during infancy [17, 18].

It is necessary to emphasise how essential it is to undertake improvement actions in preterm infants already at term which together with continuous observation of spontaneous movement functions may guarantee a lower possibility of developing incorrect movement patterns. Such procedures further support diminishing probability of preterm birth and its complications such as damages to sensory organs and mental development together with cognitive and behavioural abilities. In some of the newest research, Ma et al. emphasise that the lower the birth weight and birth age in preterm infants, the more frequent abnormal general movements are/can be observed [19]. Fjøertoft et al. suggest that infants born before the 28th week weighing less than 1,0kg have lower quality of movements assessed through the Prechtl'a method in the 3rd month of corrected age than full-term newborns [20]. This study confirms these observations and suggests that frequency of occurring of the incorrect movement patterns was increasing with lowering of the gestational age and birth weight. The third assessment suggests that abnormal fidgety movements or the lack of them were present primarily in infants born before the 30th week of pregnancy, only 2 children were born in the 35th week. Presence of abnormal general movements in prematurely born infants as opposed to the more mature ones has been confirmed by many researchers [12, 13, 17, 21, 22, 23, 24].

In the light of contemporary neonatology science, it is necessary to conduct further research on the assessment of general movements in preterm infants. It is essential to carry out long-term studies which will help to determine whether the existing development disorders revealed through abnormal general movements could have practical implications not only for assessing psychomotor development processes during infancy, but also to specify whether they could exert unfavorable outcomes in adulthood [23, 24]. This is highly relevant for developing optimal procedures during early phase of the child's life in order to restore correct neurological functions as quickly as possible.

Conclusions

1. Assessment of general movements not only allows for an early identification of risks to normal development, but above all, enables targeted initiation of specialised neurodevelopmental support to ensure correct and spontaneous activity of the child.

2. There is a close correlation between the gestational age of a preterm newborn and the occurrence of damage to the central nervous system as well as the early detection of abnormal general movements.

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Piśmiennictwo/ References

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